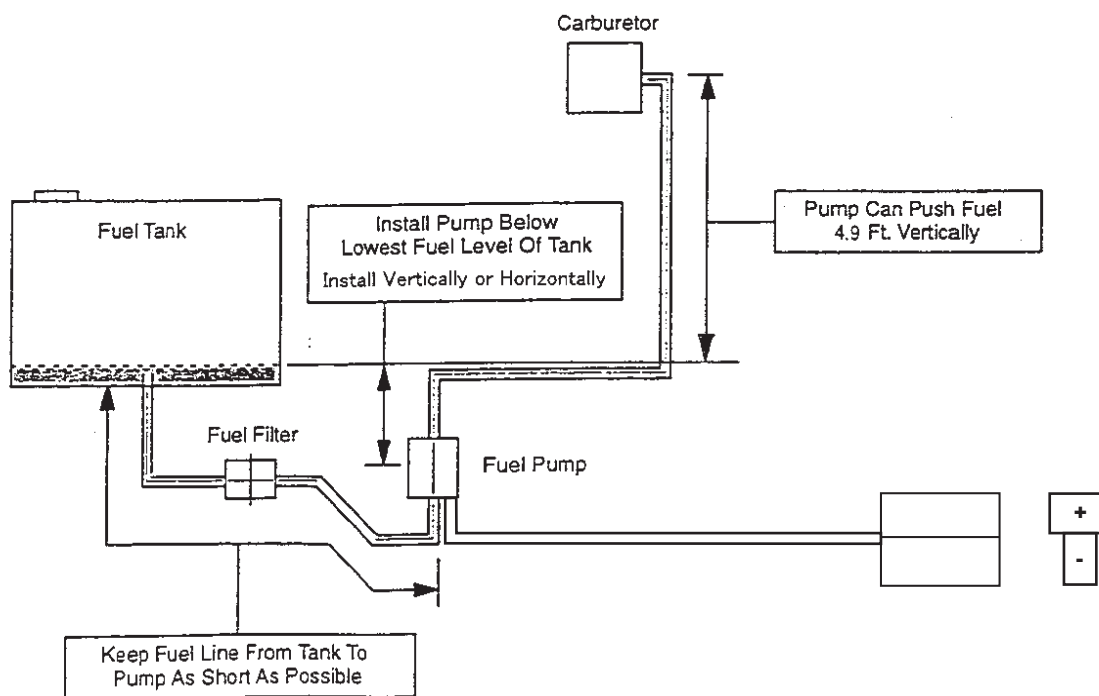

SECTION 5. FUEL SYSTEM

- 1. Fuel Pump Mounting Instructions 5-2
- 2. Diesel Fuel System 5-3
- 3. Diesel Injection Pump Identification 5-3
- 4. Fuel Piping Diagrams 5-5

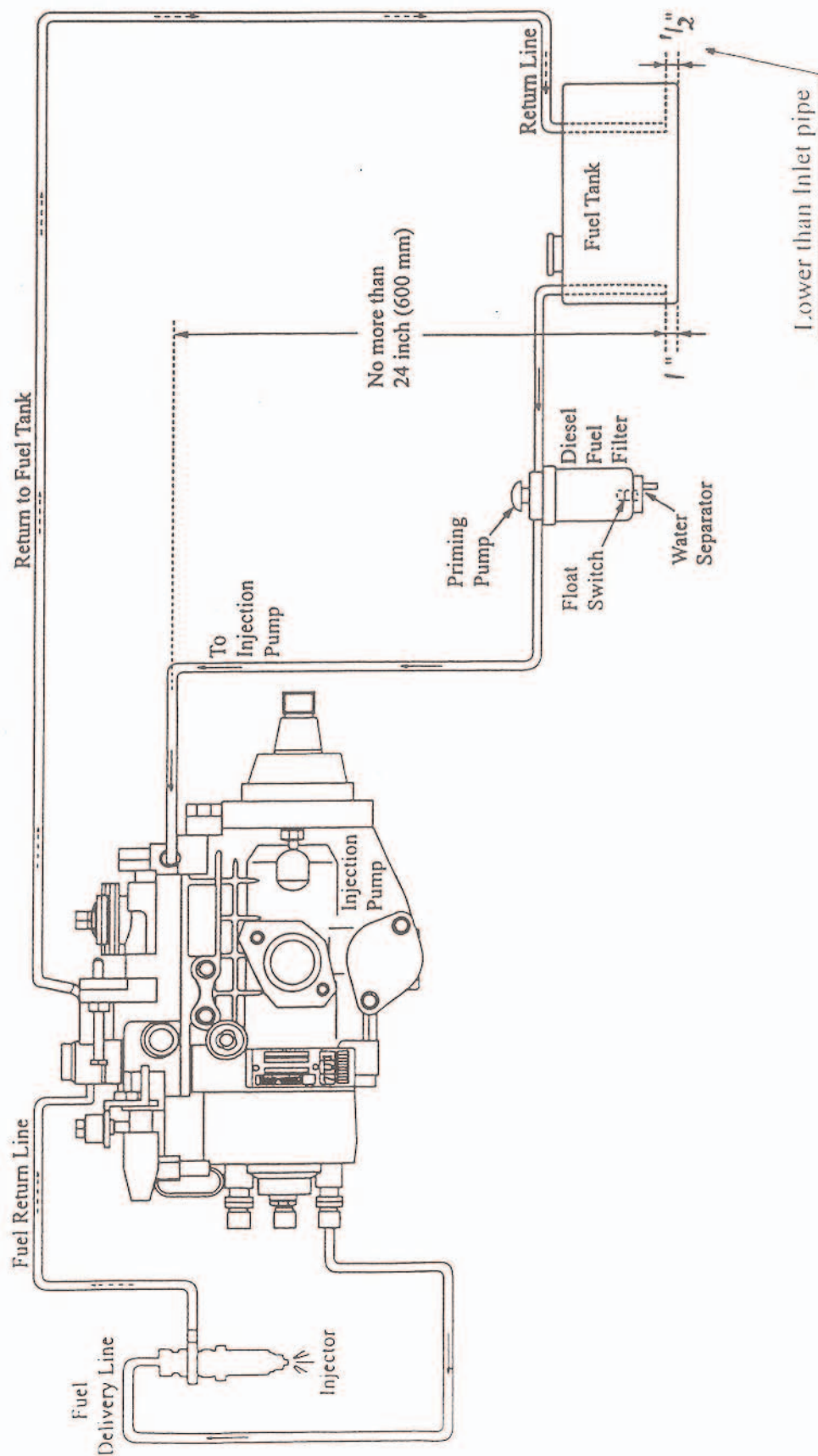
ELECTRIC FUEL PUMP MOUNTING INSTRUCTION

GASOLINE ENGINE

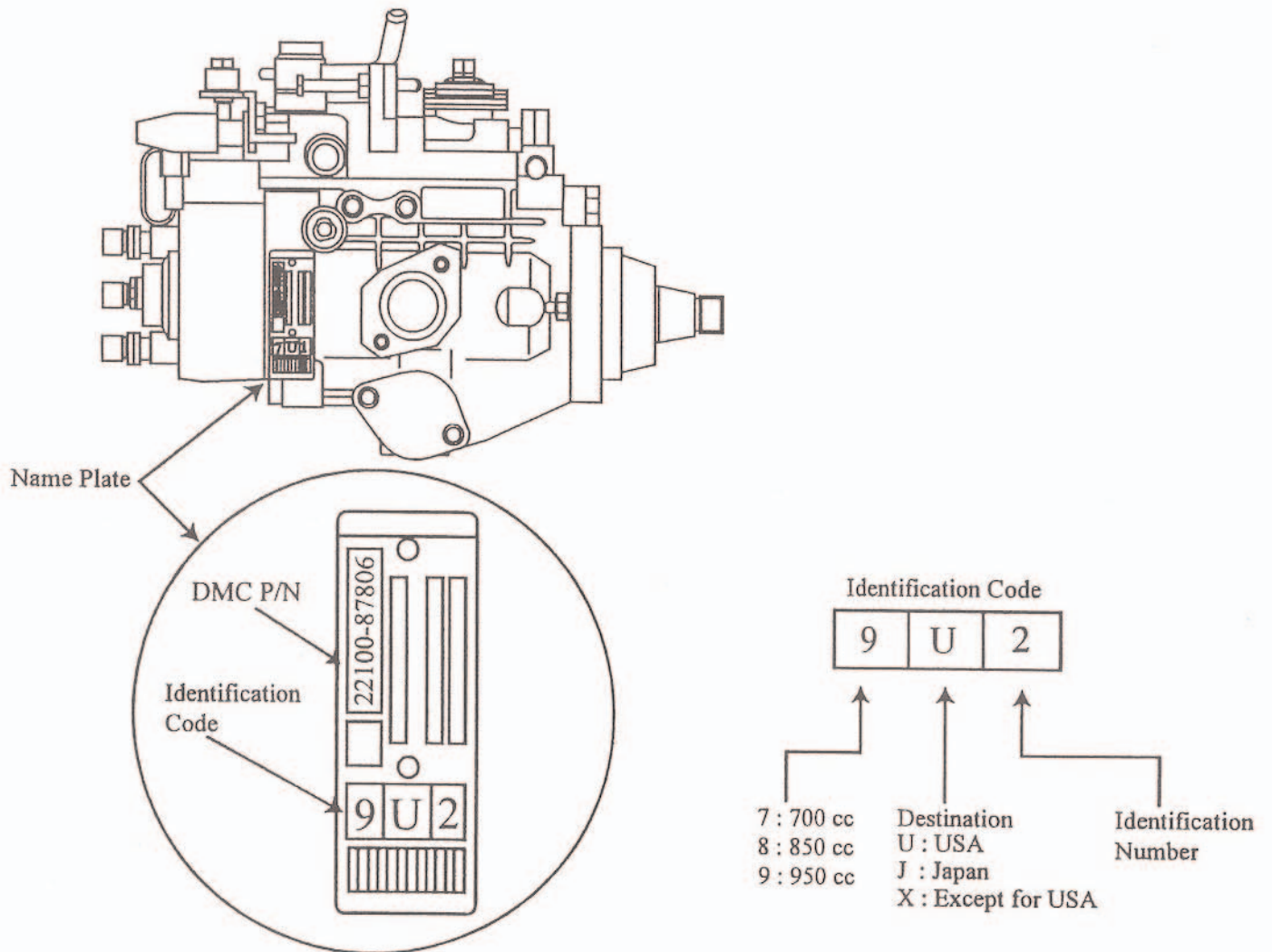
1. Fuel pump should be installed in a position lower than the low fuel level in the fuel tank to discourage the vaporization of fuel under suction.
2. Fuel pump mounting location should be in as cool as possible spot.
3. Suction hose should be as short as possible and should not be exposed to any heat source, such as exhaust manifold or muffler or exit air from radiator.
4. Fuel pump should be installed in a vertical position with exit up to allow possible vapor to easily percolate up to the carburetor.
5. Mount the fuel filter between the fuel tank and fuel pump to protect the pump from possible fuel contamination.
6. Ensure that the electrical connections for fuel pump follow the correct polarity. Reversing the polarity will cause fuel pump failure.



DIESEL FUEL SYSTEM



Injection Pump Identification



Gasoline

- Use clean, fresh, unleaded gasoline with a minimum of 85 octane. Fresh fuel prevents gum from forming in the fuel system or on essential carburetor parts. Purchase fuel in quantity that can be used within 30 days. In countries other than U.S.A., leaded gasoline may be used if it is commercially available and unleaded is unavailable.

CAUTION: Some fuels, called oxygenated or reformulated gasoline, are gasoline blended with alcohols or ethers. Excessive amounts of these blends can damage the fuel system or cause performance problems. If any undesirable operating symptoms occur, use gasoline with a lower percentage of alcohol or ether.

ADDING GASOLINE

- [1]. Remove cap. Fill tank to approximately 1-1/2 inches below top of neck to allow for fuel expansion. Be careful not to overfill.
- [2]. Replace cap before starting.
- [3]. Check for fuel leaks at fuel filter, carburetor, fuel pump, fuel pipe, etc.

LPG

- Use clean, dry LPG (propane), free of moisture or any particulate material.
- Use commercial grade HD5 propane with a minimum fuel energy of 2500 BTU/ft³, maximum propylene content of 5%, butane and heavier gas content of 2.5% and minimum propane content of 90%.

CAUTION: Using propane outside the above values may cause performance problems.

**THE LPG ENGINE IS CERTIFIED TO OPERATE ON LPG.
THE NG ENGINE IS CERTIFIED TO OPERATE ON NG.**

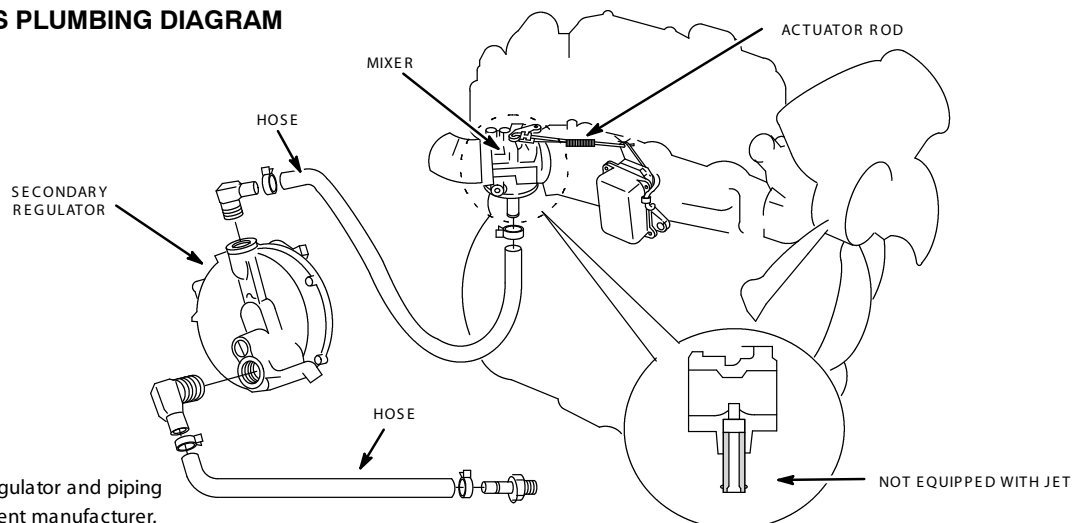
WARNING



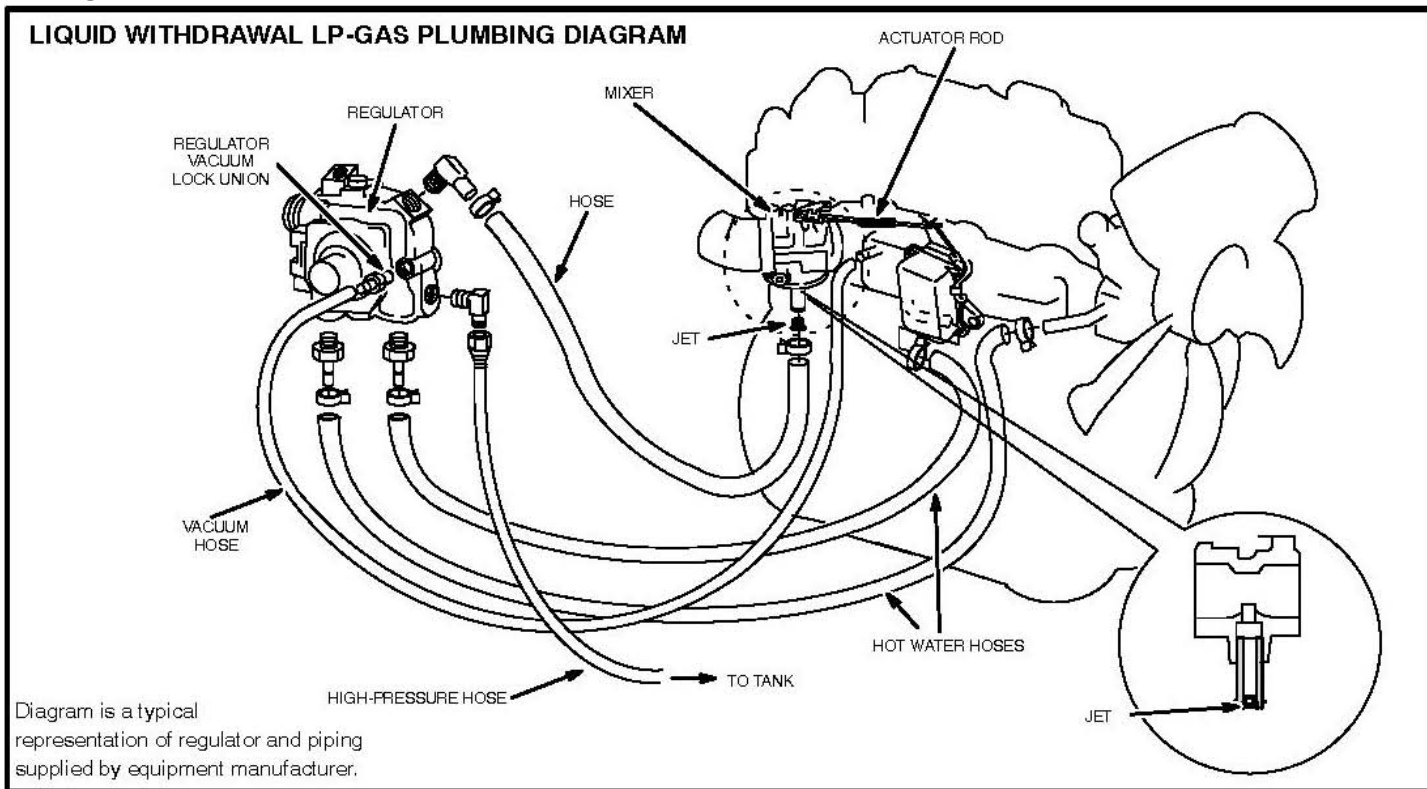
- Fill fuel tank outdoors or in well-ventilated area, away from sparks, open flames, pilot lights, heat, and other ignition sources.
- If fuel spills, wait until it evaporates before starting engine.
- Turn engine OFF and let engine cool at least 2 minutes before removing gas cap.

FUEL PLUMBING DIAGRAM with VE Mixer

NATURAL GAS PLUMBING DIAGRAM



Using VE Mixer



* Vapor withdrawal is not suitable for high speed, high load applications.

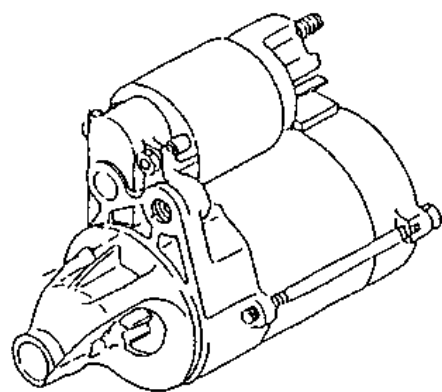
SECTION 6. ELECTRICAL SYSTEM

1. Starter Motors Identification	6-2
2. 1.2 KW Starter Motor Output	6-3
3. Starter Selenoid Current	6-4
4. Alternator Output	6-5
5. Voltage Regulator Characteristics	6-6
6. Pulsar Output	6-7
7. Fuel Pump Signal	6-8
8. Wiring Diagrams	6-9
9. Gas Control Panel wiring Diagram	6-14
10. Diesel Control Panel Wiring Diagram	6-15
11. Connectors	6-16

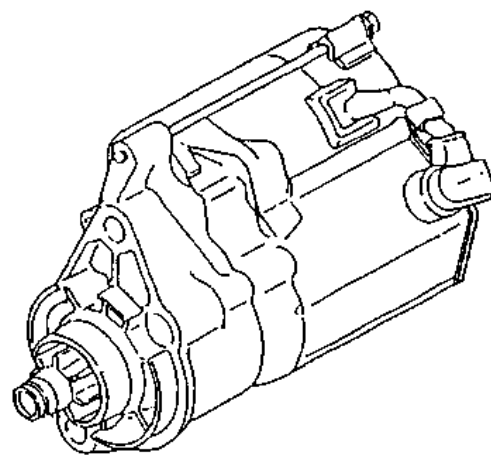
Starter Motors

12 Volt

Conventional type

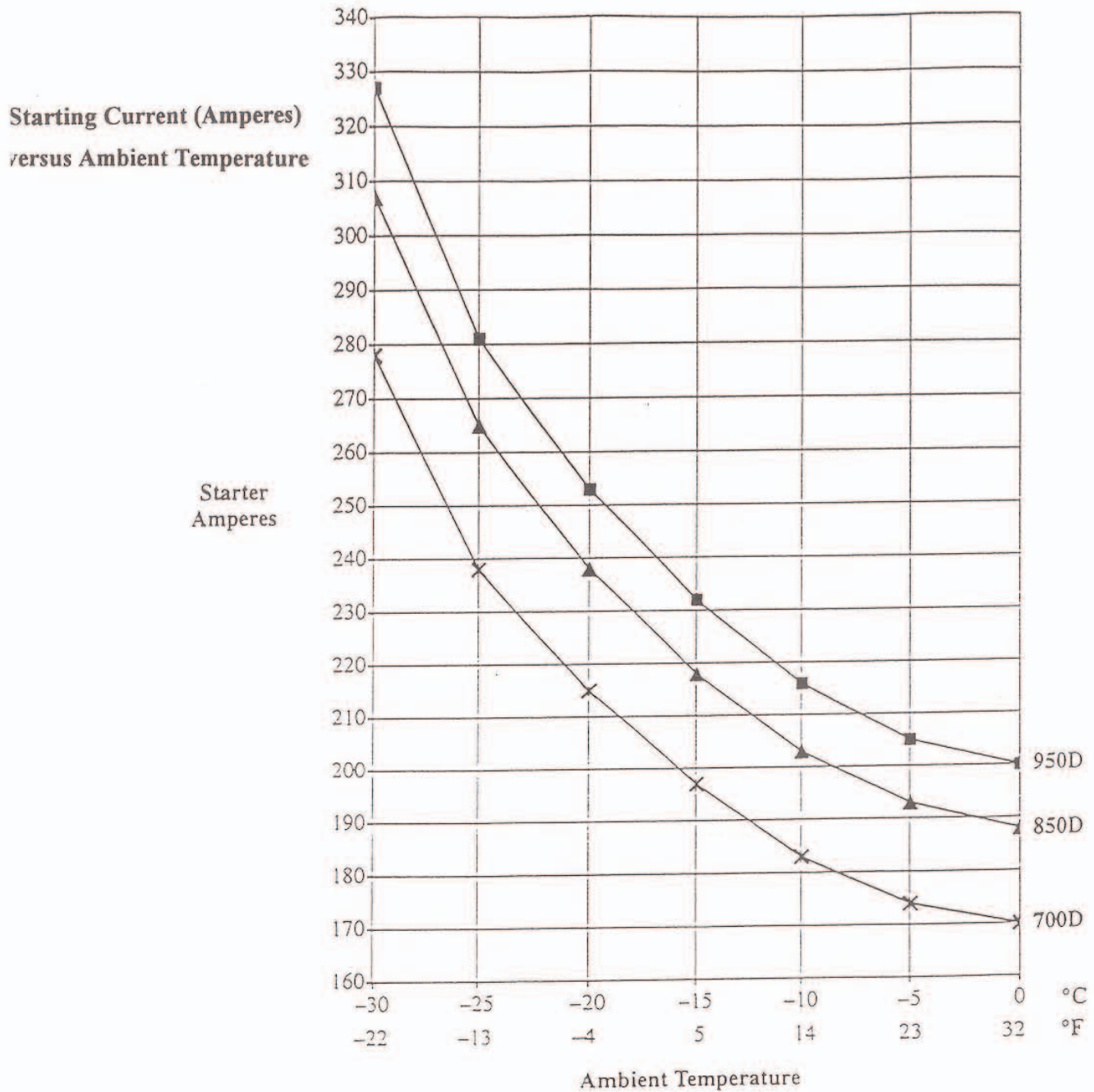


Gear reduction type



STARTER MODEL			ENGINE MODEL	
POWER	TYPE	LABEL COLOR	GASOLINE ,GAS	DIESEL
0.8KW	Conventional	Red	Standard	---
1.0KW	Gear Reduction	Green/Blue	Option	Standard
1.2KW	Gear Reduction	Purple/Brown	Option	Option

1.2 KW STARTER MOTOR



Ambient Temperature vs Battery Capacity and Engine Oil

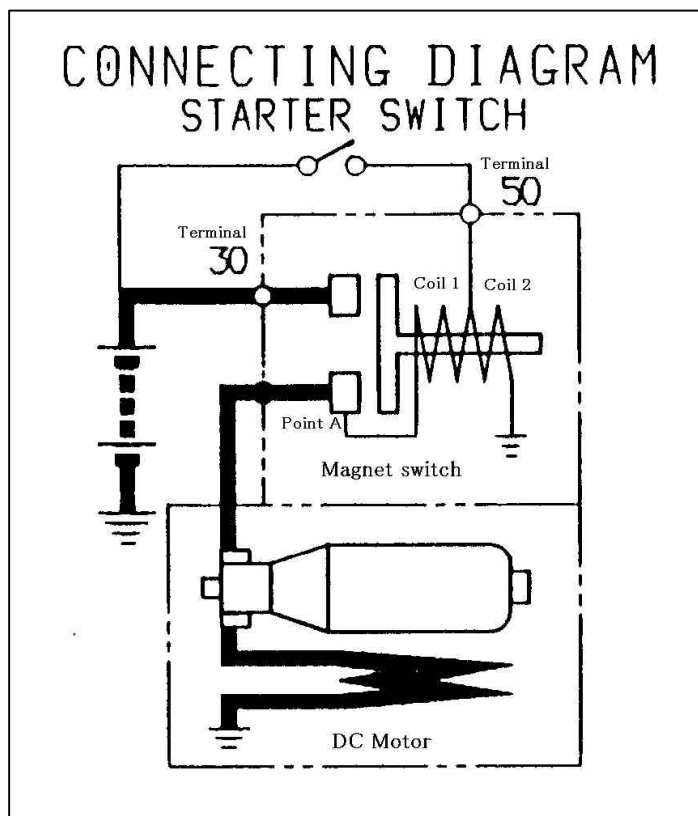
	Ambient Temperature			
	Below -13°F (-25°C)	-13°F to 5°F (-25°C to -15°C)	5°F to 32°F (-15°C to 0°C)	Above 32°F (0°C)
Battery Capacity	92 Ah	80 Ah	55 Ah	30 Ah
Engine Oil	5W-30	10W-30	10W-30	10W-30

Starter Solenoid Current

Current to Terminal 50: 12 – 45 A (0.8, 1.0, 1.2kW).

Minimum Voltage at Terminal 50: 8V or more (0.8, 1.0, 1.2kW).

Total Current to Starter: See Technical Manual page 6-3 (1.2kW).



(Reference Information)

1.0kW Starter

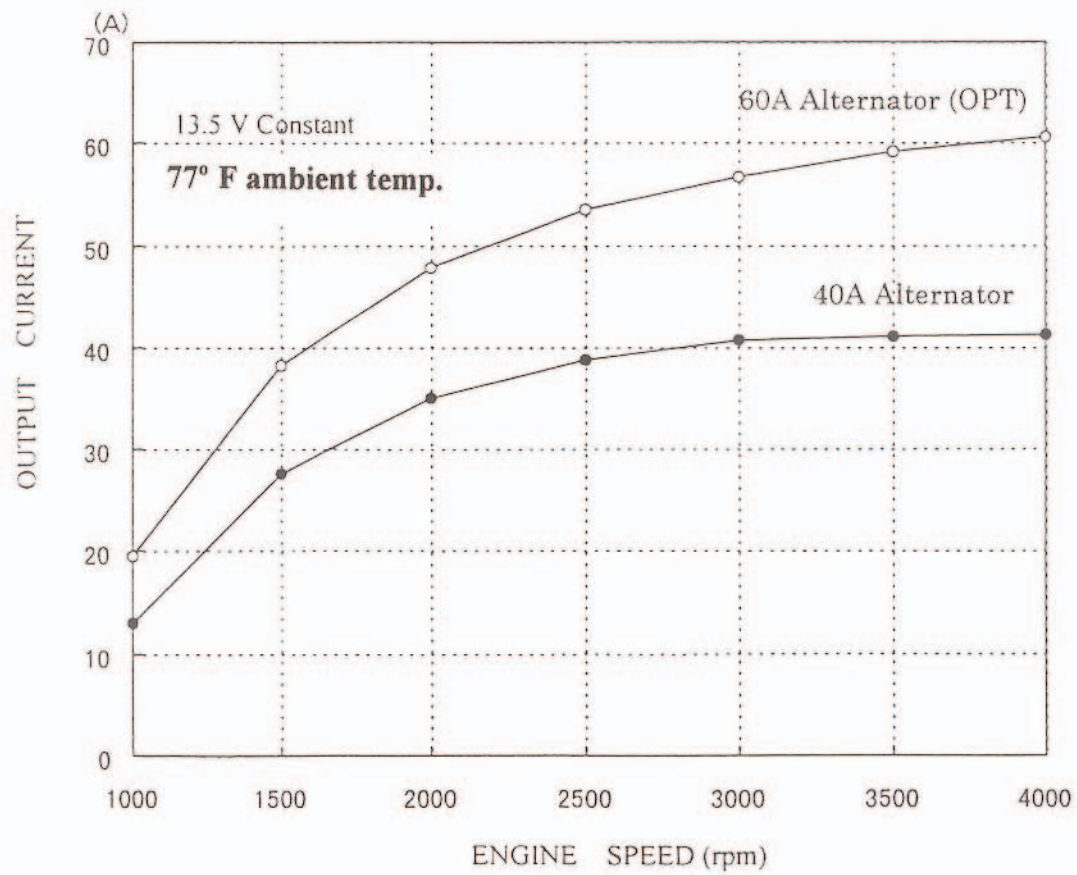
Current to coil 1: About 30A

Current to coil 2: About 15A

* The coil 1 needs high value of current in order to pull plunger with the pinion gear.

This current flow will be stopped as soon as engaged main contact point because of no potential difference between terminal 50 and point A.

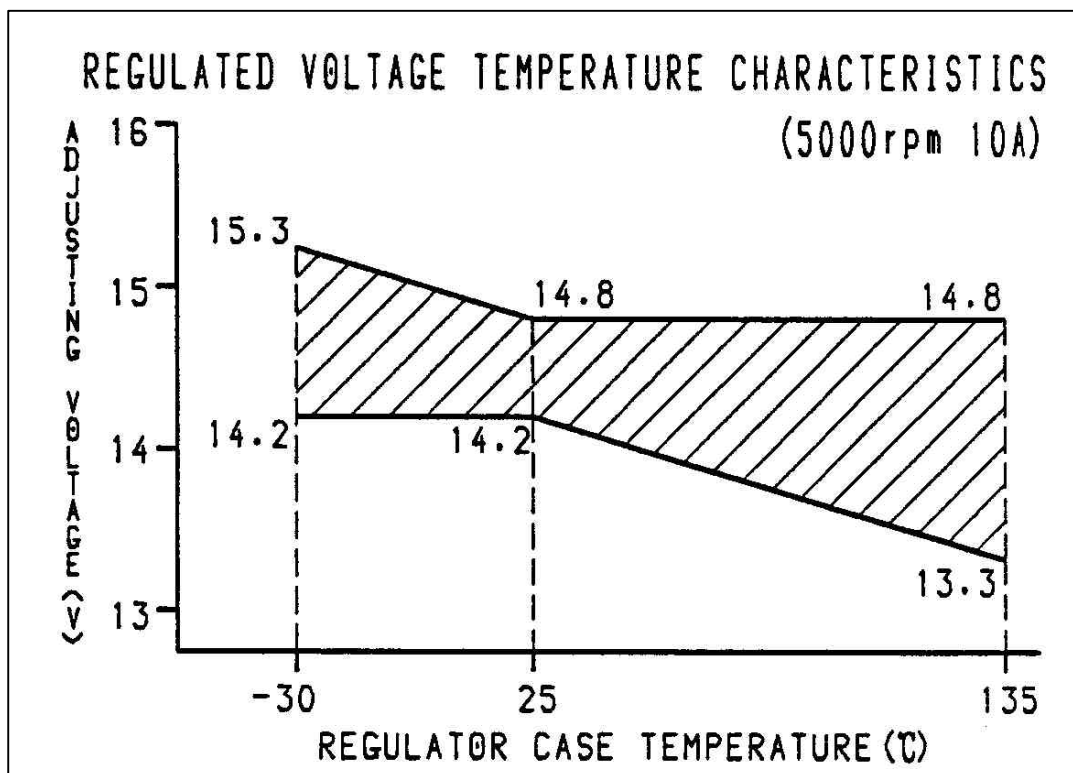
Alternator Output Characteristic



Alternator Output

Regulated Voltage: 14.2 – 14.8 V (at 25 degrees C)

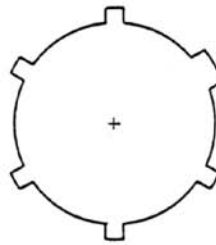
Regulated Voltage Temperature Characteristics: See below.



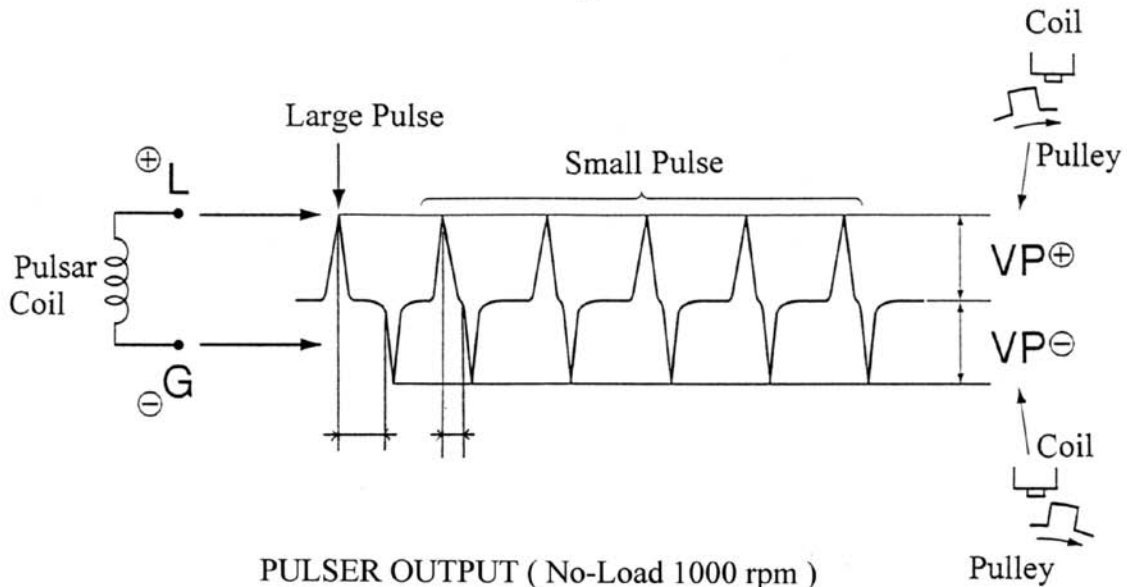
Output Current: See Technical Manual page 6 – 4.

Pulser Coil Output

Crankshaft Pulley

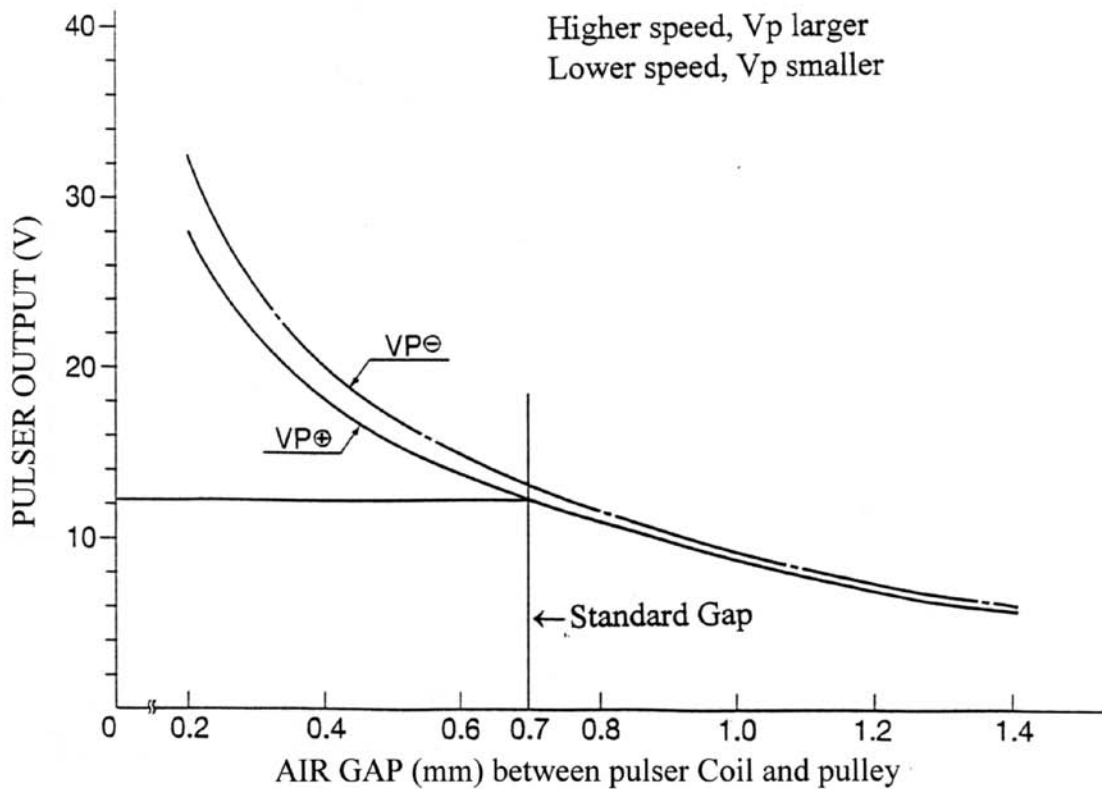


Large Pulse

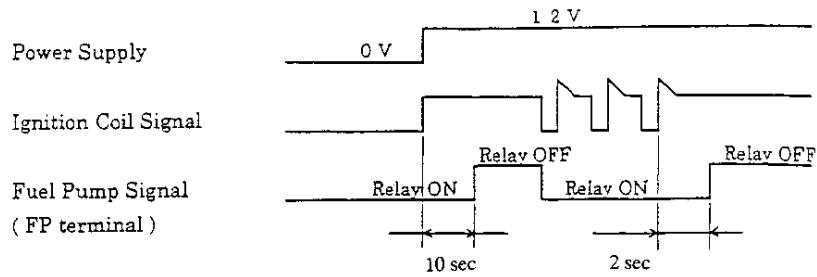


PULSER OUTPUT (No-Load 1000 rpm)

Higher speed, V_p larger
Lower speed, V_p smaller

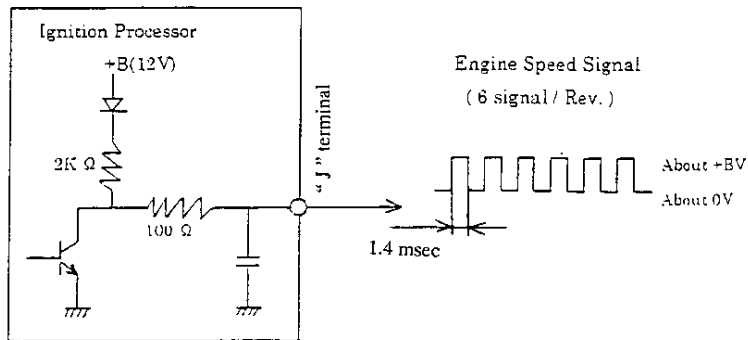


Schematic diagram of Fuel Pump signal

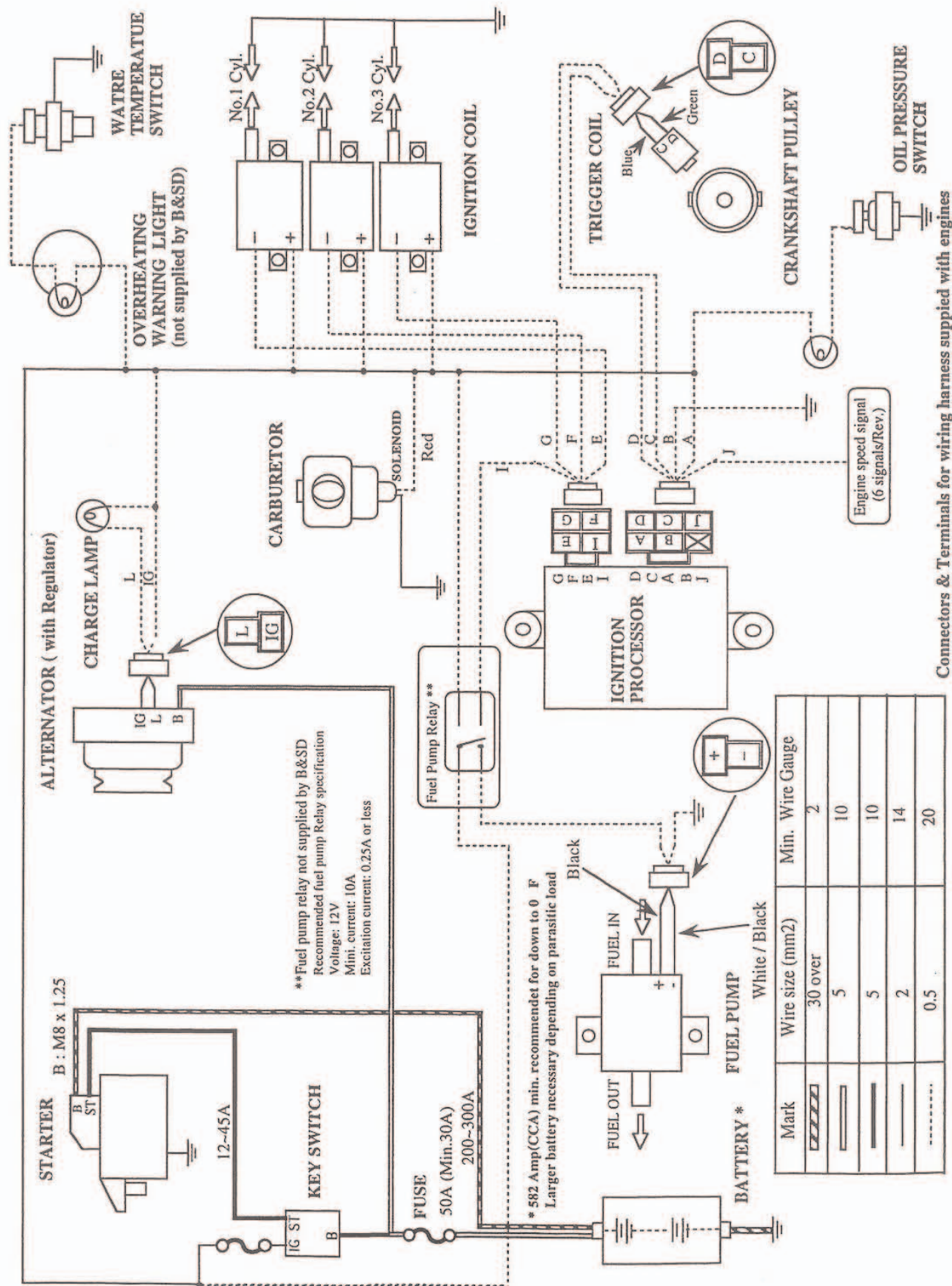


Wiring Diagram for Engine Speed Signal

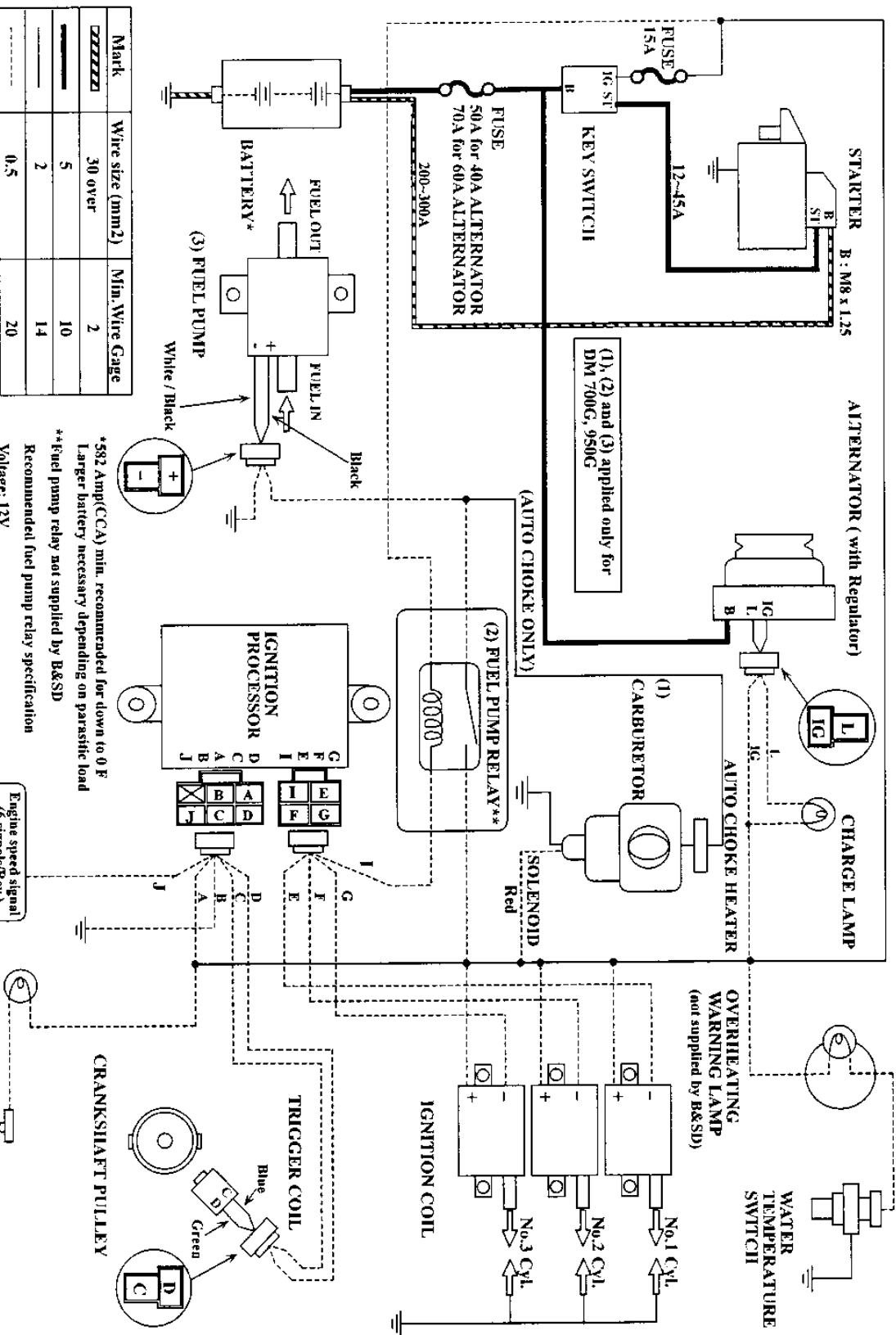
P.N.(700G&700P):19200-87810,(950G&950P):19200-87811, (950GH):19200-87812



GASOLINE WIRING DIAGRAM (40 A ALTERNATOR) W/MANUAL CHOKE



GASOLINE WIRING DIAGRAM W/AUTO CHOKE



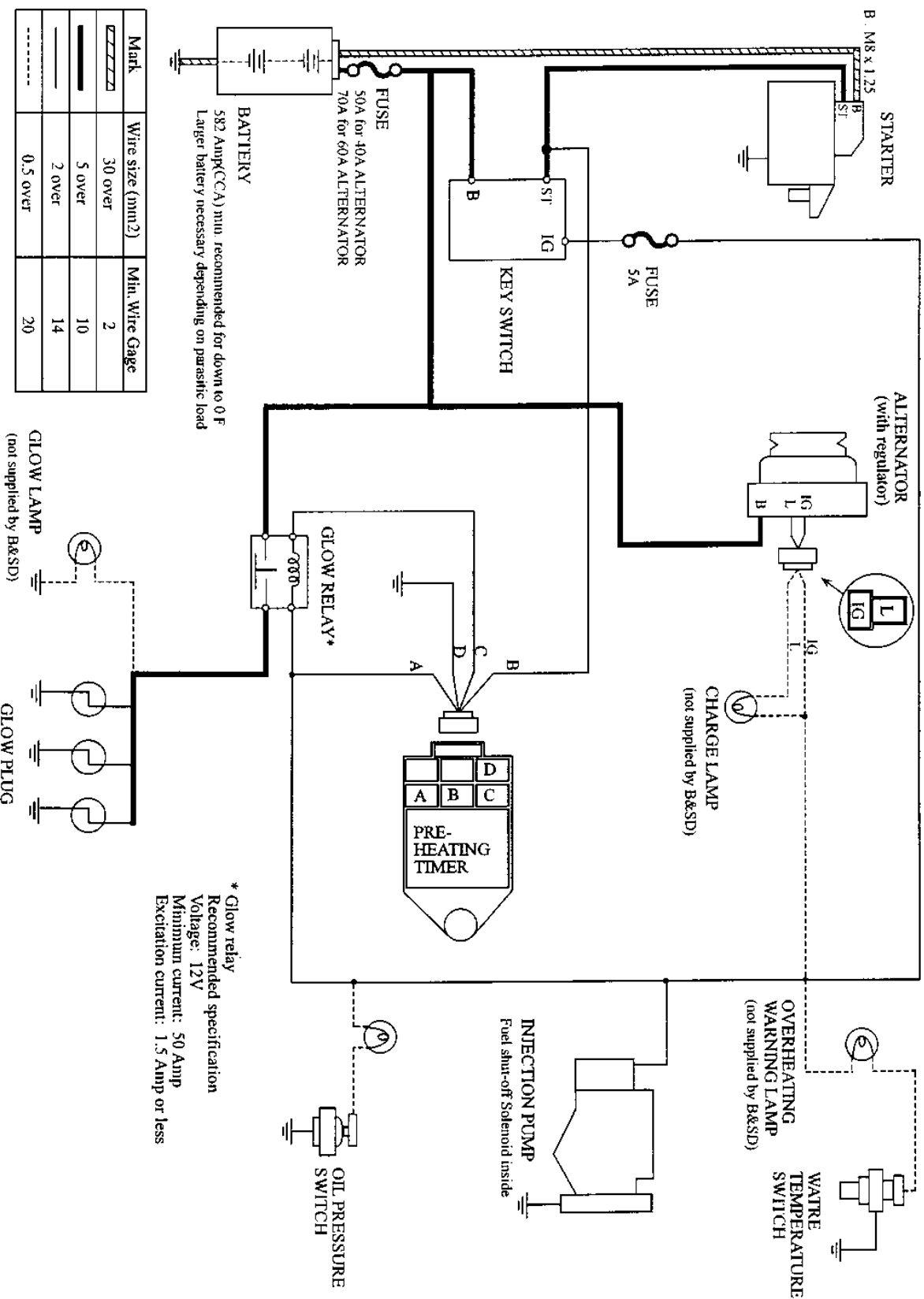
*582 Amp(CCA) min. recommended for down to 0 F
Larger battery necessary depending on parasitic load
**Fuel pump relay not supplied by B&SD
Recommended fuel pump relay specification
Voltage: 12V
Min. current: 10A
Excitation current: 0.25A or less

Connectors & Terminals for wiring must be supplied with engines

ELECTRONIC GOVERNOR WIRING DIAGRAM



DIESEL ENGINE WIRING DIAGRAM **(40A & 60A ALTERNATOR & AVOT PREHEAT TIMER)**



* Glow relay
Recommended specification
Voltage: 12V
Minimum current: 50 Amp
Excitation current: 1.5 Amp or less

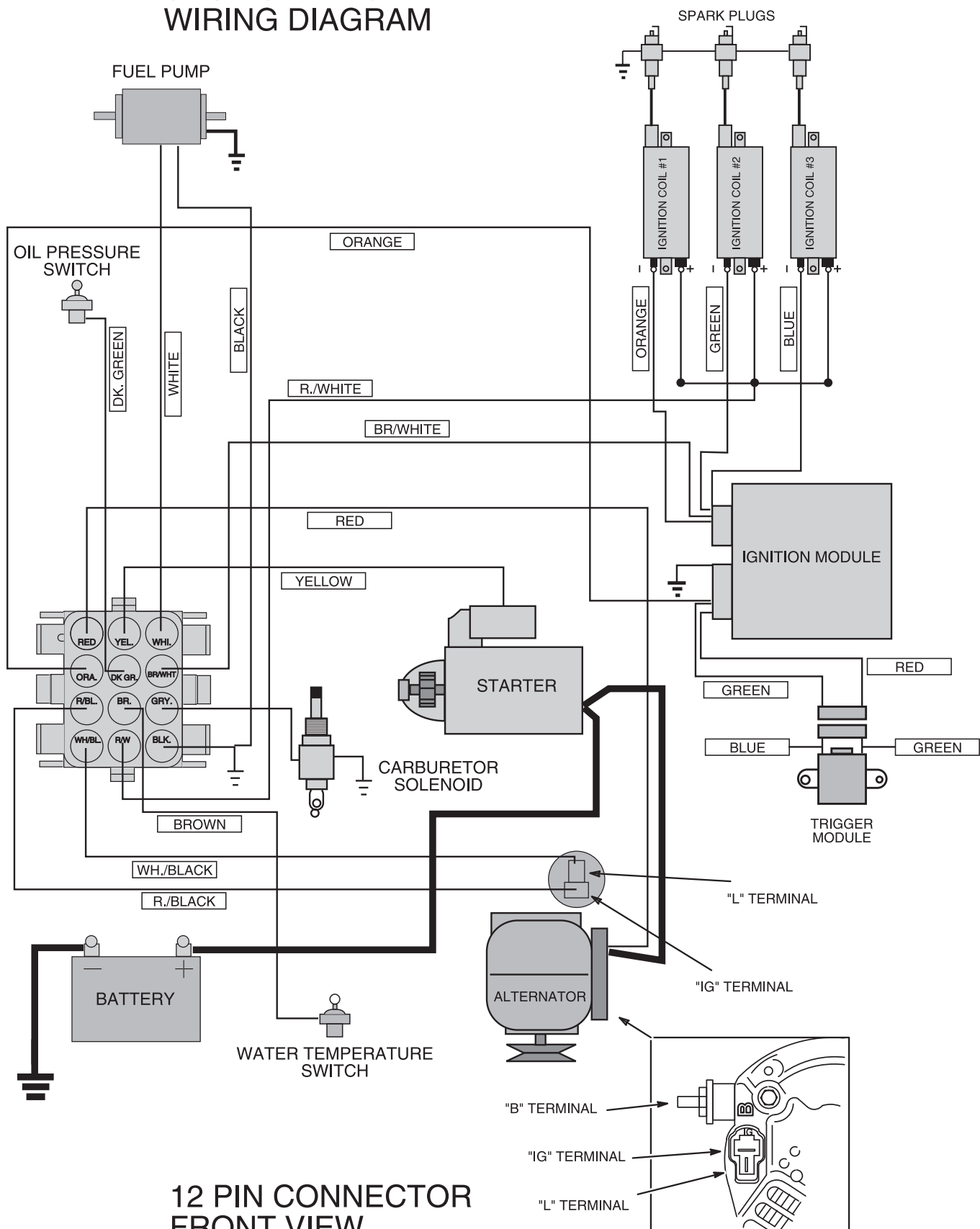
Connectors & Terminals for wiring harness supplied with engines

OPTIONAL WIRING DIAGRAM

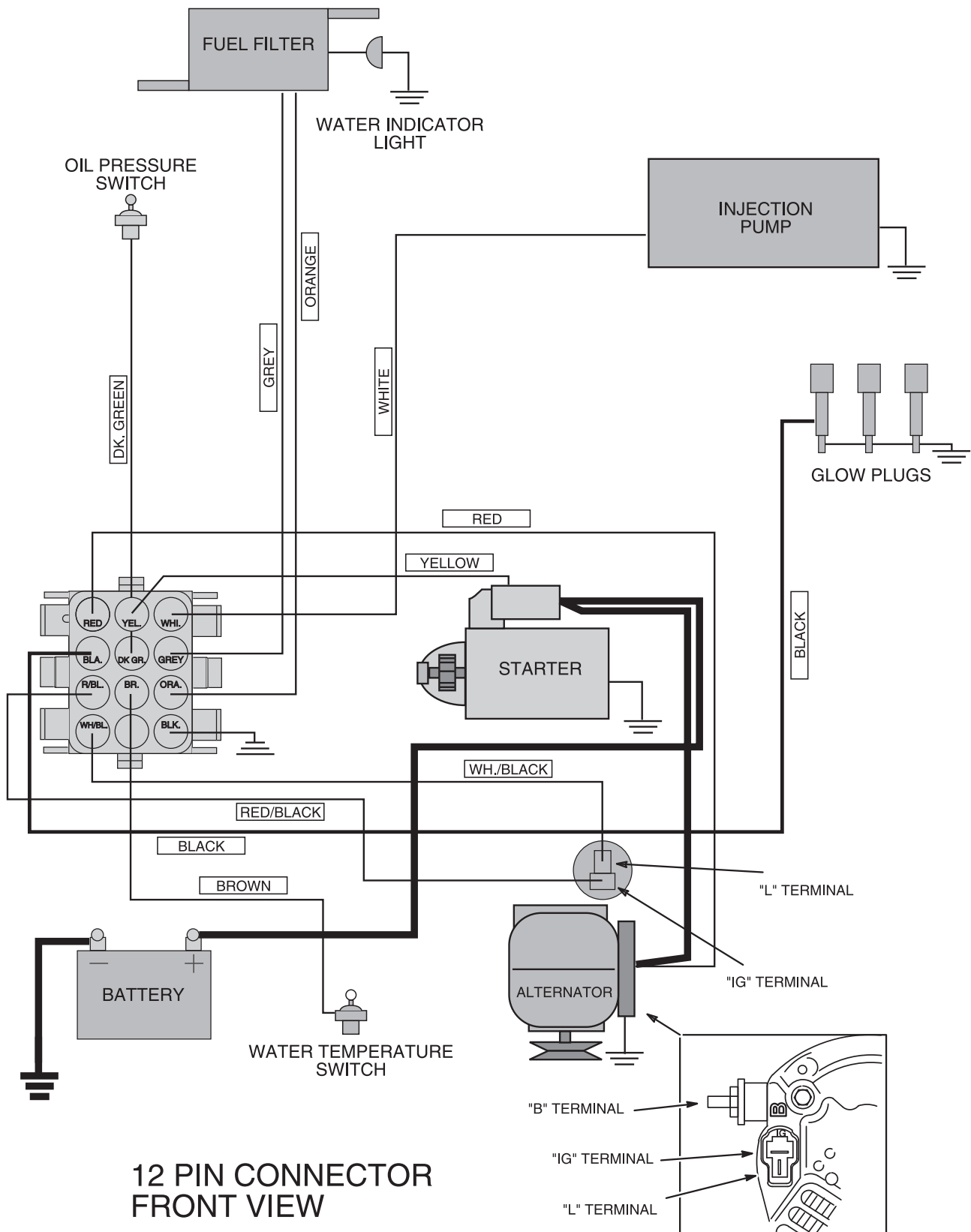


10/12/01

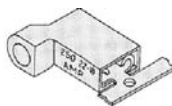
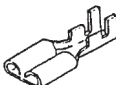
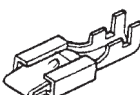
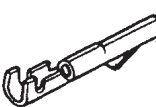
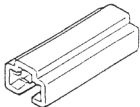
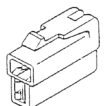
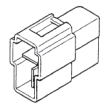
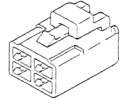
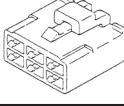
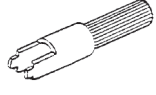
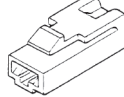
GAS POWER UNIT WIRING DIAGRAM



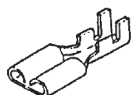
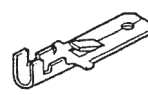
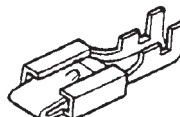
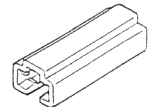
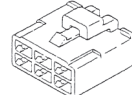
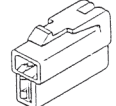
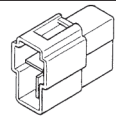
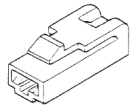
DIESEL POWER UNIT WIRING DIAGRAM



CONNECTOR/TERMINAL KIT CROSS-REFERENCE (700G, 950G & 954G)

Shape	DMC Part No.	Vendor	Part Name	Qty	Remarks
	21362-87801	AMP3-350820-2	Ultra-fast Receptacle Assy.	1 1 1	Water Temp. SW Starter Motor (0.8 kW) Carburetor (Auto Choke)
	21362-87802	AMP2-520337-2	Ultra-fast Receptacle Assy.	3	Ignition Coil (-)
	83147-87801	AMP42238-2	Terminal	2 8 2	Alternator Ignition Module Fuel Pump
	83147-87802	AMP41450-2	Terminal	3	Ignition Coil (+)
	83147-87803	Yazaki7114-2020	Terminal	2	Magnetic Trigger
	83147-87804	Yazaki7116-2030	Terminal	1 1	Oil Pressure SW Starter (1.0 kW)
	83147-87805	AMP60620-1	Terminal	1	Fuel Cut Solenoid
	90048-75016	Yazaki7123-2012	Connector	1	Oil Pressure SW
	90048-75241	Yazaki7123-2012	Connector	1 1	Fuel Pump Alternator
	90048-75253	Yazaki7123-2128	Connector	1	Magnetic Trigger
	90048-75254	Yazaki7123-2446	Connector	1	Igniter
	90048-75255	Yazaki7123-2262	Connector	1	Igniter
	90048-75256	AMP1-480351-0	Connector	1	Fuel Cut Solenoid
	90048-75291	Yazaki7123-2215	Connector	1	Starter (1.0kW)

CONNECTOR/TERMINAL CROSSREFERENCE (700D, 850D, 950D, & 950DT, 954DT)

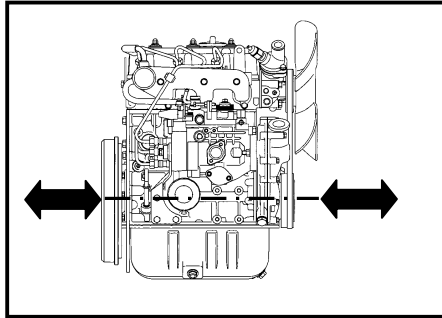
Shape	DMC Part No.	Vendor	Part Name	Qty	Remarks
	21362-87801	AMP3-350820-2	Ultra-fast Receptacle Assy.	1	Water Temp. SW
	83147-87801	AMP42238-2	Terminal	2 2	Alternator Water Separator / Fuel Filter
	83147-87803	Yazaki7114-2020	Terminal	2	Magnetic Trigger (Note trigger is not Std on diesel engines)
	83147-87804	Yazaki7116-2030	Terminal	1 1 4 1	Oil Pressure SW Injection Pump Pre-Heat Timer Starter (1 kW) or (1.2 kW)
	90048-75016	Yazaki7123-2012	Connector	1	Oil Pressure SW
	90048-75255	Yazaki7123-2262	Connector	1	Pre-Heat Timer
	90048-75241	Yazaki7123-2128	Connector	1 1	Water Separator / Fuel Filter Alternator
	90048-75253	Yazaki7122-21282	Connector	1	Magnetic Trigger (Note trigger is not Std on diesel engines)
	90048-75291	Yazaki7123-2215	Connector	1 1	Starter (1 kW) or (1.2 kW) Injection Pump

SECTION 7. PTO SYSTEM

- 1. Thrust Loads on Crankshaft 7-2
- 2. Static Radial Loads (flywheel end of crankshaft) Rear 7-2
- 3. Static Radial Loads (fan end of crankshaft) Front 7-3

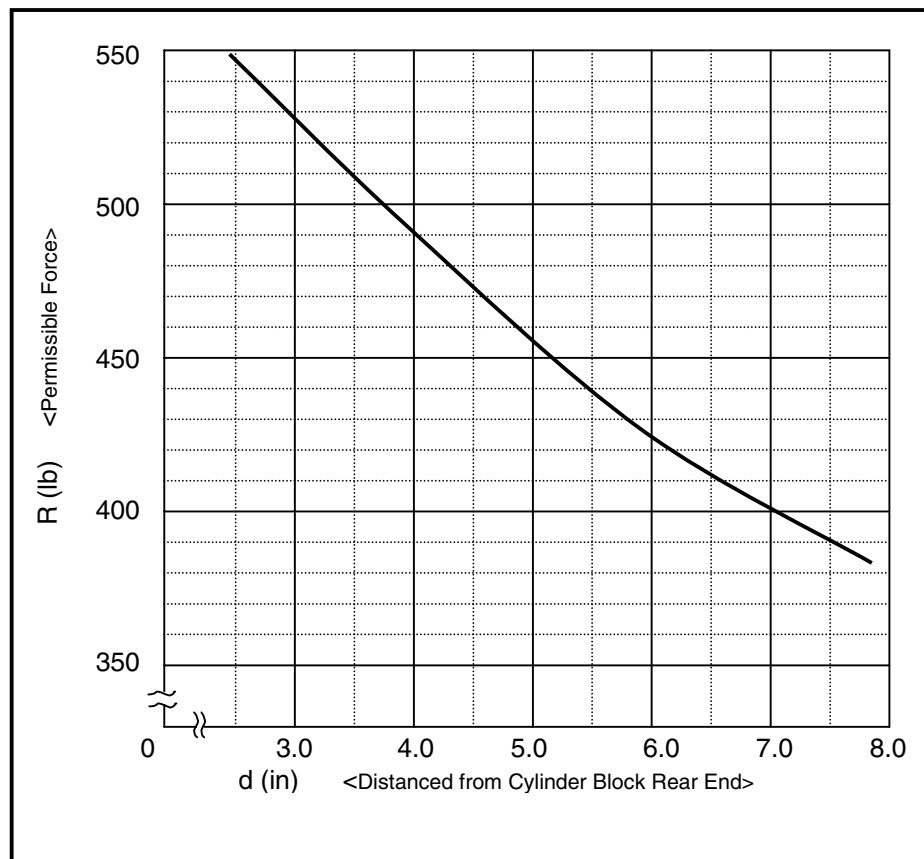
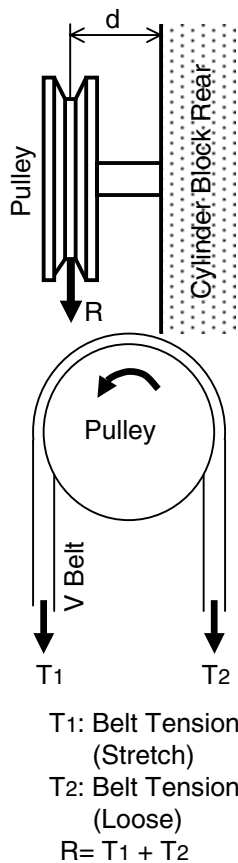
Subject: Permissible Crankshaft Loads

1. Thrust Load (IN or OUT)



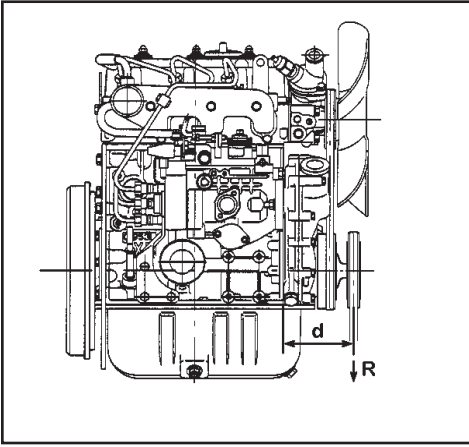
Condition	Permissible Force	Example
Continuous Load	50 .7 lb (23 kg)	Water Pump
Intermittent Load	202 .8 lb (92 kg)	Manual Clutch

2. Static Radial Load at Engine Rear

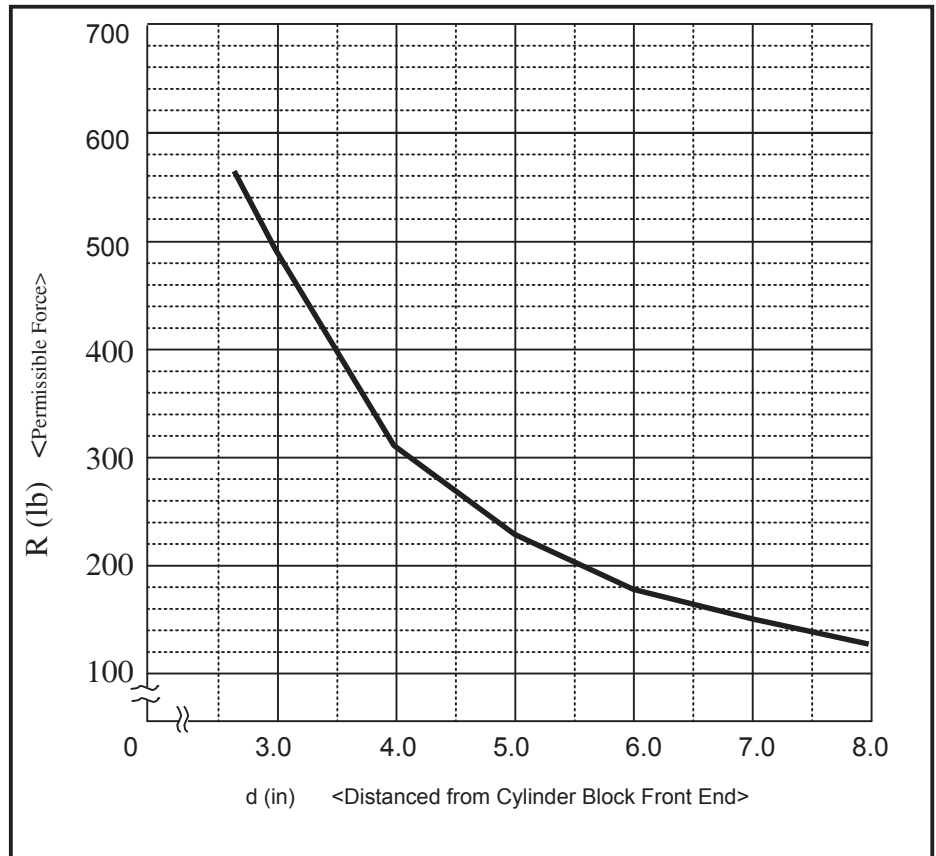


Permissible Crankshaft Loads

3. Static Radial Load at Engine Front



d: Distance from the cylinder block front end
R: Static Radial Load



Important Note:

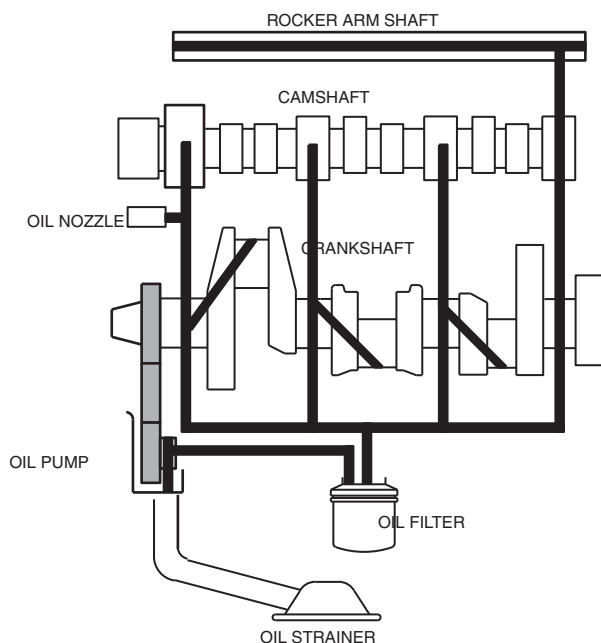
The preferred method of tensioning v-belt drive systems is with the use of spring loaded idler pulleys. Fixed centers or mechanically adjustable belt tensioning systems are prone to over-tensioning to the extent the radial load limits noted above are exceeded. This may cause engine bearing and crankshaft damage. Such damage on applications with fixed centers or mechanically adjusted tensioning systems will not be subject to warranty, regardless of the specified "design" tension of the belt drive system.

SECTION 8. LUBRICATION SYSTEM

- 1. Lubricating System 8-2
- 2. Oil Recommondations 8-3

LUBRICATING SYSTEM

Lubricating Method	Pressure lube
Oil Pump	Trochoid, gear drive
Oil Filter	Full flow, paper
Oil Capacity (including filter)	3.3 liter (3.5 qt)
Oil Pressure	2.0 ~ 5.0 Bar (28 ~ 70 psi)
Oil Pump Relief Valve Opening Pressure	4.6 (65 psi)
Max Oil Temperature	136C ° (275° F)
Oil Service Classification	API SH, SJ class or higher (gasoline)
	API CF, CF-4 class or higher (diesel)
Maximum Angle of Operation	25° continuous (all directions)
	30° intermittent (10 minutes)



ENGINE LUBRICATION CIRCUIT

Oil capacity, including oil filter, is 3.5 quarts (3.3 liters).

- Use a high quality detergent oil classified “For Service CF, or CF-4 (Diesel).”
- Use a high quality detergent oil classified “For Service SH, SJ or higher (Gasoline or Gaseous)”.
- Do not use special additives with recommended oils.
- Do not mix oil with fuel.
- Choose a viscosity according to the table opposite.

This engine is shipped

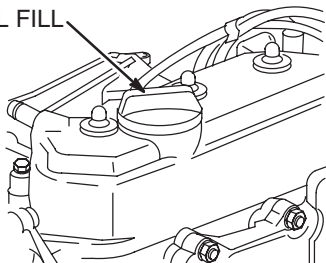
- Check oil level *before* starting the engine.
- Check level daily, or after every eight (8) hours.
- Keep oil level at FULL.
- Do not overfill.

Note: After filling with or changing oil, start and run engine at idle for 30 seconds. Shut engine off. Wait 30 seconds and check oil level. Add oil, if required, to bring level to **Full** mark on dipstick.

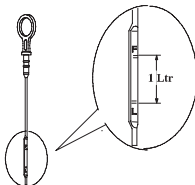
A horizontal temperature scale ranging from -30°F (-23°C) to 110°F (43°C). Three oil change intervals are indicated by arrows:

- 5W-30:** Indicated by a left-pointing arrow from 110°F to 50°F.
- 10W-30 10W-40 10W-50:** Indicated by a right-pointing arrow from 32°F to 110°F.
- 30:** Indicated by a right-pointing arrow from 50°F to 110°F.

STARTING TEMPERATURE RANGE ANTICIPATED BEFORE NEXT OIL CHANGE

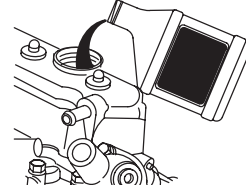
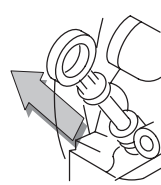


- [1]. Place equipment level.
Clean around oil fill.

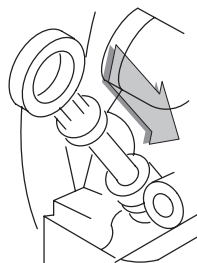


Bring oil level to **F** mark on dipstick.

- [2]. Remove dipstick and wipe with clean cloth.
- [3]. Then replace dipstick, and remove to check oil level.

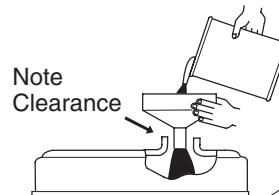


- [4]. If oil is required, remove dipstick to allow proper venting and pour oil slowly. Fill to FULL line on dipstick. Recheck.

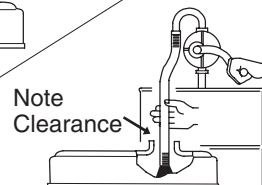


- [5]. Replace dipstick firmly.

In addition to ensuring a level engine, removing dipstick, and pouring oil **slowly**, there must be clearance between the oil fill device and the oil fill hole in the valve cover as shown. This clearance is necessary to permit venting when filling.



Note
Clearance



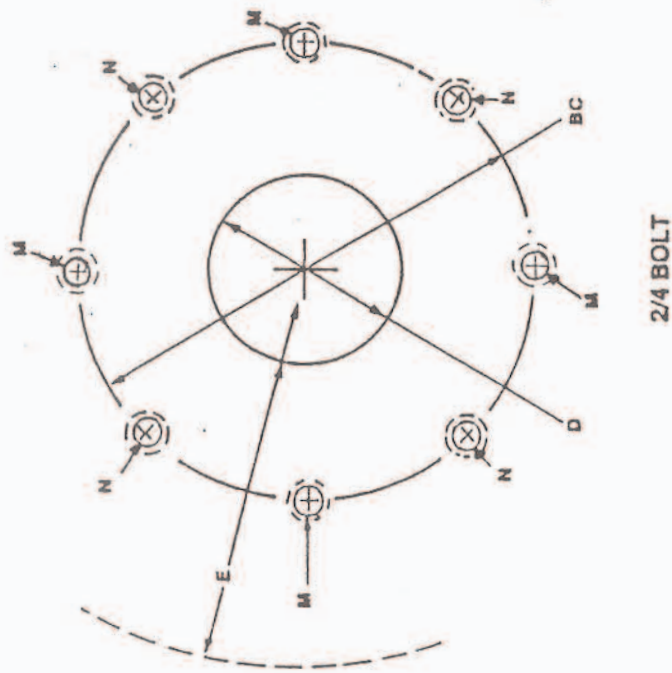
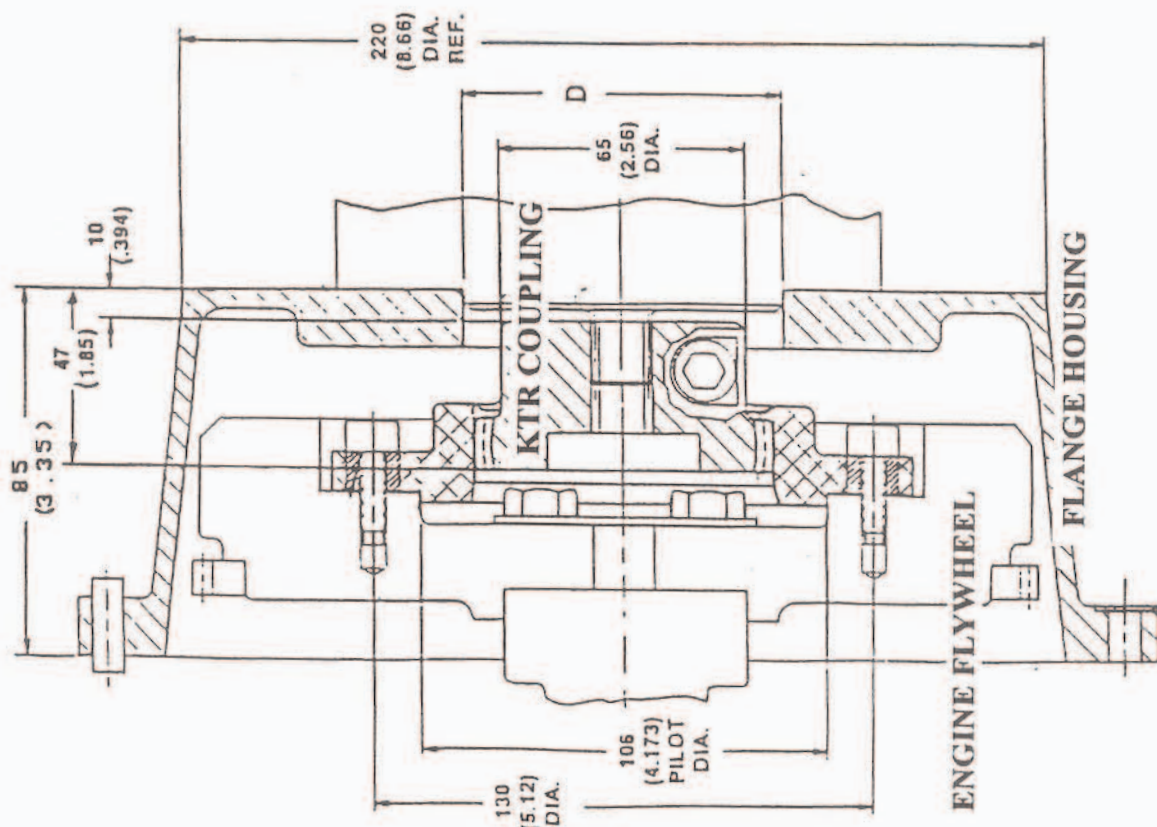
Note
Clearance

SECTION 9. ACCESSORIES

1. Full End Plate	9-2
2. Hydraulic Pump Mount Housings	9-3
3. Coolant Overflow Tank	9-4
4. Muffler w/Guard	9-5
5. Muffler w/o Guard	9-6
6. Muffler Adaptor	9-7
7. Air Funnels	9-8
8. Flywheel Stub Shaft	9-9
9. Radiator Screen	9-10
10. Fan Guards	9-11

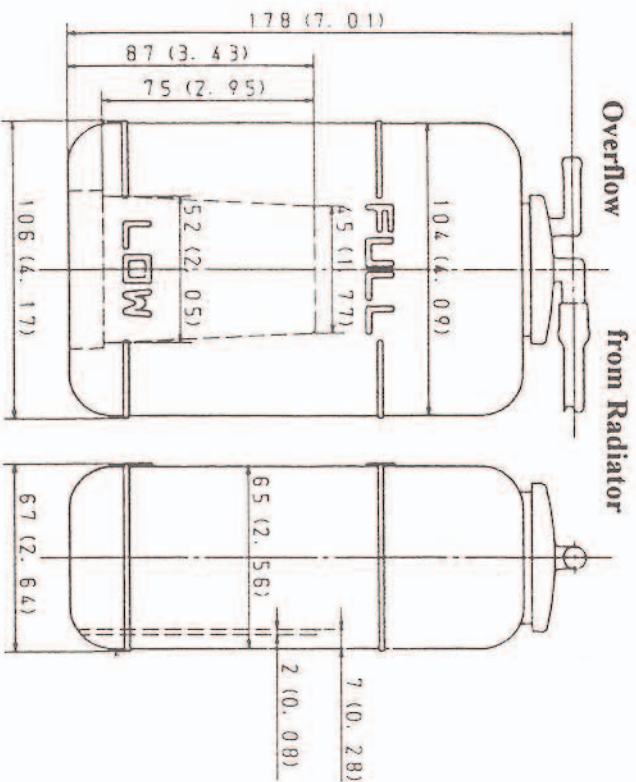
[illegible]

Hydr. Pump Drive

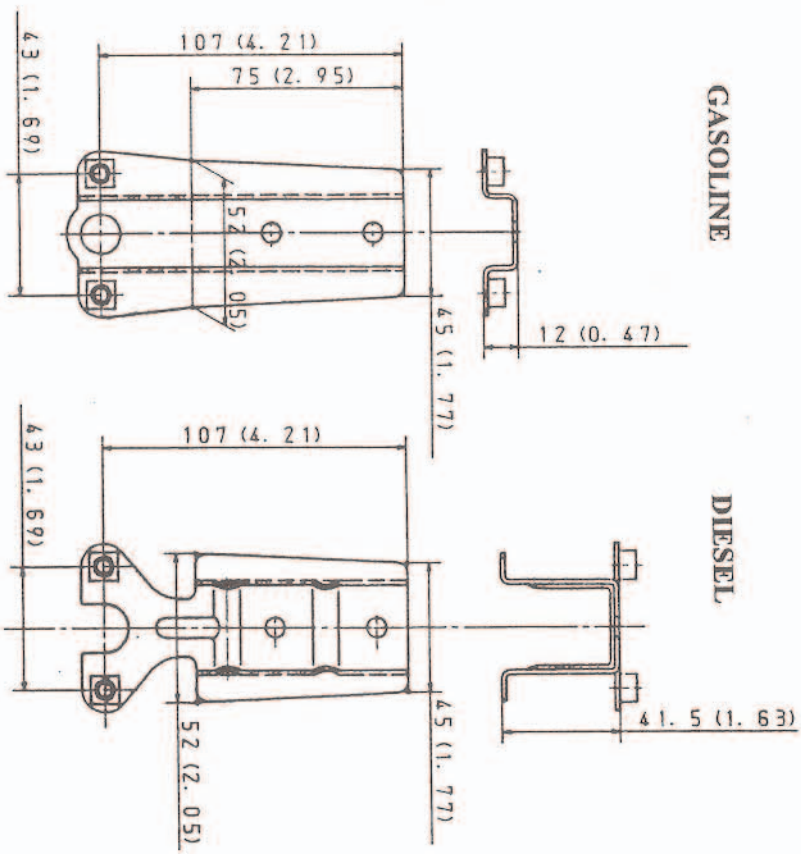


	PILOT DIA. D	2 BOLT (M) BC	4 BOLT (N) BC	BOLT SIZE
SAE "A"	82.6 (3.25)	106.2 (4.18)	-----	3/8-16 UNC
SAE "B"	101.6 (4.00)	146.1 (5.75)	127 (5.00)	1/2-13 UNC

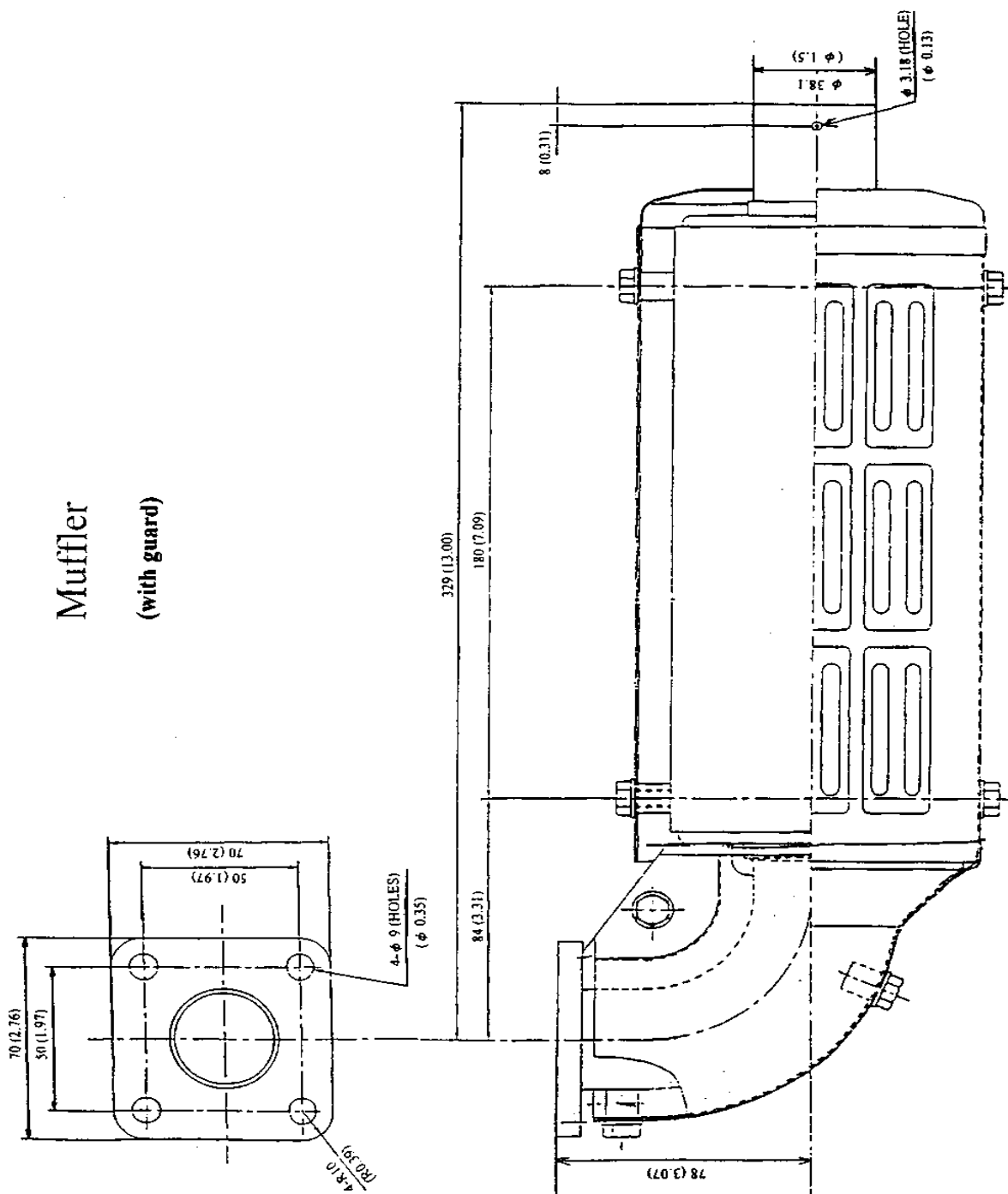
Radiator Surge Tank



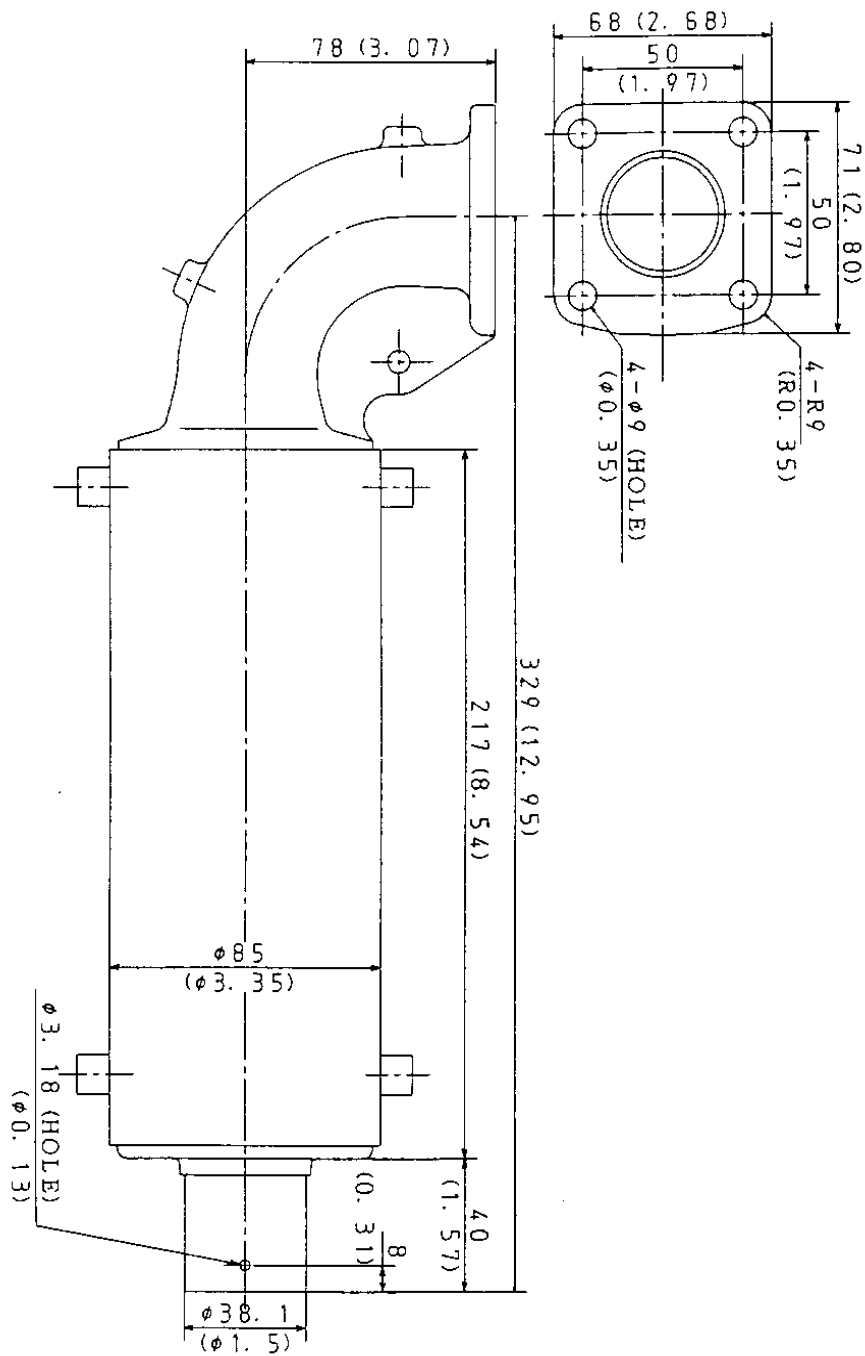
Tank Mounting Bracket for engine mounted cooling systems



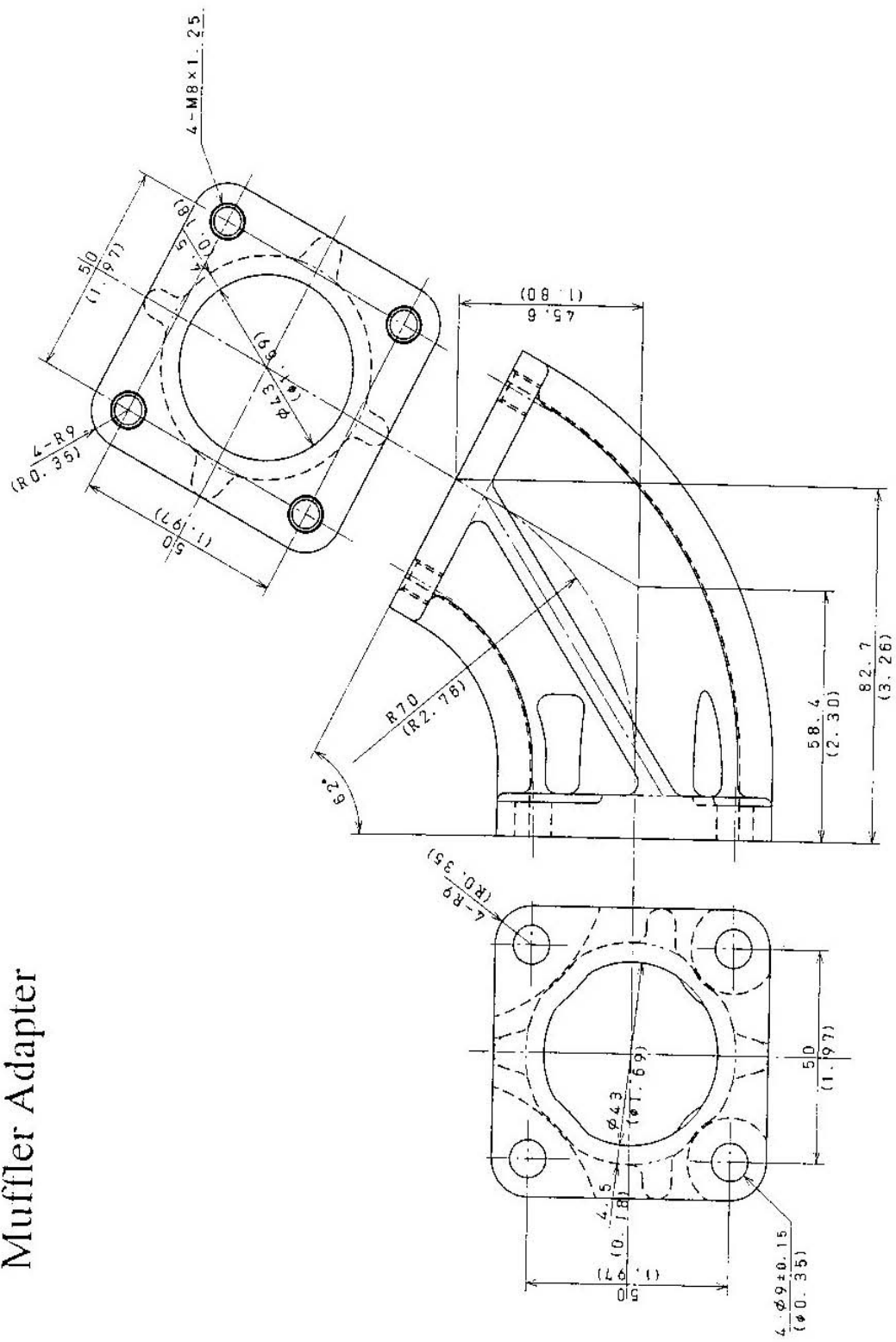
Muffler (with guard)



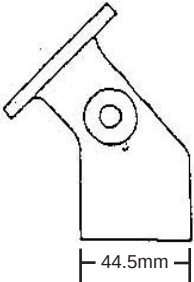
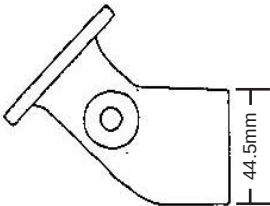
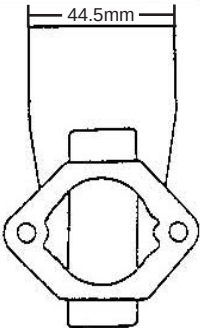
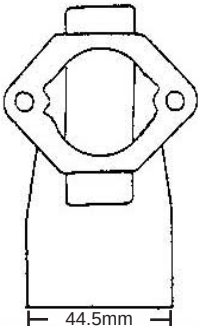
Muffler (without guard)



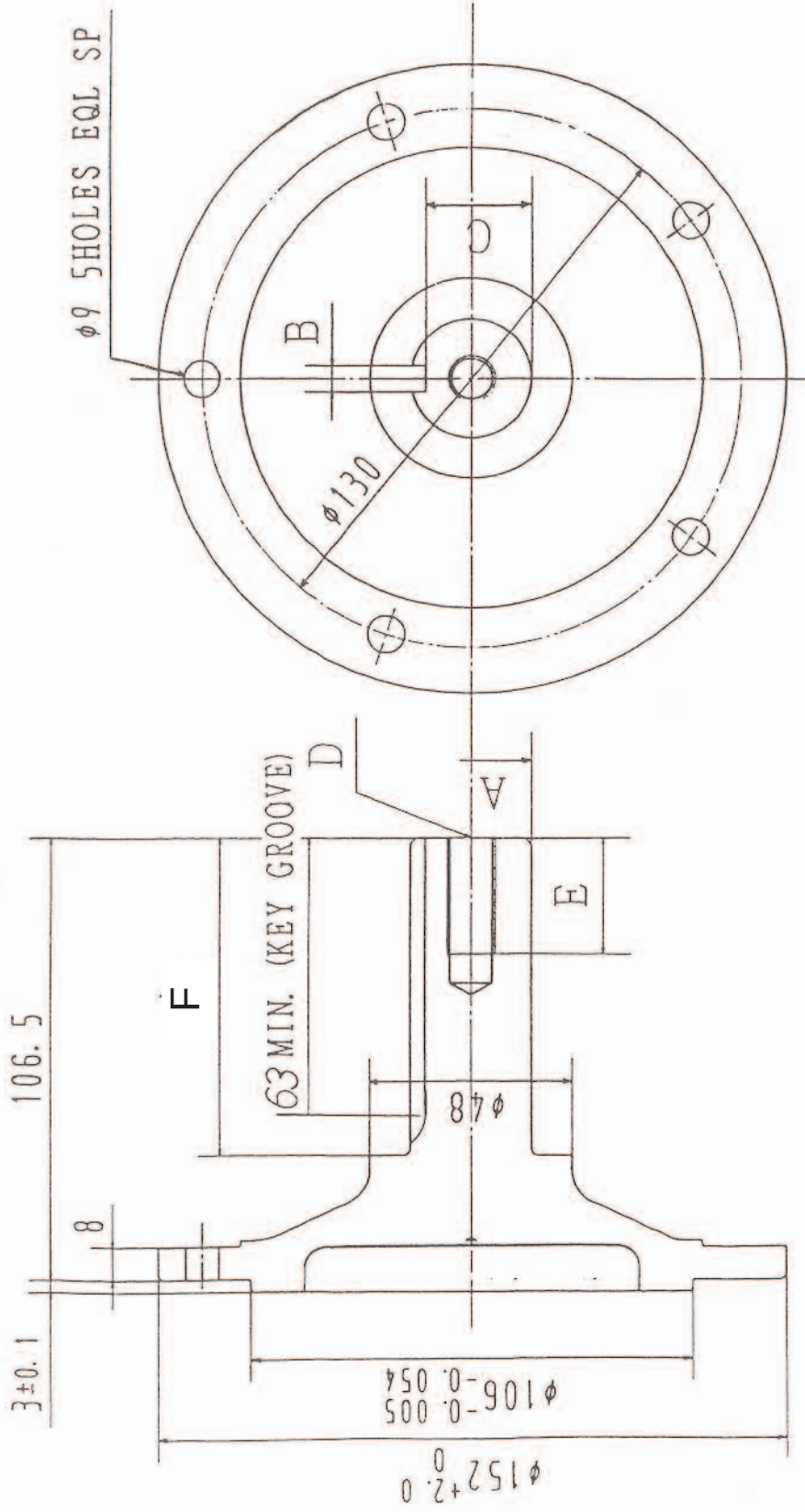
Muffler Adapter



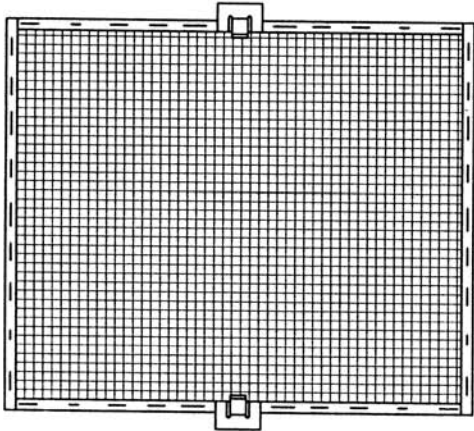
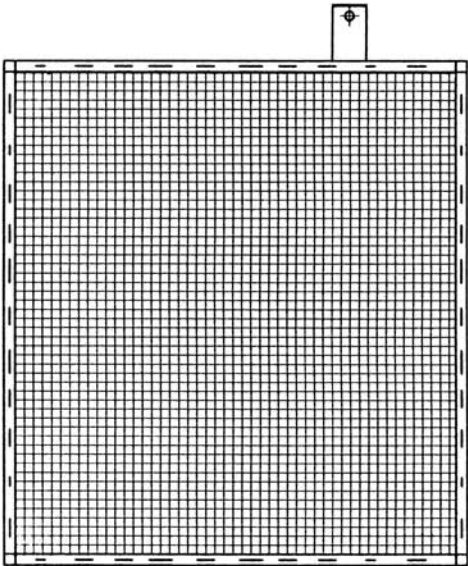
Air Funnels

<u>Standard</u> Parallel to Crankshaft	
<u>Option</u> Perpendicular to Crankshaft	
<u>Option</u> Upward	
<u>Option</u> Downward	

Flywheel PTO Stub shaft



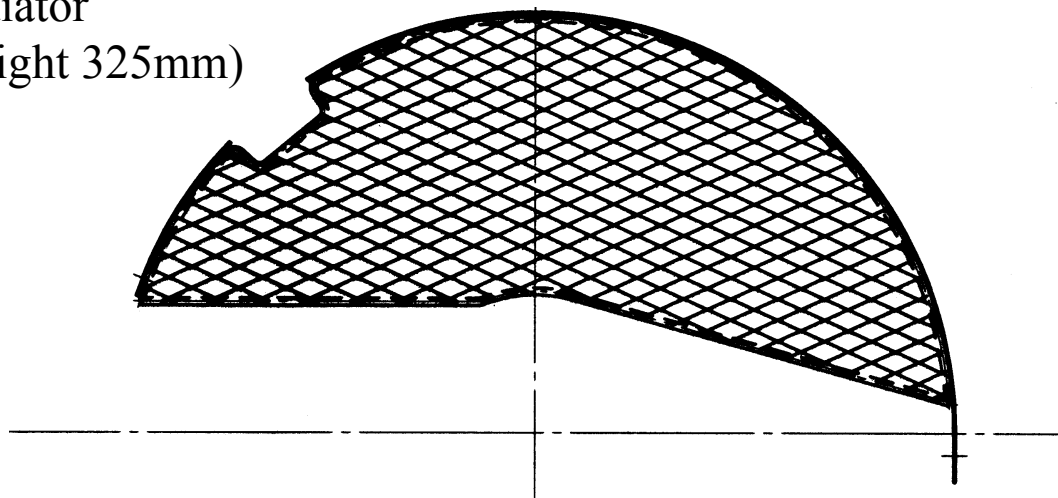
A	B	C	D	E	F
SHAFT SIZE	KEY SIZE	mm(inch)	THREAD SIZE	THREAD DEPTH mm(inch)	SHAFT LENGTH
1-1/8"	1/4"	25.0 (0.984)	7/16-20 UNF-2B	28 (1.1)	76.5 (3.0)
1-7/16"	3/8"	31.1 (1.224)	5/8-18 UNF-2B	32 (1.26)	72.4 (2.85)

For Std. Radiator (Radiator height 325mm)	For Turbo Radiator (Radiator height 375mm&425mm)
	

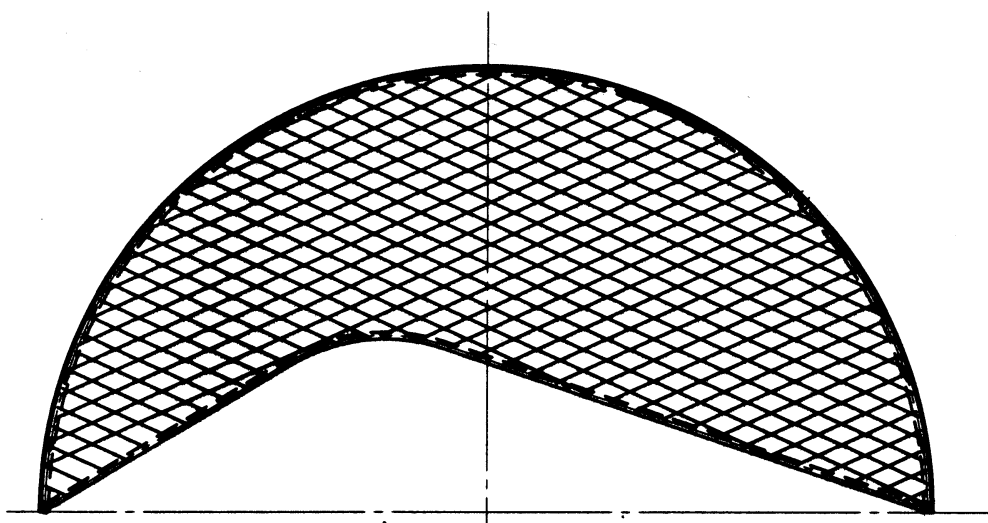
These radiator screens cannot be used with the radiator guard.

Fan Guard

For Std. Radiator
(Radiator height 325mm)



For Std. Radiator
(Radiator height 425mm)



These fan guards cannot be used for 700G and 700D.

2/7/03

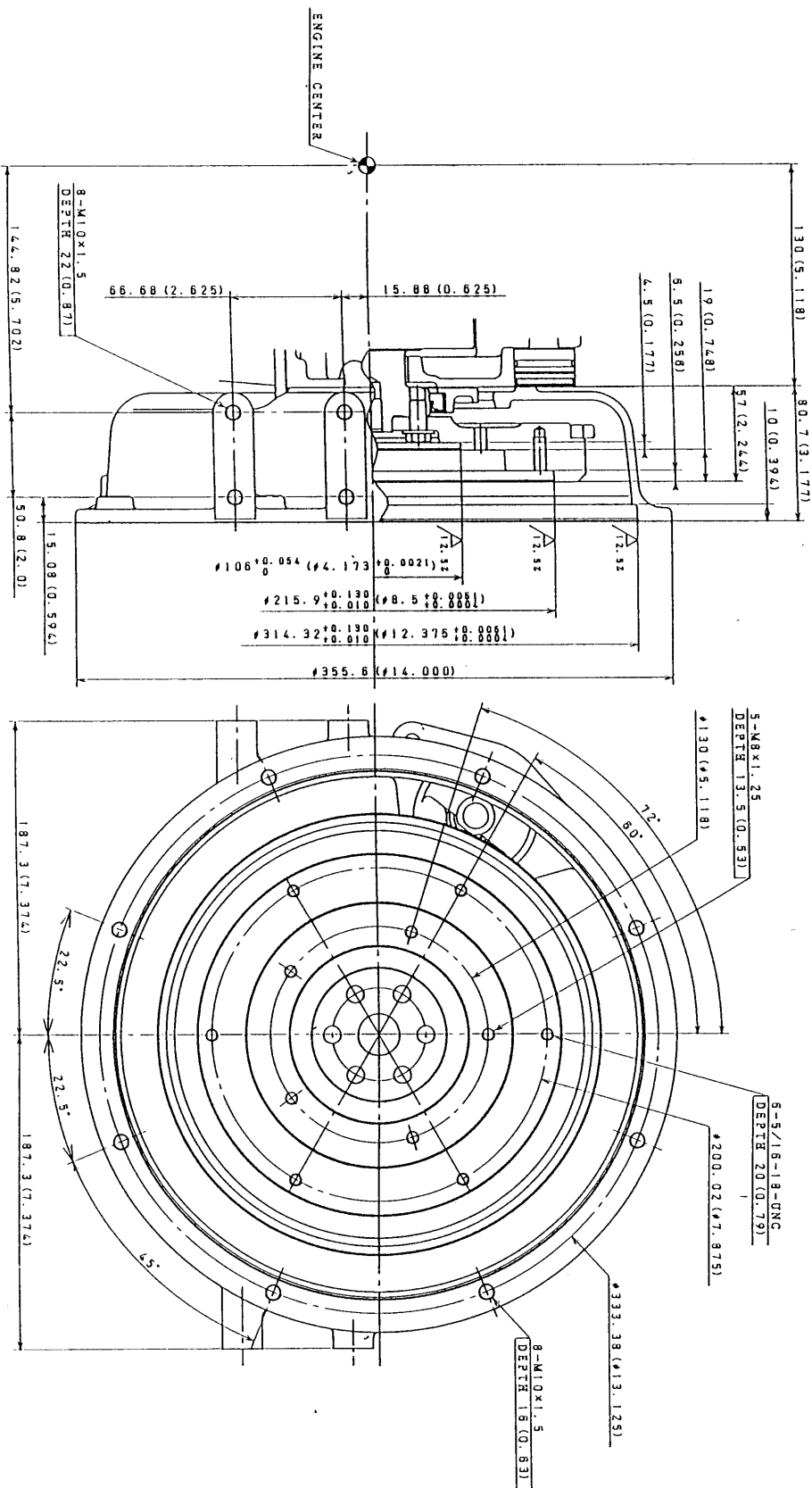
B&S D

Briggs & Stratton Daihatsu LLC



Modified SAE #5 Flywheel Housing and #6 1/2 Flywheel. No provision to mount a pilot bearing per SAE J617 dimensions.

Cast Aluminum Housing & Flywheel



9/30/04

SECTION 10. INTAKE SYSTEM

- 1. Intake System Restriction 10-2
- 2. Intake Air Consumption 10-2

Intake System Restriction

Including connecting piping and hoses:

(kPa/in H ₂ O)	Initial (Clean)	Final
700G &P	1.57/6.30	
950G & P	1.57/6.30	
954G & P	1.57/6.30	
700D		
850D		
950D	2.30/9.23	5.24/21.0
950DT	3.20/12.85	7.29/29.3
954DT	3.20/12.85	7.29/29.3

Intake Air Consumption

$$\left\{ \frac{\text{engine displacement (in}^3\text{)} \times \text{rpm}}{3456} \right\} \times \text{volumetric efficiency} = \text{intake air flow (ft}^3\text{/min)}$$

$$\left\{ \frac{\text{engine displacement (cc)} \times \text{rpm}}{2 \times 10^6} \right\} \times \text{volumetric efficiency} = \text{intake air flow (m}^3\text{/min)}$$

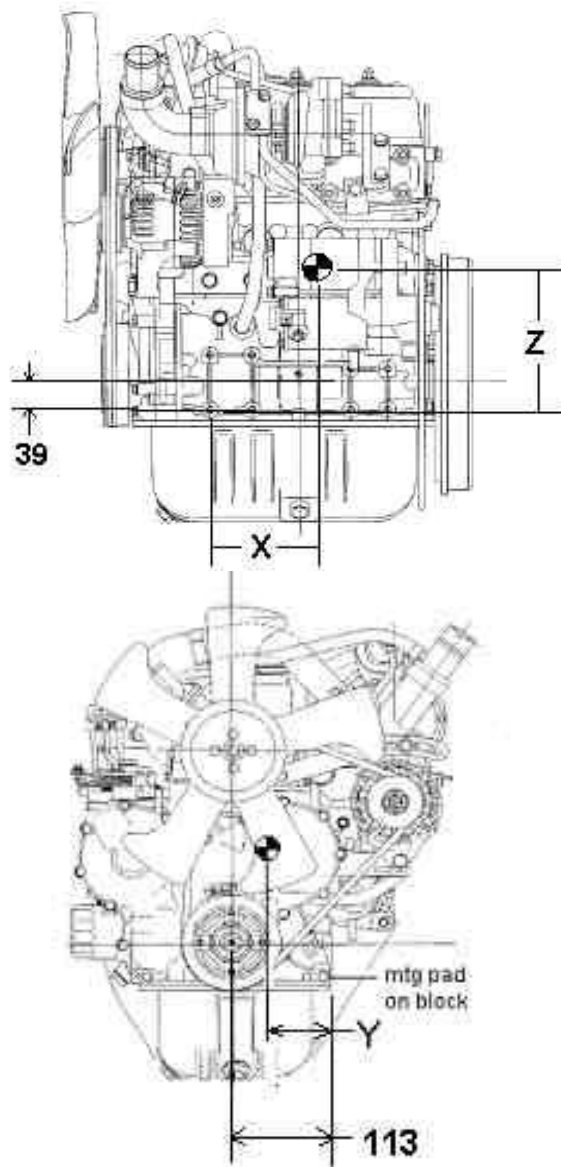
Volumetric Efficiency:

naturally aspirated spark ignition	0.75
naturally aspirated compression ignition (diesel)	0.90
turbocharged compression ignition (diesel)	1.35

SECTION 11. MASS PROPERTIES

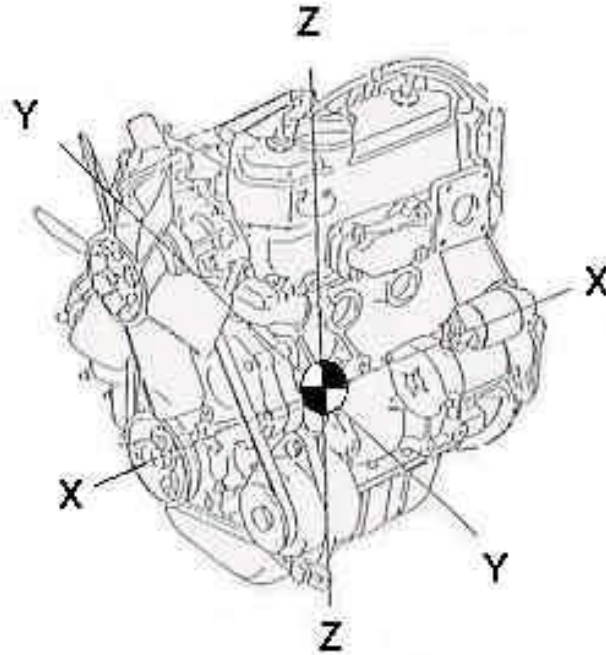
1. Center of Gravity 11-2
2. Moment of Inertia 11-3
3. Mass Elastic System 11-4
4. Unbalanced Inertia Forces & Couples 11-5

Center of Gravity Location



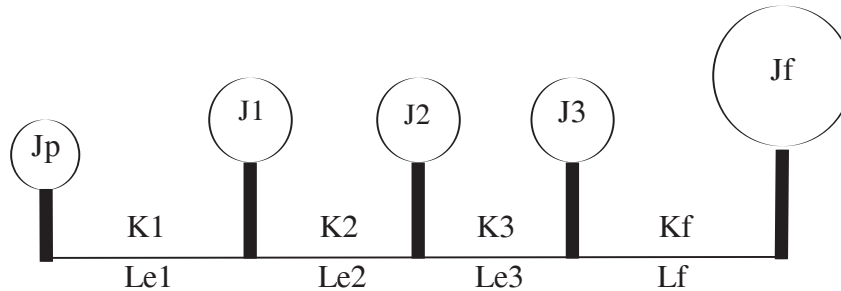
(mm)	X	Y	Z
700G	108	98	110
950G	120	99	107
954G	120	99	107
700D	98	108	117
850D	99	108	117
950D	99	108	117
950DT	99	101	124
954DT	99	101	124

Moment of Inertia



(kg m ²)	X	Y	Z
700G	1.136	1.702	1.280
950G	1.256	1.789	1.359
954G	1.256	1.789	1.359
700D			
850D	1.584	1.983	1.581
950D	1.584	1.983	1.581
950DT	1.584	2.118	1.723
954DT	1.584	2.118	1.723

3 LC engine Mass Elastic System



1. Polar Moment of Inertia (J : kgf-cm-sec²)

Model	Jp	J1	J2	J3	Jf		
					Flywheel		
					Std.	SAE	Clutch type
700G	0.0133	0.0274	0.0119	0.0274	1.124	1.389	0.732
700D		0.0414	0.0166	0.0414			
850D		0.0427	0.0179	0.0427			
950G/D		0.0435	0.0187	0.0435			

2. Stiffness (K : kgf-cm/rad)

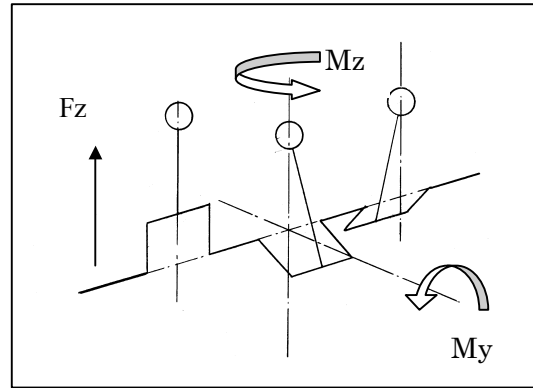
Model	K1	K2	K3	Kf
700 Series	0.846×10^6	1.700×10^6	1.700×10^6	2.773×10^6
850/950 Series	1.055×10^6	2.045×10^6	2.045×10^6	3.371×10^6

3. Equivalent Length (Le : cm) (Equivalent shaft diameter: De = 4.2 cm)

Model	Equivalent Length (cm)				Reference
	Le1	Le2	Le3	Lef	Modulus of Rigidity G (kgf/cm ²)
700 Series	23.47	11.68	11.68	7.16	6.5×10^5
850/950 Series	23.74	12.25	12.25	7.43	8.2×10^5

$$\text{Note : } K = \frac{G \times f \hat{I}}{32 \times Le} \times De^4$$

Unbalanced Inertia Forces & Couples



N : Engine Speed (rpm)

Model	Fz (kg)	Couple (Kg-m)			
		1 st Order		2 nd Order	
		My	Mz	My	Mz
700G	0	$9.49 \times 10^{-7} \times N^2$	$9.96 \times 10^{-7} \times N^2$	$5.30 \times 10^{-7} \times N^2$	0
950G/954G	0	$1.83 \times 10^{-6} \times N^2$	$7.65 \times 10^{-7} \times N^2$	$8.61 \times 10^{-7} \times N^2$	0
700D	0	$1.29 \times 10^{-6} \times N^2$	$9.28 \times 10^{-7} \times N^2$	$6.05 \times 10^{-7} \times N^2$	0
850D	0	$2.13 \times 10^{-6} \times N^2$	$6.84 \times 10^{-7} \times N^2$	$9.34 \times 10^{-7} \times N^2$	0
950D	0	$2.34 \times 10^{-6} \times N^2$	$6.84 \times 10^{-7} \times N^2$	$1.00 \times 10^{-6} \times N^2$	0
950DT/954DT	0	$2.77 \times 10^{-6} \times N^2$	$6.83 \times 10^{-7} \times N^2$	$1.15 \times 10^{-6} \times N^2$	0

Sample calculation:

950D, 3000rpm

$$1^{\text{st}} \text{ Order } My = 2.34 \times 10^{-6} \times 3000^2 = 21.06 \text{ kg-m}$$

