OPERATOR'S GUIDE

G/GTA4800

LPG & Natural Gas

HERCULES
ENGINE COMPANY

Engine Specialists Since 1915

40-0090231

INDEX

INTRODUCTION

This guide will acquaint you with the G/GTA4800 LPG, or Natural Gas engine. It provides recommendations on engine care and operating procedures.

This guide should be considered a permanent part of the engine and remain with the engine, if sold, to provide the next owner with engine operating and maintenance information.

All information and illustrations presented are based on the latest information available at the time of printing. We reserve the right to make changes at any time without notice.

HOW TO USE THIS GUIDE

This guide was written especially for you. We hope you will use it to get to know your Hercules engine.

We urge you to read it from cover to cover. This will enable you to become familiar with the engine's various features, maintenance and service requirements to keep your engine in excellent running condition.

ENGINE IDENTIFICATION PLATE

An Engine Identification Plate is affixed to the right hand side of the block. Code numbers on this plate identify certain important manufacturing specifications applicable to that particular engine including the serial number. Use the Engine Serial Number when seeking information on ordering replacement parts for this engine. For a handy reference, record the information from your engine.

PARTS AND SERVICE

Replacement parts can be obtained through authorized local Hercules Engine Distributors and Dealers. They can be found in the Yellow Pages under "Engines".

SERVICE LITERATURE

A maintenance manual, and parts catalog and installation manual can be obtained from your Distributor or Dealer. These publications will provide the necessary service, overhaul, and replacement part information for your Hercules engine.

INSTRUMENTS

OIL PRESSURE GAUGE (IF EQUIPPED)

The oil pressure gauge registers the lubricating system pressure in pounds per square inch and should be frequently checked to ensure that the system is functioning correctly. Normally the pressure registered by the gauge should remain constant for a given engine speed.

Should the pressure fluctuate, or drop, stop the engine and find the cause. Do not operate the engine at lower than normal oil pressure (12 p.s.i. minimum) at idle.

AMMETER (IF EQUIPPED)

This instrument registers the charging current which is being passed to the battery by the alternator. It also registers a discharge equivalent to the amount of current being used by the electrical equipment when the alternator is not charging.

TEMPERATURE GAUGE (IF EQUIPPED)

The temperature gauge registers the coolant temperature and will indicate overheating which may arise from low coolant level, clogged radiator, loose belt, or faulty thermostat.

By operating the engine at the correct temperature (180°-190°), maximum power, longer and better fuel economy will be ensured.

SAVE YOUR BATTERIES

One 12 volt battery will crank the engine against compression for five or six periods of fifteen seconds each with a recuperation or rest of one minute between each period of cranking.

If a battery replacement is necessary use one with a rating as high as the one furnished with new equipment. Make sure all battery connections are clean and tight.

Recommended Battery Size: 12V 800 CCA @ 0° F
24V 400 CCA @ 0° F

OPERATION

NOTE: ENGINE OPERATION BELOW 1200 RPM REQUIRES FACTORY AUTHORIZATION

This section covers those items which are of particular interest to the operator and does not necessarily cover such work as might be required of the maintenance man. Each operator should thoroughly acquaint himself with the various subjects covered in this book.

PRECAUTIONS - READ BEFORE STARTING THE ENGINE

Know how to stop the engine before attempting to start.

The following precautions, if followed, will help eliminate many operating difficulties and insure satisfactory service and engine life.

1. Do not start the engine until the lubricating oil water and fuel levels have have been checked and brought up to the full mark. (See Coolant Mixture).

2. Never run the starting motor longer than 15 seconds without a rest period of at least one (1) minute, to allow starter to cool down.

3. **REMEMBER:** Dirt, grit, water, lint, or any foreign matter is detrimental and it is your duty to see that they do not get into the engine. Keep all filters clean and serviced regularly.

Continued on next page

4. Lubricating oil recommendations are based on engine design, type of service, and ambient air temperature. High quality oils combined with necessary oil and filter changes are required to assure maximum performance, long engine life, and minimum operating cost. A listing of lubricant producers and their product is attached.

5. Oil level - maintain the level at the "FULL" mark on the dipstick; however, do not overfill. Never allow the engine to run without oil pressure showing on the gauge.

6. Do not put cold water in an overheated engine or serious damage may result. Add water slowly in radiator with engine operating at a slow idle. (See Coolant Mixture, page 6).

7. Never allow the batteries to run low or dry of water. In cold weather do not fill the batteries with water when shutting down as this makes them more likely to freeze. Add water to battery after starting engine for day's run.

8. Do not attempt to make major repairs or adjustments to the engine; rather, take it to the nearest authorized distributor.

9. Keep the fan belts at proper tension. Loose belts allow slippage and wear rapidly. Overtightening can damage the alternator and water pump bearings.

10. Do not permit oil, water or fuel leaks to go uncorrected.

11. Do not allow the air cleaner to become clogged or to operate with loose connections. Keep clean and properly serviced.

12. Check that each spark plug boot vent hole is open and unobstructed.

13. Check oil level in governor reservoir daily.(We will be adding a constant oil pressure system.)

14. All ignition wiring, spark plugs, and coils must be kept clean and free of oil, grease, and paint. Assure that all ground wires are secure and have good contact.

STARTING ENGINE

WARNING

NEVER OPERATE AN ENGINE IN A CLOSED BUILDING UNLESS ENGINE EXHAUST SYSTEM AND CRANKCASE BLOWBY HAVE BEEN VENTED OUTSIDE.

NORMAL STARTING

1. Check the fuel pressure, oil level in the pan, and cooling solution level in the radiator.

2. Do not start under load.

3. Turn the ignition switch to "On". Crank the engine until engine starts.

4. After the engine starts, if throttle is manually controlled, reduce speed to fast idle and observe all gauges for proper functioning. Particular attention should be given to the oil pressure gauge and if a minimum of 15 P.S.I. pressure does not show in a few seconds, shut engine down and determine the trouble. At normal operating temperatures, oil pressure should be between 30 and 60 P.S.I. at full speed.

5. Allow the engine to run for several minutes at fast idle or light load, if possible, before applying the load. Never attempt to pull loads beyond the power of the engine.

CAUTION

DO NOT RUN THE ENGINE UP TO GOVERNED SPEED OR MUCH OVER 800 TO 1000 RPM UNTIL THE OIL HAS BECOME WARM ENOUGH TO CIRCULATE AND THE WATER OR COOLING SOLUTION HAS BECOME WARM ENOUGH TO TAKE THE CHILL OFF THE CYLINDER BLOCK.

STOPPING THE ENGINE

1. Before stopping, always allow the engine to return to idle for at least one minute to permit engine temperatures to equalize.

COOLANT MIXTURE

The coolant mixture required is a 50/50 mix of ethylene glycol based permanent anti-freeze and water with a hardness of less than 10 grains per gallon.

TURBOCHARGER (IF EQUIPPED)

The turbocharger is a self-contained unit composed of a turbine wheel and a compressor mounted on a common shaft with the necessary surrounding castings. The exhaust gas from the engine is forced into the turbine side of the turbocharger, where the energy of the gas is used to drive the turbine. The compressor mounted on the opposite end of the shaft forces air and natural gas under pressure into the intake system. By providing a greater amount of fresh air, power output from the turbocharged engine is increased. The action of the turbocharger is entirely automatic and requires no control. The speed and output of the turbocharger will vary automatically with variations of engine load or speed, or both.

CAUTION

DO NOT OPERATE THE ENGINE IF A LEAK EXISTS IN THE DUCTING OR IF THE AIR CLEANER IS NOT FILTERING EFFICIENTLY. DUST LEAKING INTO THE AIR DUCTING CAN DAMAGE THE TURBOCHARGER OR THE ENGINE.

The exhaust system of a turbocharged engine installation is very carefully designed to eliminate restriction of the free flow of exhaust gases from the turbocharger. The turbocharger exhaust outlet pipe flange is shipped with engine. The flange is sized to accept the recommended size outlet pipe. No reduction in this pipe size is permissible.

NOTE: Back pressure in the exhaust system, measured near the turbocharger discharge, should not exceed 2.0" Hg or 25" H_2O. An increase in exhaust back pressure will result in a corresponding decrease in engine power output.

Turbocharger repairs should be made only by authorized service centers.

CAUTION

AT ALL TIMES, BEFORE SHUT DOWN, THE ENGINE MUST BE ALLOWED TO IDLE FOR ONE MINUTE TO PREVENT DAMAGE TO THE TURBOCHARGER UNIT.

1. Inspect the mounting and connections of the turbocharger to be certain they are secure and that there is no lubricant leakage or duct leakage.

2. The turbocharger does make a whining noise when functioning normally. Unusual turbocharger noise may indicate internal turbocharger problems. Return to dealer for such problems.

3. Inspect and service the engine air cleaner. (Refer to Suggested Preventive Maintenance Schedule)

STORAGE OF ENGINES FOR LONG PERIODS AND RUST PREVENTIVE TREATMENT

If the engine is to be stored for an extended period, special preparations should be made to prevent RUST from forming on the wearing surfaces or in the fuel system.

Thorough "Rustproofing Preparation Instructions" may be obtained form the authorized service dealers.

NOTE: If the engine can be started and run each week for a period of one half hour or more, rust treatment may not be required; however, it is recommended that a No-Rust type oil be used during these periods or until the equipment is put into regular service.

RUST PRESERVATIVE OILS

Shell Ensis Mill-L-21260 --	Code 66200 --	SAE #10W
	Code 66202 --	SAE #30

SERVICE AND MAINTENANCE

This section covers a brief description of various parts of the engine with instructions covering their service and maintenance requirements under normal operating conditions.

SUGGESTED PREVENTIVE MAINTENANCE SCHEDULE

A. DAILY:

1. Check air cleaner and all air inlet connections. Clean or change filter as required.
2. Check that the oil level is at the full mark on the dipstick.
3. Check coolant level and condition of the solution in radiator. Also keep the external parts of the radiator clean and free of dirt, leaves, etc.
4. Check battery solution level. Never allow it to run low.
5. Check all gauges to be sure they are functioning properly.
6. Check general condition of unit. Tighten, repair, or replace parts when necessary.

B. FIRST 125 HOURS OR 3000 MILES IN ADDITION TO "A" SERVICES

1. Change crankcase oil and filter or element.
2. Clean crankcase breather system.
3. Tighten accessory drive belts to avoid slippage.
4. Lubricate accessory items as needed.
5. Check valve clearance for proper setting of .010 intake and .025 exhaust. (cold) - Spark Plug torque - 26-30 FT. LBS.

C. EVERY 500 HOURS

ENGINE TUNE-UP

1. Spark plugs - replace. Torque to 26-30 FT LBS.
2. Check tappets for setting of .010 intake and .025 exhaust (cold)
3. Compression test on all cylinders.
4. Check linkage adjustments.
5. Check manifold vacuum, at idle, 18" Hg. Minimum @ 300 RPM.
6. Change air filter.
7. Check all electrical connections.
8. Check timing (See Chart).

ENGINE TIMING CHART
(SPARK IGNITED)

ENGINES TIMED AT 1800 RPM

When using the charts below for correct timing to type of fuel used, set the engine speed at 1800 rpm. Using a timing light, align the degree mark with the center of the timing hole in the bellhousing, or pointer located on the front gear housing with the appropriate mark on the front pulley. Degrees shown are before top dead center of #1 piston compression stroke.

G/GTA4800 SERIES

MODEL	FUEL	C RATIO	P/N	VENDOR	TIMING	RPM	PLUG GAP
G4800 NAT. ASP.	LPG	10:1	40-2505206	ALTRONIC	12°	1800	.015
G4800 NAT. ASP.	NG	10:1	40-2505206	ALTRONIC	18°	1800	.015
GTA4800 TURBO AFT/COOLED	NG	10:1	40-2505210	ALTRONIC	20°	1800	.015
GTA4800 TURBO AFT/COOLED	LPG	10:1	40-2505210	ALTRONIC	14°	1800	.015

LUBRICATING OILS FOR HERCULES NATURAL GAS ENGINES

Based on information published in the "EMA Lubricating Oils Data Book", the following listed products meet Hercules Engines requirements for low ash level (<0.5% max.). Note that this list is not meant to be all inclusive.

Single viscosity **(SAE Grade 30)** for operation in average ambient temperatures above 30°F.

COMPANY	BRAND
Archer Petroleum	GLP
Caterpillar, Inc.	CAT NGEO
Cheveron	Cheveron Gas Engine
Citgo	Citgo Pacemaker Gas Engine
Conoco	El Mar 3000/El Mar Ashless
Esso Petroleum	Essolube G30
JI Case	Case IH Low Ash Engine
Mobil Oil	Mobil 80 Super
Pennzoil	Geo LA
Petro-Canada	Sentinel 435
Phillips	HDG
Shell	Shell Mysella
Sun Refining	Sunoco SEO 683
Texaco	Geotex HD 30
	TL-13554
Troco Oil Co.	Geo-Guard 300
Unocal Corp.	76 Triton 5005 Geo
West Penn Oil Co.	Emblem Low Ash Gas Engine

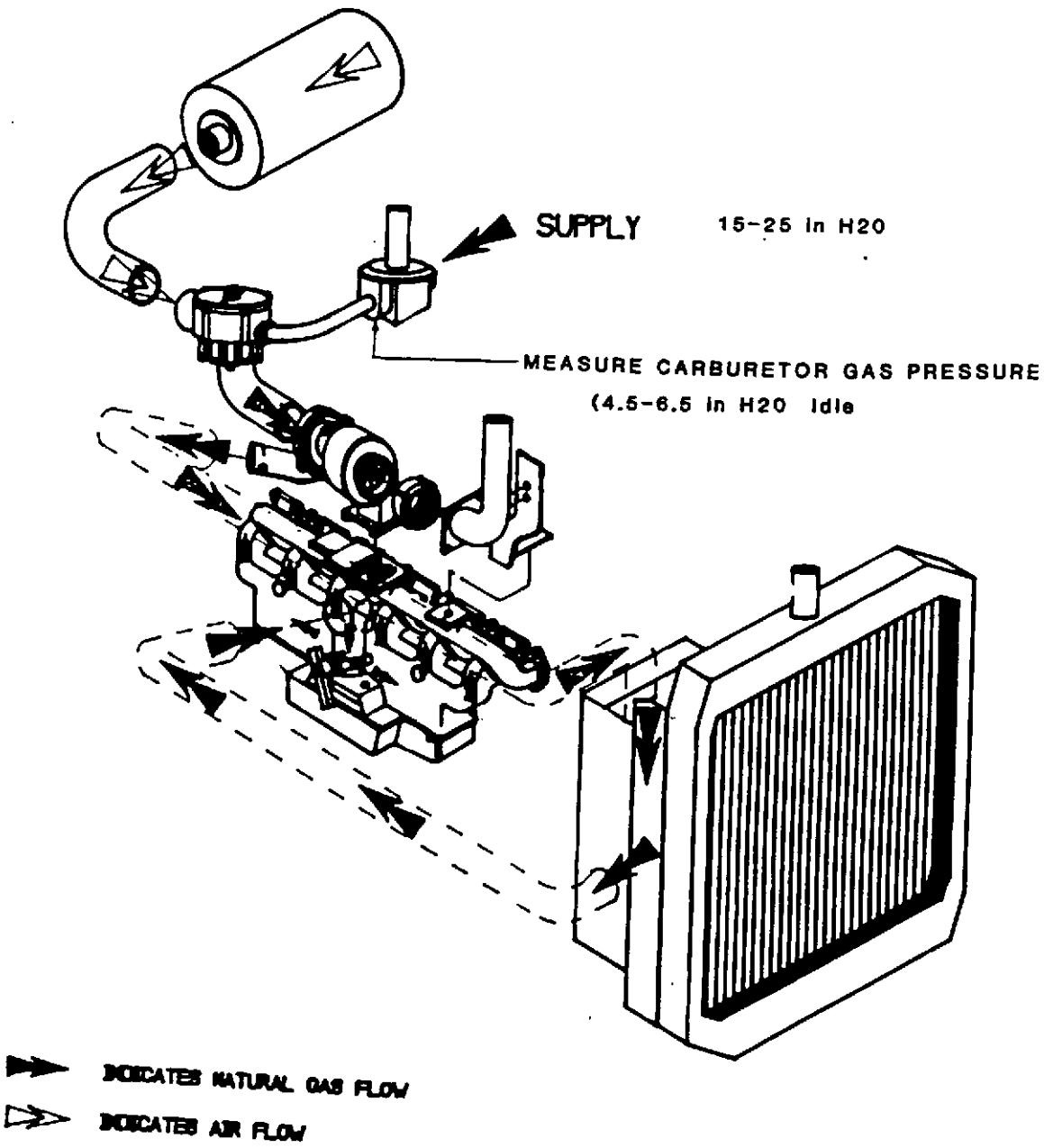
Multi-grade for operation at ambient temperature range as follows:

10 w 30	Minus 10°F to 50°F
15 w 40	Zero °F to 60°F
20 w 40	10°F to 60°F

COMPANY	BRAND	SAE GRADE
Esso Petroleum	Essolube G10w30	10 w 30
Esso Petroleum	Essolube G15w40	15 w 40
Mobil Oil	Mobil Delvac Super GEO	15 w 40
Mobil Oil	Mobil 80 Super	15 w 40
Phillips	HDG	20 w 40
Sun Refining	Sunoco SEO Ashless	15 w 40
Troco Oil Co.	Geo-Guard 300	15 w 40
Tenneco	Low Ash Geo 2030	15 w 30
West Penn Oil Co.	Emblem Low Ash Gas Engine	15 w 40

Cu. inch displacement.....478
Bore and stroke..... 4.56" x 4.88"
Number of cylinders.....6
Firing order.....1-5-3-6-2-4
Compression ratio standard.....10:1
Cylinder compression pressure.....200-250 p.s.i.
Length.....60.50"
Height.....53.44"
Width.....31.32"
Weight o.p.u.....1850 Lbs.
Cooling-Belt driven centrifugal pump-duel belts-standard.....
Water pump - Fan assembly.....Mounted on front of cylinder block
Cooling system (U.S. gallons) incl. engine radiator & hoses.....7.75
Cooling capacity - Max. ambient at sea level.....1800 RPM full load
with 7# pressure cap.....125°F
Oil pan-qts (U.S. std incl. 2 qts for oil filter.....22
Engine oil specifications or equiv. - .....
.....Mobil 80 Super
Max tipping angle (continuous) oil.....15°
Method of suspension.....4 point
Flywheel.....SAE#2 for 11-1/2" Clutch, SAE#1 for 14" Clutch
Serial number location.....nameplate R.H.side of block
Valve clearance.....{no retorque.
Hot {head gasket
Cold .010 Int. .025 Exh. (recommend cold set) {is std.
Ignition.....Altronic V
Timing.....See Engine Timing Chart
Spark Plug.....Champion: #2095 Check at 250 Hrs, Change at 500 Hrs
Spark plug gap..... .015
(Check at first 125 Hrs., check at 250 Hrs. thereafter)
Thermostat.....180°
Max air cleaner restriction.....Max 25" H20 (i.e. w/dirty element)
Turbo exhaust backpressure.....Max 2" hg
Turbo boost.....12.5 p.s.i.
Lube oil temperature under normal operating conditions (Sump)...220°
Gas Pressure to the engine Mtd. regulator.....15-25 in H20
Minimum gas operating pressure.....4.5" @ Carb @ idle
Engine idle speed.....800 RPM
Engine rated speed.....See spec
Engine torque speed.....See spec
Oil pressure-minimum idle speed.....12 Lbs.
Oil pressure at operating temp. @full load-per chart X-929 @ 1800 RPM
Water pump GPM.....60 GPM @ 1800 ERPM
Exhaust manifold temperature-1300°F (Normal), 1400°F Max
1200-1300°F out of turbo
Intake manifold temperature maximum.....150°
First oil change.....125 Hrs.
Thereafter change at.....500 Hrs.
*Extended change intervals can be used if customer uses oil analysis.

FLOW CHART


SUPPLY
15-25 in H20
MEASURE CARBURETOR GAS PRESSURE
(4.5-6.5 in H20 Idle
INDICATES NATURAL GAS FLOW
INDICATES AIR FLOW

FUEL SYSTEMS GASEOUS

Gas engines can be designed to operate on various gaseous fuels, including natural gas, HD-5 propane, digester (sewage) gas, and landfill gas.

Each engine installation must be designed with a particular fuel in mind, because the octane rating and Btu content of different fuels can vary greatly. A gas analysis should be submitted to the engine manufacturer if a non-commercial grade fuel is to be used.

FUEL SPECIFICATIONS

TYPE OF FUEL	OCTANE RATING	BTU/FT LHV
Natural Gas	115-120	900
HD-5 Propane	95	2400
Digester Gas	115-120	600
Landfill Gas	115-120	400-450

NATURAL GAS ENGINES - Natural gas engines are often used for prime power applications. Generally the gas is supplied by utility owned lines that run to the installation site. The major components in the natural gas fuel system are the pressure regulators, piping and the carburetor.

PRESSURE REGULATORS - Pressure regulators are designed to control the pressure of the gas as it enters the engine. Through an arrangement of a diaphragm and springs, the pressure of the natural gas coming to the engine is lowered and controlled. This provides a steady supply of gas to the carburetor.

The fuel system uses a high pressure line regulator, mounted in the main fuel line, and a low pressure engine mounted regulator. The line, or high pressure regulator lowers the gas pressure in the lines that feed the engine mounted gas regulators to a lower pre-determined value, depending on the application. The engine regulator sets the gas pressure to the carburetor. From the engine mounted regulator the gas flows into the carburetor, where air is mixed with the gas.

The mixture then flows into the engine to be burned. Gas pressure to the engine regulator is typically 15-25 in H_2O for G4800 Series engines.

Low gas pressure will starve the engine of fuel and reduce engine output. Excessively high pressures could damage the regulator, allowing excessive fuel to the cylinders. This could lead to detonation and serious engine damage.

If at all possible, avoid feeding any gas operated equipment from the supply line between the line regulator and the engine regulator. The supply pressure to the engine could be disrupted.

A second line regulator may also be necessary if the initial line regulator is located far from the engine.

PRESSURE DROP BETWEEN REGULATORS - The maximum pressure drop across a line regulator is generally 50-75 psi (3.5 - 5.2 bar). Consult the regulator manufacturer for specific information.

CARBURETOR - The carburetor on gaseous fueled engines is designed to mix gas and air into a combustible mixture. Through a series of orifices, springs, and diaphragms, gaseous fuel and air are mixed to provide the proper fuel-to-air ratio for efficient engine operation. Carburetors are used to provide a constant fuel-to-air ratio under varying and constant loads.

The gas-to-air mixture must be established at start-up. Consult the engine manufacturer for instructions on gas carburetor settings.

PIPING - Piping size to the engine site is generally supplied by the utility. Installation piping will have to be fitted from the meter or main feed line to the engine. This piping should be absolutely clean and scale free. If possible, blow out the lines with clean, dry compressed air before mounting the regulator. Piping should be black iron or steel to avoid reacting with the sulfur in the fuel. **NEVER USE GALVANIZED METAL OR ZINC ALLOY PIPING.**

REGULATOR - Do not reduce the fuel inlet size of the regulator. The pipe should be sized to provide the required gas volume and pressure at the engine. All threaded pipes should be sealed to prevent leaks. A shut-off valve should be installed along the pipe span just before it enters a building.

WARNING

All gas installations in closed areas or buildings should have a positive shut-off valve to prevent gas leakage when the engine is shut down. Consult all applicable local, state and federal building codes for each installation.

Natural gas piping should never run near furnaces, heating pipes, electric wiring, or exhaust manifolds. The high temperatures could cause an explosion.

Natural gas piping should always be insulated for added protection.

Always incorporate a flexible pipe connector in the piping system. Locate this flex connector as close to the engine regulator as possible.

FUEL TREATMENT - Fuel filters and/or scrubbers are often recommended to remove dirt, rust, scale, water, and chemical contaminants from the fuel. If debris remains in the fuel, the regulator orifice and gas jets in the carburetor could clog up and reduce engine performance. In areas where the gas has a large sulfur content, specially treated scrubbers and cleaners must be used. Sulfur in the fuel would combine with the water formed in the combustion process to make sulfuric acid. The acid causes rapid corrosion of engine components.

GAS MIXING - Some gas distribution systems add a propane-air mixture to the natural gas to compensate for low pressure conditions. This is called **gas mixing.**

Gas mixing lowers the octane level of the fuel. To determine the octane drop, take the percentage of propane added to the system and multiply it by the difference between the two octane levels. For example, if the normal natural gas supply is established at 115 octane and 25% of 95 octane HD-5 propane is added, the resulting octane number is decreased by 25% of the difference between 115 and 95, or 5. The resulting octane level would be 110. If the propane level is increased to 50%, the octane level would drop to 105. Depending on engine load, gas mixing can lead to damaging detonation. If detonation is experienced, the load must be reduced or the spark retarded, or both, when the engine is adjusted for natural gas. In areas where gas mixing is common, a second set of marks on the magneto will help the operator retard the spark quickly. The addition of propane-air mixture is proportioned so carburetor re-adjustment is not necessary.

HD-5 PROPANE FUEL SYSTEMS - Propane is a high Btu, low octane fuel that is generally sold and stored as a liquid. Propane can be converted to a gaseous state at the engine, in a separate piece of equipment called a vaporizer. The liquified gas runs through the vaporizer and is warmed and converted to vapor. Propane fueled engines are most often used for non-prime power installation.

CAUTION

The gas-to-air mixture must be established at start-up. Consult the engine manufacturer for instructions on gas carburetor settings.

This type of fuel system is very similar to the natural gas systems; however, several additional components are needed.

The other LPG fuel, butane, has too low an octane rating (approx. 80) to be a satisfactory fuel in modern engines.

FILTER. A small liquid stage filter should be used to protect the vaporizer, carburetor, and engine against fuel tank and line scale.

LPG VAPORIZER. This fuel is liquified by compressing it while it is ir the gaseous state. The high pressures caused by compressing the gas converts it into a liquid. The liquid fuel is then stored. Before the fuel can be used by the engine, it has to be re-converted to a gas in the fuel vaporizer. Heated air or water runs through the vaporizer and warms the fuel to a gaseous state.

From there, the gas flows to the carburetor, where it is mixed with air. A vaporizer must be used on most LPG applications. Only very small engines can runn off the gas vapor that forms in the fuel tank. Many local codes require an outside location for the fuel vaporizer. Contact your local distributor for the type of vaporizer that will be best for your installation.

Exterior porpane fueled engine installations can usually be equipped with a combination vaporizer and pressure regulator (converter) mounted on the engine. These engine mounted converters use heated engine coolant to vaporize the liquid propane.

FUEL TANK. An approved LPG fuel tank must be used to store the fuel. Shut-off valves and pressure gauges are usually incorporated in the tank. Consult the tank manufacturer for more specific information.

Due to the volatile nature of the fuel, the tank should never be located inside any structure. (Most local codes require that the tank be installed outside a building.) Always plan the installation to kee the fuel tank away from open flames, sparks or electrical connections.

Since propane gas is heavier than air, the tank enclosure should not contain any piping trenches or floor drains that would permit escaping gas to get under the building or into city storm drains or sewer systems.

PIPING. As with piping for natural gas, never run an LPG line near heat sources, exhaust manifolds, or electric wires. This particular fuel will vaporize at 44°F or (-42°C). Any excess heat or loss of pressure could lead to rapid fuel vaporization within the system. Try to keep the pipe spans as short as possible. Piping can be insulated for added protection.

CARBURETORS. As with the natural gas engines, a propane carburetor is nothing more than a gas and air mixer. The springs, orifices, and diaphrams will determine the gas-to-air ratios. Carburetor adjustment is outlined in the engine operation and service manuals.

NATURAL GAS COMPOSITION

The following is a listing of the contents of natural gas along with acceptable levels for use in HEI engines.

CONSTITUENT	CHEMICAL FORMULA	VOLUME PERCENT (mole percent)
Methane	CH_4 *	87% Min. *
Ethane	C_2H_6	8% Max.
Propane	C_3H_8	3% Max.
Butane	C_4H_{10}	1.50% Max.
Pentane	C_5H_{12}	0.50% Max.
Hexane	C_6H_{14}	0.30% Max.
Nitrogen Carbon Dioxide	N_2}* CO_2}*	*{Combined total of N_2 and CO_2 is not to exceed 15% Max.}
Oxygen Hydrogen	O_2 H_2	1% Max. 2% Max.
Hydrogen Sulfide	H_2S	0.24 Max., or 150 grains max per 100 cu. ft. of gas at 60°F and atmospheric pressure.

ALTRONIC V IGNITION SYSTEM INSTALLATION INSTRUCTIONS

WARNING: An improperly installed or operating ignition system may lead to improper engine operation which consequently could pose the threat of personal injury to operators or other nearby personnel.

The following parts are required for each installation:

1. Altronic V Unit
2. Wiring Harness
3. Ignition Coils - 40-2505254 (1 - per spark plug)

ENGINE

Set engine so that No. 1 cylinder is at the ignition firing point. See Engine Timing Chart.

Remove oil fill cap and verify that #2 Exh. rocker is in the down position, if not, rotate engine 180°.

ROTATION

Determine the rotation of the Altronic V unit (looking at the drive end of the Altronic unit) for the engine being equipped. (CW)

ALTRONIC V UNIT

Locate the timing mark on the housing for the proper rotation. Rotate the drive coupling until the red mark on the shaft lines up with the proper mark on the housing. Figure 1 shows the timing mark indicatio and drive coupling alignment for the standard SAE CCW and CW configurations.

Mount unit to engine keeping the above two red lines together as close as possible. If the two lines cannot be made to meet by rotating the entire unit, remove the four screws which fasten the back cover assembly to the unit. The entire back cover assembly should then be pulled away from the unit keeping the internal plug connected. Rotate the driven gear until the two marks described above line up. With the plastic cover removed, use one finger on the timing decal to maintain the distributor shaft in the correct position (proper red marks line up) and reinstall the cover to the unit, engaging the gears. Securely tighten the four fastening screws. Final timing should be checked using a timing light with the engine at idle speed. Rotate unit CW to retard, CCW to advance.

IGNITION COILS AND SECONDARY WIRING

Use only one of the Altronic coils listed above; standard low-tension magneto coils will not work properly with this system. Mount the coils as close as possible to the engine spark plugs.

The use of a clear, silicone grease (such as Dow Corning DC-200) is recommended for all high tension connections and boots. This material helps seal out moisture and prevent corrosion from atmospheric causes as well.

PRIMARY WIRING

The firing order of the Altronic V units is as follows:

CYL.	UNIT	CW ROTATION	WIRING DIAGRAM
6*	6A34	A-F-E-D-C-B	6

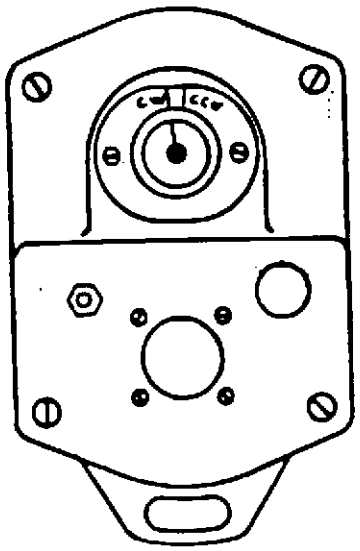
* Unit fires each cylinder individually on compression stroke only.

Starting with lead "A: to the coil of #1 cylinder, the harness leads are connected in accordance with the engine's firing order to the positive (+) terminals of the coils (see Wiring Diagarms). On exhaust stroke firing units (**), the coils for the cylinders with matching harness letters are connected in series as shown in the Wiring Diagrams. The switch or shutdown panel wire is "E: for units with 5-pin connector and "G" for units with the 7-pin connector. A common ground lead connecting the negative (-) terminals of the coils must be run as shown in the diagrams.

All connections should be made using ring type terminals specified for the 16 gauge wire and #10 stud size. Terminal should either be soldered to the wire or attached with an appropriate staking tool. All primary wiring should be protected from physical damage, vibration and temperatures in excess of 220°F. Any unused leads in the wiring harness should be taped and left open-circuited (not connected).

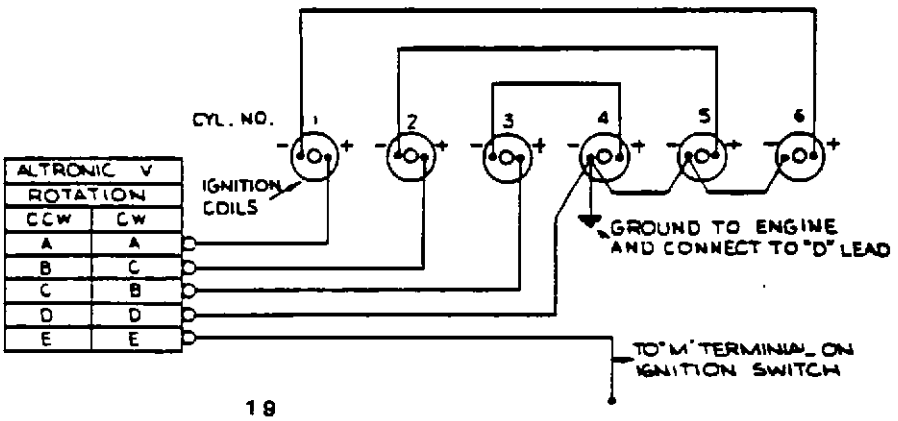
Make sure shorting plug is attached at back of mag. when not using external timing.

CW ROTATION



UNIT 6A34 - 6 CYLINDER

IGN. ROTATION		ENGINE
CW	CW	FIRING ORDER
A	A	1
B	F	5
C	E	3
D	D	6
E	C	2
F	B	4



STATIC TIMING PROCEDURE FOR ALTRONIC V IGNITION

1. Set engine so that No. 1 Cylinder is at the ignition firing point

2. Determine the rotation of the Altronic V Unit (looking at the drive end of the Altronic Unit). The G/GTA4800 Hercules engines are equipped with the Altronic V rotating in the CW rotation.

3. Locate the timing mark on the housing for the proper rotation. Rotate the drive coupling until the red mark on the shaft lines up with the proper mark on the housing. The following drawing shows the timing mark indication and drive coupling alignment for the standard SAE CW configurations.

4. Mount unit to engine keeping the above two red lines together as close as possible. If the two lines cannot be made to meet by rotating the entire unit, remove the four screws which fasten the back cover assembly to the unit. The entire back cover assembly should then be pulled away from the unit keeping the internal plug connected. Rotate the large gear until the two marks described above line up. With the plastic cover removed, use one finger on the timing decal to maintain the distributor shaft in the correct position (proper red marks lined up) and reinstall the cover to the unit, engaging the gears. Securely tighten the four fastening screws. Final timing should be checked using a timing light with the engine at operating speed.

OPTIONAL DUAL FUEL TIMING UNIT

TIMING SETTING AND ADJUSTMENT

There are two ways the 581 603 electronic timing unit can be used:

A. MANUAL ADJUSTABLE TIMING - Install the Altronic V unit with the back cover timing marks lined up and with the engine set 6° advanced from the most advanced desired timing. With the 581 603 installation complete, use the TIMING ADJUSTMENT screw to vary ignition timing to the desired setting at the normal engine operating RPM. See the Application Chart below for the range for the specific Altronic V unit.

B. TWO PRE-SET TIMING POINTS - Wire terminals A and B to a switch or relay contacts as shown in the Wiring Diagrams. With the relay or switch contacts CLOSED and the engine running at normal operating RPM, set the desired ADVANCED ignition system timing by adjusting the Altronic V unit or coupling in the noraml manner. Then OPEN the contact and turn the TIMING ADJUSTMENT screw to set the desired RETARDED timing. The differential range is shown in the Application Chart below for the specific Altronic V unit.

APPLICATION CHART - 581 603 SERIES

ELECTRONIC TIMING UNIT	ALTRONIC V MODEL	"V"TERMINAL	TIMING RANGE MANUAL(A)	TWO-POINTS(B)	ENGINE TYPE
581 603-2	6A34	To Ground	20°	6° - 26°	4 Cycl

INSTALLATION DIAGRAM

MOUNTING:

1) MOUNT 581 603 UNIT SO THAT CONNECTIONS ARE PROTECTED FROM WEATHER.

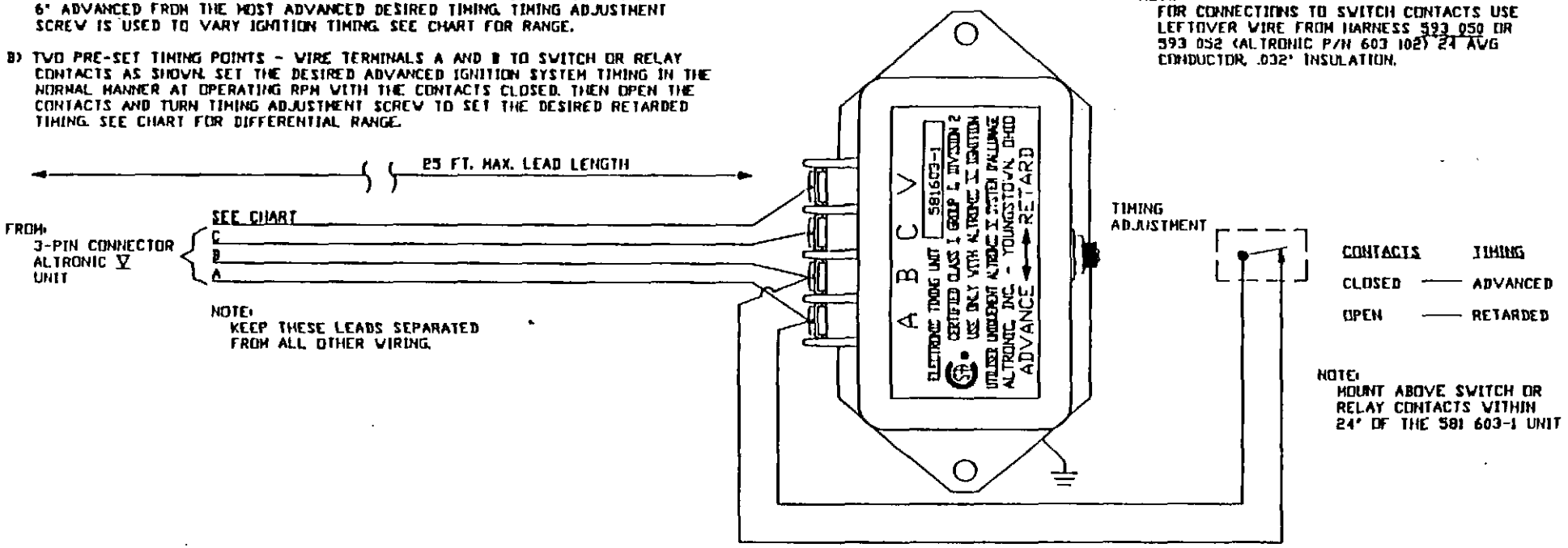
2) CASE OF BOX MUST BE CONNECTED TO ENGINE GROUND.

3) MAX. TEMPERATURE IS 150° F. - 65° C.

TIMING ADJUSTMENT:

A) MANUAL ADJUSTABLE TIMING - CONTACTS ARE NOT USED. SET THE IGNITION TIMING 6° ADVANCED FROM THE MOST ADVANCED DESIRED TIMING. TIMING ADJUSTMENT SCREW IS USED TO VARY IGNITION TIMING. SEE CHART FOR RANGE.

B) TWO PRE-SET TIMING POINTS - WIRE TERMINALS A AND B TO SWITCH OR RELAY CONTACTS AS SHOWN. SET THE DESIRED ADVANCED IGNITION SYSTEM TIMING IN THE NORMAL MANNER AT OPERATING RPM WITH THE CONTACTS CLOSED. THEN OPEN THE CONTACTS AND TURN TIMING ADJUSTMENT SCREW TO SET THE DESIRED RETARDED TIMING. SEE CHART FOR DIFFERENTIAL RANGE.



TROUBLE SHOOTING

NOTE: Numbers in each column indicate sequence in which problem should be checked

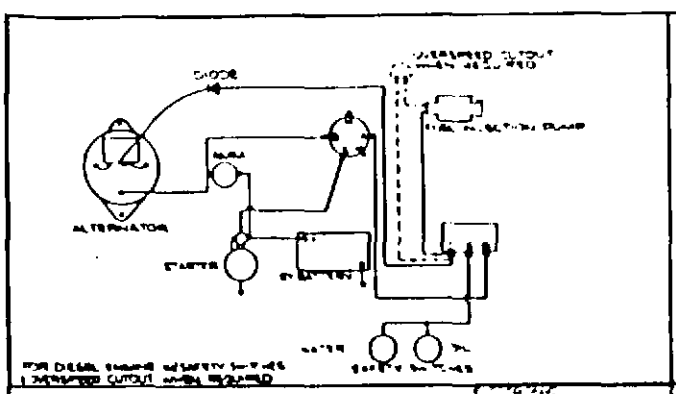
CAUSE	PROBLEM: Engine Will Not Start	Engine Stops	Hard Starting	Erratic Engineer Performance	Blue Exhaust Smoke	White Exhaust Smoke	Low Power	Engine Over-Heating	Engine Over-Cooling	Engine Knocking	Low Oil Pressure	Bearing Failures
Air Cleaner Dirty			1			1						
Air Inlet Restricted	11		2			2						
Exhaust System Restricted		6		13		13	10					
Battery Weak or Discharged	5		1									
Battery Cables Worn or Loose Connection	4	5	2	5								
Low Cylinder Compression			10	11	5	11						
Foreign Matter on Pistons				17		16		7				
Worn or Scored Pistons, Rings, Etc.			15	18	7	17	12	8		11		
Valves Leaking or Sticking	14		14	16		15		6				
Worn Valve Guides					8							
Valves Incorrectly Adjusted	13		13	15		14		5				
Luboil Level Too Low								1	1	1		
Luboil Level Too High			18		1	3						
Luboil Contaminated									4	3		
Wrong Type of Luboil					3				3	2		
Oil Pump Inlet Screen Plugged									6	8		
Pressure Regulator Not Functioning									7	9		
Rocker Arm Shaft Upside Down					6				5			
Oil Header Plug Missing or Loose									10	12		
Bearing Failed, Main, Rod, Cam			20			18		9	8			
Excessive Angle Operation					2				2	5		
Excessive Thrust Pressure on Shafts	16	12	17						9	10		
Fuel Supply Empty	2	1										
Fuel Valve Closed	3	2										
Fuel Regulator Vent Plugged		3		6								
Fuel Contamination	6		5	7	4	4		2				
Fuel Incorrect For Conditions	7	8	6	8								
Fuel Filter Dirty or Plugged	8	9	7	9		5						
Ignition Switch in OFF Position	1											
Defective Coil or S Plugs	9	7	9	4		8						
Ignition Timing Incorrect	10		8			7	7	3				
Throttle Linkage Adj Incorrect or Sticking				12		9						
Carburetor Malfunction		11	11	14		12	11					
Air Leak In Intake System			4	3								
Fan Belt Loose or Slipping							3					
Radiator Fins or Tubes Dirty or Restricted							4					
Water System Piped Incorrectly							6	1				
Low Coolant Level							1					
Coolant in Cylinders	15		16	19	3							
Inoperative Thermostat					1		5	3				
Thermostat Missing					2			2				
Internal Coolant Leak											4	
Wrong Defective Radiator Cap							2					
Engine Overload							8				6	
Engine Overspeeded							9		4		7	

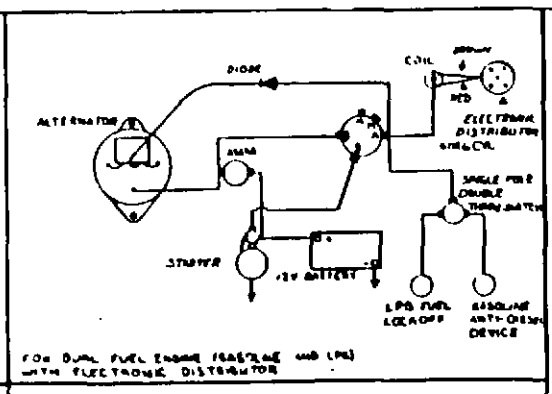
CRANKCASE OIL CAPACITIES

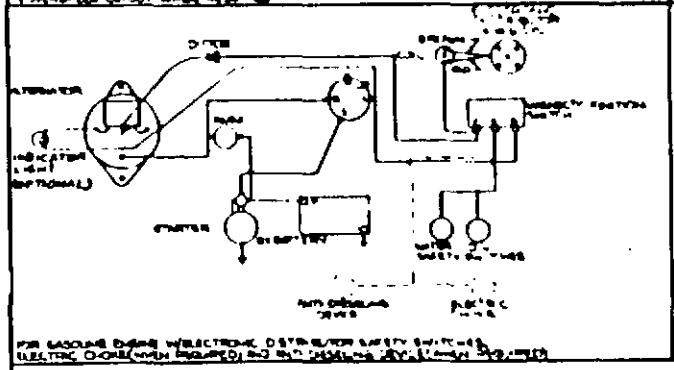
G4800	IV	15	9-3/4	18

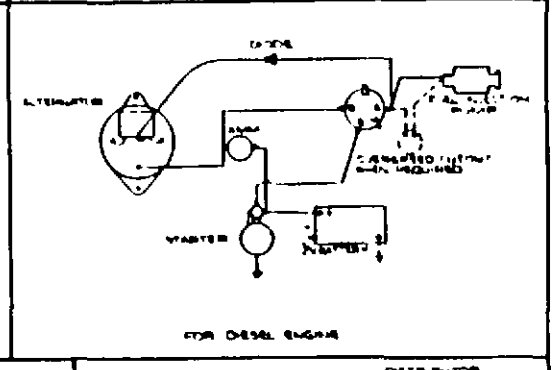
CRANKSHAFT CENTERLINE

TYPE IV

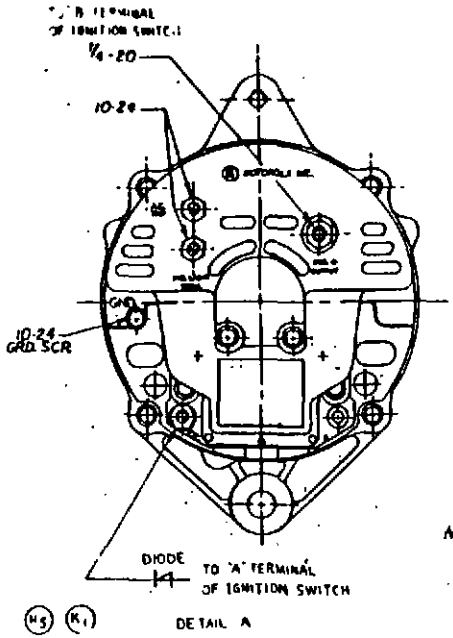


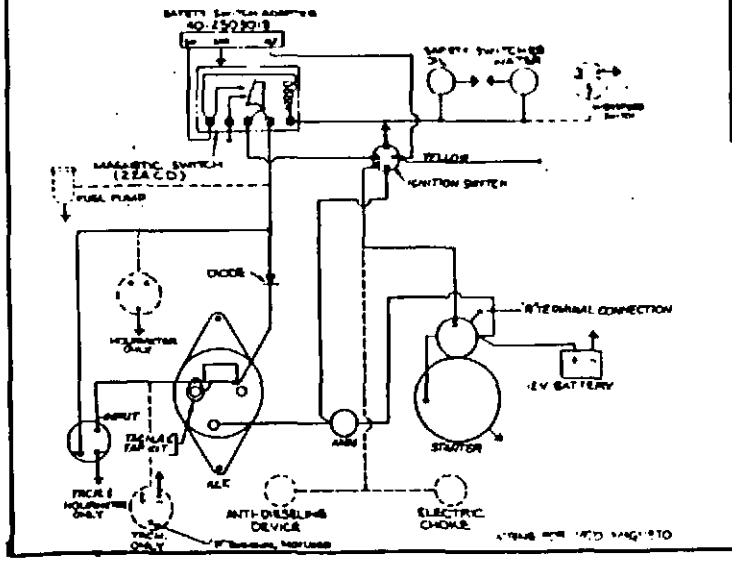


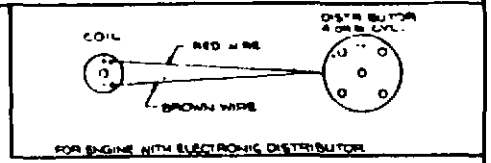




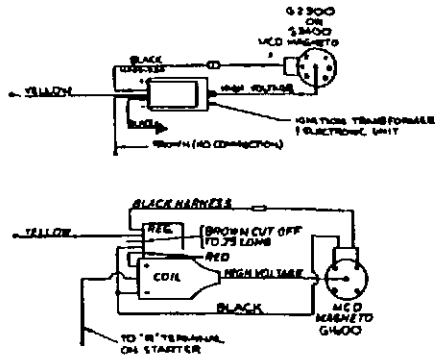
FOR DIESEL ENGINE







FOR ENGINE WITH ELECTRONIC DISTRIBUTOR

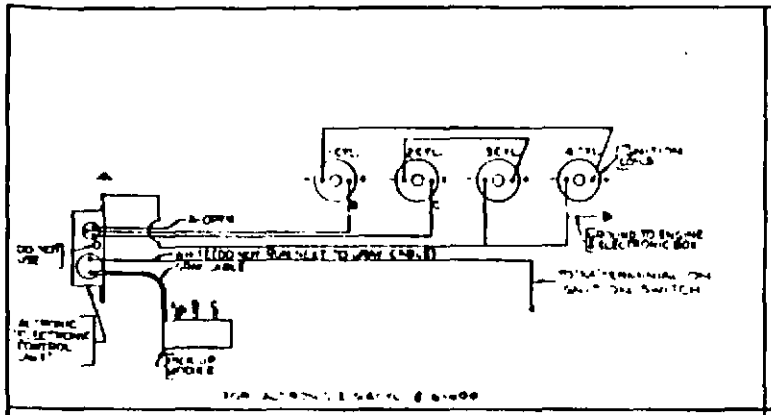


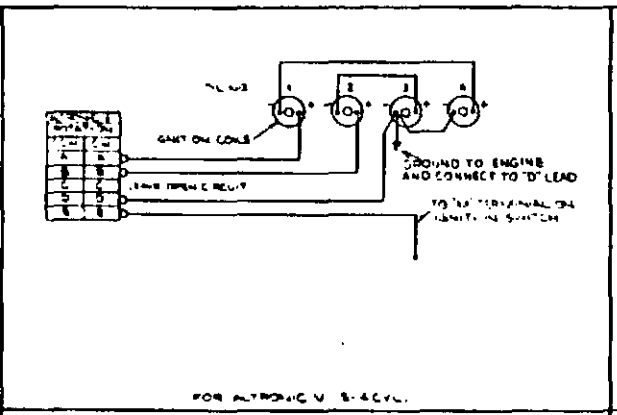
NOTE: WIRING DIAGRAMS SHOWN ON SHEET #1 USE ALTERNATOR 40-2501819, WHEN USING ALTERNATOR 40-2501516, WIRE AS SHOWN PER DETAIL A

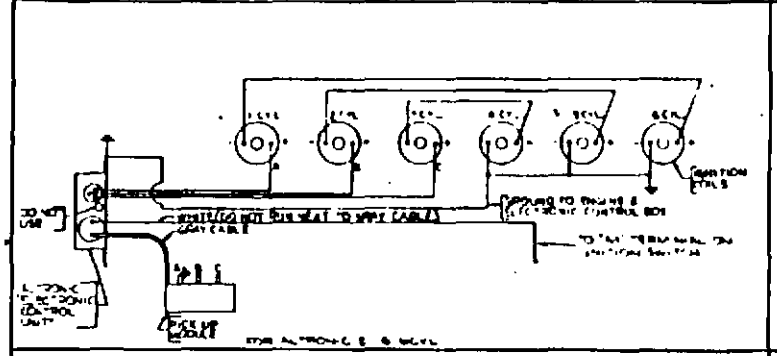
HERCULES

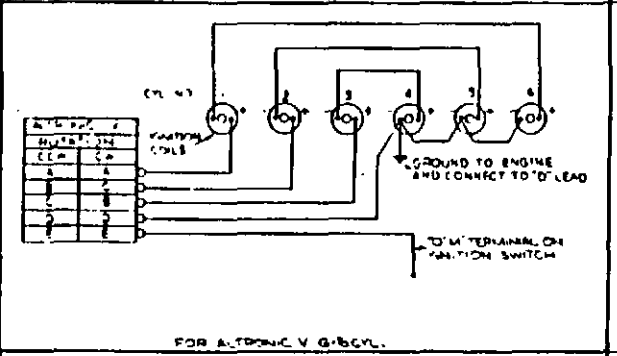
WIRING DIAGRAM

MODEL #	D AND G-1400	SPEC #
REV	PART NO.	
D	40-2502205	
SCALE NONE	COST CODE 4071	SHEET 1 OF 2

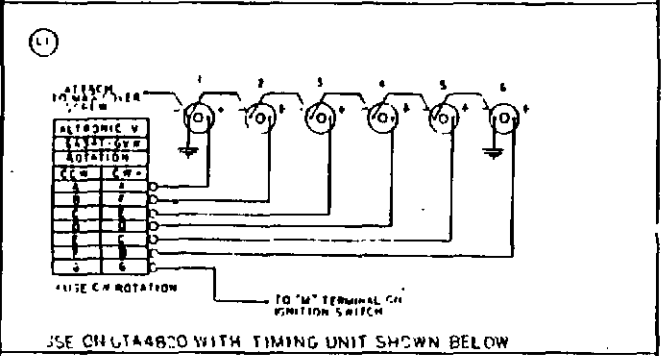




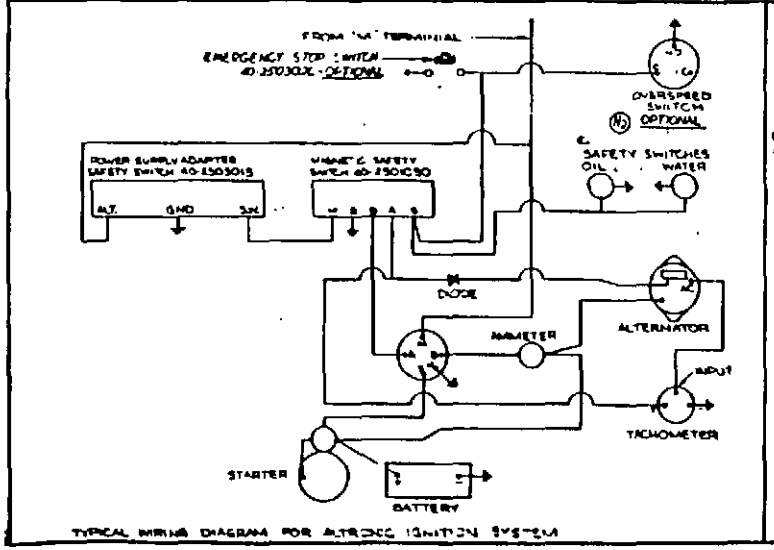




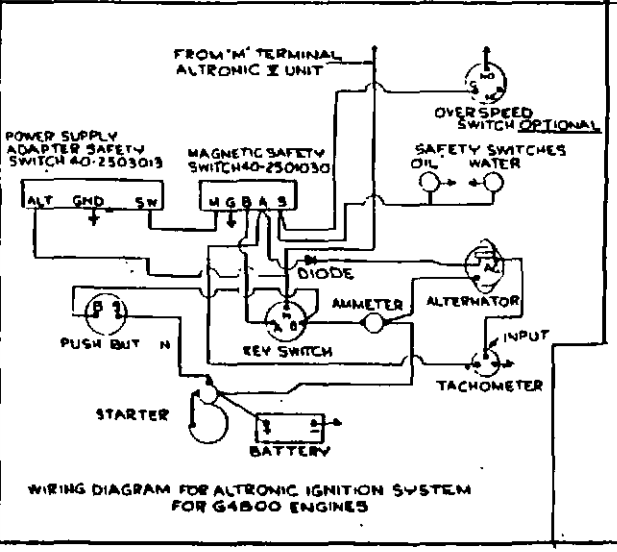
(L)



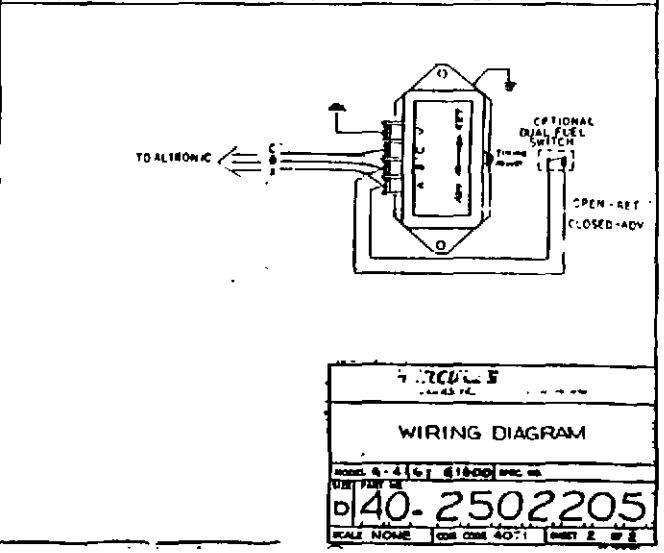
USE ON GTA4800 WITH TIMING UNIT SHOWN BELOW



TYPICAL WIRING DIAGRAM FOR ALTRONIC IGNITION SYSTEM

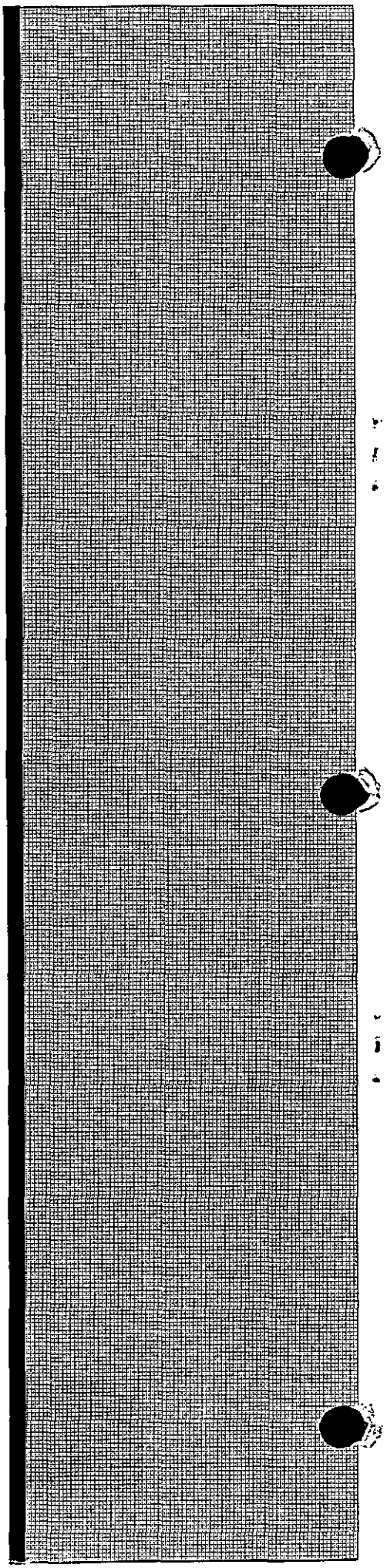


WIRING DIAGRAM FOR ALTRONIC IGNITION SYSTEM
FOR G4800 ENGINES



WIRING DIAGRAM

D 40-2502205



HERCULES
ENGINE COMPANY

101 Eleventh Street S.E., Canton, Ohio 44707-3802

Parts: **(330) 438-1025**
Fax: **(330) 438-1030**
Service: **(330) 438-1035**