TUBE FRAME GENERATOR

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TORO®

T1200-T3000D generator

SERVICE MANUAL

PREFACE

This Service and Overhaul Manual was written expressly for the Tor0 T1200, T1800, T2500 and T3000 electric generators. This manual will cover both single and dual voltage models of the T2500 and T3000 generator.

The Tor0 Company has made every effort to make this Service Manual a useful and lasting addition to every Service Facility. To assure proper and effective repairs, and to provide optimum performance for the life **of** the machine, you are urged to read this manual carefully, referencing it as necessary when generator service is required.

This manual contains a brief section on electrical theory which is essential to understanding generator operation, troubleshooting and maintenance The complete manual also provides the service technician with a working guideline of maintenance, troubleshooting, test, repair and overhaul procedures.

The Toro Company reserves the right to change product specifications or this manual without notice.

The Tor0 Company gratefully acknowledges the assistance provided by the Suzuki Motor Company in the writing ***of*** this manual.

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SAFETY INSTRUCTIONS

This safety symbol means WARNING AND/OR CAUTION - PERSONAL SAFETY INSTRUCTION - Read the instruction because it has to do with safety. Failure to comply with the instruction may result in personal injury or death.

This manual is intended to be a service and repair manual only The safety instructions provided in this manual are for the troubleshooting and service of the product only. Individual Operator's Manuals will contain safety information for the operation of the generators that are described is this manual.

Operator's Manuals with complete operational safety instructions are available through:

The Toro Company
Publications Department
8111 Lyndale Avenue South
~Minneapolis, MN 55420 U.S.A.

FOR **YOUR** SAFETY

- Mishandling gasoline and oil can be deadly. Gasoline is explosive and should never be exposed to a flame or spark. Do not smoke while working around gasoline.
- Avoid the accidental misuse of gasoline by always using a storage container designed for gasoline.
- Avoid fire hazards by operating the generator no closer than one meter, (three feet) to any combustible material.
- When decarboning the muffler, burning pieces of carbon may be discharged. Make sure there is no combustible material in the area.
- Spilled oil or gasoline can present a fire hazard or cause injury through falls. Always remove spilled oil or gasoline.
- Engine exhaust fumes can cause death. Never operate an engine in a confined area or without venting the exhaust fumes to the outside atmosphere.
- You can be killed by the electricity a generator produces. While a generator is in operation never/touch any portion of your body to exposed or uninsulated terminals or wiring.
- Make sure that the engine will not accidentally start while completing a service procedure by pulling the spark plug wire **off** the spark plug.
- Electrical line workers can be electricuted by backfeeding electricity. Never connect a generator to your house wiring without using a double throw switch to separate the generator from the incoming line.

IDENTIFICATION

Each Tor0 whole good is assigned a model and serial number. ,The model number has five digits and indicates the size and style of the product. In addition to the model number, each product also has a unique serial number which serves to differentiate products with the same model number. The serial number has seven digits, the first of which identifies the year of manufacture (ie. **6000386** indicates that the product was built in **1986.)**

These numbers are printed on a decal that **is** about 1" high and 3"wide. Units built in **1984** and **1985** have the decal located on the lower cross brace of the tube frame under the engine end of the generator. On **1986** and newer units, the decal can be found behind the **gas** tank. Always refer to specific numbers **on** the decal in correspondence or when replacement parts are needed.

An engine number **is** also located on the block of the engine. When filing warranty claims or requesting service information, please include the engine number.

TI200 SPECIFICATIONS

Model 62012 Product Specifications

Item	Specification
Type	air cooled, 4-stroke, side valve
Bore	63 mm (2.48")
Stroke	47 mm (1.85")
Displacement	146.5 cc (8.94 cu. in.)
Rated Continuous Output	2.0 kilowatt (2.7 HP) @ 3600 rpm
Engine Rotation	counterclockwise (as viewed from PTO end)
Cylinder Material	aluminum with cast iron liner
Crankshaft Bearing Material (Mag)	ball
Crankshaft Bearing Material (PTO)	ball
Connecting Rod Bearing (Lower)	plain
Carburetor	float
Fuel	unleaded regular gasoline
Fuel Tank	7.0 liters (1.84 gal.)
Run Time	5.3 hours at rated load
Ignition System	transistorized
Ignition Timing	25 ±3° BTDC @ 3600 rpm
Spark Plug	NGK BPR-6HS
Starting System	recoil
Lubrication	splash
Oil Capacity	.7 liters (23.7 oz)
Oil Level Alarm	float type
Recommended Oil	detergent SAE 10W30 or 30, API rating of SC, SD, SE, or SF
Governed Engine Speed (60 hz)	3600 rpm
Governed Engine Speed (50 hz)	3000 rpm
Dry Weight	35 kg (77.5 lbs)
Dimensions (L x W x H)	54 x 33.5 x 46.5 cm (21.2 x 13.2 x 18.3 in)
Air Cleaner	oiled foam type element

Model 62012 Generator Specifications

Item	Specification
AC Voltage	120 volts, plus or minus 10%

TI200 SPECIFICATION$ (cont'd)

Model 62012 Generator Specifications (cont'd)

Item	Specification
Rated AC Amperes	8.3 amperes.
DC Voltage	12 volts DC
Rated DC Amperes	8.3 Amperes
Rated Power	1.0 KVA (kilovolt amps)*
Maximum Power	1.2 KVA (kilovolt amps)
Frequency	60Hz at 3600 RPM
Rated Speeed	3600 RPM
Type Generator	revolving field, self-excited
Power Factor	1.0
Driving Method	directly coupled to engine
Automatic Voltage Regulator	electronic solid state design.

* 1KVA = 1000 Watts true power with a power factor of one.

Model 62012 Engine Service Specifications

Item	Standard Dimension	Allowable Limit
Spark Plug	NGK BPR-6HS	NIA
Spark Plug Gap	.75mm (.030")	NIA
Ignition Coil Air Gap (External Mount)	.38 (.015")	N/A
Ignition Coil Air Gap (Internal Mount)	fixed	N/A
Valve Margin	1.00 to 1.40 mm (.039 to .055")	.60mm (.024")
Width of Valve Seat Contact	.80 to 1.00 mm (.032 to .040")	N/A
Valve Lash	.050 mm (.002")	NIA
Valve Head Runout (Both)	NIA	.030 mm (.0012")
Intake Guide to Valve Stem Clearance	.025 to .055 mm (.0010 .0022")	.080 mm .0032"

TI200 SPECIFICATIONS (cont'd)

Model 62012 Engine Service Specifications (cont'd)

Item	Standard Dimension	Allowable Limit
Exhaust Guide to Valve Stem Clearance	.035 to .065 mm (.0014 to .0026")	.100 mm .0039"
Valve Spring Free Length	35.5to 36.5mm (1.398 to 1.437")	34.5 mm (1.358")
Cam Height Intake and Exhuast	32.465 to 32.505 mm (1.2781 to 1.2797")	32.170 mm (1.2665")
Connecting Rod Journal Diameter	25.990to 26.000 mm (1.0232 to 1.0236")	N/A
Connecting Rod Bearing Diameter (Big End)	26.005 to 26.015 mm (1.0238 to 1.0242")	N/A N/A
Connecting Rod Journal Oil Clearance	.005to .025mm (.0002 to .0010")	.060 mm (.0028")
Connecting Rod Side Clearance (Big End)	.200 to .900 (.0079 to .0354")	1.200 (.0472")
Piston Pin Clearance in Connecting Rod	.006 to .019 mm (.0002 to .0008)	.054 mm (.0022)
Cylinder Diameter	N/A	see piston to cylinder clearance
Piston Measuring Point	15 mm (.59")	N/A (from bottom of piston skirt)
Piston Diameter	N/A	see piston to cylinder clearance
Piston to Cylinder Clearance	.050 to .060 mm (.0020 to .0024")	.120 mm (.0047")
Cylinder Distortion	N/A	.030 mm (.0012")
Piston Ring End Gap (Compression Rings Only)	.200 to .400 mm (.0079 to .0158")	.800 mm (.0315")
Oil Ring End Gap	.300 to .900 mm (.0118 to .0354")	N/A N/A
Piston Ring Side Clearance (Top Ring Only)	.020 to .060 mm (.001 to .003")	.120 mm (.005")
Piston Ring Side Clearance (2nd Ring Only)	.020 to .060 mm (.001 to .003")	.100 mm (.004")
Piston Ring Thickness (Compression Rings Only)	1.97 to 1.99 mm (.0776 to .0783")	N/A
Piston Ring Groove Width (Compression Ring Grooves Only)	2.01 to 2.03 mm (.0791 to .0799")	N/A

TI200 SPECIFICATIONS (cont'd)

Model 62012 Engine Service Specifications (cont'd)

Item	Standard Dimension	Allowable Limit
Piston Mark	toward valves	N/A
Connecting Rod Mark	toward valves	N/A

Model 62012 Carburetor Specifications

Item	Specification
Type	Mikuni BV21-15-4 float type
Main Jet (STD)	#72.5 (fixed)
Pilot Jet	#40 (fixed)
Valve Seat Material	brass
Inlet Needle Material	stainless steel
Air Screw (Turns Open)	1 1/2

Model 62012 Fastener Torques

Fastener	Torque
Spark Plug	.88 kg m (6.4 ft lbs)
Cylinder Head Bolts	2.0 kg m (14.5 ft lbs)
Flywheel Nut	6.5 kg m (47 ft lbs)
Connecting Rod Nuts	.7 kg m (5.0 ft lbs)
Frame Bolts	1.3 kg m (9.4 ft lbs)
Generator Through Bolt	1.0 kg m (7.2 ft lbs)
Starter Cup Capscrews	.88 kg m (6.4 ft lbs)
Recoil Pulley Screw	.88 kg m (6.4 ft lbs)
Recoil Mounting Screws	50 kg m (3.6 ft lbs)
Air Cleaner Nuts	.75 kg m (5.4 ft lbs)
Air Cleaner Capscrew	.22 kg m (1.6 ft lbs)
Throttle Plate Screws	.88 kg m (6.4 ft lbs)
Crankcase Screws	.88 kg m (6.4 ft lbs)
Shroud Fasteners	55 kg m (4.0 ft lbs)
Muffler Nuts	1.1 kg m (8.0 ft lbs)

T I 8 0 0 SPECIFICATIONS

Model 62018 Product Specifications

Item	Specification
Type	air cooled 4-stroke, side valve
Bore	66 mm (2.60")
Stroke	*56* mm (2.20")
Displacement	191.6 cc (11.69 cu. in.)
Rated Continuous Output	2.8 kilowatt (3.8 **HP)** @ 3600 rpm
Engine Rotation	counterclockwise (as viewed from **PTO** end)
Cylinder Material	aluminum with **cast** iron liner
Crankshaft Bearing Material (Mag)	**ball**
Crankshaft Bearing Material (PTO)	**ball**
Connecting Rod Bearing (Lower)	plain
Carburetor	float
Fuel	unleaded regular gasoline
Fuel Tank	7.00 liters (1.84 gal.)
Run Time	**5.0** hours at rated load
Ignition System	transistorized
Ignition Timing	**25° BTDC** @ 3600 rpm
Spark Plug	**NGK BPR-6HS**
Starting System	recoil
Lubrication	splash
Oil Capacity	.7 liters (23.7 oz)
Recommended Oil	detergent **SAE** 10W30 or'30, **API** rating of **SC,** SD, **SE,** or **SF**
Oil Level Alarm	float type
Governed Engine Speed (60 hz)	3600 rpm
Governed Engine Speed (50 hz)	3000 rpm
Air Cleaner	oiled foam type element
Dry Weight	***40*** kg ***(88.5*** **lbs)**
Dimensions (L x W x H)	**54.1** x 33.7 x48.5 cm (21.3 x 13.3 x 19.1 in)

Model 62018 Generator Specifications

Item	Specification
AC Voltage	120 volts, plus or minus 10%

T1*800* SPECIFICATIONS (cont'd)

Model 62018 Generator Specifications (cont'd)

Item	Specification
Rated AC Amperes	12.5 amperes.
DC Voltage	12 volts DC
Rated DC Amperes	8.3 Amperes
Rated Power	1.5 KVA (kilovolt amps)*
Maximum Power	1.8 KVA (kilovolt amps)
Frequency	60Hz at 3600 RPM
Rated Speeed	3600 RPM
Type Generator	revolving field, self-excited
Power Factor	1.0
Driving Method	directly coupled to engine
Automatic Voltage Regulator	electronic solid state design.

* 1KVA = 1000 Watts true power with a power factor of one.

Model 62018 Engine Service Specifications

Item	Standard Dimension	Allowable Limit
Spark Plug	NGK BPR-6HS	N/A
Spark Plug Gap	.75 mm (.030")	N/A
Ignition Coil Air Gap (External Mount)	.38 (.015")	N/A
Ignition Coil Air Gap (Internal Mount)	fixed	N/A
Valve Margin	1.35 to 1.85 mm (.053 to .073")	.90 mm (.035")
Width of Valve Seat Contact	.80 to 1.00 mm (.032 to .039")	N/A
Valve Lash	.050 mm (.002")	N/A
Valve Head Runout (Both)	N/A	.030 mm (.0012")
Intake Guide to Valve Stem Clearance	.025 to .055 mm (.0010 to .0022")	.080 mm .0032"

TI*800* SPECIFICATIONS (cont'd)

Model 62018 Engine Service Specifications (cont'd)

Item	Standard Dimension	Allowable Limit
Exhaust Guide to Valve Stem Clearance	.035 to .065 mm (.0014 to .0026')	.100 mm .0039"
Valve Spring Free Length	35.5 to 36.5 mm (1.398 to 1.437")	34.5 mm (1.358")
Cam Height Intake and Exhaust	32.465 to 32.505 mm (1.2781 to 1.2797")	32.170 mm (1.2665")
Connecting Rod Journal Diameter	25.990 to 26.000 mm (1.0232 to 1.0236')	N/A
Connecting Rod Bearing Diameter (Big End)	26.005 to 26.015 mm (1.0238 to 1.0242")	N/A N/A
Connecting Rod Journal Oil Clearance	.005 to ..025 mm (.0002 to .00l0")	.070 mm (.0028")
Connecting Rod Side Clearance (Big End)	.200 to .900 (.0079 to .0354')	1.200 (.0472")
Piston Pin Clearance in Connecting Rod	.006 to .019 mm (.0002 to .0008)	.054 mm (.0022)
Cylinder Diameter	N/A	see piston to cylinder clearance
Piston Measuring Point	15 mm (59')	N/A (from bottom of piston skirt)
Piston Diameter	NIA	see piston to cylinder clearance
Piston to Cylinder Clearance	.045 to .065 mm (.0018 to .0026')	.120 mm (.0047")
Cylinder Distortion	NIA	.030 mm (.0012")
Piston Ring End Gap (Compression Rings Only)	.200 to .400 mm (.0079 to .0158')	.800 mm (.0315")
Oil Ring End Gap	.20 to .40 mm (.008 to .016')	1.50 mm (.059")
Piston Ring Side Clearance (Top Ring Only)	.020 to .060 mm (.001 to .003')	.120 mm (.005")
Piston Ring Side Clearance (2nd Ring Only)	.020 to .060 mm (.001 to .003")	.100 mm (.004")
Piston Ring Thickness (Compression Rings Only)	1.97 to 1.99 mm (.0776 to .0783")	N/A
Piston Ring Groove Width (Compression Ring Grooves Only)	2.01 to 2.03 mm (.0791 to .0799")	N/A

Model 62018 Engine Service Specifications (cont'd)

Item	Standard Dimenstion	Allowable Limit
Piston Mark	toward valves	N/A
Connecting Rod Mark	toward valves	N/A

Model 62018 Carburetor Specifications

Item	Specification
Type	Mikuni BV21-15-2A float type
Main Jet (STD)	#75 (fixed)
Pilot Jet	#40 (fixed)
Valve Seat Material	brass
Inlet Needle Material	stainless steel
Air Screw (Turns Open)	1 1/2

Model 62018 Fastener Torques

Fastener	Torque
Spark Plug	.88 kg m (6.4 ft lbs)
Cylinder Head Bolts	2.0 kg m (15 ft lbs)
Flywheel Nut	6.5 kg m (47 ft lbs)
Connecting Rod Nuts	.70 kg m (5.1 ft lbs)
Frame Bolts	1.3 kg m (9.4 ft lbs)
Generator Through Bolt	1.0 kg m (7.2 ft lbs)
Starter CUP Capscrews	.88 kg m (6.4 ft lbs)
Recoil Pulley Screw	.88 kg m (6.4 ft lbs)
Recoil Mounting Screws	.50 kg m (3.6 ft lbs)
Air Cleaner Nuts	.75 kg m (5.4 ft lbs)
Air Cleaner Capscrew	.22 kg m (1.6 ft lbs)
Throttle Plate Screws	.88 kg m (6.4 ft lbs)
Crankcase Screws	.88 kg m (6.4 ft lbs)
Shroud Fasteners	.55 kg m (4.0 ft lbs)
Muffler Nuts	1.05 kg m (7.6 ft lbs)

T2500 & T2500D SPECIFICATIONS

Models *62025* & *62027* Product Specifications

Item	Specification
Type	air cooled, 4-stroke, sideValve
Bore	72 mm (2.83")
Stroke	62 mm (2.44")
Displacement	252.4 cc (15.40 cu. in.)
Rated Continuous Output	3.7 kilowatt (5.0HP) at 3600 rpm
Engine Rotation	counterclockwise (as viewed from PTO end)
Cylinder Material	aluminum with cast iron Sleeve
Crankshaft Bearing Material (Mag)	ball
Crankshaft Bearing Material (PTO)	ball
Connecting Rod Bearing (Lower)	plain
Carburetor	float
Fuel	unleaded regular gasoline
Fuel Tank	11.0 liters (2.91 gal.)
Run Time	5.0hours at rated load
Ignition System	transistorized
Ignition Timing	25° BTDC @ 3600 rpm
Spark Plug	NGK BPR-6HS
Starting System	recoil
Lubrication	splash
Oil Capacity	1.0 liters (33.8 *oz)*
Oil Level Alarm	float type
Recommended Oil	detergent SAE 10W30or'30, API rating of SC, SD, SE, or SF
Governed Engine Speed (60 hz)	3600 rpm
Governed Engine Speed (50 hz)	3000 rpm
Air Cleaner	oiled foam type element
Dry Weight	52.8 kg (116.5 lbs)
Dimensions (L x W x H)	56.6 x 36.3 x 53.6 cm (22.6 x 14.3 x 21.1 in)

Model *62025* & *62027* Generator Specifications

Item	Specification
AC Voltage	120 - 220 volts, plus or minus 10%

T2500 & T2500D SPECIFICATIONS (cont'd)

Models 62025 & 62027 Generator Specifications:(cont'd)

Item	Specifications
Rated AC Amperes	21.0 amperes.(120) - 11.4 amperes (220)
DC Voltage	12 volts DC
Rated DC Amperes	8.3 amperes
Rated Power	2.5 KVA (kilovolt amps)*
Maximum Power	2.64 KVA (kilovolt amps)
Frequency	60Hz at 3600 RPM
Rated Speeed	3600 RPM
Type Generator	revolving field, self-excited
Power Factor	1.0
Driving Method	directly coupled to engine
Automatic Voltage Regulator	electronic solid state design.

* 1KVA = 1000 Watts true power with a power factor of one.

Models 62025 & 62027 Engine Service Specifications

Item	Standard Dimension	Allowable Limit
Spark Plug	NGK BPR-6HS	N/A
Spark Plug Gap	0.75mm (.030")	N/A
Ignition Coil Air Gap (External Mount)	.38 (0.015")	N/A
Ignition Coil Air Gap (Internal Mount)	fixed	N/A
Valve Margin	.95 to 1.45 mm (.037 to .057")	.70mm (.028")
Width of Valve Seat Contact	.90 to 1.10 mm (0.035 to 0.043")	N/A
Valve Lash	.050 mm (.002")	N/A
Valve Head Runout (Both)	N/A	.030mm (.0012")
Intake Guide to Valve Stem Clearance	.025 to .055 mm (.0010 to .0022")	.080mm .0032"

Models *62025* & *62027* Engine Service Specifications (cont'd)

Item	Standard Dimension	Allowable Limit
Exhaust Guide to Valve Stem Clearance	.040 to .070 mm (.0016 to .0028")	.100 mm .0039"
Valve Spring Free Length	39.5 to 40.5 mm (1.555 to 1.595")	38.0 mm (1.496")
Cam Height Intake and Exhuast	32.472 to 32.512 mm (1.2784 to 1.2800')	32.180 mm (1.2669")
Connecting Rod Journal Diameter	27.991 to 28.000 mm (1.1020 to 1.1024")	N/A
Connecting Rod Bearing Diameter (Big End)	28.013 to 28.027 mm (1.1029 to 1.1034")	N/A N/A
Connecting Rod Journal Oil Clearance	.013 to .036 mm (.0005 to .0014")	.080 mm (.0031")
Connecting Rod Side Clearance (Big End)	.400 to .800 (.0158 to .0315")	1.200 (.0472")
Piston Pin Clearance in Connecting Rod	.006 to .019 mm (.0002 to .0008)	.054 mm (.0022)
Cylinder Diameter	N/A	see piston to cylinder clearance
Piston Measuring Point	8.0 mm (.32")	N/A (from bottom of piston skirt)
Piston Diameter	N/A	see piston to cylinder clearance
Piston to Cylinder Clearance	0.030 to 0.050 mm (0.0012 to 0.0020")	0.120 mm (.0047")
Cylinder Distortion	N/A	.030 mm (.0012")
Piston Ring End Gap (Compression Rings Only)	0.200 to 0.400 mm (0.0079 to 0.0158')	0.800 mm (.0315")
Oil Ring End Gap	0.20 to 0.80 mm (0.008 to 0.032")	1.50 mm (.059")
Piston Ring Side Clearance (Top Ring Only)	0.030 to 0.070 mm (0.001 to 0.003')	0.120 mm (.005")
Piston Ring Side Clearance (2nd Ring Only)	0.020 to 0.060 mm (0.001 to 0.003")	0.100 mm (.004")
Piston Ring Thickness (Compression Rings Only)	2.46 to 2.48 mm (0.0969 to .0976")	N/A
Piston Ring Groove Width (Compression Ring Grooves Only)	2.51 to 2.53 mm (.0988 to .0996")	N/A

T2500 & T2500D SPECIFICATIONS (cont'd)

Models *62025* & *62027* Engine Service Specifications (cont'd)

Item	Standard Dimension	Allowable Limit
Piston Mark	toward valves	N/A
Connecting Rod Mark	toward valves	N/A

Models *62025* & *62027* Carburetor Specifications

Item	Specification
Type	Mikuni BV21-17-35 float type
Main Jet (STD)	#77.5 (fixed)
Pilot Jet	#47.5 (fixed)
Valve Seat Material	brass
Inlet Needle Material	stainless steel
Air Screw (Turns Open)	one

Models *62025* & *62027* Fastener Torques

Fastener	Torque
Spark Plug	.88 kg m (6.4 ft lbs)
Cylinder Head Bolts	2.5 kg m (19 ft lbs)
Flywheel Nut	6.5 kg m (47 ft lbs)
Connecting Rod Nuts	1.8 kg m (13 ft lbs)
Frame Bolts	1.3 kg m (9.0 ft lbs)
Generator Through Bolt	1.0 kg m (7.3 ft lbs)
Starter Cup Capscrews	.88 kg m (6.4 ft lbs)
Recoil Pulley Screw	.88 kg m (6.4 ft lbs)
Recoil Mounting Screws	.50 kg m (3.6 ft lbs)
Air Cleaner Nuts	.75 kg m (5.4 ft lbs)
Air Cleaner Capscrew	.22 kg m (1.6 ft lbs)
Throttle Plate Screws	.88 kg m (6.4 ft lbs)
Crankcase Screws	.88 kg m (6.4 ft lbs)
Shroud Fasteners	.55 kg m (4.0 ft lbs)
Muffler Nuts	1.1 kg m (8.0 ft lbs)

T3000 & T3000D SPECIFICATIONS

Models 62030 & 62032 Product Specifications

Item	Specification
Type	air cooled, 4-stroke, side valve
Bore	76 mm (2.99")
Stroke	62 mm (2.44")
Displacement	281.3 cc (17.16 cu. in.)
Rated Continuous Output	4.2 kilowatt (5.6 HP) at 3600 rpm
Engine Rotation	counterclockwise (as viewed from PTO end)
Cylinder Material	aluminum with cast iron liner
Crankshaft Bearing Material (Mag)	ball
Crankshaft Bearing Material (PTO)	ball
Connecting Rod Bearing (Lower)	plain
Carburetor	float
Fuel	unleaded regular gasoline
Fuel Tank	11.0 liters (2.91 gal.)
Run Time	5.0 hours at rated load
Ignition System	transistorized
Ignition Timing	25é BTDC @ 3600 rpm
Spark Plug	NGK BPR-6HS
Starting System	recoil
Lubrication	splash
Oil Capacity	1.0 liter (33.8 oz)
Oil Level Alarm	float type
Recommended Oil	detergent SAE 10W30 or 30, API rating of SC, SD, SE, or SF
Governed Engine Speed (60 hz)	3600 rpm
Governed Engine Speed (50 hz)	3000 rpm
Air Cleaner	oiled foam type element
Dry Weight	54.8 kg (121.0 lbs)
Dimensions (L x W x H)	57.5 x 38.5 x 54.0 cm (22.6 x 15.2 x 21.3 in)

Model 62030 & 62032 Generator specifications

Item	Specifications
AC Voltage	120 - 220 volts, plus or minus 10%

T3000 & T3000D SPECIFICATIONS (cont'd)

Models 62030 & 62032 Generator Specifications (cont'd)

Item	Specification
Rated AC Amperes	24.2 amperes.(120) - 13.2 amperes (220)
DC Voltage	12 volts DC
Rated DC Amperes	8.3 amperes
Rated Power	2.9 KVA (kilovolt amps)*
Maximum Power	3.10 KVA (kilovolt amps)
Frequency	60Hz at 3600 RPM
Rated Speeed	3600 RPM
Type Generator	revolving field, self-excited
Power Factor	1.0
Driving Method	directly coupled to engine
Automatic Voltage Regulator	electronic solid state design.

* 1KVA = 1000 Watts true power with a power factor of one.

Models 62030 & 62032 Engine Service Specifications

Item	Standard Dimension	Allowable Limit
Spark Plug	NGK BPR-6HS	N/A
Spark Plug Gap	.75mm (.030')	N/A
Ignition Coil Air Gap (External Mount)	.38 (.015")	N/A
Ignition Coil Air Gap (Internal Mount)	fixed	N/A
Valve Margin	.95 to 1.45 mm (.037 to .057")	.70mm (.028")
Width of Valve Seat Contact	.90to 1.10 mm (.035to .043")	N/A
Valve Lash	.050 mm (.002")	N/A
Valve Head Runout (Both)	N/A	.030mm (.0012")
Intake Guide to Valve Stem Clearance	.025to .055mm (.0010 to .0022")	.080 mm .0032"

Models 62030 & 62032 Engine Service Specifications (cont'd)

Item	Standard Dimension	Allowable Limit
Exhaust Guide to Valve Stem Clearance	.040 to .070 mm (.0016 to .0028")	.100 mm .0039"
Valve Spring Free Length	39.5 to 40.5 mm (1.555 to 1.595")	38.0 mm (1.496")
Cam Height Intake and Exhuast	32.472 to 32.512 mm (1.2784 to 1.2800")	32.180 mm (1.2669")
Connecting Rod Journal Diameter	27.991 to 28.000 mm (1.1020 to 1.1024")	N/A
Connecting Rod Bearing Diameter (Big End)	28.013 to 28.027 mm (1.1029 to 1.1034")	N/A N/A
Connecting Rod Journal Oil Clearance	.013 to .036" mm (.0005 to .0014")	.080 mm (.0031")
Connecting Rod Side Clearance (Big End)	.400 to .800 (.0158 to .0315")	1.200 (.0472")
Piston Pin Clearance in Connecting Rod	.006 to .019 mm (.0002 to .0008)	.054 mm (.0022)
Cylinder Diameter	*NIA*	see piston to cylinder clearance
Piston Measuring Point (from bottom of piston skirt)	8.0 mm (.32")	N/A
Piston Diameter	*NIA*	see piston to cylinder clearance
Piston to Cylinder Clearance	.030 to .050 mm (.0012 to .0020")	.120 mm (.0047")
Cylinder Distortion	*NIA*	.030 mm (.0012")
Piston Ring End Gap (Compression Rings Only)	.20 to .40 mm (.008 to .016")	.80 mm (.032")
Oil Ring End Gap	.20 to .80 mm (.008 to .032")	1.50 mm (.060")
Piston Ring Side Clearance (Top Ring Only)	.030 to .070 mm (.001 to .0003")	.120 mm (.005")
Piston Ring Side Clearance (2nd Ring Only)	.020 to .060 mm (.001 to .003")	.100 mm (.004")
Piston Ring Thickness (Compression Rings Only)	2.46 to 2.48 mm (.0969 to .0976")	N/A
Piston Ring Groove Width (Compression Ring Grooves Only)	2.51 to 2.53 mm (.0988 to .0996")	N/A

T3000 & T3000D SPECIFICATIONS (cont'd)

Models 62030 & 62032 Engine Service Specifications (cont'd)

Item	Standard Dimension	Allowable Limit
Piston Mark	toward valves	N/A
Connecting Rod Mark	toward valves	N/A

Models 62030 & 62032 Carburetor Specifications

Item	Specification
Type	Mikuni BV21-17-1 float type
Main Jet (STD)	#82.5 (fixed)
Pilot Jet	#45 (fixed)
Valve Seat Material	brass
Inlet Needle Material	stainless steel
Air Screw (Turns Open)	1 1/4

Models 62030 & 62032 Fastener Torques

Fastener	Torque
Spark Plug	.88 kg m (6.4 ft lbs)
Cylinder Head Bolts	3.2 kg m (23 ft lbs)
Flywheel Nut	6.5 kg m (47 ft lbs)
Connecting Rod Nuts	2.0 kg m (15 ft lbs)
Frame Bolts	1.3 kg m (9.4 ft lbs)
Generator Through Bolt	1.0 kg m (7.2 ft lbs)
Starter Cup Capscrews	.88 kg m (6.4 ft lbs)
Recoil Pulley Screw	.88 kg m (6.4 ft lbs)
Recoil Mounting Screws	.50 kg m (3.6 ft lbs)
Air Cleaner Nuts	.75 kg m (5.4 ft lbs)
Air Cleaner Capscrew	.22 kg m (1.6 ft lbs)
Throttle Plate Screws	.88 kg m (6.4 ft lbs)
Crankcase Screws	.88 kg m (6.4 ft lbs)
Shroud Fasteners	.55 kg m (4.0 ft lbs)
Muffler Nuts	1.1 kg m (8.0 ft lbs)

SPECIAL TOOLS

Description	Part Number
1. Bearing and seal installer handle	50-9330
2. Bearing and seal installers (used with handle above)	50-9350, 50-9360
3. 46° cutter head	50-9440
4. 60° cutter head	81-4830
5. Cutter pilot	50-9520
6. "T" handle and adaptor for valve seat cutter	50-9410
7. Slide hammer (for removing rotor)	50-9210
8. Oil seal remover	50-9320
9. Valve spring compressor	50-9380
10. 15°/75° cutter head	50-9450
11. 45° cutter head	50-9430

TROUBLESHOOTING

Engine Does Not Produce Spark

Possible Causes	Remedy
engine switch in “off” position	move switch to “on” position
spark plug fouled or damaged	replace spark plug
spark plug wire damaged	replace coil
ignition coil primary wire grounding out	repair damaged wire with electrical tape
ignition coil has failed	replace ignition coil

Engine Floods During Starting

Possible Causes	Remedy
no spark	see “Engine Does Not Produce Spark’ troubleshooting section above
stale gasoline	fill tank with fresh unleaded gasoline
engine overchoked	open choke, close fuel shutoff valve and turn over until engine fires
choke not opening	replace damaged parts
leaking needle/seat	clean carburetor and pressure check
water in fuel	drain tank and fill with fresh gasoline
plugged air filter	clean air filter

Engine Does Not Get Fuel During Starting

Possible Causes	Remedy
fuel shutoff closed	open fuel shutoff valve
fuel tank empty	fill fuel tank with fresh unleaded gasoline
plugged fuel line or filter	clean or replace plugged component
fuel cap not venting properly	repair or replace fuel cap

* For generating troubleshooting information, see Section 7, page 74.

TROUBLESHOOTING (cont'd)

Engine Difficult to Start

Possible Causes	Remedy
no spark	see "Engine Does Not Produce Spark" troubleshooting section (page *8)*
engine not getting fuel	see "Engine Does Not Get Fuel During Starting" troubleshooting section (page *8)*
engine flooded	see "Engine Floods During Starting" troubleshooting section (page *8)*
engine has low compression	compare compression to compression of new unit--repair as necessary

Engine Lacks Power

Possible Causes	Remedy
choke partially closed	open choke
carburetor not adjusted properly	adjust carburetor
sheared or missing flywheel key	replace flywheel key
lack of lubrication	fill crankcase with proper lubricant
air cleaner plugged	clean or replace air cleaner
valves leaking	grind valves and set valve lash
generator overloaded or faulty	see "Generator Troubleshooting Guide", page 74
low compression	compare compression to new unit and overhaul if necessary

Engine Knocks

Possible Causes	Remedy
excessive carbon build up in combustion chamber	clean carbon from combustion chamber
loose connecting rod	replace damaged or worn parts
loose flywheel	tighten flywheel nut
loose rotor	tighten rotor bolt
sheared flywheel key	replace key

* For generating troubleshooting information, see Section 7, page 74.

TROUBLESHOOTING (cont'd)

Engine Misses Under Load

Possible Causes	Remedy
spark plug damaged or fouled	replace spark plug
improper plug gap	gap spark plug
main jet plugged	clean carburetor
improper valve lash	adjust valve lash to .050 mm (.002 in.)
weak valve spring	replace valve springs

Engine Overheats

Possible Causes	Remedy
cooling fins clogged	clean cooling fins
air flow obstructed	ensure all inlets and outlets are clear
lack of lubrication	ensure crankcase is filled to full mark with proper lubricant
engine not running at proper speed	adjust engine speed
missing or damaged flywheel key	replace key

Engine Surges or Runs Unevenly

Possible Causes	Remedy
pilot jet in carburetor clogged	clean carburetor
air leak in intake system	replace damaged or worn parts
fuel cap vent plugged	repair or replace fuel cap
fuel line or filter partially obstructed	clean fuel line and filter
fuel shutoff valve not opened all the way	open fuel shutoff valve

* For generating troubleshooting information, see Section **7,** page **74.**

TROUBLESHOOTING (cont'd)

Engine Vibrates Excessively

Possible Causes	Remedy
bent crankshaft	replace damaged parts
engine not mounted securely	tighten engine mounting bolts

Engine Uses Excessive Oil or Smokes

Possible Causes	Remedy
engine speed too fast	set engine to proper speed
crankcase over filled	drain excess oil
oil filler cap not sealing properly	ensure that cap does not pass oil or air
breather tube passing oil into carburetor	replace damaged or worn parts
piston to cylinder clearance excessive	overhaul engine

* For generating troubleshooting information, see Section 7, page 74.

MAINTENANCE

Maintenance - Air Cleaner

The air cleaner should be serviced every **50** hours. Maintenance may have to be completed as often as every 25 hours *if* the generator is being operated in dirty or dusty conditions.

1. Shut the generator off and close the fuel shutoff valve.
2. Remove the thumb screw retaining the air cleaner cover. See Figure 1.

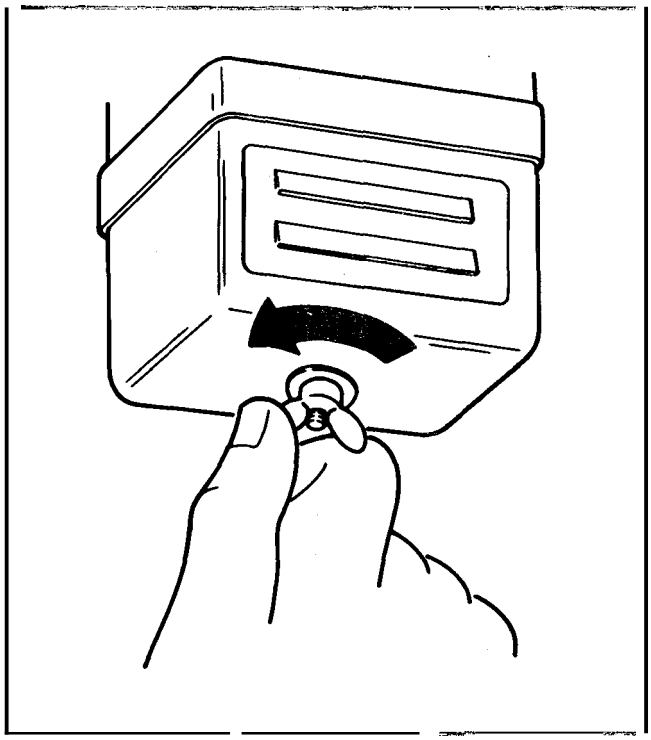


Figure **1**

3. Remove the dust cup, baffel, foam element and element holder.
4. Wash the element in soap and water or **a** solvent made for cleaning air cleaner elements.
5. Squeeze the element dry **of** the cleaning solution.
6. Saturate the element with 30 weight motor oil and then squeeze the excess oil out of the element. Note: an element that is too heavily saturated with oil may restrict air flow and cause a rich running condition for the engine.
7. Reinstall the element holder, foam element, baffel and dust cup.
8. Secure the air cleaner cover with the single mounting screw.
9. Make sure the breather hose is properly connected to the body of the air cleaner.

Maintenance - Spark Plug

The spark plug is the ignition source for the fuel air mix in the combustion chamber of the engine. The engine will not run properly *if* the spark plug is not inspected and replaced **a8** required. Spark plugs should not be cleaned; *if* the plug is fouled or dirty, replace it. Abrasive spark plug cleaners will leave grit on the plug that can cause rapid :enginewear.

Type:	NGK **BP-5HS**
Substitute:	Champion L92Y/L92YC
Electrode Gap:	.6-.7mm (.024-.028')
Inspection:	Every 100 hours
Torque:	70-105 Kg-cm (80-120 in-lbs)

Maintenance - Changing Oil

Tor0 generators are shipped without oil. Do not start the generator until you have added the correct amount of engine oil.

Quantity:	see spec. on page 3
Viscosity:	**30** summer 20 fall, spring 10 winter
Service Classification	**MS,** SC, **SD, SE**
Oil change frequency:	After the first 20 hrs. and every **50** hrs. thereafter.

1. Stop the engine and remove the spark plug wire from the spark plug.
2. Remove the oil fill plug.
3. Position and drain pan under the engine and remove the drain plug. See Figure 2.

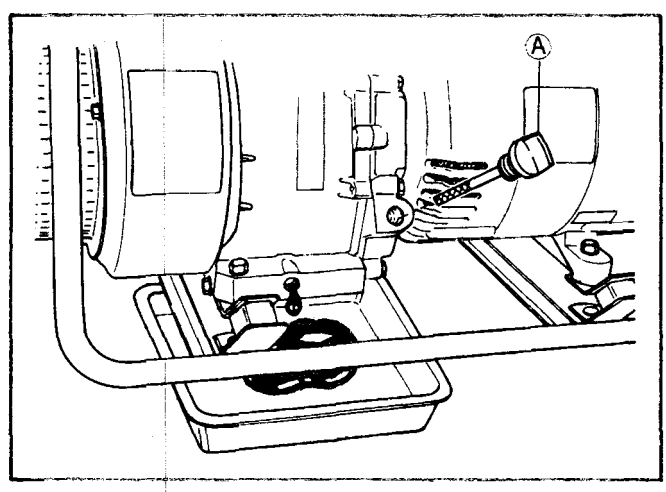


Figure 2

Maintenance - Changing Oil (cont'd)

4. Reinstall the drain plug and dispose of the used oil at a proper waste oil disposal site.

5. Fill the crankcase with oil. See the Specification Section on page 3 for the proper quantity. When replacing the oil it will be helpful to tilt the generator back about **10°-15°,** this will allow the oil to enter the filler neck without spilling. See Figure 3.

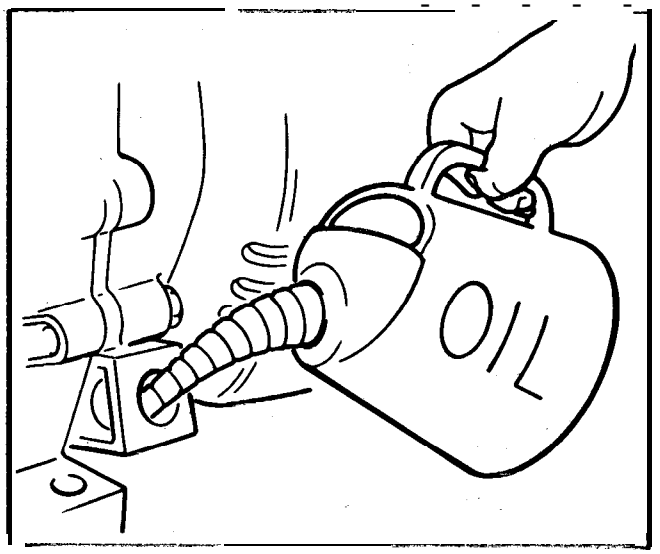


Figure 3

Maintenance - Fuel Sediment Bowl

The **T1200 - T3000** generators are equipped with a fuel sediment bowl and strainer that will filter debris from the fuel and will trap water before the fuel reaches the carburetor. The sediment bowl should be cleaned at least once a season.

Cleaning the fuel sediment bowl will require working with gasoline.

CAUTION: Misuse of gasoline can cause death. Do not work with gasoline around open flames. Do not smoke in the presence of gasoline. Always keep gasoline in a container designed for the storage of flammable liquids.

1. Stop the engine and remove the spark plug wire.
2. Close the fuel shutoff valve.
3. Prepare a drain pan to catch a small amount of gasoline that may be spilled or released when the fuel bowl is removed.
4. Unscrew the plastic'collar retaining the fuel bowl and pull the fuel bowl off the head assembly.
5. Empty the fuel bowl and clean it of any debris.
6. The filter screen is located in the head of the bowl and may be removed and cleaned at this time. See Figure 4.
7. On reinstallation make sure the screen is properly seated to prevent unfiltered fuel from entering the carburetor.
8. Reinstall the sediment bowl and tighten the plastic collar.
9 Turn the fuel valve back on and visually check for leaks.

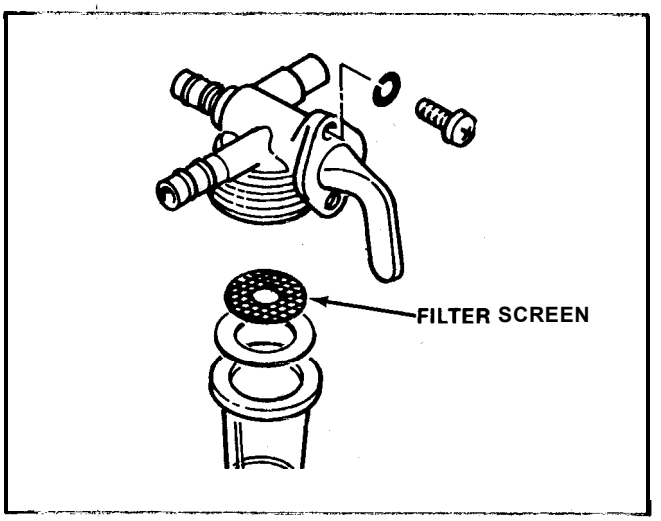


Figure 4

10. Return the valve to the "off' position when the cleaning and inspection are complete.

Maintenance - Frequency Adjustment

All Toro generators including the T1200 - **T3000** are designed to run at a speed of 3600 rpm. The frequency of the **electricity** produced is (controlled by the engine speed) **60** cycles of alternating current per second **(60Hz); This** is, of course, the same as 60 engine revolutions per second or 3600 rpm.

Engine Speed:	3600 rpm
Frequency:	60 Hz

1. Check the engine oil level.
2. Disconnect any load that may be connected to the generator.
3. Start the generator.
4. Connect a load to the generator that is similar to the load the generator is normally under when used by the customer.
5. Adjust the speed of the engine with the speed adjustment screw to 3600 rpm. The speed **adjust-**

Maintenance- Frequency Adjustment (cont'd)

ment screw is located behind the air cleaner and connects to the governor arm.

6. With the engine at 3600 rpm the 60Hz reed on the front of the generator will resonate. (some models are not equipped with a frequency meter.) See Figure **5.**

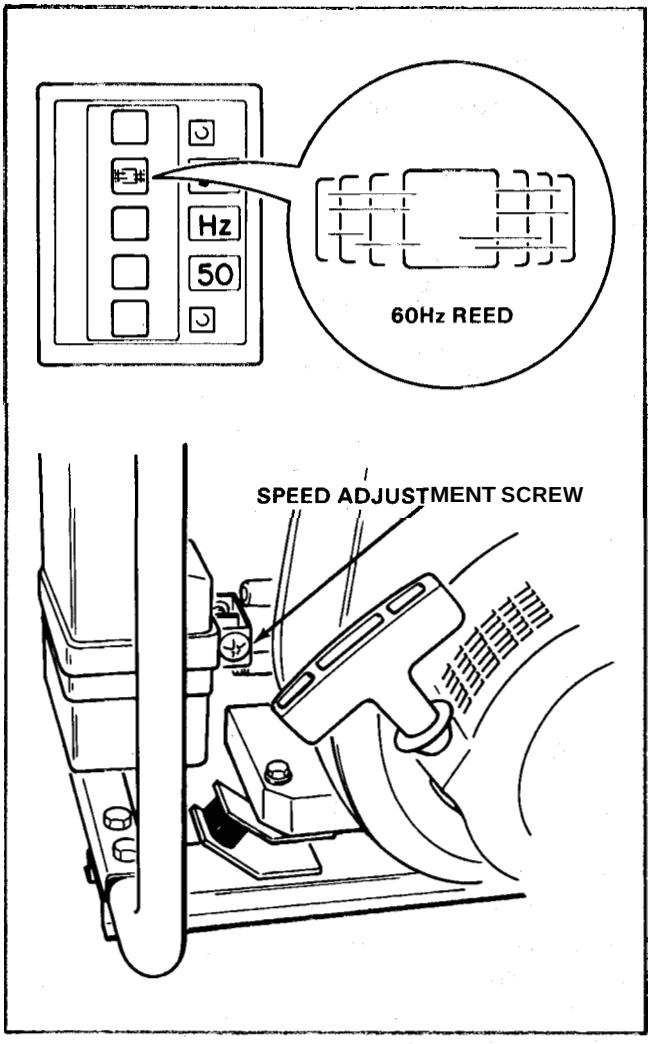


Figure 5

7. The speed of the engine may also be set using a variety of tachometers. Once the engine speed is adjusted to 3600 rpm the electrical frequency will be set at 60 **Hz.**

Maintenance- Valve Clearance

The **T1200** - T3000 generators use side valve engines. The valves are opened and closed with solid cam followers. If the clearance between the end of the valve stem and the cam follower is too small the valve may not close. The clearance is factory set at **.05-.15** mm (.002-.006'"). After many hours of use the valve seat and face may wear causing the valve stem and follower clearance to decrease. If the performance of the engine degrades after many hours of use, the valves may not be closing completely and the valve clearance will have to be adjusted.

Clearance:	**.05-.15** mm (.002-.006") for both intake and exhaust valves.
Adjustment Frequency:	Every 300 hrs

Maintenance- Valve Clearance Inspection

1. Stop /the generator and remove the spark plug wire.
2. Close the fuel shutoff valve.
3. Remove the single screw retaining the air cleaner bracket to the engine block.
4. Remove the two screws retaining the air cleaner assembly to the carburetor.
5. **Pull** the breather hose off the breather assembly.
6. Remove the two screws retaining the breather assembly
7. Remove the breather assembly. Take note of how the gaskets and reed plate are installed.
8. Measure the valve clearance with the engine cold and on top dead center (TDC) of the compression stroke. See Figure **6.**

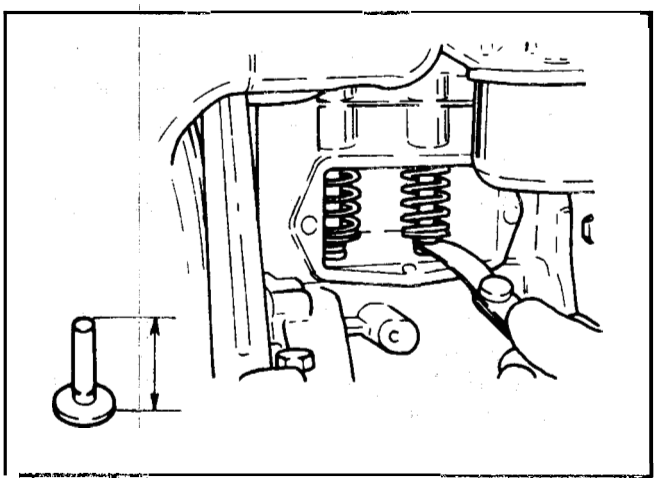


Figure **6**

To determine TDC; remove the spark plug and place: a clean wooden dowel in the spark plug opening **so** the dowel rests on the top of the piston.

Rotate the engine until both valves are closed (watch the cam followers in the breather opening.) When both valves **stop** moving as the dowel reaches the highest point in **its** travel you have TDC of the compression stroke. TDC can be determined with more accuracy by using a depth reading dial indicator.

Maintenance - Valve Clearance Inspection (cont'd)

9. The correct clearance is .05-.15 mm (.002-.006"). If the clearance is not within tolerance, the valves must be removed from the engine and the appropriate amount of material ground off the stem of the valve.

Maintenance - Valve Clearance Adjustment

1. Follow steps 1 - 7 as described above.
2. Remove the fuel hose from the carburetor.
3. Remove two hair pin clips from the bottom of the front control panel. See Figure 7.

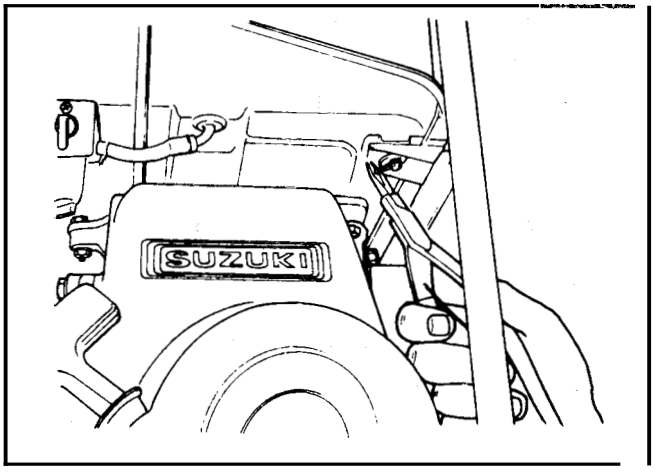


Figure 7

4. Remove two hair pin clips from the bottom of the gasoline tank. See Figure 8.

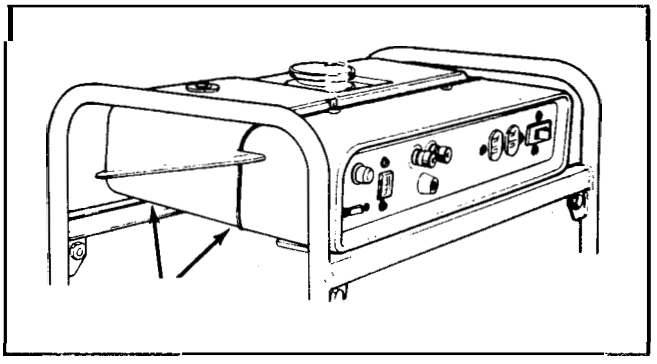


Figure 8

5. Lift the tank and front panel assembly forward and away from the head of the engine.
6. Remove the screws retaining the metal shield on the head of the engine (three screws on the T1200, T1800 and four on the T2500, T3000).
7. Remove the screws retaining the head of the engine.
8. Use a valve spring compressor to remove the valve keepers.
9. Remove the valves.
10. After the valves are removed the ends of the stems should be ground to provide the required clearance.
11. Check the condition of the valve seat and valve face. Recondition the face and seat if necessary.
12. Reinstall the valves and keepers.
13. Reinstall the head of the engine. Consult the Specification Section for correct head bolt torque.
14. Replace the metal shield over the cylinder head of the engine. This shroud is part of the cooling system and must be properly installed.
15. Remount the fuel tank with the four hair pin clips.
16. Install the fuel hose on the carburetor.
17. Reinstall the spark plug wire.

Maintenance - Decarboning Spark Arrester

All Toro generators are fitted with spark arresting mufflers. If the spark arrester is not serviced, the ability of the engine to exhaust will be restricted and the performance of the generator will drop.

Decarboning Interval: 100 hrs

1. Stop the engine.
2. Remove the spark plug wire.
3. Remove the two spark arrester clean out bolts. See Figure 9.

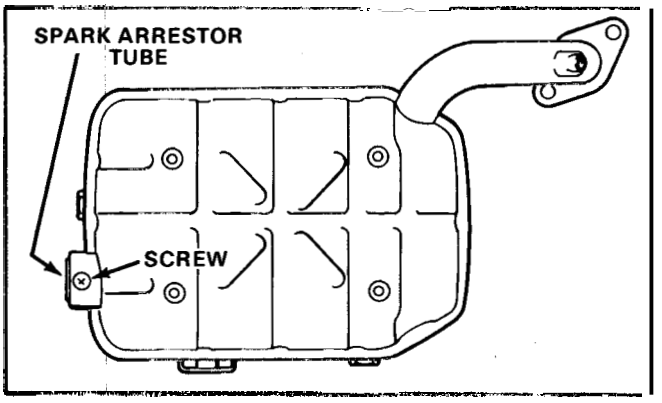


Figure 9

4. Remove the single screw retaining the spark arrester tube in the end of the exhaust pipe and pull the tube out of the pipe. See Figure 9 above.
5. Take the generator to a well ventilated area that is free of combustible material.
6. Start the generator and tap on the side of the muf-

Maintenance - Decarboning Spark Arrester (cont'd)

fler to dislodge any carbon build up within the spark arrester.

CAUTION: Exhaust fumes can cause death. Operate the generator only In a well ventilated area.

CAUTION: The muffler will cause burns if it is touched.

7. Allow the mufflerto cool. Remove any remaining carbon from the clean out ports and the exhaust discharge opening.

8. Reinstall the muffier clean out bolts.

10. Reinstall the spark arrester.

Maintenance - Storage

If the generator is not going to be used for a period of three months or more the following long term storage procedures should be completed:

1. Drain all gasoline from the fuel tank into a container designed for storing flammable liquids.

CAUTION: Misuse of gasoline can cause death. Never smoke while working with gasoline. Never expose gasoline to open flame or fire. Always use proper ventilation while working with gasoline.

2. Start the generator and run the remaining fuel out of the carburetor.

3. Turn the engine over with the recoil starter until you feel the resistance of compression; this will indicate that both valves are in the closed position sealing the cylinder.

4. Drain the existing engine oil and refill the engine with fresh oil.

5. Remove the spark plug and pour one or two tablespoons of oil into the cylinder and replace the plug.

6. Service the air cleaner element. See the instructions on page 24 on air cleaner maintenance

7. Check the tightness of all fasteners.

8. cover the generator and put it away for storage.

SECTION 1 CARBURETOR

Carburetor - Operation

The carburetor receives fuel from the gasoline tank and mixes it with air in the right proportions to provide a highly combustible mixture to the engine.

As the piston moves up on the compression stroke, a partial vacuum is created within the engine crankcase, causing the greater atmospheric pressure to force air to flow through the carburetor into the cylinder. The velocity of the air increases as it flows through the carburetor venturi and the air pressure is reduced at this point to less than atmospheric pressure. The low pressure in the venturi of the carburetor causes atmospheric pressure to push raw fuel from the float bowl into the air stream in the throat of the carburetor, where it breaks up into a fine spray, or becomes atomized, and mixes with the air stream. See Figure 10.

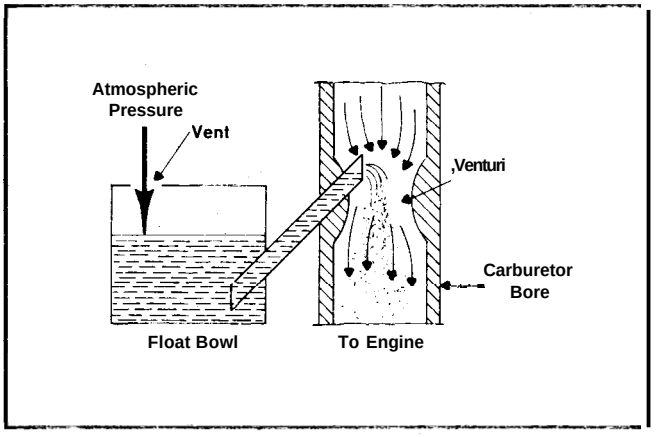


Figure 10

When starting the engine an extra rich mixture is required. The choke plate is closed by the operator to provide an approximate 8:1 ratio of fuel to air for this rich mixture. Closing the choke plate further reduces the air pressure in the venturi to increase the fuel pushed into the carburetor throat. In this condition fuel also flows from the float bowl through the pilot system ports as well as the main discharge tube to achieve the proper starting mixture. See Figure 11.

Fuel atomization becomes more efficient, due to heat, once the engine has reached normal operating temperature. As a result the engine does not require the rich mixture it did for starting and the choke plate must be moved to the open position. The engine speed is now regulated by the throttle plate. In no load conditions a small portion of the fuel may be drawn from the main discharge tube, however the primary fuel supply is drawn from the pilot circuit. Air passing through the pilot jet from the pilot air fitting draws fuel *out* of the pilot jet orifice from the float bowl. This fuel premixes with the incoming air, then is discharged into the intake port of the engine. See Figure 12.

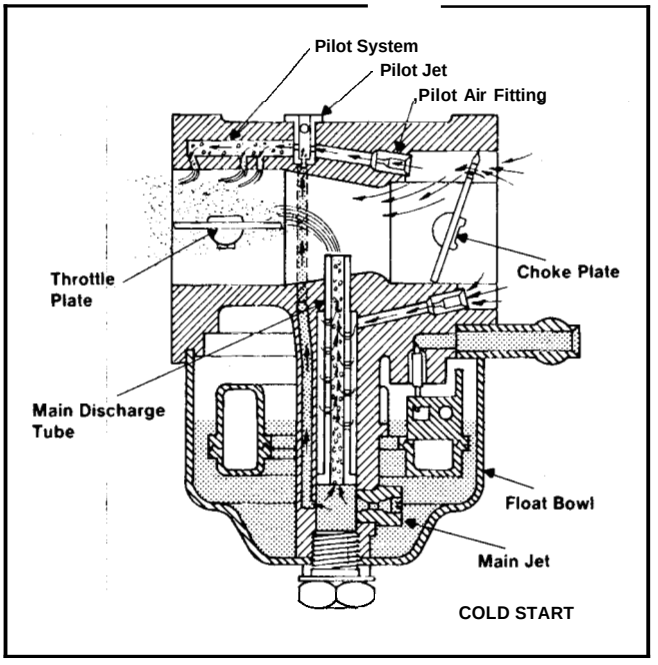


Figure 11

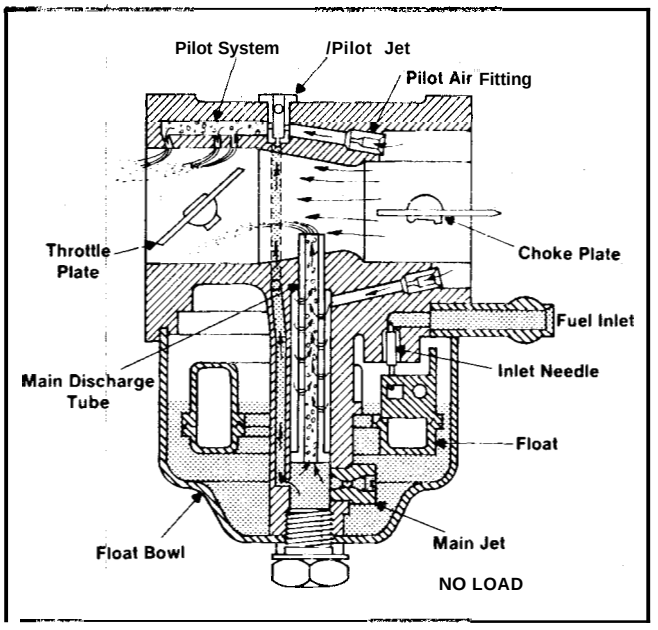


Figure 12

As the throttle plate is opened to compensate for engine load, the main discharge tube becomes the main source of fuel. Opening the throttle plate increases the flow of air through the venturi and strengthens the low pressure area at the main discharge tube. Fuel discharge increases at the main discharge tube as it decreases from the pilot system. Air is drawn from the air correction jet through holes along the length of the main discharge tube. This premixes air with the fuel before it enters the

Carburetor - Operation (cont'd)

carburetor throat for more efficient atomizing of the fuel. See Figure **13.**

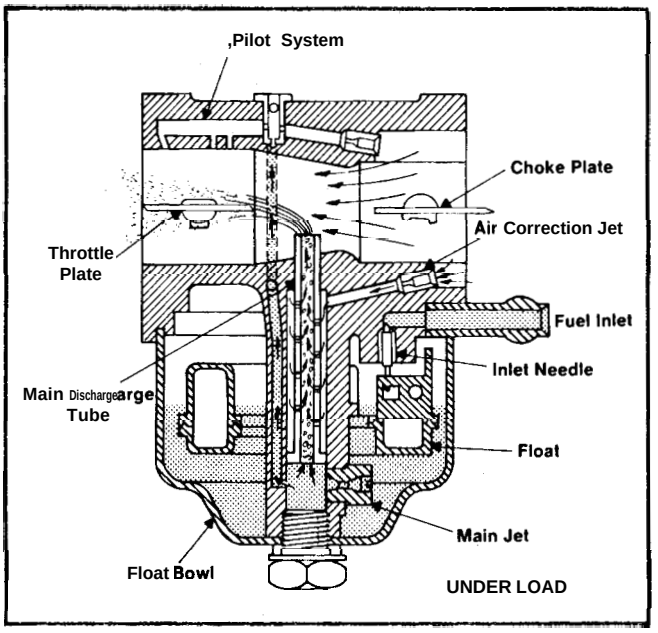


Figure **13**

Carburetor - Removal

1. Stop the generator and remove the spark plug wire.
2. Close the fuel shutoff valve.
3. Remove the single screw retaining the air cleaner body to the engine block.
4. Remove the two screws retaining the air cleaner to the carburetor.
5. Remove the fuel inlet hose.
6. Remove the two nuts retaining the carburetor to the engine. See Figure **14.**

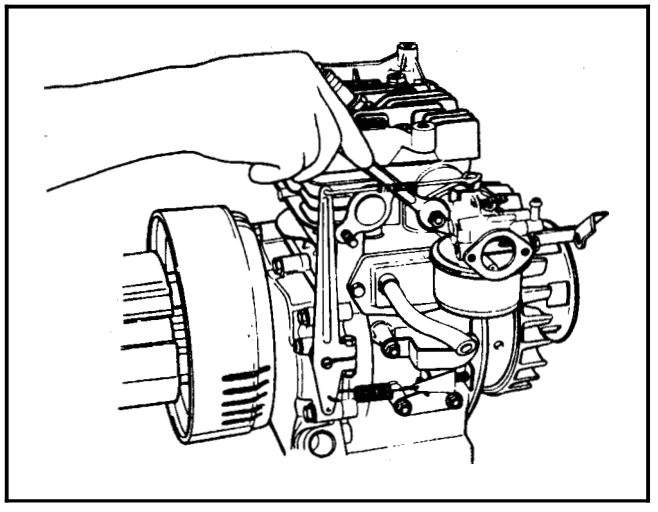


Figure **14**

7. Slide /the carburetor off its studs and disconnect the governor link rod.
8. There will be a small amount of gasoline in the bowl of the carburetor. Drain this gasoline into a suitable container by opening the drain screw on the bottom of the carburetor.

CAUTION: Mishandling gasoline can cause death. Always work with gasoline in a well ventilated area free of open flame or sparks. Do not smoke around gasoline

Carburetor - Disassembly

1. Remove the carburetor bowl nut. It is not necessary to remove the drain screw. See Figure **15.**

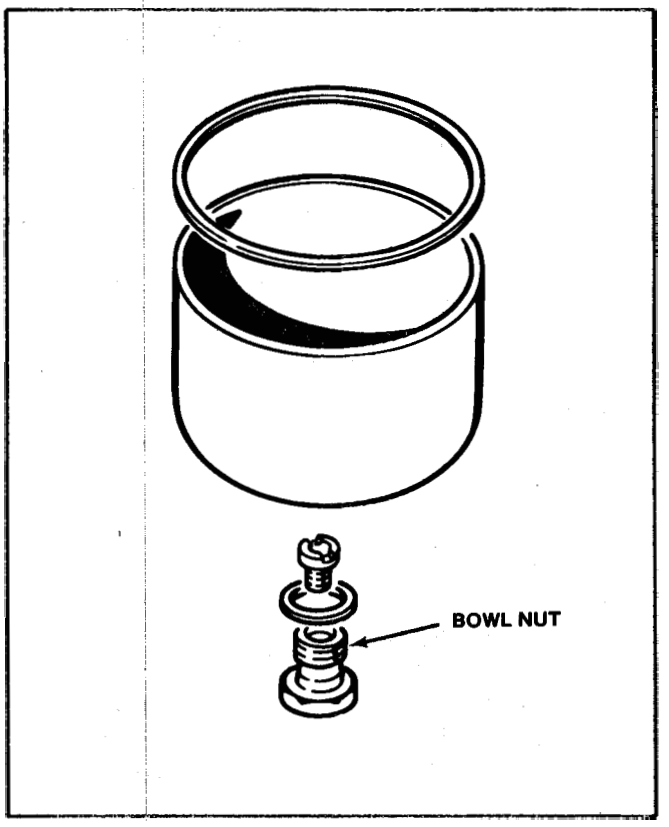


Figure **15**

2. The main jet is threaded into the carburetor bowl nut. The float and inlet needle may be removed by pulling out the float hinge pin. Note: one end of the hinge pin is flattened slightly. The pin must be removed from this end. See Figure **16.**
3. The pilot jet may be removed from the top of the carburetor and can be cleaned or replaced. Fuel flows through the small opening in the end of the

Carburetor - Disassembly (cont'd)

jet and air enters through the holes in the side. The opening on the top of the jet is a drilling passage and is plugged.

The pilot screw controls air in the pilot circuit. It should be open 1 to 1-1/2 turns on all engines. See Figure 17.

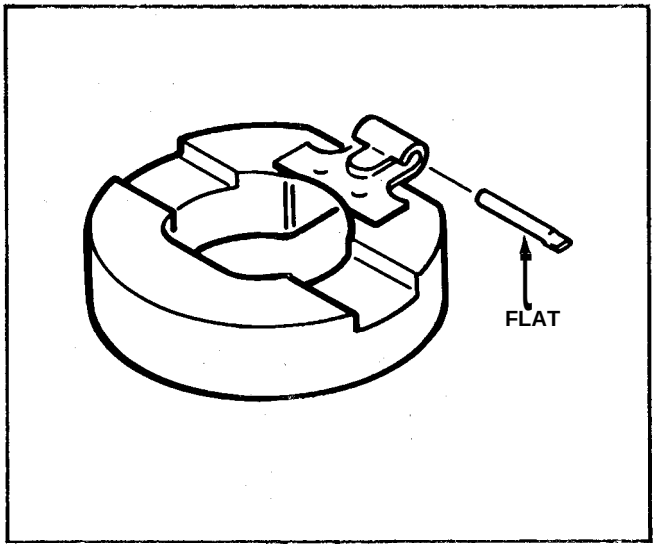


Figure 16

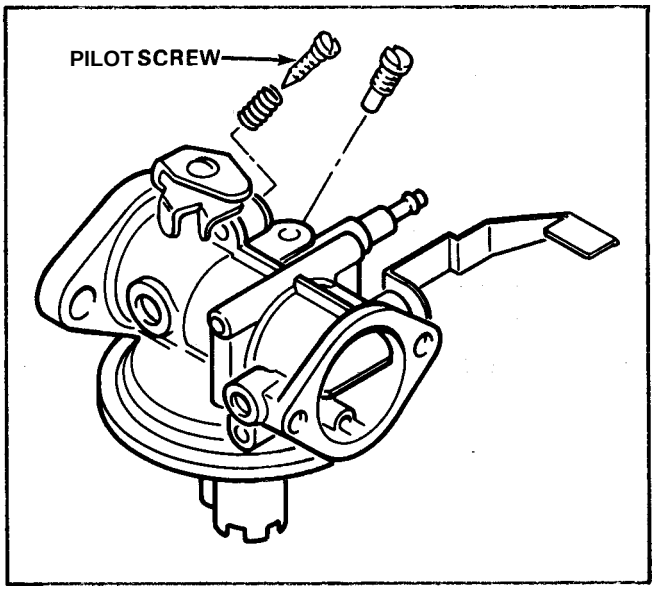


Figure 17

Carburetor - Service

1. The metallic body of the carburetor may be cleaned in carburetor cleaner. Plastic parts may be damaged by some carburetor cleaners.

   Carburetor passages may be cleaned out with compressed air.

2. Replace any components that show wear or damage. The inlet needle is replaceable but the seat is not.

CAUTION: Be sure to wear safety glasses when using compressed air. Use pressure of no more than 40 PSI.

3. If it is suspected that the seat is leaking, the carburetor can be pressure tested after it has been cleaned. Use Toro Pressure tester, Number 41-7910. If the seat is good, it will hold .5 kg/cm^2 (7 psi) for at least 10 seconds. This procedure should be completed with the carburetor turned upside down so the seat holds the needle closed. See Figure 18. If the pressure leaks down, replace the 'needle and try the test again. If the carburetor fails again, the seat is bad and the carburetor must be replaced

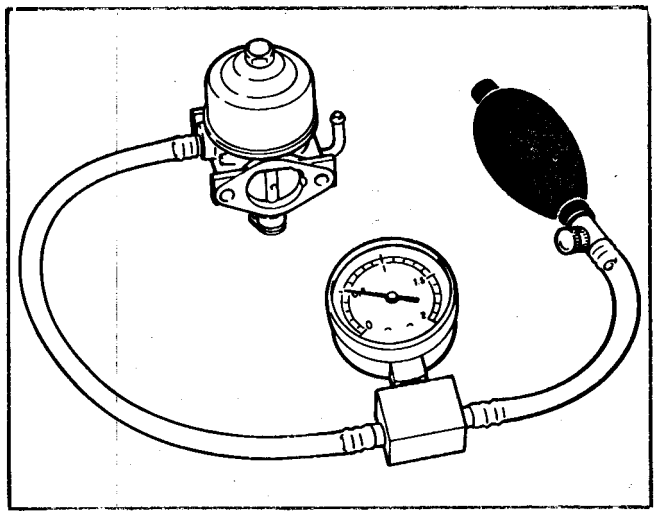


Figure 18

Carburetor - Reassembly

1. Replace the main nozzle and bowl gasket.
2. Install the pilot jet and pilot screw. Refer to Figure 17. The pilot screw should be open 1 to 1-1/2 turns.
3. Hook the inlet needle into the float and secure the float and needle in place with the hinge pin. See Figure 19.
4. Remount the bowl and gasket.

Carburetor - Installation

1. Mount one gasket, one spacer and one additional gasket on the carburetor mounting studs.
2. Connect the tension spring from the governor arm to the throttle shaft.

Carburetor Installation (cont'd)

3. Connect the governor link rod. See Figure 20.

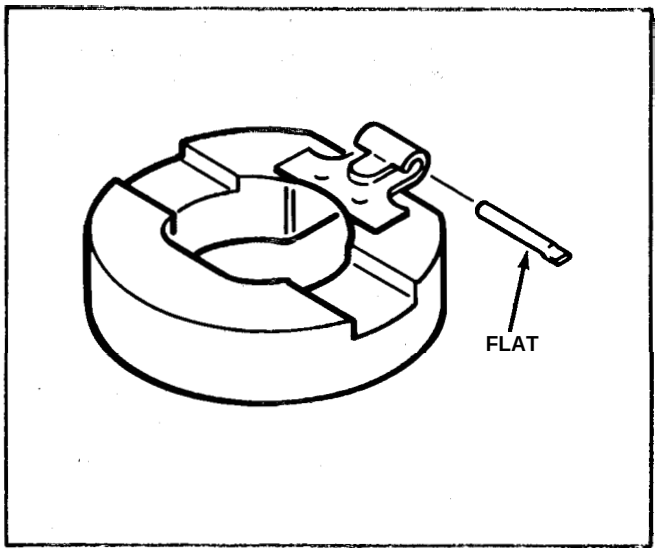


Figure 19

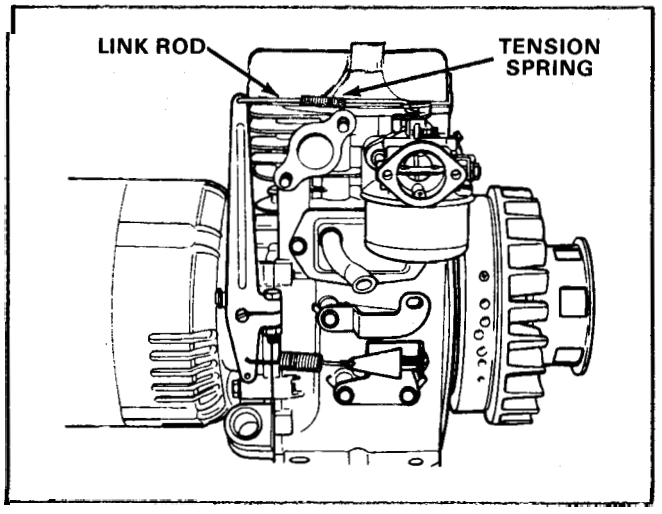


Figure 20

4. Install the carburetor on the mounting studs.

5. Straighten the governor arm if it has been bent to allow connection of the linkage rod to the carburetor.

6. Install the carburetor mounting nuts.

7. Connect the fuel inlet hose.

8. If the governor arm has been removed to provide additional working clearance, make sure it is correctly reset.

   The governor shaft is turned full counterclockwise while the governor holds the throttle plate wide open.

   The governor spring connects in the upper hole of the governor arm. See Figure 21.

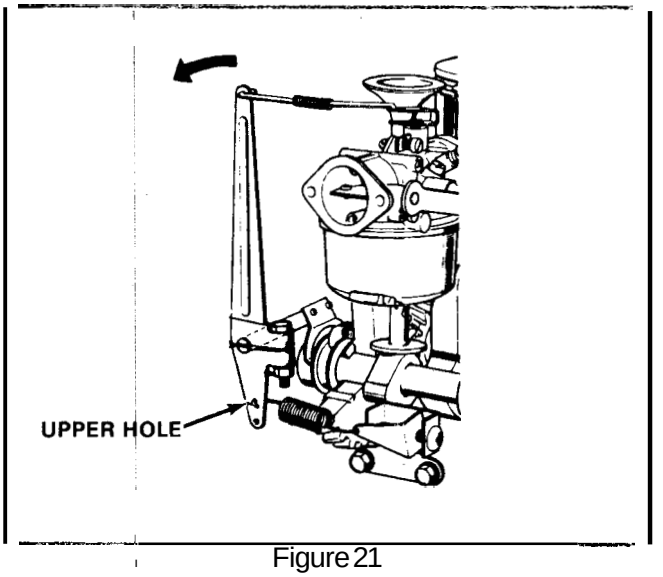


Figure 21

14. Remount the air cleaner body to the carburetor with two screws.

15. Secure the air cleaner bracket to the engine block. Carburetor reinstallation is now complete.

SECTION 2 FUEL SYSTEM

FUEL TANK AND STRAINER

See the Specification Section for the capacity of each fuel tank and approximate running time under full load. The required fuel is regular unleaded gasoline.

Fuel Tank and Strainer - Removal

1. Shut off the generator.
2. Drain the fuel tank. Remove the line on the inlet side of the fuel shutoff valve. See Figure 22.

   NOTE: Have a container suitable for flammable liquids available to receive the gasoline from the tank.

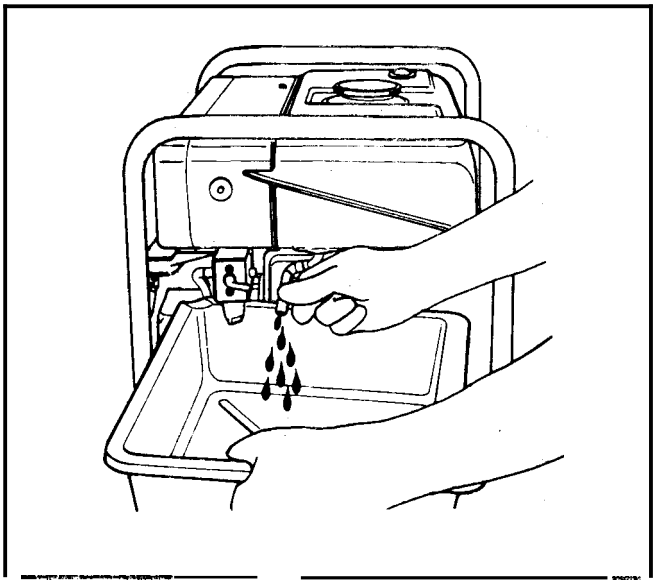


Figure 22

CAUTION: Mishandling gasoline can cause death. Always work with gasoline in a well ventilated area free of open flame or sparks. Do not smoke around gasoline.

3. Remove the fuel tank cap.
4. **Pull** the fuel strainer out of the tank.
5. Examine the fuel strainer for debris and wash it out in a suitable solvent.
6. Remove the four hairpin clips retaining the fuel tank and front panel to the frame of the generator.
7. Lift the fuel tank away from the engine and remove the ***five*** screws retaining fuel tank to the front panel. The fuel tank is now separate from the generator. See Figure 23.
8. Examine the fuel tank for debris and wash the tank with a cleaning solvent if necessary.

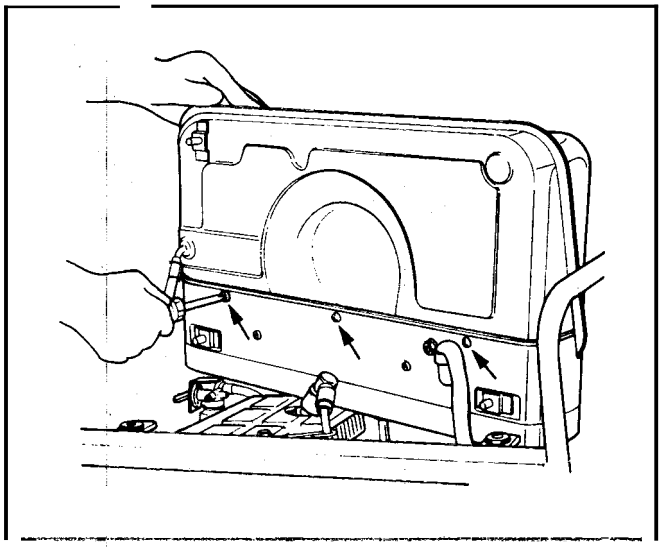


Figure 23

Fuel Tank and Strainer - Installation

1. Install the fuel tank on the front panel.
2. Reset the fuel tank and front panel on the generator frame and install the hairpin clips.
3. Connect the fuel hose to the fitting on the shutoff valve and sediment bowl. If the clamp is bent or distorted it should be replaced.
4. Install the fuel strainer and tank cap.

FUEL TANK CAP

The fuel tank cap is an important **but** often ignored part of the fuel system. It has several important jobs that it must do: It must keep debris, water, etc., out of the tank. It must allow atmospheric pressure into the tank and it must allow any buildup of pressure out of the tank. The cap also has to keep fuel in the tank.

Fuel Tank Cap - Service

1. Examine the condition of the cap. Look for distortion or bending.
2. Examine the gasket. The gasket should indicate an even seal for a full 360 degrees. The gasket part number is 53-1420 for T1200 -:T3000 generators. See Figure 24.
3. Make sure the cap is venting properly. **You** should be able to force air through the cap from the inside out and the outside in. Replace the cap if it does not vent properly.

Fuel Tank Cap - Service (cont'd)

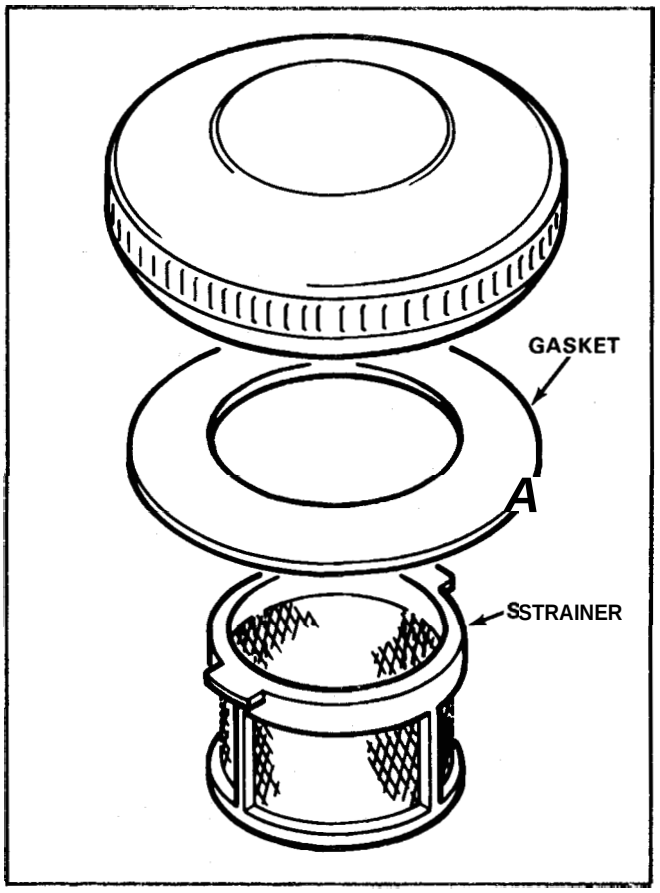


Figure 24

4. Install the cap and make sure the tabs on the cap pull it fully against the tank as it is turned in place.

FUEL SHUTOFF AND SEDIMENT BOWL

The **T1200 - T3000** generators use a combined shutoff valve and sediment bowl. The valve is mounted to the tube frame under the fuel tank. See Figure 25.

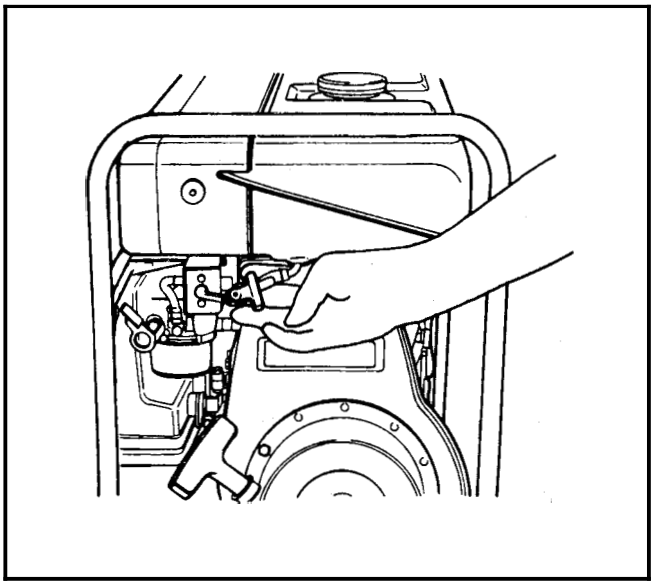


Figure **25**

Fuel Shutoff and Sediment Bowl - Removal

1. Drain the fuel tank. Remove the line on the inlet side **of** the fuel shutoff valve. See Figure **22** on page **33.**

NOTE: Have a container suitable for flammable liquids available to receive the gasoline from the tank.

CAUTION: Mishandling gasoline can cause death. Always work with gasoline in a well ventilated area free of open flame or sparks. Do not smoke around gasoline.

2. Disconnect the outlet hose from the fuel shutoff valve.

Fuel Shutoff and Sediment Bowl - Service

1. Complete service of the valve may be accomplished without removing the valve from its mounting bracket.

2. Remove the sediment bowl by unscrewing the collar around the **bowl.** See Figure ***26.***

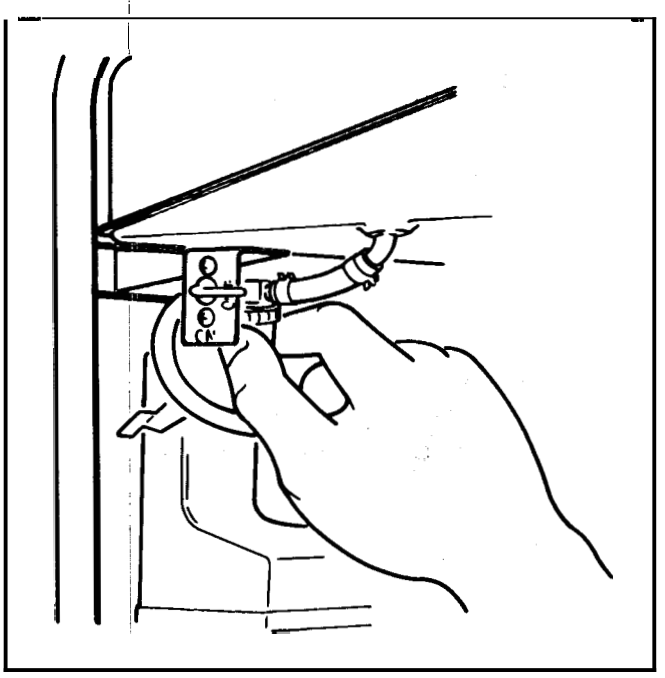


Figure **26**

3. Take note that there is a filter screen in the head of the valve that may be cleaned or replaced as required. The part number of the screen is **50-3770.** See Figure **27.**

4. The valve may be serviced by removing the set screw on the side of the valve. Use care, as the valve stem is under spring pressure and must be restrained as the set screw is loosened.

Fuel Shutoff and Sediment Bowl - Service (cont'd)

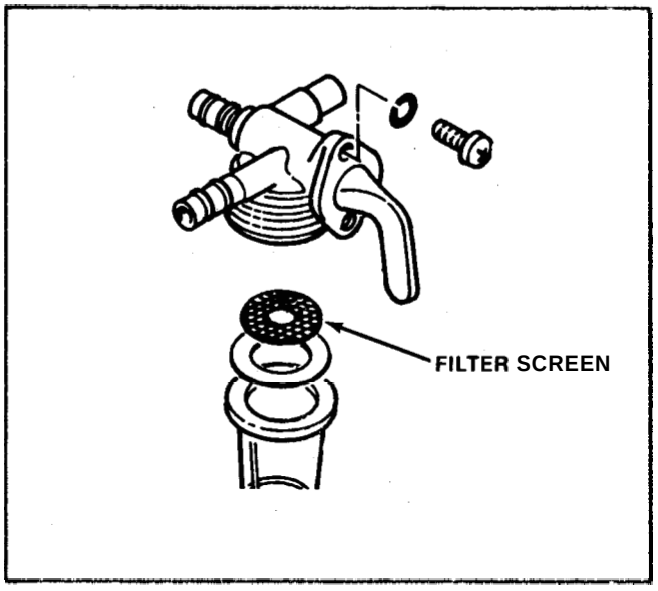


Figure 27

5. After the valve stem is removed, the plastic valve cylinder may be withdrawn with a needle nose pliers.

6. When the stem and valve cylinder are removed, the valve may be cleaned in a nonflammable cleaning solvent.

Fuel Shutoff and Sediment Bowl - Installation

1. Reassemble the valve by inserting the valve cylinder and stem in the body of the valve. Make sure the cylinder and hole in the valve cylinder lines up with the handle of the valve stem. Restriction of fuel flow may occur if the two parts are not indexed correctly.

2. Install the valve stem retaining screw. Make sure the valve is free to turn. If the valve will not turn it is likely that the end of the retaining screw is not located in the slot on the side of the valve stem. The slot is there to limit the rotation of the valve to about 90 degrees.

3. Fasten the valve to its mounting plate with two screws.

4. Install the inlet and outlet hoses to the valve.

SECTION 3 IGNITIONSYSTEM

IGNITION OPERATION

The firing of the spark plug at the proper time is the culmination of a number of components working together. In the T1200 - T3000 generator, the components used are:

- Flywheel
- Ignition coil
- Trigger circuit (molded into the ignition coil)
- Spark plug

See Figure **28.**

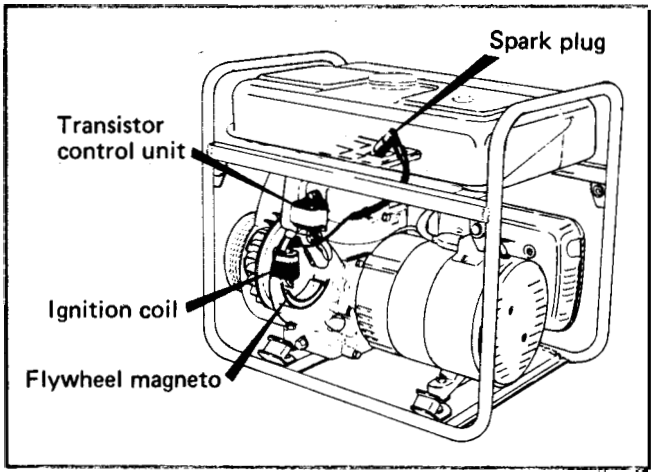


Figure 28

The following describes the function of each of the above components.

Ignition Operation - Flywheel

The engine flywheel is the generating force for the ignition system.

Imbedded in the flywheel are permanent magnets. These magnets rotate past the coil to generate electricity.

Imbedded in the opposite side of the flywheel is a steel counterweight which offsets the weight of the three magnets. It is not magnetic.

Ignition Operation - Ignition Coil

The ignition coil is actually a transformer. It is positioned close to the flywheel to allow the magnetic field of the flywheel magnets to cut through the coils to generate electricity. See Figure 29.

Low voltage is produced in the primary coil which is sent to the trigger circuit. This voltage would be much too low to produce a spark at the spark plug.

The secondary coil serves to amplify the voltage produced in the primary. To accomplish this, the secondary coil must have many more windings than the primary. The higher the ratio between the primary coil to secondary coil windings, the greater the voltage amplification will be.

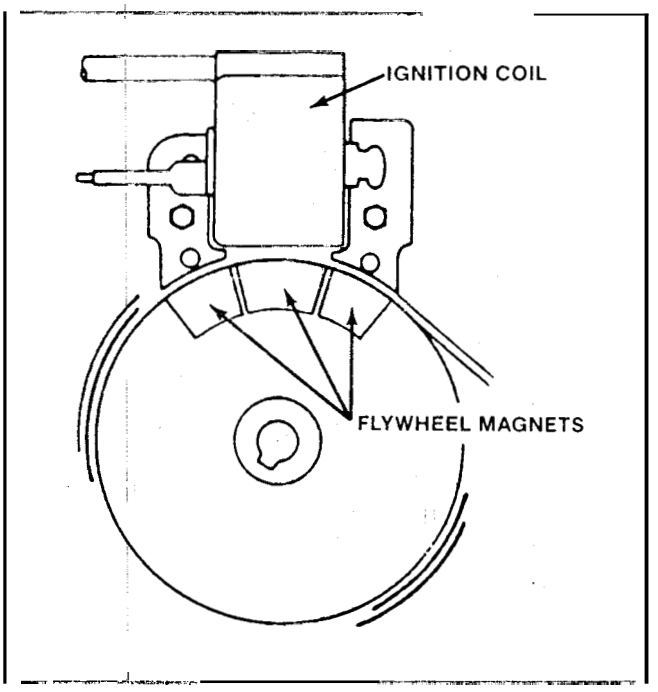


Figure 29

Even though the secondary coil has considerably many more windings than the primary, the voltage produced is still not high enough to produce spark across the spark plug electrodes To further amplify the voltage, the trigger circuit is used.

Ignition Operation - Trigger Circuit

The trigger circuit amplifies the voltage in the secondary coil by breaking the primary circuit just as the primary voltage reaches its peak. This breaking of the primary circuit results in a rapid collapse of the magnetic field surrounding the primary coil. The collapse of the primary magnetic field induces a large voltage surge in the secondary which is sufficient to produce a spark across the spark plug electrodes.

Before getting into the actual electronics used inside the trigger circuit, it is important to have an understanding of the voltage waveform produced by the flywheel magnets moving by the ignition coil. See Figure 30.

As the magnets rotate past the coil, voltage is produced. This voltage, when uninterrupted, is first positive, then negative as the magnet passes by the coil. This effect is caused by the two opposing poles of the magnet.

Explanation of the trigger circuit also requires an understanding of the NPN transistor. See Figure 31.

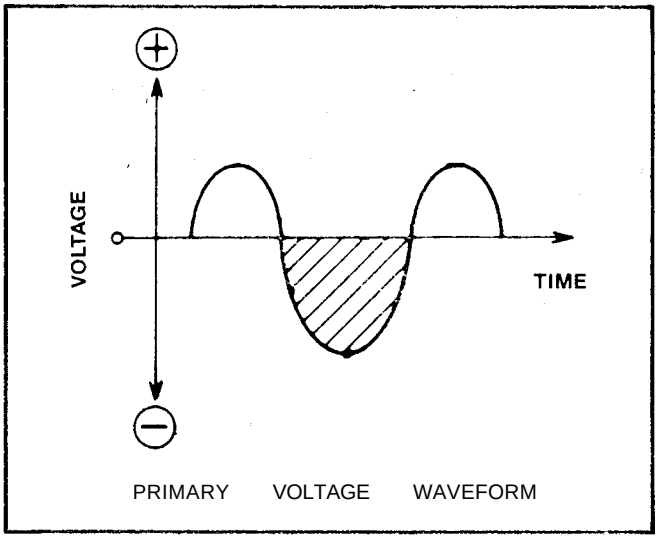


Figure 30

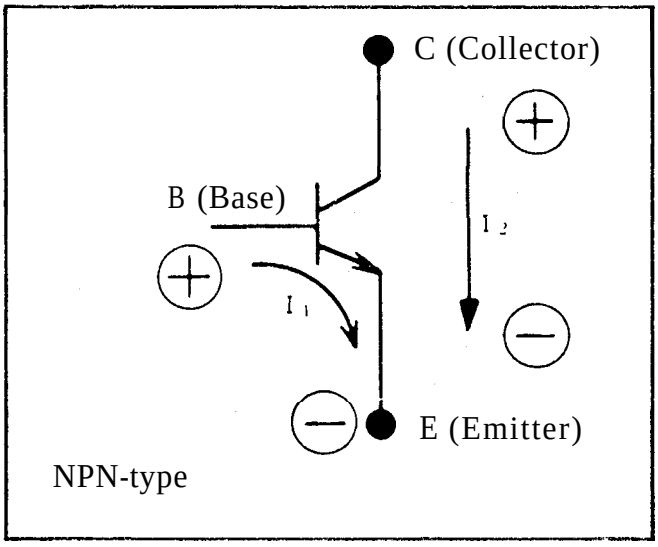


Figure 31

A transistor has a certain minimum voltage that it requires across the base and emitter (points B and E in the Figure above) before it will "turn on". Once it has turned on it allows a small current, I1, to flow as shown above. At the same time the transistor allows a large current, I2, to flow from point C to E. The magnitude of current I2 will vary in proportion to the smaller current, I1. Thus, the transistor functions as an amplifier in that it allows a small current to control a large one.

The following is the process the trigger circuit uses to break the primary circuit to produce spark:

1. The magnet passes by the coil and induces an alternating voltage. See Figure 32.
2. As the voltage begins to increase (approximately point "a" in Figure 30), transistor Tr2 is turned on and current flows from point "c" to point "d" through R3, R4, and Tr2. See Figure 33.
3. Current I1 flowing through Tr2 induces a larger current, I2. Note that current I1 is very small and that I2 is much larger. See Figure 34.

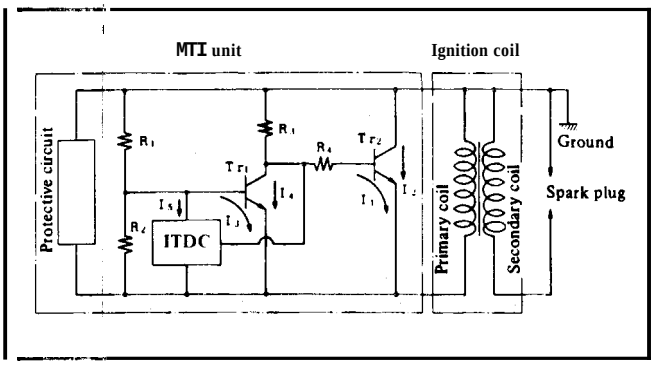


Figure 32

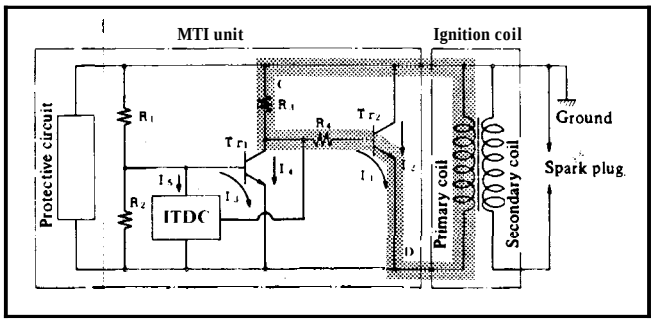


Figure 33

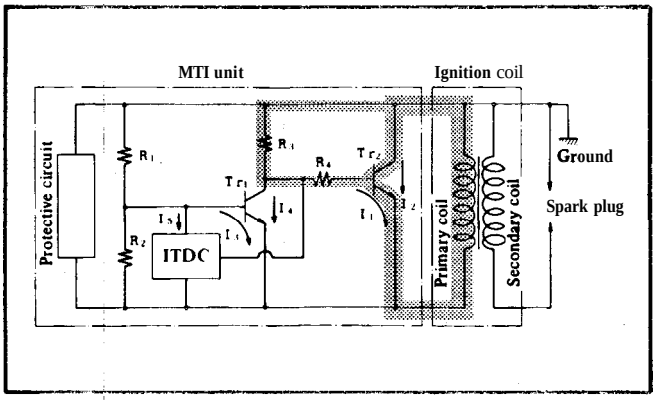


Figure 34

4. When the voltage is at the point "a" level as denoted above in Figure 30, Tr1 is still in the "off' mode and allows no current I3 or I4 to flow. See Figure 35.

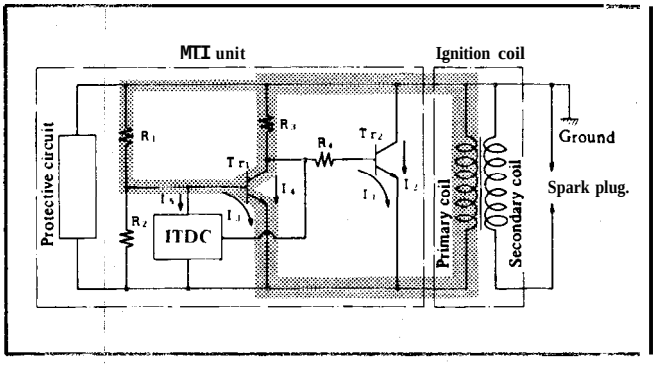


Figure 35

Ignition Operation - Trigger Circuit (cont'd)

5. As the voltage produced in the primary coil reaches its negative peak (point "b" in Figure 39), transistor Tr1 is turned on and allows small current I3 and large current I4 to flow.

6. When transistor Tr1 turns on, nearly all of the current flow through R4 and Tr2 is diverted through path I4 since it is the path of least resistance. This drop in current I1 results in transistor Tr2 turning Off.

7. When Tr2 turns off, current I2 drops rapidly and causes the magnetic field surrounding the primary coil to rapidly collapse. This in turn causes a voltage surge in the secondary which is sufficient to produce a spark across the spark plug.

Ignition Operation - Spark Plug

The spark plug is used to ignite the air fuel mixture by producing a spark just before the piston reaches top dead center. A spark plug is typically constructed as shown in Figure 36.

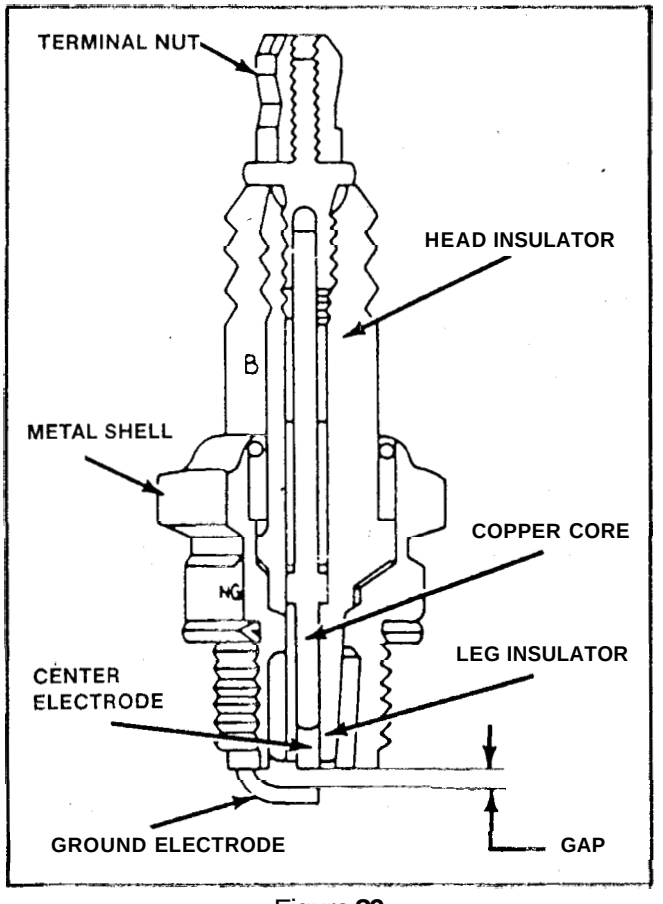


Figure 36

There are two critical areas important to proper spark plug function. The first is that the electrodes are properly gapped and are clean. This ensures that a strong spark will be present and that it occurs at the proper time. Excessive gap or fouling can delay firing enough to cause a loss of power or stalling.

The other important area is the insulator. The insulator prevents arcing from taking place in another portion of the plug, away from the electrodes. Because of the extremely high voltage present, even a slight crack or fouling of the head insulator can result in arcing and a malfunction of the plug.

IGNITION COIL

Ignition Coil - Testing

The operation of the ignition coil should be tested before the product is disassembled.

1. Shut off the fuel supply valve and disconnect any appliances that may be plugged into the generator.

2. Remove the rubber spark plug cover and remove the spark plug.

3. Inspect the spark plug and ensure that it is in good condition. Make sure there are no particles bridging the spark gap.

4. Ground the body of the plug on the side of the engine. Turn the ignition switch on. Pull the starter cord and watch for a spark at the gap of the plug.

5. If there is a strong spark, the ignition module is intact and working properly.

6. If there is a lack of spark, check the oil level in the engine. The engine uses a low oil shut down device that will prevent the engine from starting if the oils low. For operation of the low oil level shut down device, see Low Oil Shutdown, page 44.

7. If the oil level is normal, disconnect the yellow wire connected to the low oil shut down module. Access to the yellow wire may be obtained by removing the single screw that retains a wire connector bracket on the front crossframe of the generator. See Figure 37 for the exact location of the wire.

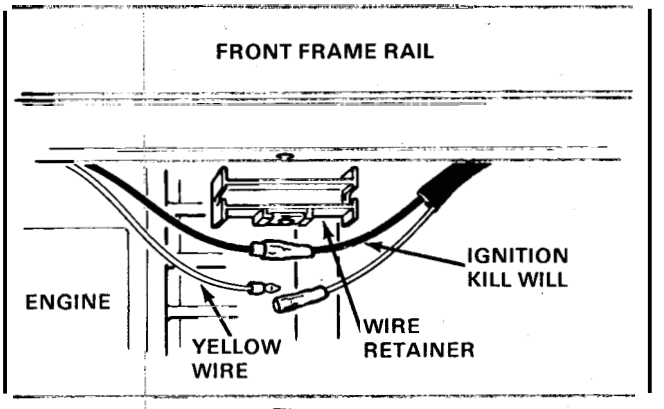


Figure 37

Ignition Coil - Testing (cont'd)

8. Insulate the wire from ground and attempt to start the generator. **If** the ignition has spark the low oil shut down circuit is at fault. See the section on the low oil shutdown circuit, page 44.

9 **If** the ignition has no spark with the low oil shut down circuit disconnected the fault is with the Ignition circuitry and the coil may have to **be** removed. See the section on coil removal below.

Ignition Coil - Removal

1. Stop the generator and remove the spark plug wire.
2. Close the fuel shutoff valve.
3. Remove the four screws retaining blower housing of the generator.
4. **Pull** some slack in the spark plug wire and remove the blower housing.
5. On the T1200 and T1800 the coil is now exposed and may be removed after unplugging the ignition kill wire.
6. T1200 and T1800 generators built in 1983 and all T2500 and T3000 generators have the ignition coil mounted on the engine block behind the flywheel. The flywheel magnets are located on an internal counterbore in the flywheel. The flywheel must be removed to expose the ignition coil.
7 Remove the flywheel nut and the three screws retaining the starter cup. See Figure 38.

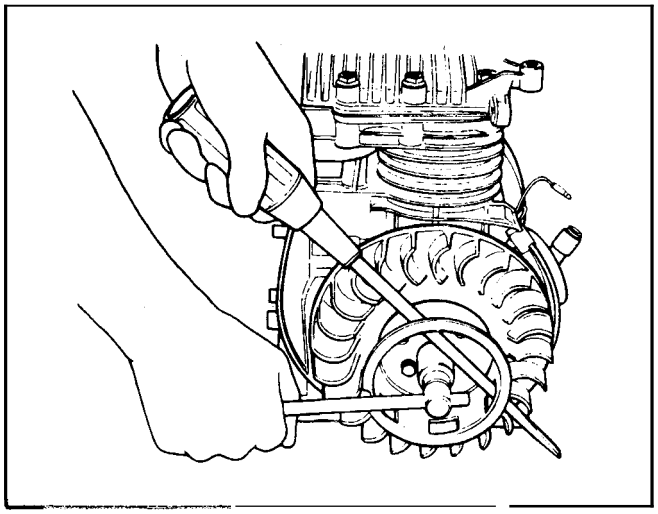


Figure 38

8. Use a puller or remover to remove the flywheel. See the section on special tools on page 19, for the correct tool and part number. See Figure 39.
9. The ignition on T2500 and T3000 generators is now exposed. See Figure 40.
10. Unplug the black ignition kill wire and and the entire coil may be removed.

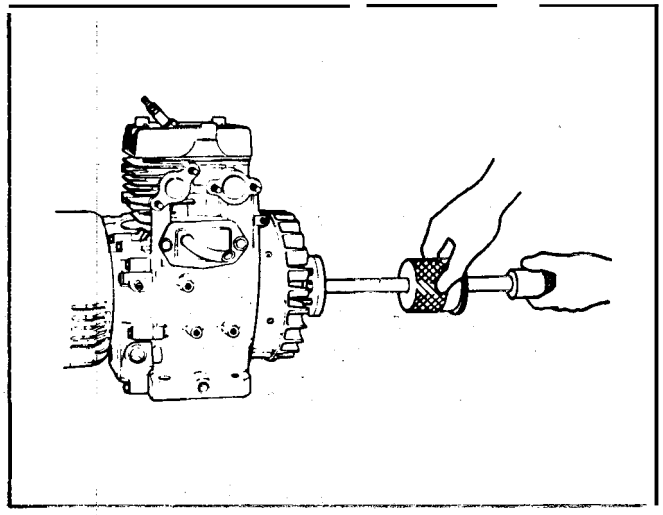


Figure 39

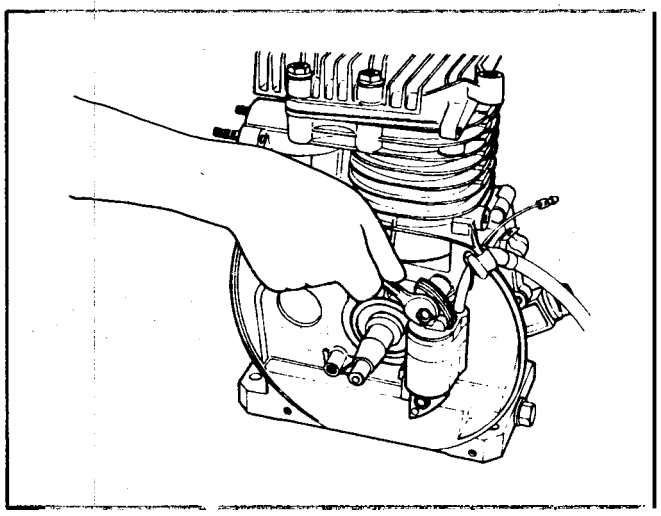


Figure 40

Ignition Coil - Installation

1. Mount the ignition coil on the engine block. On the T1200 and T1800 an air gap ***of*** .381 mm (.015") should be set between the coil and flywheel. On the T2500 and T3000 and 1983 models **of** T1200 and T1800 that have ignition coils that are mounted on the engine block behind the flywheel, the ignition coil location is fixed and no adjustment is possible
2. Route and secure the spark plug wire in the wire retainer on the back of the engine block.
3. On models with internal ignition coils, remount the flywheel. Make sure the taper on the flywheel and the taper on the crankshaft are clean. Torque the flywheel nut to 6.0 - 7.0 kg m (43 - 50 ft lbs) on all engines. See Figure 41.
4. Remount the blower housing with the recoil starter attached.

Ignition **Coil -** Installation (cont'd)

5. Reconnect the Ignition kill wire.

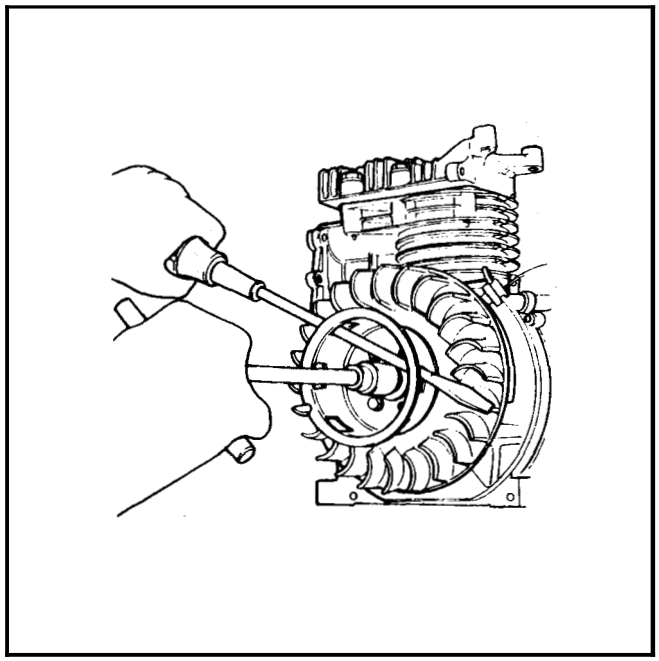


Figure 41

SPARK PLUG

The correct spark plug is an **NGK BP-5HS.** An acceptable substitute is a Champion L92Y or L92YC. The correct gap on the electrodes of the plug is ***.6*** **- .7**mm (.024 **-** .028").

Spark Plug **- Removal**

1. Stop the engine and remove the rubber dust cover.
2. Remove the spark plug wire.
3. Clean debris from around the spark plug **so** dirt does not fall into the engine when the plug **is** removed
4. Remove the plug with a 19 mm (3/4") wrench.
5. Spark 'plugs should not be cleaned by abrasive cleaners and reused. Grit **will** eventually fall out of the plug and cause engine damage. Dirty spark plugs Should be replaced.

Spark Plug **-** Installation

1. Use an NGK **BP-5HS** or Champion L92Y **or** L92YC spark plug.
2. Set the plug gap to **.6 - .7**mm (.024 - .028")
3. Install the plug with a 19 mm **(3/4")** wrench. Do not use a release agent **or** oil on the threads **of** the plug.
4. Torque the plug to 1.2 kg m (8.5 ft lbs).
5. Replace the spark plug wire.
6. Reinstall the rubber dust cover.

SECTION 4 RECOIL STARTER

Recoil Starter - Removal

1. Turn off the generator, shut *off* the fuel and disconnect the spark plug.
2. Remove the three screws retaining the recoil starter. Note the position of the recoil handle for proper reinstallation.

Recoil Starter - Disassembly

1. Begin disassembly by relieving the spring tension on the reel. Pull approximately 30 cm (12") of starter cord out of the reel and hold the reel in place.
2. Place the cord in the notch in the reel and slowly release the reel. This will unload the spring tension without rewinding the cord on the reel.

   NOTE: The rope is wound around the reel in a counterclockwise direction as you are looking at the bottom of the reel. See Figure 42.

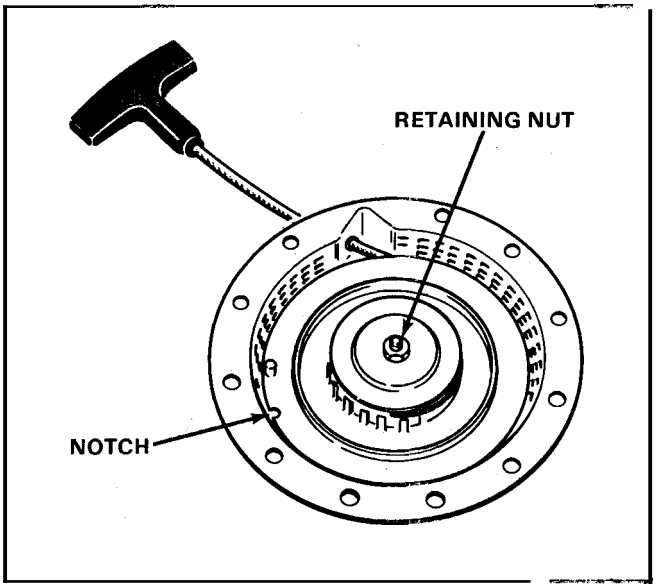


Figure 42

3. Remove the friction disc retaining nut. This nut is under a small amount of spring tension, release **It** slowly.
4. Carefully **lift** off the friction plate. Note how the spring is mounted on the center post and engages the starter pawl. See Figure 43.
5. Remove the starter pawl and pivot pin. See Figure 44.
6. Remove the starter pawl spring.
7. Remove the bushing and nylon washer from the center post of the starter assembly. See Figure **45.**

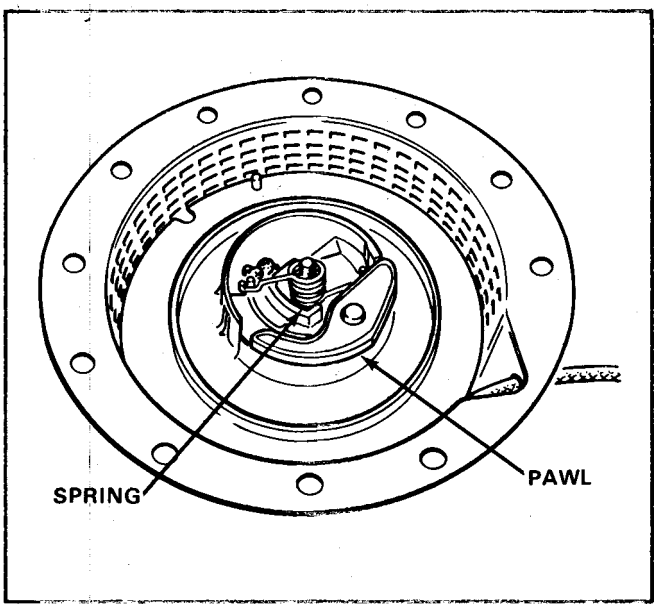


Figure 43

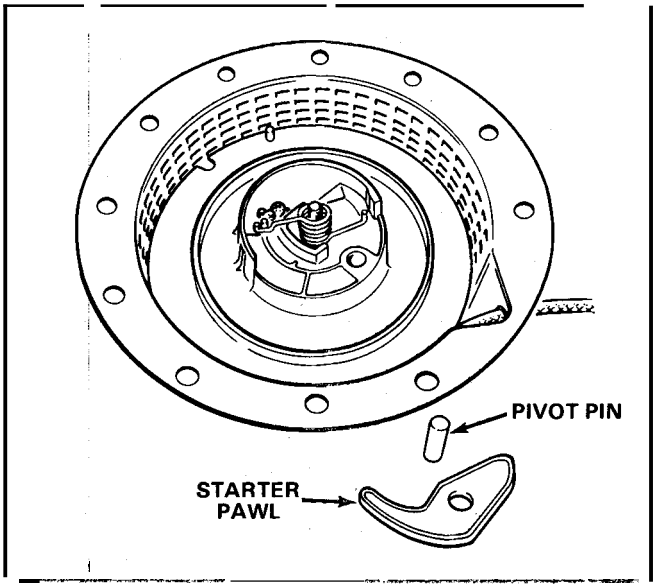


Figure 44

8. R,emove the knot from the starter grip and remove the grip.
9. If, replacement of the starter rope is all that is necessary the rope may be removed and replaced at this time.
10. Lift the reel out of the starter housing. Be careful not to disturb the coil spring under the reel.

CAUTION: The recoil spring may cause injury. The spring is captured in the recoil housing and may rapidly expand out **of** the housing if disturbed or dropped.

Recoil Starter - Disassembly (cont'd)

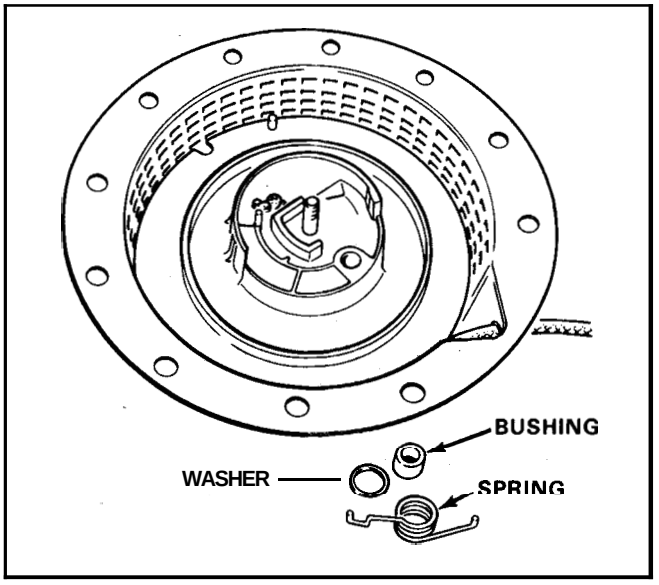


Figure 45

11. The coil spring should not be removed unless it is broken and needs to be replaced. Use extreme care when relieving spring tension. Hold the body of the spring in place with a gloved hand and slowly withdraw the spring from the inside out with a pair of pliers until the spring is completely relaxed.

Recoil Starter - Reassembly

1. New recoil springs are secured with a wire around the circumference of the spring. Install it in the spring case with the outside hook of the spring engaging the slot in the outside rim of the spring case. See Figure 46.

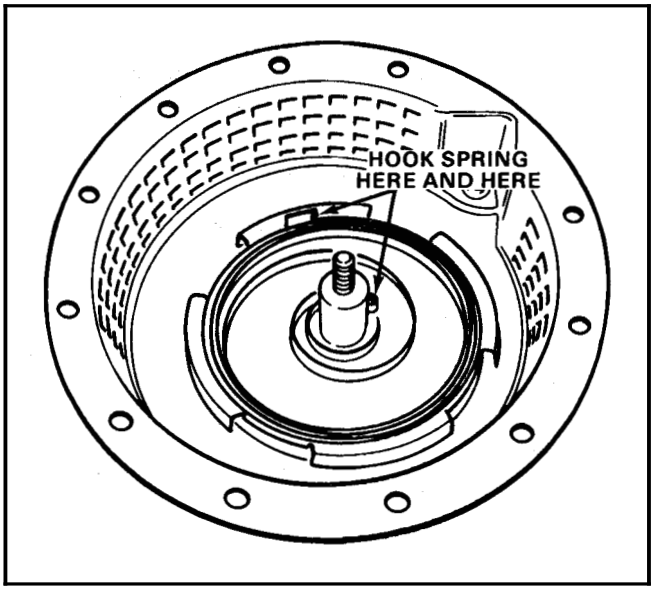


Figure 46

2. The inside hook of the recoil spring engages the slot on the inside diameter of the recoil housing.

3. If the recoil rope has been removed insert a new rope and wind it in a counterclockwise direction around the reel. The recoil rope is approximately **120** cm **(48')** long.

4. Feed the end of the rope through the opening in the recoil housing and attach the "T" handle.

5. Install the reel. The bosses on the inside diameter of the reel engage the slots on the outside diameter of the /springcase. See Figure **47.**

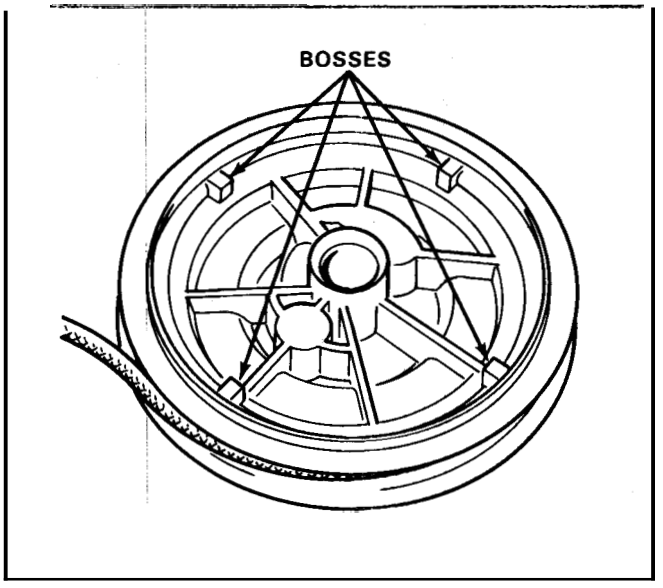


Figure 47

6. Install the starter pawl pivot pin. Then install the starter pawl. See Figure **48.**

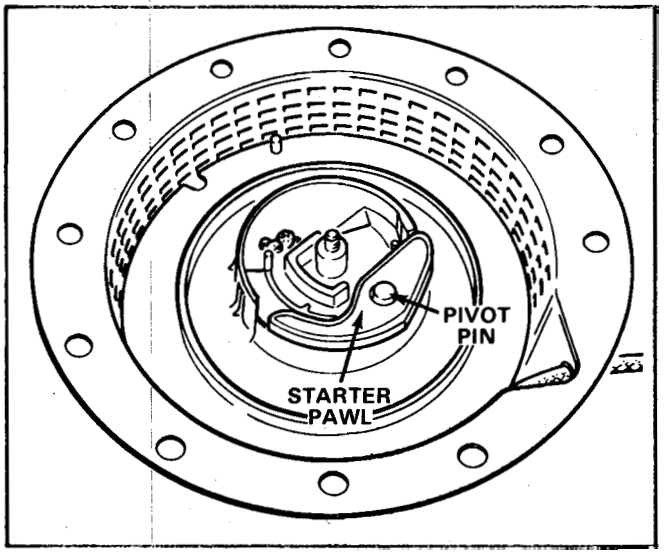


Figure 48

7. Mount the bushing and nylon washer on the center post of the recoil assembly.

8. Install ;the spring and friction disc. Make sure the spring engages the starter pawl. Refer to Figure **43.**

9. Install the friction disc retaining nut.

Recoil Starter - Reassembly (cont'd)

10. **Pull** about 30 cm (12') **of** cord out of the recoil. Turn the reel (it will now **be** under some spring tension) **so** the notch in the outside diameter of the reel lines up with the cord as it leaves the recoil assembly. **Pull** about **15** cm **(6')** of cord **up** into the notch and rotate the reel counterclockwise one or **two** revolutions to provide sufficient spring tension to pull the cord back into the recoil assembly when released.

Recoil Starter - Installation

1. Mount the recoil assembly to the generator with the recoil grip facing the front of the generator.
2. Reconnect the spark plug wire.

SECTION 5 LOW OIL SHUTDOWN

LOW OIL SHUTDOWN CIRCUIT

Low Oil Shutdown Circuit -Purpose

If the engine oil drops below a safe level or if the engine is operated at an extreme angle, the oil alarm will turn on a warning light and at the same time ground the engine ignition.

Low **Oil** Shutdown Circuit **-** Operation

The circuit operation is described in the following steps. Please see Figure **49** to help clarify how the circuit works.

1. There is a magnetic float in the sump of the engine that will close the contacts of a reed switch when the oil level drops to the "low" point on the dipstick.
2. The reed switch completes a circuit to ground that turns on a silicon controlled rectifier **(SCR).**
3. The **SCR** closes a circuit that turns on the warning light and at the same time grounds the engine ignition.
4. The light remains illuminated until the engine stops rotating. The engine cannot be restarted until the oil level is returned to normal.

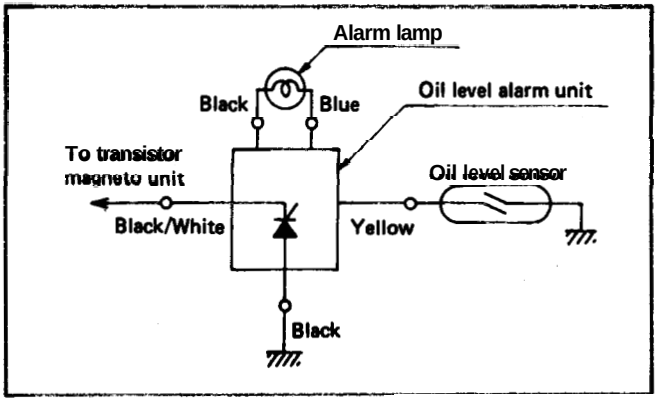


Figure **49**

5. The operation of the **SCR** may be verified by grounding the yellow wire while the engine is running. The yellow wire is at magneto potential and the engine should stop as soon as the wire is grounded.
6. If the engine does not stop with the yellow wire grounded the module containing the **SCR** is defective and must be replaced.
7. The operation of the oil switch may be verified by checking continuity between the switch connecting wire and ground. With the correct amount of oil there should be no circuit to ground. With low oil there should be a complete circuit to ground.

Low **Oil** Shutdown Circuit **-** Testing

Verify the operation of the float operated switch in the sump by checking for continuity between the yellow wire coming off the switch and the engine block.

1. Stop the generator by turning off the ignition switch.
2. Locate the yellow wire from the float switch. It is routed, along the inside of the blower housing and exits the blower housing along with the spark plug wire.
3. The wire is retained by a plastic clip to the crossbar of the tube frame on the front of the generator. Remove the clip with one screw and disconnect the wire See Figure *50.*

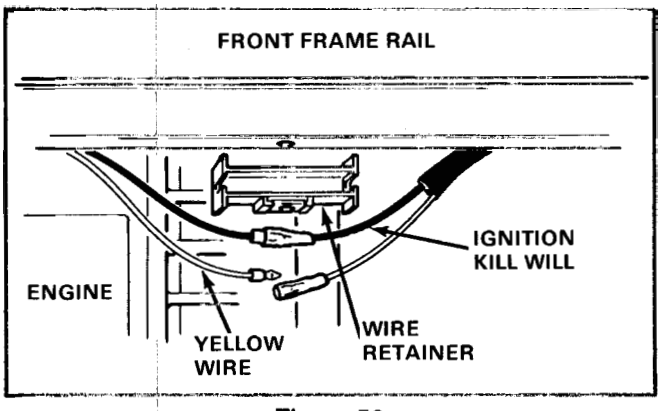


Figure 50

4. Place the probe of a continuity tester or resistance tester (**R x** 1 scale) on the terminal end of the yellow wire coming from the engine block.
5. Place the other probe of your tester on the engine block itself.
6. With the proper level of oil there should be no continuity.
7. Drain the oil out of the engine and complete the test again With no oil there should be a complete circuit between the yellow wire and ground.

a. If the switch operates normally but the engine does not stop with low oil or will not run with a normal oil level, the low oil shutdown module may be defective.

9. The low oil shutdown module on the T1200 - T3000 is located inside the control panel of the

Low Oil Shutdown Circuit - Testing (cont'd)

generator. Remove the six screws retaining the front panel and disconnect the module. See Figure **51.**

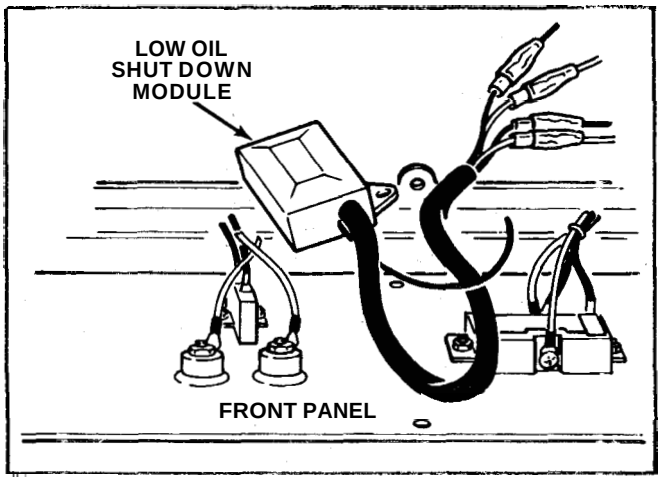


Figure **51**

10. Replace the module by separating it from the harness and install a new unit.

LOW OIL SHUTDOWN SWITCH

Low Oil Shutdown Switch - Removal

1. Stop the engine and remove the spark plug wire.

2. Close the fuel shutoff valve.

3. Place a drain pan under the engine and remove the oil drain plug.

4. Remove the two engine base mounting bolts. With the bolts removed, use a prying tool to **lift** the engine to increase clearance between the base of the engine and the tube frame crossbar.

5. Remove the four screws retaining the oil level switch. See Figure ***52.***

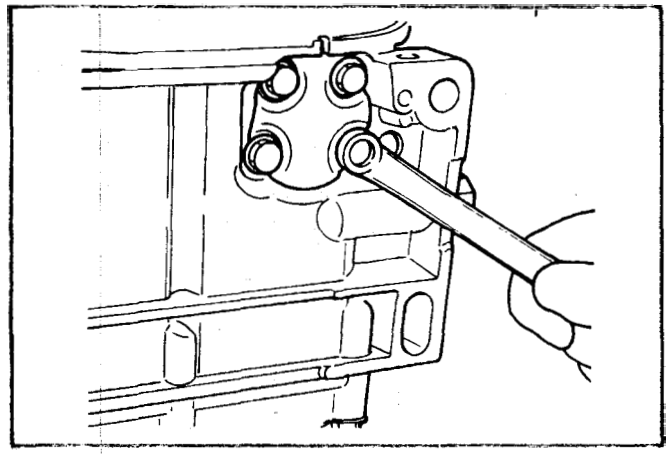


Figure 52

4. Repair of the float switch is not possible. **If** the switch is defective (determined by continuity testing) it must be replaced.

Low Oil Shutdown Switch - Installation

1. Replace the gasket if necessary.

2. Make sure the float is free to move, and install the float assembly in the bottom of the engine.

3. Ground the short wire with the eyelet to the bottom of the engine.

4. Install the wire protector and route the yellow wire with the grommet out from underneath the bottom of the engine.

5. Reconnect the yellow wire to the single connector with the yellow wire from the oil shutdown module.

6. Connect the wire retainer clip to the tube frame crossbar.

7. Remount the engine **base** to the tube frame.

8. Replace the drain plug and fill the engine with the correct amount of engine oil. See the Specification Section for the correct type and amount.

9. Reconnect the spark plug wire.

SECTION 6 ENGINE

Engine - Disassembly

1. Turn the engine off and remove the spark plug wire.

2. Remove the fuel hose and drain any gasoline remaining in the tank. See Figure **53.**

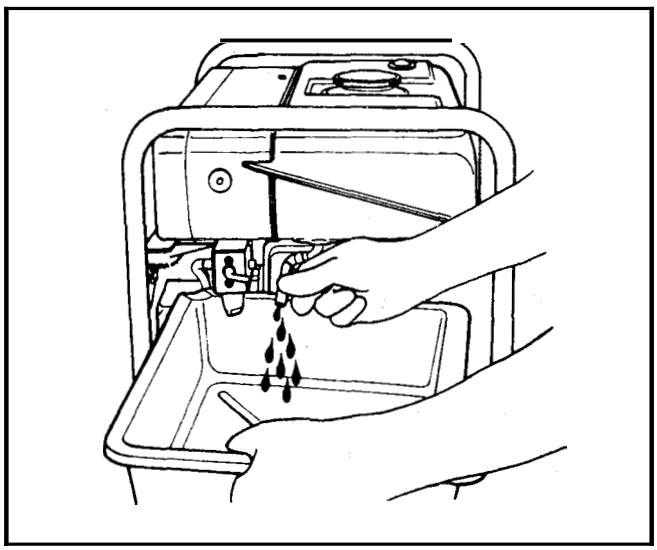


Figure **53**

CAUTION: Misuse of gasoline can cause death. Do not work with gasoline around open flames. do not smoke in the presence of gasoline. always keep gasoline in a container designed for the storage of flammable liquids.

3. After draining the fuel, crimp or seal the end of the hose to prevent the entrance of dirt.

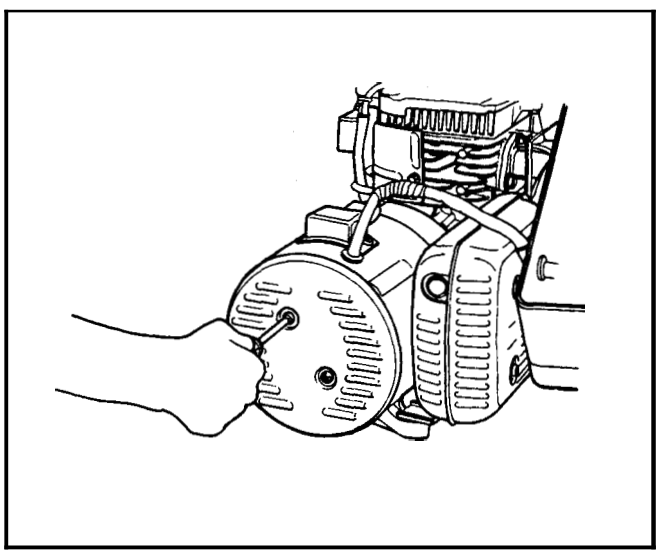


Figure **54**

4. Drain the engine **oil** as described in the Maintenance Section on page **24.**

5. Remove the end cover of the generator. See Figure **54.**

6. Disconnect and remove the AC output wires at the terminal block. See Figure **55.**

7. Disconnect the control wiring plug on the top of the generator assembly. See Figure **55.**

8. Unplug the black ignition kill wire and the yellow low oil shutdown wire. These are located on the front of the generator under the frame crossbar. See Figure **56.**

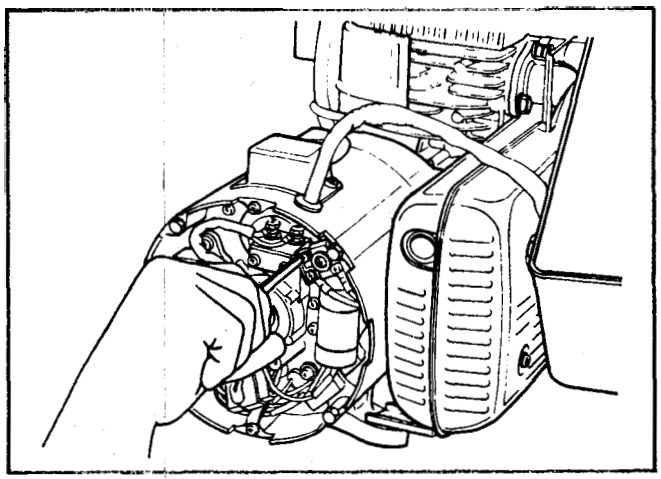


Figure 55

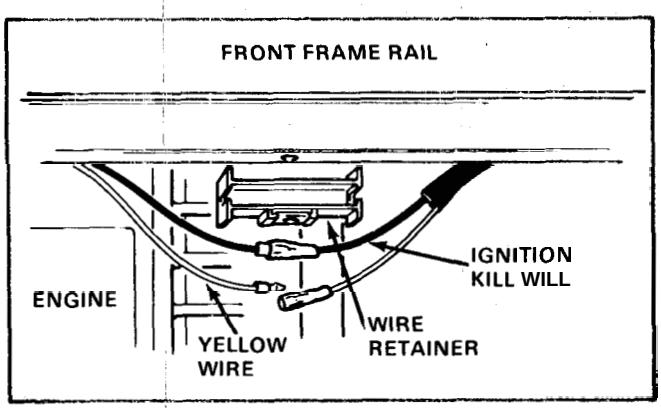


Figure 56

9. Remove the hair pin clips retaining the fuel tank and front panel to the frame of the generator. See Figure **57.**

10. The gasoline tank and front panel may now be lifted away from the generator.

11. The upper tube frame may be removed to provide additional clearance. Remove the four bolts retaining the frame halves. See Figure **58.**

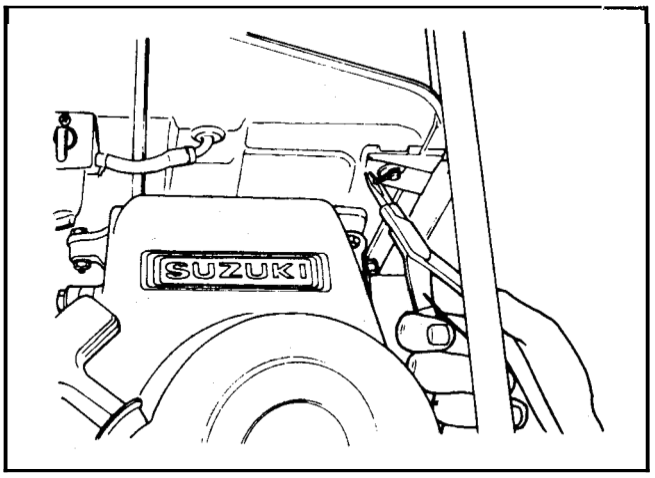


Figure *57*

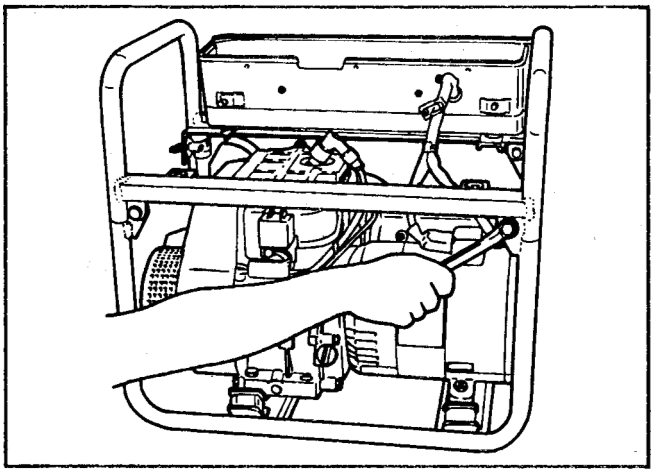


Figure *58*

12. Remove the engine and generator from the tube frame by removing the four mounting bolts. See Figure **59.**

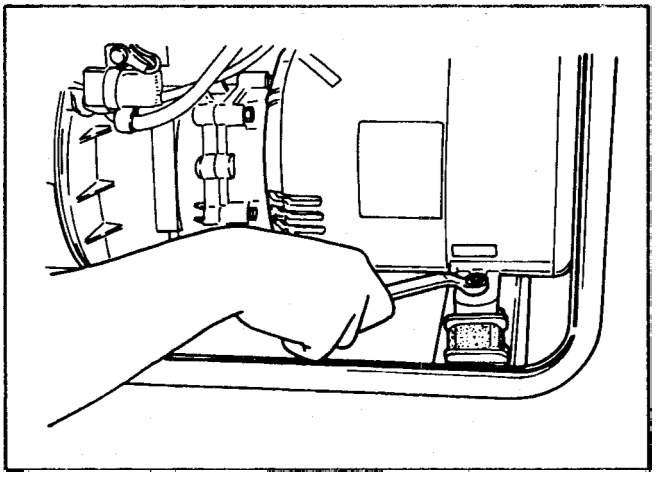


Figure **59**

13. To completely tear down the engine the generator must be removed from the engine. Continue disassembly by removing the brush holder. See Figure 60.

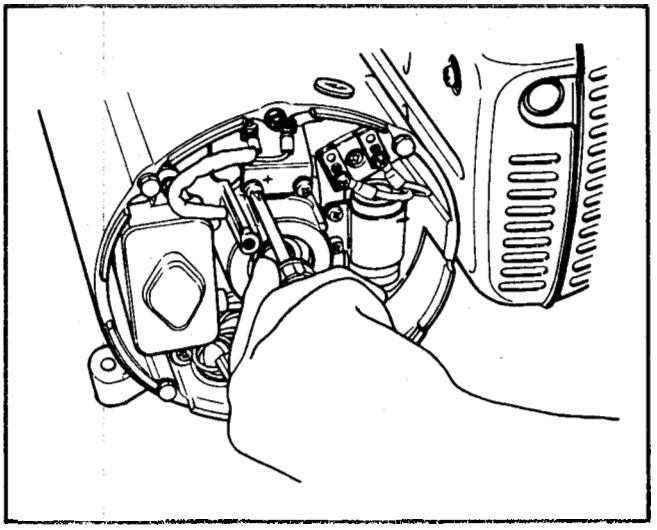


Figure *60*

14. Remove the four generator through bolts. See Figure 61.

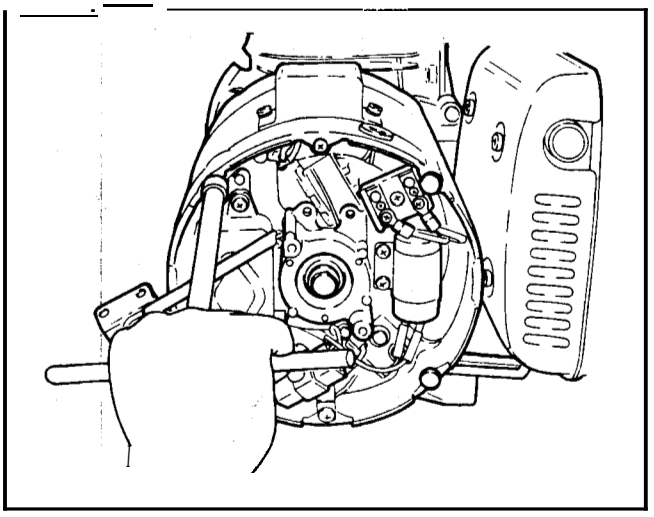


Figure 61

15. Use a plastic hammer to remove the end cover and stator assembly. See Figure 62.

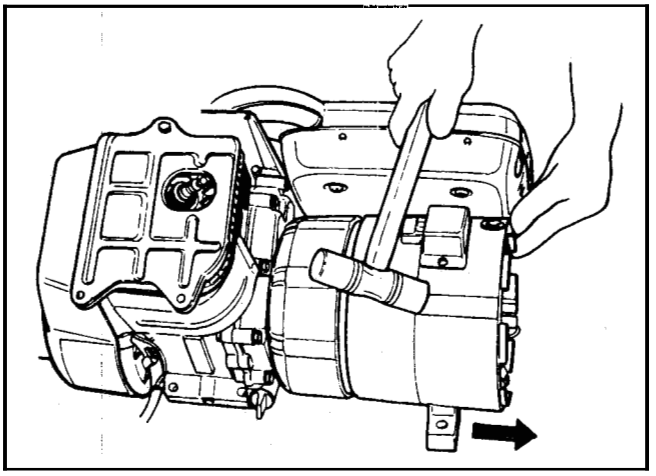


Figure 62

16. Remove the recoil starter as shown in Figure 63.

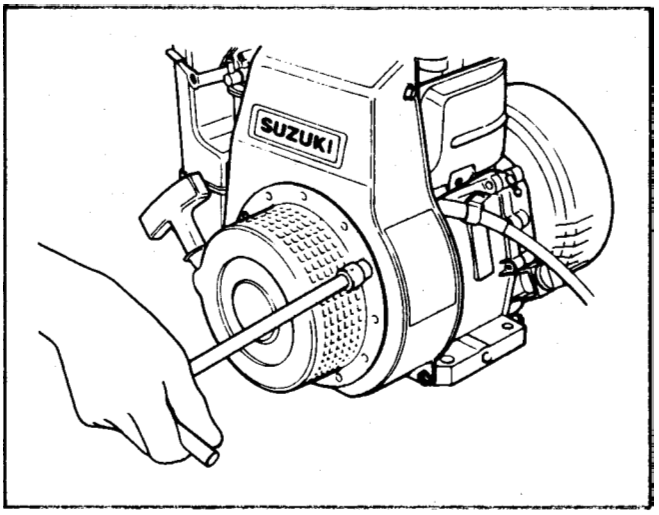


Figure 63

17. Hold the crankshaft in place with a screwdriver or bar through the recoil starter cup and remove the rotor set bolt. See Figure *64.*

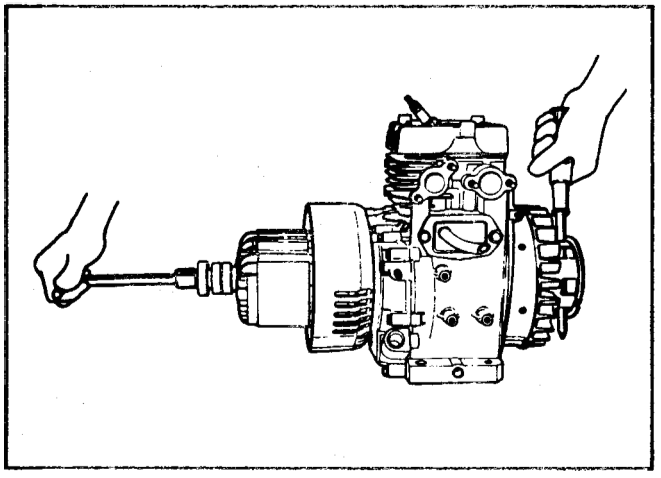


Figure **64**

18. Remove the blower housing and all other sheet metal from the engine.

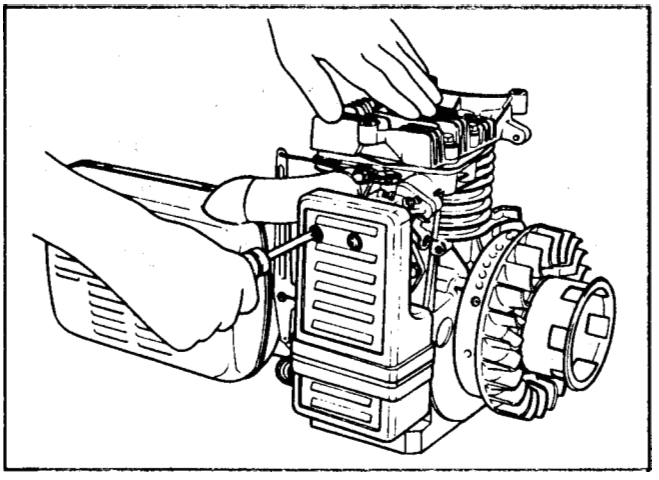


Figure **65**

19. Remove the air cleaner assembly as shown in Figure *65.*

20. Remove the two nuts securing the muffler to the engine. See Figure 66.

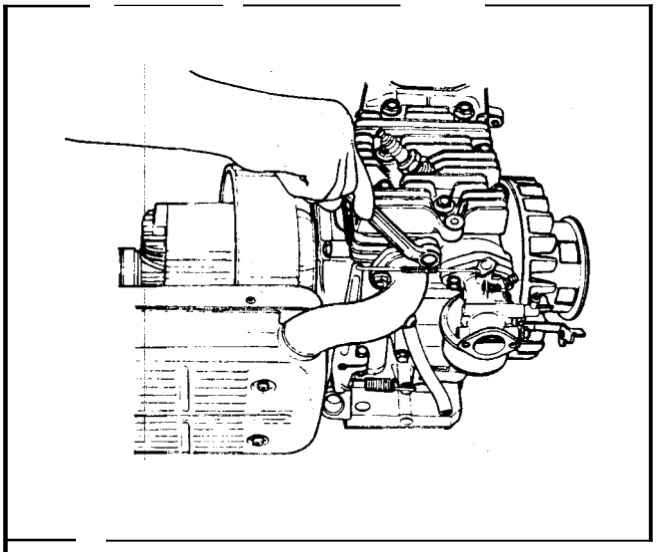


Figure 66

21. Remove the carburetor. Use care as the carburetor fuel bowl will still contain gasoline. See Figure **67.**

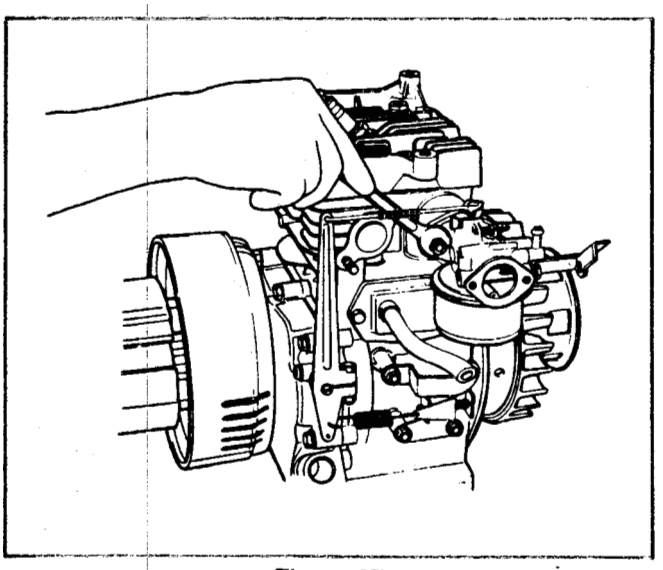


Figure 67

22. Remove the carburetor bowl and drain the gasoline into a suitable container.

23. Use a rotor remover bolt (see the Special Tool Section on page **19** for the correct part number) to remove the rotor assembly. The rotor is secured to the crankshaft of the engine with a tapered fit. The crankshaft has an external taper and the rotor has an internal taper. See Figure **68.**

24. Hold the starter cup in place and remove the flywheel nut. See Figure **69.**

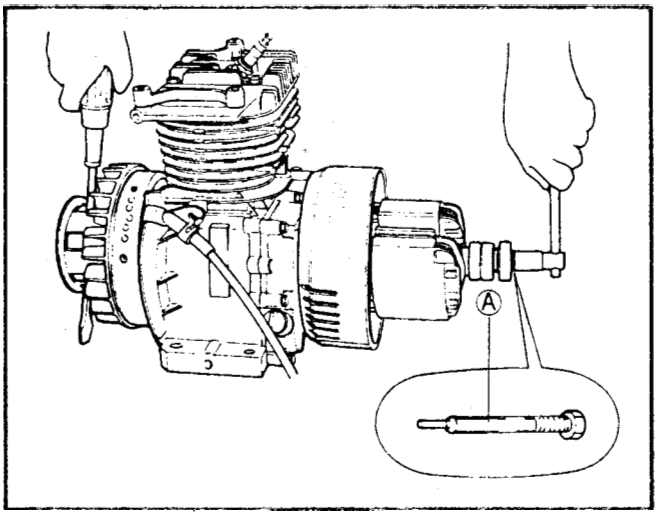


Figure 68

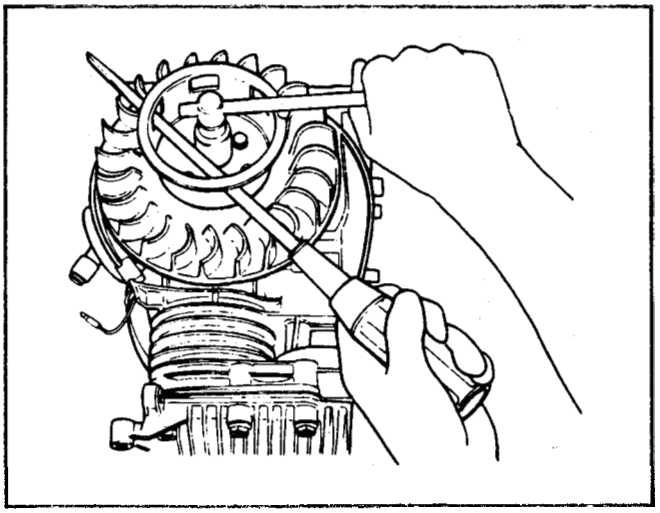


Figure 69

25. The next step is to remove the three screws retaining the starter cup.

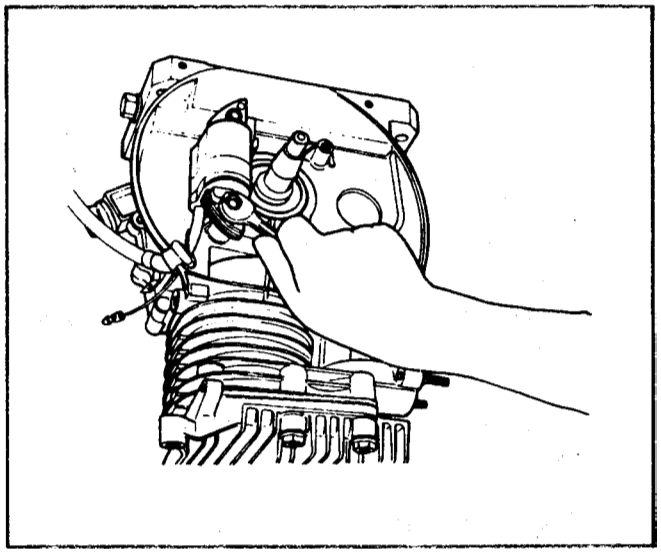


Figure 70

26. If the generator uses an external ignition coil the coil should be removed at this time.

27. Remove the flywheel using Tor0 flywheel puller part number 41-7650.

28. If the generator uses as internal ignition coil it will be exposed on removal of the flywheel and should be,removed. See Figure 70.

29. Turn the engine around and remove the front generator housing. See Figure 71.

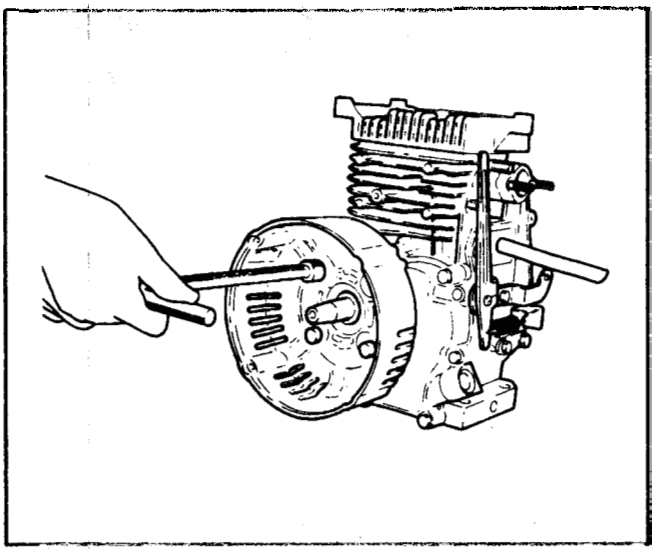


Figure 71

30. Remove the governor lever and the governor spring bracket. See Figure 72.

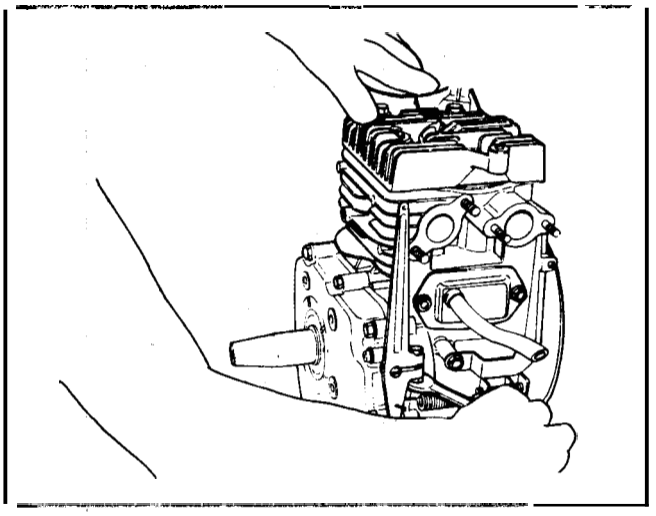


Figure 72

31. Remove the crankcase breather assembly. See Figure 73.

32. Remove the cylinder head. See Figure 74.

33. Use a valve spring compressor to compress the valve springs and then remove the valve spring keepers. See Figure 75.

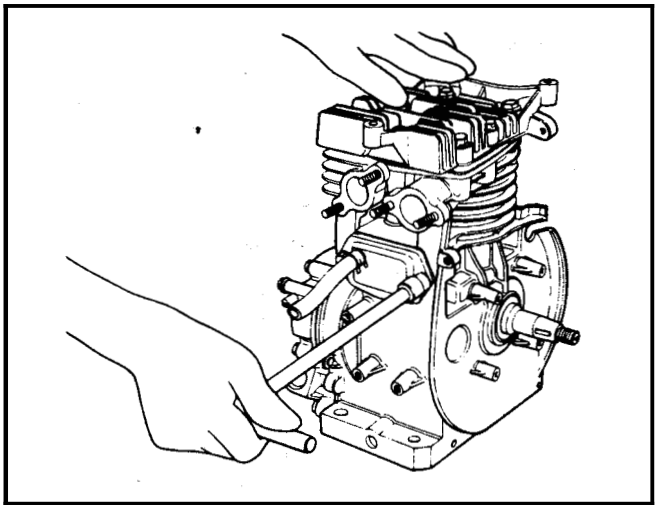


Figure **73**

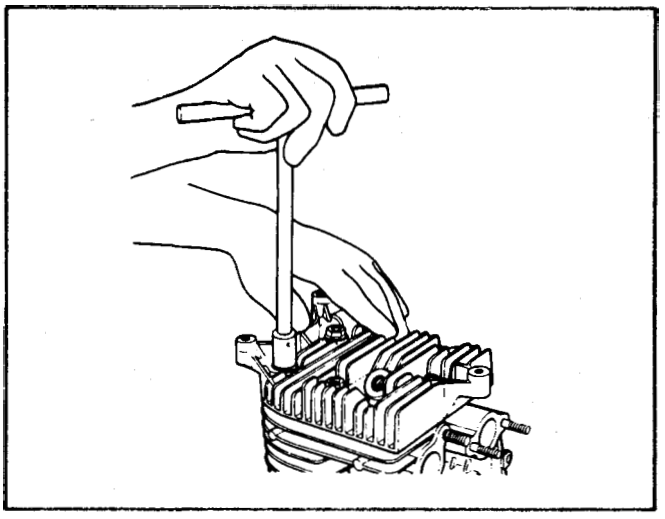


Figure **74**

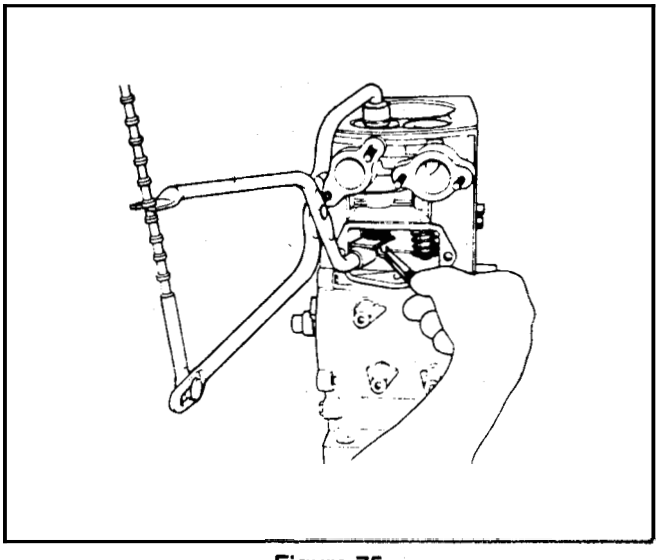


Figure 75

34. Remove the crankcase side cover. Take care not to damage the seals or crankshaft on removal of the cover. See Figure **76.**

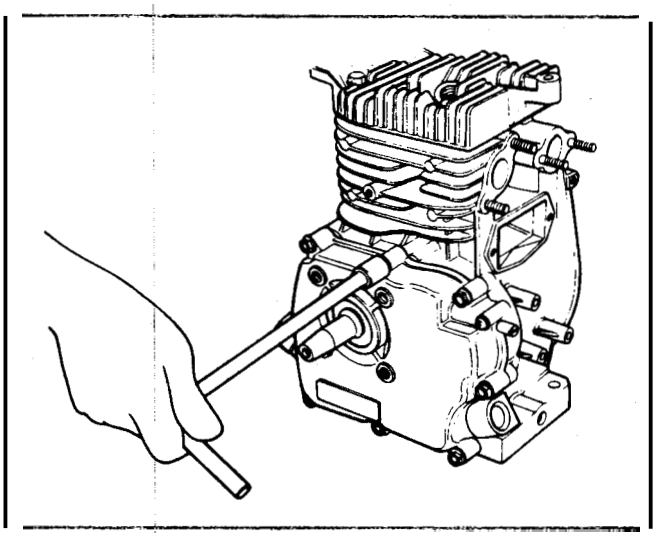


Figure **76**

35. The camshaft may now be pulled out **of** the crankcase Take note of the location of the timing marks on the crankshaft and camshaft gear prior to disassembly On reassemblythese marks must line up with one another. See Figure **77.**

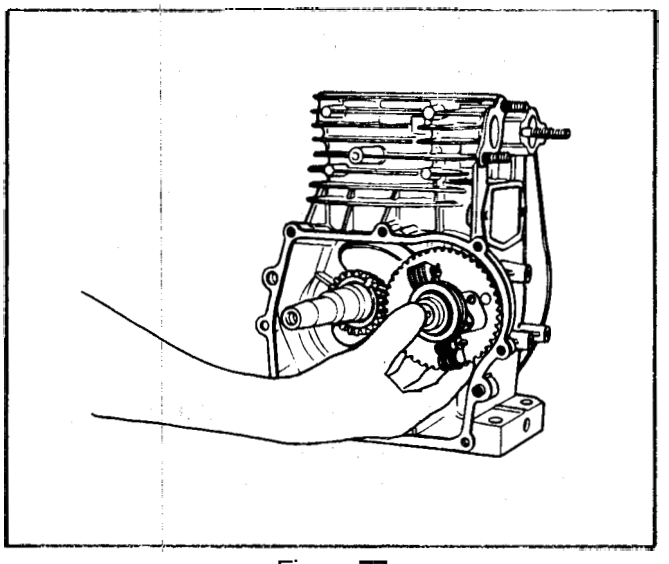


Figure **77**

36. Straighten the locking tabs on the connecting rod nuts. See Figure **78.**

37. Remove the connecting rod nuts, splasher plate (with locking tabs) and rod cap. Please take note of the orientation **of** the rod cap for proper reinstallation. See Figure **79.**

38. The piston and connecting rod may be withdrawn from the cylinder block.

Please notethe arrow on the face of the piston and the arrow **on** the connecting rod. When the piston and connecting rod are reinstalled thses arrows should point to the valves. See Figure *80.*

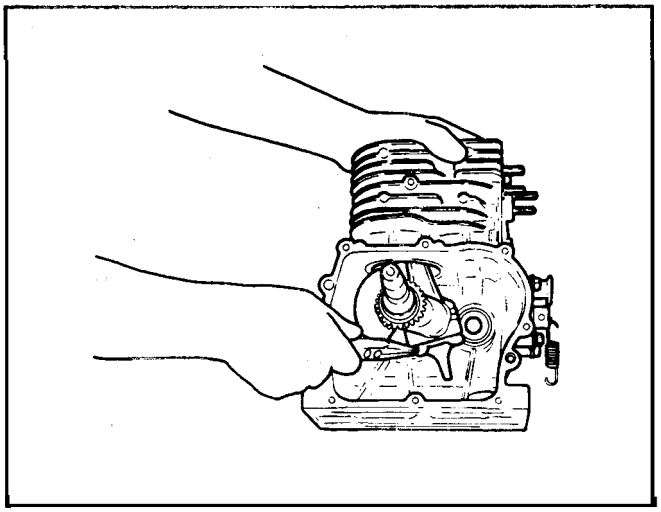


Figure 78

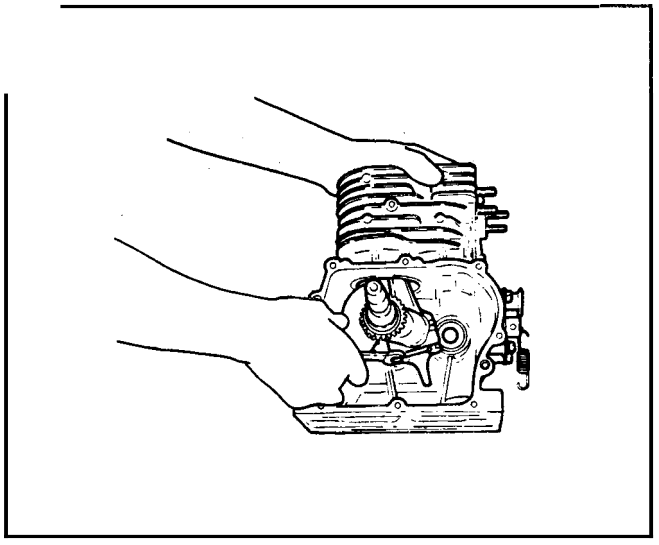


Figure 79

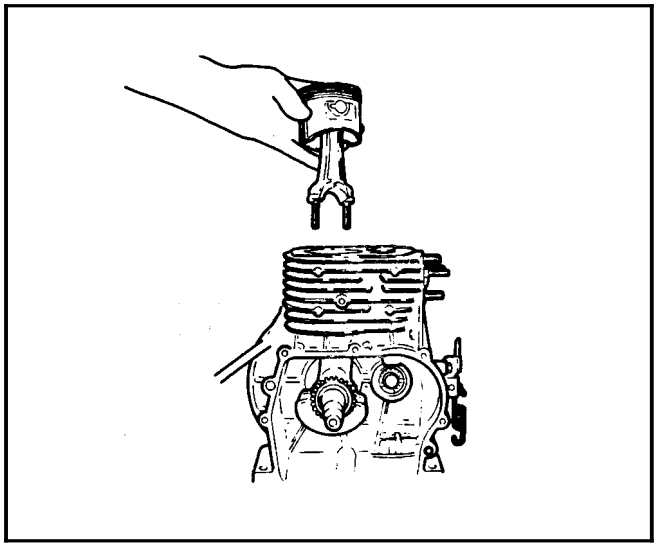


Figure 80

39. The crankshaft may now be removed. See Figure 81.

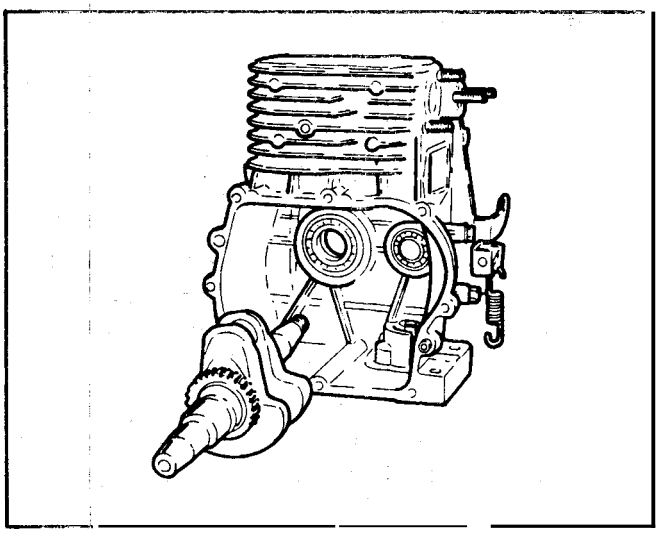


Figure 81

Engine - Cleaning After Disassembly

1. Clean all parts in appropriate solvents according to the solvent manufacturer's recommendations.
2. Inspect all parts for wear and damage. Make certain that moving parts will move freely.
3. Remove carbon from the cylinder head and combustion chamber. Carbon can be removed with a non-marring scraper. Be careful not to damage the cylinder head or bore.
4. Clean the air filter element in soap and water. Moisten the air filter element with clean 30 weight engine oil before installation.
5. Clean the fuel strainer on the tank inlet.
6. Clean the fuel sediment bowl and filter screen.
7. Refer to the Maintenance Section on page 24 for more information on scheduled maintenance.

Engine - Inspection

Inspect all parts for wear and damage. Do not reuse parts that are damaged or worn beyond specification.

1. Valve guide - valve stem clearance:

T120 , T1800, T2500, T3000

Maximum allowable clearance:	
Intake	.080 mm (.0032")
Exhaust	.100 mm (.0039')

2. valve seat contact width:

T1200, T1800

Minimum allowable width:	
Intake	.8 mm (.0315")
Exhaust	.8 mm (.0315")

T2500, T3000

Minimum allowable width:	
Intake	.9 mm (.0354")
Exhaust	.9 mm (.0354")

Valve seat contact is determined by coating the valve seat with Prussian blue and rotating the valve in the seat. The width of the contact area will be disclosed on the face of the valve.

The pattern must be a continuous ring without a break. If the pattern is not within specification, the valve seat must be reconditioned. See Figure 82.

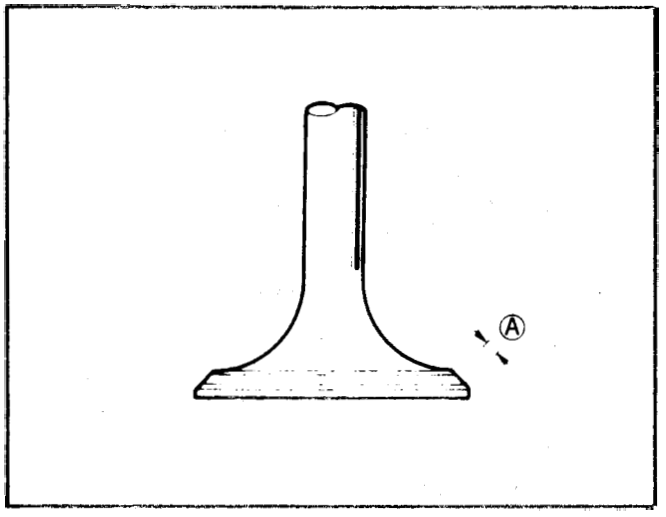


Figure 82

3. Valve seat reconditioning:

Two cuts (15° and 46°) are required to properly recondition the valve seat on the T1200.

Three cuts (15°, 45°, 75°) are required to properly recondition the valve seat on the T1800, T2500, T3000. See Figure 83.

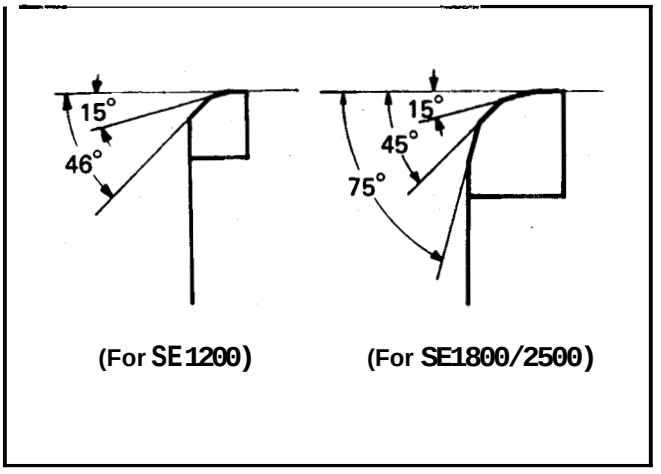


Figure 83

The Special tools required for valve seat reconditioning are as follows:

Special Tools

"T" handle wrench	50,-9400
Adaptor	50-9410
Expandable pilot	50-9500
75°/15° cutter	50-9450
46° cutter	50-9440
45° cutter	50-9430

4. Cylinder head distortion:

T1200, T1800, T2500, T2000

Maximum allowable distortion:
.030 mm (.0012')

Check the gasket surface of the cylinder head for distortion with a straightedge and thickness gauge. Take a clearance reading at several places. If the clearance at any position exceeds the limit, replace the cylinder head. See Figure 84.

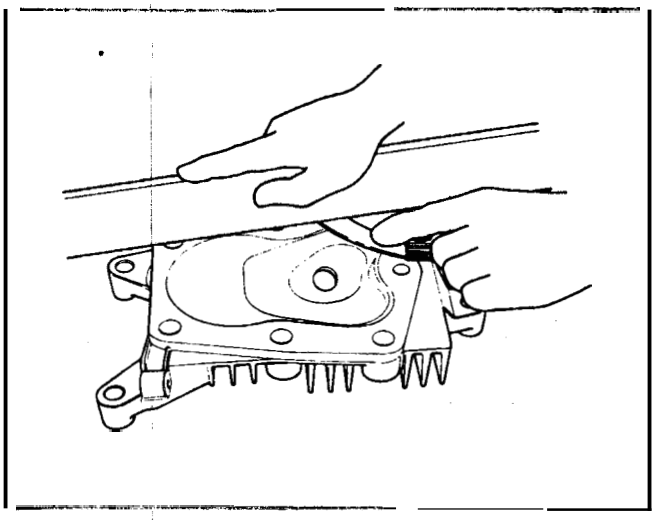


Figure 84

5. Cylinder bore wear:

T1200, T1800, T2500, T3000

Maximum allowable cylinder wear:
.100 mm (.004")

Cylinder wear is determined by taking measurements of the diameter in six locations. See Figure 85.

The amount of wear is the difference between the largest and smallest measurement. If the wear limit is exceeded the cylinder must be bored oversize.

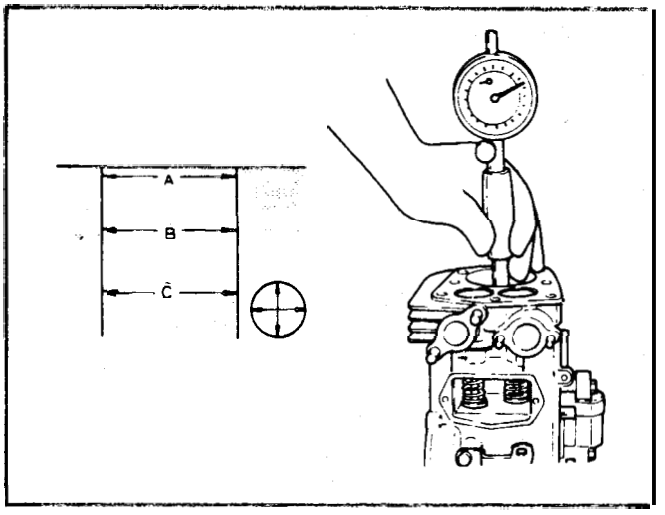


Figure *85*

6. Piston diameter:

T1200

Minimum allowable piston diameter:
62.88 mm (2.4756")

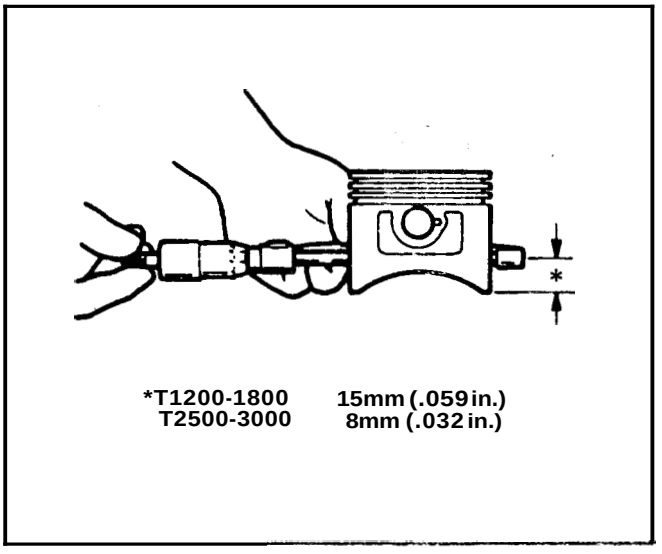
T1800

Minimum allowable piston diameter:
65.88 mm (2.5937")

T2500, T3000

Minimum allowable piston diameter:
71.88 mm (2.8299")

Measure the outside diameter of the piston. **If** the piston is smaller in diameter that the wear limit dimension the piston must be replaced. See Figure 86.



***T1200-1800 15mm (.059 in.)**
T2500-3000 8mm (.032 in.)

Figure 86

7. Piston *to* cylinder clearance

T1200, T1800, T2500, T3000

Maximum piston *to* cylinder clearance;
.120 mm **(.0047")**

Calculate the difference between the piston diameter and the cylinder diameter. If the figure exceeds the clearance limit, the cylinder **must** be bored and an oversize piston installed or replace **the** cylinder and piston.

8. Piston pin to connecting rod clearance:

T1200, T1800, T2500, T3000

Maximum piston pin to rod clearance:
.05 mm ***(.002')***

Measure the difference between the diameter **of** the piston pin and the piston pin bearing in the connecting rod. See Figure 87 and Figure 88.

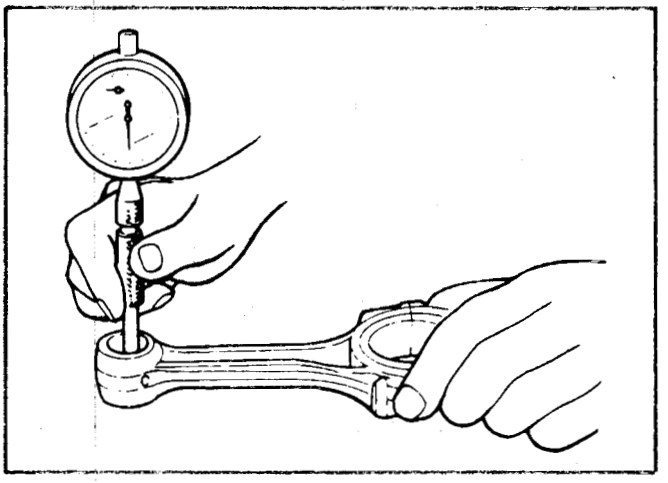


Figure 87

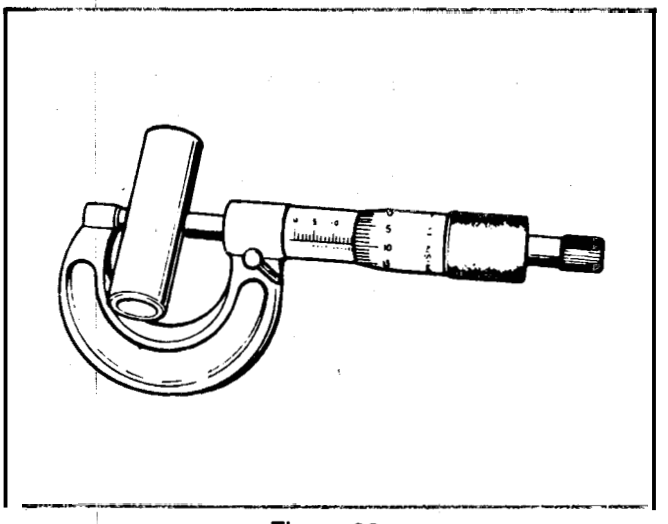


Figure 88

9. Connecting rod side clearance:

T1200, T1800, T2500, T3000

Maximum rod side clearance:
1.200 mm (.0472')

Measure the side clearance of the connecting rod while secured to the crankshaft. If the clearance exceeds the limit, replace the connecting rod. See Figure 89.

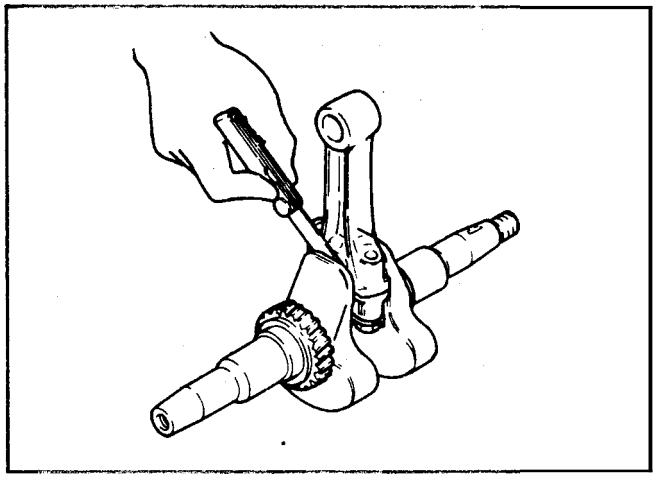


Figure 89

10. Crank pin to connecting rod clearance:

T1200, T1800

Maximum crank pin to rod clearance:
.070 mm (.0027")

T2500, T3000

Maximum crank pin to rod clearance:
.080 mm (.0031")

Measure the diameter of the crank pin and the diameter of the big end of the connecting rod. The difference between the two will be the crank pin to connecting rod clearance. If the clearance is beyond specification replace the connecting rod and or the crankshaft. See Figure 90.

11. Piston ring to groove, clearance limit:

T1200, T1800, T2500, T3000

Maximum piston ring to groove clearance:	
Top ring	.120 mm (.0047")
2nd ring	.100 mm (.0039')

Use a feeler gauge to measure the clearance between the top ring and ring groove and the 2nd ring and ring groove. If the clearance exceeds the maximum allowable clearance value the rings or piston must be replaced. See Figure 91.

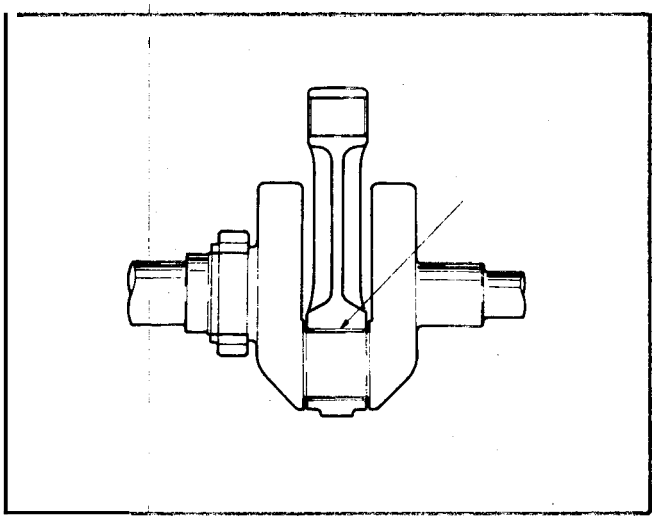


Figure 90

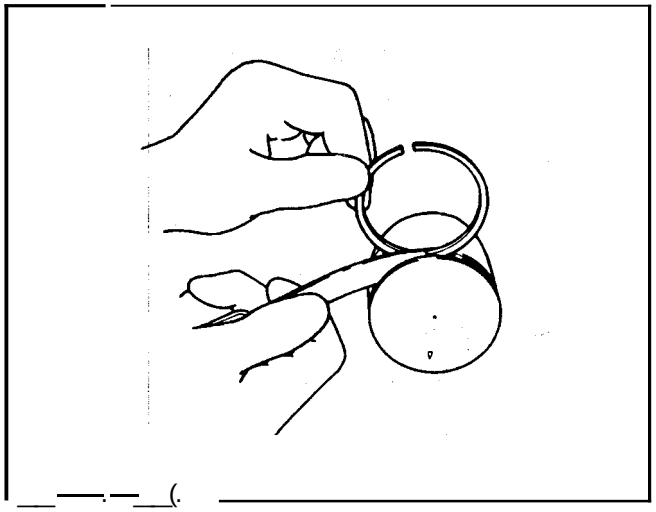


Figure 91

12. Piston ring groove width:

T1200, T1800

Maximum piston ring groove width:	
Top groove	2.03 mm (.0799")
2nd groove	2.03 mm (.0799")

T2500, T3000

Maximum piston ring groove width:	
Top groove	2.51 mm (.0988")
2nd groove	2.51 mm (.0988")

Use a thickness gauge to measure the width of the top and 2nd ring groove. If the width is greater than the maximum allowable clearance value the piston must be replaced. See Figure 92.

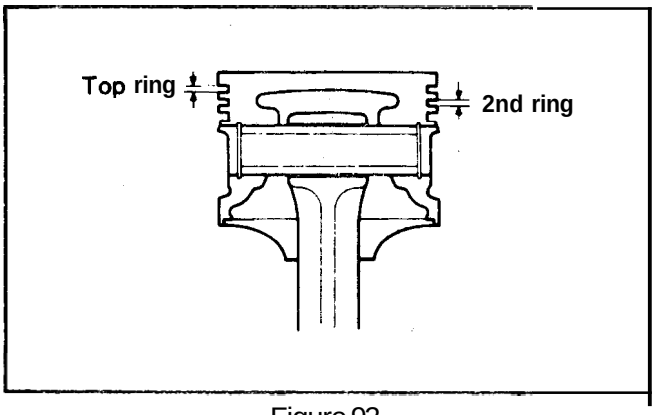


Figure 92

13. Piston ring thickness:

T1200, T1800

Minimum piston ring thickness:	
Top ring	1.97 mm (.0776')
2nd ring	1.97 mm (.0776')

T2500, T3000

Minimum allowable thickness:	
Top ring	2.46 mm (.0969')
2nd ring	2.47 mm (.0972")

Measure the thickness of the piston rings with a micrometer or precision measuring device. If the ring measures less than the minimum allowable thickness it must be replaced See Figure 93.

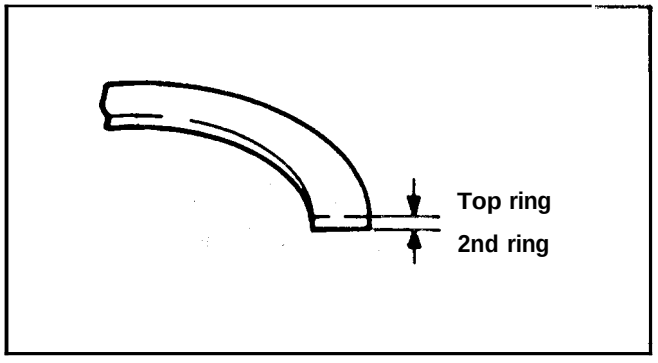


Figure 93

14. Piston ring end gap:

T1200

Maximum allowable gap:	
Top ring	.8 mm (.3151")
2nd ring	.8 mm (.3151")
Oil ring	1.8 mm (.0709")

T1800

Maximum allowable gap:	
Top ring	.8 mm (.3151")
2nd ring	.8 mm (.3151")
Oil ring	1.5 mm (.0591")

T2500 T3000

Maximum allowable gap:	
Top ring	.7 mm (.0276')
2nd ring	.8 mm (.03151")
Oil ring	1.5 mm (.0591")

When measuring piston ring end gap, place the ring in an area of the cylinder where there is a minimum amount of wear, e.g. near the top of the cylinder. Remember, we are trying to determine how much the ring has worn, not the cylinder. Use a piston to push the ring squarely into the cylinder. insert a feeler gauge and measure the end gap. Rings that exceed the maximum allowable gap must be replaced. See Figure 94.

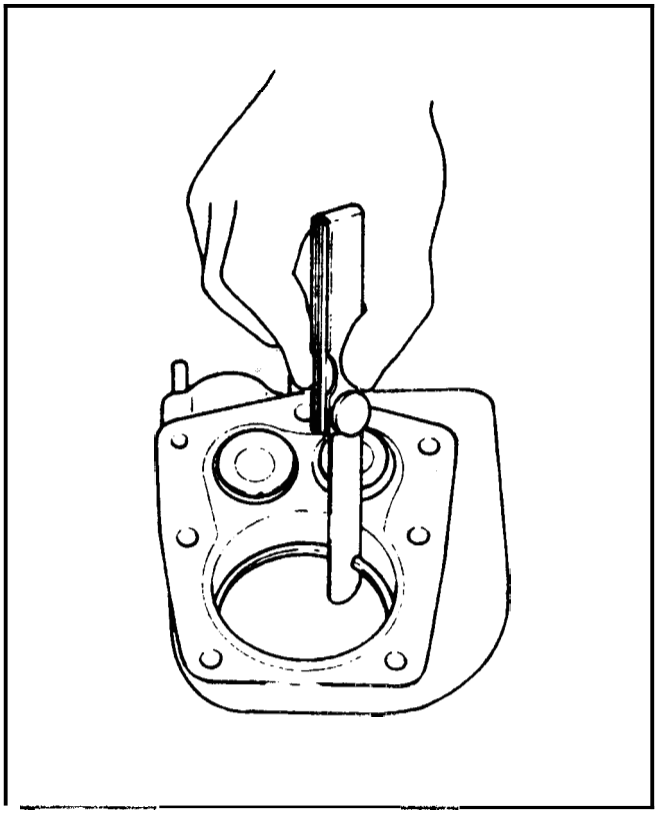


Figure 94

Engine - Reassembly

1. Examine the bearings and seals in the block of the engine. Replace the bearings and or seals if necessary.

2. Install the intake and exhaust valves. Coat the valve stems with a liberal amount of engine oil and insert them into the valve guides in the cylinder. See Figure **95** for correct placement of the intake and exhaust valves. The intake valve has the letters "IN" stamped in the head of the valve.

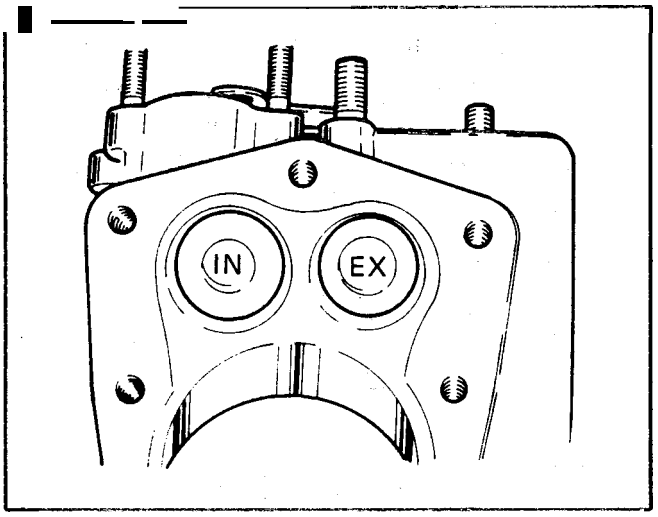


Figure **95**

3. Install the valve springs, spring retainers and valve keepers. See Figure **96.**

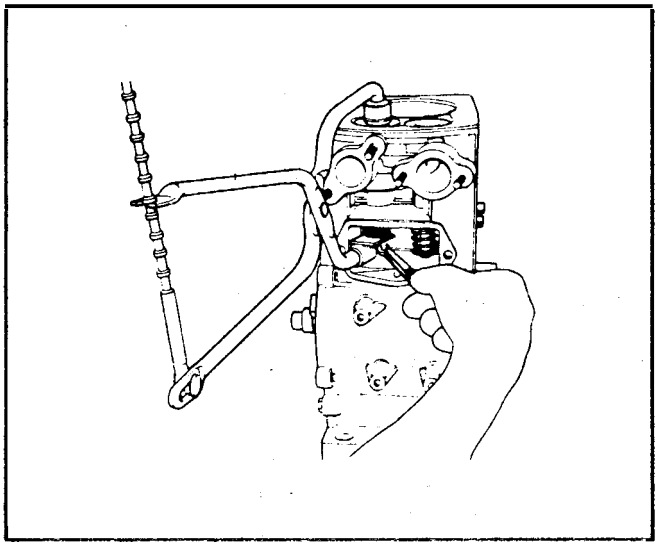


Figure **96**

4. Install the governor operating shaft in the crankcase side cover. Mount the governor shift fork to the shaft with two mounting screws. Use a thread locking compound, e.g. Loctite **242,** on the threads of the screws. See Figure **97.**

5. Mount the connecting **rod** to the piston. Lubricate the piston pin with engine oil and retain it in the piston with a circlip on either end. The arrow mark on the head of the piston should point in the same direction as the arrow on the connecting rod for proper installation. See Figure **98.**

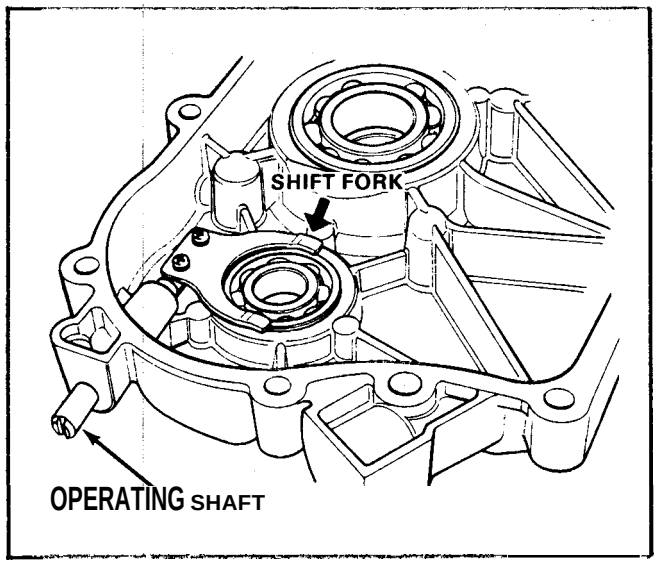


Figure **97**

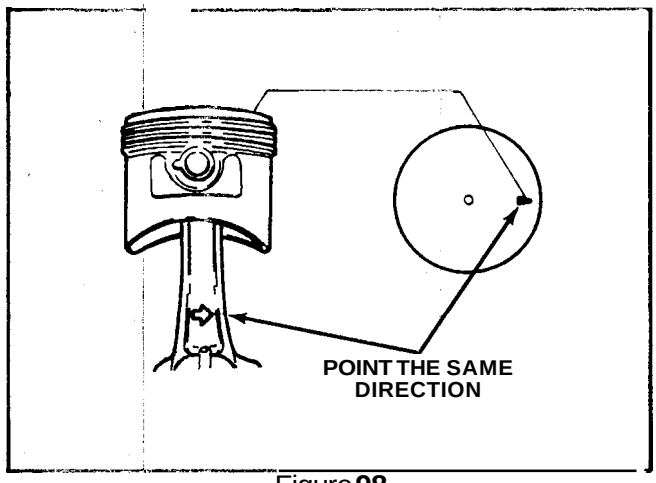


Figure **98**

6. Mount the piston rings on the piston. Use a ring expander and make sure the "**R**" mark faces the top of the piston on each ring. See Figure 99.

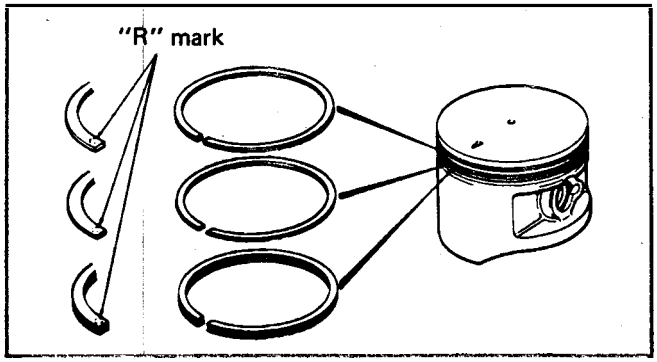


Figure **99**

7. The piston and connecting rod may now be installed from the top **of** the cylinder. Make sure the entire piston has been lubricated with engine oil. The arrow on the connecting rod and piston should face the valve side of the engine. Use a piston ring compressor as shown in Figure **100** to install the piston.

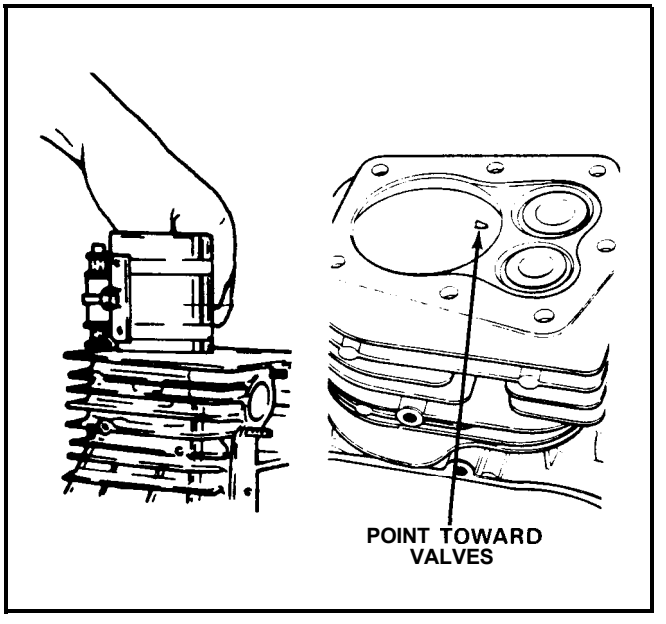


Figure 100

8. Install the crankshaft. Lubricate the area of the crankshaft that must pass through the crankcase seal and bearing. If necessary wrap the crankshaft with a plastic sleeve to prevent seal damage.

9. Mount the rod, splasher, lock plate and rod cap to the crankshaft as shown in Figure 101. Take note of the match marks on the rod cap and rod for proper assembly.

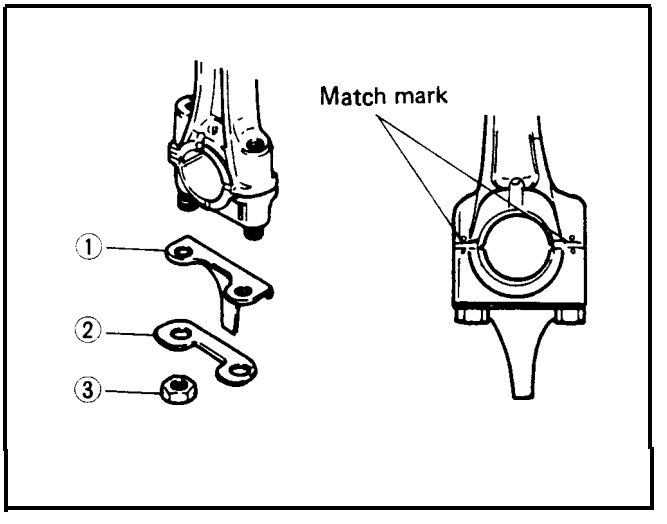


Figure 101

T1200, T1800, T2500, T3000

Rod cap bolt torque:
.4 kg m (3.5 ft lbs)

10. Bend the tabs on the locking plate to prevent loosening of the rod bolts. See Figure 102.

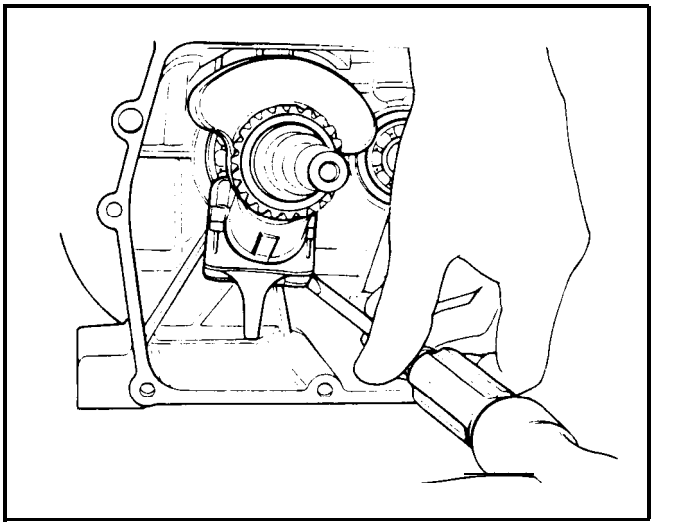


Figure 102

11. Mount the governor flyweight assembly to the camshaft drive gear. Make sure the flyweights are properly retained with two cotter pins. See Figure 103.

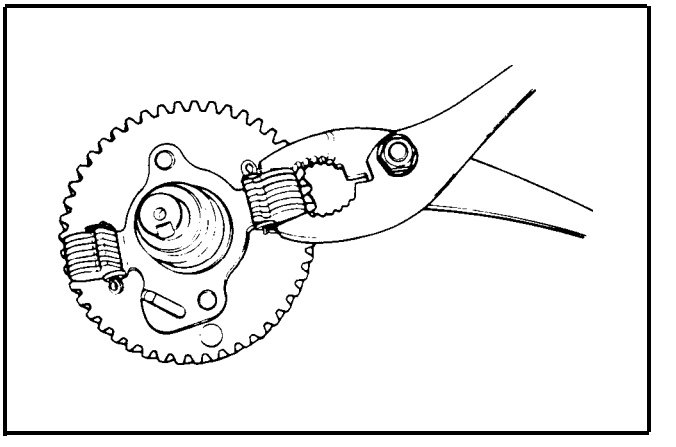


Figure 103

12. Lubricate and install the cam followers. If the same cam followers that came out of the engine are being reinstalled, make sure they are put in the same guide they came out of, a wear pattern will have been established that should be maintained.

13. Install the camshaft in the crankcase. Take care to properly line up the matchmarks for correct valve timing. See Figure 104.

14. Lubricate the inside diameter of the governor collar and install it on the flyweight assembly. Make sure the lower edge of the collar engages the flyweights. Also, make sure the slit in the governor collar engages the cam shaft gear. See Figure 105.

15. Install a gasket on the crankcase and install the crankcase side cover. Lubricate the crankshaft to assist installation. Take care not to damage the seal in the side cover. Secure the side cover mounting screws as shown in Figure 106.

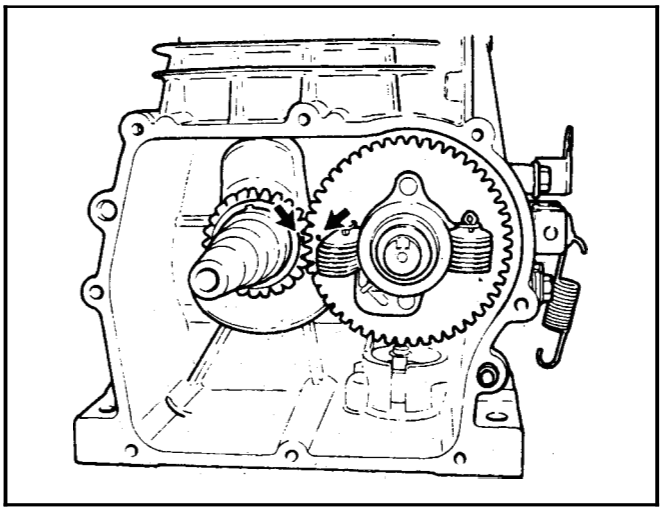


Figure 104

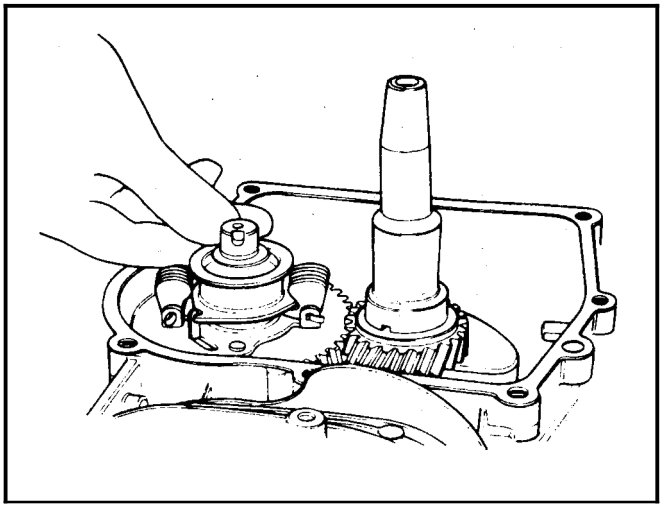


Figure 105

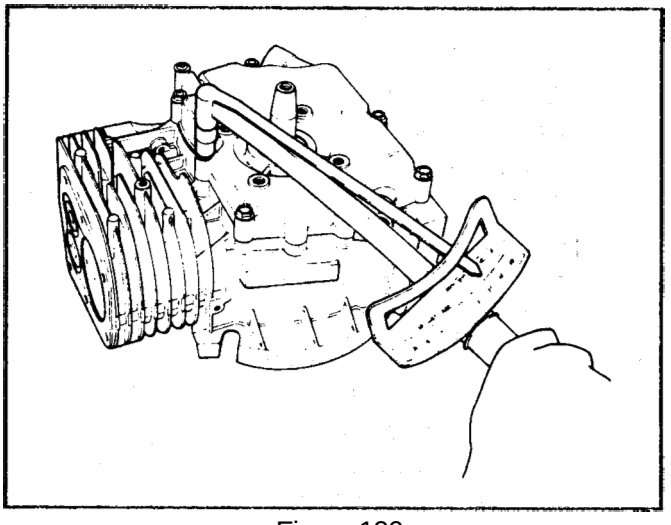


Figure 106

T1200, T1800, T2500, T3000

Side cover screw torque:
1.0 kg **m** (7.2 ft lbs)

16. Measure the valve clearance.

T1200, T1800, T2500, T3000

Valve clearance specification:	
Intake	.05-.15 **mm** (.002-.006")
Exhaust	.05-.15 **mm** (.002-.006")

If the valve clearance is not within specification the valves should be removed and adjusted per the Specifications Section for your particular engine. See Figure 107.

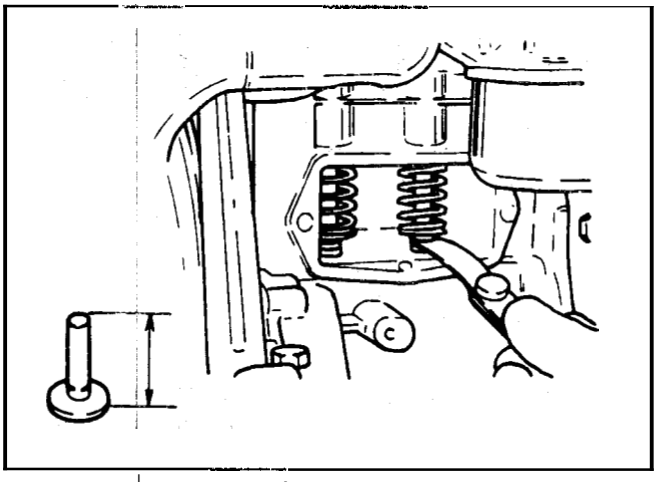


Figure 107

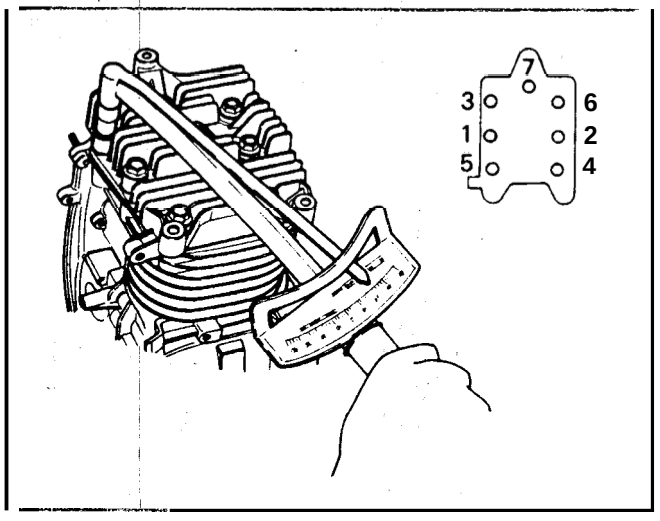


Figure 108

17. Install a new head gasket and the cylinder head.

T1200, T1800

Headbolt torque:
1.0 kg **m** (7.0 ft lbs)

T2500

Headbolt torque:
2.5 kg **m** (18 ft lbs)

T3000

Headbolt torque:
3.2 kg m (23 ft lbs)

Tighten the head bolts in a diagonal sequence to prevent warping of the head. See Figure 108.

18. Install the generator front bracket. The bracket should be installed with the "up" mark of the inner surface of the bracket facing up. See Figure 109.

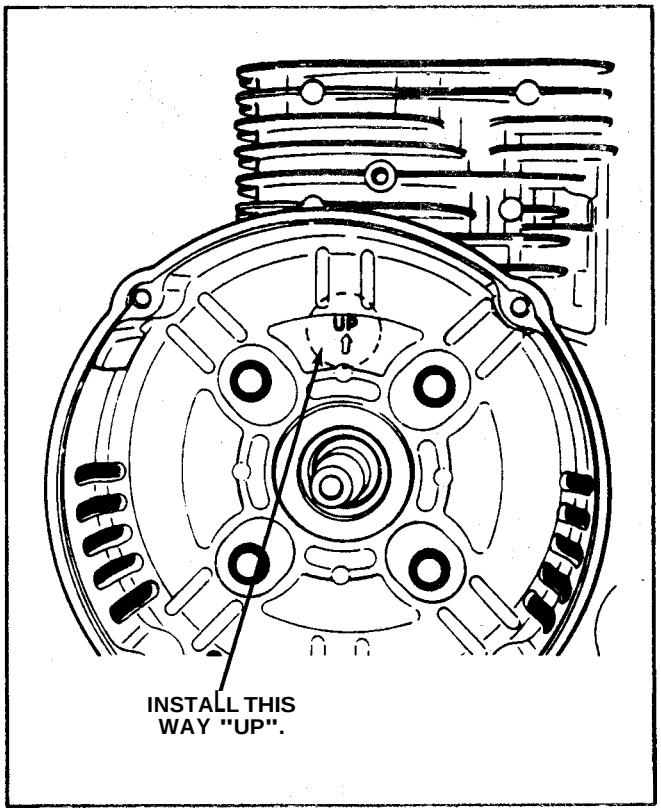


Figure 109

19. Tighten the bolts in a diagonal sequence as shown in Figure 110.

T1200, T1800, T2500, T3000

Generator front bracket torque:
2.0 kg m (14.5 ft lbs)

20. Install the ignition coil on units that have ignition coils that are internal to the flywheel. The position of the coil is fixed on these units. Apply thread locking compound to the mounting screws and tighten the screws to 1 kg m (7 ft lbs).

21. On units with ignition coils that are external to the flywheel the next step is to install the flywheel key and flywheel. See Figure 111.

22. Install the starter cup as shown in Figure 112.

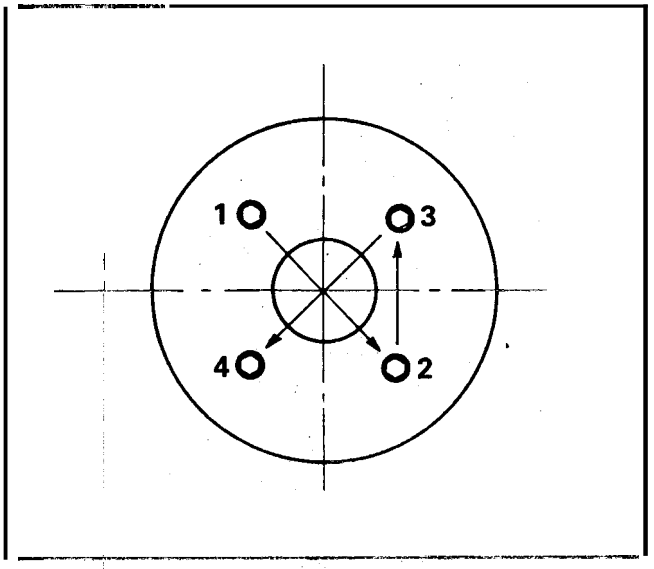


Figure 110

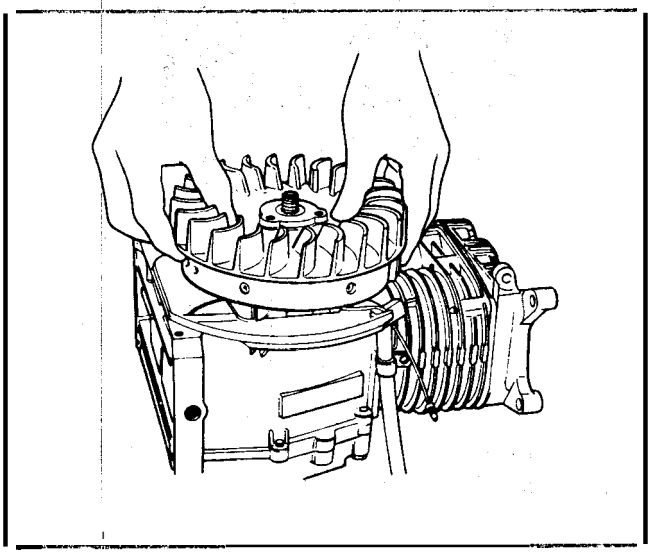


Figure 111

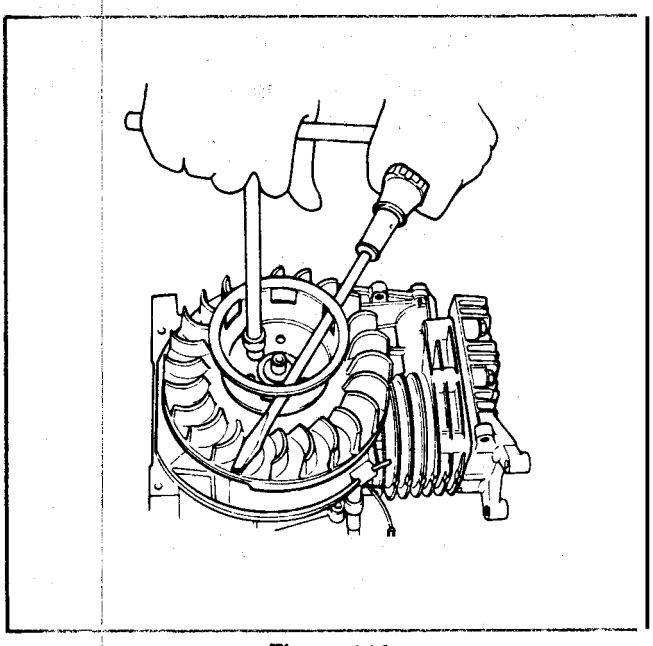


Figure 112

23. Install the flywheel nut. See Figure 113.

T1200, **T1800,** T2500, T3000

Flywheel nut torque:
6.5 kg m (47 ft lbs)

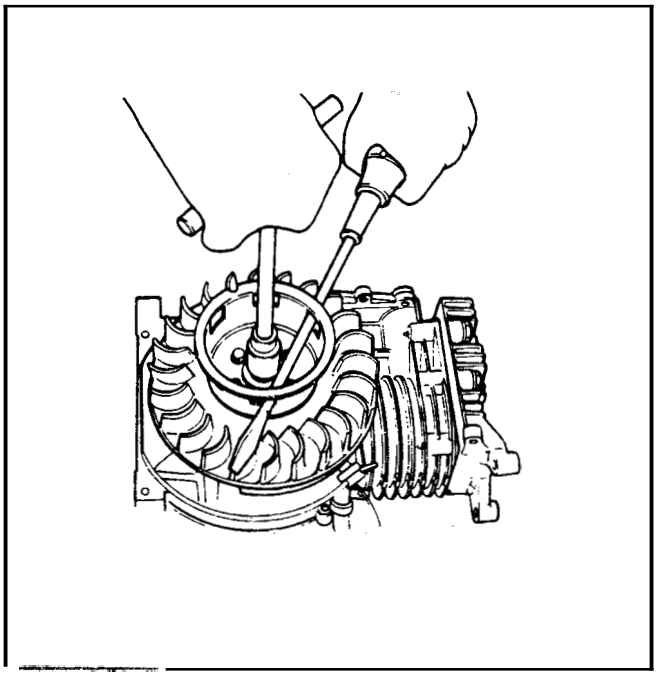


Figure 113

24. If the generator is equipped with an externally mounted coil, the coil should be installed with an air gap of .38 mm (.015").

25. Route the spark plug wire and the ignition wires through the grommet in the block of the engine. The spark plug wire should pass through the wire retainer mounted on the block of the engine.

26. Install the oil level sensor in the crankcase of the engine. See Figure 114.

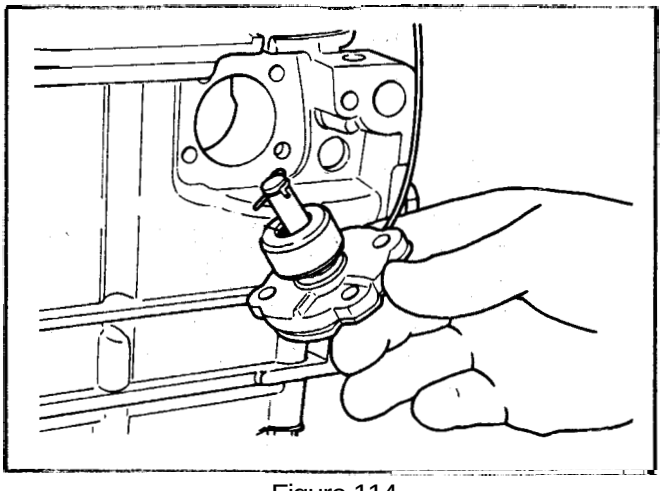


Figure 114

27. **Route** the oil sensor wire in the channel provided in the crankcase. The wire groove is accessible with the flywheel installed. See Figure 115.

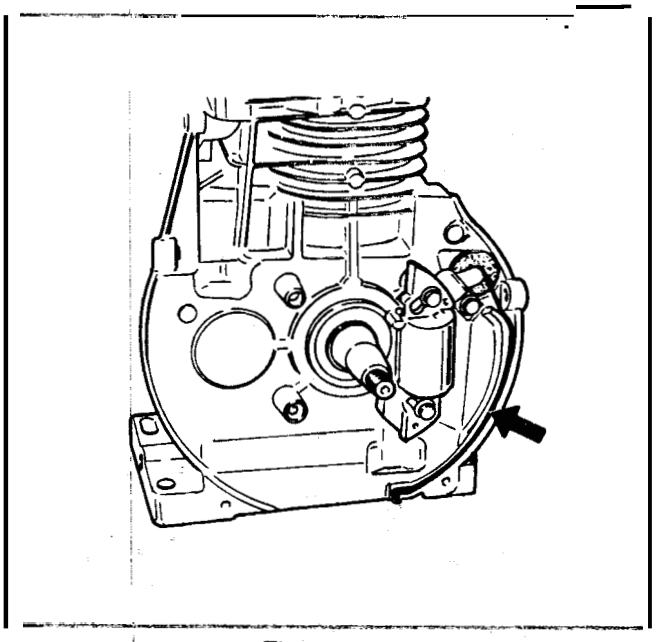


Figure 115

28. Inspect the rotor assembly for defects; broken wires: worn or damaged slip rings, damaged insulation.

29. Install the rotor assembly. Some units use a key or pin to align the rotor to the crankshaft. Make sure the tapers are clean and that the rotor and crankshaft line up correctly. See Figure 116.

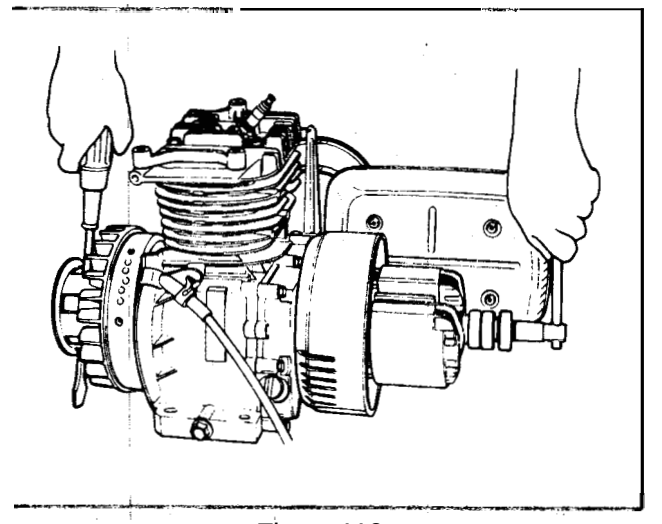


Figure 116

T1200, T1800, T2500, T3000

Rotor set bolt torque:
2.2 kg m (16 ft lbs)

30. Inspect the stator assembly for defects. Check for broken wires, bad insulation, broken wire ties etc.

Engine- Reassembly (cont'd)

31. Remove the brush holder if it is still installed on the stator.

32. Align the through bolt holes with the holes in the front generator cover (the cover bolted to the engine) and install the stator. Take extreme care **not** to damage any of the coils in the stator. See Figure 117.

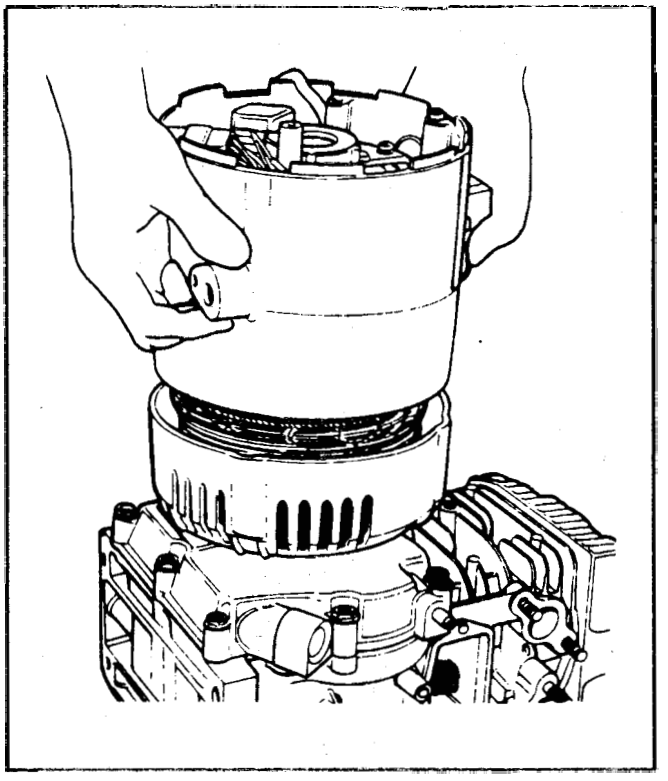


Figure 117

33. Tighten the through bolts in the sequence **as** shown in Figure **118.**

T1200, T1800, T2500, T3000

Through bolt torque:
1.0 kg m (7 ft lbs)

34. The brush holder may be reinstalled at this time.

35. Continue engine reassembly by installing the breather assembly. Make sure the parts are assembled as shown in Figure 119. Incorrect assembly will result in **a** breather that leaks oil. The projection on the outside cover always points down. See Figure 119.

36. Install the governor arm (throttle control lever) and the governor spring bracket. Tighten the governor arm screw only temporarily at this time. See Figure **120.**

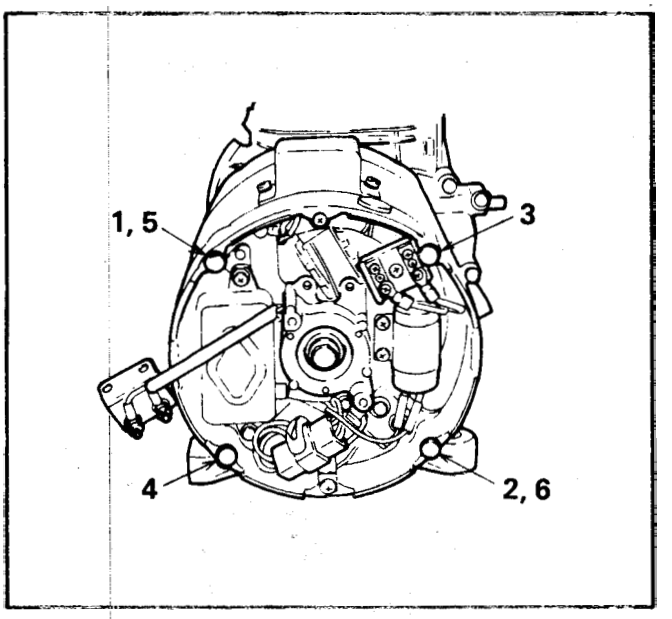


Figure 118

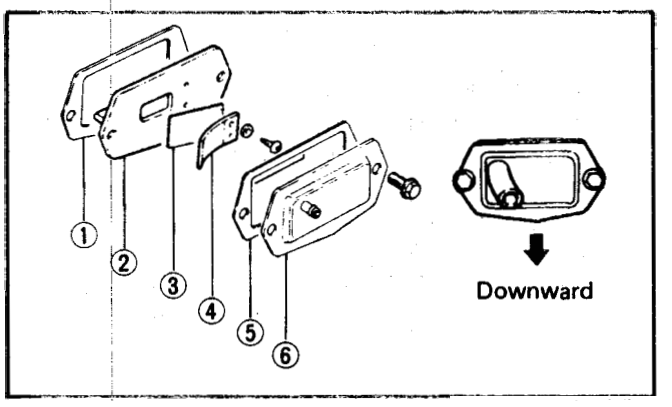


Figure 119

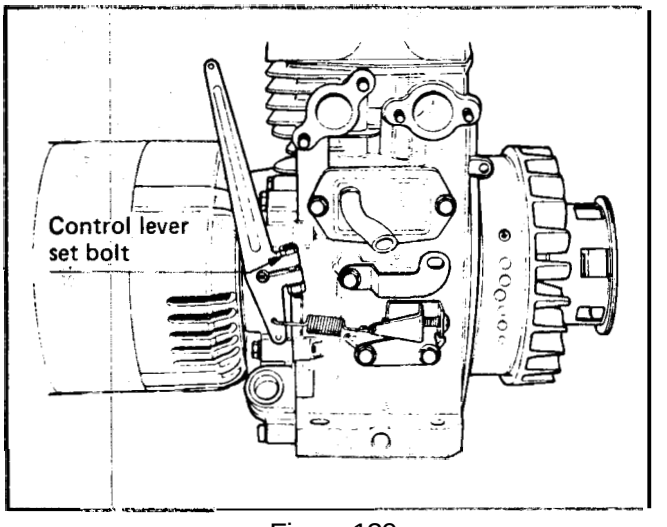


Figure 120

37. Hook the carburetor control rod and rod spring into the throttle control lever on the end of the throttle shaft. Connect the other end of the carburetor control rod to the governor arm and install the carburetor. The correct sequence is one gasket, spacer, and one gasket. Tighten the two

nuts securing the carburetor to the engine. See Figure 121.

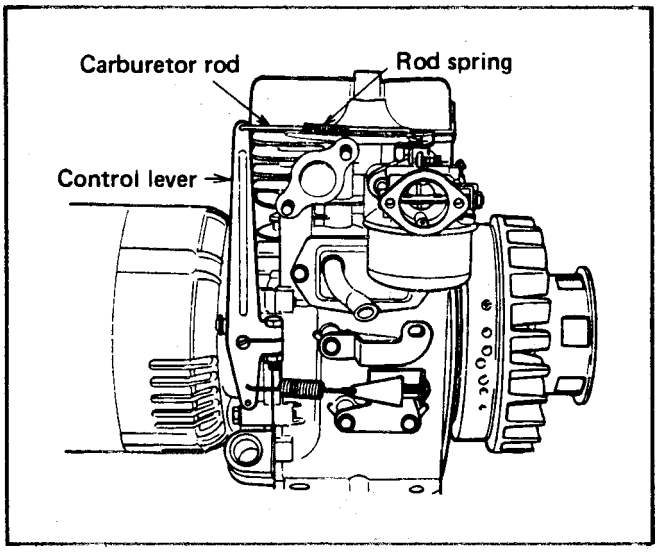


Figure 121

38. Adjust the governor by rotating the governor shaft fully counterclockwise. The end of the shaft is slotted for a screwdriver. Move the governor arm (throttle control lever) to the full throttle position (rotate it fully counterclockwise). Tighten the retaining nut on the governor arm. Make sure the throttle control spring is installed in the upper hole on the governor arm. See Figure 122.

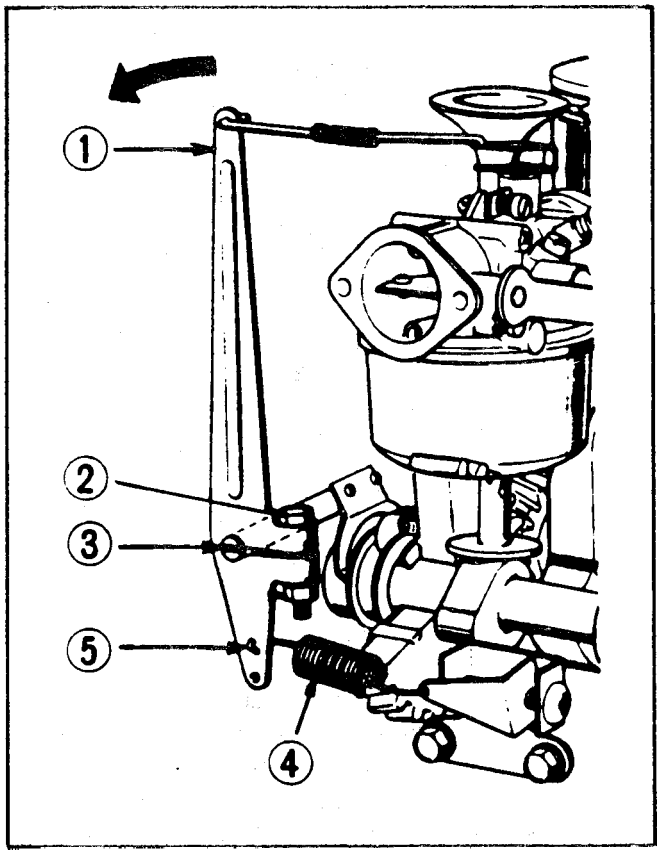


Figure 122

39. Install the muffler. Mount one gasket and secure the muffler with two nuts. See Figure 123.

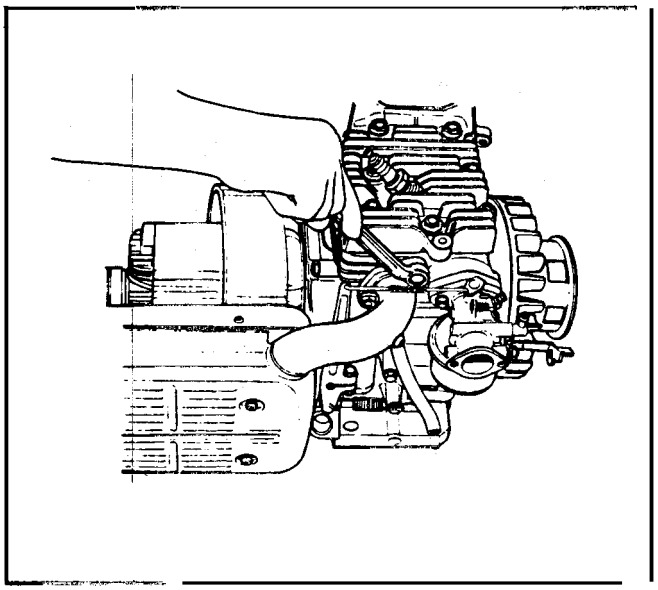


Figure 123

40. Install the sheet metal components on the engine. See Figure 124 and 125.

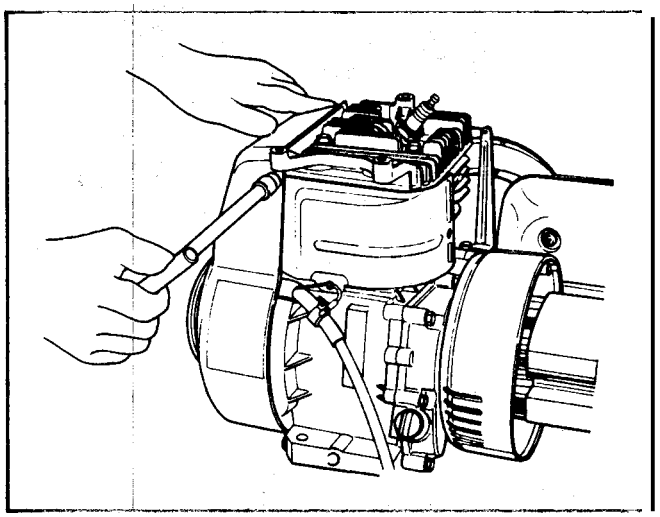


Figure 124

41. Remount the generator in the tube frame.

42. Attach the upper frame amd reinstall the fuel tank and control panel.

43. Reconnect the AC output wires on the terminal block. Be sure to match the color coding. See Figure 126.

44. Reconnect the lead wire from the control panel to the connector on the top of the generator. See Figure 127.

45. Reconnect the ignition ground wire and yellow wire from the low oil level shut down system. Clamp these wires under the front frame rail of the generator. Use the plastic retainer, **P/N** 55-0230, that is secured to the frame rail with one screw.

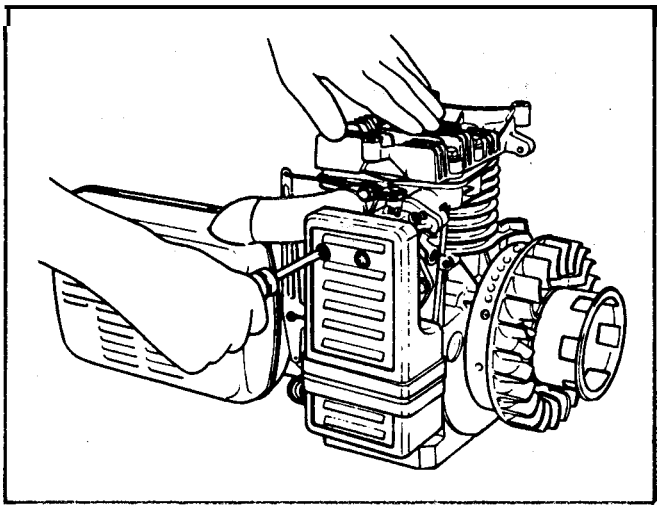


Figure 125

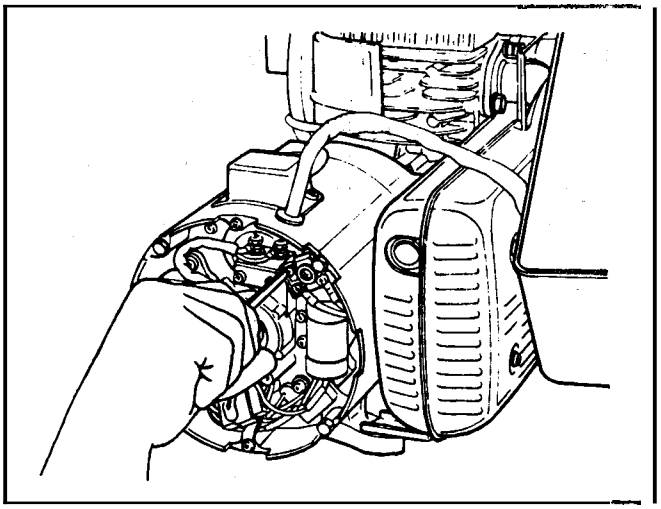


Figure 126

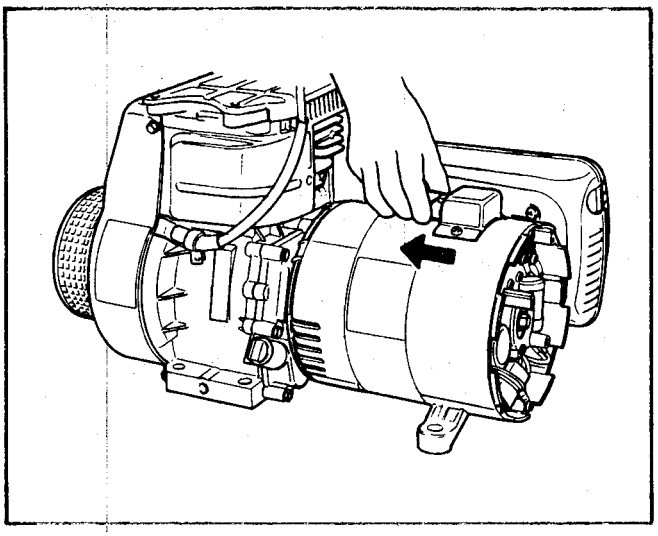


Figure 127

46. Install the air cleaner element. Make sure the element has been cleaned and oiled. See the Maintenance Section on page 24 for details on air cleaner maintenance.

47. **If** the fuel line from the tank to the shut off valve has been disconnected, reconnect the line. Connect the fuel line from the shut off valve to the carburetor

48. Install the recoil starter. The handle should face toward the front of the generator.

49. Fill the crankcase with motor oil. Check the Specification Section for the correct amount and type of oil.

SECTION 7 GENERATOR

DEFINITION OF TERMS

Definition of Terms - Voltage

Voltage (E) is a unit of electrical pressure and is measured in volts. Think of voltage as being similar to the pressure that oil is under in a hydraulic hose. The voltage in a circuit is equal to the current in the circuit multiplied by the resistance in the circuit. A 150 watt light bulb will have 96 (ohms) of resistance and a current flow of 1.25 amperes. 1.25 amperes X 96 ohms = 120 volts.

Definition of Terms - Amperage

Amperage (I) is a measure of electric current or the flow of electrons in a circuit. Electric current flow is measured in amperes. Think of amperage as being similar to the quantity of oil flowing in a hydraulic hose. Amperage is equal to the voltage in the circuit divided by the resistance in the circuit. A 150 watt light bulb will operate at 120 volts and will have an internal resistance of 96 ohms. 120 volts + 96 ohms = 1.25 amperes.

Definition of Terms - Resistance

Resistance (R) is measured in ohms and uses the greek letter omega (Ω) as a symbol. Resistance is that value that opposes the flow of electric current. Think of resistance as a restriction in a hydraulic hose. Resistance is equal to the voltage in the circuit divided by the amperage in the circuit. A 150 watt light bulb will operate at 120 volts with a current flow of 1.25 amperes. 120 volts + 1.25 amperes = 96 ohms of resistance.

Definition of Terms - Wattage

Wattage (P) is a measure of electric power or work that is being done. Power is measured in watts. Wattage is equal to the voltage in the circuit multiplied by the amperage in the circuit. A light bulb connected to a 120 volt source with a current of 1.25 amperes flowing through it will dissipate 150 watts of power. The power is given off in the form of heat and light. 120 volts X 1.25 amperes = 150 watts.

Definition of Terms - Direct Current

Direct current (DC) has a voltage level that may vary in intensity but will not drop below a 0 reference line. A battery may gradually lose its charge but the voltage level will always be above the 0 reference line. Batteries produce direct current that is very stable and will vary only as the charge decreases. Generators and rectifiers produce direct current that may vary in intensity from 0 to the maximum level, this is sometimes called "Pulsating Direct Current". See Figure 128.

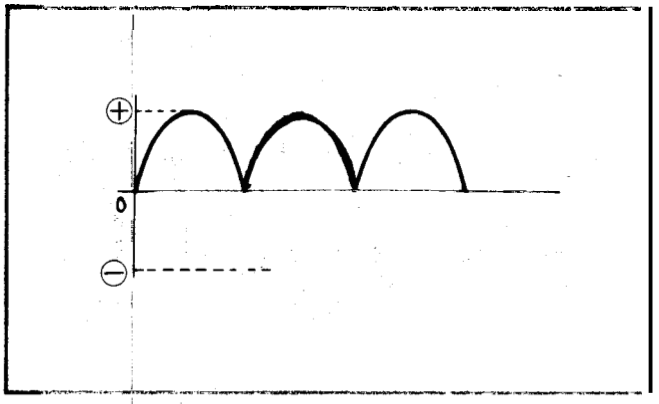


Figure 128

Definition of Terms - Alternating Current

Alternating current (AC) has a voltage level that will vary equally above and below a 0 reference line. The alternating current we use in our homes will vary from a + 120 volts to a -120 volts 60 times each second. The voltage is actually reversing its direction above and below a 0 reference line. See Figure 129.

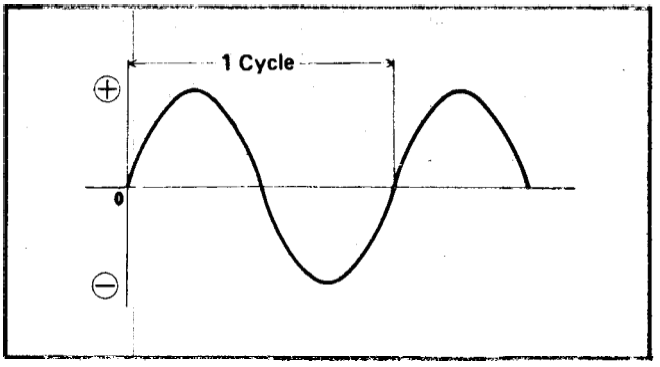


Figure 129

Definition of Terms - Frequency

Alternating current will reverse its direction at a frequency controlled by the speed of the engine. When the engine IS running at 3600 RPM (3600 revolutions per minute or 60 revolutions per second), the frequency of the alternating current will be 60 cycles per second (60 Hz). The speed of all Tor0 generators is governed at 3600 RPM.

Definition of Terms - Automatic Voltage Regulator

An automatic voltage regulator (AVR) will control the output of a generator. When a load is applied to the generator the voltage tends to drop; the AVR will sense this and will increase the amount of DC current being

Definition of Terms - Automatic Voltage Regulator (cont'd)

sent to the rotor to produce the magnetic field in the generator. The output of the generator will in turn increase. If a heavy load is removed from a generator the voltage will tend to increase; the **AVR** will respond to this by decreasing the size of the field. The **AVR** will hold the voltage to within 10% of the rated voltage.

Definition of Terms - Field

The word field refers to the magnetic field produced in the rotor. The magnetic field will spin with the rotor to generate electricity in the stator. The size of the field is controlled by the **AVR** and the **AVR** will in turn regulate the output of the generator.

Definition of Terms - Rotor

The rotor is a single coil of wire wrapped on a laminated steel core. During operation the rotor becomes an electromagnet and produces the field that causes electricity to be produced in the stator. The rotor is bolted to the engine crankshaft and spins at the same speed as the engine. Two small permanent magnets are bonded to the rotor core to get the generating process started.

Definition of Terms - Slip Rings

The slip rings (two) are an integral part of the rotor. One ring is attached to each end of the rotor coil. It is through the slip rings and the brushes that the exciter coil and **AVR** provide electricity to the rotor.

Definition of Terms - Brushes

The brushes are made of carbon and connected to the **AVR.** The brushes ride on the slip rings and act as the connector between the **AVR** and the rotor.

Definition of Terms - Stator

The stator is made of three separate coils of wire wrapped on an laminated steel core:

1. Main coil - The main coil provides 120 volts **AC** direct to the generator outlet.
2. Exciter coil - The exciter coil provides **AC** electricity to the **AVR** where it is rectified into **DC** electricity and sent to the rotor to create the field.
3. **DC** coil - The **DC** coil is a separate coil in the stator that provides **AC** electricity to a rectifier where it is changed to approximately **14** volts **DC.** The rectifier is connected directly to the **DC** terminals on the generator.

Definition of Terms - Diode

A diode is an electronic component that allows electric current to pass only in one direction.

Definition of Terms - Rectifier

A rectifier is an electronic device made of one or more diodes and is used to change alternating current to direct current.

Definition of Terms - Induction

Electricity is produced when a magnetic field moves across a conductor (wire), this is called induction.

GENERATOR OPERATION

Generator Operation - Exciter Coil and Permanent Magnet

In its simplest form, a generator is a permanent magnet moving close to a fixed coil of wire. When the magnetic field moves across the wires in the coil a voltage is produced. The exciter coil is part of the stator assembly and the permanent magnets are fixed to the rotor. When the engine is started, the rotor with the magnets fixed to it will begin to spin. The field of the magnets will move across the wires of the exciter coil and the generating process will begin. See Figure 130 and 131.

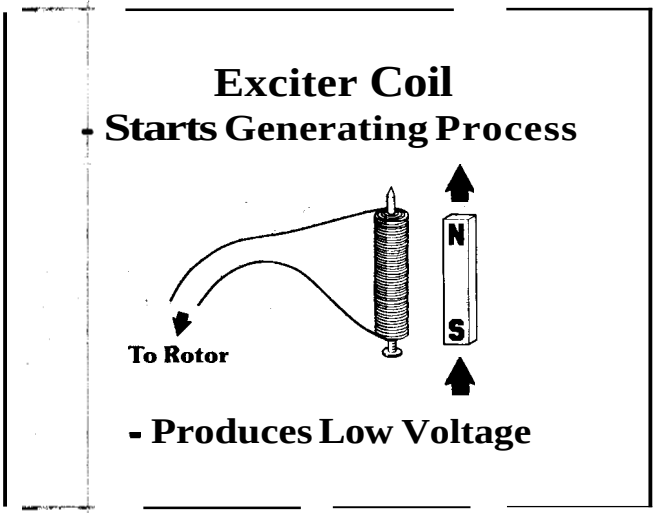


Figure 130

Generator Operation - AVR and Rotor Coil

Electricity from the exciter coil is sent to the AVR where it is rectified (changed to **DC)** and is then sent to the rotor to form an electromagnet. The **AVR** will control the size of the magnetic field based on how much electricity the generator is being asked to produce. See Figure 132.

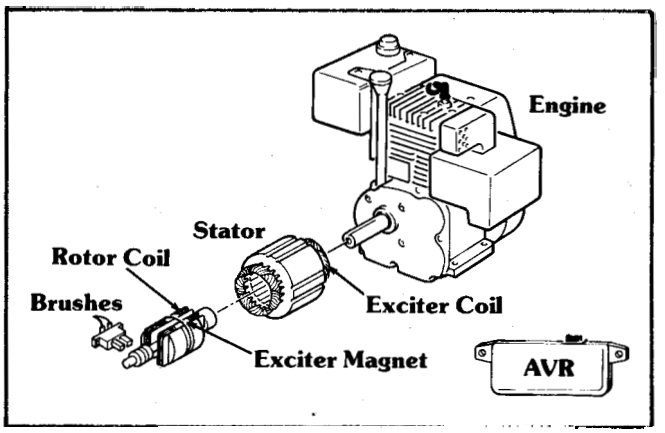


Figure 131

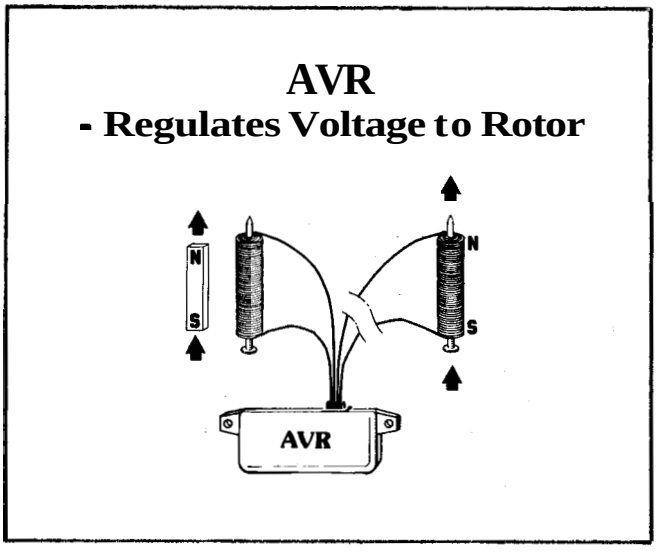


Figure 132

Generator Operation - Stator Coil and Receptacles

The magnetic field surrounding the rotor (which is now an electromagnet) will move across the wires of the stator coil and will induce AC electricity. The speed of the rotor is constant so any variation in the amount of electricity produced will be controlled by the size of the magnetic field. The stator coil is connected to the electrical outlets of the generator and to two sensor wires that let the AVR know how much voltage is being generated. See Figure 133.

Generator Operation - Generating Process

1. The engine turns the crankshaft.
2. The crankshaft turns the rotor which houses the exciter magnets.
3. The exciter magnets rotate past the exciter coil to start the generation process.
4. The exciter coil initially produces about 6 volts and sends it to the automatic voltage regulator, (AVR).
5. The AVR sends all or part of the electricity produced in the exciter coil through the brushes to the rotor. it decides how much by measuring the out put voltage through two sensor circuit wires.)
6. The rotor spins inside the stator coil which produces the output voltage.

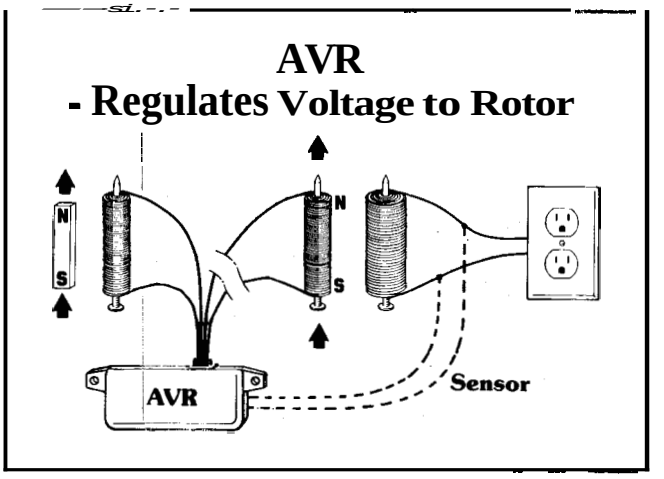


Figure 133

Generator Operation - Automatic Voltage Regulator

The automatic voltage regulator (AVR) functions much like the governor on a small engine. It keeps the output voltage very close to the required 120 (or 240) volts and compensates for varying loads.

The AVR is placed between the exciter coil and the rotor. It regulates the low voltage going into the rotor. In doing so it controls the size of the electromagnetic field around the rotor and in turn controls the output voltage. The AVR decides how much voltage to send to the rotor by sampling the output voltage through the sensor wires shown in the pictorial diagram in Figure 133.

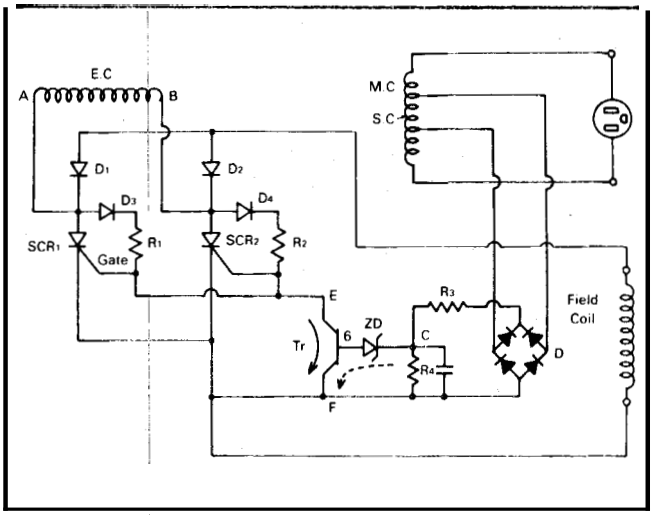


Figure 134

During operation the ends of the exciter coil (E.C.) will alternate positive (+) and negative (-) at a frequency of 60Hz.

Generator Operation - Automatic Voltage Regulator (cont'd)

Refer to Figure 134 for the following description of the AVR. To begin, assume that the end of the exciter coil labeled "A" is positive. The following sequence of events will occur:

1. Diode D3 will be forward biased. The arrowhead end (anode) is positive (connected to the positive end of the exciter coil) and the diode will conduct.
2. Diode D1 will not conduct as it is reverse biased. The flat end (cathode) is connected to the positive end of the exciter coil. SCR will not conduct until it has the proper voltage at its gate.
3. Current will flow through D3 and R1 to the gate of SCR1.
4. With current at its gate SCR1 will turn on and conduct because it is also forward biased.
5. Current will not flow through D4, R2 or SCR2 because they are reverse biased; (their anode ends are connected to the negative end of the exciter coil). Initially current will not flow through the transistor (Tr) as it has not been turned on with the proper base current.
6. When SCR1 turns on it provides a very low resistance path for current to flow from the positive end of the exciter coil to the field coil (rotor) where it will build an electromagnetic field.
7. Return current can now flow from the field coil (rotor) through diode D2 (it will conduct in this direction because it is forward biased), back to the negative end of the Exciter coil.
8. When the end of the exciter coil labeled "B" becomes positive, diode D4 and SCR2 will become forward biased. A repeat of steps 1-7 using D4, R2 and SCR2 will occur. It is important to note that the arrangement of D1, D2, SCR1 and SCR2 form a full wave bridge rectifier and will send DC electricity to the field coil.

The amount of current that is sent to the field coil is controlled by the transistor (Tr) and zener diode (ZD). The control circuit operates as follows:

1. Two sensor wires are connected to the main coil (MC) to monitor the output voltage of the generator.
2. The electricity from the sensor wires is changed to DC by the full wave bridge rectifier (D).
3. The electricity from the rectifier (D) flows to a voltage divider network made up of resistors R3 and R4. When the voltage at the connecting point (C) reaches the breakdown level of the zener diode (ZD), the zener diode will allow current to flow to the base (b) of the transistor (Tr).
4. The current at the base of the transistor will turn the transistor "on" and will allow current to flow with almost no resistance from point E to point F.
5. Electricity from R1 and R2 that would normally be used to turn on SCR1 and SCR2 is now diverted through the transistor and the SCR'S remain in the "off' mode. Electricity will not flow from the anode to cathode of the SCR.
6. The amount of current flowing through the transistor is very small and flows through the field coil, creating an insignificant magnetic field and then back to the exciter coil.
7. When the output voltage of the main coil drops the zener diode will turn off and block current to the base of the transistor. The SCR's will turn on and full current flow will return to the field coil.

GENERATOR TESTING

ION: The following tests will be completed with the generator running. The electricity this generator produces can cause death. Never touch any part of your body to exposed or uninsulated terminals or wiring.

Generator Testing - Color Code

P	Pink
G	Green
R	Red
B	Black
W	White
Y	Yellow
Bl	Blue
Br	Brown
Or	Orange
Ltbl	Light Blue
Ltg	Light Green
Ltg/R	Light Green with Red Tracer
W/R	White with Red Tracer
R/B	Red with Black Tracer
Y/G	Yellow with Green Tracer
R/W	Red with White Tracer
W/B	White with Black Tracer
G/W	Green with White Tracer
Bl/R	Blue with Tracer
Bl/W	Blue with White Tracer
G/R	Green with Red Tracer
Br/Y	Brown with Yellow Tracer
G/Y	Green with Yellow Tracer

Generator Testing - Measuring AC Voltage

1. Check the oil in the engine of the generator.
2. Unplug any appliances that may be connected to the generator.
3. Start the generator.
4. Place a multimeter on the 250 volt AC scale.
5. Insert the probes in the AC outlet and measure the voltage. The unloaded output voltage should be 120 volts ± 10%. See Figure 135.

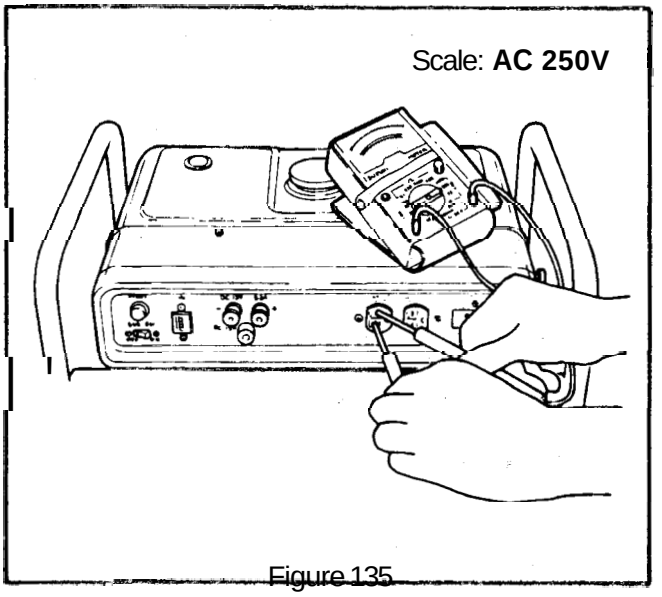


Figure 135

Generator Testing - Measuring DC voltage

1. Check the oil in the engine of the generator.
2. Unplug any appliances that may be connected to the generator.
4. Set your multimeter on the 25 VDC scale.
5. Connect the probes to the DC terminals on the generator, plus to plus and minus to minus, (red to red and black to black). The unloaded DC voltage should be approximately 14 VDC. At **full** load (8.3 amps) the voltage may drop as **low** as 11 volts. See Figure 136.

Generator Testing - Measuring Stator Coil Resistance

1. Stop the generator and pull the spark plug wire off the spark plug.
2. Remove the two screws retaining the generator end cover.
3. Disconnect the main **AC** output wires that lead to the control panel.
4. Place your multimeter on the **R X** 1 scale and measure the stator resistance through the AC terminal block. On dual voltage models that have three terminals measure between the terminals with the red and blue wires.

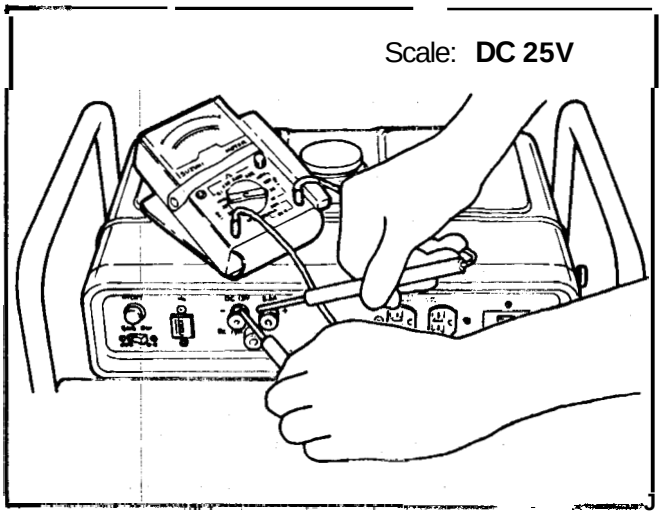


Figure 136

5. The stator coils should have the following resistance value + or - 20%

T1200

Stator coil resistance
1.733 ohms

Ti800

Stator coil resistance
1.05 ohms

T2500

Stator coil resistance
0.5 ohms

T2500,D

Stator coil resistance
1.86 ohms

T3000

Stator coil resistance
0.6 ohms

T3000D

Stator coil resistance
2.23 Ohms

Generator Testing - Measuring Stator Coil Resistance (cont'd)

The resistance values measured will be very low and the accuracy of some meters may not indicate 10th'sof an ohm. It is important to remember that the main values that we are looking for are short circuits (0 resistance) or open circuits (infinite resistance).

Generator Testing - Measuring Rotor Coil Resistance

1. Stop the generator and pull the spark plug wire *off* the spark plug.
2. Remove the **two** screws retaining the end cover of the generator.
3. Remove the wires connected to the brushes.
4. The resistance measurement will be taken at the brush holder.
5. Disconnect the wires connected to the brush holder.
6. Place your multimeter on the **R X** 1 scale and measure the resistance of the rotor through the brushes. See Figure 137.

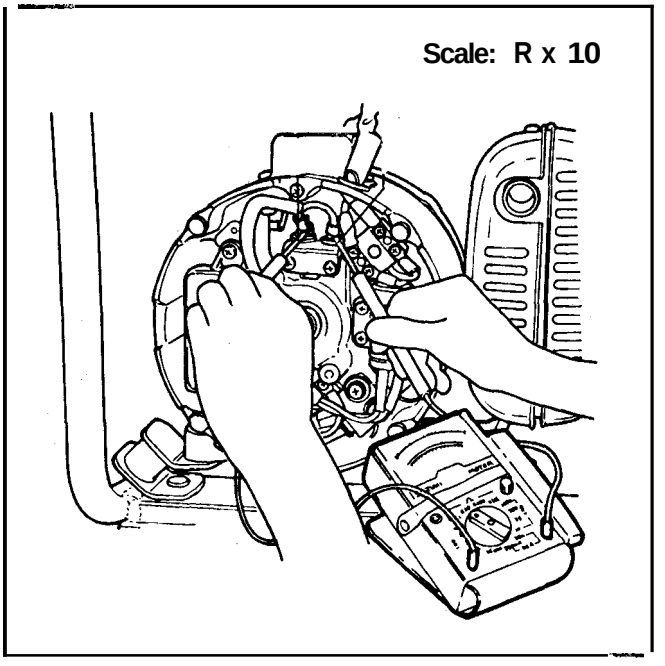


Figure 137

7. The rotor coil should have the following resistance + or - 20%.

T1200

Rotor coil resistance
46.1 ohms

T1800

Rotor coil resistance
51.5 ohms

T2500

Rotor coil resistance
68.8 ohms

T2500D

Rotor coil resistance
68.8 ohms

T3000

Rotor coil resistance
74.5 ohms

T3000D

Rotor coil resistance
74.5 ohms

NOTE The resistance values measured will be low and the accuracy of some meters may not indicate 10th's of an ohm. It **is** important to remember that the values we are looking for are short circuits (0 ohms or a value that deviates more than 20% below the standard resistance) or open circuits (infinite resistance).

If the measurement is more than 20% above the standard resistance the brushes should be removed and the meter probes applied directly to the slip rings. The brushes should not add more than a fraction of one ohm of resistance to the rotor circuit. If the resistance value of the rotor is normal when measured at the slip rings it indicates that there is a problem with the brushes or brush contact to the slip rings.

Generator Testing - Measuring Exciter Coil Resistance

1. Stop the generator and remove the spark plug wire.
2. Remove the two screws retaining the end cover of the generator.
3. Disconnect the four prong connector at the **AVR.**
4. Measure the exciter coil resistance at the the end of the wire connector that leads to the generator wiring harness. See Figure 138.

Generator Testing - Measuring Exciter Coil Resistance (cont'd)

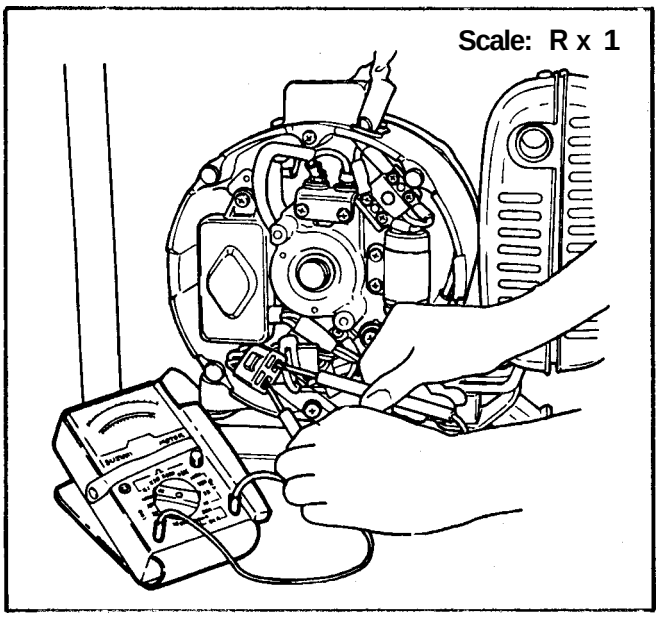


Figure 138

5. The exciter coil should have the following resistance + or - 20%. Take your measurement at the terminals connected to the color coded wires indicated in the chart below. See color code chart on page *67.*

T1200

Exciter coil resistance and wire color	
3.09 ohms	G & Ltg/R

T1800

Exciter coil resistance and wire color	
2.86 ohms	G & Ltg/R

T2500

Exciter coil resistance and wire color	
2.36 ohms	Bl & Bl

T2500D

Exciter coil resistance and wire color

T3000

Exciter coil resistance and wire color	
2.10 ohms	Bl & Bl

T3000D

Exciter coil resistance and wire color	
2.10 ohms	Bl & Bl

The resistance values measured will be very low and the accuracy of some meters may not indicate 10th'sof an ohm. It is important to remember that the main things we are looking for are short circuits (0 resistance) or open circuits (infinite resistance). An open circuit or short circuit will require replacement of the stator.

Generator Testing - Sensor Circuit Continuity

The sensorcircuit continuously monitors the AC output of the generator to determine how much voltage the AVR should send from the exciter coil to the rotor coil. The sensor circuit is wired in parallel with the main AC output wires. The continuity measurement is taken at the four pin connector from the harness that connects to the AVR. Two of the terminals connect to the exciter coil, the other two connect to the sensor circuit.

The resistance measurement will be from 2 ohms on the T1200 and T1800 to over 13,000 ohms on the T3000. The most likely failure will be an open circuit that will measure infinite resistance.

Generator/Testing- DC Circuit Diodes

Tor0 generators use a center tapped coil with two diodes to accomplish full wave rectification for DC output. Generators with a serial number that starts with "3" use part of the AC coil for DC output, and all other units use a separate DC coil. The cathode ends of the diodes are wired together for form the positive output terminal. The anode ends are connected to opposite ends of the coil with the center tap forming the negative output terminal. Tor0 generators use both single piece molded diode assemblies and dual piece assemblies with two separate diodes bonded to a common plate. When testing the diodes of either assembly the diodes must be disconnected from the circuit.

1. Disconnect the diodes from the generator wiring.
2. Check the continuity of each individual diode. The diode should pass current with low resistance in one direction and block the flow of current in the opposite direction. If a diode blocks current in both directions or allows current to flow in both directions the diode is bad and the entire diode assembly will have to be replaced.
3. If a diode is tested in circuit, a false reading may result by current flow back through the DC coil and the diode you don't intend to test. The diode you

Generator Testing - DC Circuit Diodes (cont'd)

are attempting to check may actually have an open circuit that would not be discovered because of the parallel wiring that exists with these diodes.

Generator Testing - Brush Inspection

1. Stop the generator and pull the spark plug wire off the spark plug.
2. Remove the two screws retaining the generator end cover.
3. Remove the brush holder.
4. Use a caliper or other measuring device to determine the length of the brushes. See Figure 139.

Brush length limit
3.5 mm (.138')

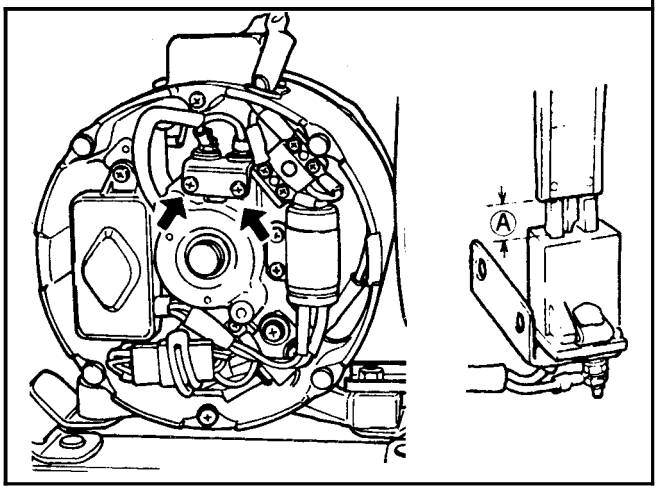


Figure 139

GENERATOR SERVICE

Generator Service - Disassembly

1. Turn the engine off and remove the spark plug wire.
2. Turn the fuel shut off valve to the "off" position.
3. Remove the end cover of the generator. See Figure 140.
4. Disconnect and remove the **AC** output wires at the terminal block. See Figure 141.
5. Disconnect the control wiring plug on the top of the generator assembly.
6. Continue disassembly **by** removing the brush holder. See Figure 142.

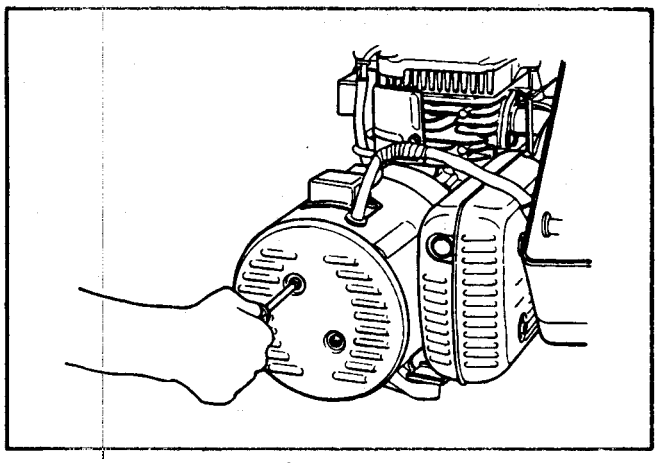


Figure 140

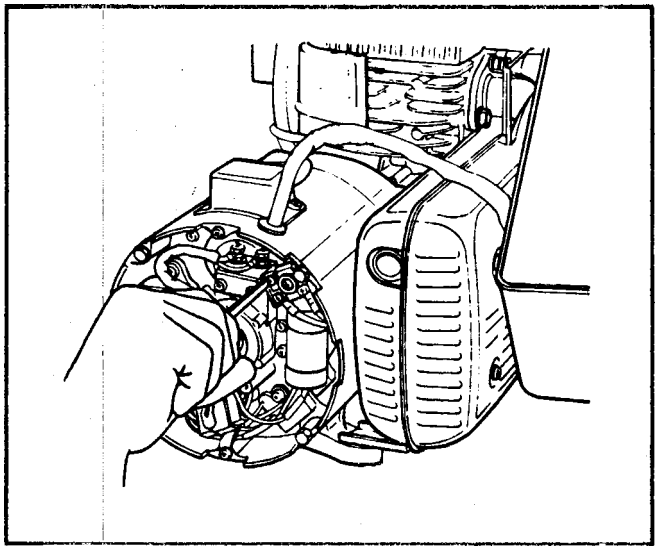


Figure 141

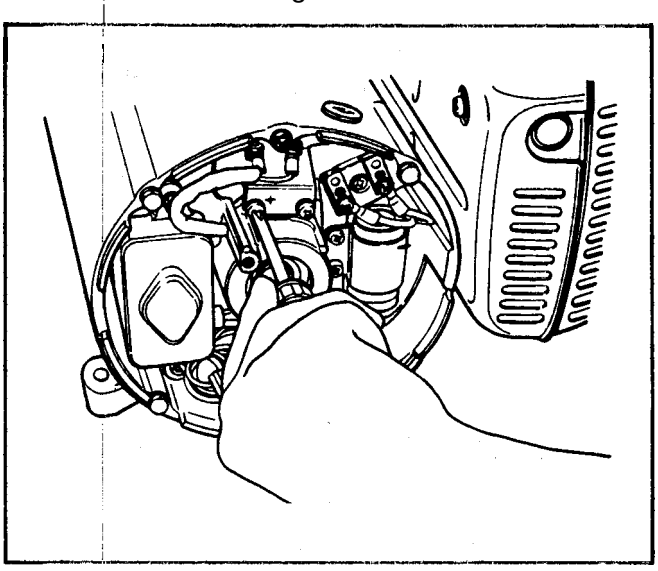


Figure 142

7. Remove the two nuts securing the rear frame of the generator **to** the tube frame shock mounts. The rear right-hand nut also retains the muffler bracket.
8. Remove the four generator through bolts. See Figure 143.

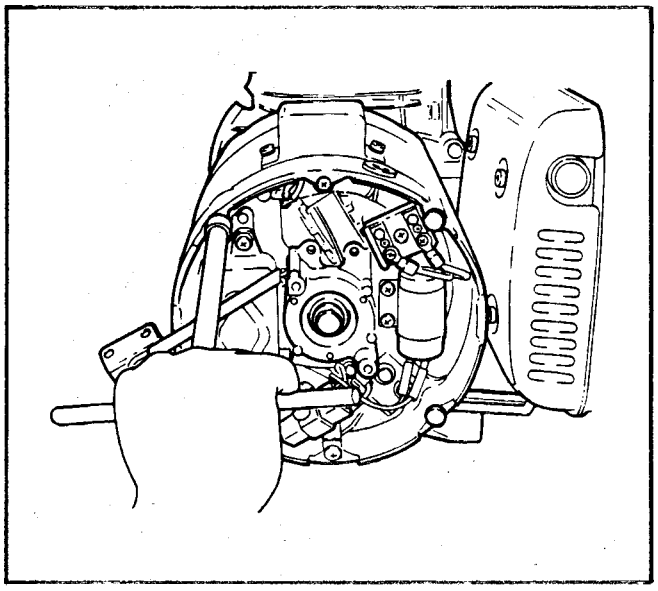


Figure 143

9. Use a plastic hammer to remove the end cover and stator assembly.

   IMPORTANT: when setting the stator aside do not place the stator on its coil ends, this may damage the windings. Allow the stator to rest on its laminations only. See Figure 144.

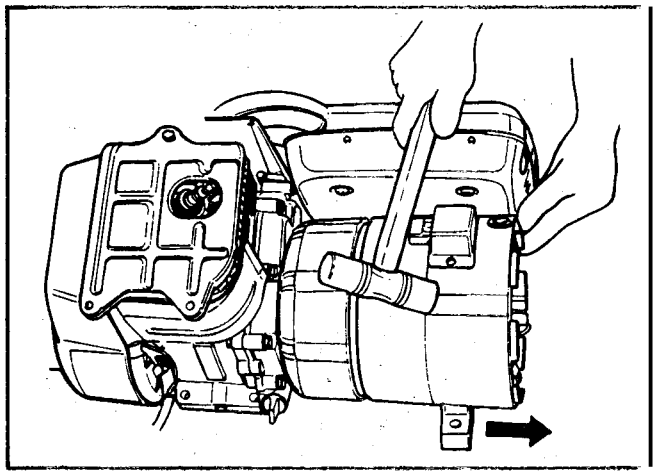


Figure 144

10. Remove the recoil starter.

11. Hold the crankshaft in place with a screwdriver or bar through the recoil starter cup and remove the rotor set bolt. See Figure 145.

12. Use a rotor remover bolt (see the Special Tool Section, page 19, for the correct part number) to remove the rotor assembly. The rotor is secured to the crankshaft of the engine with a tapered fit. The crankshaft has an external taper and the rotor has an internal taper. See Figure 146.

    Generator disassembly is now complete.

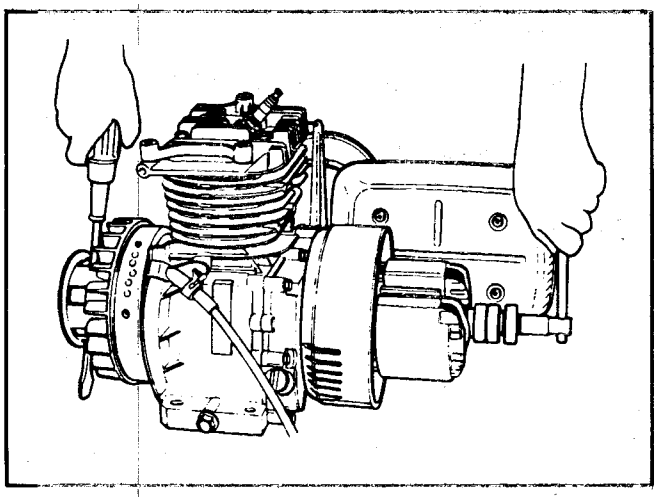


Figure 145

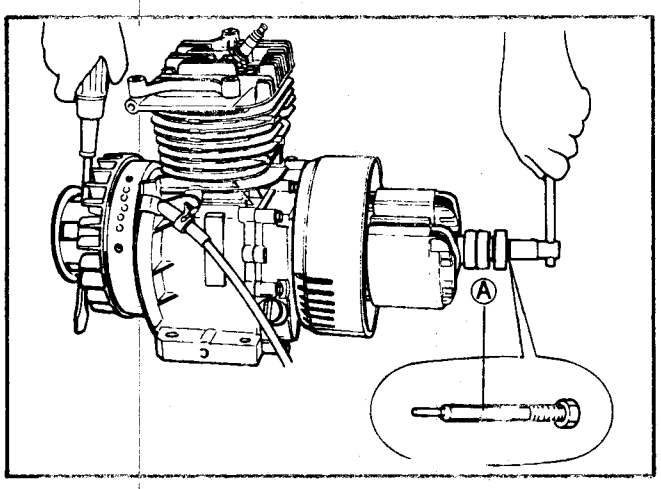


Figure 146

13. Inspect the individual generator components for obvious defects or failures. Inspect the integrity of all insulation and connections. Protect the rotor and stator coils from damage while the generator is disassembled

Generator Service - Reassembly

1. Inspect the rotor assembly for defects; broken wires,' worn or damaged slip rings, damaged insulation.

2. Install the rotor assembly. Some units use a key or pin to, align the rotor to the crankshaft. Make sure the tapers are clean and that the rotor and crankshaft line up correctly.

Rotor set bolt torque
2.2 kg m (16 ft lbs)

3. Inspect the stator assembly for defects. Check for broken wires, bad insulation, broken wire ties etc.

4. Remove the brush holder if it is still installed on the stator.

Generator Service - Reassembly (cont'd)

5. Align the through bolt holes with the holes in the front generator cover .(the cover bolted to the engine) and install the stator. Take extreme care not to damage any **of** the coils in the stator. See Figure 147.

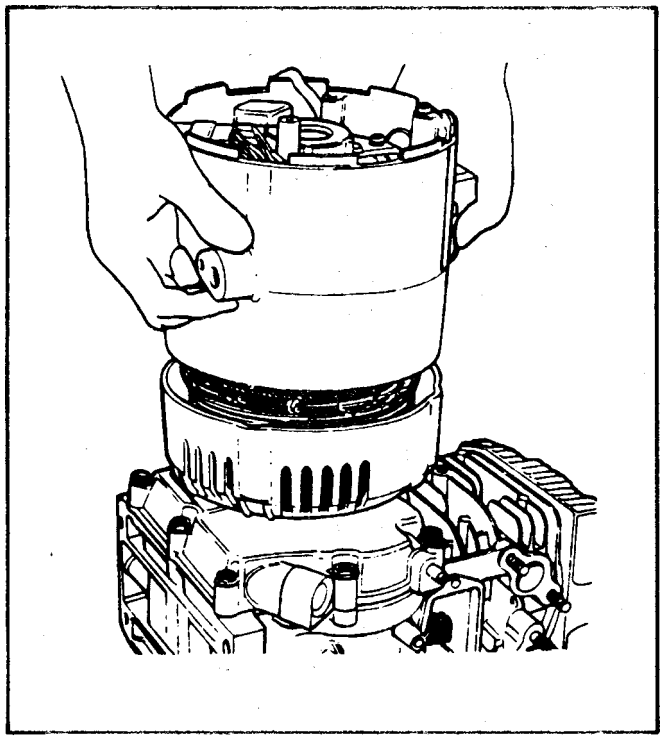


Figure 147

6. Tighten the through bolts in the sequence as shown in Figure 148.

Through bolt torque
1.0kgm (7ftlbs)

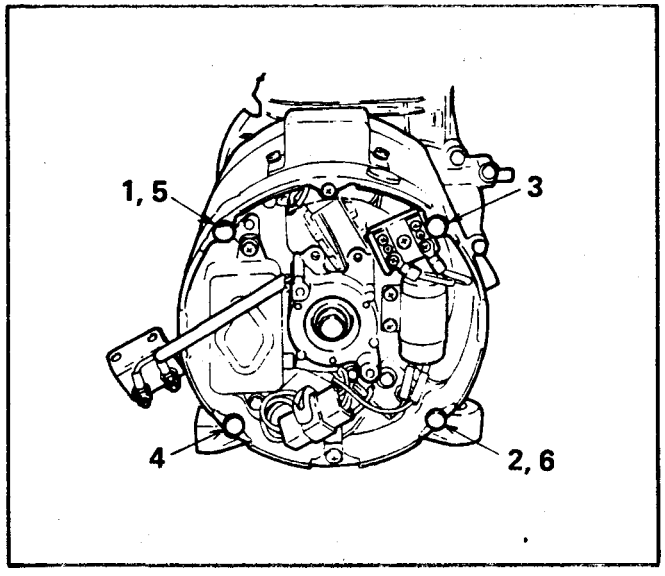


Figure 148

7. The brush holder may be reinstalled at this time. **If** the wires have been disconnected from the holder make certain that the polarity is correct. The brush wire with the collar that is marked + must be connected to the positive brush terminal.

8. Reconnect the AC output wires on the terminal block. Be sure to match the color coding. See Figure 149.

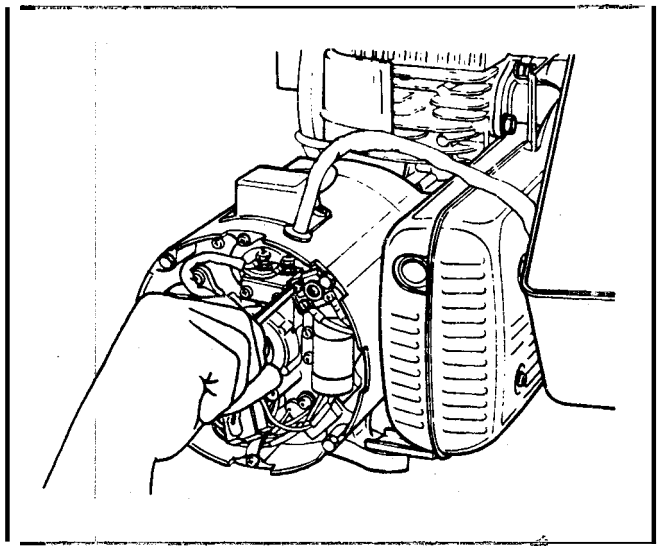


Figure 149

9. Reconnect the lead wire from the control panel to the connector on the top of the generator.

10. If ,the diode assembly has been disconnected it should be reinstalled at this time. On some units the assembly is soldered in place, others use connectors There are three wires connected to each diode assembly, two that supply AC power to the diodes and one positive output wire. The negative output wire comes directly from the center tap of the winding that supplies power for the DC circuit. The positive output wire is white on T1200 through T2500 and pink on the T3000. The remaining two wires are connected to the anode (positive) ends of the diodes. See Figure 150.

Model	Diode Wire Colors
T1200	Br & Br
T1800	Br & Br
T2500	R & W/R
T3000	R&W/R

11. Reconnect the four pin connector to the AVR.

12. Make sure all wires are clamped in place and reinstall the end cover **of** the generator.

13. Remount the generator to the shock mounts. Secure the muffler bracket to the right-hand shock mount.

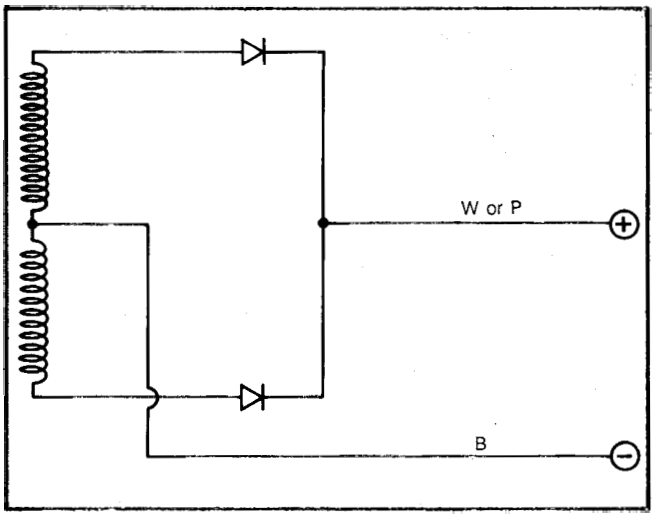


Figure 150

TROUBLESHOOTING

When troubleshooting, remember to keep it simple and look for the most obvious cause for a failure. Most generator troubleshooting is very straight forward and most failures are easy to detect.

To use this troubleshooting guide, look for the failure description that matches the failure you have encountered and follow the outlined steps.

Troubleshooting - No AC Output (0 volts AC)

1. Verify 3600 RPM engine speed.
2. Check voltmeter on the generator panel. If it is indicating 120 - 240 volts, go to step 3. If it indicates 0 volts, go to step 4.
3. Verify the operation of the circuit breaker. The meter is wired to the unswitched side of the circuit breaker and will indicate voltage if the breaker is open or failed. See Control Panel Inspection on page 77 for information on testing the circuit breakers.
4. Remove the end cover of the generator and measure the AC voltage at the terminal block. If the meter indicates 0 volts, go to step **5.** If the voltage is normal, 120 VAC (single voltage units), 240 VAC (dual voltage units), repair the wiring between the terminal block and control panel.
5. Check the contact of the brushes with the slip rings on the rotor. The brushes should be of the appropriate length (minimum 3.5 mm, .138 in). If the brushes are short or not making contact replace the brush assembly. If the brushes are making contact go to step 6.
6. Check the resistance of the rotor. See Generator Testing, page 69 for the correct procedure and resistance value. If the resistance is out of specification, high or low, replace the rotor. If the resistance is within specification go to step 7.
7. Check the resistance of the stator main coil. See Generator Testing, page 68 for the correct procedure and resistance value. If the resistance is out/of specification, high or low, replace the stator; If the resistance is within specification go to step 8,.
8. Check the resistance of the exciter coil. See Generator Testing, page 69 for the correct procedure and resistance value. If the resistance is out of specification, high or low, replace the stator.: If the resistance is within specification go to step 9.
9. Flash the field with a 12 volt battery. Start the generator and connect the 12 volt battery to the brush terminals + to + and - to - . Reverse connection will damage the AVR. Make sure the brushes are connected to the automatic voltage regulator (AVR) during this test.

CAUTION: There is exposed wiring that contains potentially lethal voltage - Do not touch any of the exposed terminals.

10. Measure the AC output voltage. If the voltage is within specification leave the generator running and disconnect the battery. If the voltage stays within specification it indicates that the permanent magnets on the rotor were demagnetized. Flashing the field should restore the magnetism. If on restarting the generator after flashing the field the voltage again is at 0 it may indicate that the brush connections are reversed at the brushes. Check the sections on Schematics, pages 78, 79 and 80 for correct wiring. If the voltage falls to 0 with disconnection of the battery, replace the AVR.

Troubleshooting - Low AC Output (3-6 volts)

An output of 3-6 volts indicates that the permanent magnets on the rotor are functioning. It also indicates that the following components are operating:

- The wiring to the receptacle is **OK.**
- The receptacle is **OK.**
- The AC circuit breaker is allowing current to flow.
- The main stator coil has continuity.

Troubleshooting - **Low** AC Output **(3-6** volts) (cont'd)

1. Verify 3600 RPM engine speed.
2. Check the contact of the brushes with the slip rings on the rotor. The brushes should be of the appropriate length (minimum 3.5 mm, .138"). If the brushes are short or not making contact replace the brush assembly. If the brushes are making contact go to step 3.
3. Check the resistance of the rotor. See Generator Inspection on page **69** for the correct procedure and resistance value. If the resistance is out of specification, high or low, replace the rotor. **If** the resistance is within specification go to step **4.**
4. Check the exciter coil resistance. See Generator Inspection on page 69 for the correct procedure and resistance value. If the resistance is out of specification, high or low, replace the stator. If the resistance is within specification go to step **5.**
5. Replace the automatic voltage regulator (AVR).

Troubleshooting - High AC Output (over **132** volts AC)

The no load AC voltage should be 120 volts + or - 10%.

CAUTION: High voltage may cause damage and/or fires in connected appliances.

High AC output indicates too much voltage being sent to the field (rotor). The AVR determines how much voltage to send from the exciter coil to the rotor by continuously sampling the AC output voltage through two sensor circuit wires. If this circuit is damaged or open, the AVR will interpret this as a low AC output voltage situation and will respond by sending maximum exciter voltage to the rotor. High output voltage also indicates that the following components are operating or functional:

- The stator coil has continuity.
- The exciter coil has continuity.
- The permanent magnets are OK.
- The receptacle and wiring to the receptacle is OK.
- The AC circuit breaker **is** OK.
- The rotor coil has continuity.
- The brushes are contacting the slip rings.

1. Verify 3600 RPM engine speed.
2. Stop the generator and remove the end cover.
3. Disconnect the four pin connector at the AVR. Check the sensor circuit for continuity. On the T1200 and **T1800** this is done at terminal **S1** and S2 of the four pin connector coming from the stator coil See Figure 151.

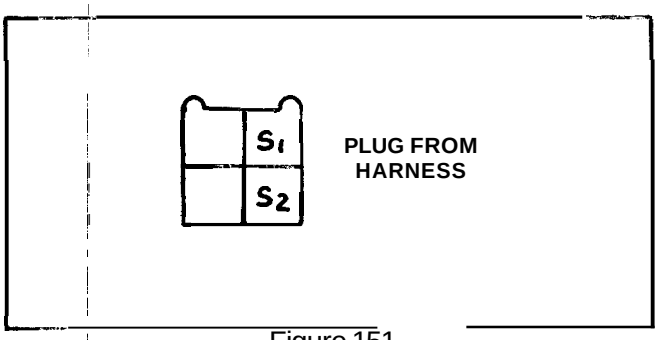


Figure 151

4. Sensor circuit continuity on the T2500 and T3000 is measured at **S1** and S2 as shown in Figure 152.

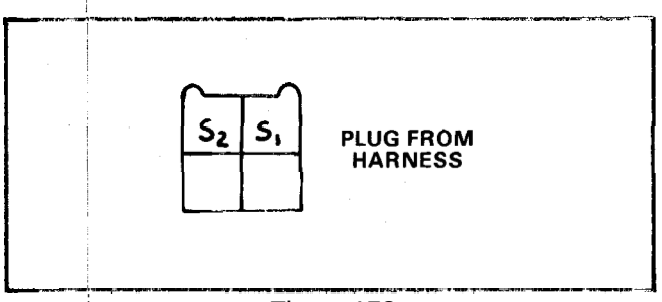


Figure 152

5. Refer to the Generator Testing section on page **70** for a complete description of sensor circuit testing procedures.
6. If the circuit is open (infinite resistance) the stator coil must be replaced.
7. If the sensor circuit has continuity and the high voltage situation remains, replace the AVR.

Troubleshooting - No DC Output ***(0*** volts DC)

1. Verify 3600 RPM engine speed.
2. verify AC output. If the AC output is normal go to step three. **If** the AC output is 0 volts, follow the steps in the No AC Output Procedure, page **74.**
3. Check the DC circuit breaker. **If** it has tripped, find the cause of the overload in the circuit wired to the DC output terminals and reset the breaker.
4. Check the continuity of the DC coil. Place your multimeter in the **R X 1** mode and test continuity at the anode end of the two diodes (this will be where the wires from the DC winding are connected). If there is no continuity the stator coil must be replaced **If** there is continuity go to step ***5.***
5. Check the function of the diodes. See Generator testing - DC Circuit Diodes, page **70. If** one or both diodes have an open circuit, replace the diode assembly.

Troubleshooting- Engine Labors Heavily

The generator will start and run but will not carry the load, the engine labors heavily.

1. Verify **3600** RPM no load engine speed.
2. Verify the current demand or power consumption of the load. Make sure the generator is not being overloaded. Inductive loads such as motors may require **3** to **4** times normal running power just to get them started. A one H.P. induction motor (one H.P. = ***750*** watts) may require 3000 watts just to get it started. The condition of the appliance, along with the length and condition of the extension cord will also be important factors in the ability of a generator to start and run a load.
3. Verify the condition of the engine. An engine with long hours of use and wear may not be developing enough horse power to power a load that it may have easily run when new.
4. Verify the condition of the muffler. If the muffler or spark arrestor is clogged with carbon, the engine may not be able to exhaust efficiently which will result in reduced output.

Troubleshooting- Low Output Power On Dual Voltage Generators

1. Dual voltage generators that were built in 1983 and 1984 were equipped with two 15 amp 120 volt receptacles and one 240 volt receptacle. Full power is available on these generators at 240 volts but because the main winding is center tapped only half the total power is available to each 120 volt outlet, e.g., a T3000D **of** 1983-1984 design would provide only 1500 watts per 120 volt receptacle and **3000** watts at 240 volts.
2. In 1985 we introduce dual voltage generators that were equipped with a fourth receptacle that would provide full power at 120 volts. This is accomplished without switching or paralleling the windings. There is actually a bifilar winding on one of the; 120 main coil halves that supplies this receptacle. All outlets may be used at the same time as long as the total capacity of the generator is not exceeded

Troubleshooting- Can I use DC and AC at the same time?,

1. On 19& and 1984 generators the DC winding was part of the AC winding and use of both AC and DC at the same time could lead to overheating.
2. 1985 and newer product use a DC winding that is separate from the AC winding and on these units it is possible to use both AC and DC at the same time. The DC circuit will consume about 100 watts when fully loaded.

SECTION 8 CONTROL PANEL

Control Panel - Disassembly

1. Turn the engine off and pull the spark plug wire off the spark plug.
2. Turn the fuel shut off valve to the "off" position.
3. On generators with a serial number starting with "3" the control panel is secured to the fuel tank with four screws and secured to the front frame rail with two hair pin clips. Remove the two clips and then remove the four screws. The back of the control panel may now be exposed.
4. On generators with a serial number starting with "4" and above, it is necessary to remove only the six screws that retain the front panel to the control panel body.
5. With the panel pulled open, the engine "on-off" switch, receptacles and circuit breakers are visible.
6. The low oil level shut down module is mounted inside the control panel and is secured with one screw, it may also be removed if necessary.
7. See the Schematic Diagrams on pages **78,79** and **80** to verify correct wiring of the control panel components.

Control Panel - Inspection

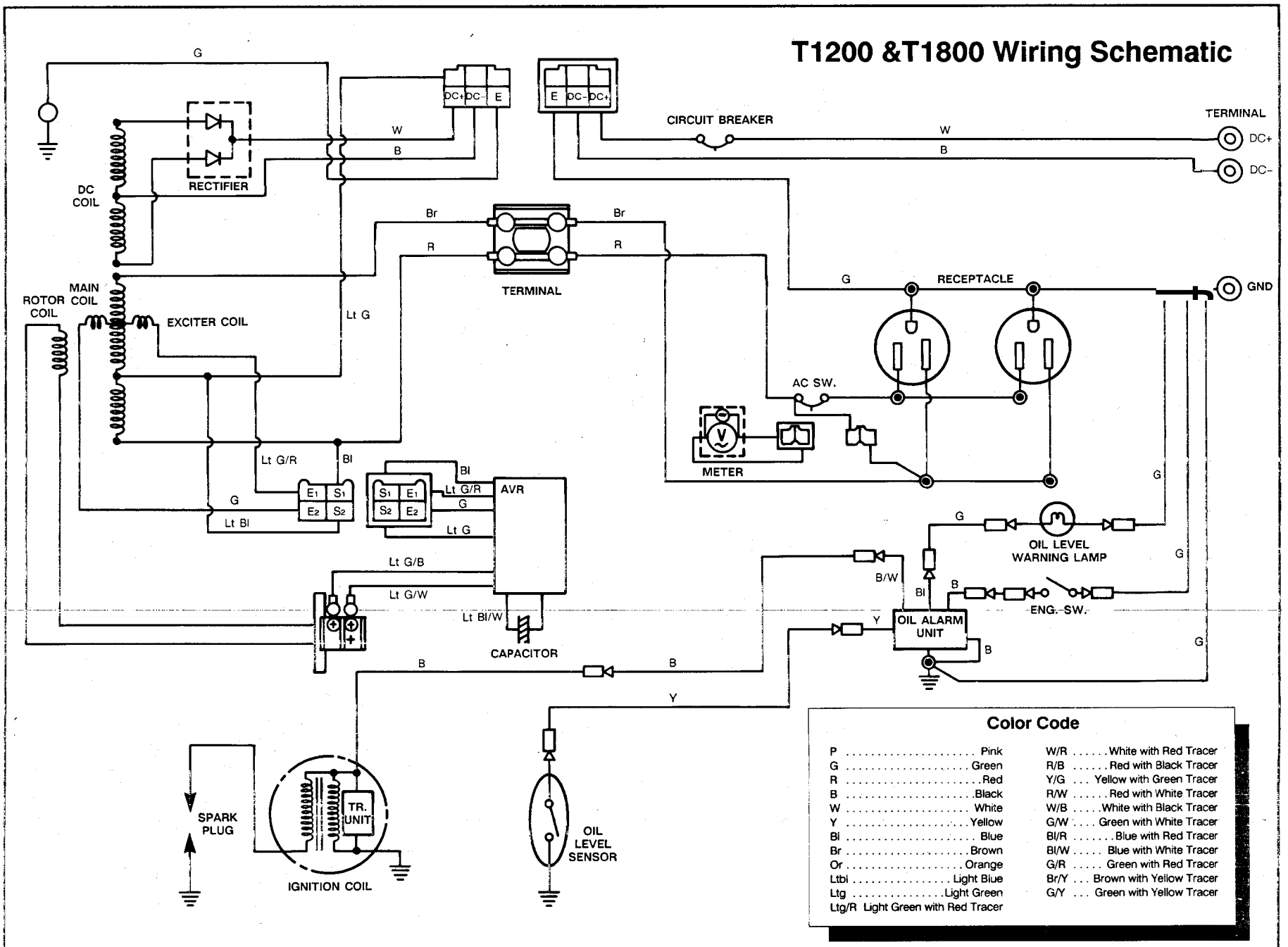
1. It is not necessary to remove individual components from the control panel for inspection and testing. Failure of most of the panel components will be obvious without disassembly of the panel.
2. The operation of the circuit breakers may be verified with a multimeter. It is a good habit to always disconnect a component from the circuit when making a continuity or resistance check. This will eliminate the possibility of any other portion of the wiring causing a false reading.
3. Place your multimeter in the **R X 1** mode and check the continuity of the AC circuit breaker (breakers) in the "on" and "off" position. If the circuit breaker does not open and close under manual operation of the switch arm, the breaker must be replaced.
4. The DC breaker is a thermally activated device and it is not possible to manually open its contacts. The breaker should open the circuit under a load of **8.3** amps DC. If the breaker does not appear to be operating properly, connect a DC ammeter in the series with the load in the DC circuit connected to the generator and measure the current to verify the point at which the circuit breaker trips.
5. The engine ignition switch is a single pole, single throw switch that may be tested by disconnecting it from the circuit and checking the opening and closing of the contacts with a multimeter in the **R X ~ I** mode.
6. The receptacles are friction and twist lock connection devices. There are no moving parts and are not subject to failure uless they are mechanically damaged. The receptacles should be tested by disconnecting them from the circuit and checking for shorts and continuity with a test light or multimeter.
7. The volt meter in the panel is connected in parallel with the AC output circuit of the generator. If the meter is not functioning, verify the AC output voltage with an external AC volt meter. If the AC voltage is normal and the meter is not indicating, verify its connections and replace the meter if necessary.
8. The DC output terminals should be fully insulated from the front panel. Verify the the integrity of the insulation with a multimeter in the **R X 1** mode connected alternately, to each terminal and ground. There should be infinite resistance.

   NOTE: This test, as with other continuity tests, should be completed with the wires disconnected from the terminals.
9. The low oil level warning lamp may be tested by unplugging its connectors and checking the resistance of the lamp. It should measure approximately **18** ohms. If a reading of infinity is indicated the filament in the lamp is open and the lamp must be replaced.

Control Panel - Reassembly

1. Remount any component that may have been removed from the panel.
2. Reconnect all panel components per the Schematic Diagrams shown on pages **78,79** and **80**
3. Reinstall the low oil level shutdown module. Make sure the module is securely grounded.
4. Remount the control panel with four or six screws as required.
5. **On 1983** models (serial number starts with a "**3**") install the two hair pin clips retaining the control panel to the front frame rail. That completes reassembly.

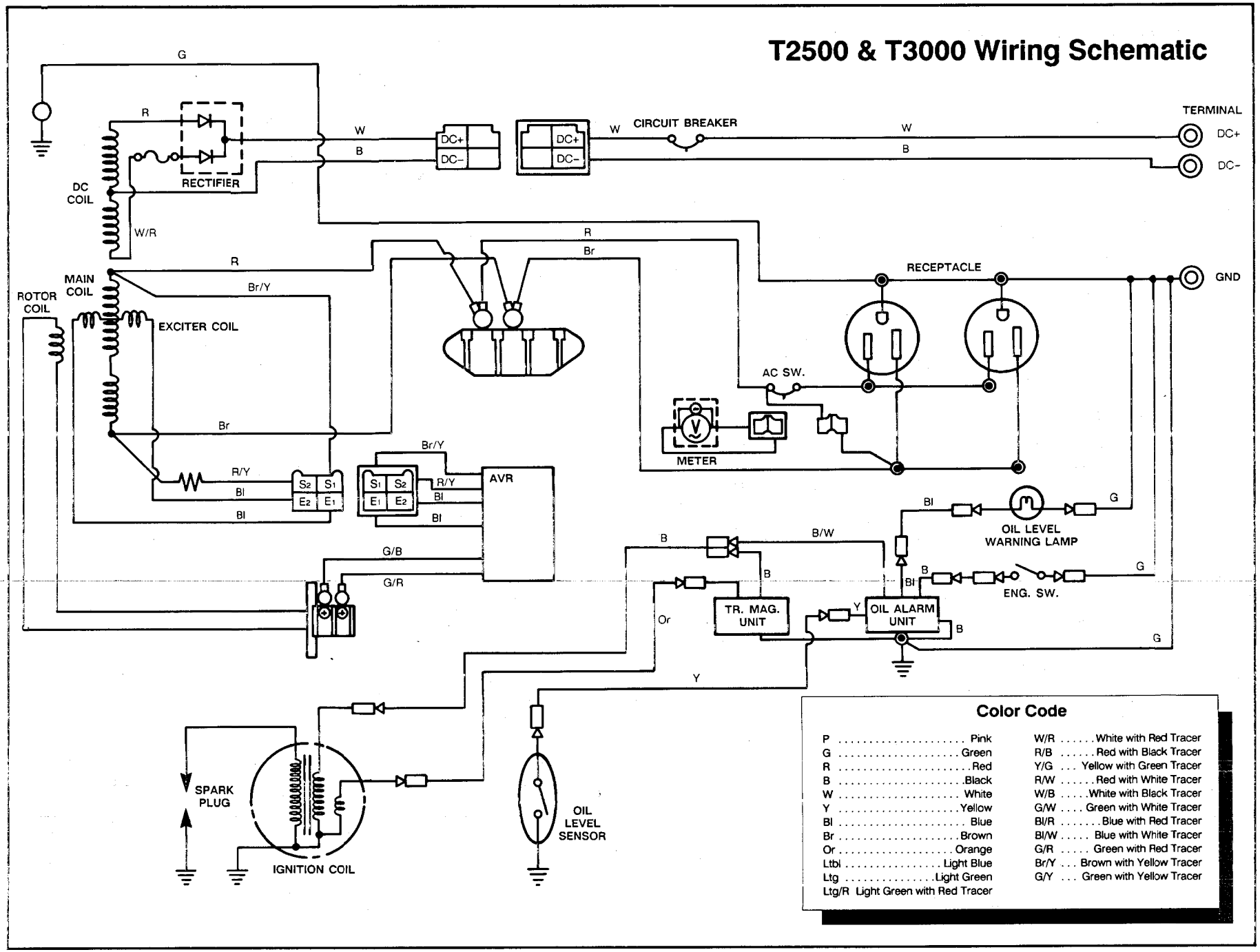
T1200 &T1800 Wiring Schematic



Color Code

P	Pink	W/R	White with Red Tracer
G	Green	R/B	Red with Black Tracer
R	Red	Y/G	Yellow with Green Tracer
B	Black	R/W	Red with White Tracer
W	White	W/B	White with Black Tracer
Y	Yellow	G/W	Green with White Tracer
Bl	Blue	Bl/R	Blue with Red Tracer
Br	Brown	Bl/W	Blue with White Tracer
Or	Orange	G/R	Green with Red Tracer
Ltbl	Light Blue	Br/Y	Brown with Yellow Tracer
Ltg	Light Green	G/Y	Green with Yellow Tracer
Ltg/R	Light Green with Red Tracer		

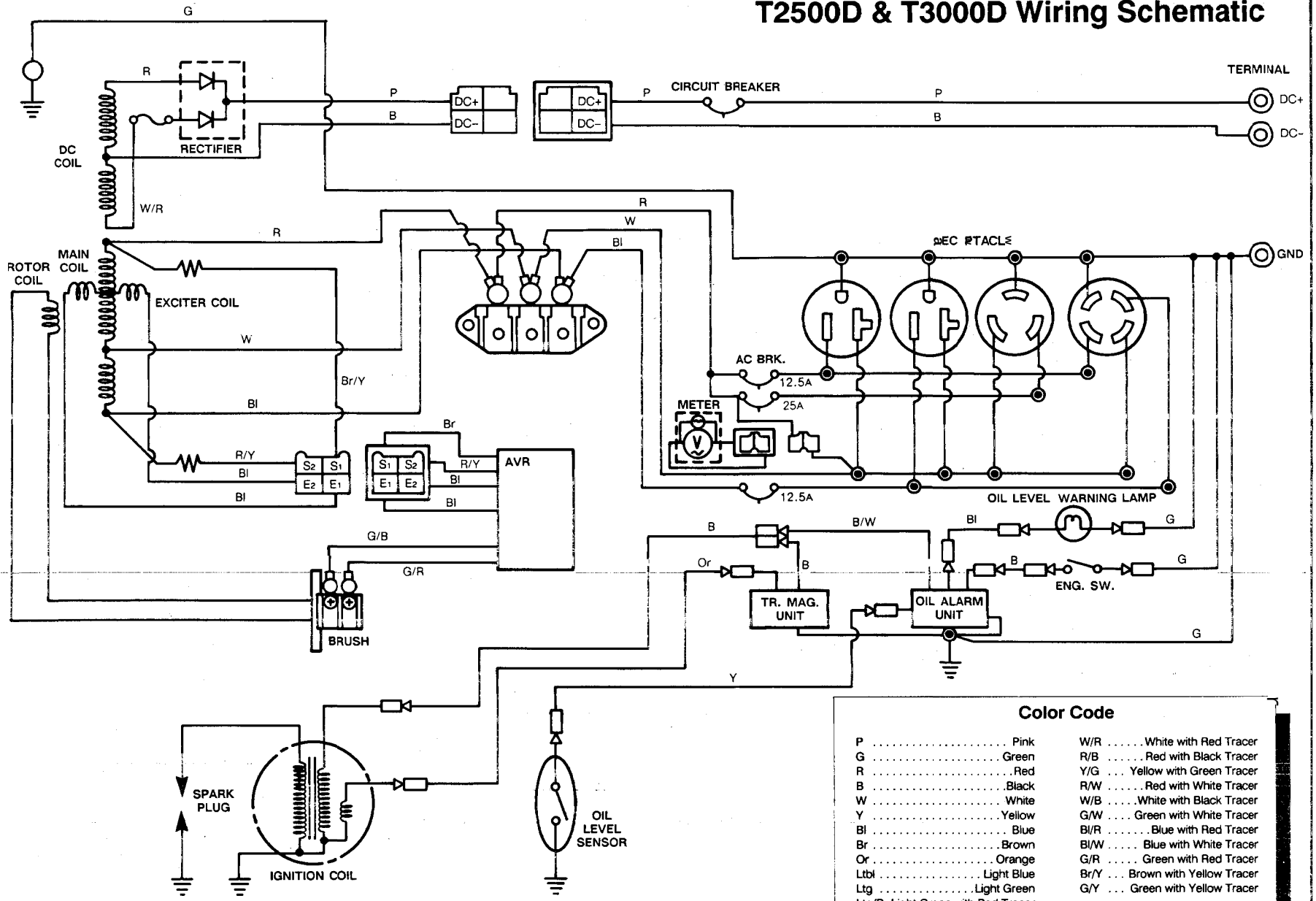
T2500 & T3000 Wiring Schematic



Color Code

P	Pink	W/R	White with Red Tracer
G	Green	R/B	Red with Black Tracer
R	Red	Y/G	Yellow with Green Tracer
B	Black	R/W	Red with White Tracer
W	White	W/B	White with Black Tracer
Y	Yellow	G/W	Green with White Tracer
Bl	Blue	Bl/R	Blue with Red Tracer
Br	Brown	Bl/W	Blue with White Tracer
Or	Orange	G/R	Green with Red Tracer
Ltbl	Light Blue	Br/Y	Brown with Yellow Tracer
Ltg	Light Green	G/Y	Green with Yellow Tracer
Ltg/R	Light Green with Red Tracer		

T2500D & T3000D Wiring Schematic



Color Code

P	Pink	W/R	White with Red Tracer
G	Green	R/B	Red with Black Tracer
R	Red	Y/G	Yellow with Green Tracer
B	Black	R/W	Red with White Tracer
W	White	W/B	White with Black Tracer
Y	Yellow	G/W	Green with White Tracer
Bl	Blue	Bl/R	Blue with Red Tracer
Br	Brown	Bl/W	Blue with White Tracer
Or	Orange	G/R	Green with Red Tracer
Ltbl	Light Blue	Br/Y	Brown with Yellow Tracer
Ltg	Light Green	G/Y	Green with Yellow Tracer
Ltg/R	Light Green with Red Tracer		