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TOMIhawk TRAILER

MANUAL

Pre-Operation Inspection and Warranty Activation

After the machine has been completely setup, the customer is to inspect the following.
After each item is checked, fax back to (770) 920-1113 to activate your warranty.

Pre-Operation Inspection:

- ☐ No parts or components on the machine have been damaged in shipment. Check for things such as dents and loose, broken, or missing parts; correct or replace as required.
- ☐ All bolts and fasteners are in place and tightly secured.
- ☐ Bearings have been properly lubricated; see Lubrication information in this manual.
- ☐ Engine Started and is performing up to specs.
- ☐ All Decals are in place and securely attached.
- ☐ The Serial Number of your machine is recorded in the space provided on this page.
- ☐ Test and run the unit while checking that all components are operating correctly.
- ☐ Operating Guide and Engine Manual Read.

I acknowledge that the procedures, as outlined above, were performed on this unit.

Print Name

Signature

Company Name

Date

Phone

Equipment Model

Serial Number

Engine Model

Serial Number

Delivery Date

Seller

FALCON KETTLE & TRAILER MANUAL

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FALCON KETTLES – Safety Operations and Considerations

When working with our Falcon pre-melting kettles, we here at Advanced Striping Equipment, *urge* you to practice very cautious measures with your equipment. Your safety matters.

Please read the following, and apply these safety considerations when operating the equipment. *

*The following is just a brief listing of some safety considerations, and does not cover all situations that could result from using and maintaining this equipment. Any person(s) operating this equipment must always utilize common sense and proper judgment regarding all areas of care, maintenance, and general operations of the equipment.

Safety Precautions and Considerations:

- i Our equipment should be used by professionals only.
- i Each person(s) involved with the operations, maintenance, and any other aspects of the equipment should read and refer to our handbook, which explains some of the basic information on how to safely operate and maintain our equipment.
- i Our equipment is sold with the understanding that it will be utilized solely for its intended purposes.
- i Do not try to change, alter or adjust this equipment in any way. If there is a performance problem with the equipment, please contact our office for advice.
- i Perform regular checks and inspection of the equipment and its components and parts. Follow the maintenance instructions listed in your manual for care of the equipment, and always replace worn or broken parts immediately.
- i Educate yourself on all fluids and chemicals used for the machines. Use only materials that are compatible with your equipment – and read all labels of solvents before ever mixing.
- i Follow, and enforce to all equipment operators, any local, state, and national laws which may be applied. Be informed of fire, electric and safety measures on all levels of government.

- i Wear personal protective wear, (proper clothing, gloves and eyewear – and respirator when necessary). Avoid breathing chemical and fuel fumes.
- i Working around thermoplastic melting equipment means working around intense heat and flames. Use common sense and caution around hot metal parts of the machine, burners, flames, and hot products within. *In instances of burn from heated, melted thermoplastic material – DO NOT attempt to remove from skin. Run under cold water and seek medical attention immediately.*
- i ALWAYS perform random checks for fuel leaks, and repair immediately before attempting to use.
- i Do not leave kettle un-attended when operating.

AIR JACKETED THERMOPLASTIC MELTING KETTLE
DIESEL and PROPANE FIRED
(Specifications)

Overview: It is the intent of these specifications to describe the minimum requirements for a bottom diesel or propane fired, air jacketed thermoplastic material heating kettle, suitable for skid mounting and preheating material to be applied by thermoplastic applicators.

KETTLE SIZES:

Material Capacity (lbs.)	Feed Height	Exterior Diameter	Min. BTU
800	47"	35.00"	175,000
1200	48"	39.75"	250,000
1500	57"	39.75"	290,000
2000	61"	39.75"	325,000
2500	72"	39.75"	350,000

1. **Melting Performance:** The unit shall be capable of melting two-thirds of its material capacity to a temperature exceeding 400 degrees F within 75 minutes of initial heating and shall be capable of continuously melting material while traveling.
2. **Material Heating Tank:** Tank shall be a vertically mounted, cylindrical barrel-shaped container with a 34" maximum interior diameter with 3/16 inch thick walls and 5/8 inch thick bottom. The bottom of the inner kettle will have a steel deflection plate to protect from scorching.
3. **Material Agitators:** Upper and lower paddles shall be mounted on a 1 1/4 inch diameter shaft and connected with two vertical blades 1/4 inch thick wiping within 3/16 inch of tank wall. The aforesaid paddles and a center paddle shall be positioned to gently blend material homogeneously. The shaft and agitator shall be easily removable from the melting kettle to facilitate cleaning. The shaft support mounts shall only be located above the top plate of the kettle. The agitator shall be driven by one hydraulic motor which shall be offset chain sprocket mounted providing at least a 2:1 torque power ratio.
4. **Exterior Design:**
 - a. **Shell:** Exterior wall shall be of 11 gauge steel with unitized construction to maximize heat efficiency and conform to the National Fire Protection Association Code 58. The interior side of the insulation shall have a metal baffle of 14 gauge steel, which shall surround the heating tank directing the exhaust heat against the material heating tank, to assure even heating.
 - b. **Ventilation Stack:** Expanded heat vapor shall be exhausted through two 11 gauge rectangular stacks located 180 degrees opposite each other. Exhaust stacks shall rise at least 12" above kettles and outside the kettle. One flash tube shall be located behind feed door, designed to exhaust fumes above operator head with a water-proof door that closes and opens automatically.
 - c. **Material Feed Door:** Door shall be water-proof and constructed at a 30 degree slope enabling user to insert material without loss of product or danger of molten spillage. Its volume opening shall be 121 square inches. The kettle shall be capable of accepting either block or granulated.

Advanced Stripping Equipment's FALCON KETTLE - Specifications

AIR JACKETED

- d. Material Discharge Valve: A 3" knife gate type material valve shall rapidly discharge and securely close without the need for auxiliary heating.
 - e. Gauges and Alarms: Material temperature gauge shall be visible at the discharge valve end of the kettle, with readings up to 550 degrees F. A commercial gas thermostat model FDO 150-550 F. snap throttle with 72" capillary shall be used to control propane ring burner to maintain proper temperature of plastic. An electrical adjustable thermostat will be provided to control the diesel fired burner to maintain proper temperature of plastic. Either thermostat will be backed up by a high temp limit switch. The diesel burner is connected to a control panel that will permit turning on and off the burner. Control panel will have 1 or 2 lights for operation sequence.
 - f. Top Plate: The entire 1/4" thick top plate of the preheating kettle shall be divided into two removable sections.
 - g. Transport Rings: Top hoist or metal platform shall be provided.
 - h. Heat Shields: Solid heat protection shields of 14 gauge thick steel shall be secured to the feed side of the kettle. The shields shall be constructed to have a 1 inch air flow space and shall have a 33 inch width dimension and cover from the top edge of the kettle to approximately 24 inches below the top of the kettle. Heat shields shall be mounted around the exhaust stacks of single kettle application.
 - i. Instructions: A metal instruction plate shall be durably attached to the discharge side of the kettle.
5. Burner (FOR PROPANE FIRED): Shall be propane fired and provided with valves, regulator, lines and all fittings necessary for operation when supplied from L.P.G. tanks. The burner shall be Barber impinged jets equipped with a pilot control system and a Burkert high temp limit system which should allow for safe usage in the event of thermostat failure. An automatic temperature control shall be installed to maintain material temperature at a preset adjustable level in a range up to 550 degrees F. Gas shall automatically shut off in the event flame is extinguished. The burner access door shall be 14 gauge steel and mounted under the material discharge valve next to the burner controls to ensure safe lighting.
6. Burner (DIESEL FIRED)
- a. Oil Burner: The kettle shall be equipped with an oil burner having a combustion chamber for the ignition of the fuel oil. The burner shall be 12 volt DC with a rating of 225,000 BTU/HR for melting of the thermoplastic. (fuel shall be supplied from an auxiliary tank)
 - b. Combustion Chamber: The kettle shall have a Pyrolite shell combustion chamber. The Pyrolite chamber shall withstand a minimum of 2000 degrees F temperature and be inserted into a circular stainless steel cylinder. This replaceable chamber shall be 14" diameter X 12" height X 3/4" thick.
 - c. A replaceable 1/2" thick steel baffle shall be mounted between the burner and the bottom of the kettle. Baffle shall be held in place with 3 support legs and bolts. Baffle is not allowed to be attached to bottom of kettle. The purpose of the baffle is to protect the bottom of the kettle from direct contact with the flame. Perforated baffles will not be acceptable.
 - d. Tray: The combustion chamber is to be on a slide out tray to allow easy removal for servicing.
7. Auxiliary Engine (FOR DIESEL FIRED): A diesel fueled, water cooled engine of at least 11 hp to operate the hydraulic system shall be supplied. The engine shall be equipped with an air cleaner, muffler, adjustable throttle, alternator, and battery charged electric start.
8. Auxiliary Engine (FOR PROPANE FIRED): An L.P.G. fueled 4 cycle, air-cooled engine of at least 13 hp to operate the agitator shall be supplied. The engine shall be equipped with an air

Advanced Striping Equipment's FALCON KETTLE -- Specifications

AIR JACKETED

cleaner, muffler, adjustable throttle, variable speed governor, alternator and battery charged electric started, and an oil alert safety shutdown system.

9. **Hydraulic System:** The system shall include a hydraulic pump, incorporating a pressure relief valve, hydraulic filter, a bi-directional hydraulic motor geared to rotate in excess of 40 rpm, selector valve, adequate size reservoir with filter screen, shut-off valve, oil temperature and level gauge and all necessary pipes, hoses and fittings to complete the system in accordance with established hydraulic standards. The selector valve shall be positioned in close proximity to the kettle feed door.
10. **Paint:** All exposed metal surfaces shall be primed with a rust and heat preventative and finished in a high heat resistant paint.
11. **Service Representative:** A qualified, factory-authorized service representative shall be available to assure correct use of the unit.
12. **Manuals:** Two copies of the Instruction Manual and parts book for kettles and accessories shall be supplied. The Instruction Manual shall include proper thermoplastic handling procedures.
13. **General:**
 - a. All equipment catalogued as standard to be furnished and included in purchase price of the unit.
 - b. When delivered, the unit shall be completely assembled and ready to operate, except for propane or diesel fuel.
 - c. All hoses supplied in assembling units described in these specifications shall have temperature and PSI ratings in excess of maximum operating temperatures in pressure fluids and materials being transferred.
 - d. The component parts of the unit shall be of proper size and design to safely operate with stresses imposed by maximum capacity operation. Only new models in current production, which are catalogued by the manufacturer, and for which manufacturer's published literature and printed specifications are available, will be considered. Current models may be modified to comply with these specifications.

OIL JACKETED THERMOPLASTIC MELTING KETTLE
DIESEL and PROPANE FIRED
(Specifications)

Overview: It is the intent of these specifications to describe the minimum requirements for a bottom diesel or propane fired, oil jacketed thermoplastic material heating kettle, suitable for preheating material to be applied by thermoplastic applicators.

KETTLE SIZES:

Material Capacity (lbs.)	Feed Height	Exterior Diameter	Min. BTU
800	46"	40"	275,000
1500	59"	40"	290,000
2000	70"	40"	340,000
2500	72"	42"	375,000

1. **Melting Performance:** The unit shall be capable of melting two-thirds of its material capacity to a temperature exceeding 400 degrees F within 75 minutes of initial heating and shall be capable of continuously melting material while traveling.
2. **Material Heating:** Tank shall be a vertically mounted, cylindrical barrel-shaped container with a 32" to 34" maximum interior diameter with 3/16 inch thick walls and 3/8 inch thick bottom. The tank walls shall be oil jacketed. The exterior tank walls shall be 1/8 inch thick with a 3/8 inch thick bottom and form a cavity having a minimum spacing of 1 inch between vertical walls and 3 inches between bottom plates, which shall be filled with high temperature heat transfer oil. Heating oil for the oil jacketed kettles shall be manufacture's standard. This oil jacket shall not be under pressure.
3. **Exterior Design:**
 - a. **Shell:** Shall be of 11 Ga. HR. Steel unitized construction to maximize heat efficiency and conform to the National Fire Protection Association Code 58. The interior side of the insulation shall have 14 GA. HR. which shall surround the heating tank directing the exhaust heat against the material heating tank and away from insulation, to assure even heating.
 - b. **Ventilation Stack:** Expanded heat vapor shall be exhausted through two 11-gauge rectangular (8"X12") stacks located 180 degrees opposite each other. Exhaust stacks shall rise at least 12" to 18" above kettles. One 2 inch square flash tube shall be located behind feed door, designed to exhaust fumes above operator head with a water-proof door that closes and opens automatically.
 - c. **Material Feed Door:** Shall be water-proof and constructed at a 30 degree slope enabling user to securely insert material without loss of product or danger of molten slippage. Its volume opening shall be 121 square inches. The kettle shall be capable of accepting either block or granulated thermoplastic material.
 - d. **Material Discharge Valve:** A 3" knife gate type material valve with trough shall rapidly discharge and securely close without the need for auxiliary heating.
 - e. **Gauges:** Oil and material temperature gauges shall be visible at the discharge valve end of the kettle, with readings up to 550 degrees F.
 - f. **Top Plate:** The entire 1/2" thick top HR. plate of the preheating kettle shall be divided into two removable sections.

Advanced Striping Equipment's FALCON KETTLE - Specifications

OIL JACKETED

- g. Transport Rings: Top hoist rings or metal platform shall be provided.
 - h. Heat Shields: Solid heat protection panels 11 gauge thick shall be secured to the feed side of the kettle. The panels shall be constructed to have a 1 inch air flow space and shall have a 33 inch width dimension and cover from the top edge of the kettle to approximately 24 inches from the floor. Heat shields shall be mounted around the exhaust stacks.
 - i. Instruction: Shall be durably attached to the discharge side of the kettle.
4. Material Agitators: Upper and lower paddles shall be mounted on a 1 $\frac{1}{2}$ inch diameter shaft and connected with two vertical blades $\frac{1}{2}$ inch thick wiping within $\frac{1}{4}$ " inch of tank wall. The aforesaid paddles and a center paddle shall be positioned to gently blend material homogeneously. The shaft and agitator shall be easily removable from the melting kettle to facilitate cleaning. The shaft support mounts shall only be located above the top plate of the kettle. The agitator shall be driven by one hydraulic motor which shall be offset chain sprocket mounted providing at least a 2:1 torque power ratio. Agitator shall be locked in place by 2 - $\frac{1}{4}$ " bolts drilled through agitator shaft between the upper and lower bearing
5. Burner/Combustion Chamber (FOR DIESEL FIRED): Each kettle burner shall be 12 volt, single phase, 5.8 amps. Diesel fired and provided with valves, regulators, lines and all fittings necessary for operation when supplied from the diesel tanks. The burner assembly shall be mounted on a slide out tray for easy access and maintenance. The kettle shall have a Pyrolite shell combustion chamber. The Pyrolite chamber shall be inserted into a circular stainless steel mount. This chamber shall be 14" diameter X 12" height X $\frac{1}{4}$ " thick. Combustion chamber shell must be replaceable. The combustion chamber must be air tight. The exhaust vents will be the only access to atmosphere. The only air access to the combustion chamber shall be through the burner blower. No fire brick type system is acceptable. A replaceable heat deflector shall be used to protect bottom of kettle.
6. Burner Chamber (FOR PROPANE FIRED): Shall be propane fired and provided with valves, regulator, lines and all fittings necessary for operation when supplied from L.P.G. tanks. The burner shall be Barber impinged jets equipped with a pilot control system. An automatic temperature control shall be installed to maintain heat transfer oil temperature at a pre-set adjustable level in a range up to 550 degrees F; gas shall automatically shut off in the event flame is extinguished. The burner access door shall be a minimum 14 gauge steel and mounted under the material discharge valve to the left of burner controls to ensure safe lighting.
7. Safety Systems: Kettles shall have both primary and secondary burner/temperature control devices. The primary device shall be an automatic temperature control to maintain heat transfer oil temperature at a pre-set adjustable level in a range up to 550 degrees F. The secondary device is a high temperature limit switch. When activated this device will stop the 12 volt power to the diesel burner fuel solenoid on (DIESEL FIRED) or 12 volt power to the fuel solenoid between the thermostat and main burner on (PROPANE SYSTEM).
8. Engine (FOR DIESEL FIRED): A diesel fueled, air cooled engine of at least 6.4 hp to operate the agitator shall be supplied. The engine shall be equipped with an air cleaner, muffler, adjustable throttle, variable speed governor, alternator and battery charged electric starter.
9. Engine (FOR PROPANE FIRED): An L.P.G. fueled 4 cycle, air cooled engine of at least 8.5 hp to operate the agitator shall be supplied. The engine shall be equipped with an air cleaner, muffler, adjustable throttle, variable speed governor, alternator and battery charged electric starter.

Advanced Striping Equipment's FALCON KETTLE - Specifications

OIL JACKETED

10. Hydraulic System (FOR DIESEL FIRED): The valve shall be a four-way control valve to operate a two-way hydraulic circuit from a single hydraulic source. The valve shall be positioned in close proximity to the kettle feed door. The valve shall allow reversal of the agitator. Controls shall have easy operator accessibility. Each chain drive shall have an adequate removable covering to prevent accidents.
11. Hydraulic System (FOR PROPANE FIRED): The system shall include a gear-type or pressure comp. hydraulic pump, incorporating a pressure relief valve, hydraulic filter, a bi-directional hydraulic motor geared to rotate in excess of 40 rpm, selector valve, adequate size reservoir with filter screen, shut-off valve, oil temperature and level gauge and all necessary pipes, hoses and fittings to complete the system in accordance with established hydraulic standards. The selector valve shall be positioned in close proximity to the kettle feed door.
12. Paints: All exposed metal surfaces shall be primed with a rust and heat preventative and finished in a high heat resistant white paint.
13. Service Representative: A qualified, factory-authorized service representative shall be available to assure correct use of the unit.
14. Manuals: Two copies of an Instruction Manual and parts book for kettles and accessories shall be supplied. The Instruction Manual shall include proper thermoplastic handling procedures.
15. General:
 - a. All equipment catalogued as standard to be furnished and included in purchase price of the unit.
 - b. When delivered, the unit shall be completely assembled and ready to operate except for diesel or propane fuel.
 - c. All hoses supplied in assembling units described in these specifications shall have temperature and PSI ratings in excess of maximum operating temperatures in pressure fluids and materials being transferred.
 - d. The component parts of the unit shall be of proper size and design to safely operate with stresses imposed by maximum capacity operation. Only new models in current production, which are catalogued by the manufacturer, and for which manufacturer's published literature and printed specification are available, will be considered. Current models may be modified to comply with these specifications.

MOUNTING & INSTALLATION OF THE ASE FALCON KETTLE

A. INTRODUCTION: The selection of trucks to accommodate ASE Falcon kettles depends, to a large degree, on the user's individual needs and arrangements. However, the following suggestions, being based largely on general field experience, are made mainly to point out some criteria of truck selection which the user should carefully consider.

B. LOAD CARRYING CONSIDERATIONS: Approximate weights of unloaded ASE kettles are tabulated below, weights include the engine stand assembly.

Oil Jacketed

<u>Size</u>	<u>Weight</u>	
40 gal.	600 lb.	1275 lbs. (578 kgs)
80 gal.	1200 lb.	1675 lbs. (760 kgs)
100 gal.	1500 lb.	1875 lbs. (850 kgs)
135 gal.	2000 lb.	2275 lbs. (1032 kgs)
175 gal.	2500 lb.	2475 lbs. (1123 kgs)

Air Jacketed

<u>Size</u>	<u>Weight</u>	
60 gal.	800 lb.	1105 lbs. (501 kgs)
80 gal.	120 lb.	1450 lbs. (658 kgs)
100 gal.	1500 lb.	1625 lbs. (737 kgs)
135 gal.	2000 lb.	1960 lbs. (890 kgs)
175 gal.	2500 lb.	2180 lbs. (989 kgs)
205 gal.	3000 lb.	2360 lbs. (1080 kgs)

ASE material is normally carried on the truck to facilitate processing. The ASE ThermoMark II applicator which weighs approximately 284 lbs. (129 kgs) would also be carried on the truck. Therefore, it is recommended that a truck for a single ASE kettle have a minimum carrying capacity of 6000 lbs. (2723 kgs).

C. TRUCK DIMENSIONS: It is necessary that an 8 foot (2435 mm) wide body be specified to provide sufficient width for a single kettle mounting plus applicator. A body length of not less than 12 feet (3658 mm), is recommended to accommodate the kettle, applicator, plus ASE material storage area. The height of the truck floor from the ground should be at least 42 inches (1067 mm).

D. TARPAULINS: To protect equipment and material from inclement weather it is desirable to provide means for covering equipment on the truck when it is not in use, particularly if vehicles are ever stored outside. It is best to keep equipment garaged. The material can be rain protected with a plastic or rubber coated tarpaulin.

- E. PROPANE TANK MOUNTING:** Provisions must be made for carrying at least four 100 pound tanks of liquid petroleum gas propane (vapor) fuel. These tanks are approximately 15 inches (381 mm) in diameter. It is preferable to mount these tanks behind the cab of the truck therefore, if you can, move the bed back to allow the tanks to be attached on a low platform right behind the cab. Tanks should be fastened down securely. Larger tanks may be used for less servicing. Mounting one or two 50 gallon saddle tanks under the sides of the truck bed is recommended.
- F. FIRE EXTINGUISHERS:** Fire extinguisher mountings should be provided at convenient locations, either on the sides of the truck below the frame or outside the body above the floor frame. Fire extinguisher mountings should be provided with quick clamps to insure easy removal of the extinguisher. The type and size should conform with local fire regulations.
- G. TRUCK FLOORING:** The truck bed should be constructed of metal. Do Not Use a wood platform. A diamond plate floor is preferable.
- H. HOIST:** While a gate lift can be used, we prefer that the ASE ThermoMark II applicator be raised and lowered by means of a swing pulley hoist. This hoist can be located at the bed forward section or the middle left side of the truck bed, away from the kettle. An electric hoist is most convenient.
- I. KETTLE MOUNTING LOCATIONS AND PROCEDURE:** The kettle location should be approximately as follows:
1. The base of the discharge end of the kettle frame should be approximately flush with the rear of the truck bed. This will permit proper fore and aft position of the kettle for filling applicators.
 2. For a single kettle mount, the kettle should be centered from the body sides with the spout flush or extended slightly from the back of the bed of the truck to make filling the Apollo easier.
 3. Kettles should be secured to the truck bed with 1/2-13unc bolts through the bottom of the mounting frame. Where possible, mounting should be done through the truck's transverse chassis frame members rather than through only the flooring.
- J. PROPANE GAS CONNECTIONS:** Gas lines should be located beneath the truck bed. Under bed piping should be 1/2" pipe fastened to bed approximately every three feet. A 1/2" ball valve should be used for shut off. The 1/2" pipe should run up through the floor before connecting to a 1/2" flexible LP gas hose which would be securely fastened to the LP regulator with a POL connector. When 100 lb. tanks are used for propane supply, a pressure gauge capable of reading 160 psi should be mounted after the POL line fittings to reflect the pressure available in the propane tank when the shut-off valve is open.
- K. TRAILERS:** ASE offers trailers of different designs to transport Falcon kettles, depending on individual customer requirements. All feature space for the Falcon kettle, the ThermoMark II hand applicator, a mechanical, electrical, or hydraulic hoist for loading and unloading the applicator, racks for 2-100 lb. LP gas bottles, and 2-20 lb. LP gas bottles (spares for the ThermoMark II). Space can be provided for up to two pallets of material. ASE can also furnish an optional die cleaning or storage box.

ASE FALCON PREMELTING KETTLES

Operations and Maintenance

Advanced Striping Equipment's FALCON Diesel and Propane Fired Kettles are engineered to provide high-quality, unmatched performance through fast material melting, accurate temperature maintenance, and monitoring. They are built to efficiently and homogenously melt thermoplastic marking materials supplied in either block or granular forms, and with a "flame-out" proof pilot system, the kettles can perform continuous agitation.

Please take the time to read the following information regarding your Falcon Kettle. Should you have any questions or concerns, please contact us at Advanced Striping Equipment, Inc.

1. KETTLE INSTALLATION

Kettles should be secured with (8) ½ - 13 Grade 8 nuts and bolts to a metal trailer or truck bed floor plate.

Note: Weight is an approximation based on heated thermoplastic weighing 15 pounds per gallon. Thermoplastic formulation weights per gallon can vary plus or minus 20%. Kettle volume, for safety, is measured 5 inches below cover.

2. DIESEL FUEL CONNECTIONS

For diesel fuel, use a minimum of one 50 gallon tank for diesel supply.

3. PROPANE GAS CONNECTIONS

Use a minimum of two 100 pound tanks for propane supply with a pressure gauge capable of reading up to 300 PSI.

4. PRE-OPERATION CHECK

- A. Check hydraulic fluid level at tank sight gauge. Use Texaco Regal 32 hydraulic fluid or equivalent. Check for leaks in line.
- B. For Oil-Jacketed kettle, check that the heat transfer oil level is up to ring on dip stick on kettle. Use one of the following heat transfer oils: Texaco Regal R&O 220 oil, Shell Vitrea oil 72, or Martemp 2525. **DO NOT** mix oil brands.

Part Number	Kettle Size	Oil Capacity
ASE06100000	40 gal./600 lb.	17.5 gallons
ASE06200000	80 gal./1200 lb.	26.5 gallons
ASE06300000	100 gal./1500 lb.	30 gallons
ASE06400000	135 gal./2000 lb.	26.5 gallons
ASE06500000	175 gal./2500 lb.	40.5 gallons

Diesel

- C. For diesel kettles, check oil level in the Diesel Engine. Service with SAE #30 oil. Check engine air cleaner. Change oil at least every 24 engine working hours or every week. Refer to engine manual for further maintenance and information.
- D. Check fuel fittings from main supply tank to kettle burner.

Propane

- E. For propane kettles, check engine oil level in 8.5hp Honda engine. Service with SAE # oil. Check engine air cleaner. Change oil at least every 24 engine working hours, or every week.
- F. Check LP gas fittings from main gas supply tank to kettle burners.

5. LIGHTING PREMELTER KETTLE BURNER*Diesel*

- A. At the electrical control box, turn temperature control to the lowest possible setting.
- B. Open ball valve next to filter.
- C. Turn ignition switch (master switch) on, a red light will glow – then turn temperature control up to 250°F.
- D. If burner fails to light, bleed fuel system at the fuel filter and burner with master switch in the “on” position, and repeat the above procedure.
- E. Load kettle with 150 to 300 lbs. of material, depending on kettle size (approximately ¼ full).
- F. With burner operating, raise temperature control to 350°F. When oil temperature approaches 350°F, reset temperature between 400°F (205°C) to 450°F (232°C).
- G. When material temperature gauge approaches 350°F (177°C), reset temperature setting above 400°F (205°C) to as high as 450°F (232°C), depending on weather conditions and quantity of material you plan to insert in the kettle. Oil Jacketed kettle Heat Transfer Oil Temperature **SHOULD NEVER EXCEED 550°F (288°C)**. Start feeding thermoplastic into the kettle once oil temperature exceeds 400°F (205°C).

Propane

- A. Turn thermostat and pilot light valve knob to “off” position.
- B. Turn main LP gas tank valves to “on” position.
- C. Turn pilot light valve to “on” position.
- D. Open burner access door located below material discharge valve. Depress pilot RED button and light the pilot. Keep pilot RED button depressed for 60 seconds. **CAUTION:** If pilot fails to light, wait until gas is absent prior to relighting. Protect against flame.
- E. Close burner door.
- F. Allow pilot flame to stabilize a few minutes.
- G. With door closed, raise thermostat to 350°F (177°C).
- H. Load kettle with 150 to 300 lbs. Of material, depending on kettle size (approximately ¼ full).
- I. When material temperature gauge approaches 350°F (177°C), reset temperature setting above 400°F (205°C) to as high as 450°F (232°C), depending on weather conditions and quantity of material you plan to insert in the kettle. Oil jacketed kettle Heat Transfer Oil Temperature **SHOULD NEVER EXCEED 550°F (288°C)**. Start feeding thermoplastic into the kettle once oil temperature exceeds 400°F (205°C).

6. THERMOPLASTIC MATERIAL FEED

- A. Make sure material discharge valve (slide gate) is closed.
- B. Practice timing the feeding of granulated bags or hand size chunks for block thermoplastic into kettle. Once molten, add more material.
- C. When material temperature gauge approaches 350°F (177°C) and the material is molten, turn on your engine and commence agitating material.

ASE FALCON PREMELTING KETTLES

Operations and Maintenance

- D. Material should be heated between 400-444°F (205-227°C). On cooler working days, higher temperatures may be required (up to 440°F (227°C)).
- E. Occasionally, insert a long stem thermometer in thermoplastic to check the calibration of your kettle material temperature gauge.
- F. The higher the volume of molten material in kettle, the quicker fresh cold material will achieve working temperature.
- G. During non-working or extensive travel time, reduce the temperature of the material. Although heat stable, thermoplastic material should not be held for more than 4 hours at or near its application temperature without being used.
- H. Constantly turn over material adding fresh material. Read and understand "Standard Practices for Successful Alkyd Hydrocarbon and Epoxy Thermoplastic Pavement Markings".

7. ENGINE OPERATION

Diesel Fired

- A. Throttle should be approximately 1/3 open.
- B. Hydraulic selector valve should be in neutral position during the engine starting cycle.
- C. Rotate engine ignition key to start engine. Let engine warm up a few minutes, then place high pressure valve to the "off" position.
- D. Engage the energy valve clockwise or counter-clockwise to engage material agitator.
- E. Open material feed door and check for movement of paddles. If no movement, material has not liquefied sufficiently. Return selector valve to neutral until material melts.

Propane Fired

- A. Throttle should be approximately 1/3 open.
- B. Hydraulic selector valve should be in neutral position during the engine starting cycle.
- C. Prime engine by depressing push button on engine regulator.
- D. Press engine ignition button to start engine.
- E. Let engine warm up a few minutes, then place hydraulic selector valve forward to engage material agitation blades.
- F. Open material feed door and check for movement of paddles. If no movement, material has not liquefied sufficiently. Return selector valve to neutral until material melts.

8. HYDRAULIC SYSTEM

- A. Selector valve allows for forward, reverse, and neutral operating positions. Obstructions such as solid material or foreign debris will prevent free rotation of paddle.
- B. Needle valve is used to adjust the speed of the mixing paddle.
- C. Check hydraulic oil temperature and maintain below (180°F (82°C)).

9. DAILY SHUT DOWN

Diesel Fired

- A. Extinguish burner by turning the thermostat to the lowest possible setting. Turn the electrical switch to the kettles "off".
- B. Turn ignition switch "off".
- C. Continue material agitation until material and oil are below 300°F (149°C). During non-productive times, keep material at lowest possible setting.
- D. For next day use, keep kettle full of material to facilitate the ease of heating up faster.

ASE FALCON PREMELTING KETTLES

Operations and Maintenance

- E. Drain the material from the reservoir into draw-off boxes, pan, etc., until the reservoir is empty.
- F. Turn main gas control valves on diesel tanks "off", located on power pack.
- G. Turn engine ignition switch off to protect battery.
- H. Keep material feed door closed to avoid water or foreign matter from entering kettle.

Propane Fired

- A. Turn thermostat and pilot light valve to "off" position. Depress RED button on pilot light valve for approximately 10 seconds to shut off flame. Look inside lighting door to insure that flame is out.
- B. Continue material motor agitation until oil and material temperature are below 300°F (149°C). During non-productive times, keep material at lowest possible setting.
- C. Turn main gas control valves on propane tanks to "off".
- D. Turn engine ignition switch off to protect battery.
- E. For next day use, keep kettle full of material to facilitate ease of heating. Material level should be kept low for next day's introduction of fresh material.
- F. Keep material feed door closed to avoid water or foreign matter from entering kettle.
- G. Drain the material from reservoir into draw-off boxes, pan, etc., until reservoir is empty.

10. SEASONAL SHUTDOWN

- A. Drain material and clean inside of kettle.
- B. Lubricate all grease fittings.
- C. Clean exterior and, if required, repaint with high temperature silver paint.

Propane Fired

- D. Disconnect and paint propane tanks.

11. MAINTENANCE

A. DAILY:

- a) Check hydraulic oil level.
- b) Check that hydraulic shut-off valve is open.

Diesel Fired

- c) Check diesel fuel lines.

Propane Fired

- d) Check propane lines.

Diesel and Propane Fired

- e) Check hydraulic lines for leaks and hose deterioration.
- f) Make sure cap is on LP GAS PRESET REGULATOR.
- g) Check engine oil level.

Propane Fired

- h) Check propane tank condition. Tanks should be leak and rust free.

B. WEEKLY:

- a) Grease shaft bearing with lubriplate AC-2A, Enco Andock B or equivalent.
- b) Check heat transfer oil level.
- c) Change engine oil at least every 24 hours of operation, and maintain oil change records.

ASE FALCON PREMELTING KETTLES

Operations and Maintenance

- d) Check material and oil temperature gauges with a long stem, high temperature thermometer. Calibrate gauges when necessary.
 - e) Check interior of kettle and remove excessive resin build-up, particularly inside kettle top.
- C. EVERY SIX MONTHS:**
- a) Remove and replace hydraulic filter.
- D. ANNUALLY:**
- a) Drain a quart of heat transfer oil and have analyzed by oil company for flash point, carbon and other impurities. (Minimum flash point of oil should be above 490°F (254°C).
 - b) Replace hydraulic fluid with Texaco Regal 32 equivalent.

12. CHANGING MATERIAL COLORS OR MATERIAL RESIN TYPES

- A. Maintain an inventory of reusable material boxes for draining material.
- B. White to Yellow: Drain all of the remaining material from kettle into ASE material boxes for later reuse. Scrape as much of the material from the kettle as possible while warm; including discharge spout. Residue white material will blend into your fresh yellow material.
- C. Yellow to White: Thoroughly drain and wipe clean kettle interior of all yellow material. You may melt 50 lbs. Of new white material for dilution of yellow residue. This material, when discharged into a drain-off box, can be reused with next yellow use.
- D. Alkyd: Hydrocarbon and Epoxy thermoplastic materials are kettle incompatible with each other. Therefore, the kettles should be nearly completely cleaned out when changing material types. ASE cleaning fluids and recommendations are available for intense kettle clean-out.

13. PARTS LIST and DIAGRAMS

SEE ATTACHED SHEETS



KETTLE WARNING SYMBOLS & SAFETY CONSIDERATIONS

Safety and Warning Plates

Following is a list, drawing of location on unit, and example of the safety caution and warning plates that are installed on each unit manufactured by Advanced Striping Equipment, Inc. It is **MANDATORY** that all necessary plates be displayed in their proper areas and are clearly legible, regardless of the knowledge or level of experience of the operator of the unit. Should at any time during the length of use and operation of your machine the plates become lost, damaged, moved from it's proper positioning, or otherwise non-legible, all operations of the unit should stop until the missing or damaged plate has been replaced.

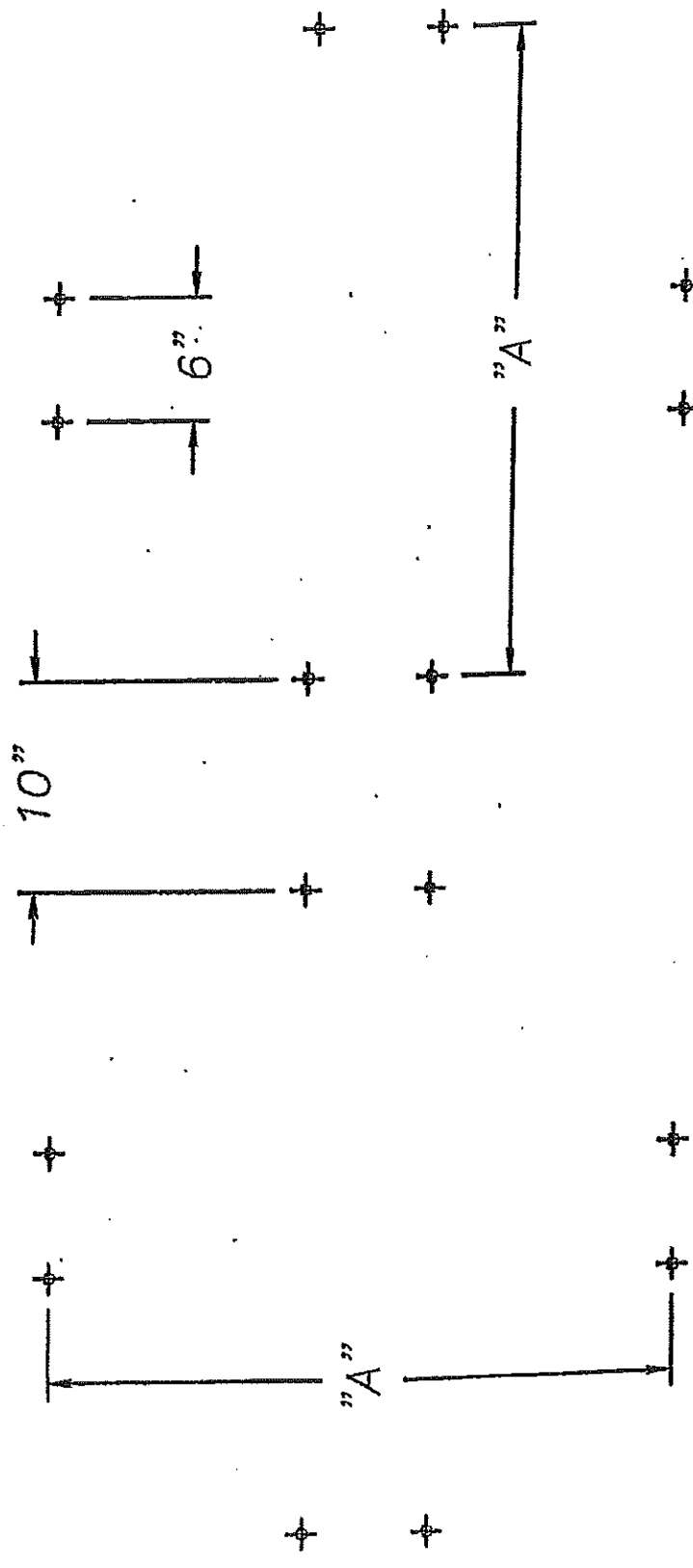
For replacement safety and warning plates, please contact us here at Advanced Striping Equipment, Inc., and we will immediately send replacements. We will also provide plates in Spanish or other foreign languages upon request.

PARTS LIST

Item	Part Number	Description
1	ASE08000101	Sight Gauge
2	ASE 06007000	Dip Stick
3	ASE 08120000	Honda Engine
4	ASE 05030102	3/4" Thermostat
5	ASE 05030103	Pilot Safety Light Valve
6	ASE 06003000	Burner Access Door
7	ASE 05000103	Temperature Gauge
8	ASE 05040000	Slide Gate
9	ASE 08130101	Needle Valve
10	ASE 08030101	Selector Valve
11	ASE 05030104	LP Regulator
12	ASE 05000104	Stuffing Box Kit
13	ASE 05020101	Shaft Bearing
14	ASE 08000101	Hydraulic Filter
15	ASE 05033101	Pilot Light
16	ASE 05030101	X88 Burner Ring
	ASE 05130101	X44 Burner Ring (600 lb. Only)
17	ASE 05030102	Oil Thermocoupler
18	ASE 00026044	Drive Sprocket
19	ASE 00026206	Driven Sprocket
20	ASE 05020106	Chain
21	ASE 05023000	Chain Guard
22	ASE 05020100	Hydraulic Motor
23	ASE 05021000	Motor Mount
24	ASE 08000104	Regulator
25	ASE 08020106	Battery

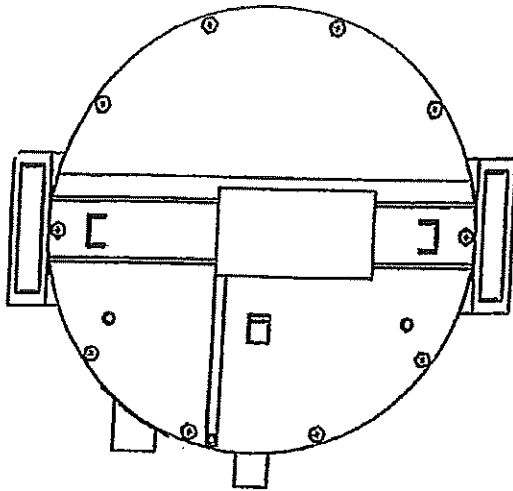
Additional parts available. Call for parts not listed.
For best results, know your Kettle type, capacity and serial number before calling.
Serial numbers are located on the kettle name plate.

Advanced Striping Equipment Inc
8905 Gurley Rd.
Douglasville, Ga. 30134
Phone: 770-920-1090
Fax: 770-920-1113
Toll Free: 1-866-273-4357
E-Mail: tmwaxler@advancedstripingequipment.com.
Website: www.advancedstripingequipment.com

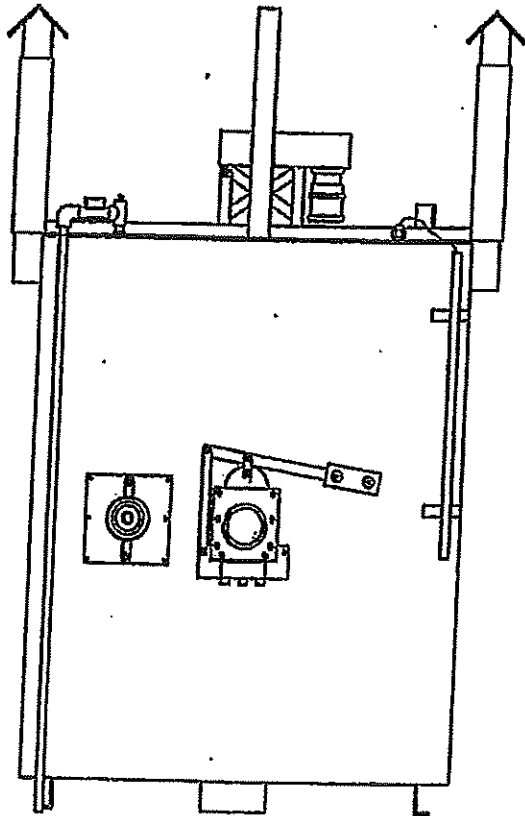


OIL JACKETED KETTLES		
KETTLE SIZE	"A"	
10 GAL-600 LB	30	3/4"
0 GAL-1200 LB	35	3/4"
10 GAL-1500 LB	35	3/4"
35 GAL-2000 LB	35	3/4"
75 GAL-2500 LB	38	3/8"

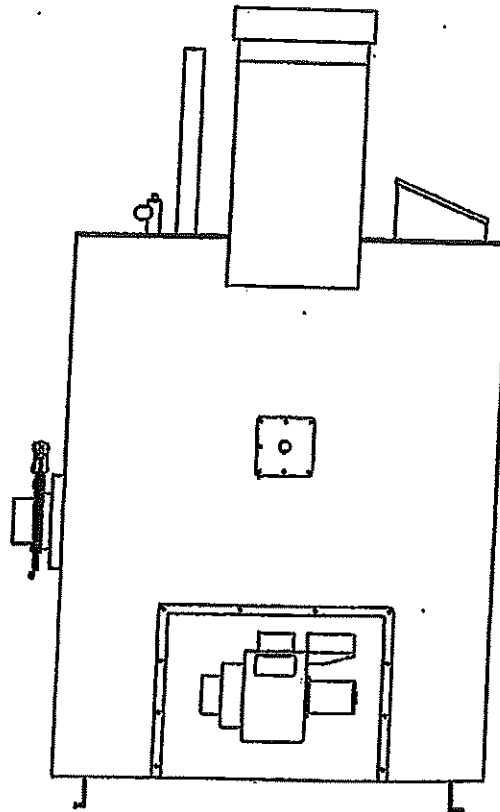
AIR JACKETED KETTLES		
KETTLE SIZE	"A"	
60 GAL-800 LB	30	3/4"
80 GAL-1200 LB	35	3/4"
100 GAL-1500 LB	35	3/4"
135 GAL-2000 LB	35	3/4"
175 GAL-2500 LB	35	3/4"
205 GAL-3000 LB	38	3/8"



TOP VIEW



FRONT VIEW



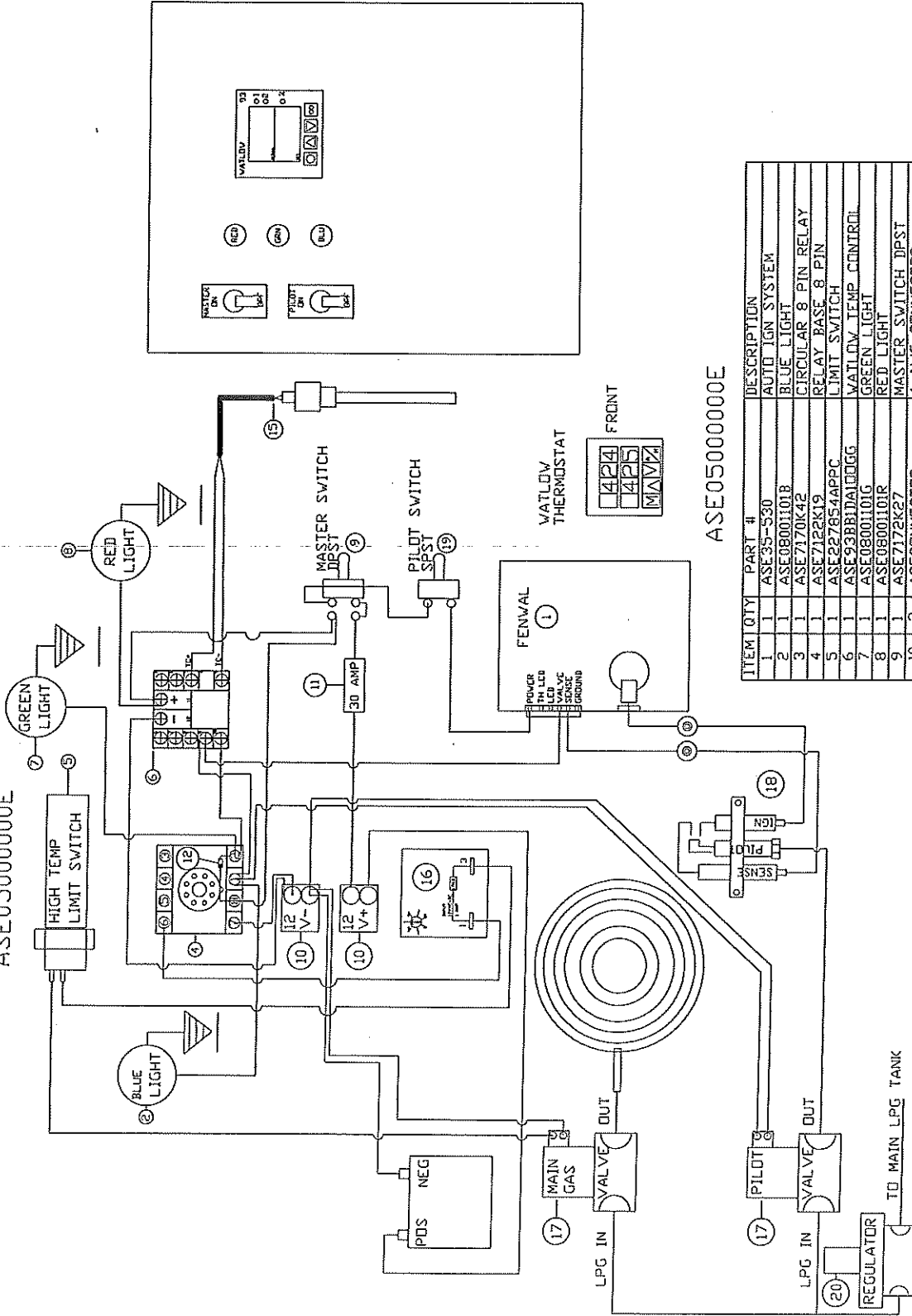
SIDE VIEW

LTR.	DATE	REVISIONS	DFT
THE INFORMATION ON THIS DRAWING IS THE EXCLUSIVE PROPERTY OF A.S.E. INC. IT CANNOT BE USED OR COPIED WITHOUT THE WRITTEN CONSENT OF A.S.E. INC. DOUGLASVILLE, GA. USA.			
A.S.E. 8905 GURLEY RD DOUGLASVILLE GA, 30134 (770) 920-1090			DATE
			SCALE
			PLOT 0:
			DRAWN
			CHK'D
TOLERANCES UNLESS OTHERWISE SPECIFIED DECIMAL $\pm .005$			APP'D
FRACTIONAL $\pm 1/32$ ANGLE $\pm 1/2^\circ$ WELDING $\pm 1/16$			
METRIC TOLERANCES : ± 0.1 MM			

ITEM	QTY	PART #	DESCRIPTION
1	1	ASE7434H	AUX CONTROLLER
2	1	ASE7327K91	TERMINAL STRIP
3	4	ASE6535K454	KP 10 RELAY
4	4	ASE2122K22	RELAY BASE
5	1	ASE22783AAPEC	LIMIT SWITCH
6	1	ASE1884A01	THERMAL OX
7	1	ASE0800H01G	GREEN LIGHT
8	1	ASE0800H01R	RED LIGHT
9	1	ASE00PP6025	PUSH/PULL SWITCH
10	2	ASE00P6025	4 AWG CONNECTOR
11	1	ASE00H0R4	30 AMP FUSE HOLDER
12	1	ASE00H0R4	DIODE
13	1	ASE7353K45	DE CONTROL BOX
14	1	PLA5125EG	WON STRIP

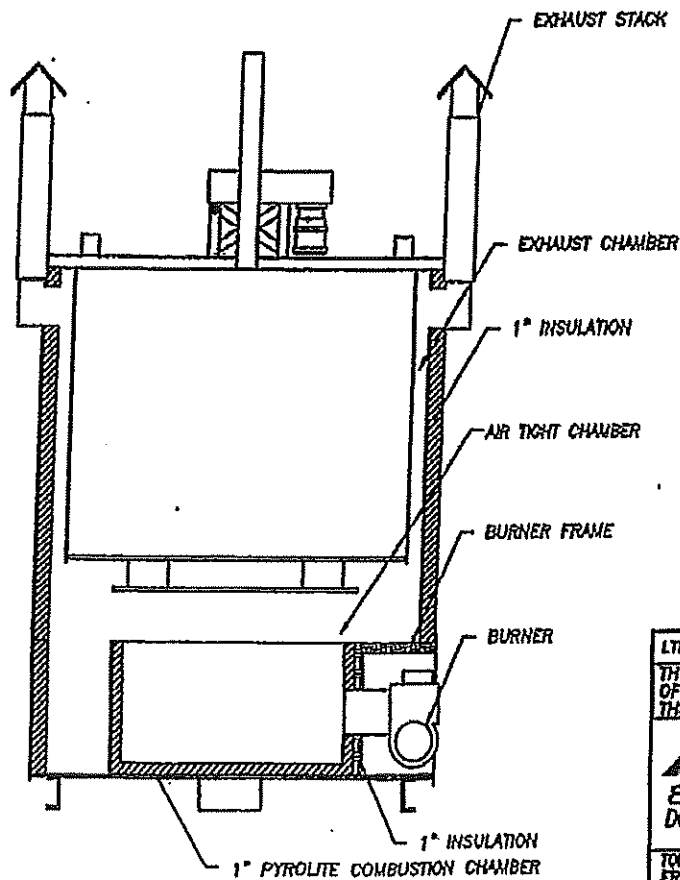
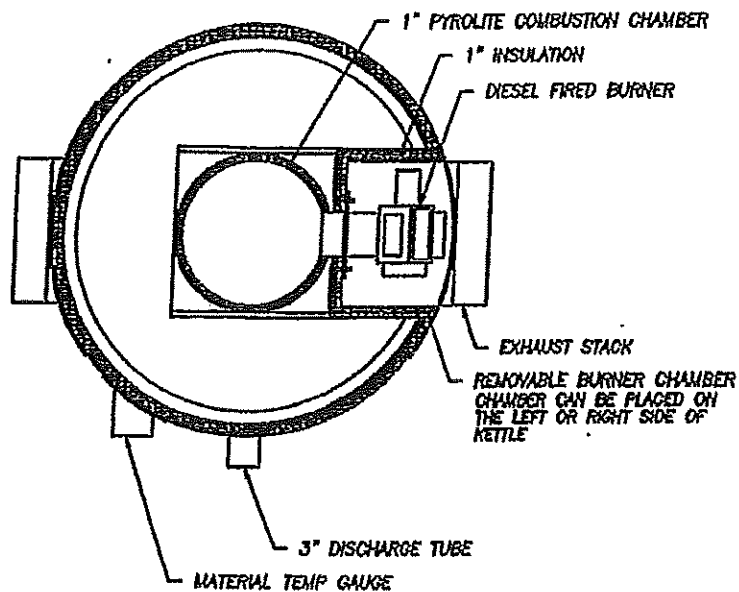
ITEM	QTY	PART #	DESCRIPTION
1	1	ASE7434U	AOC CONTROLLER
2	1	ASE7527K9A	TERMINAL STRIP
3	4	ASE65B5K454	KP 10 RELAY
4	4	ASE212Z6G2	RELAY BASE
5	1	ASEZZ7B5APEC	LIMIT SWITCH
6	1	ASE18B4U01	CRIMINAL OX
7	1	ASE0800101G	GREEN LIGHT
8	1	ASE0800101R	RED LIGHT
9	1	ASE00P7602S	PUSH/PULL SWITCH
10	2	ASE00N12C	4 AVG CONNECTOR
11	1	ASEB10K4	30 AMP FUSE HOLDER
12	1	ASE00B7E	DIODE
13	1	ASE756SK45	DC CONTROL BOX
14	1	ASE756SE6	ION STRIP

PROPANE FIRED ELEC. CAL BOX
ALL PROPANE KETTLES
ASE05000000E



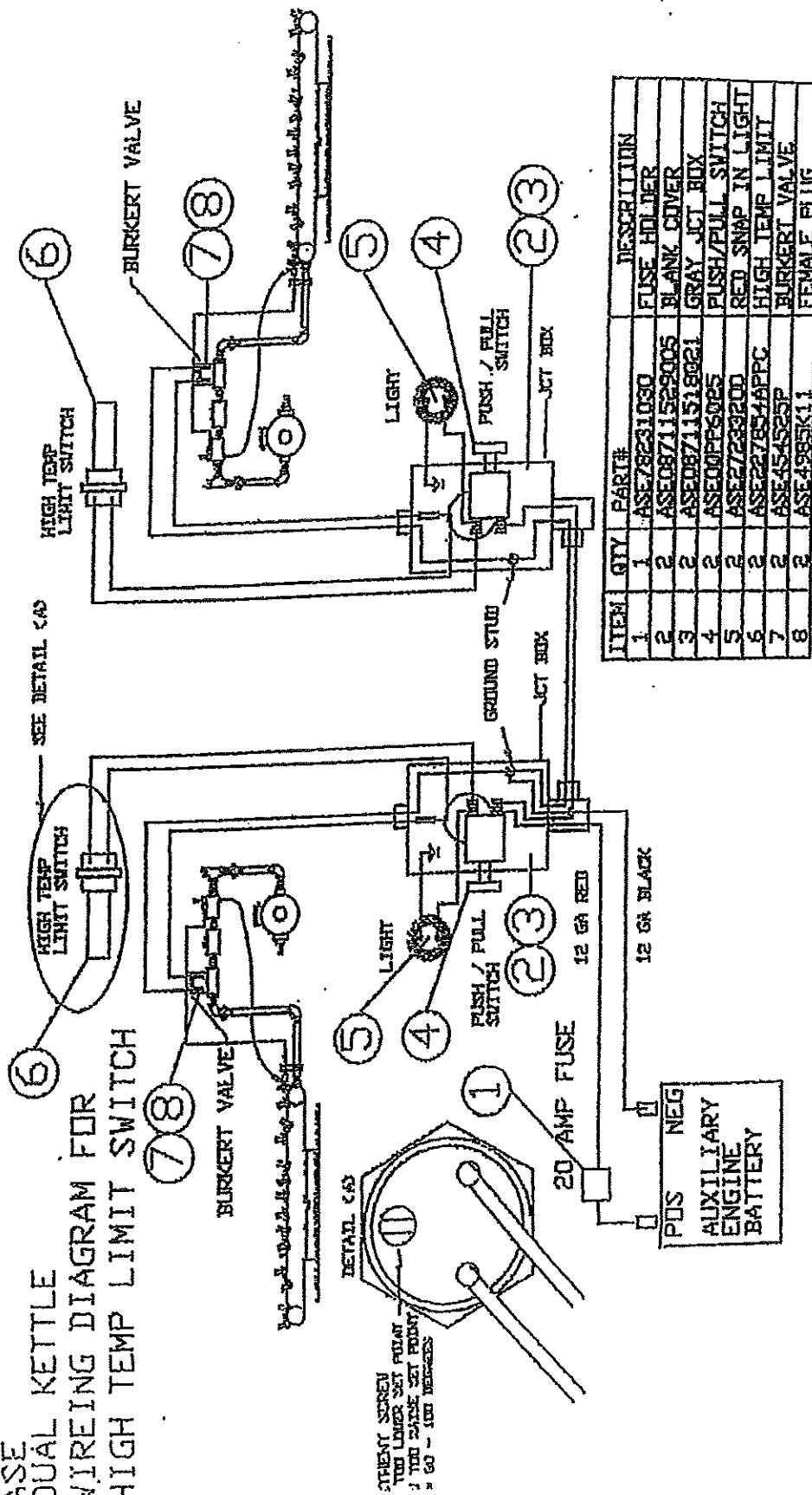
ASE05000000E

ITEM	QTY	PART #	DESCRIPTION
1	1	ASE35-530	AUTO IGN SYSTEM
2	1	ASE08001018	BLUE LIGHT
3	1	ASE7170K42	CIRCULAR 8 PIN RELAY
4	1	ASE7122K19	RELAY BASE 8 PIN
5	1	ASE227854APPC	LIMIT SWITCH
6	1	ASE938810A100GG	WATLOW TEMP CONTROL
7	1	ASE0800101G	GREEN LIGHT
8	1	ASE0800101R	RED LIGHT
9	1	ASE7172K27	MASTER SWITCH DPST
10	2	ASECONNECTOR	4 AVG CONNECTOR
11	1	ASE8110K4	30 AMP FUSE HOLDER
12	1	ASE100DE	DIODE
13	1	ASE7563K45	OF CONTROL BOX
14	1	RLY9125ECG	DIN STRIP
15	1	ASEAF JRPV4540UJ25H	WATLOW INSULATED SENSOR
16	1	ASE419-0023	TIME DELAY 3-60 SEC 12V
17	1	ASE20294	REDHAT 12V GAS VALVE
18	1	ASE0179C1033	PILOT BURNER W/SENSE/IGN
19	1	ASE7172K21	PILOT SWITCH SPST
20	1	ASE05030104	LARGE LPG REGULATOR



LTR.	DATE	REVISIONS	DATE
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A.S.E. 8905 GURLEY RD DOUGLASVILLE GA, 30134 (770) 920-1090			PLOT 0:
			DRAWN
TOLERANCES UNLESS OTHERWISE SPECIFIED DECIMAL ±.005			CHK'D
FRACTIONAL ±1/32 ANGLE ±1/2° WELDING ±1/16			APP'D
METRIC TOLERANCES : ± 0.1 MM			

ASE DUAL KETTLE WIRING DIAGRAM FOR HIGH TEMP LIMIT SWITCH



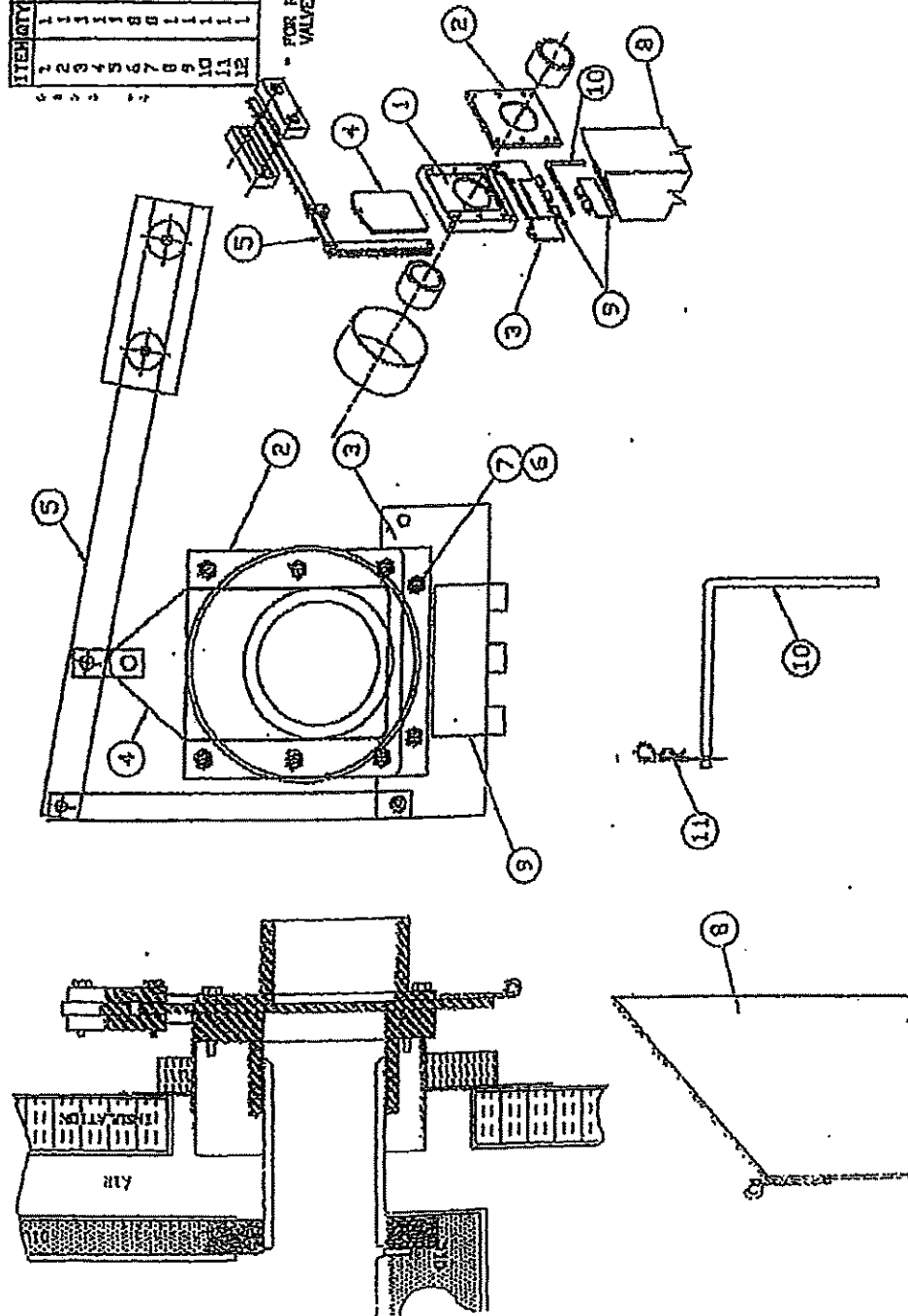
ITEM	QTY	PART#	DESCRIPTION
1	1	ASE78231030	FUSE HOLDER
2	2	ASE08711529005	BLANK COVER
3	2	ASE08711518021	GRAY JCT BOX
4	2	ASE00PP6085	PUSH/FULL SWITCH
5	2	ASE27233200	RED SNAP IN LIGHT
6	2	ASE227854APPC	HIGH TEMP LIMIT
7	2	ASE454525P	BURKERT VALVE
8	2	ASE4985K11	FEMALE FLUG

FALCON PREMELTING KETTLE - PROPANE FIR

Operations and Maintenance

ITEM	QTY	PART #	DESCRIPTION
1	1	ASE00040800	REAR PLATE
2	1	ASE00040801	FRONT PLATE
3	1	ASE00040802	BASE
4	1	ASE00040803	GATE
5	1	ASE00040804	HANDLE
6	1	ASE00040805	3/4" X 2 3/4" HEX BOLT
7	1	ASE00040806	WASHER
8	1	ASE00040807	4 X 3 HINGE
9	1	ASE00040808	HINGE PIN
10	1	ASE00040809	6/16" HINGE PIN
11	1	ASE00040810	SLIDE VALVE KIT
12	1	ASE00040811	SLIDE VALVE KIT

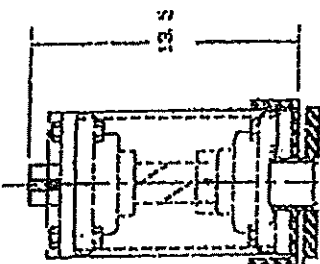
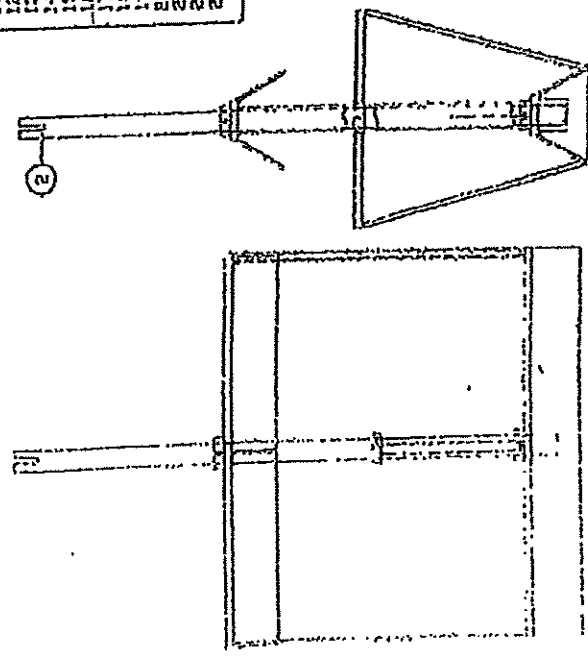
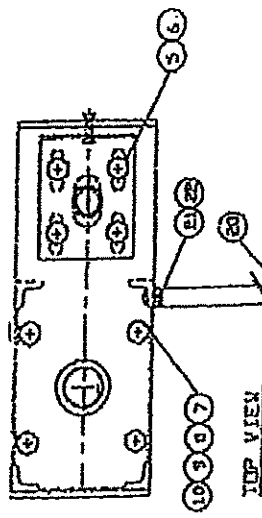
FOR REFERENCE ONLY, SEE SLIDE VALVE ASSEMBLY KIT (ASE00040800).



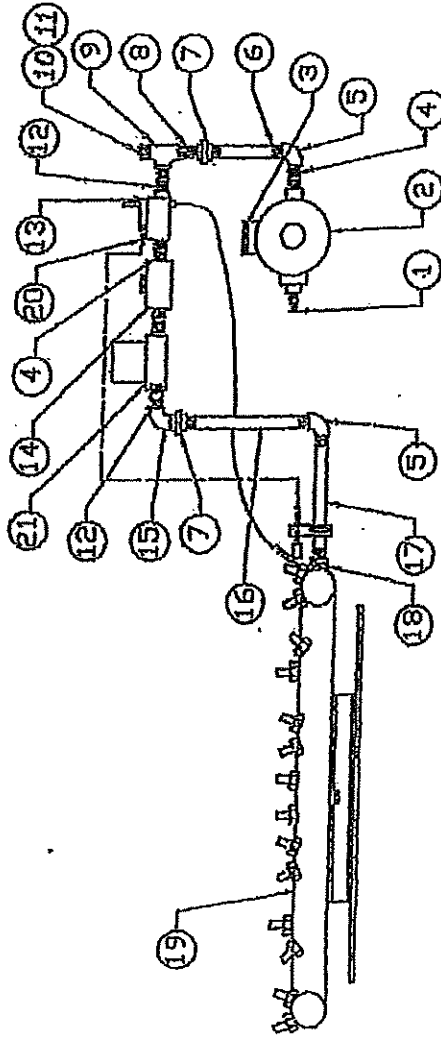
FALCON PREMELTING KETTLE - PROPANE FIA

Operations and Maintenance

ITEM	QTY	PART #	DESCRIPTION
1	1	ASEG0021000	HYDRAULIC MOTOR HNT
2	1	ASEG0023000	AGITATOR ASSY
3	2	ASEG017500223	1 1/2" SET COLLAR
4	4	ASEG0020101	VCJ 1 1/2" BEARING
5	4	ASEG0091411	3/8-16X3 BOLT
6	4	ASEG0055900	3/8 LOCKWASHER
7	8	ASEG0091813	1/2-13 XE BOLT
8	4	ASEG0094300	1/2-13 HEX NUT
9	8	ASEG0094100	1/2 LOCKWASHER
10	2	ASEG0097400	1/2 USS FLAT WASR
11	1	ASEG0099800	1/4-20 HEX NUT
12	1	ASEG0094115	3/16X2 ROLL PIN
13	1	ASEG0023000	CHAIN GAUGE
14	1	ASEG0027486	FR428-12 BRONZE BSN
15	1	ASEG0020101	WIRE HYDRAULIC MOTOR HNT
16	1	ASEG0028044	SPROCKET 30 TS 15
17	1	ASEG0028206	SPROCKET 50 TS 30
18	1	ASEG0024001	50 RIV ROLLER CHAIN 21 LMS
19	1	ASEG0021411	3/8 KEYSTOCK
20	1	ASEG0021006	MOUNTING BRACE
21	1	ASEG0091811	1/2-13 BOLT 1 I.C.
22	2	ASEG0094100	1/2 LOCK WASHER
23	1	ASEG0026991	450 LINK CONN.



FALCON PREMELTING KETTLE - PROPANE FIRE Operations and Maintenance



1	ASE0013880	1/4 NPT - 9/16 SAE LH
2	ASE0013881	FISHER REG.
3	ASE0013882	REGULATOR MNT. BRACKET
4	ASE0013883	1/2 X 2 NIPPLE
5	ASE0013884	1/2 90° ELBOW
6	ASE0013885	1/2 X 2-1/2 NIPPLE
7	ASE0013886	1/2 NPT UNION
8	ASE0013887	1/2 CLOSE NIPPLE
9	ASE0013888	1/2 NPT "TEE"
10	ASE0013889	1/2 - 1/4 BUSHING
11	ASE0013890	1/4 PLUG
12	ASE0013891	1/2 X 1-1/2 NIPPLE
13	ASE0013892	PILOT ASSEMBLY
14	ASE0013893	ROBERT SHAW #420-009
15	ASE0013894	1/2 X 90° ST. ELBOW
16	ASE0013895	1/2 X 4 NIPPLE
17	ASE0013896	1/2 X 11 NIPPLE
18	ASE0013897	1-1/2 - 1/2 BUSHING
19	ASE0013898	BURNER RING
20	ASE0013899	1/4 CUPPER TUBING 3/4 16
21	ASE0013900	LPG BURKERT VALVE

CHART

MODEL #	KETTLE SIZE
ASE05130101	40 GAL-600 LB 24 JETS
ASE05030101	ALL OTHERS 88 JETS

Additional parts available. Call ASE for parts not listed above. For better assistance, please have kettle type, capacity and serial number when placing call. Serial numbers are located on the kettle heat shield.

Advanced Striping Equipment Inc., 8905 Gurley Road, Douglasville, GA 30134
 Phone: 770-920-1090 Toll Free: 866-273-4357 Fax: 770-920-1113
 Email: info@stripingequipment.com
www.stripingequipment.com



ADVANCED STRIPING EQUIPMENT TERMS AND CONDITIONS

1. **ACCEPTANCE:** Advanced Striping Equipment (Seller) accepts Buyer's verbal or written product order upon Buyer's assent to the terms and conditions herein which constitutes the only binding contract terms and conditions between the parties in the absence of a written agreement. Seller shall not be bound by any terms of Buyer's purchase order which provide conditions additional to or different from the terms hereof, not any representations made by Seller's agents or distributors. (See Number 10 WARRANTY).
2. **PRICES & TERMS:** All prices are subject to change by Seller at any time before delivery in respect to all or any portion of the items on order to the extent necessary to cover Seller's increased costs applicable thereto. Items sold on open account shall bear interest at the rate of 18% per annum after 30 days from date of invoice.
3. **SHIPMENT AND PLACE OF DELIVERY:** Seller's products are sold F.O.B. shipping point and Dealer's placement of such goods in the possession of a trucking company, railroad company or common carrier shall constitute delivery to the Buyer and all risk of loss in transit shall be borne by the Buyer. Shipping dates are approximate and based on prompt receipt of all necessary information.
4. **FINANCIAL RESPONSIBILITY:** Sales and deliveries hereunder, shall at all times be subject to the approval of Seller's credit department and at anytime Seller may require evidence payment or satisfactory security or guaranty that invoices will be paid promptly when due. If Buyer fails to comply with any terms of payment Seller in addition to its other rights and remedies, but not in limitation thereof reserves the right to withhold further deliveries and any unpaid amount thereupon, shall become due immediately. If Buyer shall fail or refuse to accept delivery of equipment and/or material ordered hereunder or shall default in the performance of any of the terms, covenants and conditions of this agreement, Seller may retain the cash deposited or paid to it and apply the same toward payment of its damages. If products ordered have been delivered to Buyer or Seller at the time of default, Seller may declare the full amount due and payable without notice; or demand and may repossess said products. Repossession and disposition of equipment and suit for any deficiency shall be pursuant to applicable laws. The remedies provided herein in favor of Seller shall not be deemed exclusive but shall be cumulative and shall be in addition to all other remedies in Seller's favor existing at law or in equity.
5. **DELAYS:** Seller shall not be liable for loss or damage due to delay in delivery or manufacture of all or any portion of a purchase order, resulting from any cause beyond Seller's reasonable control, including, but not limited to, compliance with any regulations, orders or instructions of any government department or agency thereof, acts of God, acts or omissions of the Buyer, acts or civil or military authority, fires, strikes, factory shutdowns or alterations, embargoes, war, riot, delays in transportation or inability due to causes beyond the Seller's reasonable control to obtain necessary labor, manufacturing facilities or materials from the Seller's usual sources and any delays resulting from any such cause, shall constitute cause for extending delivery dates and receipt of the goods shall constitute a waiver of all claims for damages. In no event shall Buyer or Seller be liable for special or consequential damages.
6. **SPECIAL ORDERS:** Where conformance to a State or other agency's specification, inspections, delivery or special provisions is a condition of acceptance of Seller's shipment, the Buyer's written purchase order must so indicate with reference to the agency, and complete requirements concerned. Buyer accepts full responsibility for communicating detail product specification to Seller prior to manufacture and delivery of product.
7. **CANCELLATION:** Buyer may cancel its order, reduce quantities, revise specifications or extend schedules only by mutual agreement as to reasonable and proper cancellation charges which shall take into account expenses already incurred and commitments made by Seller and Buyer shall indemnify Seller against any loss resulting there from.

8. **CLAIMS:** All shipments must be inspected prior to acceptance and claims for loss or damage filed by the consignee with the carrier within five (5) days of delivery. Any claims of shortage must be based on complete inspection of the shipment and accompanying papers and reported to Seller in writing within five (5) days of receipt.
9. **TAXES:** The amount of taxes stated on the face hereof, if any, is approximate only. Buyer is liable for the full amount of all taxes applicable to or as a result of this transaction. Buyer shall pay the amount of all such taxes at any time required by Seller, as if originally added to the price. If Seller pays such taxes Buyer shall reimburse Seller therefore.
10. **SAMPLING AND TESTING:** Buyer shall make an examination and test of any material and/or equipment delivered hereunder immediately upon receipt. Failure of the Buyer to give notice in writing of any claim for defects or breaches of warranty within twenty (20) days after receipt of such product, shall be an unqualified acceptance of said product and a waiver of all claims by Buyer.
11. **WARRANTY:** All statements, technical information and recommendations contained in Seller's literature are based on tests believed to be reliable, but the accuracy or completeness thereof is not guaranteed, and the following made in lieu of all warranties, expressed or implied.

EQUIPMENT: Seller warrants each new piece of equipment to be free from defects in material and workmanship under normal use and maintenance as herein provided. This warranty does not apply to components manufactured by others such as, but not limited to compressors, engines and vehicles; such components may or may not have their own warranties. Seller's sole obligation to any breach of warranty or breach of contract for defects, deliberate or accidental omissions, shall be limited to repairing, replacing or allowing credit for, at Seller's option, any part which under normal and proper use and maintenance, provides defective in material or workmanship within ninety (90) days after delivery to or five hundred (500) hours of use by Buyer, whichever shall occur first; provided however, that notice of any such defect or omission and satisfactory proof thereof is promptly given by Buyer to Seller, and thereafter, such defective part is returned to Seller with transportation charges prepaid and Seller's examination proves such part to have been defective. This warranty does not apply in respect to damages to any product or accessory or attachment thereof caused by overloading or other misuse, neglect or accident, nor does this warranty apply to any product or accessory or attachment thereof, which has been repaired in anyway which, in the sole judgment of Seller, affect the performance, stability or general purpose for which it was manufactured. In the manufacture of Buyer's equipment, parts may be omitted or equivalent functioning equipment and components may be substituted for the original specified equipment upon the sole judgment and discretion of Seller.

THIS WARRANTY IS IN LIEU OF ALL OTHER WARRANTIES (EXCEPT OF TITLE) EXPRESSED OR IMPLIED, AND THERE IS NO IMPLIED WARRANTY OF MERCHANTABILITY OR OF FITNESS FOR A PARTICULAR PURPOSE. IN NO EVENT SHALL SELLER BE LIABLE FOR CONSEQUENTIAL OR SPECIAL DAMAGES. USED PRODUCTS ARE SOLD ON AN "AS IS" BASIS, THERE IS NO IMPLIED WARRANTY OF MERCHANTABILITY OR OF FITNESS FOR A PARTICULAR PURPOSE, UNLESS OTHERWISE EXPRESSLY STATED ON THE FACE OF THIS FORM.

12. **CORRECTION:** Typographical or clerical errors contained herein are subject to correction by Seller.
13. **FAIR LABOR STANDARDS:** Sellers products are produced in the United States and in conformity with all applicable provisions of the Fair Labor Standards Act of 1938 as amended, and any regulations and orders of the United States Department of Labor issued thereunder.
14. **LEGAL ACTION:** Buyer shall be responsible for all costs of collection of outstanding indebtedness, including but not limited to attorney's fees and court costs to Seller. Buyer shall reimburse Seller for any and all litigation expenses. Seller incurs as a result of an unsuccessful Buyer claim. The jurisdiction and venue of the court for Any litigation, state or Federal, brought by the Buyer and/or Seller shall be located in Fulton County, Georgia

15. **ENTIRE AGREEMENT AND APPLICABLE LAW:** The rights and obligations of Seller and Buyer shall be governed by the laws of the State of Georgia, U.S.A. In force on date hereof. The provisions hereof are intended by Buyer and Seller as a final expression of agreement, and are intended also as a complete and exclusive statement of all terms applicable to Buyer's order. No waiver, modification or addition to any of the terms hereof shall be binding on Seller, unless made in writing by an Officer or General Sales Manager at Seller's office as stated herein. In the event of conflict between Buyer's purchase order and the terms hereof, the latter shall control.

If any provisions herein are to any extent invalid or unenforceable, the remainder of the Terms and Conditions shall not be affected thereby and shall be valid and enforceable to the fullest extent permitted by law.

16. **ASSIGNMENT:** Buyer shall not assign or transfer this contract without Seller's written consent.



STANDARD WARRANTY

90 Day – Limited Equipment

All statements, technical information and recommendations contained in seller's literature are based on tests believed to be reliable, but the accuracy or completeness thereof is not guaranteed, and the following is made in lieu of all warranties, expressed or implied.

Seller warrants each new piece of equipment to be free from defects in material and workmanship under normal use and maintenance as herein provided. This warranty does not apply to components manufactured by others such as, but not limited to compressors, engines and vehicles; such components may or may not have their own warranties. Seller's sole obligation to any breach of warranty or breach of contract for defects, deliberate or accidental omissions, shall be limited to repairing, replacing or allowing credit for, at Seller's option, any part which under normal and proper use and maintenance, provides defective in material or workmanship within ninety (90) days after delivery to or five hundred (500) hours of use by Buyer, whichever shall occur first; provided however, that notice of any such defect or omission and satisfactory proof thereof is promptly given by Buyer to Seller, and thereafter, such defective part is returned to Seller with transportation charges prepaid and Seller's examination proves such part to have been defective. This warranty does not apply in respect to damages to any product or accessory or attachment thereof caused by overloading or other misuse, neglect or accident, not does this warranty apply to any product or accessory or attachment thereof, which has been repaired in anyway which, in the sole judgment of Seller, affect the performance, stability or general purpose for which it was manufactured. In the manufacture of Buyer's equipment, parts may be omitted or equivalent functioning equipment and components may be substituted for the original specified equipment upon the sole judgment and discretion of Seller.

Seller's only obligation shall be to replace such quantity of the product proved to be defective. This warranty does not obligate ASE to bear any transportation charges or personnel time in connection with the replacement or repair of defective parts. This warranty does not obligate ASE to bear any expense for travel time or of personnel in connection with any service calls. ASE will not, in any event, be liable to the user for any consequential damages arising out of this sale for the loss of use, lost profits or revenue, interest, lost goodwill or work stoppage. Seller shall not be liable for any injury, loss or damage, direct or consequential, arising out of the use or the inability to use the product or for environmental claims. It being understood that the seller has no means of controlling the products final use; therefore, it shall be buyer's responsibility to determine suitability of product for intended use and buyer assumes all risks and liabilities whatsoever, in connection therewith.

This warranty is in lieu of all other warranties (except of title), expressed or implied, and there is no implied warranty of merchantability or of fitness for a particular purpose. In no event shall Seller be liable for consequential or special damages. Used products are sold on an "as is" basis, and there is no implied warranty of merchantability or of fitness for a particular purpose, unless otherwise expressly stated on the face of this form.

Fair labor standards – seller's products are produced in the U.S. and in conformity with all applicable provisions of the fair labor standards act of 1938 as amended, and any regulations and orders of the U.S. Department of Labor issued thereunder.

Legal action – buyer shall be responsible for all costs of collection of outstanding indebtedness, including but not limited to attorney's fees and court costs to seller. Buyer shall reimburse seller for any and all litigation expenses seller incurs as a result of an unsuccessful buyer claim. The jurisdiction and venue of the court for any litigation, state or federal, brought by the buyer and/or seller shall be located in venue determined by seller.

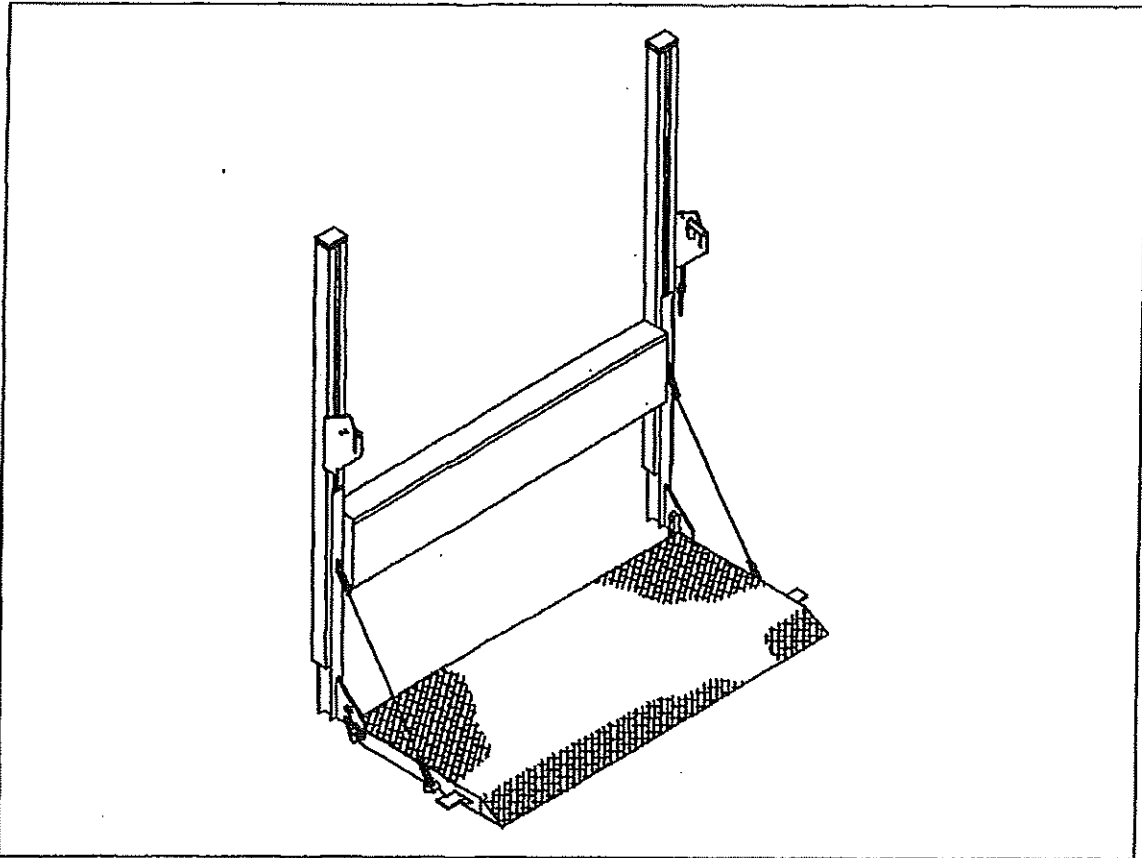
Entire agreement and applicable law - the rights and obligations of seller and buyer shall be governed by the laws of the state of Georgia, U.S.A. In force on date hereof. The provisions hereof are intended by buyer and seller as a final expression of their agreement, and are intended also, as a complete and exclusive statement of all terms applicable to buyer's order. No waiver, modification, or addition to any of the terms hereof shall be binding on the seller, unless made in writing by an officer at seller's office as stated herein. In the event of conflict between buyer's purchase order and the terms hereof, the latter shall control. If any provisions herein are to any extent invalid or unenforceable, the remainder of the warranty shall not be affected thereby and shall be valid and enforceable to the fullest extent permitted by law.

Assignment – buyer shall not assign or transfer this warranty without seller's written consent.

TVL *SERIES*

Railgates By THIEMAN

TVL 125, TVL 16, TVL 125A, TVL 16A OWNERS MANUAL/PARTS LIST



IMPORTANT! KEEP IN VEHICLE!

**PLEASE READ AND UNDERSTAND THE CONTENTS OF THIS
MANUAL BEFORE OPERATING THE EQUIPMENT.**



THIEMAN
TAILGATES, INC.

600 East Wayne Street
Celina, Ohio 45822

Phone: 419-586-7727 Fax: 419-586-9724

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FOR YOUR RECORDS

Model No. _____ Date Purchased _____

Serial No. _____

NOTE: When Ordering Parts Be Sure To Include This Information!

Your Thieman Tailgate is constructed of top quality material and is warranted to be free from defects in material and workmanship under normal use. With routine maintenance and proper operation this liftgate will provide long lasting service and dependability.

PARTS ORDERING PROCEDURE

When ordering parts, please include all the information asked below. If this information is not available, a complete written description or sketch of the required part will help Thieman identify and deliver the needed part to you.

THE FOLLOWING INFORMATION MUST BE INCLUDED:

1. Serial Number – Thieman TVL liftgate serial numbers can be found on the tag located on the inner side of the curb side frame rail
2. Model number and capacity
3. Platform size and material – steel or aluminum
4. Part number
5. Description
6. Quantity required


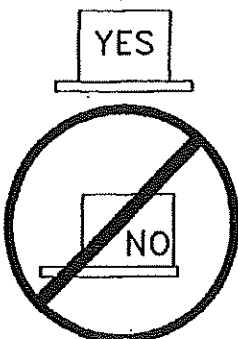
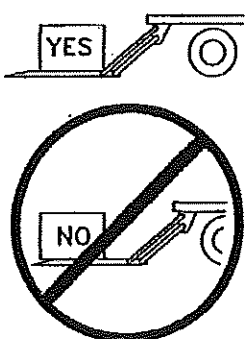
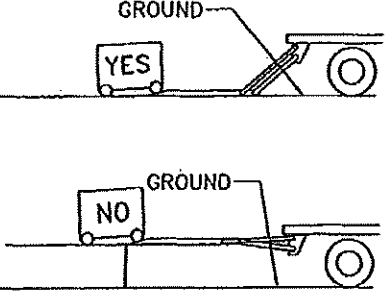
WARNING!

The following list of warnings are to be read before operating the TVL series liftgate.

- +Read this Owner's Manual and all of the decals on the liftgate BEFORE operating the liftgate.
- +All protective covers and guards must be in place before operating the liftgate.
- +DO NOT operate the liftgate if you do not have a thorough knowledge and understanding of the operation of the liftgate.
- +NEVER OVERLOAD THE LIFTGATE. The maximum rated capacity of the TVL series liftgate differs with each model as follows:
 - TVL 125 - 1250 lbs. Maximum Load
 - TVL 16 - 1600 lbs. Maximum Load
- +Never use the liftgate if it makes any unusual noises, has vibrations, or fails to operate freely.
- +Make certain that the area below the platform is clear before and at all times during operation of the liftgate.
- +Keep hands and feet clear of all pinch points.
- +The platform must be in the closed position and the cam latches properly pinned before transit.
- +Always load as close to the center of the platform and as close to the cylinder housing as possible. See figure 1.
- +Never operate lift trucks on or over any part of the platform.
- +Load and unload the platform from the rear and not from the side of the platform. Never remove the platform support chains to load or unload.
- +Only operate liftgate when vehicle is on level ground and parking brake is set.
- +Follow the maintenance guide as outlined in this manual.
- +DO NOT attempt any repairs unless you are a qualified and authorized THIEMAN distributor.
- +If any repairs, adjustments, or maintenance not covered in this manual are required, contact your nearest Thleman distributor or the factory.
- +DO NOT ride the liftgate, it is not intended as personnel lift.
- +This liftgate is intended for the use of loading and unloading cargo only, and it is not to be used for anything other than this.
- +DO NOT modify this liftgate. Altering this liftgate may cause serious personal injury or damage the liftgate and will void all warranties.

WATER LEVEL LOADING

When a maximum load is to be raised or lowered, this load must be centered on the load bearing platform, both front to back and side to side.

 WARNING		
<p>SIDE TO SIDE</p>  <p>DO NOT OFF CENTER LOAD</p>	<p>FRONT TO BACK</p>  <p>DO NOT OFF CENTER LOAD</p>	<p>GROUND</p>  <p>DO NOT LOAD OR UNLOAD WITH RAMP OFF GROUND</p>

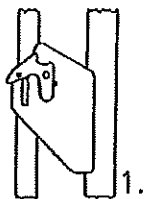
THERMAL DATA: To avoid overheating the motor do not operate this unit for more than 13 cycles/10 minutes with the maximum load. The motor then must be allowed to completely cool down to ambient temperature before cycling the lift again. This unit also has a 20% duty cycle, which means the liftgate can be cycled no more than 4 cycles/10 minutes constantly with a maximum load.

OPERATING INSTRUCTIONS

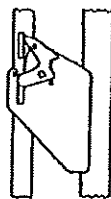
CAUTION:

Be sure to operate liftgate at a safe distance and never improperly load platform as this may cause personal injury or damage to the liftgate.

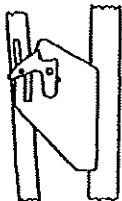
OPENING OF PLATFORM



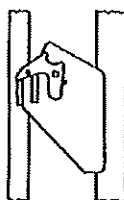
1.



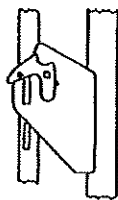
2.



3.



4.



5.

1. Remove latch pin and raise platform until it is completely out of the resting plates. Lower platform so guide plate rides over cam and is below resting plate. See Illustrations.

2. Lower platform to a comfortable height for unfolding. Unfold the platform manually to the horizontal position.

LOADING AND UNLOADING

3. Raise or lower platform to the desired level for loading or unloading.

CLOSING OF PLATFORM

4. Fold platform up manually and raise until guide plates raise locking cam and are free to drop into resting plates.

LIFTGATE TRANSIT

5. Lower platform until guide plates are in resting plates completely. Push latch pin in hole through resting plate and cam to secure platform.

MAINTENANCE GUIDE

The following inspection and maintenance operations should be performed at the recommended intervals or anytime the liftgate shows signs of abuse, and improper or abnormal operation.

MONTHLY INSPECTION AND MAINTENANCE

Operate the liftgate throughout its entire operational cycle and check the following:

1. Check that there are no unusual noises or vibrations.
2. Check that the platform is level when raised to bed height. If adjustments are necessary, this can be done by adjusting nuts (A) on U-bolt (B) on platform block (C). See Figure 2.

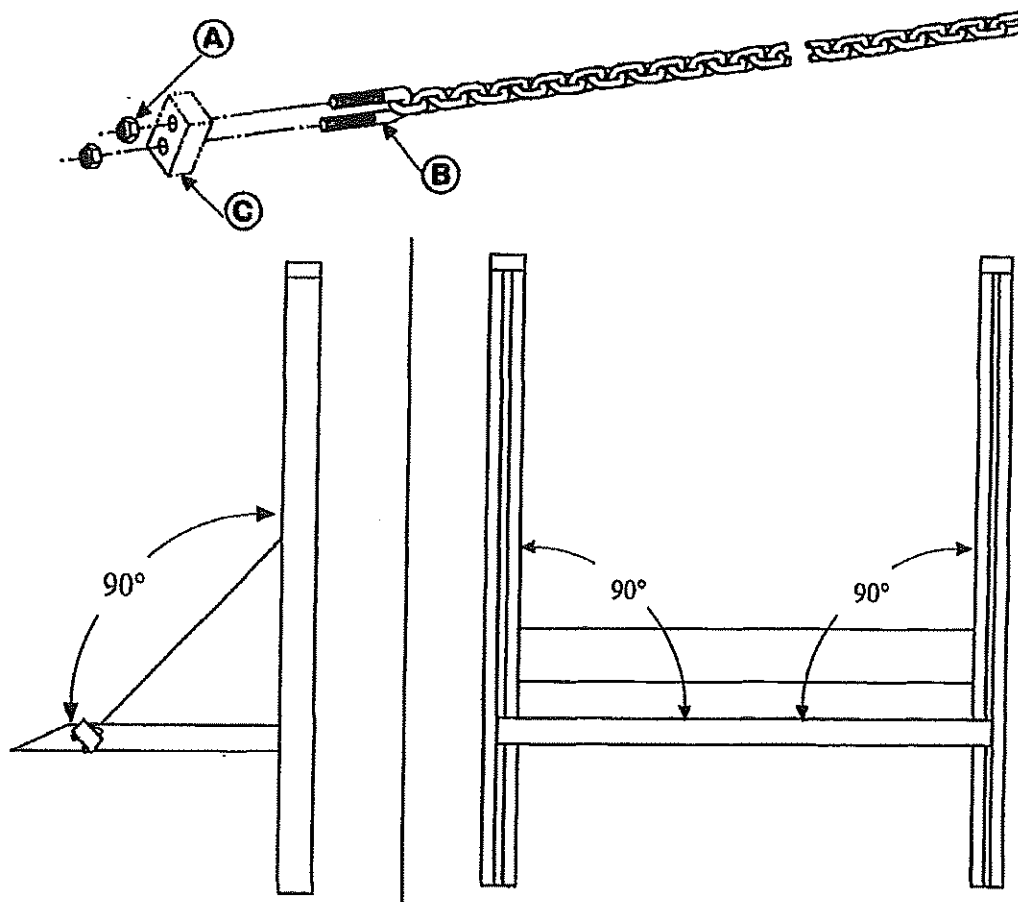


FIG. 2.

3. Check for apparent damage to the liftgate such as bent or distorted members, any cracked welds, which may have resulted from overloading or abuse.
4. Check for any excessive wear in the following areas:
 - A. Roller and pin assemblies
 - B. Platform and hinge pins and pivot plates
 - C. Platform support chains and chain anchor points
5. Check that all platform pivot pins are in place and retained by their proper retainers.
6. Check that all protective covers and guards are properly in place and secured.
7. Check for oil leaks in these areas:
 - A. Lift cylinder
 - B. Hydraulic hose - replace if it shows signs of wear or cracking.
 - C. Hydraulic fittings - tighten or replace as may be required to stop leakage.
8. Check the oil level in the hydraulic reservoir located in the cylinder housing. With the platform open and at ground level, the oil should be within 1/2 inch from the top of the reservoir. See chart below.

HYDRAULIC FLUID CHART	
Temperature Range	Acceptable Fluids
-75 to 165°F	Exxon Univils J-26
-20 to 130°F	Dexron III Exxon Superflo ATF Shell Donax(R) TG
-50 to 80°F	Shell Aero Fluid 4 Mobil Aero HFA Exxon Univils J-13 MIL H-5606

9. Check that all wiring and battery cable connections are tight and free of corrosion.

10. Lubrication of the TVL series gate should be as follows for all user conditions:

<u>Area of Tailgate</u>	<u>Type of Lubrication</u>	<u>*Frequency</u>
Slider Rails	SAE 10 to SAE 20 oil	50 cycles
Lift Chain	SAE 10 to SAE 20 oil	100 cycles
Chain Anchor Links	SAE 10 to SAE 20 oil	100 cycles
Locking Cams	SAE 10 to SAE 20 oil	100 cycles

*NOTE: TVL gates which see less than 50 cycles per week must be lubricated in the areas listed above no less than once a week. Once lubricated, run the gate up and down through one complete cycle to spread lubricant more evenly.

11. Check the pump relief pressure and also the motor amperage at this pressure. These values should be as follows:

<u>Model</u>	<u>Max Amp Draw</u>	<u>Relief Pressure (psi)</u>
TVL125	145	1950
TVL16	160	2500

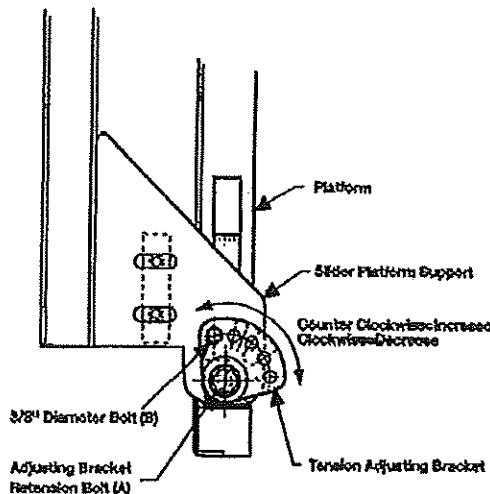


Fig.3

12. Torsion bar adjustment (See figure 3).

- Place platform in stowed (vertical) position.
- Remove 5/8" diameter bolt (A) from center of tension adjusting bracket.
- Place 1/2" square breaker bar in the square hole of the adjusting bracket pin.
- Turn breaker bar clockwise to relieve tension on 3/8" diameter bolt (B) and remove it from the bracket.
- To Increase tension, rotate bracket counterclockwise until desired tension is reached. Line up hole in bracket to hole in slider platform support and replace bolt (B).

Semi-Annual Inspection

1. Perform the procedures outlined in the "Monthly Inspection and Maintenance."

2. Inspect pump motor by:

- Disconnecting battery cable
- Remove motor end cover
- Examine the armature brushes for wear. (Brushes should be replaced if they are less than 1/8" long).
- Clean all residue out from inside of the motor housing.
- Apply several drops of light weight machine oil to the armature shaft bearing in the motor end cover and reassemble the motor end cover.

3. If hydraulic oil in the reservoir is dirty:

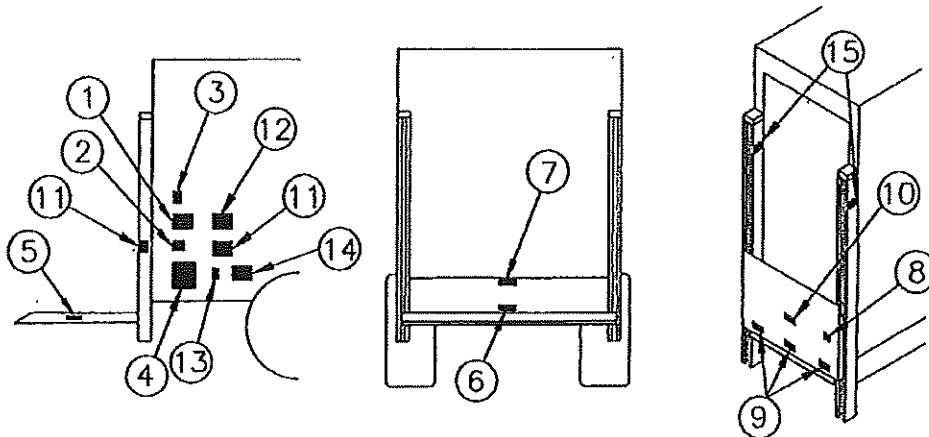
- A. Unfold platform and lower platform to the ground so the cylinder is fully retracted.
- B. Drain the oil from the hydraulic system and flush the entire system.
- C. Remove the reservoir from the pump and clean the suction line filter. Also clean out any contaminants from the reservoir. Remount the reservoir when completed.
- D. Replace the oil as outlined in Section 8 under Monthly Maintenance and Inspection.

INSPECTION AND LOCATION OF DECALS

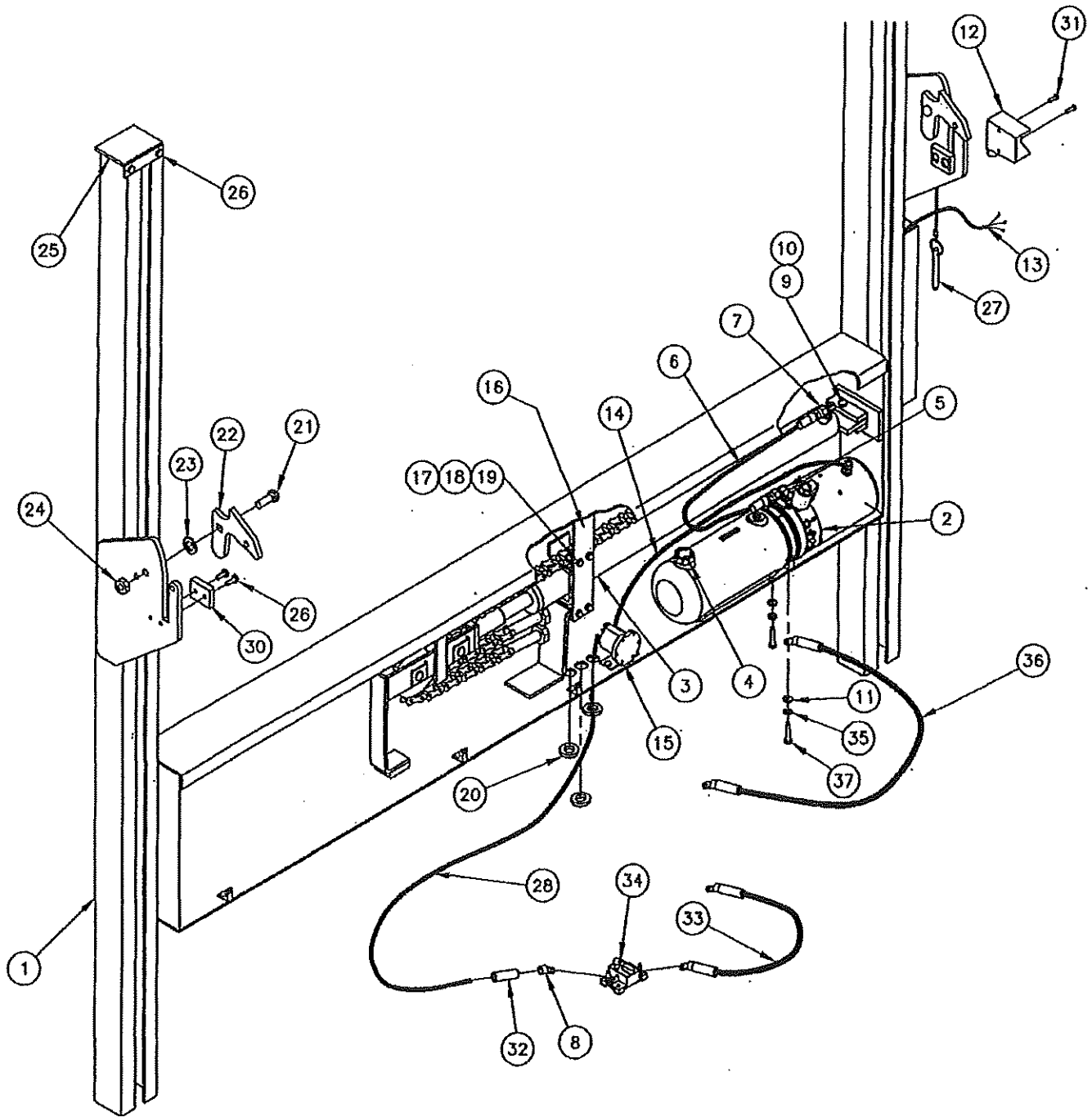
Inspect all decals listed below to be certain that they are in the proper location and they are legible.

ALL DECALS MUST BE IN PLACE AND LEGIBLE OR ALL WARRANTIES ARE VOID!

Item	Part Name	Part Number
1	Warning Decal	4671050
2	PTO Decal	4650140
2	Fast Idle Decal	4650150
3	Danger Decal	4609
4	Operating Decal	4650780
5	Capacity Decal 1250#	4650060
5	Capacity Decal 1600#	4650750
6	Warning Decal	4650790
7	Warning Decal	4650760
8	Caution Decal	4650770
9	Reflector(3)	5705
10	Thieman Nameplate	4650801
11	Toggle Switch Decal	4650820
12	Wiring Decal	4617
13	Warning Decal-High Pressure	4620
14	Lubrication Decal	4662
15	Lube Location Decal (4)	4663

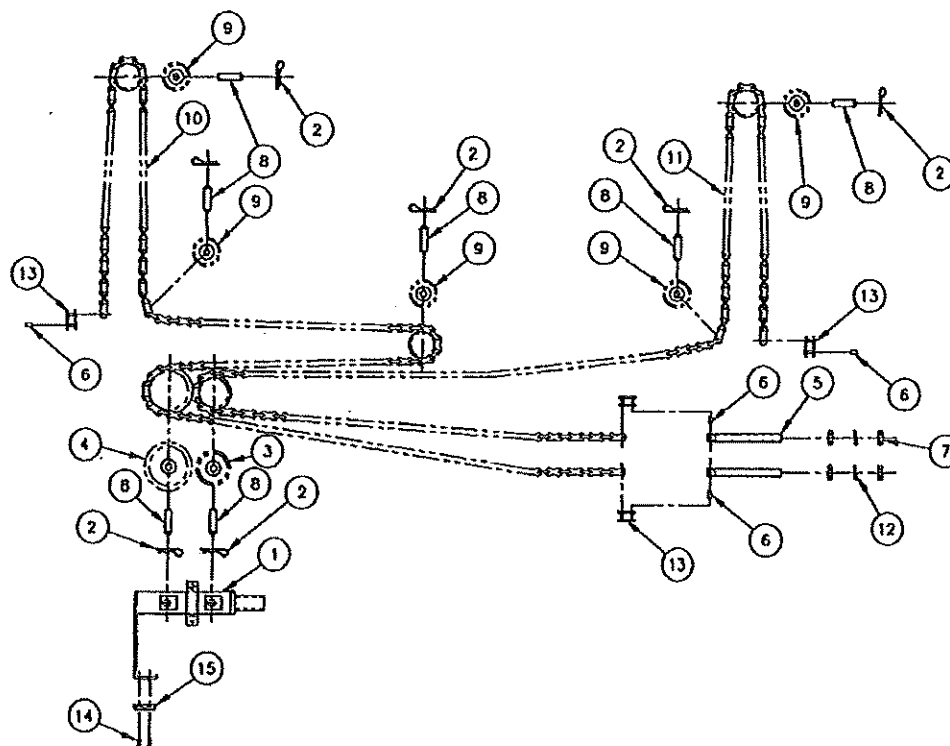


MAIN FRAME ASSEMBLY



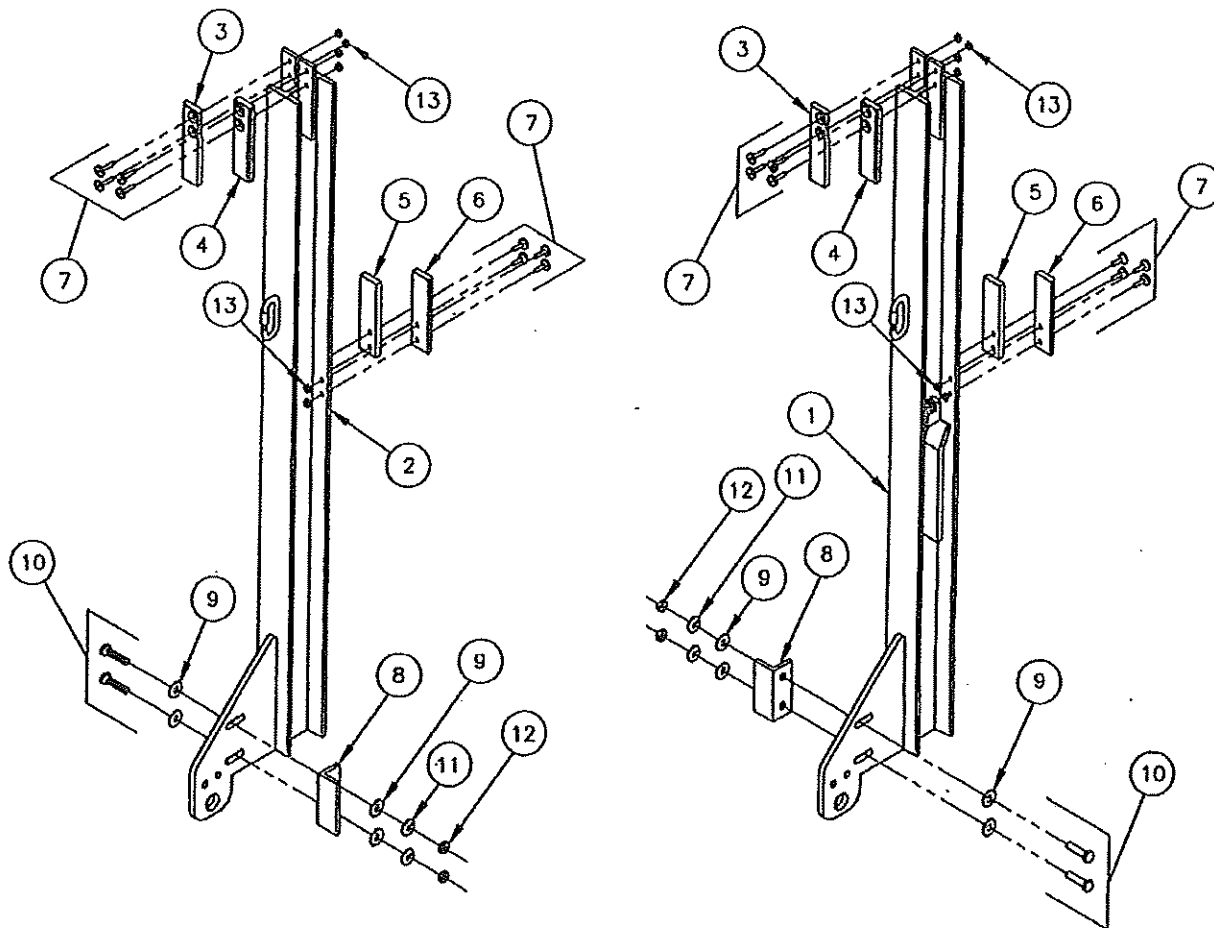
Item	Part Number	Description	Gate Model Qty.			
			125	125A	16	16A
1	3140-001	Main frame 80 (56"BH)	1		1	
1	3140-002	Main frame 90 (56"BH)	1		1	
1	3140-003	Main frame 95 (56"BH)	1		1	
1	3140-004	Main frame 100 (56"BH)	1		1	
1	3140-005	Main frame 80 (46"BH)		1		1
1	3140-006	Main frame 90 (46"BH)		1		1
1	3140-007	Main frame 95 (46"BH)		1		1
1	3140-008	Main frame 100 (46"BH)		1		1
1	3140-009	Main frame 80 (37"BH)		1		1
1	3140-010	Main frame 90 (37"BH)		1		1
1	3140-011	Main frame 95 (37"BH)		1		1
1	3140-012	Main frame 100 (37"BH)		1		1
2	4473	Power unit	1	1	1	1
3	42004	Cylinder assembly	1	1	1	1
4	4420410	Breather cap	1	1	1	1
5	4930-001	MJ-MAORB 90°	1	1	1	1
6	4951-002	.25 Hose assembly	1	1	1	1
7	4931-001	Restrictor MJ-MAORB 90°	1	1	1	1
8	4350	Cable lug	1	1	1	1
9	8101-001	Clevis pin	1	1	1	1
10	5700022	Hairpin cotter	1	1	1	1
11	8120388	Flatwasher .38	2	2	2	2
12	31447	Toggle switch Asm	1	1	1	1
13	4301290	Wire harness	1	1	1	1
14	4318-002	Battery cable	1	1	1	1
15	4477	Solenoid	1	1	1	1
16	31558	Cylinder Retainer Weld	1	1	1	1
17	8180022	Screw .25 x 1	4	4	4	4
18	8120380	Lockwasher .25	4	4	4	4
19	8120375	Nut .25	4	4	4	4
20	5701960	Grommet	3	3	3	3
21	8456922	.50 x 1.50 carriage bolt	2	2	2	2
22	2103160	Locking cam	2	2	2	2
23	8120396	.50 Flatwasher	2	2	2	2
24	8103-021	.50 Lock nut	2	2	2	2
25	3109577	Sprocket housing assembly	2	2	2	2
26	5793010	.25 x .75 Screw	8	8	8	8
27	3109140	Latch cable assembly	2	2	2	2
28	4300030	Battery cable 25'	1	1	1	1
29	8180126	Screw .38 x 1.50	2	2	2	2
30	5703	Pad	2	2	2	2
31	8111-005	Screw #10 x .75	2	2	2	2
32	4319-002	Heat Shrink	1	1	1	1
33	4318-001	Battery cable #2 x 2'	1	1	1	1
34	4301770	Circuit breaker	1	1	1	1
35	8120382	Lockwasher .38	2	2	2	2
36	4318-003	Cable #2 x 5'	1	1	1	1

LIFTING CHAIN ASSEMBLY



Item	Part Number	Description	Gate Model Qty.			
			125	125A	16	16A
1	31528	Pusher weld	1	1	1	1
2	5700022	Hairpin cotter	7	7	7	7
3	31214-002	15T Sprocket assembly	1	1	1	1
4	31214-001	21T Sprocket assembly	1	1	1	1
5	5084-002	Tension rod	2	2	2	2
6	2504030	Chain pin bushing	4	4	4	4
7	8219758	.75 Jam nut	4	4	4	4
8	5067	Pin	7	7	7	7
9	31214-003	13T Sprocket assembly	5	5	5	5
10	4100-002	Chain SS 90 (56" BH)	1		1	
10	4100-003	Chain SS 95 (56" BH)	1		1	
10	4100-004	Chain SS 100 (56" BH)	1		1	
10	4100-006	Chain SS 90 (37",46" BH)		1		1
10	4100-007	Chain SS 95 (37",46" BH)		1		1
10	4100-008	Chain SS 100 (37",46" BH)		1		1
10	4100-016	Chain SS 80 (56" BH)	1		1	
10	4100-017	Chain SS 80 (37", 46" BH)		1		1
11	4100-001	Chain CS 90,95,100 (56" BH)	1		1	
11	4100-005	Chain CS 90,95,100 (37",46" BH)		1		1
11	4100-020	Chain CS 80 (56" BH)	1		1	
11	4100-021	Chain CS 80 (37",46" BH)		1		1
12	8106-005	.75 Lockwasher	2	2	2	2
13	4100320	Connecting link	4	4	4	4
14	8449646	Self tap screw	2	2	2	2
15	5703	Wear pad	1	1	1	1

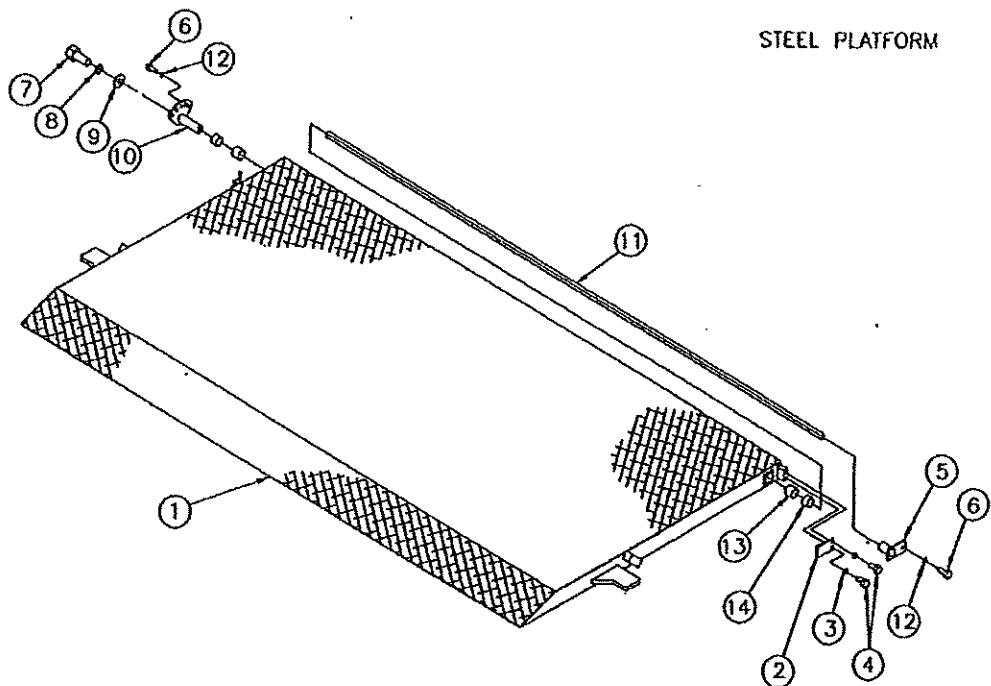
SLIDER ASSEMBLY



Item	Part Number	Description	Gate Model Qty.			
			125	125A	16	16A
1	31540-001	Slider weldment RH	1	1	1	1
1	31540-002+	Slider weldment RH	1	1	1	1
2	31541-001	Slider weldment LH	1	1	1	1
3	5702201	Wear pad LH upper	2	2	2	2
4	5702202	Wear pad RH upper	2	2	2	2
5	5702241	Wear pad LH lower	2	2	2	2
6	5702242	Wear pad RH lower	2	2	2	2
7	8109-012	Screw .25 x .75	16	16	16	16
8	2013	Adjustment angle	2	2	2	2
9	8120388	.38 Flatwasher	8	8	8	8
10	8180126	.38-16 x 1.50 Screw	4	4	4	4
11	8120382	.38 Lockwasher	4	4	4	4
12	8120377	.38-16 Nut	4	4	4	4
13	8103-019	.25 Locknut	16	16	16	16

+Used with aluminum platforms requiring a spring assembly.

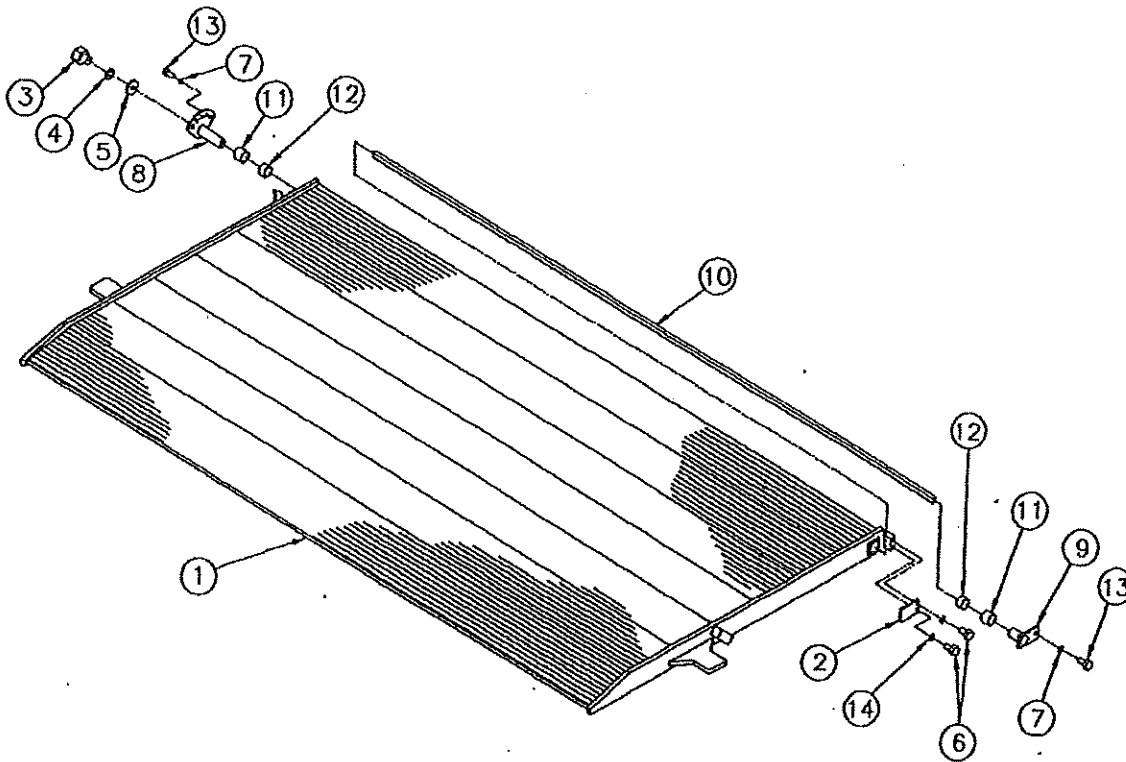
STEEL PLATFORM ASSEMBLY



Item	Part Number	Description	Gate Model Qty.			
			125	125A	16	16A
1	3408-001	7530 Platform	1	1	1	1
1	3408-002	7536 Platform	1	1	1	1
1	3408-003	7542 Platform	1	1	1	1
1	3408-004	8530 Platform	1	1	1	1
1	3408-005	8536 Platform	1	1	1	1
1	3408-006	8542 Platform (see note 1)	1	1	1	1
1	3408-007	9030 Platform	1	1	1	1
1	3408-008	9036 Platform	1	1	1	1
1	3408-009	9042 Platform (see note 1)	1	1	1	1
1	3408-010	9530 Platform	1	1	1	1
1	3408-011	9536 Platform	1	1	1	1
1	3408-012	9542 Platform (see note 1)	1	1	1	1
2	2329	Stop	1	1	1	1
3	8120380	.25 Lockwasher	2	2	2	2
4	8180022	.25 x 1.00 Screw	2	2	2	2
5	3199	Pin retainer	1	1	1	1
6	8180120	.38 x .75 Screw	2	2	2	2
7	8271713	.62 x .75 Screw	1	1	1	1
8	8121574	.62 Lockwasher	1	1	1	1
9	8130999	.62 Flatwasher	1	1	1	1
10	3108980	Adjusting bracket	1	1	1	1
11	5101-001	Torsion bar 85" platform	1	1	1	1
11	5101-002	Torsion bar 90" platform	1	1	1	1
11	5101-003	Torsion bar 95" platform	1	1	1	1
11	5101-004	Torsion bar 75" platform	1	1	1	1
12	8120382	.38 Lockwasher	2	2	2	2
13	5504-001	Bushing	2	2	2	2
14	5504-005	Bushing	2	2	2	2

Notes: 1. Requires one spring assembly and appropriate RH slider.

ALUMINUM PLATFORM ASSEMBLY



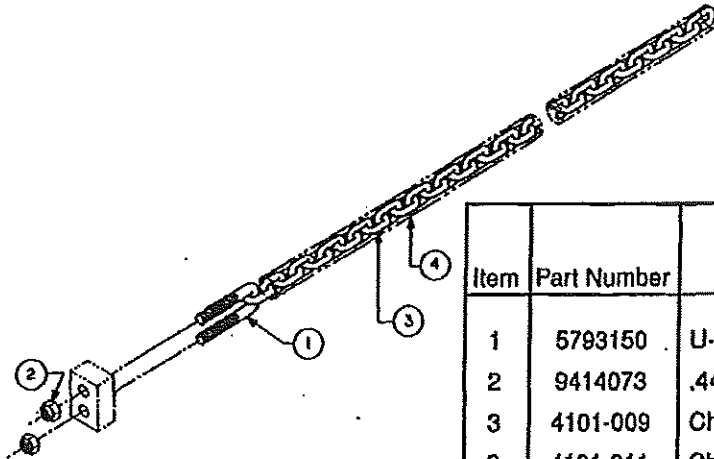
Item	Part Number	Description	Gate Model Qty.			
			125	125A	16	16A
1	3407-001	7530 Platform	1	1	1	1
1	3407-002	7536 Platform	1	1	1	1
1	3407-003	7542 Platform	1	1	1	1
1	3407-004	7548 Platform	1	1	1	1
1	3407-005	7554 Platform	1	1	1	1
1	3407-006	7560 Platform	1	1	1	1
1	3407-007	7566 Platform	1	1	1	1
1	3407-008	8530 Platform	1	1	1	1
1	3407-009	8536 Platform	1	1	1	1
1	3407-010	8542 Platform	1	1	1	1
1	3407-011	8548 Platform	1	1	1	1
1	3407-012	8554 Platform	1	1	1	1
1	3407-013	8560 Platform	1	1	1	1
1	3407-014	8566 Platform (see note 1)	1	1	1	1
1	3407-015	9030 Platform	1	1	1	1
1	3407-016	9036 Platform	1	1	1	1
1	3407-017	9042 Platform	1	1	1	1
1	3407-018	9048 Platform	1	1	1	1
1	3407-019	9054 Platform	1	1	1	1
1	3407-020	9060 Platform	1	1	1	1
1	3407-021	9066 Platform (see note 1)	1	1	1	1
1	3407-022	9530 Platform	1	1	1	1

Item	Part Number	Description	Gate Model Qty.			
			125	125A	16	16A
1	3407-023	9536 Platform	1	1	1	1
1	3407-024	9542 Platform	1	1	1	1
1	3407-025	9548 Platform	1	1	1	1
1	3407-026	9554 Platform	1	1	1	1
1	3407-027	9560 Platform (see note 1)	1	1	1	1
1	3407-028	9566 Platform (see note 1)	1	1	1	1
2	2329	Stop	1	1	1	1
3	8271713	.62 x .75 Screw	1	1	1	1
4	8121574	.62 Lockwasher	1	1	1	1
5	8130999	.62 Flatwasher	1	1	1	1
6	8109-001	.25 x 1.00 Screw SS	2	2	2	2
7	8120382	.38 Lockwasher	2	2	2	2
8	3108980	Adjusting bracket	1	1	1	1
9	3199	Pin retainer	1	1	1	1
10	5101-001	Torslon bar 85" platform	1	1	1	1
10	5101-002	Torslon bar 90" platform	1	1	1	1
10	5101-003	Torslon bar 95" platform	1	1	1	1
10	5101-004	Torslon bar 75" platform	1	1	1	1
11	5504-001	Bushing	2	2	2	2
12	5504-005	Bushing	2	2	2	2
13	8180120	.38 x .75 Screw	2	2	2	2
14	8108-002	.25 Lockwasher SS	2	2	2	2

Notes:

1. Requires one spring assembly and appropriate RH slider.

PLATFORM CHAIN ASSEMBLY

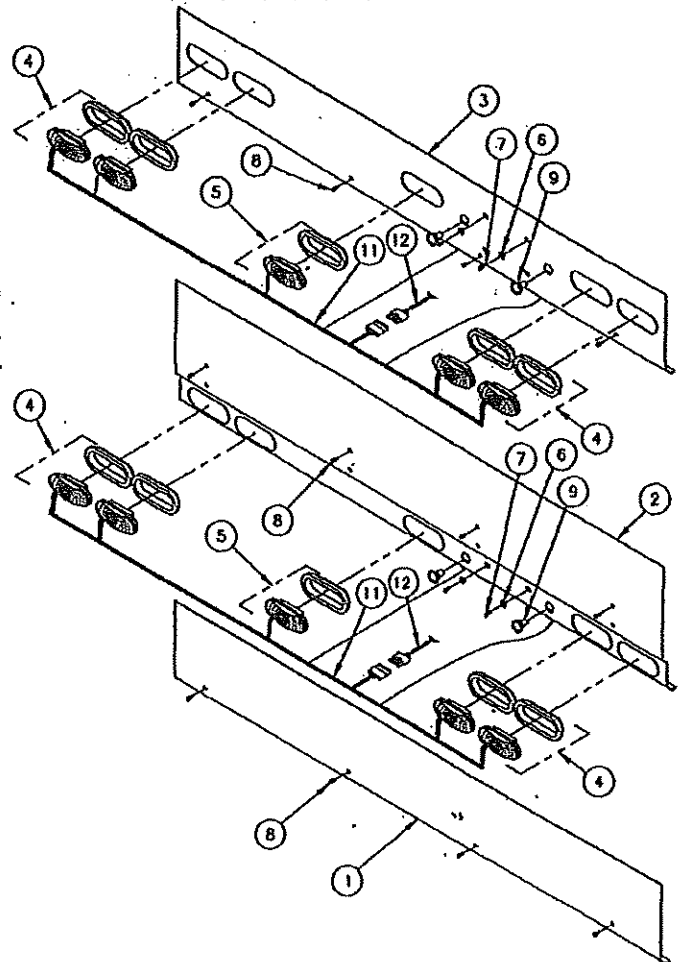


Item	Part Number	Description	Gate Model Qty.			
			125	125A	16	16A
1	5793150	U-Bolt	2	2	2	2
2	9414073	.44 Locknut	4	4	4	4
3	4101-009	Chain 48,54" deep alum.	2	2	2	2
3	4101-011	Chain 60,66" deep alum.	2	2	2	2
3	4101-012	Chain-steel,30,36,42" alum.	2	2	2	2
4	5702300	Protective sleeve	2	2	2	2

HOUSING COVERS

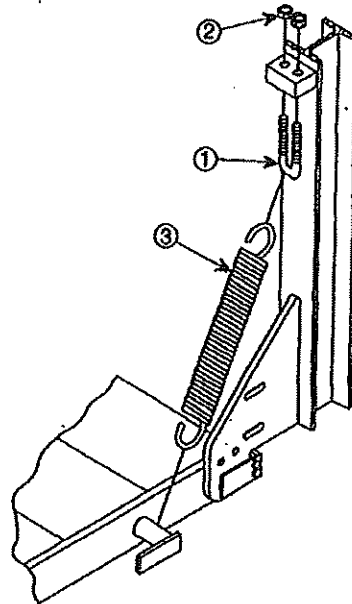
Item	Part Number	Description	Gate Model Qty.			
			125	125A	16	16A
1	2714-001	Steel Cover 80	1	1	1	1
1	2714-002	Steel Cover 90	1	1	1	1
1	2714-003	Steel Cover 95	1	1	1	1
1	2714-004	Steel Cover 100	1	1	1	1
2	2715-001	Steel Cover 80 W/Lower Lights*	1	1	1	1
2	2715-002	Steel Cover 90 W/Lower Lights*	1	1	1	1
2	2715-003	Steel Cover 95 W/Lower Lights*	1	1	1	1
2	2715-004	Steel Cover 100 W/Lower Lights*	1	1	1	1
3	27158-001	Steel Cover 80 W/Upper Lights	1	1	1	1
3	27158-002	Steel Cover 90 W/Upper Lights	1	1	1	1
3	27158-003	Steel Cover 95 W/Upper Lights	1	1	1	1
3	27158-004	Steel Cover 100 W/Upper Lights	1	1	1	1
3	2711411	Aluminum Cover 80 W/Upper Lights	1	1	1	1
3	2711412	Aluminum Cover 90 W/Upper Lights	1	1	1	1
3	2711413	Aluminum Cover 95 W/Upper Lights	1	1	1	1
3	2711414	Aluminum Cover 100 W/Upper Lights	1	1	1	1
4	4301320	Stop/Turn/Tailight	4	4	4	4
6	4301330	Back-up light	1	1	1	1
6	5702270	Plastic square nut	2	2	2	2
7	5702280	Screw	2	2	2	2
8	5793010	.25 x .62 Screw	4	4	4	4
9	4300550	License plate light	2	2	2	2
10	5792020	Gasket (not shown)	1	1	1	1
11	4308	Tailight Wiring Harness	1	1	1	1
12	4368	Tailight Wiring Harness	1	1	1	1

*Not for use on Low Bed applications



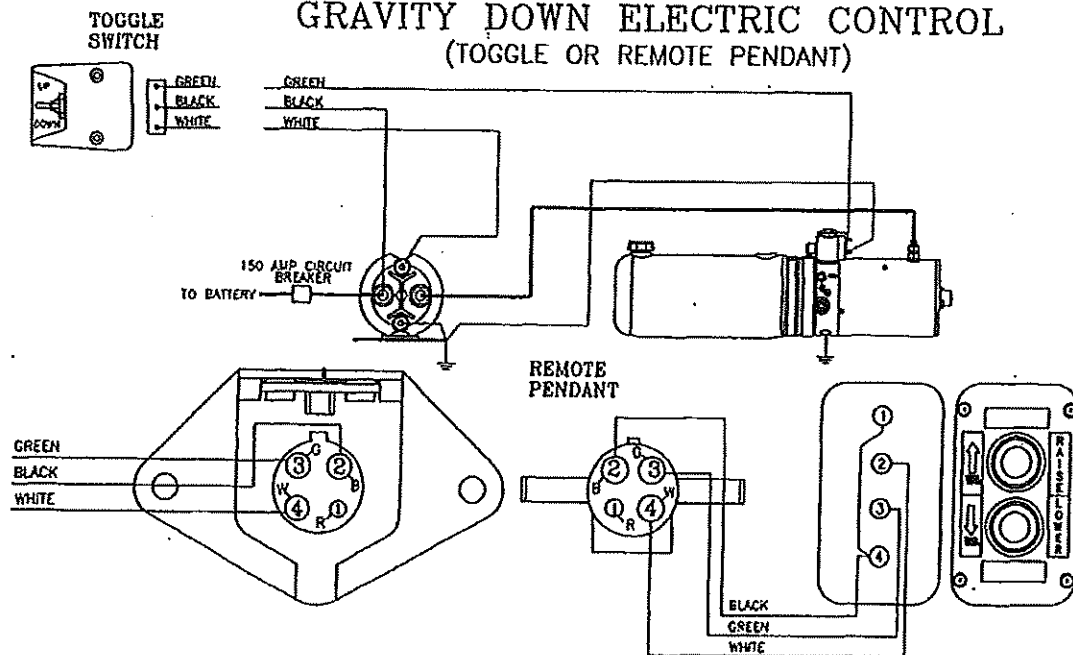
SPRING ASSEMBLY

Item	Part Number	Description	Qty.
1	5793150	U-BOLT	1
2	9414073	Locknut	2
3	5101120	Spring	1



ELECTRICAL PICTORIAL

GRAVITY DOWN ELECTRIC CONTROL (TOGGLE OR REMOTE PENDANT)



TROUBLESHOOTING GUIDE TVL125/16ET

- Test Equipment:**
1. 0-5000 psi pressure gauge
 2. DC voltmeter/ohm meter
 3. DC amp meter
 4. standard mechanics tools

Note: Please refer to the electrical diagrams and hose connection drawings in the liftgate's owners manual when troubleshooting. This guide is only for standard Thiemann liftgates. Special liftgates with options other than those in the owner's manual will require special diagrams for troubleshooting. Read and understand this entire guide completely before doing any troubleshooting. Certain listed problems may be related to other problems listed so a comprehensive knowledge is required before proceeding.

1. Problem – Pump motor will not run in the raise mode

- Causes –**
- a. Tripped circuit breaker
 - b. Defective or undercharged battery(ies)
 - c. Improper battery cable connection or improper ground connection
 - d. Defective or improperly wired raise switch
 - e. Defective or improperly wired solenoid start switch
 - f. Defective pump motor

- Corrections –**
- a. Reset the circuit breaker located within 2ft of the liftgate supply battery(ies).
 - b. The "at rest" voltage for the batteries without the engine running and under no load should be at least 12.5V. The minimum voltage between the motor stud and ground is 9V at maximum conditions. If proper voltage is not present, charge or replace the batteries. The battery(ies) on the vehicle should be that which has a minimum 150 amp reserve capacity.
 - c. Trace battery and ground cable connections to locate improper connection(s). Make sure the ground cable is installed going from the pump mounting screws to bare metal on the truck frame. The ground cable from the batteries to the frame must be a heavy 2ga. cable and that is connected to bare metal on the frame. There must be 12.5V present at the large terminal on the motor start solenoid where the 2ga. cable from the batteries is connected. Replace any damaged cables and repair any bad connections.
 - d. Check for voltage on the black wire at the control switch. If no voltage is present the black wire from the motor start solenoid is loose or broken and needs repaired. If voltage is present then check for voltage at the white wire on the switch with the switch in the "RAISE" position. If no voltage is present, replace the switch.
 - e. Check for voltage on the white wire at the motor start switch when the switch is activated. If no voltage exists the white wire is loose or broken between the switch and the motor start solenoid. Check that the ground wire on the start solenoid is connected properly and there are no bad connections. If there is voltage on the white wire and the coil does not energize or if there is no voltage present at the motor terminal then replace the start switch.
 - f. With the switch activated in the "RAISE" position and the motor start solenoid is activated, check for voltage at the motor terminal. If voltage is present and the motor is not running, replace the motor.

2. Problem – Liftgate will not raise to bed with a load and the pump motor running

- Causes –**
- a. Low hydraulic fluid
 - b. Overload condition
 - c. Improperly adjusted or defective main relief valve
 - d. Lift cylinder is bypassing, liftgate is drifting down
 - e. Broken hydraulic line

- f. Clogged or disconnected suction line
- g. Defective pump

Corrections -

- a. Make sure the reservoir has the proper amount of fluid. Check for the fluid line through the plastic reservoir. The hydraulic fluid should be within 1/2" of the top of the reservoir with the liftgate in the lowered position. Fill with Dexron III automatic transmission fluid.
- b. The power unit on the TVL125/16 is equipped with a lifting relief valve to prevent overloading of the liftgate. The relief setting for the TVL's are:
TVL125 - 1950 psi
TVL16 - 2500 psi
- c. See section "c" above for relief valve setting. Plumb a pressure gauge into the high pressure circuit of the liftgate. Remove all loads from the liftgate's platform. Engage the "RAISE" switch until the liftgate is fully raised. Keep the "RAISE" switch engaged until the pump bypasses through the relief valve and note the pressure on the gauge at this time. If the rated relief pressure is not present during relief, adjust the high pressure relief valve setting as necessary. If the relief pressure is not attainable the relief valve must be cleaned and/or replaced or the pump is defective. See part "g" below.
- d. If the liftgate will not raise with a load on the platform but empty is raising slowly or only partially, the cylinder may be bypassing. To check for a bypassing cylinder do the following. Lower the gate to the ground to relieve all pressure from the cylinder. Disconnect the cylinder from the pusher. Press the "RAISE" switch until the cylinder is fully extended and then for 15 to 20 seconds and watch for a steady stream of fluid coming out of the breather port. Replace or rebuild any cylinders with fluid coming out of the breather port, as this indicates fluid is bypassing the piston seals on the cylinder. Reconnect rebuilt or replaced cylinder and hoses as before.
- e. Broken or punctured hydraulic lines and fittings must be replaced with care to avoid injury from high pressure oil streams.
- f. With the liftgate at the ground, disconnect the power unit and remove the reservoir. Check to see if the suction tube is clogged or has fallen out of the pump base. Clean the screen or reattach the suction tube as required.
- g. If all else fails replace the power unit, it is probably worn out.

3. Problem - Liftgate will not lower

Causes -

- a. Defective lowering solenoid coil or valve
- b. Clogged or defective hydraulic lines, fittings or flow controls

Corrections -

- a. With the "LOWER" switch engaged check for voltage on the green wire at the switch. If no voltage is present replace the switch. If voltage is present, with the "LOWER" switch engaged, check for voltage at the green wire on the lower solenoid valve coil terminal. If no voltage is present, the green wire from the "LOWER" switch is loose or broken and needs replaced. If there is voltage (minimum of 9.5 volts) and the valve is not opening to allow the gate to lower, either the lower coil is bad or the entire lower coil/valve assembly is bad. To check to see if the coil is defective, remove the green wire from the spade terminal on the lower coil and check for continuity between the spade terminal and the nut, which holds the coil on the valve stem. If continuity does not exist, replace the defective coil, otherwise replace the defective lower coil/valve assembly.
- b. Remove any obstruction in the hoses, fittings or flow controls or replace any hose, fitting or flow control, which does not allow fluid to flow through freely.

4. Problem - Liftgate raises slowly - The raise speed of the TVL125/16 on a 56" bed height while empty at 70° F is approximately 18-20 seconds. The raise speed loaded for the same conditions is approximately 28-30 seconds.

- Causes -
- a. Overload condition
 - b. Cold weather
 - c. Partially blocked suction screen
 - d. Lift cylinder is bypassing
 - e. Improperly adjusted or defective raise relief valve
 - f. Low voltage and/or bad ground
 - g. Worn out pump
- Corrections -
- a. See section 2b
 - b. Refer to Owner's Manual for alternative oils to use for cold weather conditions.
 - c. Remove reservoir and clean or replace suction screen as necessary.
 - d. See section 2d
 - e. See section 2c
 - f. The minimum voltage between the motor stud and ground is 9.5 volts at maximum load conditions. See section 1b and 1c.
 - g. After all other corrections are performed it will be necessary to replace the pump.

5. Problem - Foamy oil flowing from reservoir breather

- Causes -
- a. Air is present in the system

- Corrections -
- a. This can occur if air enters the system if the fluid level is low, see problem 2, part a, or if the suction tube is disconnected, see problem 2, part f. Also air may enter through fittings, which are not tightened properly, so check for any leaks around fittings or hoses. Once the source of the air is determined, the cylinder must be bled of all air. Most air can be removed from the system by lowering the gate to the ground to relieve all pressure from the cylinder, unpinning the cylinder and cycling it back and forth several times from fully extended to fully retracted and allowing the pump to bypass through the relief valves for a few seconds in each direction.

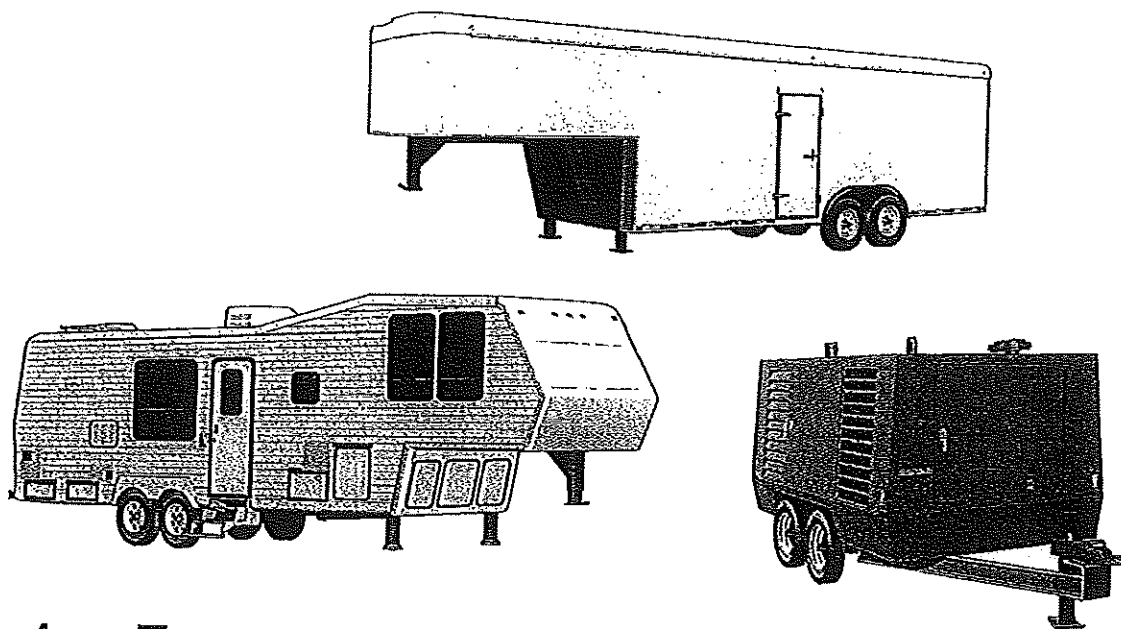
6. Problem - Liftgate chatters when raising or lowering

- Causes -
- a. Inadequate lubrication between sliders and rails
 - b. Rail wear surfaces are dirty & contaminated
 - c. Wear pads are worn down or embedded with contaminants
 - d. Wear pad mounting screws are loose
 - e. Platform chains are not in equal tension

- Corrections -
- a. The rails should be lubricated on a regular basis. See the Owner's Manual for the type and frequency of lubrication. Use lubrication holes at the top of each rail for optimum lubrication dispersal. **DO NOT USE GREASE!**
 - b. If lubrication of the rails does not eliminate the chattering it may be necessary to completely clean the rails and slider wear pads. The sliders should be removed from the rails to thoroughly clean the rails and pads. Use a degreaser to accomplish this. Lubricate the pads and rails before reassembly. See step c.
 - c. If the wear pads are worn down to the mounting screw heads or if they are embedded with contaminants it will be necessary to replace them at this time.
 - d. Apply a thread locker loctite to the threads of the screws and tighten.
 - e. Adjust the platform support chains so they are in equal tension.

If you have any questions or problems that are not covered in this guide please call Thieman's Engineering Department at 1-800-524-5210.

GENERAL APPLICATIONS



5500 - 7000 LBS. CAPACITY

AXLE TYPES

5500-7000 lbs. capacity

- Complete service manual
- Precision machined, forged steel spindles
- Precision machined integral cast iron hub/drums
- 8-bolt and 6 bolt (UTG) hubs available
- Standard grease; optional oil bath; E-Z Lube® or Nev-R-Lube™ option
- Press-In wheel studs (8-bolt)
- 12 x 2" CSA approved electric brakes (at 6000#), 12 x 2" hydraulic brakes
- Brakes are available with and without parking feature
- Hydraulic free backing brakes available
- Hydraulic brakes - uni-servo and duo-servo available
- Inner wiring system for easier installation and protection of brake wiring
- Heavy wall 3" diameter tube
- Straight or Drop spindles (4" drop only)

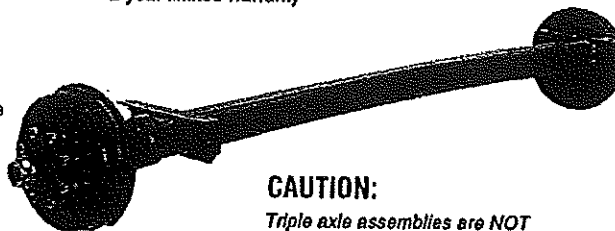
TORFLEX®

- Totally rubber-cushioned for smooth, quiet independent ride
- Easy installation with less maintenance
- Less transfer of road shock which insulates cargo from road shocks and vibration
- Self-damping action
- Load-carrying cross member
- Rubber cords compounded for maximum dependability and durability
- Independent wheel suspension system
- 5 year limited warranty on suspension system
- Low profile for maximum road clearance
- Various starting angles to control trailer height

D60 & D70 LEAF SPRING



- High quality alloy steel springs in a variety of capacities
- Single, tandem or triple axle assemblies with equalized suspensions
- Slipper spring or double eye leaf spring suspension
- Optional hanger and attaching parts kits available
- Durable, wear-resistant components
- 2 year limited warranty



CAUTION:

Triple axle assemblies are NOT recommended for Torflex® axles.

- High and low profile brackets with optional mounting brackets are available
- Rubber cushioning eliminates metal-to-metal contact
- Shock absorption provided by the natural hysteresis of rubber
- Single or tandem axle assemblies (triple assemblies are not recommended)
- Durable, wear-resistant components

DEXTER AXLE

LEAF SPRING APPLICATION INFORMATION

DOUBLE EYE SPRINGS

For standard 33" axle spacing
Single A/P-122
Tandem A/P-233
Triple A/P-335
Spring Length

	21"	24"	26"
A	19.62	23.50	25.75
B	25.00	27.50	29.50
C	28.75	31.00	33.00
D	10.62	12.00	13.00
E	28.75	31.00	33.00

For optional 35" axle spacing
X Tandem A/P-264
Triple A/P-364
Spring Length

	21"	24"	26"
B	26.00	28.50	30.50
C	30.80	33.00	35.00
D	10.62	12.00	13.00
E	30.80	33.00	35.00

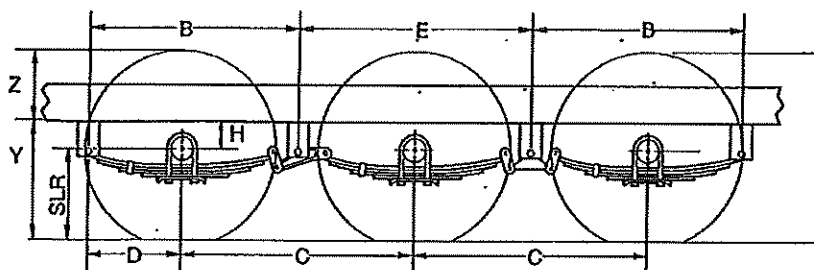
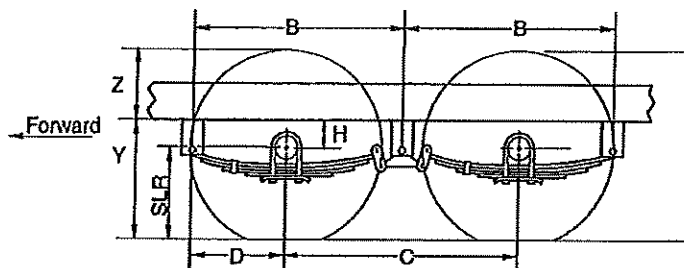
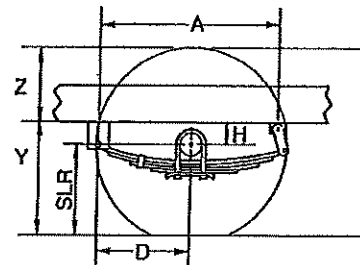
D60 OVERHANG PER SIDE

	Min.	Disc.*	Max.
Straight	6.63"	9.00"	10.00"
4" Drop-Short	7.87"	9.00"	10.00"
4" Drop	8.25"	9.00"	10.00"
Nev-R-Lube™	6.19"	9.00"	10.00"

* Minimum overhang with disc brakes

D70 OVERHANG PER SIDE

	Min.	Max.
Straight	6.63"	9.00"
4" Drop	7.87"	9.00"
Nev-R-Lube™	6.37"	9.00"

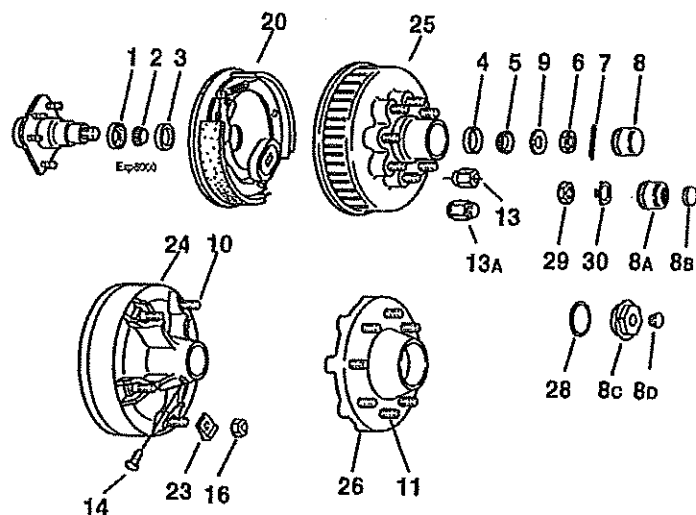


DOUBLE EYE AXLE ASSEMBLIES

Hanger Kits		Quantity Per Kit X				
Part No.	Description	Ht.	HGR-104	HGR-105	HGR-248	HGR-249 HGR-348
028-005-00	Hanger	3.25"	2	....	4	2 4
028-006-00	Front Hanger	1.44"	....	2	....	....
029-008-00	Front Hanger	2.06"	....	....	....	4
029-031-00	Center Hanger	3.62"	....	....	2	.... 4
030-020-00	Rear Hanger	.91"	2	2	....	....
Attaching Parts Kit		X				
Part No.	Description	A/P-122	A/P-233	A/P-264†	A/P-335	A/P-364†
006-092-01	Flange Locknut	6	14	14	22	22
007-126-00	Shackle Bolt	2	6	6	10	10
013-104-02	Equalizer	....	2	....	2	....
013-105-02	Equalizer	....	....	....	2	....
013-122-02	Equalizer	....	....	2	....	2
013-128-02	Equalizer	....	....	....	....	2
018-011-00	Shackle Link	....	4	4	6	6
018-012-00	Shackle Link, Long	2	....	....	....	....
018-020-00	Shackle Link Assy.	....	4	4	6	6
018-021-00	Shackle Link Assy., Long	2	....	....	....	....

† For 35" axle spacing using 26" springs

865 AND DEMOUNTABLE HUB GROUP



GREASE LUBE PARTS

Item	Part No.	Description
1	010-054-00	Grease Seal 2.25"
1	010-036-00	E-Z Lube Seal 2.25"
2	031-030-02	25580 Inner Bearing Cone
3	031-030-01	25520 Inner Bearing Cup
4	031-017-01	14276 Outer Bearing Cup - 865 Hub
4	031-029-01	15245 Outer Bearing Cup - UTG Hub
5	031-029-02	15123 Outer Bearing Cone - UTG Hub
5	031-017-02	14125A Outer Bearing Cone - 865 Hub
6	006-001-00	Spindle Nut
7	018-002-00	Collar Pin (not used on E-Z Lube)
8	021-001-00	Grease Cap - UTG Hub
8	021-038-00	Grease Cap - 865 Hub
8A	021-042-01	Grease Cap E-Z Lube-UTG
8A	021-042-02	Grease Cap E-Z Lube Chrome Option-UTG
8A	021-043-01	Grease Cap E-Z Lube-865 Hub
8A	021-043-02	Grease Cap E-Z Lube Chrome Option-865 Hub
8B	085-001-00	E-Z Lube Rubber Plug
9	005-057-00	Spindle Washer
10	006-005-00	1/4-18 Nut for Rim Clamp
23	015-002-00	Rim Clamp
29	008-191-00	Special Jam Nut for E-Z Lube (after 2002)
30	006-190-00	Spindle Nut Retainer for E-Z Lube (after 2002)

OIL LUBE PARTS

Item	Part No.	Description
1	010-063-00	Oil Seal 2.25"
2	031-030-02	25580 Inner Bearing Cone
3	031-030-01	25520 Inner Bearing Cup
4	031-017-01	14276 Outer Bearing Cup - 865 Hub
4	031-029-01	15245 Outer Bearing Cup - UTG Hub
5	031-029-02	15123 Outer Bearing Cone
5	031-017-02	14125A Outer Bearing Cone
6	006-001-00	Spindle Nut
7	018-002-00	Collar Pin
8C	021-035-00	Oil Cap (865 Hub)
ns	021-040-00	Oil Cap (UTG Hub)
8D	046-032-00	Oil Cap Plug
9	005-057-00	Spindle Washer
14	046-052-00	Oil Filler Plug (865 and demountable)
ns	046-032-00	Oil Cap Plug
16	006-005-00	1/4-18 Nut for Rim Clamp
23	015-002-00	Rim Clamp
28	010-045-00	865 'O' Ring
ns	010-059-00	UTG 'O' Ring

ns - not shown

HUBS

Item	Part No.	Description	Bolt Circle
Hubs and Drums			
24	008-174-05	Grease 1/4" stud	Demountable
24	008-174-06	Oil 1/4" stud	Demountable
25	008-219-04	Grease 1/2" stud	8 on 6.50
25	008-219-13	Grease 1/4" stud	8 on 6.50
25	008-219-18	Grease 1/4" stud	8 on 6.50
25	008-219-09	Oil 1/2" stud	8 on 6.50
25	008-219-20	Oil 1/4" stud	8 on 6.50
25	008-219-26	Oil 1/4" stud	8 on 6.50
Plain Hubs			
26	008-231-09	Grease 1/2" stud	8 on 6.50
26	008-231-18	Grease 1/4" stud	8 on 6.50
26	008-231-20	Grease 1/4" stud	8 on 6.50
26	008-231-16	Oil 1/4" stud	8 on 6.50

BRAKES

Item	Part No.	Description
20	K23-105-00/K23-106-00	LH/RH DXG Electric-6K
20	K23-180-00/K23-181-00	LH/RH Electric-7K
ns	K23-338-00/K23-339-00	LH/RH Hyd. Uni-servo-7K
ns	K23-334-00/K23-335-00	LH/RH Hyd. Uni-servo w/park-7K
ns	K23-336-00/K23-337-00	LH/RH Hyd. Duo-servo-7K
ns	K23-332-00/K23-333-00	LH/RH Hyd. Duo-servo w/park-7K
ns	K23-342-00/K23-343-00	LH/RH Hyd. Uni-servo FB-7K
ns	K23-340-00/K23-341-00	LH/RH Hyd. Uni-servo FB w/park-7K
ns	K23-328-00/K23-327-00	LH/RH Electric 6K CSA

STUDS & WHEEL NUTS

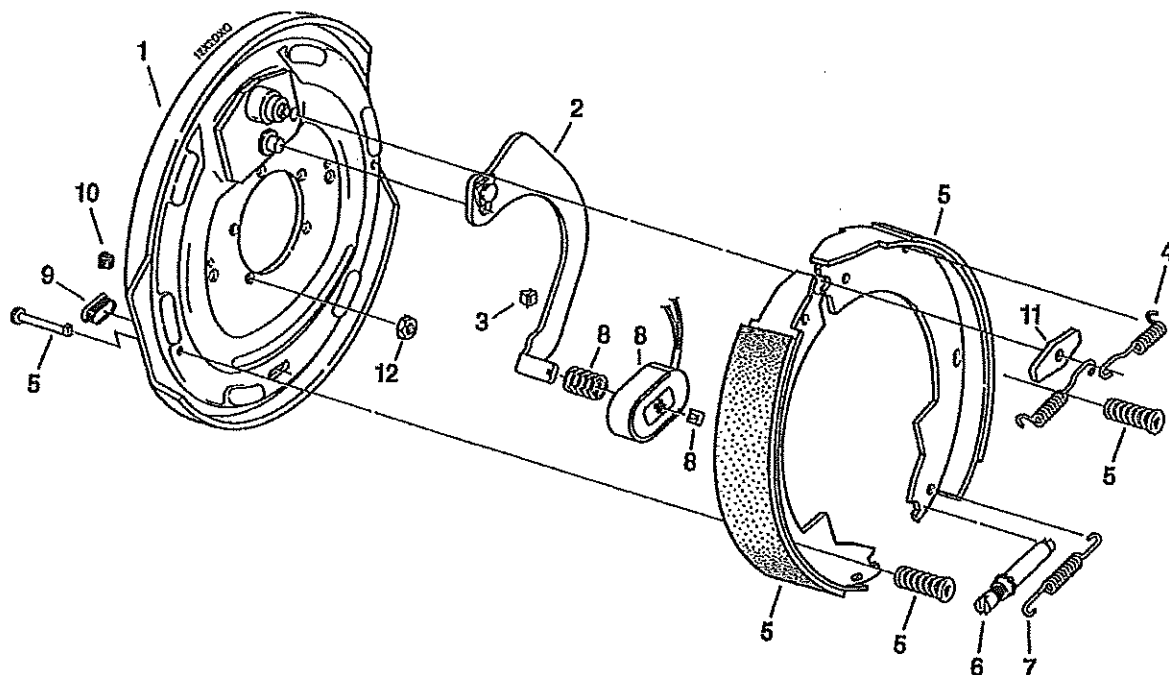
Item	Part No.	Description
10	025-011-00	1/4-18 Stud - UTG
11	007-122-00	1/2-20 x 1.84 Long Press-In Stud* (hubs prior to 1/04)
11	007-282-00	1/2-20 x 2.50 Long Press-In Stud* (hubs after 1/04)
13	006-080-00	1/2-20 60° Cone Nut
13A	006-088-00	1/2-20 Stainless Steel Capped Wheel Nut
ns	007-132-00	1/4-18 Press-In Stud
ns	006-053-00	1/4-18 60° Cone Nut
ns	007-232-00	1/4-18 Press-In Stud
ns	006-109-00	1/4-18 90° Cone Nut

* Stud length measured under head to end of stud.

Note: 6 on 5.5 hubs are available on these axles. See section in 4000-6000 lbs. category.

5500 - 7000 LBS. CAPACITY

12x2" ELECTRIC BRAKE



DXQ ELECTRIC BRAKE 6000#

Item	Part No.	Qty/Brk	Description
0	K23-105-00	1	LH Complete Brake Assembly
0	K23-106-00	1	RH Complete Brake Assembly
1	036-089-05	1	Backing Plate Assembly
2	047-107-05	1	LH Actuating Lever Arm Assembly
2	047-108-05	1	RH Actuating Lever Arm Assembly
3	027-005-00	2	Wire Clip
4	046-009-00	2	Retractor Spring
5	K71-048-00	1	Shoe and Lining Kit containing: 1 #040-044-00 Primary S&L 1 #040-045-00 Secondary S&L 2 #040-011-00 Shoe Hold Down Pin #2 2 #048-077-00 Shoe Hold Down Spring & Cup
6	043-004-00	1	Adjuster Assembly
7	048-018-00	1	Adjusting Screw Spring
8	K71-105-00	1	Magnet Kit containing: 1 #042-099-01 Magnet (white wire) 1 #027-009-00 Magnet Clip 1 #046-080-00 Magnet Spring
9	046-007-00	1	Adjuster Slot Plug
10	046-016-00	1	Wire Grommet
11	005-067-00	1	Anchor Post Washer
*12	006-193-00	5	Nut Washer Assembly

* Not Included with complete brake assembly. Items sold separately.

ELECTRIC BRAKE 6000#

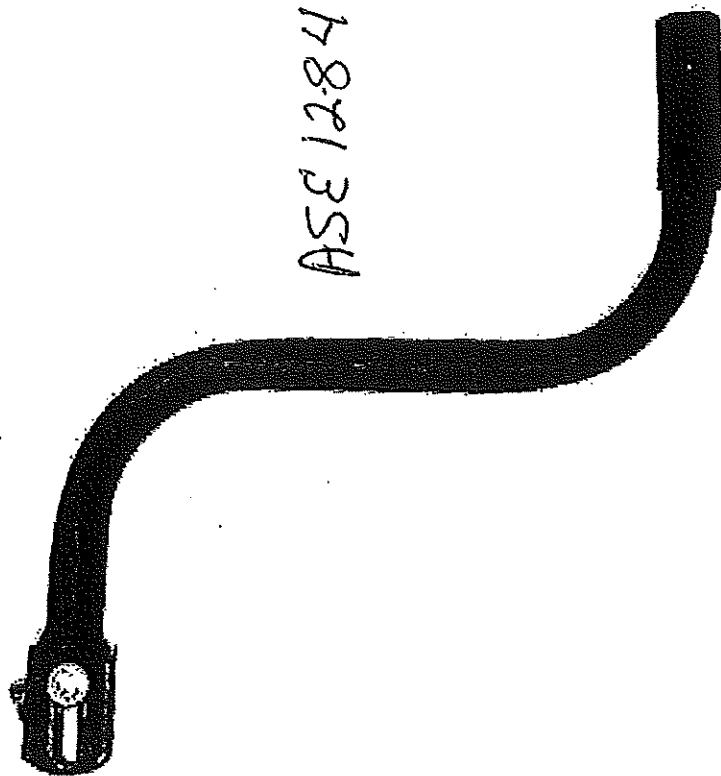
Item	Part No.	Qty/Brk	Description
0	K23-326-00	1	LH Complete Brake Assembly, Non Asbestos
0	K23-327-00	1	RH Complete Brake Assembly, Non Asbestos
1	036-089-05	1	Backing Plate Assembly
2	047-107-05	1	LH Actuating Lever Arm Assembly
2	047-108-05	1	RH Actuating Lever Arm Assembly
3	027-005-00	2	Wire Clip
4	046-009-00	2	Retractor Spring
5	K71-127-00	1	Shoe and Lining Kit containing: 1 #040-215-00 Primary S&L 1 #040-216-00 Secondary S&L 2 #040-011-00 Shoe Hold Down Pin #2 2 #048-077-00 Shoe Hold Down Spring & Cup
6	043-004-00	1	Adjuster Assembly
7	048-018-00	1	Adjusting Screw Spring
8	K71-105-00	1	Magnet Kit containing: 1 #042-099-01 Magnet (white wire) 1 #027-009-00 Magnet Clip 1 #046-080-00 Magnet Spring
9	046-007-00	1	Adjuster Slot Plug
10	046-016-00	1	Wire Grommet
11	005-067-00	1	Anchor Post Washer
*12	006-193-00	5	Nut Washer Assembly

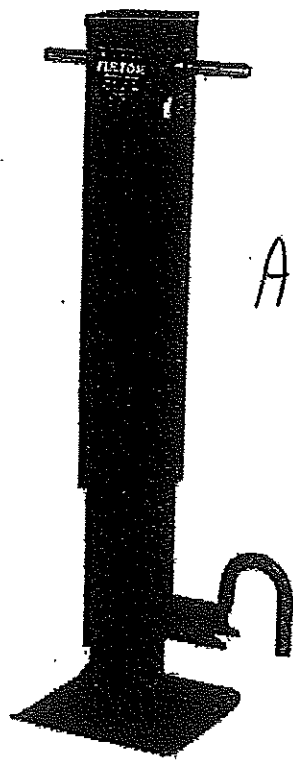
CSA approved at 6000#/14.2 SLR

These brakes are rated to a maximum capacity of 6000 lbs. / pair

DEXTER AXLE

ASE 12-8401





ASE 128405

**SPECIFICATION FOR 12000 GVW
TOMIHAWK TRAILER**

TOMIHAWK TRAILER

Tandem Axle = Heavy Duty

Capacity:

Tandem axle: 12,000 GVW

Size:

Tongue: 60 inches long

Bed: Tandem axle: 96" W by 15'

Bed and Frame: Shall be all steel construction with a minimum of 3" channel on 16" centers. Main rails shall be C7 * 12.25 pounds on 10' and 12' trailer beds and C7 * 12.25 pounds on 15' trailer beds. The deck shall be covered with 1/4-inch thick diamond tread plate with rolled over edges.

Tires:

Tandem axle:

FIVE LT235/85R/16G tires on 16 x 8 CONV 8 bolt rims (Load Range "G" - 8LUG). Rims must be supplied with HI-PRES bolt in valve. One tire & rim to be mounted as spare.

Coupler Hitch: Adjustable position ball type hitch with 2-5/16 ball or Pintle and High test safety chains.

Tongue Jack: 12,000 lb. rated SWQ 180 DL-B W / SR firmly attached through tongue.

Brakes: Electrical brakes on all axles with emergency break-away switch and 12-volt battery for independent operation of brakes.

Lights & Electrical: Tail and running lights provided in accordance with ICC regulations with all wiring run in protective conduit. License plate mounting bracket attached and six-way male connecting plug with matching female plug provided.

Paint: Unless otherwise specified, one coat of Gray primer with one finish coat of Wheatland yellow.

Hoist & Tie Downs: Hydraulically operated hoist provided on bracket situated to lift applicator onto and off trailer. Tie down chains attached to bed of trailer.

**TOMIHAWK TRAILER
SPECIFICATION CONTINUED**

Provisions shall be made for mounting two 100 lb. and two 20 lb. L.P. gas tanks in the tongue section of the trailer. An upright bracket shall be provided to anchor the two 100 lb. tanks in which will be run the necessary piping and shut-off valves and flex lines.

Optional Equipment:

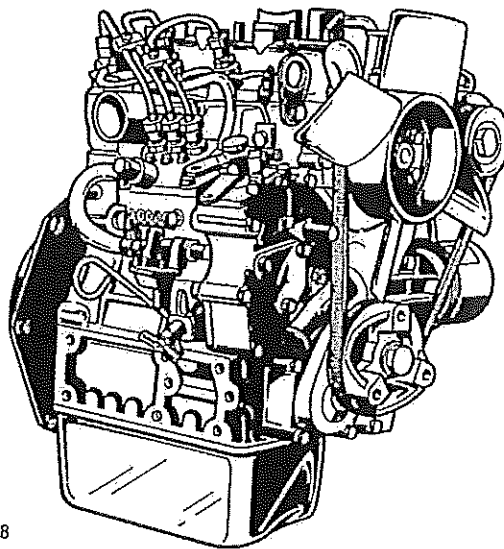
- (1) Rotating flashing light (available with Honda and Kubota engines only)
- (2) Strobe light (available with Honda and Kubota engines only)
- (3) Ten pound fire extinguisher
- (4) Die storage box
- (5) 3' x 5' Arrowboard (available with Kubota engines only)

OPERATOR'S MANUAL

ENGLISH

KUBOTA DIESEL ENGINE

MODELS Z482-E · Z602-E
D662-E · D722-E
D782-E · D902-E



B-1418

READ AND SAVE THIS BOOK

Kubota

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FOREWORD

You are now the proud owner of a KUBOTA Engine. This engine is a product of KUBOTA quality engineering and manufacturing. It is made of fine materials and under a rigid quality control system. It will give you long, satisfactory service. To obtain the best use of your engine, please read this manual carefully. It will help you become familiar with the operation of the engine and contains many helpful hints about engine maintenance. It is KUBOTA's policy to utilize as quickly as possible every advance in our research. The immediate use of new techniques in the manufacture of products may cause some small parts of this manual to be outdated. KUBOTA distributors and dealers will have the most up-to-date information. Please do not hesitate to consult with them.



SAFETY FIRST

This symbol, the industry's "Safety Alert Symbol", is used throughout this manual and on labels on the machine itself to warn of the possibility of personal injury. Read these instructions carefully. It is essential that you read the instructions and safety regulations before you attempt to assemble or use this unit.



DANGER : Indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury.



WARNING : Indicates a potentially hazardous situation which, if not avoided, **COULD** result in death or serious injury.



CAUTION: Indicates a potentially hazardous situation which, if not avoided, **MAY** result in minor or moderate injury.

IMPORTANT : Indicates that equipment or property damage could result if instructions are not followed.

NOTE : Gives helpful information.



SAFE OPERATION

Careful operation is your best assurance against an accident. Read and understand this section carefully before operating the engine. All operators, no matter how much experience they may have, should read this and other related manuals before operating the engine or any equipment attached to it. It is the owner's obligation to provide all operators with this information and instruct them on safe operation.

Be sure to observe the following for safe operation.

1. OBSERVE SAFETY INSTRUCTIONS

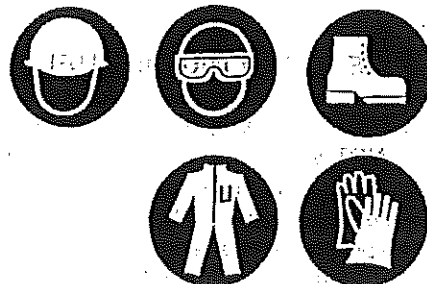
- Read and understand carefully this "OPERATOR'S MANUAL" and "LABELS ON THE ENGINE" before attempting to start and operate the engine.
- Learn how to operate and work safely. Know your equipment and its limitations. Always keep the engine in good condition.
- Before allowing other people to use your engine, explain how to operate and have them read this manual before operation.
- DO NOT modify the engine. UNAUTHORIZED MODIFICATIONS to the engine may impair the function and/or safety and affect engine life. If the engine does not perform properly, consult your local Kubota Engine Distributor first.



1AAACAAAP008B

2. WEAR SAFE CLOTHING AND PERSONAL PROTECTIVE EQUIPMENT (PPE)

- DO NOT wear loose, torn or bulky clothing around the machine that may catch on working controls and projections or into fans, pulleys and other moving parts causing personal injury.
- Use additional safety items-PPE, e.g. hard hat, safety protection, safety goggles, gloves, etc., as appropriate or required.
- DO NOT operate the machine or any equipment attached to it while under the influence of alcohol, medication, or other drugs, or while fatigued.
- DO NOT wear radio or music headphones while operating the engine.



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2 SAFE OPERATION

3. CHECK BEFORE STARTING & OPERATING THE ENGINE

- Be sure to inspect the engine before operation. Do not operate the engine if there is something wrong with it. Repair it immediately.
- Ensure all guards and shields are in place before operating the engine. Replace any that are damaged or missing.
- Check to see that you and others are a safe distance from the engine before starting.
- Always keep the engine at least 3 feet (1 meter) away from buildings and other facilities.
- DO NOT allow children or livestock to approach the machine while the engine is running.
- DO NOT start the engine by shorting across starter terminals. The machine may start in gear and move. Do not bypass or defeat any safety devices.



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4. KEEP THE ENGINE AND SURROUNDINGS CLEAN

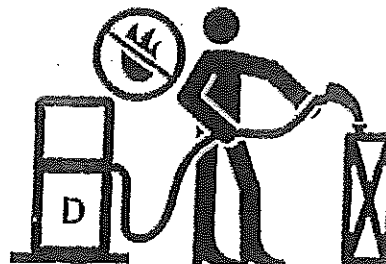
- Be sure to stop the engine before cleaning.
- Keep the engine clean and free of accumulated dirt, grease and trash to avoid a fire. Store flammable fluids in proper containers and cabinets away from sparks and heat.
- Check for and repair leaks immediately.
- DO NOT stop the engine without idling; Allow the engine to cool down, first. Keep the engine idling for about 5 minutes before stopping unless there is a safety problem that requires immediate shut down.



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5. SAFE HANDLING OF FUEL AND LUBRICANTS -KEEP AWAY FROM FIRE

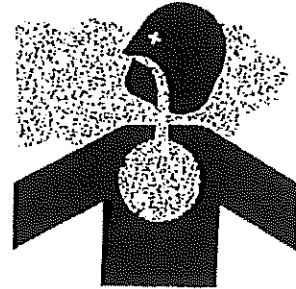
- Always stop the engine before refueling and/or lubricating.
- DO NOT smoke or allow flames or sparks in your work area. Fuel is extremely flammable and explosive under certain conditions.
- Refuel at a well ventilated and open place. When fuel and/or lubricants are spilled, refuel after letting the engine cool down.
- DO NOT mix gasoline or alcohol with diesel fuel. The mixture can cause a fire or severe engine damage.
- Do not use unapproved containers e.g. buckets, bottles, jars. Use approved fuel storage containers and dispensers.



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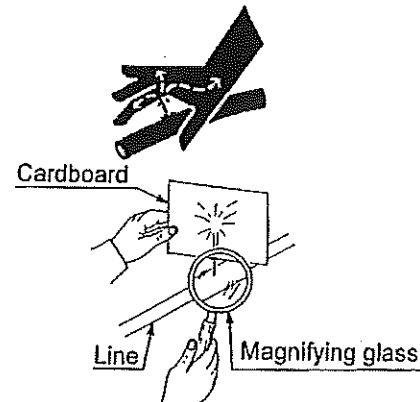
6. EXHAUST GASES & FIRE PREVENTION

- Engine exhaust fumes can be very harmful if allowed to accumulate. Be sure to run the engine in a well ventilated location and where there are no people or livestock near the engine.
- The exhaust gas from the muffler is very hot. To prevent a fire, do not expose dry grass, mowed grass, oil or any other combustible materials to exhaust gas. Keep the engine and muffler clean at all times.
- To avoid a fire, be alert for leaks of flammable substances from hoses and lines. Be sure to check for leaks from hoses or pipes, such as fuel and hydraulic fluid by following the maintenance check list.
- To avoid a fire, do not short across power cables and wires. Check to see that all power cables and wirings are in good condition. Keep all electrical connections clean. Bare wire or frayed insulation can cause a dangerous electrical shock and personal injury.



7. ESCAPING FLUID

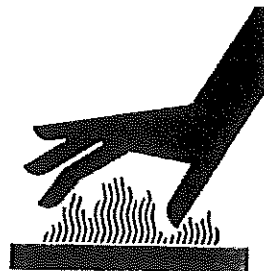
- Relieve all pressure in the air, the oil and the cooling systems before disconnecting any lines, fittings or related items.
- Be cautious of possible pressure relief when disconnecting any device from a pressurized system that utilizes pressure. DO NOT check for pressure leaks with your hand. High pressure oil or fuel can cause personal injury.
- Escaping fluid under pressure has sufficient force to penetrate skin causing serious personal injury.
- Fluid escaping from pinholes may be invisible. Use a piece of cardboard or wood to search for suspected leaks; do not use hands and body. Use safety goggles or other eye protection when checking for leaks.
- If injured by escaping fluid, see a medical doctor immediately. This fluid can produce gangrene or severe allergic reaction.



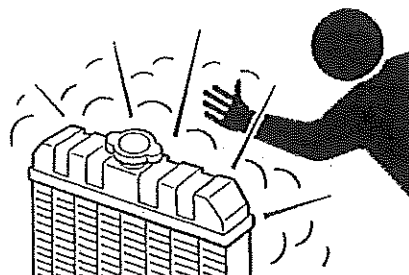
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8. CAUTIONS AGAINST BURNS & BATTERY EXPLOSION

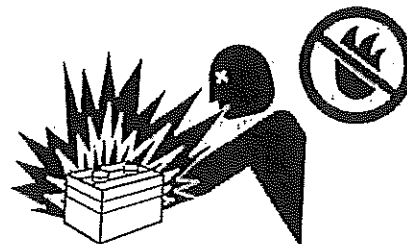
- To avoid burns, be cautious of hot components, e.g. muffler, muffler cover, radiator, hoses, engine body, coolants, engine oil, etc. during operation and after the engine has been shut off.
 - DO NOT remove the radiator cap while the engine is running or immediately after stopping. Otherwise hot water will spout out from the radiator. Wait until the radiator is completely cool to the touch before removing the cap. Wear safety goggles.
 - Be sure to close the coolant drain valve, secure the pressure cap, and fasten the pipe band before operating. If these parts are taken off, or loosened, it will result in serious personal injury.
 - The battery presents an explosive hazard. When the battery is being charged, hydrogen and oxygen gases are extremely explosive.
 - DO NOT use or charge the battery if its fluid level is below the LOWER mark.
- Otherwise, the component parts may deteriorate earlier than expected, which may shorten the service life or cause an explosion. Immediately, add distilled water until the fluid level is between the UPPER and LOWER marks.
- Keep sparks and open flames away from the battery, especially during charging. DO NOT strike a match near the battery.
 - DO NOT check the battery charge by placing a metal object across the terminals. Use a voltmeter or hydrometer.
 - DO NOT charge a frozen battery. There is a risk of explosion. When frozen, warm the battery up to at least 16°C (61°F).



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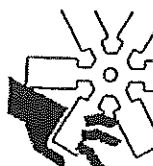
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9. KEEP HANDS AND BODY AWAY FROM ROTATING PARTS

- Be sure to stop the engine before checking or adjusting the belt tension and cooling fan.
- Keep your hands and body away from rotating parts, such as the cooling fan, V-belt, fan drive V-belt, pulley or flywheel. Contact with rotating parts can cause severe personal injury.
- DO NOT run the engine without safety guards. Install safety guards securely before operation.



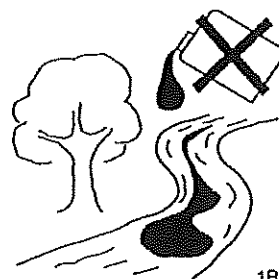
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10. ANTI-FREEZE & DISPOSAL OF FLUIDS

- Anti-freeze contains poison. Wear rubber gloves to avoid personal injury. In case of contact with skin, wash it off immediately.
- DO NOT mix different types of Anti-freeze. The mixture can produce a chemical reaction causing harmful substances. Use approved or genuine KUBOTA Anti-freeze.
- Be mindful of the environment and the ecology. Before draining any fluids, determine the correct way to dispose of them. Observe the relevant environmental protection regulations when disposing of oil, fuel, coolant, brake fluid, filters and batteries.
- When draining fluids from the engine, place a suitable container underneath the engine body.
- DO NOT pour waste onto the ground, down a drain, or into any water source. Dispose of waste fluids according to environmental regulations.



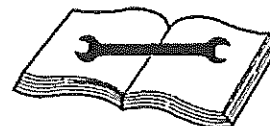
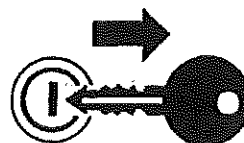
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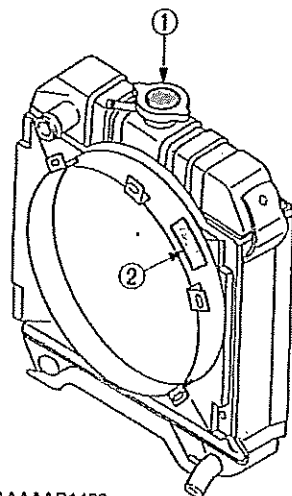
11. CONDUCTING SAFETY CHECKS & MAINTENANCE

- When inspecting the engine or servicing, place the engine on a large flat surface. DO NOT work on anything that is supported ONLY by lift jacks or a hoist. Always use blocks or the correct stands to support the engine before servicing.
- Disconnect the battery from the engine before conducting service. Put a "DO NOT OPERATE!" tag on the key switch to avoid accidental starting.
- To avoid sparks from an accidental short circuit always disconnect the battery's ground cable (-) first and reconnect it last.
- Be sure to stop the engine and remove the key when conducting daily and periodic maintenance, service and cleaning.
- Check or conduct maintenance after the engine, coolant, muffler, or muffler cover have cooled off completely.
- Always use the appropriate tools and fixtures. Verify that they are in good condition before performing any service work. Make sure you understand how to use them before service.
- Use ONLY correct engine barring techniques for manually rotating the engine. DO NOT attempt to rotate the engine by pulling or prying on the cooling fan and V-belt. This practice can cause serious personal injury or premature damage to the cooling fan and belt.
- Replace fuel pipes and lubricant pipes with their hose clamps every 2 years or earlier whether they are damaged or not. They are made of rubber and age gradually.
- When servicing is performed together by two or more persons, take care to perform all work safely.
- Keep a first aid kit and fire extinguisher handy at all times.



1BJABAAAP0200

12. WARNING AND CAUTION LABELS



1ABAAAAAP1480

- ① Part No.19077-8724-1 or 16667-8724-1
(55mm in diameter) (37mm in diameter)



1ABAAAAAP1490

- ② Part No.TA040-4957-1
Stay clear of engine
fan and fan belt



1ABAAAAAP1500

13. CARE OF WARNING AND CAUTION LABELS

1. Keep warning and caution labels clean and free from obstructing material.
2. Clean warning and caution labels with soap and water, dry with a soft cloth.
3. Replace damaged or missing warning and caution labels with new labels from your local KUBOTA dealer.
4. If a component with warning and caution label(s) affixed is replaced with a new part, make sure the new label(s) is (are) attached in the same location(s) as the replaced component.
5. Mount new warning and caution labels by applying to a clean dry surface and pressing any bubbles to the outside edge.

SERVICING OF THE ENGINE

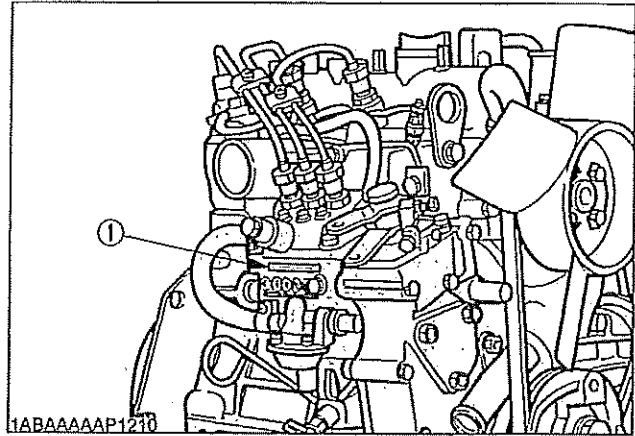
Your dealer is interested in your new engine and has the desire to help you get the most value from it. After reading this manual thoroughly, you will find that you can do some of the regular maintenance yourself.

However, when in need of parts or major service, be sure to see your KUBOTA dealer.

For service, contact the KUBOTA Dealership from which you purchased your engine or your local KUBOTA dealer. When in need of parts, be prepared to give your dealer the engine serial number.

Locate the serial number now and record them in the space provided.

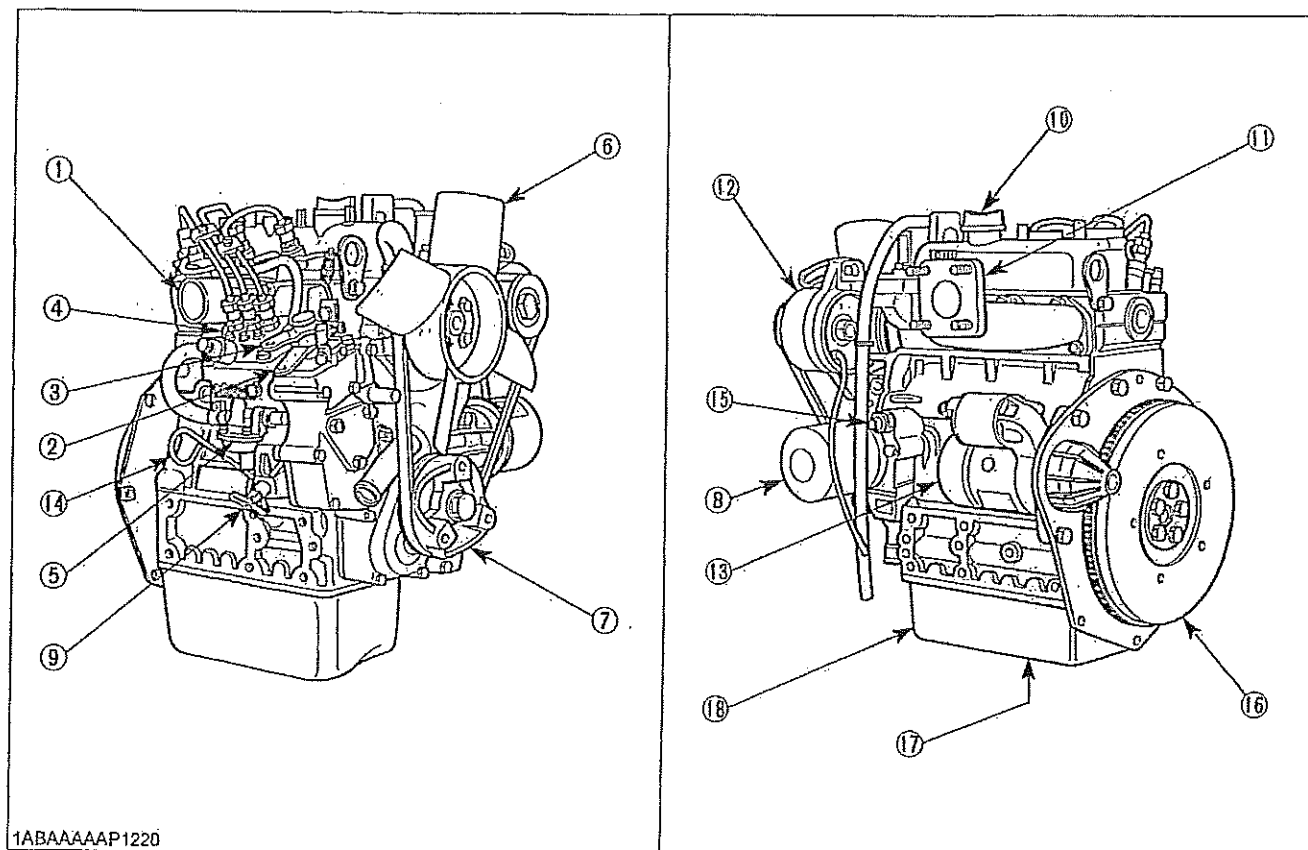
	Type	Serial No.
Engine		
Date of Purchase		
Name of Dealer		
(To be filled in by purchaser)		



(1) Engine serial number

2 NAMES OF PARTS

NAMES OF PARTS



1ABAAAAAP1220

- (1) Intake manifold
- (2) Speed control lever
- (3) Engine stop lever
- (4) Injection pump
- (5) Fuel feed pump
- (6) Cooling fan
- (7) Fan drive pulley
- (8) Oil filter cartridge
- (9) Water drain cock

- (10) Oil filler plug
- (11) Exhaust manifold
- (12) Alternator
- (13) Starter
- (14) Oil level gauge
- (15) Oil pressure switch
- (16) Flywheel
- (17) Oil drain plug
- (18) Oil pan

PRE-OPERATION CHECK

BREAK-IN

During the engine break-in period, observe the following by all means:

1. Change engine oil and oil filter cartridge after the first 50 hours of operation (See "ENGINE OIL" in Periodic Service Section).
2. When ambient temperature is low, operate the machine after the engine has been completely warmed up.

DAILY CHECK

To prevent trouble from occurring, it is important to know the conditions of the engine well. Check it before starting.



CAUTION

To avoid personal injury:

- Be sure to install shields and safeguards attached to the engine when operating.
- Stop the engine at a flat and wide space when checking.
- Keep dust or fuel away from the battery, wiring, muffler and engine to prevent a fire.

Check and clear them before operating everyday. Pay attention to the heat of the exhaust pipe or exhaust gas so that it can not ignite trash.

Item		Ref. page
1. Parts which had trouble in previous operation		-
2. By walking around the machine	(1) Oil or water leaks	13 to 15
	(2) Engine oil level and contamination	13
	(3) Amount of fuel	11
	(4) Amount of coolant	15
	(5) Dust in air cleaner dust cup	18
	(6) Damaged parts and loosened bolts and nuts	-
3. By inserting the key into the starter switch	(1) Proper functions of meters and pilot lamps; no stains on these parts	-
	(2) Proper function of glow lamp timer	-
4. By starting the engine	(1) Color of exhaust fumes	7
	(2) Unusual engine noise	7

OPERATING THE ENGINE

STARTING THE ENGINE(NORMAL)



CAUTION

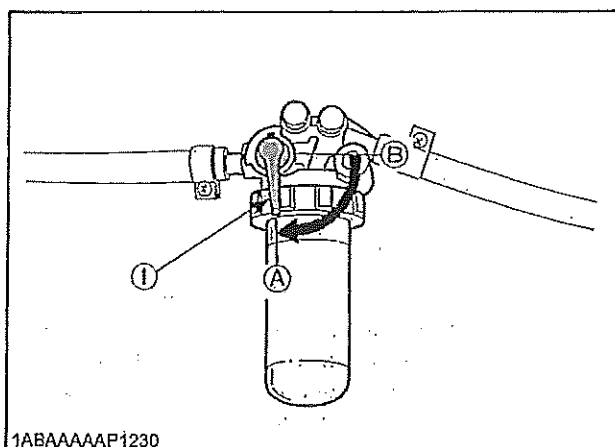
To avoid personal injury:

- Do not allow children to approach the machine while the engine is running.
- Be sure to install the machine on which the engine is installed, on a flat place.
- Do not run the engine on gradients.
- Do not run the engine in an enclosed area. Exhaust gas can cause air pollution and exhaust gas poisoning.
- Keep your hands away from rotating parts (such as fan, pulley, belt, flywheel etc.) during operation.
- Do not operate the machine while under the influence of alcohol or drugs.
- Do not wear loose, torn or bulky clothing around the machine. It may catch on moving parts or controls, leading to the risk of accident. Use additional safety items, e.g. hard hat, safety boots or shoes, eye and hearing protection, gloves, etc., as appropriate or required.
- Do not wear radio or music headphones while operating engine.
- Check to see if it is safe around the engine before starting.
- Reinstall safeguards and shields securely and clear all maintenance tools when starting the engine after maintenance.

IMPORTANT:

- Do not use ether or any starting fluid for starting the engine, or a severe damage will occur.
- When starting the engine after a long storage (of more than 3 months), first set the stop lever to the "STOP" position and then activate the starter for about 10 seconds to allow oil to reach every engine part.

1. Set the fuel lever to "ON".

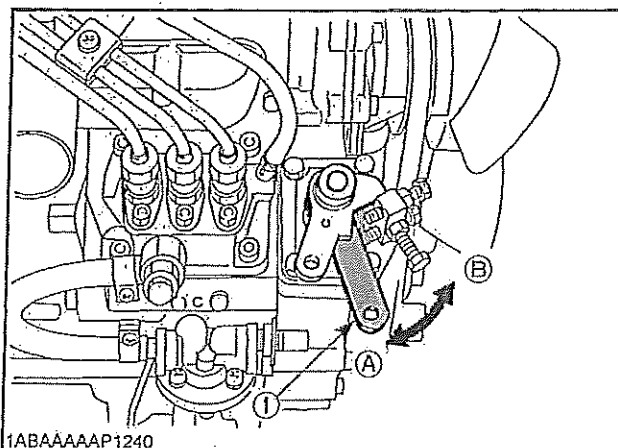


(1) Fuel lever

(A) "ON"

(B) "OFF"

2. Place the engine stop lever in the "START" position.
3. Place the speed control lever at more than half "OPERATION"

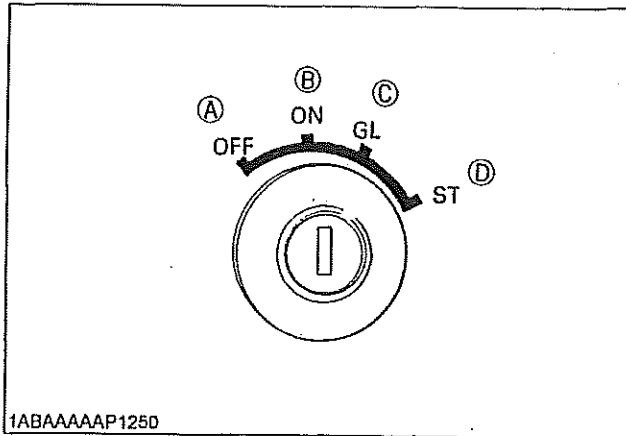


(1) Speed Control lever

(A) "OPERATION"

(B) "IDLING"

4. Insert the key into the key switch and turn it "ON".



- (A) "OFF" SWITCHED OFF
(B) "ON" OPERATION
(C) "GL" PREHEATING
(D) "ST" STARTING

5. Turn the starter switch to the "PREHEATING" position to allow the glow lamp to redden.
6. Turn the key to the "STARTING" position and the engine should start. Release the key immediately when the engine starts.
7. Check to see that the oil pressure lamp and charge lamp are off. If the lamps are still on, immediately stop the engine, and determine the cause.

(See "CHECKS DURING OPERATION" in Operating the Engine Section)

NOTE :

- If the oil pressure lamp should be still on, immediately stop the engine and check;
 - If there is enough engine oil.
 - if the engine oil has dirt in it.
 - if the wiring is faulty.

8. Warm up the engine at medium speed without load.

IMPORTANT :

- If the glow lamp should redden too quickly or too slowly, immediately ask your KUBOTA dealer to check and repair it.
- If the engine does not catch or start at 10 seconds after the starter switch is set at "STARTING" position, wait for another 30 seconds and then begin the engine starting sequence again. Do not allow the starter motor to run continuously for more than 20 seconds.

COLD WEATHER STARTING

If the ambient temperature is below* -5° C (23° F) and the engine is very cold, start it in the following manner: Take steps (1) through (4) left.

5. Turn the key to the "PREHEATING" position and keep it there for a certain period mentioned below.

IMPORTANT :

- Shown below are the standard preheating times for various temperatures. This operation, however, is not required, when the engine is warmed up.

Ambient temperature	Preheating time	
	Ordinary heat type	With glow lamp timer
Above 10° C (50° F)	NO NEED	See NOTE:
10° C (50° F) to -5° C (23° F)	Approx. 5 seconds	
*Below -5° C (23° F)	Approx. 10 seconds	
Limit of continuous use	20 seconds	

NOTE :

- In case of installing standard glow lamp, glow lamp goes off after about 6 seconds, when the starter switch key is turned to the "PREHEATING" position. However if necessary, keep the starter switch key at the "PREHEATING" position for longer time, according to the left recommendation.

6. Turn the key to the "STARTING" position and the engine should start.

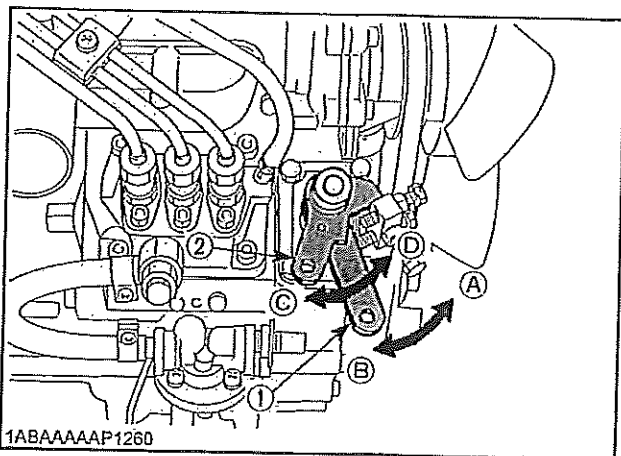
(If the engine fails to start after 10 seconds, turn off the key for 5 to 30 seconds. Then repeat steps (5) and (6).)

IMPORTANT :

- Do not allow the starter motor to run continuously for more than 20 seconds.
- Be sure to warm up the engine, not only in winter, but also in warmer seasons. An insufficiently warmed-up engine can shorten its service life.
- When there is fear of temperature dropping below -15° C (5° F) detach the battery from the machine, and keep it indoors in a safe area, to be reinstalled just before the next operation.

STOPPING THE ENGINE

1. Return the speed control lever to low idle, and run the engine under idling
2. Set the engine stop lever to "STOP" position.
3. With the starter switch placed at "OFF" position, remove the key. (Be sure to return the stop lever as it was after stopping the engine, and get ready for the next starting.)



- (1) Speed control lever (A) "IDLING"
 (2) Engine stop lever (B) "OPERATION"
 (C) "START"
 (D) "STOP"

CHECKS DURING OPERATION

While running, make the following checks to see that all parts work well.

■ Radiator Cooling water (Coolant)



WARNING

To avoid personal injury:

- Do not remove radiator cap until coolant temperature is well below its boiling point. Then loosen cap slightly to the stop position, to relieve any pressure, before removing cap completely.

When the engine overheats and hot coolant overflows through the radiator and hoses, stop the engine immediately and make the following checks to determine the cause of trouble:

Check item

1. Check to see if there is any water leak;
2. Check to see if there is any obstacle around the cooling air inlet or outlet;
3. Check to see if there is any dirt or dust between radiator fin and tube;
4. Check to see if the fan belt is too loose;
5. Check to see if radiator water pipe is clogged;
6. Check to see if anti-freeze is mixed into coolant in warm seasons;

■ Oil pressure lamp

The lamp lights up to warn the operator that the engine oil pressure has dropped below the prescribed level. If this should happen during operation or should not go off even after the engine is accelerated more than 1000rpm, immediately stop the engine and check the following:

1. Engine oil level (See "ENGINE OIL" in Maintenance Section).
2. Lubricant system (See "ENGINE OIL" in Maintenance Section).

■ Fuel



CAUTION

To avoid personal injury:

- Fluid escaping from pinholes may be invisible. Do not use hands to search for suspected leaks; Use a piece of cardboard or wood, instead. If injured by escaping fluid, see a medical doctor at once. This fluid can produce gangrene or a severe allergic reaction.
- Check any leaks from fuel pipes or fuel injection pipes. Use eye protection when checking for leaks.

Be careful not to empty the fuel tank. Otherwise air may enter the fuel system, requiring fuel system bleeding. (See "FUEL" in Maintenance Section).

■ Color of exhaust

While the engine is run within the rated output range:

- The color of exhaust remains colorless.
- If the output slightly exceeds the rated level, exhaust may become a little colored with the output level kept constant.
- If the engine is run continuously with dark exhaust emission, it may lead to trouble.

■ Immediately stop the engine if;

- The engine suddenly slow down or accelerates.
- Unusual noises suddenly appear.
- Exhaust fumes suddenly become very dark.
- The oil pressure lamp or the water temperature alarm lamp lights up.

REVERSED ENGINE REVOLUTION AND REMEDIES



CAUTION

To avoid personal injury:

- Reversed engine operation can make the machine reverse and run it backwards. It may lead to serious trouble.
- Reversed engine operation may make exhaust gas gush out into the intake side and ignite the air cleaner; It could catch fire.

Reversed engine revolution must be stopped immediately since engine oil circulation is cut quickly, leading to serious trouble.

■ How to tell when the engine starts running backwards

1. Lubricating oil pressure drops sharply. Oil pressure warning light, if used, will light.
2. Since the intake and exhaust sides are reversed, the sound of the engine changes, and exhaust gas will come out of the air cleaner.
3. A louder knocking sound will be heard when the engine starts running backwards.

■ Remedies

1. Immediately set the engine stop lever to "STOP" position to stop the engine.
2. After stopping the engine, check the air cleaner, intake rubber tube and other parts and replace parts as needed.

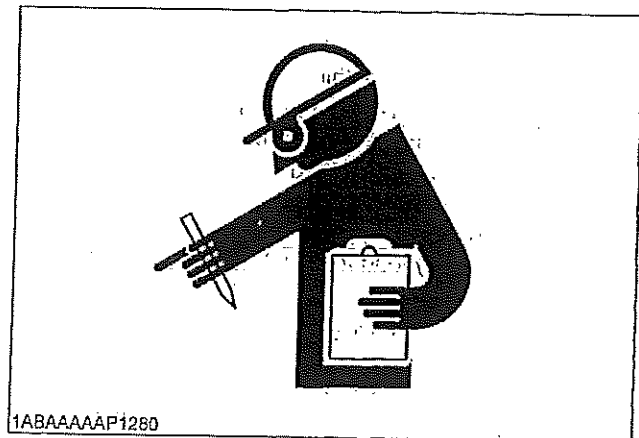
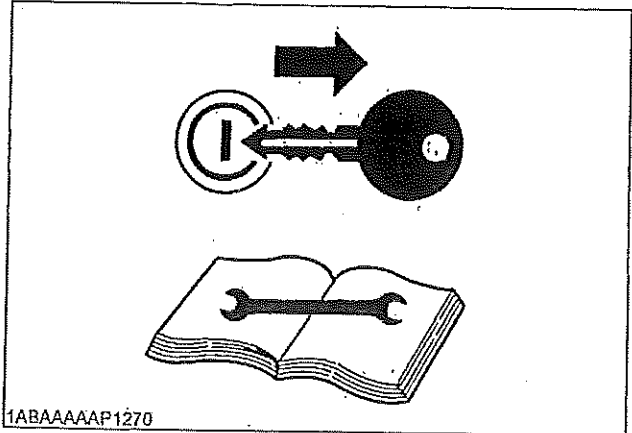
MAINTENANCE



CAUTION

To avoid personal injury:

- Be sure to conduct daily checks, periodic maintenance, refueling or cleaning on a level surface with the engine shut off and remove the key.
- Before allowing other people to use your engine, explain how to operate, and have them read this manual before operation.
- When cleaning any parts, do not use gasoline but use regular cleanser.
- Always use proper tools, that are in good condition. Make sure you understand how to use them, before performing any service work.
- When installing, be sure to tighten all bolts lest they should be loose. Tighten the bolts by the specified torque.
- Do not put any tools on the battery, or battery terminals may short out. Severe burns or fire could result. Detach the battery from the engine before maintenance.
- Do not touch muffler or exhaust pipes while they are hot; Severe burns could result.



SERVICE INTERVALS

Observe the following for service and maintenance.

The lubricating oil change intervals listed in the table below are for Classes CF, CE and CD lubricating oils of API classification with a low-sulfur fuel in use. If the CF-4 or CG-4 lubricating oil is used with a high-sulfur fuel, change the lubricating oil at shorter intervals than recommended in the table below depending on the operating condition.

Interval	Item	Ref.page		
Every 50 hours	Check of fuel pipes and clamp bands	12		@
See NOTE	Change of engine oil (depending on the oil pan)	13,14	◎	
Every 100 hours	Cleaning of air cleaner element	18,18	*1	@
	Cleaning of fuel filter	12		
	Check of battery electrolyte level	19,20		
	Check of fan belt tightness	20		
Every 200 hours	Check of radiator hoses and clamp bands	16		
	Replacement of oil filter cartridge (depending on the oil pan)	15	◎	
	Check of intake air line	-		@
Every 400 hours	Replacement of fuel filter element	12		@
Every 500 hours	Removal of sediment in fuel tank	-		
	Cleaning of water jacket (radiator interior)	-		
	Replacement of fan belt	20		
Every one or two months	Recharging of battery	19,20		
Every year or every 6 cleanings of air cleaner element	Replacement of air cleaner element	18,18	*2	@
Every 800 hours	Check of valve clearance	22		
Every 1500 hours	Check of fuel injection nozzle injection pressure	-	*3	@
Every 3000 hours	Check of turbo charger	-	*3	@
	Check of injection pump	-	*3	@
	Check of fuel injection timer	-	*3	@
Every two years	Replacement of battery	19,20		
	Replacement of radiator hoses and clamp bands	16		
	Replacement of fuel pipes and clamps	12	*3	@
	Change of radiator coolant (L.L.C.)	15		
	Replacement of intake air line	-	*4	@

IMPORTANT :

- The jobs indicated by ◎ must be done after the first 50 hours of operation.
- *1 Air cleaner should be cleaned more often in dusty conditions than in normal conditions.
- *2 After 6 times of cleaning.
- *3 Consult your local KUBOTA Dealer for this service.
- *4 Replace only if necessary.
- The items listed above (@ marked) are registered as emission related critical parts by KUBOTA in the U.S. EPA nonroad emission regulation. As the engine owner, you are responsible for the performance of the required maintenance on the engine according to the above instruction.
Please see the Warranty Statement in detail.

10 MAINTENANCE

NOTE:

- Changing interval of Engine oil and oil filter cartridge.

		*Oil pan depth	
		101 mm (3.98 in.)	121 mm (4.76 in.)
Z602-E D902-E	Engine oil	50 Hrs (Initial)	-
		100 Hrs	
	Oil filter cartridge	200 Hrs	
Z482-E D662-E D722-E	Engine oil	50 Hrs (Initial)	
		75 Hrs	100 Hrs
	Oil filter cartridge	150 Hrs	200 Hrs
D782-E	Engine oil	-	50 Hrs (Initial)
			100 Hrs
	Oil filter cartridge		200 Hrs

* 101 mm (3.98 in.) oil pan depth is optional for Z482-E, D662-E, D722-E.

**Standard replacement interval

- API service classification: above CD grade
- Ambient temperature: below 35° C (95° F)

● Lubricating oil

With the emission control now in effect, the CF-4 and CG-4 lubricating oils have been developed for use of a low-sulfur fuel on on-road vehicle engines. When an off-road vehicle engine runs on a high-sulfur fuel, it is advisable to employ the CF, CD or CE lubricating oil with a high total base number. If the CF-4 or CG-4 lubricating oil is used with a high-sulfur fuel, change the lubricating oil at shorter intervals.

- Lubricating oil recommended when a low-sulfur or high-sulfur fuel is employed.

○ : Recommendable X : Not recommendable

Lubricating oil class	Fuel		Remarks
	Low-sulfur	High-sulfur	
CF	○	○	TBN ≥ 10
CF-4	○	X	
CG-4	○	X	

PERIODIC SERVICE

FUEL

Fuel is flammable and can be dangerous. You should handle fuel with care.



CAUTION

To avoid personal injury:

- Do not mix gasoline or alcohol with diesel fuel. This mixture can cause an explosion.
- Be careful not to spill fuel during refueling. If fuel should spill, wipe it off at once, or it may cause a fire.
- Do not fail to stop the engine before refueling. Keep the engine away from the fire.
- Be sure to stop the engine while refueling or bleeding and when cleaning or changing fuel filter or fuel pipes. Do not smoke when working around the battery or when refueling.
- Check the above fuel systems at a well ventilated and wide place.
- When fuel and lubricant are spilled, refuel after letting the engine cool off.
- Always keep spilled fuel and lubricant away from engine.

Fuel level check and refueling

1. Check to see that the fuel level is above the lower limit of the fuel level gauge.
2. If the fuel is too low, add fuel to the upper limit. Do not overfill.

No.2-D is a distillate fuel oil of lower volatility for engines in industrial and heavy mobile service.

(SAE J313 JUN87)

Grade of Diesel Fuel Oil According to ASTM D975

Flash Point, °C (°F)	Water and Sediment, volume %	Carbon Residue on, 10 percent Residuum, %	Ash, weight %
Min	Max	Max	Max
52 (125)	0.05	0.35	0.01

Distillation Temperatures, °C(°F) 90% Point		Viscosity Kinematic cSt or mm ² /s at 40°C		Viscosity Saybolt, SUS at 37.8°C(100°F)	
Min	Max	Min	Max	Min	Max
282 (540)	338 (640)	1.9	4.1	32.6	40.1

Sulfur, weight %	Copper Strip Corrosion	Cetane Number
Max	Max	Min
0.40	No. 3	40

The cetane number is required not less than 45.

IMPORTANT :

- Be sure to use a strainer when filling the fuel tank, or dirt or sand in the fuel may cause trouble in the fuel injection pump.
- For fuel, always use diesel fuel. You are required not to use alternative fuel, because its quality is unknown or it may be inferior in quality. Kerosene, which is very low in cetane rating, adversely affects the engine. Diesel fuel differs in grades depending on the temperature.
- Be careful not to let the fuel tank become empty, or air can enter the fuel system, necessitating bleeding before next engine start.

Air bleeding the fuel system



CAUTION

To avoid personal injury:

- Do not bleed a hot engine as this could cause fuel to spill onto a hot exhaust manifold creating a danger of fire.

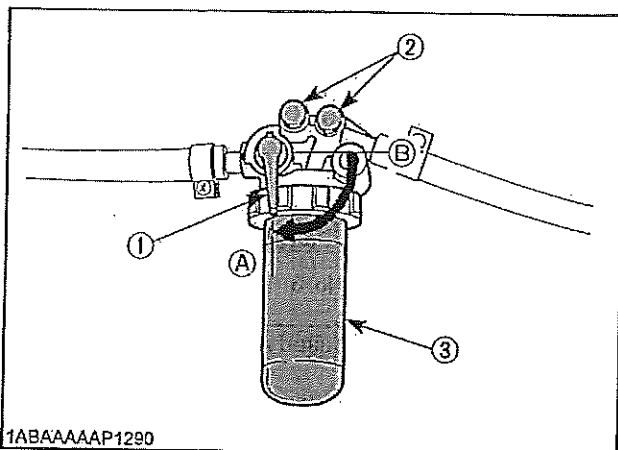
Air bleeding of the fuel system is required if;

- after the fuel filter and pipes have been detached and refitted;
- after the fuel tank has become empty; or
- before the engine is to be used after a long storage.

12 PERIODIC SERVICE

[PROCEDURE]

1. Fill the fuel tank to the fullest extent. Open the fuel filter lever.
2. Loosen air vent plug of the fuel filter a few turns.
3. Screw back the plug when bubbles do not come up any more.
4. Open the air vent plug on top of the fuel injection pump.
5. Retighten the plug when bubbles do not come up any more.



1ABAAAAAP1290

- (1) Fuel filter lever
(2) Air vent plug
(3) Fuel filter pot
- (A) "ON"
(B) "OFF"

■ Checking the fuel pipes



CAUTION

To avoid personal injury;

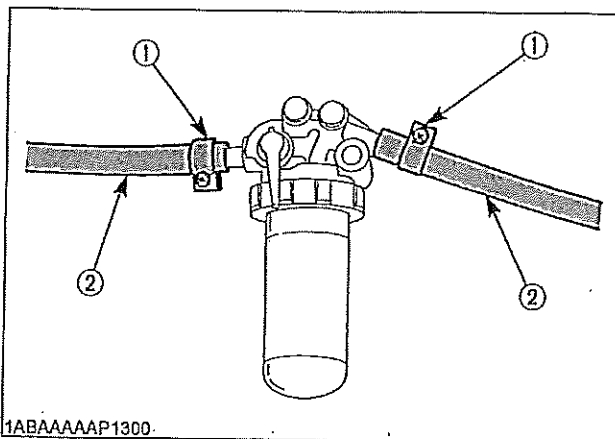
- Check or replace the fuel pipes after stopping the engine. Broken fuel pipes can cause fires.

Check the fuel pipes every 50 hours of operation. When if;

1. If the clamp band is loose, apply oil to the screw of the band, and tighten the band securely.
2. If the fuel pipes, made of rubber, became worn out, replace them and clamp bands every 2 years.
3. If the fuel pipes and clamp bands are found worn or damaged before 2 years' time, replace or repair them at once.
4. After replacement of the pipes and bands, air-bleed the fuel system.

IMPORTANT :

- When the fuel pipes are not installed, plug them at both ends with clean cloth or paper to prevent dirt from entering. Dirt in the pipes can cause fuel injection pump malfunction.



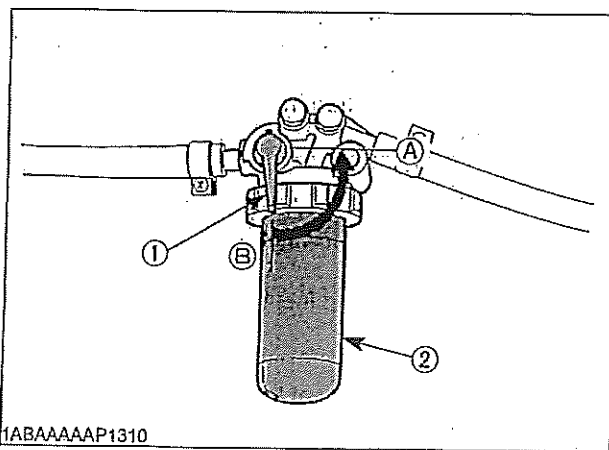
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- (1) Clamp band
(2) Fuel pipe

■ Cleaning the fuel filter pot

Every 100 hours of operation, clean the fuel filter in a clean place to prevent dust intrusion.

1. Close the fuel filter lever.



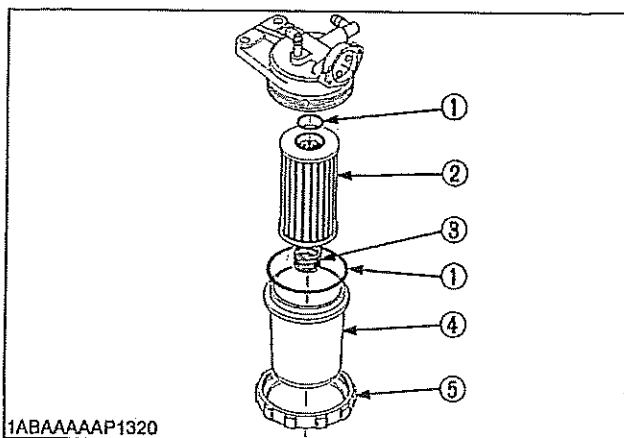
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- (1) Fuel filter lever
(2) Fuel filter pot
- (A) "OFF"
(B) "ON"

2. Remove the top cap, and rinse the inside with diesel fuel.
3. Take out the element, and rinse it with diesel fuel.
4. After cleaning, reinstall the fuel filter, keeping out of dust and dirt.
5. Air-bleed the injection pump.

IMPORTANT :

- Entrance of dust and dirt can cause a malfunction of the fuel injection pump and the injection nozzle. Wash the fuel filter cup periodically.



- (1) O ring
(2) Filter element
(3) Spring
(4) Filter bowl
(5) Screw ring

ENGINE OIL



CAUTION

To avoid personal injury:

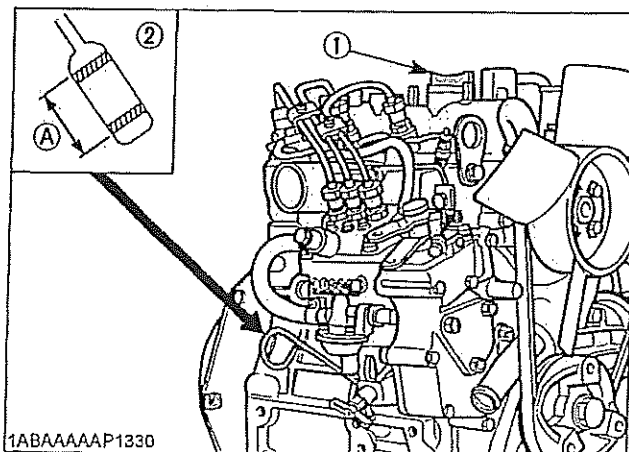
- Be sure to stop the engine before checking and changing the engine oil and the oil filter cartridge.
- Do not touch muffler or exhaust pipes while they are hot; Severe burns could result. Always stop the engine and allow it to cool before conducting inspections, maintenance, or for a cleaning procedure.
- Contact with engine oil can damage your skin. Put on gloves when using engine oil. If you come in contact with engine oil, wash it off immediately.

NOTE:

- Be sure to inspect the engine, locating it on a horizontal place. If placed on gradients accurately, oil quantity may not be measured.
- Be sure to keep the oil level between upper and lower limits of the oil gauge. Too much oil may cause a drop in output or excessive blow-by gas. On the closed breather type engine in which mist is sucked through port, too much oil may cause oil hammer. While too little oil, may seize the engine's rotating and sliding parts. (The closed breather is an option.)

■ Checking level and adding engine oil

1. Check the engine oil level before starting or more than 5 minutes after stopping the engine.
2. Remove the oil level gauge, wipe it clean and reinstall it.
3. Take the oil level gauge out again, and check the oil level.



- (1) Oil filler plug
(2) Oil level gauge

[Lower end of oil level gauge]
(A): Engine oil level within this range is proper.

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4. If the oil level is too low, remove the oil filler plug, and add new oil to the prescribed level.
5. After adding oil, wait more than 5 minutes and check the oil level again. It takes same time for the oil to come down to the oil pan.

Engine oil quantity

Models	Oil pan depth	
	*101 mm (3.98 in.)	121 mm (4.76 in.)
Z482-E	2.1 L (0.55 U.S.gals.)	2.5 L (0.66 U.S.gals.)
D662-E D722-E	3.2 L (0.84 U.S.gals.)	3.8 L (1.0 U.S.gals.)
D782-E	-	3.6 L (0.95 U.S.gals.)
Z602-E	101 mm (3.98 in.)	-
	2.5 L (0.66 U.S.gals.)	
D902-E	101 mm (3.98 in.)	-
	3.7 L (0.98 U.S.gals.)	

*101mm(3.98in.) oil pan depth is optional.

Oil quantities shown are for standard oil pans.

IMPORTANT :

- Engine oil should be MIL-L-2104C or have properties of API classification CD grades or higher.
Change the type of engine oil according to the ambient temperature.

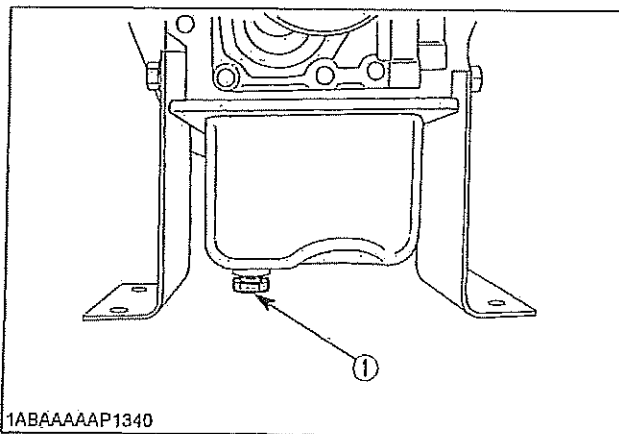
above 25° C (77° F)	SAE30	or SAE10W-30 SAE10W-40
0° C to 25° C (32° F to 77° F)	SAE20	or SAE10W-30 SAE10W-40
below 0° C (32° F)	SAE10	or SAE10W-30 SAE10W-40

- When using oil different from the previous one, be sure to drain all the previous oil before adding the new engine oil.

Changing engine oil**CAUTION**

To avoid personal injury:

- Be sure to stop the engine before draining engine oil.
 - When draining engine oil, place some container underneath the engine and dispose it according to local regulations.
 - Do not drain oil after running the engine. Allow engine to cool down sufficiently.
1. Change oil after the initial 50 hours of operation and every 100 hours thereafter.
 2. Remove the drain plug at the bottom of the engine, and drain all the old oil. Drain oil easier and completely while the engine is hot.



(1) Oil drain plug

3. Add new engine oil up to the upper limit of the oil level gauge.

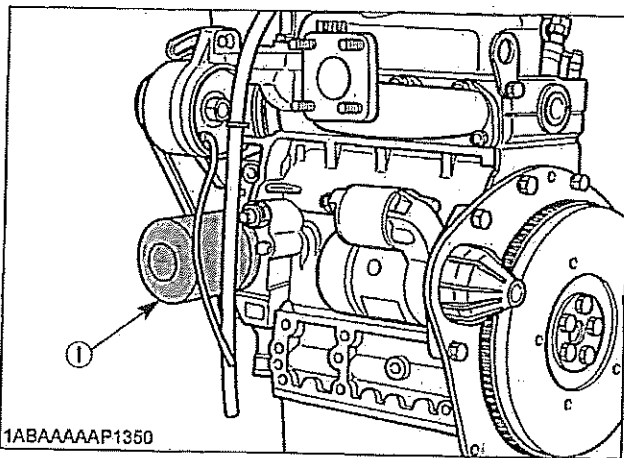
■ Replacing the oil filter cartridge

⚠ CAUTION

To avoid personal injury:

- Be sure to stop the engine before changing the oil filter cartridge.
- Allow engine to cool down sufficiently, oil can be hot and cause burns.

1. Replace the oil filter cartridge after the initial 50 hours of operation and every 200 hours thereafter.
2. Remove the old oil filter cartridge with a filter wrench.
3. Apply a film of oil to the gasket for the new cartridge.
4. Screw in the cartridge by hand. When the gasket contacts the seal surface, tighten the cartridge enough by hand. Because, if you tighten the cartridge with wrench, it will be tightened too much.



- (1) Oil filter cartridge
Remove with a filter wrench
(Tighten with your hand)

5. After the new cartridge has been replaced, the engine oil level normally decreases a little. Thus, run the engine for a while and check oil leaks through the seal before checking the engine oil level. Add oil if necessary.

NOTE :

- Wipe off any oil sticking to the machine completely.

RADIATOR

Coolant will last for one day's work if filled all the way up before operation start. Make it a rule to check the coolant level before every operation.

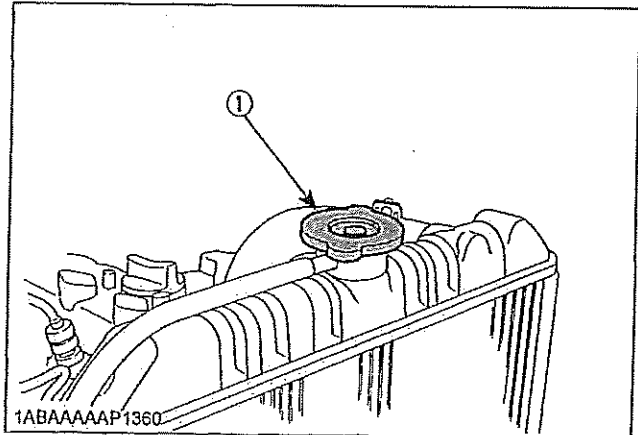
⚠ WARNING

To avoid personal injury:

- Do not stop the engine suddenly, stop it after about 5 minutes of unloaded idling.
- Work only after letting the engine and radiator cool off completely (more than 30 minutes after it has been stopped).
- Do not remove the radiator cap while coolant is hot. When cool to the touch, rotate cap to the first stop to allow excess pressure to escape. Then remove cap completely. If overheats should occur, steam may gush out from the radiator or reserve tank; Severe burns could result.

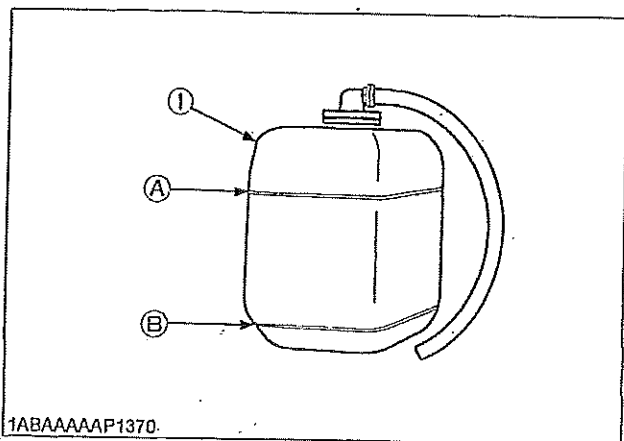
■ Checking coolant level, adding coolant

1. Remove the radiator cap after the engine has completely cooled, and check to see that coolant reaches the supply port.



- (1) Radiator pressure cap

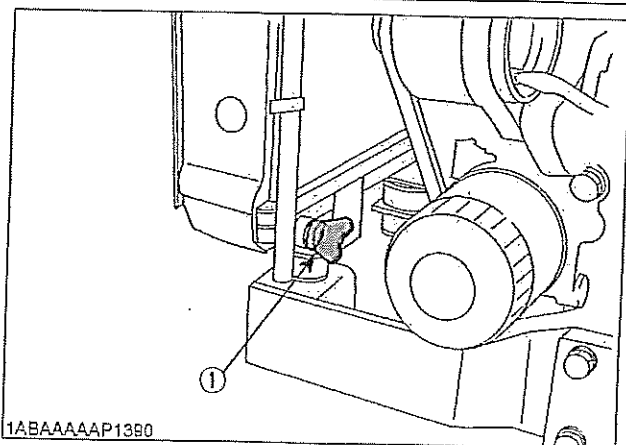
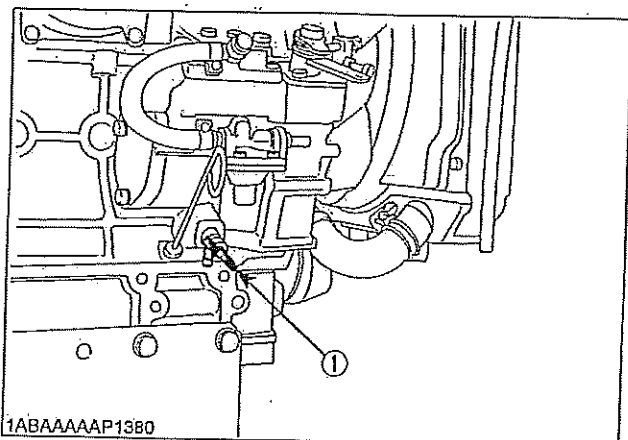
2. If the radiator is provided with a reserve tank, check the coolant level of the reserve tank. When it is between the "FULL" and "LOW" marks, the coolant will last for one day's work.



(1) Reserve tank

(A) "FULL"
(B) "LOW"

3. When the coolant level drops due to evaporation, add water only up to the full level.
4. Check to see that two drain cocks; one is at the crankcase side and the other is at the lower part of the radiator as figures below.



(1) Coolant drain cock

IMPORTANT :

- If the radiator cap has to be removed, follow the caution and securely retighten the cap.
- If coolant should be leak, consult your local KUBOTA dealer.
- Make sure that muddy or sea water does not enter the radiator.
- Use clean, fresh water and 50% anti-freeze to fill the recovery tank.
- Do not refill reserve tank with coolant over the "FULL" level mark.
- Be sure to close the radiator cap securely. If the cap is loose or improperly closed, coolant may leak out and decrease quickly.

Changing coolant

1. To drain coolant, always open both drain cocks and simultaneously open the radiator cap as well. With the radiator cap kept closed, a complete drain of water is impossible.
2. Remove the overflow pipe of the radiator pressure cap to drain the reserve tank.
3. Prescribed coolant volume (U.S.gallons)

Models	Quantity
Z482-E, Z602-E	2.8L (0.74 U.S.gals.)
D662-E, D722-E, D782-E, D902-E	3.1L (0.82 U.S.gals.)

NOTE :

- Coolant quantities shown are for standard radiators.
4. An improperly tightened radiator cap or a gap between the cap and the seat quickens loss of coolant.
 5. Coolant (Radiator cleaner and anti-freeze)

Season	Coolant
Summer	Pure water and radiator cleaner
Winter (when temperature drops below 0° C (32° F) or all season)	Pure water and anti-freeze (See "Anti-freeze" in Maintenance Section)

Checking radiator hoses and clamp**CAUTION**

To avoid personal injury:

- Be sure to check radiator hoses and hose clamps periodically. If radiator hose is damaged or coolant leaks, overheats or severe burns could occur.

Check to see if radiator hoses are properly fixed every 200 hours of operation or 6 months, whichever comes first.

1. If hose clamps are loose or water leaks, tighten hose clamp securely.
2. Replace hoses and tighten hose clamps securely, if radiator hoses are swollen, hardened or cracked. Replace hoses and hose clamps every 2 years or earlier, if checked and found that hoses are swollen, hardened or cracked.

■ Precaution at overheating

Take the following actions in the event the coolant temperature be nearly or more than the boiling point, what is called "Overheating". Take these actions if the engine's alarm buzzer sounds or the alarm lamp lights up.

1. Stop the engine operation in a safe place and keep the engine unloaded idling.
2. Do not stop the engine suddenly. Stop it after about 5 minutes of unloaded idling.
3. If the engine stalls within about 5 minutes of running under no load, immediately leave and keep yourself away from the machine. Never open the hood and any other part.
4. Keep yourself and others well away from the engine for further 10 minutes or while the steam blown out.
5. Checking that there gets no danger such as burn, get rid of the causes of overheating according to the manual, see "Troubleshooting" section. And then, start again the engine.

■ Anti-freeze



CAUTION

To avoid personal injury:

- When using anti-freeze, put on some protection such as rubber gloves.
- If should drink anti-freeze, throw up at once and take medical attention.
- When anti-freeze comes in contact with the skin or clothing, wash it off immediately.
- Do not mix different types of anti-freeze.
- Keep fire and children away from anti-freeze.
- Be mindful of the environment and ecology. Before draining any fluids, find out the correct way of disposing by checking with local codes.
- Also, observe the relevant environmental protection regulations when disposing of oil, fuel, coolant, brake fluid, filters and batteries.

If it freezes, coolant can damage the cylinders and radiator. It is necessary, if the ambient temperature falls below 0°C (32°F), to remove coolant after operating or to add anti-freeze to it.

1. There are 2 types of anti-freeze available; use the permanent type (PT) for this engine.
2. Before adding anti-freeze for the first time, clean the radiator interior by pouring fresh water and draining it a few times.

3. The procedure for mixing of water and anti-freeze differs according to the make of the anti-freeze and the ambient temperature. Refer to SAE J1034 standard, more specifically also to SAE J814c.
4. Mix the anti-freeze with water, and then fill in to the radiator.

IMPORTANT :

- When the anti-freeze is mixed with water, the anti-freeze mixing ratio must be less than 50%.

Vol % Anti-freeze	Freezing Point		Boiling Point *	
	°C	°F	°C	°F
40	-24	-12	106	222
50	-37	-34	108	226

*At 1.013 x 10⁵ Pa (760 mmHg) pressure (atmospheric). A higher boiling point is obtained by using a radiator pressure cap which permits the development of pressure within the cooling system.

NOTE :

- The above data represent industry standards that necessitate a minimum glycol content in the concentrated anti-freeze.
- When the coolant level drops due to evaporation, add water only to keep the anti-freeze mixing ratio less than 50%. In case of leakage, add anti-freeze and water in the specified mixing ratio before filling into the radiator.
- Anti-freeze absorbs moisture. Keep unused anti-freeze in a tightly sealed container.
- Do not use radiator cleaning agents when anti-freeze has been added to the coolant. (Anti-freeze contains an anti-corrosive agent, which will react with the radiator cleaning agent forming sludge which will affect the engine parts.)

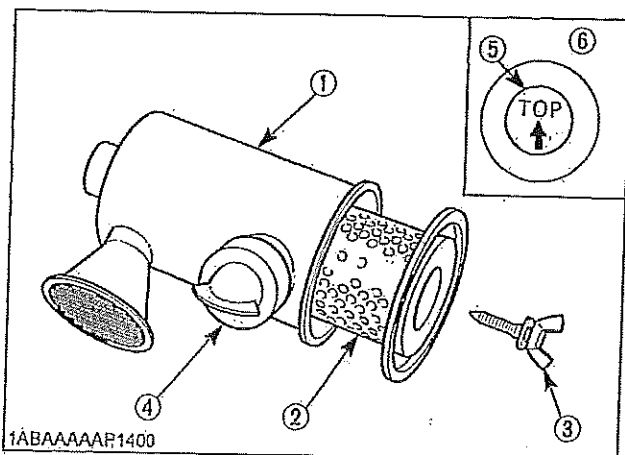
■ Radiator cement

As the radiator is solidly constructed, there is little possibility of water leakage. Should this happen, however, radiator cement can easily fix it. If leakage is serious, contact your local KUBOTA dealer.

AIR CLEANER

As the element of the air cleaner employed on this engine is a dry type, never apply oil to it.

1. Open the evacuator valve once a week under ordinary conditions or daily when used in a dusty place to get rid of large particles of dust and dirt.
2. Wipe the inside air cleaner clean with cloth or the like if it is dirty or wet.
3. Avoid touching the element except when cleaning.
4. When dry dust adheres to the element, blow compressed air from the inside turning the element. Pressure of compressed air must be under 205kPa (2.1kgf/cm², 30psi).
5. When carbon or oil adheres to the element, soak the element in detergent for 30 minutes, then wash it several times in water, rinse with clean water and dry it naturally.
6. After element is fully dried, inspect inside of the element with a light and check if it is damaged or not. (referring to the instructions on the label attached to the element.)
7. Replace the element every year or every six cleanings.



- 1ABAAAAAR1400
- (1) Air cleaner body
 - (2) Element
 - (3) Wing bolt
 - (4) Evacuator valve
 - (5) "TOP" mark
 - (6) Dust cup

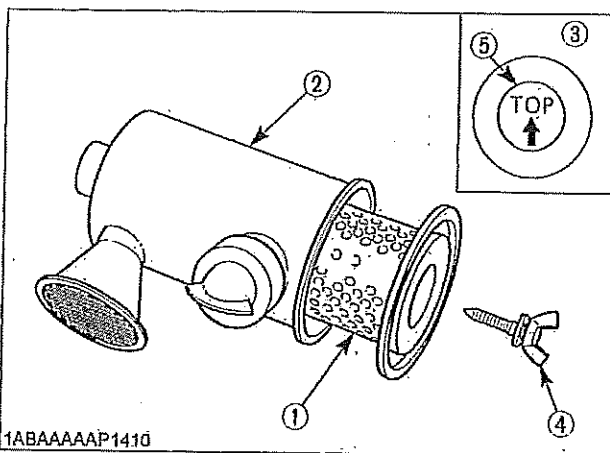
IMPORTANT :

- Make sure the wing bolt for the element is tight enough. If it is loose, dust and dirt may be sucked, wearing down the cylinder liner and piston ring earlier and thereby resulting in poor power output.

■ For the air cleaner with a dust cup (optional)

Remove and clean out the dust cup before it becomes half full with dust; usually once a week, or even every day if the working surroundings are dusty.

Install the air cleaner dust cup with "TOP" indicated on the rear of the cup in the upside. (However, it may be installed in either direction when the cover is placed at the lower part.)



- 1ABAAAAAP1410
- (1) Element
 - (2) Air cleaner body
 - (3) Dust cup
 - (4) Wing bolt
 - (5) "TOP" mark

IMPORTANT :

- If the dust cup is mounted incorrectly, dust or dirt does not collect in the cup, and direct attachments of the dust to the element will cause its lifetime to shorten to a great extent.

BATTERY



CAUTION

To avoid personal injury:

- Be careful not to let the battery electrolyte contact your body or clothing.
- Wear eye protection and rubber gloves, since the diluted sulfuric acid solution burns skin and eats holes in clothing. Should this occur, immediately wash it off with running water and get medical attention.

Mishandling of the battery shortens the service life and adds to maintenance costs. Obtain the maximum performance and the longest life of the battery by handling properly and with care.

Engine starting will be more difficult, if the battery charge is low. Be careful to recharge it at an early occasion before it is too late.

Battery charging



DANGER

The battery comes in two types: refillable and non-refillable.

- For using the refillable type battery, follow the instructions below.

Do not use or charge the battery if its fluid level stands below the LOWER (lower limit level) mark.

Otherwise, the battery component parts may deteriorate earlier than expected, which may shorten the battery's service life or cause an explosion.

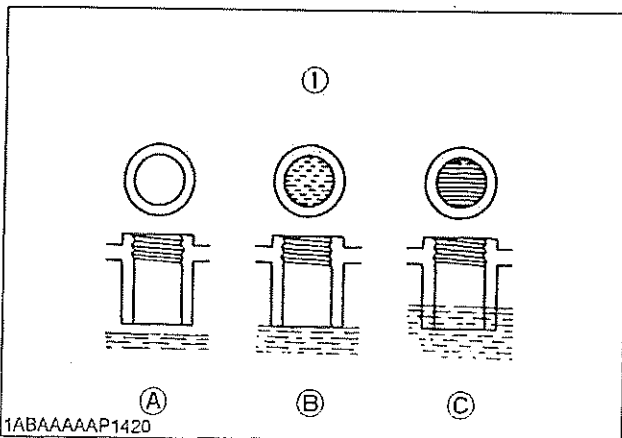
Immediately, add distilled water until the battery's fluid level is between the UPPER and LOWER levels.



CAUTION

To avoid personal injury:

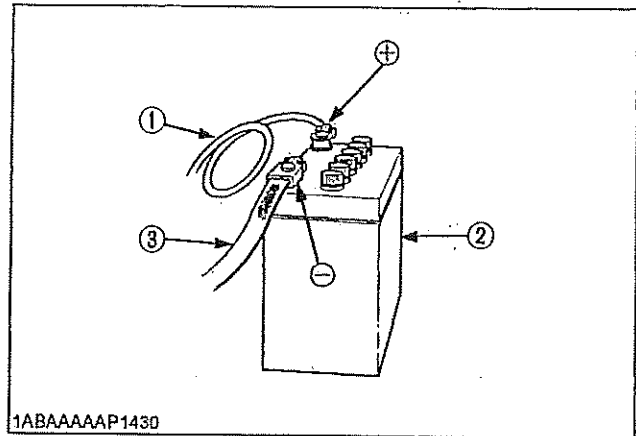
- When the battery is being activated, hydrogen and oxygen gases in the battery are extremely explosive. Keep open sparks and flames away from the battery at all times, especially when charging the battery.
 - When charging the battery, remove the battery vent plugs.
 - When disconnecting the cable from the battery, start with the negative terminal, and when connecting them, start with the positive terminal first.
 - DO NOT check the battery charge by placing a metal object across the terminals. Use a voltmeter or hydrometer.
- Make sure each electrolyte level is to the bottom of vent wells, if necessary, add only distilled water in a well-ventilated place.



1ABAAAAAP1420

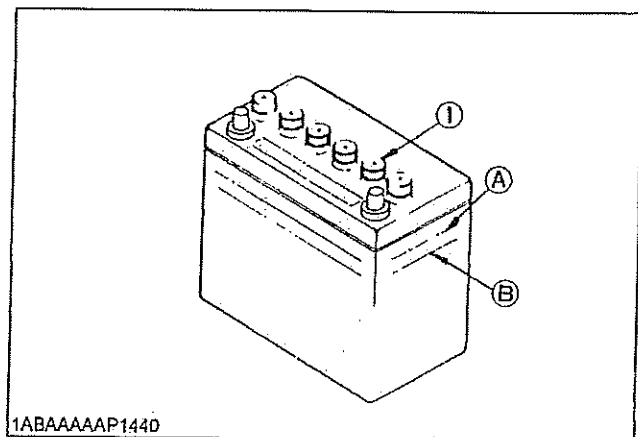
- (1) Battery electrolyte level
- (A) "TOO LOW"
(B) "PROPER"
(C) "TOO HIGH"

- To slow charge the battery, connect the charger positive terminal to the battery positive terminal, and negative to the negative.
- Quick recharging charges the battery at a high rate in a short time. As this is only for emergencies.
- Recharge the battery as early as possible, or battery life will be extremely shortened.
- When exchanging an old battery into new one, use battery of equal specification shown in page 26.



1ABAAAAAP1430

- (1) Thick black cable
(2) Battery case
(3) Earth cable



1ABAAAAAP1440

- (1) Plug
- (A) "HIGHEST LEVEL"
(B) "LOWEST LEVEL"

IMPORTANT :

- Connect the charger positive terminal to the battery positive terminal, and negative to the negative.
 - When disconnecting the cable from the battery, start with the negative terminal first. When connecting the cable to the battery, start with the positive terminal first.
- If reversed, the contact of tools on the battery may cause a short.

■ Direction for long term storage

1. When storing the engine for long periods of time, remove the battery, adjust the electrolyte to the proper level, and store in a dry and dark place.
2. The battery naturally discharges while it is stored. Recharge it once a month in summer, and every 2 months in winter.

ELECTRIC WIRING



CAUTION

To avoid personal injury:

- ◆ Shorting of electric cable or wiring may cause a fire.
 - Check to see if electric cables and wiring are swollen, hardened or cracked.
 - Keep dust and water away from all power connections.
- Loose wiring terminal parts, make bad connections. Be sure to repair them before starting the engine.

Damaged wiring reduces the capacity of electrical parts. Change or repair damaged wiring immediately.

1. Use automobile low voltage wiring cables for this wiring harness.
2. Use fuse and slow blow fuse as wiring protection.
3. Generally, available current of each fuse and size of wire in this drawing are recommendable value showed by Kubota, use suitable size fuses and wires for each machine to consideration to wiring setting and connection with another lines.
4. Install slow blow fuse near by battery, and install fuse box near by key switch.
5. Do not connect any parts which may cause induction current like motors to AC line.
6. Use heatproof cables, if room temperature around wire harness become over 75°C (167°F).
7. Remove painting at connecting position before installation of each cable to any parts.

FAN BELT

■ Adjusting Fan Belt Tension



CAUTION

To avoid personal injury:

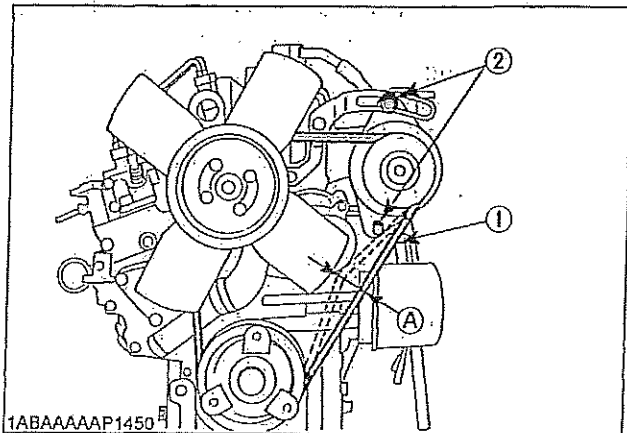
- Be sure to stop the engine and remove the key before checking the belt tension.
- Be sure to reinstall the detached safety shield after maintenance or checking.

Proper fan belt tension	A deflection of between 7 to 9 mm (0.28 to 0.35 in.) when the belt is pressed in the middle of the span.
-------------------------	----------------------------------------------------------------------------------------------------------

1. Stop the engine and remove the key.
2. Apply moderate thumb pressure to belt between the pulleys.
3. If tension is incorrect, loosen the alternator mounting bolts and, using a lever placed between the alternator and the engine block, pull the alternator out until the deflection of the belt falls within acceptable limits.
4. Replace fan belt if it is damaged.

IMPORTANT:

- If belt is loosen or damaged and the fan is damaged, it could result in overheats or 'insufficient' charging. Correct or replace belt.



- (1) Fan belt
(2) Bolt and nut

(A) 7 to 9 mm (0.28 to 0.35 in.)
(under load of 10 kgf (22.1 lbs))

CARRIAGE AND STORAGE

CARRIAGE



CAUTION

To avoid personal injury:

- Fix the engine securely not to fall during operation.
- Do not stand near or under the engine while carrying it.
- The engine is heavy. In handling it, be very alert not to get your hands and body caught in.

1. Use carrier such as crane when carrying the engine, or hurt your waist and yourself. Support the engine securely with rope not to fall while carrying it.
2. When lifting the engine, put the hook securely to metal fittings attached to the engine. Use strong hook and fittings enough to hang the engine.

STORAGE



CAUTION

To avoid personal injury:

- Do not clean the machine with engine running.
- To avoid the danger of exhaust fume poisoning, do not operate the engine in a closed building without proper ventilation.
- When storing the engine just after running, let the engine cool off.

Before storing the engine for more than a few months, remove any dirt on the machine, and:

1. Drain the coolant in the radiator. Open the cock at the bottom of the radiator, and remove the pressure cap to drain water completely. Leave the cock open. Hang a note written "No water" on the pressure cap. Since water may freeze when the temperature drops below 0° C (32° F), it is very important that no water is left in the machine.
2. Remove dirty engine oil, fill with new oil and run the engine for about 5 minutes to let the oil penetrate to all the parts.
3. Check all the bolts and nuts, and tighten if necessary.
4. Remove the battery from the engine, adjust the electrolyte level, and recharge it. Store the battery in a dry and dark place.
5. When the engine is not used for a long period of time, run it for about 5 minutes under no load every 2 to 3 months to keep it free from rust. If the engine is stored without any running, moisture in the air may condense into dew over the sliding parts of the engine, resulting in rust there.
6. If you forget to run the engine for longer than 5 to 6 months, apply enough engine oil to the valve guide and valve stem seal and make sure the valve works smoothly before starting the engine.
7. Store the engine in a flat place and remove the key from engine.
8. Do not store the engine in a place where has flammable materials such as dry grass or straw.
9. When covering the engine for storage, let engine and muffler cool off completely.
10. Operate the engine after checking and repairing damaged wirings or pipes, and clearing flammable materials carried by mouse.

TROUBLESHOOTING

If the engine does not function properly, use the following chart to identify and correct the cause.

■ When it is difficult to start the engine

Cause	Countermeasures
Fuel is thick and doesn't flow.	<ul style="list-style-type: none"> *Check the fuel tank and fuel filter. *Remove water, dirt and other impurities. *As all fuel will be filtered by the filter, if there should be water or other foreign matters on the filter, clean the filter with kerosene.
Air or water mixed in fuel system	<ul style="list-style-type: none"> *If air is in the fuel filter or injection lines, the fuel pump will not work properly. To attain proper fuel injection pressure, check carefully for loosened fuel line coupling, loose cap nut, etc. *Loosen air vent screws stop fuel filter and fuel injection pump to eliminate all the air in the fuel system.
Thick carbon deposits on orifice of injection nozzle.	<ul style="list-style-type: none"> *This is caused when water or dirt is mixed in the fuel. Clean the nozzle injection piece, being careful not to damage the orifice. *Check to see if nozzle is working properly or not. If not, install a new nozzle.
Valve clearance is wrong.	<ul style="list-style-type: none"> *Adjust valve clearance to 0.145-0.185mm(0.0057-0.0072in) when the engine is cold.
Leaking valves	<ul style="list-style-type: none"> *Grind valve.
Fuel injection timing is wrong.	<ul style="list-style-type: none"> *Adjust injection timing *The injection timing is 0.366 rad(20°) before top dead center.
Engine oil becomes thick in cold weather and engine cranks slow.	<ul style="list-style-type: none"> *Change grade of oil according to the weather (temperature.)
Low compression	<ul style="list-style-type: none"> *Bad valve or excessive wear of rings, pistons and liners cause insufficient compression. Replace with new parts.
Battery is discharged and the engine will not crank.	<ul style="list-style-type: none"> *Charge battery. *In winter, always remove battery from machine, charge fully and keep indoors. Install in machine at time of use.

■ When output is insufficient

Cause	Countermeasures
Carbon stuck around orifice of nozzle piece	<ul style="list-style-type: none"> *Clean orifice and needle valve, being very careful not to damage the nozzle orifice. *Check nozzle to see if good. If not, replace with new parts.
Compression is insufficient. Leaking valves	<ul style="list-style-type: none"> *Bad valve and excessive wear of rings, pistons and liners cause insufficient compression. Replace with new parts. *Grind valves.
Fuel is insufficient.	<ul style="list-style-type: none"> *Check fuel system.
Overheating of moving parts	<ul style="list-style-type: none"> *Check lubricating oil system. *Check to see if lubricating oil filter is working properly. *Filter element deposited with impurities would cause poor lubrication. Change element. *Check the clearance of bearing are within factory specs. *Check injection timing. *Adjust timing 0.366 rad(20°) before top dead center.
Valve clearance is wrong.	<ul style="list-style-type: none"> *Adjust to proper valve clearance of 0.145 to 0.185 mm(0.0057 to 0.0072 in.) with engine cold.
Air cleaner is dirty	<ul style="list-style-type: none"> *Clean the element every 100 hours of operation.
Fuel injection pressure is wrong.	<ul style="list-style-type: none"> *Adjust to proper pressure. 13.7Mpa (140 kgf/cm²; 1991 psi)
Injection pump wear	<ul style="list-style-type: none"> *Do not use poor quality fuel for it will cause wear of the pump. Only use No. 2-D diesel fuel. *Check the fuel injection pump element and delivery valve assembly and replace as necessary.

NOTE:

- If the cause of trouble can not be found, contact your KUBOTA dealer.

■ When engine suddenly stops

Cause	Countermeasures
Lack of fuel	*Check the fuel tank and refill the fuel, if necessary. *Also check the fuel system for air or leaks.
Bad nozzle	*If necessary, replace with a new nozzle.
Moving parts are overheated due to shortage of lubrication oil or improper lubrication.	*Check amount of engine oil with oil level gauge. *Check lubricating oil system. *At every 2 times of oil change, oil filter cartridge should be replaced. *Check to see if the engine bearing clearances is within factory specs.

NOTE :

- When the engine has suddenly stopped, decompress the engine by the decomp and turn the engine lightly by pulling on the fan belt. If the engine turns easily without abnormalities, the cause of the trouble is usually lack of fuel or bad nozzle.

■ When color of exhaust is especially bad

Cause	Countermeasures
Fuel governing device bad	*Contact dealer for repairs.
Fuel is of extremely poor quality.	*Select good quality fuel. Use No. 2-D diesel fuel only.
Nozzle is bad.	*If necessary, replace with new nozzle.
Combustion is incomplete.	*Cause is poor atomization, improper injection timing, etc. Because of trouble in injection system or in poor valve adjustment, or compression leakage, poor compression, etc. Check for the cause.

■ When engine must be stopped immediately

Cause	Countermeasures
Engine revolution suddenly decreases or increases.	*Check the adjustments, injection timing and the fuel system.
Unusual sound is heard suddenly.	*Check all moving parts carefully.
Color of exhaust suddenly turns dark.	*Check the fuel injection system, especially the fuel injection nozzle.
Bearing parts are overheated.	*Check the lubricating system.
Oil lamp lights up during operation.	*Check the lubricating system. *Check, if the engine bearing clearances are within factory specs. *Check the function of the relieve valve in the lubricating system. *Check pressure switch. *Check filter base gasket.

■ When engine overheats

Cause	Countermeasures
Engine oil insufficient	*Check oil level. Replenish oil as required.
Fan belt broken or elongated	*Change belt or adjust belt tension.
Coolant insufficient	*Replenish coolant.
Excessive concentration of antifreeze	*Add water only or change to coolant with the specified mixing ratio.
Radiator net or radiator fin clogged with dust	*Clean net or fin carefully.
Inside of radiator or coolant flow route corroded	*Clean or replace radiator and parts.
Fan or radiator or radiator cap defective	*Replace defective parts.
Thermostat defective	*Check thermostat and replace if necessary.
Temperature gauge or sensor defective	*Check temperature with thermometer and replace if necessary.
Overload running	*Reduce load.
Head gasket defective or water leakage	*Replace parts.
Incorrect injection timing	*Adjust to proper timing.
Unsuitable fuel used	*Use the specified fuel.

SPECIFICATIONS

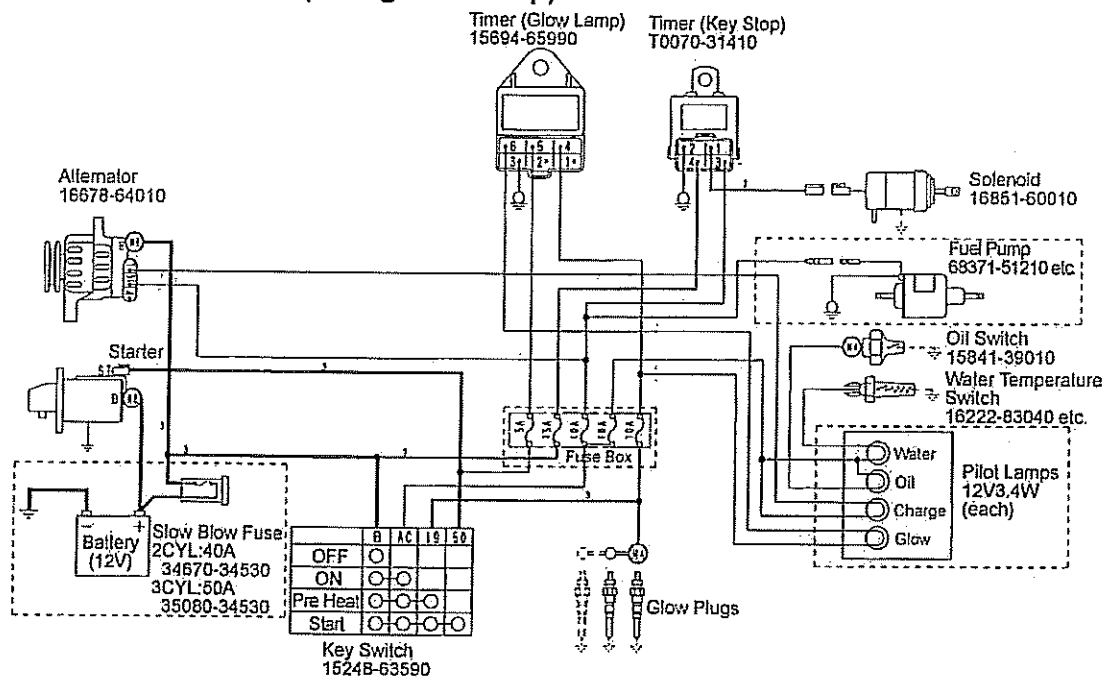
Model	Z482-E	Z602-E	D662-E	D722-E	D782-E	D902-E
Type	Vertical, water-cooled, 4-cycle diesel engine					
Number of cylinders	2		3			
Bore and stroke mm (in.)	67 x 68 (2.64 x 2.68)	72 x 73.6 (2.83 x 2.90)	64 x 68 (2.52 x 2.68)	67 x 68 (2.64 x 2.68)	67 x 73.6 (2.64 x 2.90)	72 x 73.6 (2.83 x 2.90)
Total displacement L (cu.in.)	0.479 (29.23)	0.599 (36.55)	0.656 (40.03)	0.719 (43.88)	0.778 (47.46)	0.898 (54.80)
Combustion chamber	Spherical Type (ETVCS)					
SAE NET Intermittent kW / rpm H.P. (SAEJ1349) (HP / rpm)	9.32 / 3600 (12.5 / 3600)	11.6 / 3600 (15.6 / 3600)	12.9 / 3600 (17.3 / 3600)	14.0 / 3600 (18.8 / 3600)	13.5 / 3200 (18.1 / 3200)	17.5 / 3600 (23.5 / 3600)
SAE NET Continuous kW / rpm H.P. (SAEJ1349) (HP / rpm)	8.05 / 3600 (10.8 / 3600)	10.1 / 3600 (13.5 / 3600)	11.18 / 3600 (15.0 / 3600)	12.15 / 3600 (16.3 / 3600)	11.7 / 3200 (15.7 / 3200)	15.2 / 3600 (20.4 / 3600)
Maximum bare speed rpm	3800	3850	3800		3450	3850
Maximum bare idling speed rpm	800 to 900	900 to 1000	800 to 900			900 to 1000
Order of firing	1-2		1-2-3			
Direction of rotation	Counter-clockwise (viewed from flywheel side)					
Injection pump	Bosch MD Type mini pump					
Injection pressure	13.73 MPa, 1991 psi (140 kgf/cm ²)					
Injection timing (Before T.D.C.)	0.366rad(20°)	0.35rad(20°)	0.366rad(20°)			0.35rad(20°)
Compression ratio	23.5 : 1	24 : 1	23.5 : 1			24 : 1
Fuel	Diesel Fuel No.2-D					
Lubricant (API classification)	above CC grade					
Dimension mm (in.) (length x width x height)	351 x 389 x 520 (13.82 x 15.31 x 20.47)	385 x 421 x 544 (15.16 x 16.57 x 21.42)	426 x 389 x 520 (16.77 x 15.31 x 20.47)			467 x 421 x 544 (18.39 x 16.57 x 21.42)
Dry weight (BB Spec.) kg (lbs.)	53.1 (117.1)	57.0 (125.7)	63.7 (140.4)	63.1 (139.1)	63.5 (140.0)	72.0 (158.7)
Starting system	Cell starter (with glow plug)					
Starting motor	12 V, 0.8 kW	12 V, 1.0 kW	12 V, 0.8 kW			12 V, 1.2 kW
Charging generator	12 V, 150 W	12 V, 480 W	12 V, 150 W			12 V, 480 W
Recommended battery capacity (5Hr capacity)	12 V, 28 AH, equivalent	12 V, 36 AH, equivalent				12 V, 52 AH, equivalent

NOTE :

- Specifications are subject to change without notice.
- The battery capacity is indicated in 5-hour ratio.

WIRING DIAGRAMS

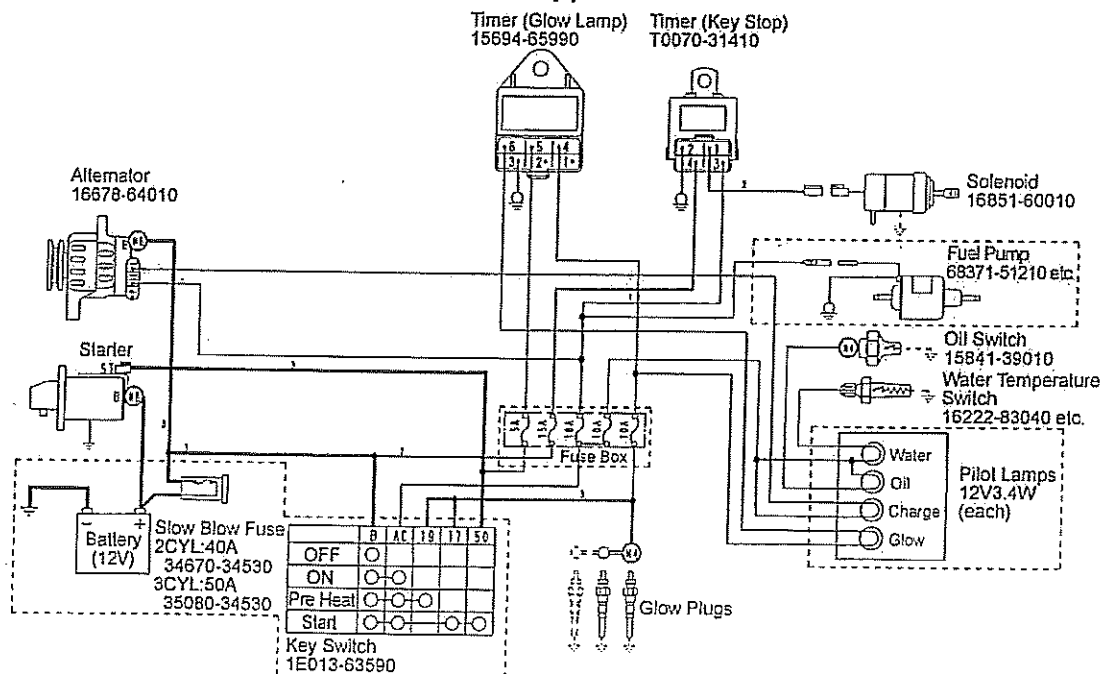
EU standard for Alternator (Energize to stop)



*The parts boxed in [] are reference, NOT equipped for standard engine spec.
*Use wire size 0.5 ~ 0.85 mm² with no mark.

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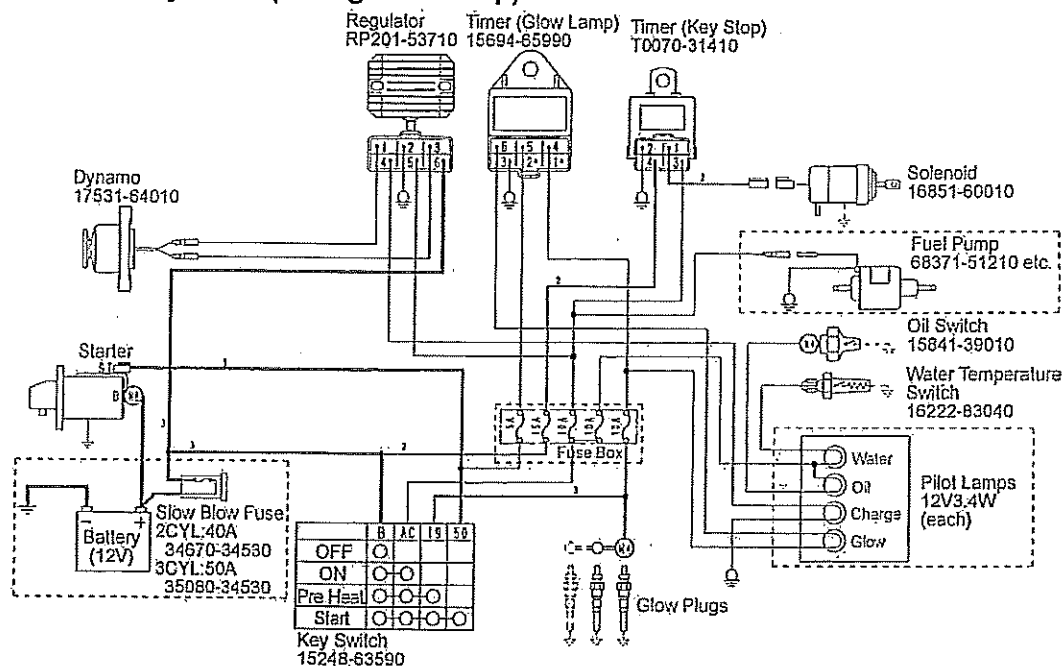
KEA standard for Alternator (Energize to stop)



*The parts boxed in [] are reference, NOT equipped for standard engines spec.
*Use wire size 0.5 ~ 0.85 mm² with no mark.

1ABAAAAAP152A

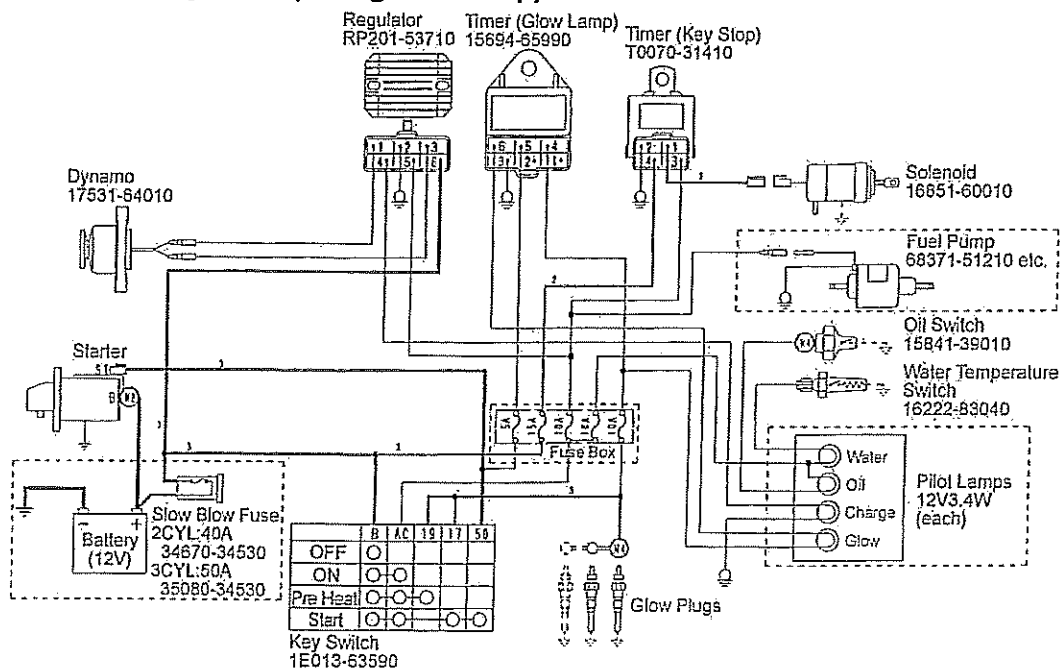
EU standard for Dynamo (Energize to stop)



*The parts boxed in [] are reference, NOT equipped for standard engine spec.
*Use wire size 0.5 ~ 0.85 mm² with no mark.

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KEA standard for Dynamo (Energize to stop)

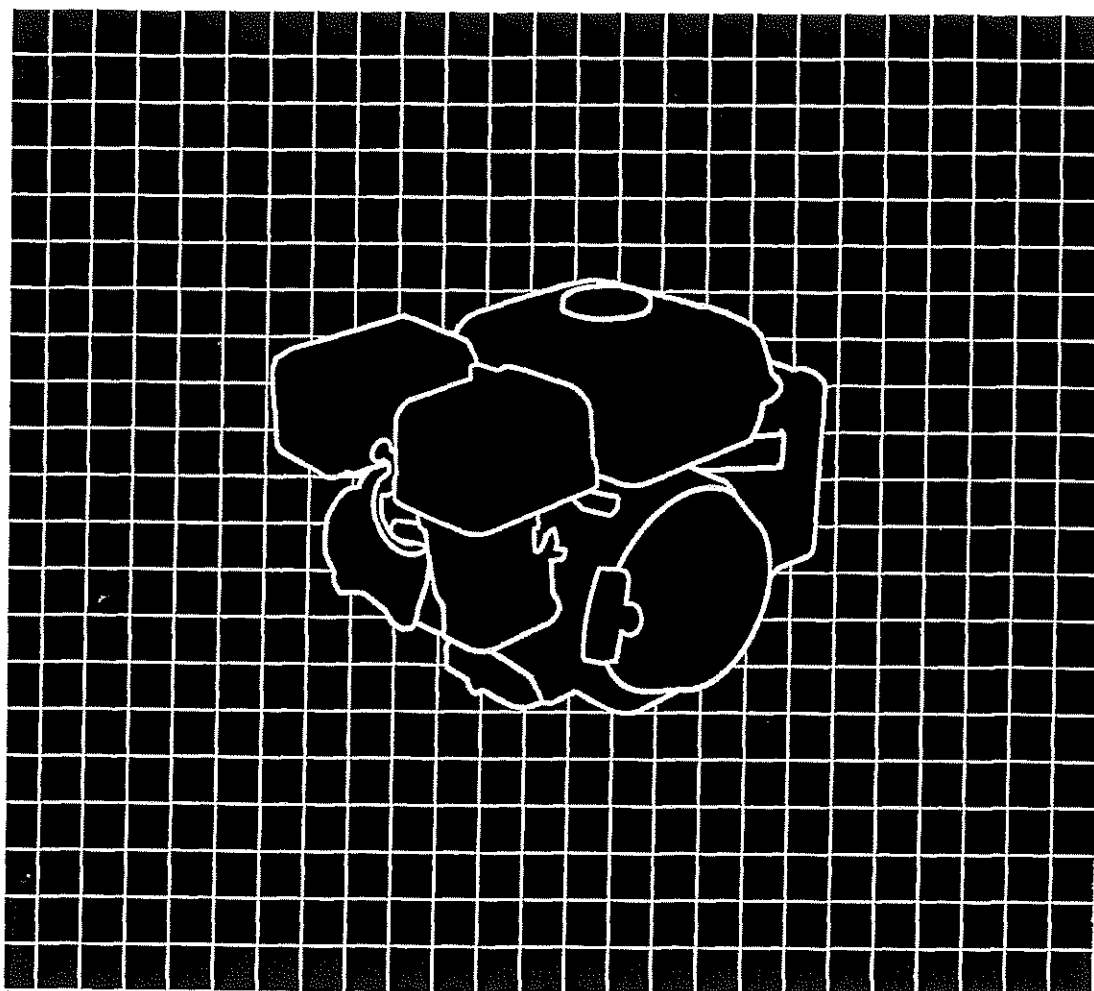


*The parts boxed in [] are reference, NOT equipped for standard engine spec.
*Use wire size 0.5 ~ 0.85 mm² with no mark.

1ABAAAAAP154A

HONDA
ENGINES

Owner's Manual
GX240•GX270•GX340•GX390





WARNING:



The engine exhaust from this product contains chemicals known to the State of California to cause cancer, birth defects or other reproductive harm.

Keep this owner's manual handy, so you can refer to it at any time. This owner's manual is considered a permanent part of the engine and should remain with the engine if resold.

The information and specifications included in this publication were in effect at the time of approval for printing. Illustrations are based on the GX270. Only the QAE2 type is equipped for both electric and manual starting. Honda Motor Co., Ltd. reserves the right, however, to discontinue or change specifications or design at any time without notice and without incurring any obligation whatever. No part of this publication may be reproduced without written permission.

INTRODUCTION

Congratulations on your selection of a Honda engine. We are certain you will be pleased with your purchase of one of the finest engines on the market.

We want to help you get the best results from your new engine and to operate it safely. This manual contains the information on how to do that; please read it carefully.

As you read this manual, you will find information preceded by a **NOTICE** symbol. That information is intended to help you avoid damage to your engine, other property, or the environment.

We suggest you read the warranty policy to fully understand its coverage and your responsibilities of ownership. The warranty policy is a separate document that should have been given to you by your dealer.

When your engine needs scheduled maintenance, keep in mind that your Honda servicing dealer is specially trained in servicing Honda engines. Your Honda servicing dealer is dedicated to your satisfaction and will be pleased to answer your questions and concerns.

Best Wishes,
Honda Motor Co., Ltd.

INTRODUCTION


A FEW WORDS ABOUT SAFETY

Your safety and the safety of others are very important. And using this engine safely is an important responsibility.


To help you make informed decisions about safety, we have provided operating procedures and other information on labels and in this manual. This information alerts you to potential hazards that could hurt you or others.


Of course, it is not practical or possible to warn you about all the hazards associated with operating or maintaining an engine. You must use your own good judgment.


You will find important safety information in a variety of forms, including:

- **Safety Messages** — preceded by a safety alert symbol  and one of three signal words, DANGER, WARNING, or CAUTION.

These signal words mean:

 DANGER You **WILL** be **KILLED** or **SERIOUSLY HURT** if you don't follow instructions.

 WARNING You **CAN** be **KILLED** or **SERIOUSLY HURT** if you don't follow instructions.

 CAUTION You **CAN** be **HURT** if you don't follow instructions.

- **Safety Headings** — such as *IMPORTANT SAFETY INFORMATION*.
- **Safety Section** — such as *ENGINE SAFETY*.
- **Instructions** — how to use this engine correctly and safely.

This entire book is filled with important safety information — please read it carefully.

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ENGINE SAFETY

IMPORTANT SAFETY INFORMATION

Most accidents with engines can be prevented if you follow all instructions in this manual and on the engine. Some of the most common hazards are discussed below, along with the best way to protect yourself and others.

Owner Responsibilities

- Honda engines are designed to give safe and dependable service if operated according to instructions. Read and understand this owner's manual before operating the engine. Failure to do so could result in personal injury or equipment damage.
- Know how to stop the engine quickly, and understand the operation of all controls. Never permit anyone to operate the engine without proper instructions.
- Do not allow children to operate the engine. Keep children and pets away from the area of operation.

Refuel With Care

Gasoline is extremely flammable, and gasoline vapor can explode. Refuel outdoors, in a well-ventilated area, with the engine stopped. Never smoke near gasoline, and keep other flames and sparks away. Always store gasoline in an approved container. If any fuel is spilled, make sure the area is dry before starting the engine.

Hot Exhaust

- The muffler becomes very hot during operation and remains hot for a while after stopping the engine. Be careful not to touch the muffler while it is hot. Let the engine cool before storing it indoors.
- To prevent fire hazards and to provide adequate ventilation for stationary equipment applications, keep the engine at least 3 feet (1 meter) away from building walls and other equipment during operation. Do not place flammable objects close to the engine.

ENGINE SAFETY

Carbon Monoxide Hazard

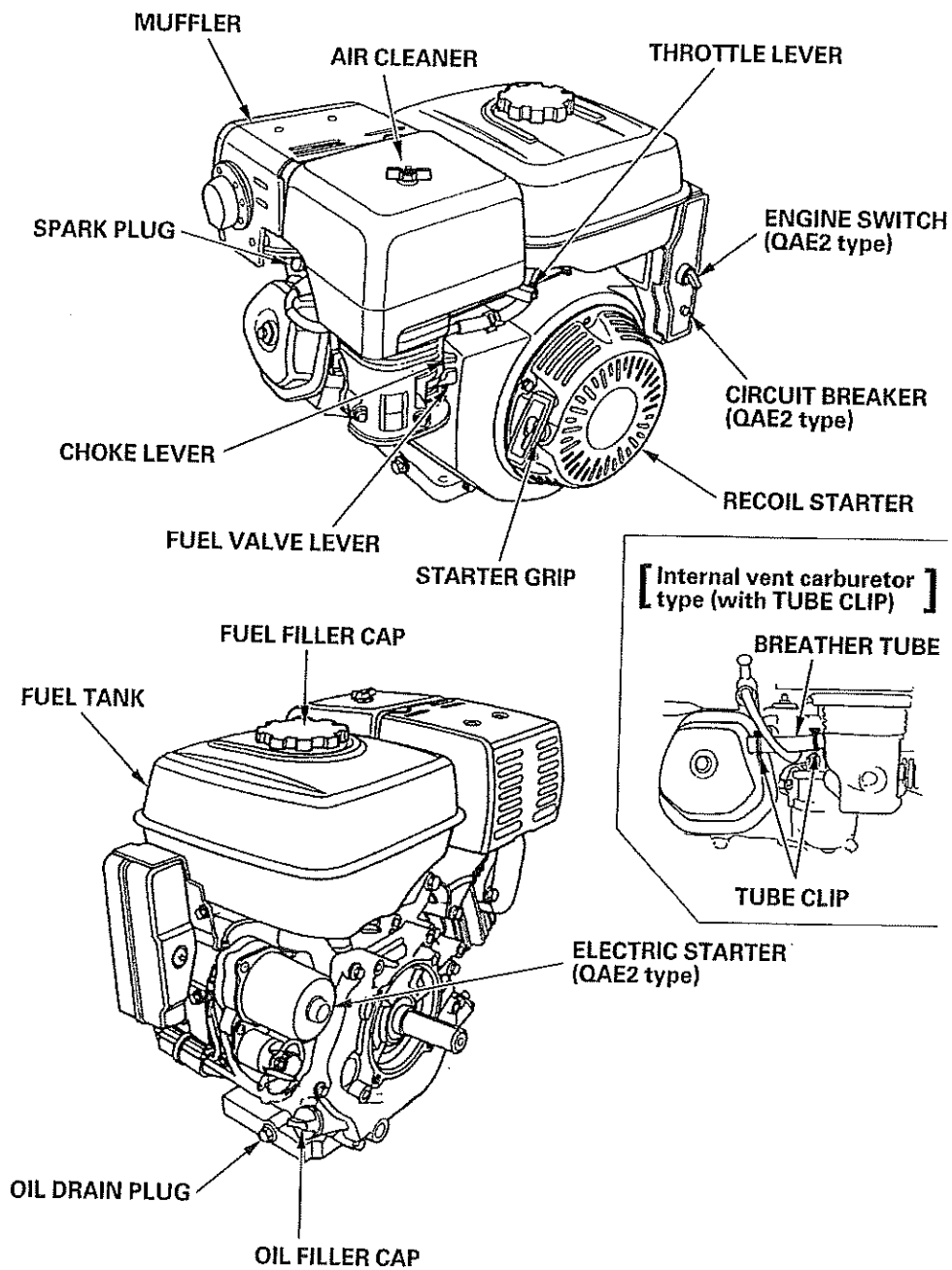
Exhaust gas contains poisonous carbon monoxide. Avoid inhalation of exhaust gas. Never run the engine in a closed garage or confined area.

Other Equipment

Review the instructions provided with the equipment powered by this engine for any additional safety precautions that should be observed in conjunction with engine startup, shutdown, or operation, or protective apparel that may be needed to operate the equipment.

CONTROLS & FEATURES

COMPONENT & CONTROL LOCATIONS



CONTROLS & FEATURES

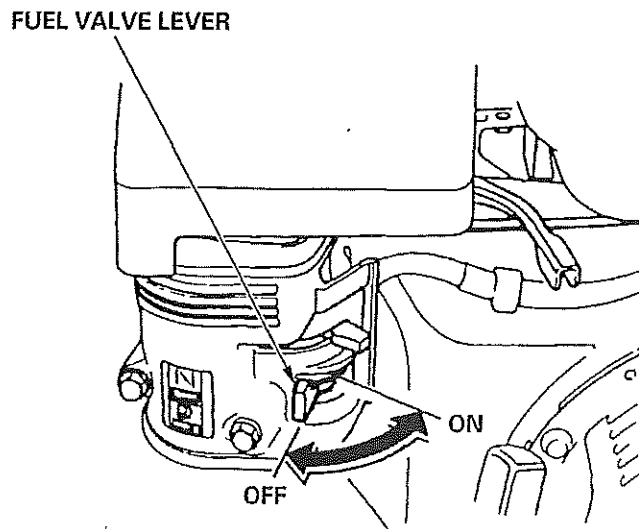
CONTROLS

Fuel Valve Lever

The fuel valve opens and closes the passage between the fuel tank and the carburetor.

The fuel valve lever must be in the ON position for the engine to run.

When the engine is not in use, leave the fuel valve lever in the OFF position to prevent carburetor flooding and to reduce the possibility of fuel leakage.



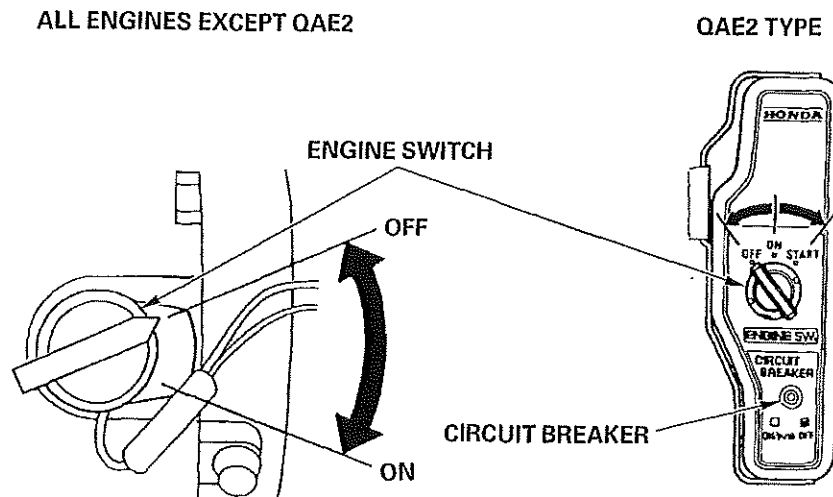
CONTROLS & FEATURES

Engine Switch

The engine switch enables and disables the ignition system.

The engine switch must be in the ON position for the engine to run.

Turning the engine switch to the OFF position stops the engine.



QAE2 Type

The engine switch on the QAE2 type includes a START position for operating the electric starter. The key automatically returns to the ON position when released from the START position.

The circuit breaker, which is located below the key, protects the battery charging circuit (see page 12).

CONTROLS & FEATURES

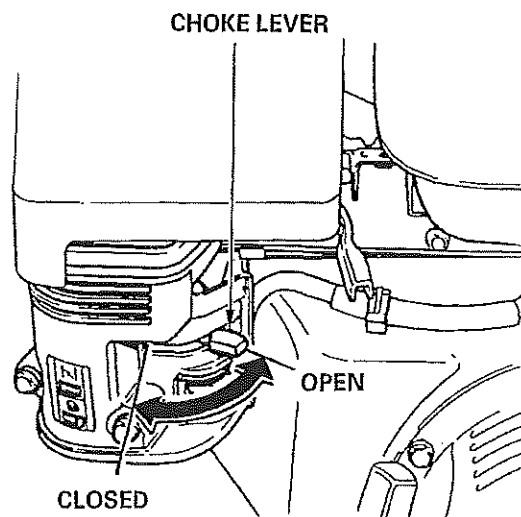
Choke Lever

The choke lever opens and closes the choke valve in the carburetor.

The CLOSED position enriches the fuel mixture for starting a cold engine.

The OPEN position provides the correct fuel mixture for operation after starting, and for restarting a warm engine.

Some engine applications use a remotely-mounted choke control rather than the engine-mounted choke lever shown here.



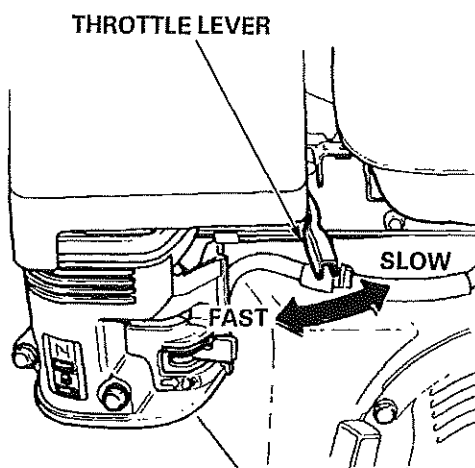
CONTROLS & FEATURES

Throttle Lever

The throttle lever controls engine speed.

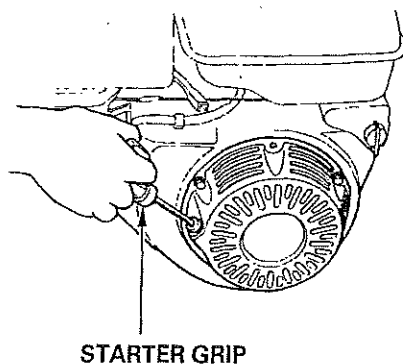
Moving the throttle lever in the directions shown makes the engine run faster or slower.

Some engine applications use a remotely-mounted throttle control rather than the engine-mounted throttle lever shown here.



Recoil Starter Grip

Pulling the starter grip operates the recoil starter to crank the engine.



CONTROLS & FEATURES

FEATURES

Oil Alert® System (applicable engine types)

The Oil Alert® system is designed to prevent engine damage caused by an insufficient amount of oil in the crankcase. Before the oil level in the crankcase can fall below a safe limit, the Oil Alert® system will automatically stop the engine (the ignition switch will remain in the ON position).

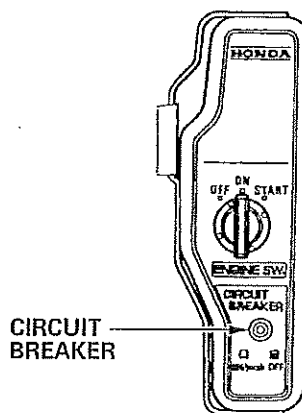
If the engine stops and will not restart, check the engine oil level (page 26) before troubleshooting in other areas.

Circuit Breaker(QAE2 type only)

The circuit breaker protects the battery charging circuit. A short circuit, or a battery connected with reverse polarity, will trip the circuit breaker.

The green indicator inside the circuit breaker will pop out to show that the circuit breaker has switched off. If this occurs, determine the cause of the problem, and correct it before resetting the circuit breaker.

Push the circuit breaker button to reset.



BEFORE OPERATION

IS YOUR ENGINE READY TO GO?

For your safety, and to maximize the service life of your equipment, it is very important to take a few moments before you operate the engine to check its condition. Be sure to take care of any problem you find, or have your servicing dealer correct it, before you operate the engine.

⚠ WARNING

Improperly maintaining this engine, or failing to correct a problem before operation, could cause a malfunction in which you could be seriously injured.

Always perform a preoperation inspection before each operation, and correct any problem.

Before beginning your preoperation checks, be sure the engine is level and the engine switch is in the OFF position.

Check the General Condition of the Engine

- Look around and underneath the engine for signs of oil or gasoline leaks.
- Remove any excessive dirt or debris, especially around the muffler and recoil starter.
- Look for signs of damage.
- Check that all shields and covers are in place, and all nuts, bolts, and screws are tightened.

BEFORE OPERATION

Check the Engine

- Check the engine oil level (see page 26). Running the engine with a low oil level can cause engine damage.

The Oil Alert® system (applicable engine types) will automatically stop the engine before the oil level falls below safe limits. However, to avoid the inconvenience of an unexpected shutdown, always check the engine oil level before startup.

- Check the transmission oil level on applicable engine types (see page 29). Oil is essential to transmission operation and long life.
- Check the air filter (see page 31). A dirty air filter will restrict air flow to the carburetor, reducing engine performance.
- Check the fuel level. Starting with a full tank will help to eliminate or reduce operating interruptions for refueling.

Check the Equipment Powered by This Engine

Review the instructions provided with the equipment powered by this engine for any precautions and procedures that should be followed before engine startup.

OPERATION

SAFE OPERATING PRECAUTIONS

Before operating the engine for the first time, please review the *IMPORTANT SAFETY INFORMATION* on page 5 and the chapter titled *BEFORE OPERATION*.

⚠ WARNING

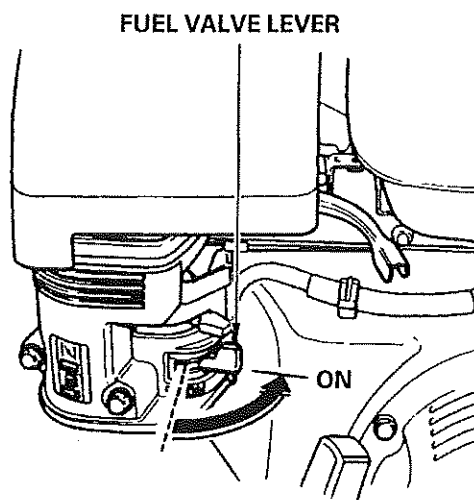
Carbon monoxide gas is toxic.
Breathing it can cause
unconsciousness and even kill you.

Avoid any areas or actions that
expose you to carbon monoxide.

Review the instructions provided with the equipment powered by this engine for any safety precautions that should be observed in conjunction with engine startup, shutdown, or operation.

STARTING THE ENGINE

1. Move the fuel valve lever to the ON position.

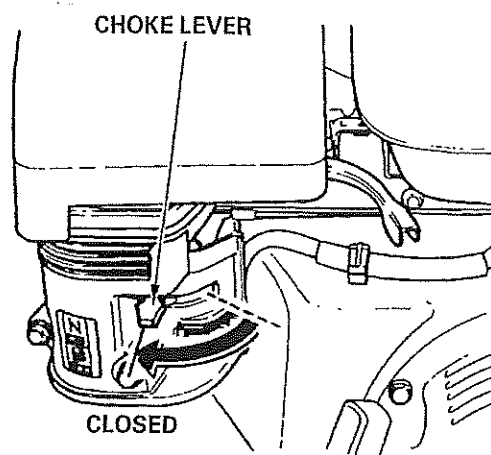


OPERATION

2. To start a cold engine, move the choke lever to the CLOSED position.

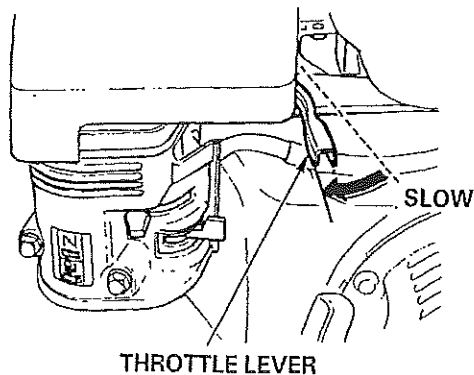
To restart a warm engine, leave the choke lever in the OPEN position.

Some engine applications use a remotely-mounted choke control rather than the engine-mounted choke lever shown here.



3. Move the throttle lever away from the SLOW position, about 1/3 of the way toward the FAST position.

Some engine applications use a remotely-mounted throttle control rather than the engine-mounted throttle lever shown here.

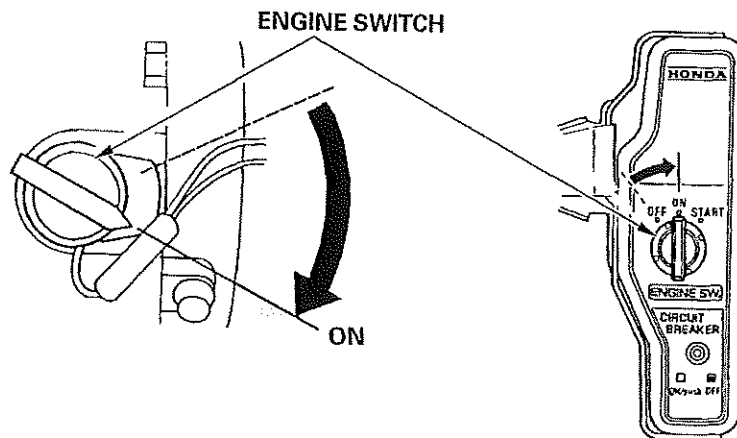


OPERATION

4. Turn the engine switch to the ON position.

ALL ENGINES EXCEPT QAE2

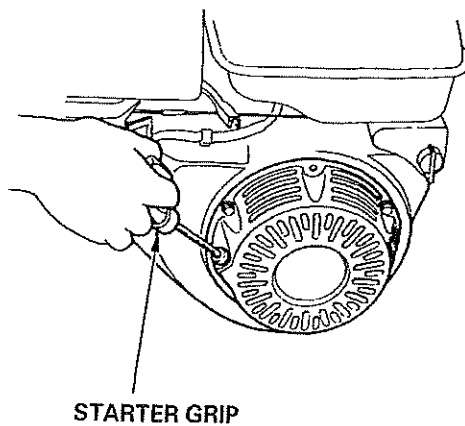
QAE2 TYPE



5. Operate the starter.

RECOIL STARTER (all engine types):

Pull the starter grip lightly until you feel resistance, then pull briskly.
Return the starter grip gently.



OPERATION

ELECTRIC STARTER (QAE2 type):

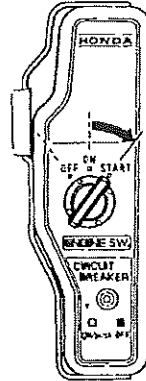
Turn the key to the START position, and hold it there until the engine starts.

If the engine fails to start within 5 seconds, release the key, and wait at least 10 seconds before operating the starter again.

NOTICE

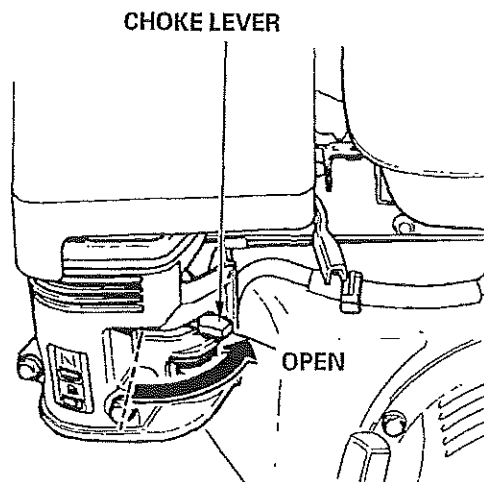
Using the electric starter for more than 5 seconds at a time will overheat the starter motor and can damage it.

When the engine starts, release the key, allowing it to return to the ON position.



ENGINE SWITCH
(QAE2 type)

6. If the choke lever has been moved to the CLOSED position to start the engine, gradually move it to the OPEN position as the engine warms up.



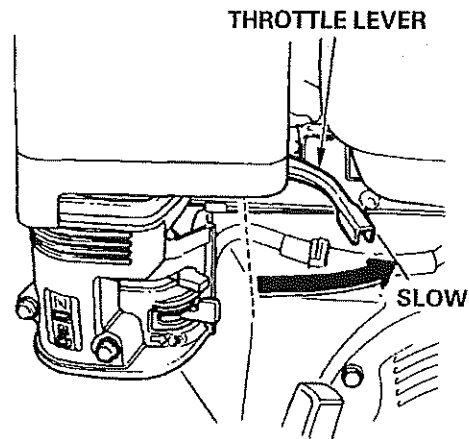
OPERATION

STOPPING THE ENGINE

To stop the engine in an emergency, simply turn the engine switch to the OFF position. Under normal conditions, use the following procedure.

1. Move the throttle lever to the SLOW position.

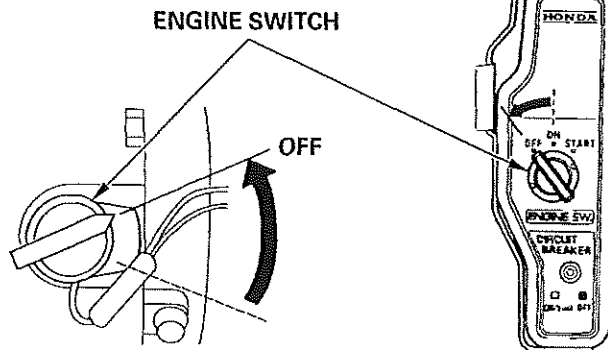
Some engine applications use a remotely-mounted throttle control rather than the engine-mounted throttle lever shown here.



2. Turn the engine switch to the OFF position.

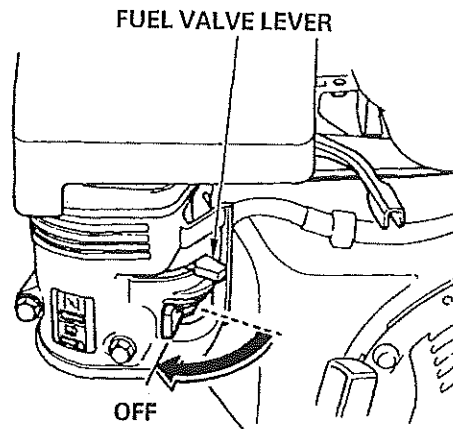
ALL ENGINES EXCEPT QAE2

QAE2 TYPE



OPERATION

3. Turn the fuel valve lever to the OFF position.

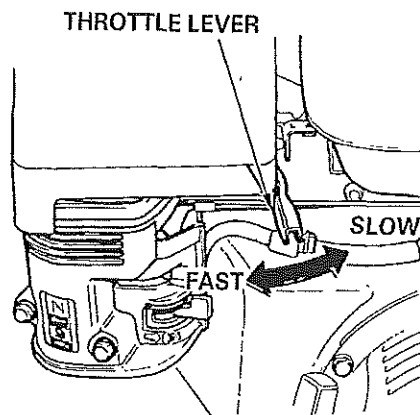


SETTING ENGINE SPEED

Position the throttle lever for the desired engine speed.

Some engine applications use a remotely-mounted throttle control rather than the engine-mounted throttle lever shown here.

For engine speed recommendations, refer to the instructions provided with the equipment powered by this engine.



SERVICING YOUR HONDA ENGINE

THE IMPORTANCE OF MAINTENANCE

Good maintenance is essential for safe, economical, and trouble-free operation. It will also help reduce air pollution.

⚠ WARNING

Improperly maintaining this engine, or failure to correct a problem before operation, can cause a malfunction in which you can be seriously hurt or killed.

Always follow the inspection and maintenance recommendations and schedules in this owner's manual.

To help you properly care for your engine, the following pages include a maintenance schedule, routine inspection procedures, and simple maintenance procedures using basic hand tools. Other service tasks that are more difficult, or require special tools, are best handled by professionals and are normally performed by a Honda technician or other qualified mechanic.

The maintenance schedule applies to normal operating conditions. If you operate your engine under unusual conditions, such as sustained high-load or high-temperature operation, or use in unusually wet or dusty conditions, consult your servicing dealer for recommendations applicable to your individual needs and use.

Maintenance, replacement or repair of emission control devices and systems may be done by any engine repair establishment or individual, using parts that are "certified" to EPA standards.

SERVICING YOUR HONDA ENGINE

MAINTENANCE SAFETY

Some of the most important safety precautions follow. However, we cannot warn you of every conceivable hazard that can arise in performing maintenance. Only you can decide whether or not you should perform a given task.

⚠ WARNING

Failure to properly follow maintenance instructions and precautions can cause you to be seriously hurt or killed.

Always follow the procedures and precautions in the owner's manual.

Safety Precautions

- Make sure the engine is off before you begin any maintenance or repairs. This will eliminate several potential hazards:
 - **Carbon monoxide poisoning from engine exhaust.**
Be sure there is adequate ventilation whenever you operate the engine.
 - **Burns from hot parts.**
Let the engine and exhaust system cool before touching.
 - **Injury from moving parts.**
Do not run the engine unless instructed to do so.
- Read the instructions before you begin, and make sure you have the tools and skills required.
- To reduce the possibility of fire or explosion, be careful when working around gasoline. Use only a nonflammable solvent, not gasoline, to clean parts. Keep cigarettes, sparks and flames away from all fuel-related parts.

Remember that your servicing dealer knows your engine best and is fully equipped to maintain and repair it.

To ensure the best quality and reliability, use only new, genuine Honda parts or their equivalents for repair and replacement.

SERVICING YOUR HONDA ENGINE

MAINTENANCE SCHEDULE

REGULAR SERVICE PERIOD (3)		ITEM	Perform at every indicated month or operating hour interval, whichever comes first.	Each use	First month or 20 Hrs.	Every 3 months or 50 Hrs.	Every 6 months or 100 Hrs.	Every year or 300 Hrs.	Refer to page
•	Engine oil	Check level	○						26
		Change			○		○		27
•	Reduction gear oil (applicable types)	Check level	○						29
		Change			○		○		30
•	Air filter	Check	○						31
		Clean				○ (1)	○ * (1)		32
		Replace						○ * *	
•	Sediment cup	Clean					○		35
•	Spark plug	Check-adjust					○		36
		Replace						○	
	Spark arrester (optional parts)	Clean					○		38
•	Idle speed	Check-adjust						○ (2)	37
•	Valve clearance	Check-adjust						○ (2)	—
•	Combustion chamber	Clean			After every 500 Hrs. (2)				—
•	Fuel tank & filter	Clean					○ (2)		—
•	Fuel tube	Check			Every 2 years (Replace if necessary) (2)				—

• Emission-related items.

* Internal vent carburetor (See page 7) with dual element type only. (Cyclone type every 6 months or 150 hours.)

* * Replace paper element type only. Cyclone type every 2 years or 600 hours.

(1) Service more frequently when used in dusty areas.

(2) These items should be serviced by your servicing dealer, unless you have the proper tools and are mechanically proficient. Refer to Honda shop manual for service procedures.

(3) For commercial use, log hours of operation to determine proper maintenance intervals.

SERVICING YOUR HONDA ENGINE

REFUELING

Fuel tank capacities

GX240/GX270: 1.59 US gal (6.0 ℓ, 1.32 Imp gal)

GX340/GX390: 1.72 US gal (6.5 ℓ, 1.43 Imp gal)

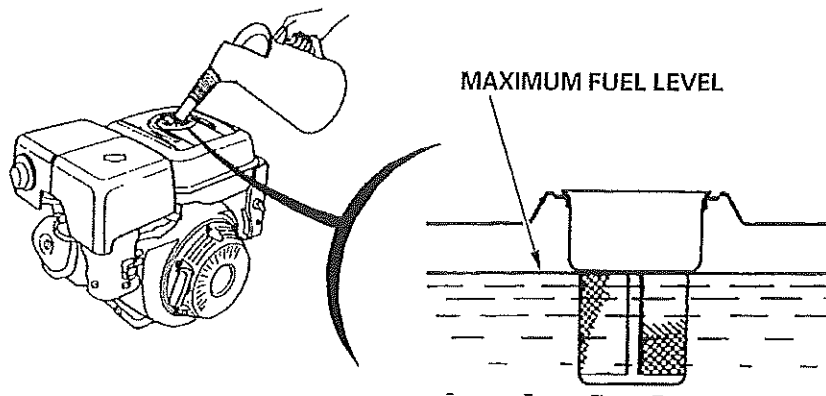
With the engine stopped, remove the fuel tank cap and check the fuel level. Refill the tank if the fuel level is low.

⚠ WARNING

Gasoline is highly flammable and explosive.

You can be burned or seriously injured when handling fuel.

- Stop the engine and keep heat, sparks, and flame away.
- Handle fuel only outdoors.
- Wipe up spills immediately.



Refuel in a well-ventilated area before starting the engine. If the engine has been running, allow it to cool. Refuel carefully to avoid spilling fuel. Do not fill above the fuel strainer shoulder. After refueling, tighten the fuel tank cap securely.

SERVICING YOUR HONDA ENGINE

Never refuel the engine inside a building where gasoline fumes may reach flames or sparks. Keep gasoline away from appliance pilot lights, barbecues, electric appliances, power tools, etc.

Spilled fuel is not only a fire hazard, it causes environmental damage. Wipe up spills immediately.

NOTICE

Fuel can damage paint and plastic. Be careful not to spill fuel when filling your fuel tank. Damage caused by spilled fuel is not covered under warranty.

FUEL RECOMMENDATIONS

Use unleaded gasoline with a pump octane rating of 86 or higher.

These engines are certified to operate on unleaded gasoline. Unleaded gasoline produces fewer engine and spark plug deposits and extends exhaust system life.

Never use stale or contaminated gasoline or an oil/gasoline mixture. Avoid getting dirt or water in the fuel tank.

Occasionally you may hear a light "spark knock" or "pinging" (metallic rapping noise) while operating under heavy loads. This is no cause for concern.

If spark knock or pinging occurs at a steady engine speed, under normal load, change brands of gasoline. If spark knock or pinging persists, see an authorized Honda servicing dealer.

NOTICE

Running the engine with persistent spark knock or pinging can cause engine damage.

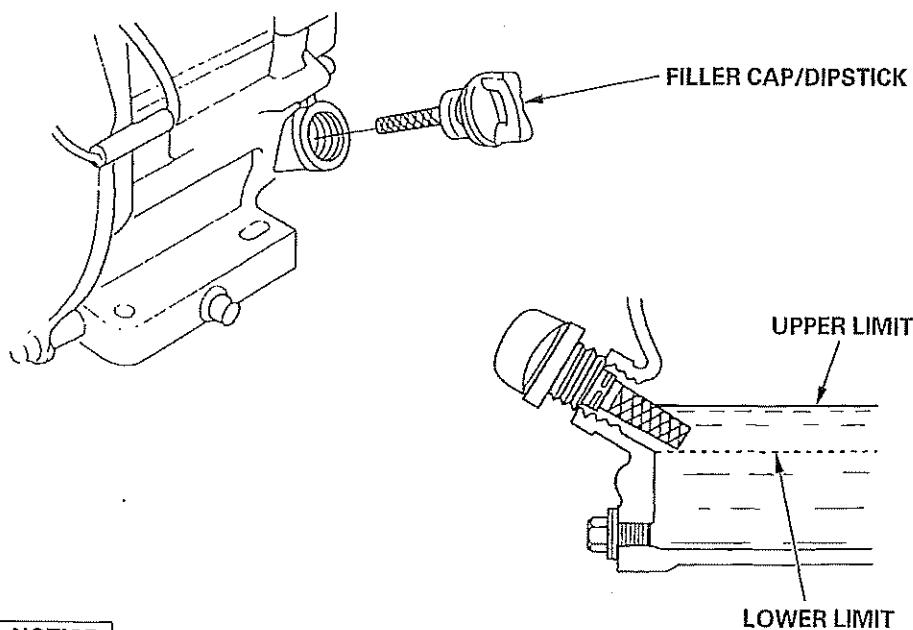
Running the engine with persistent spark knock or pinging is misuse, and the *Distributor's Limited Warranty* does not cover parts damaged by misuse.

SERVICING YOUR HONDA ENGINE

ENGINE OIL LEVEL CHECK

Check the engine oil level with the engine stopped and in a level position.

1. Remove the filler cap/dipstick and wipe it clean.
2. Insert and remove the dipstick without screwing it into the filler neck. Check the oil level shown on the dipstick.
3. If the oil level is low, fill to the edge of the oil filler hole with the recommended oil (see page 28).
4. Screw in the filler cap/dipstick securely.



NOTICE

Running the engine with a low oil level can cause engine damage.

The Oil Alert® system (applicable engine types) will automatically stop the engine before the oil level falls below safe limit. However, to avoid the inconvenience of an unexpected shutdown, always check the engine oil level before startup.

SERVICING YOUR HONDA ENGINE

ENGINE OIL CHANGE

Drain the used oil while the engine is warm. Warm oil drains quickly and completely.

1. Place a suitable container below the engine to catch the used oil, then remove the filler cap/dipstick and the drain plug.
2. Allow the used oil to drain completely, then reinstall the drain plug, and tighten it securely.
3. Please dispose of used motor oil in a manner that is compatible with the environment. We suggest you take used oil in a sealed container to your local recycling center or service station for reclamation. Do not throw it in the trash, pour it on the ground, or down a drain.
4. With the engine in a level position, fill to the outer edge of the oil filler hole with the recommended oil (see page 28).

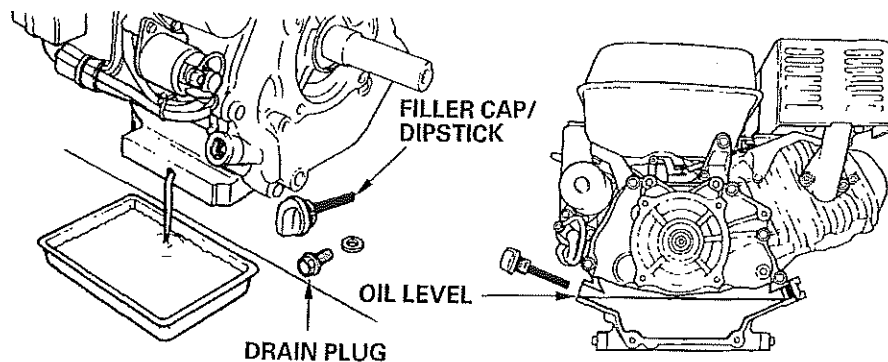
Engine oil capacity: 1.16 US qt (1.10 ℓ, 0.97 Imp qt)

NOTICE

Running the engine with a low oil level can cause engine damage.

The Oil Alert® system (applicable engine types) will automatically stop the engine before the oil level falls below the safe limit. However, to avoid the inconvenience of an unexpected shutdown, fill to the upper limit, and check the oil level regularly.

5. Screw in the filler cap/dipstick securely.

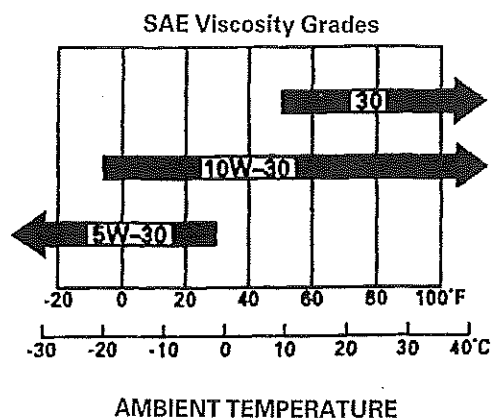


SERVICING YOUR HONDA ENGINE

ENGINE OIL RECOMMENDATIONS

Oil is a major factor affecting performance and service life. Use 4-stroke automotive detergent oil.

SAE 10W-30 is recommended for general use. Other viscosities shown in the chart may be used when the average temperature in your area is within the recommended range.



The SAE oil viscosity and service classification are in the API label on the oil container. Honda recommends that you use API SERVICE category SJ oil.

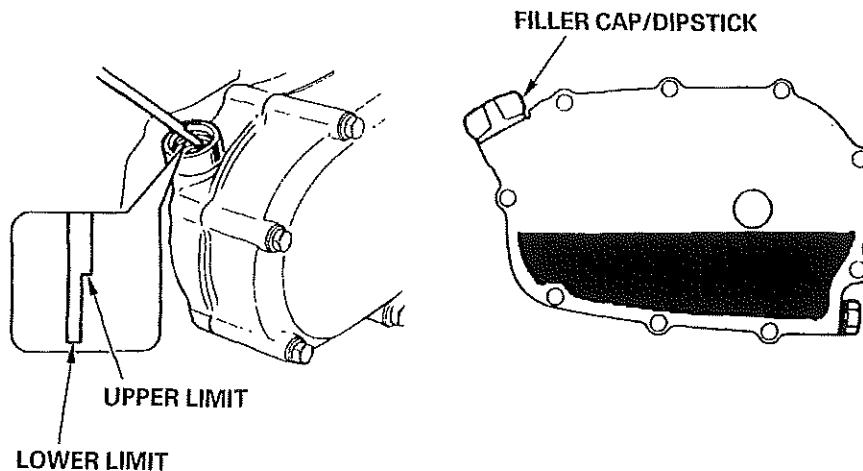
SERVICING YOUR HONDA ENGINE

TRANSMISSION OIL LEVEL CHECK (applicable engine types)

Check the transmission oil level with the engine stopped and in a level position.

1/2 Reduction Transmission With Centrifugal Clutch

1. Remove the filler cap/dipstick and wipe it clean.
2. Insert and remove the dipstick without screwing it into the filler hole. Check the oil level shown on the dipstick.
3. If the oil level is low, add oil to reach the upper limit mark on the dipstick. Use the same oil that is recommended for the engine (see page 28).
4. Screw in the filler cap/dipstick securely.



SERVICING YOUR HONDA ENGINE

TRANSMISSION OIL CHANGE

(1/2 reduction transmission with centrifugal clutch)

Drain the used oil while the engine is warm. Warm oil drains quickly and completely.

1. Place a suitable container below the transmission to catch the used oil, then remove the filler cap/dipstick and the drain plug.
2. Allow the used oil to drain completely, then reinstall the drain plug, and tighten it securely.

Please dispose of used motor oil in a manner that is compatible with the environment. We suggest you take used oil in a sealed container to your local recycling center or service station for reclamation. Do not throw it in the trash, pour it on the ground, or down a drain.

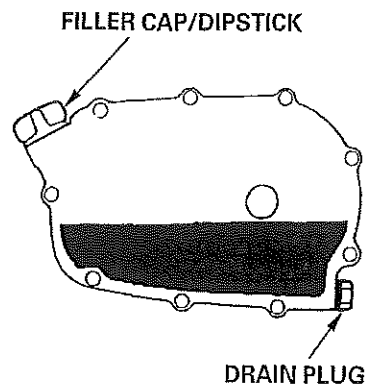
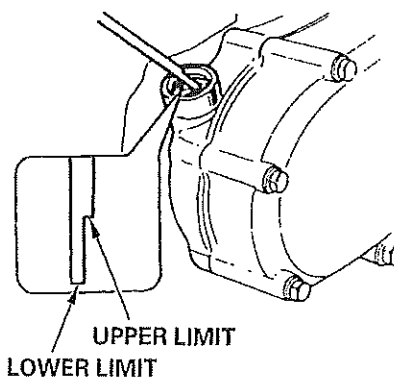
3. With the engine in a level position, fill to the upper limit mark on the dipstick with the same oil that is recommended for the engine (see page 28). To check the oil level, insert and remove the dipstick without screwing it into the filler hole.

Transmission oil capacity: 0.32 US qt (0.30 ℓ , 0.26 Imp qt)

NOTICE

Running the engine with a low transmission oil level can cause transmission damage.

4. Screw in the filler cap/dipstick securely.

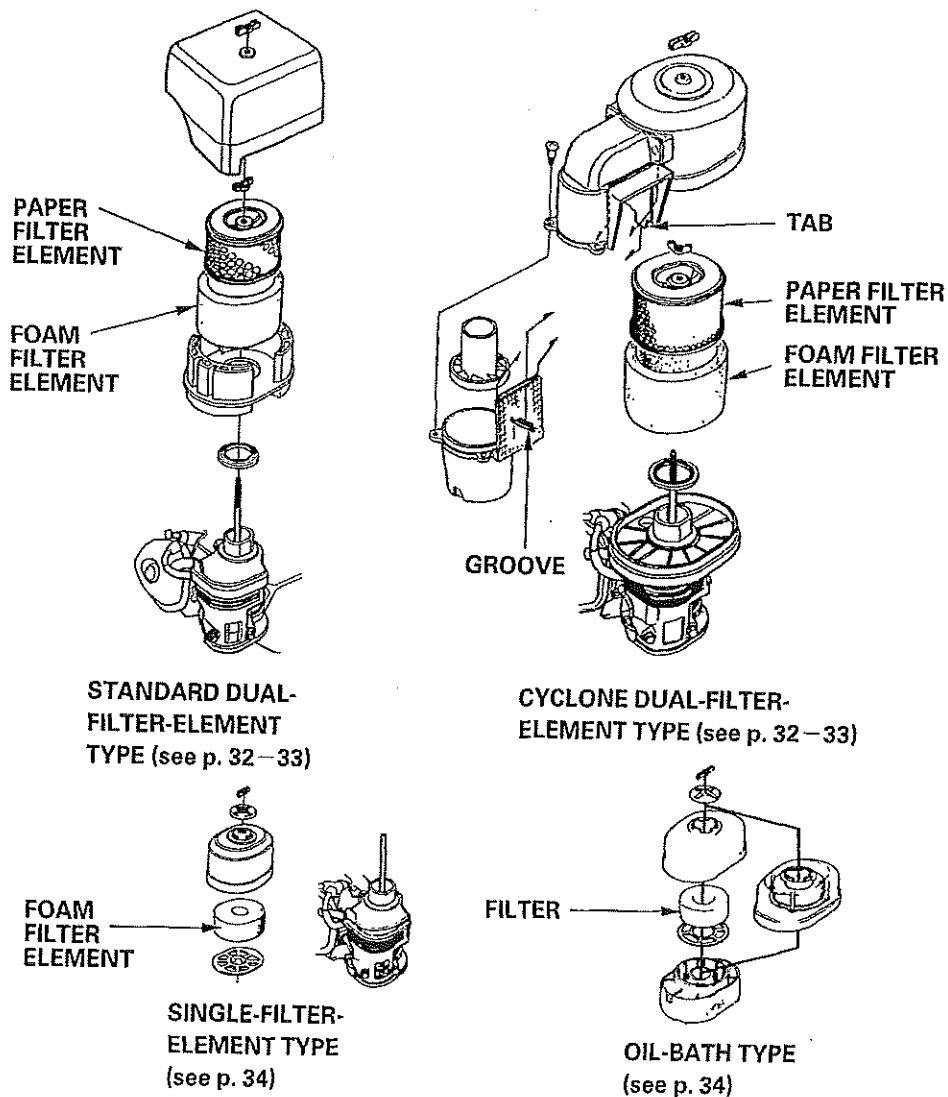


SERVICING YOUR HONDA ENGINE

AIR FILTER INSPECTION

Remove the air cleaner cover and inspect the filter. Clean or replace dirty filter elements. Always replace damaged filter elements. If equipped with an oil-bath air cleaner, also check the oil level.

Refer to pages 32–34 for instructions that apply to the air cleaner and filter on your type of engine.



SERVICING YOUR HONDA ENGINE

AIR CLEANER SERVICE

A dirty air filter will restrict air flow to the carburetor, reducing engine performance. If you operate the engine in very dusty areas, clean the air filter more often than specified in the MAINTENANCE SCHEDULE.

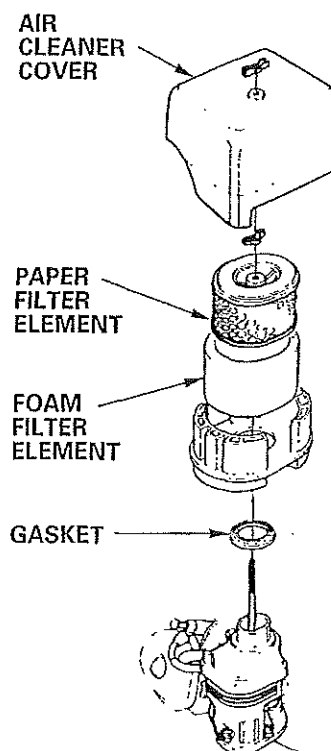
NOTICE

Operating the engine without an air filter, or with a damaged air filter, will allow dirt to enter the engine, causing rapid engine wear. This type of damage is not covered by the *Distributor's Limited Warranty*.

Dual-Filter-Element Type

1. Remove the wing nut from the air cleaner cover, and remove the cover.
2. Remove the wing nut from the air filter, and remove the filter.
3. Remove the foam filter from the paper filter.
4. Inspect both air filter elements, and replace them if they are damaged. Always replace the paper air filter element at the scheduled interval (see page 23).
5. Clean the air filter elements if they are to be reused.

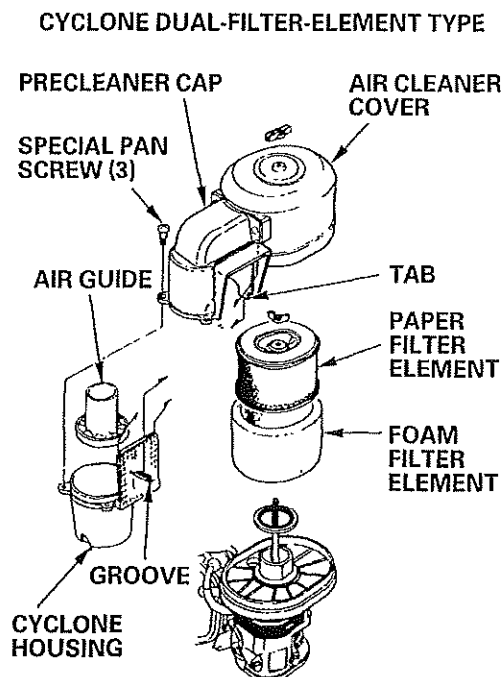
STANDARD DUAL-FILTER-ELEMENT TYPE



SERVICING YOUR HONDA ENGINE

Paper air filter element: Tap the filter element several times on a hard surface to remove dirt, or blow compressed air [not exceeding 30 psi (207 kPa, 2.1 kgf/cm²)] through the filter element from the inside. Never try to brush off dirt; brushing will force dirt into the fibers.

Foam air filter element: Clean in warm soapy water, rinse, and allow to dry thoroughly. Or clean in nonflammable solvent and allow to dry. Dip the filter element in clean engine oil, then squeeze out all excess oil. The engine will smoke when started if too much oil is left in the foam.



6. CYCLONE TYPE ONLY: Remove the three pan-head screws from the precleaner cap, then remove the cyclone housing and air guide. Wash the parts with water, dry them thoroughly, and reassemble them.

Be sure to install the air guide as shown in the illustration.

Install the cyclone housing so the air intake tab fits into the groove in the precleaner cap.

7. Wipe dirt from the inside of the air cleaner base and cover, using a moist rag. Be careful to prevent dirt from entering the air duct that leads to the carburetor.
8. Place the foam air filter element over the paper element, and reinstall the assembled air filter. Be sure the gasket is in place beneath the air filter. Tighten the air filter wing nut securely.
9. Install the air cleaner cover, and tighten the cover wing nut securely.

SERVICING YOUR HONDA ENGINE

Oil-Bath & Single-Filter-Element Types

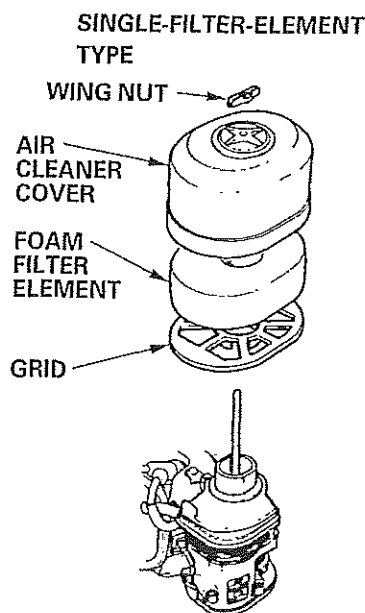
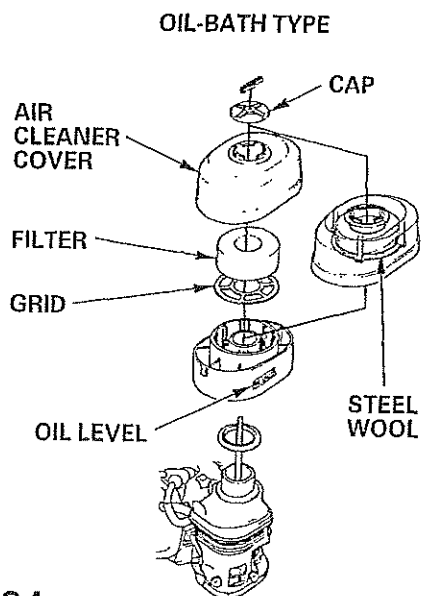
1. Remove the wing nut, and remove the air cleaner cap and cover.
2. Remove the air filter from the cover. Wash the cover and filter in warm, soapy water, rinse, and allow to dry thoroughly. Or clean in nonflammable solvent and allow to dry.
3. Dip the filter in clean engine oil, then squeeze out all excess oil. The engine will smoke if too much oil is left in the foam.
4. OIL BATH TYPE ONLY: Empty the used oil from the air cleaner case, wash out any accumulated dirt with nonflammable solvent, and dry the case.
5. OIL BATH TYPE ONLY: Fill the air cleaner case to the OIL LEVEL mark with the same oil that is recommended for the engine (see page 28).

Oil capacities

GX240/GX270: 2.0 US oz (60 cm³, 2.1 Imp oz)

GX340/GX390: 2.7 US oz (80 cm³, 2.8 Imp oz)

6. Reassemble the air cleaner, and tighten the wing nut securely.



SERVICING YOUR HONDA ENGINE

SEDIMENT CUP CLEANING

1. Move the fuel valve to the OFF position, then remove the fuel sediment cup and O-ring.

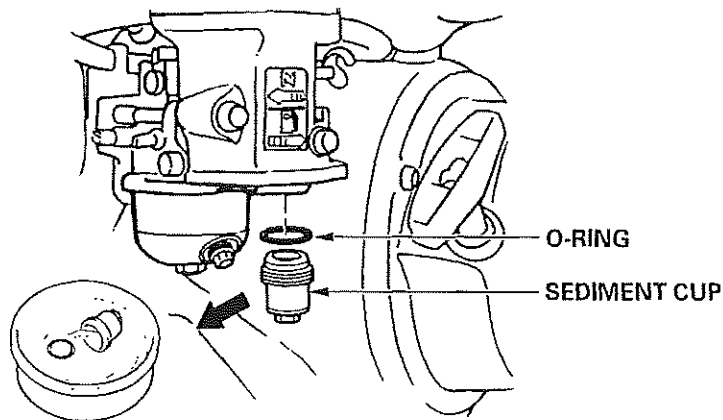
⚠ WARNING

Gasoline is highly flammable and explosive.

You can be burned or seriously injured when handling fuel.

- Keep heat, sparks and flame away.
- Handle fuel only outdoors.
- Wipe up spills immediately.

2. Wash the sediment cup and O-ring in nonflammable solvent, and dry them thoroughly.
3. Place the O-ring in the fuel valve, and install the sediment cup. Tighten the sediment cup securely.
4. Move the fuel valve to the ON position, and check for leaks. Replace the O-ring if there is any leakage.



SERVICING YOUR HONDA ENGINE

SPARK PLUG SERVICE

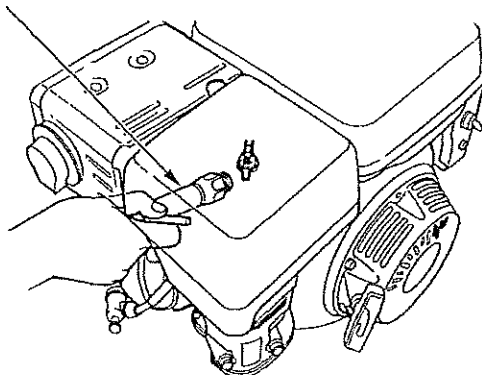
Recommended spark plugs: BPR6ES (NGK)
W20EPR-U (DENSO)

NOTICE

An incorrect spark plug can cause engine damage.

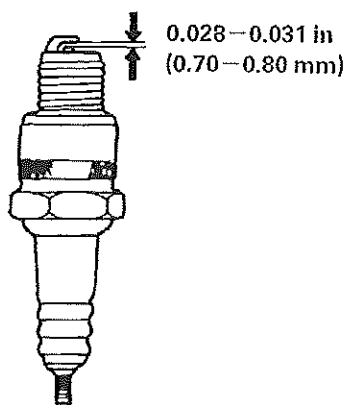
1. Disconnect the spark plug cap, and remove any dirt from around the spark plug area.
2. Remove the spark plug with a 13/16-inch spark plug wrench.

SPARK PLUG WRENCH



3. Inspect the spark plug. Replace it if the electrodes are worn, or if the insulator is cracked or chipped. Clean the spark plug with a wire brush if you are going to reuse it.

4. Measure the spark plug electrode gap with a suitable gauge. The gap should be 0.028–0.031 in (0.70–0.80 mm). Correct the gap, if necessary, by carefully bending the side electrode.



5. Install the spark plug carefully, by hand, to avoid cross-threading.

SERVICING YOUR HONDA ENGINE

6. After the spark plug seats, tighten with a 13/16-inch spark plug wrench to compress the washer.

If reinstalling the used spark plug, tighten 1/8–1/4 turn after the spark plug seats.

If installing a new spark plug, tighten 1/2 turn after the spark plug seats.

NOTICE

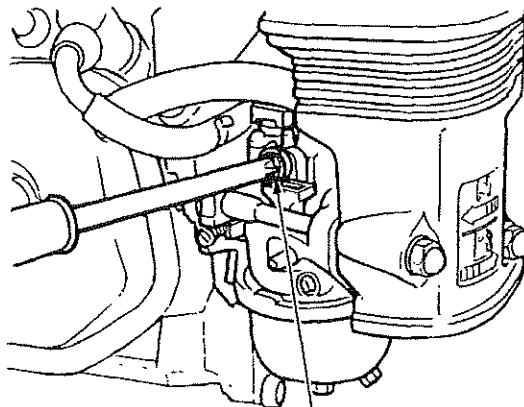
A loose spark plug can overheat and damage the engine. Overtightening the spark plug can damage the threads in the cylinder head.

7. Attach the spark plug cap.

IDLE SPEED ADJUSTMENT

1. Start the engine outdoors, and allow it to warm up to operating temperature.
2. Move the throttle lever to its slowest position.
3. Turn the throttle stop screw to obtain the standard idle speed.

Standard idle speed: 1,400 ± 150 rpm



THROTTLE STOP SCREW

SERVICING YOUR HONDA ENGINE

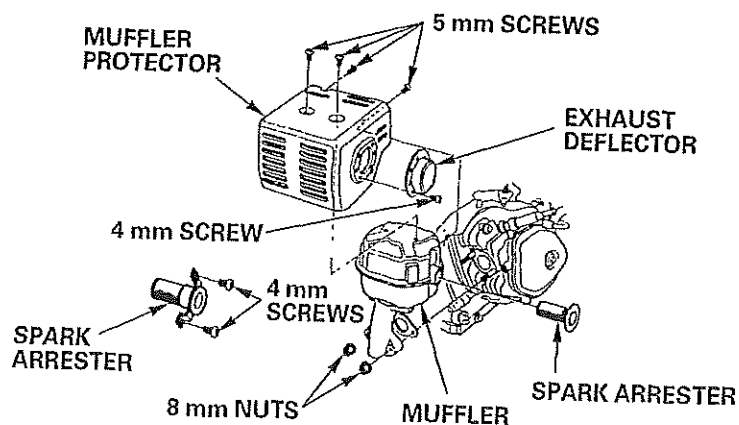
SPARK ARRESTER SERVICE (optional equipment)

Your engine is not factory-equipped with a spark arrester. In some areas, it is illegal to operate an engine without a spark arrester. Check local laws and regulations. A spark arrester is available from authorized Honda servicing dealers.

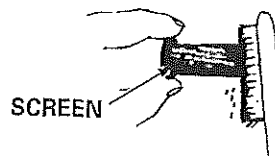
The spark arrester must be serviced every 100 hours to keep it functioning as designed.

If the engine has been running, the muffler will be very hot. Allow the muffler to cool before servicing the spark arrester.

1. Remove the two 8 mm nuts and remove the muffler from the cylinder.
2. Remove the three 4 mm screws from the exhaust deflector, and remove the deflector.
3. Remove the four 5 mm screws from the muffler protector and remove the muffler protector.
4. Remove the 4 mm screws from the spark arrester, and remove the spark arrester from the muffler.



5. Use a brush to remove carbon deposits from the spark arrester screen. Be careful to avoid damaging the screen. The spark arrester must be free of breaks and holes. Replace the spark arrester if it is damaged.
6. Install the spark arrester, muffler protector, exhaust deflector, and muffler in the reverse order of disassembly.



HELPFUL TIPS & SUGGESTIONS

STORING YOUR ENGINE

Storage Preparation

Proper storage preparation is essential for keeping your engine troublefree and looking good. The following steps will help to keep rust and corrosion from impairing your engine's function and appearance, and will make the engine to start easier when you use it again.

Cleaning

If the engine has been running, allow it to cool for at least half an hour before cleaning. Clean all exterior surfaces, touch up any damaged paint, and coat other areas that may rust with a light film of oil.

NOTICE

- Using a garden hose or pressure washing equipment can force water into the air cleaner or muffler opening. Water in the air cleaner will soak the air filter, and water that passes through the air filter or muffler can enter the cylinder, causing damage.
- Water contacting a hot engine can cause damage. If the engine has been running, allow it to cool for at least half an hour before washing.

Fuel

Gasoline will oxidize and deteriorate in storage. Old gasoline will cause hard starting, and it leaves gum deposits that clog the fuel system. If the gasoline in your engine deteriorates during storage, you may need to have the carburetor and other fuel system components serviced or replaced.

The length of time that gasoline can be left in your fuel tank and carburetor without causing functional problems will vary with such factors as gasoline blend, your storage temperatures, and whether the fuel tank is partially or completely filled. The air in a partially filled fuel tank promotes fuel deterioration. Very warm storage/temperatures accelerate fuel deterioration. Fuel deterioration problems may occur within a few months, or even less if the gasoline was not fresh when you filled the fuel tank.

HELPFUL TIPS & SUGGESTIONS

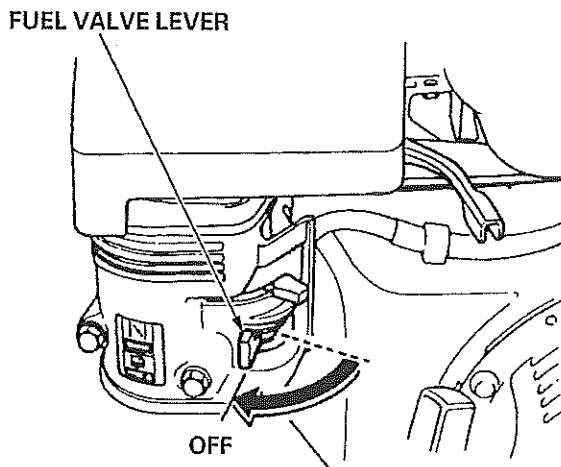
The *Distributor's Limited Warranty* does not cover fuel system damage or engine performance problems resulting from neglected storage preparation.

You can extend fuel storage life by adding a fuel stabilizer that is formulated for that purpose, or you can avoid fuel deterioration problems by draining the fuel tank and carburetor.

ADDING A FUEL STABILIZER TO EXTEND FUEL STORAGE LIFE

When adding a fuel stabilizer, fill the fuel tank with fresh gasoline. If only partially filled, air in the tank will promote fuel deterioration during storage. If you keep a container of gasoline for refueling, be sure that it contains only fresh gasoline.

1. Add fuel stabilizer following the manufacturer's instructions.
2. After adding a fuel stabilizer, run the engine outdoors for 10 minutes to be sure that treated gasoline has replaced the untreated gasoline in the carburetor.
3. Stop the engine, and move the fuel valve lever to the OFF position.



HELPFUL TIPS & SUGGESTIONS

DRAINING THE FUEL TANK AND CARBURETOR

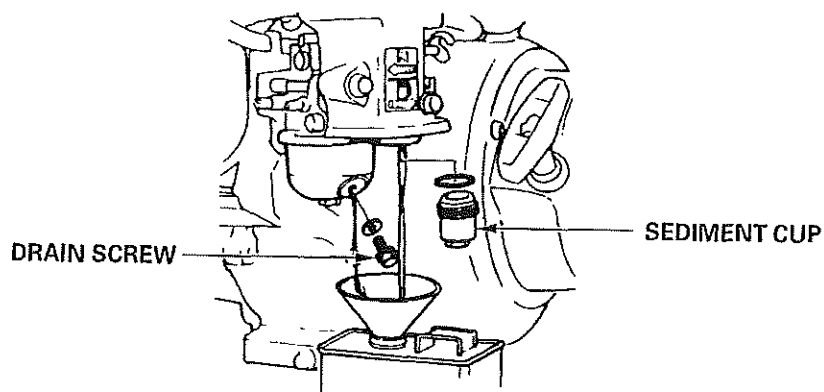
1. Place an approved gasoline container below the carburetor, and use a funnel to avoid spilling fuel.
2. Remove the carburetor drain bolt and sediment cup, then move the fuel valve lever to the ON position.

⚠ WARNING

Gasoline is highly flammable and explosive.

You can be burned or seriously injured when handling fuel.

- Keep heat, sparks and flame away.
- Handle fuel only outdoors.
- Wipe up spills immediately.



3. After all the fuel has drained into the container, reinstall the drain bolt and sediment cup. Tighten them securely.

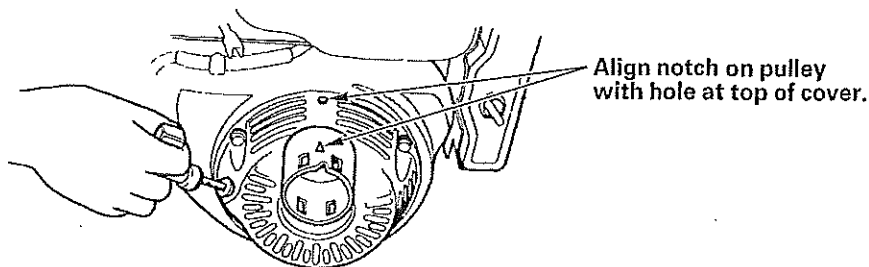
HELPFUL TIPS & SUGGESTIONS

Engine Oil

1. Change the engine oil (see page 27).

Engine Cylinder

2. Remove the spark plug (see page 36).
3. Pour a tablespoon (5 — 10 cc) of clean engine oil into the cylinder.
4. Pull the starter rope several times to distribute the oil in the cylinder.
5. Reinstall the spark plug.
6. Pull the starter rope slowly until resistance is felt and the notch on the starter pulley aligns with the hole at the top of the recoil starter cover. This will close the valves so moisture cannot enter the engine cylinder. Return the starter rope gently.



Storage Precautions

If your engine will be stored with gasoline in the fuel tank and carburetor, it is important to reduce the hazard of gasoline vapor ignition. Select a well-ventilated storage area away from any appliance that operates with a flame, such as a furnace, water heater, or clothes dryer. Also avoid any area with a spark-producing electric motor, or where power tools are operated.

If possible, avoid storage areas with high humidity, because that promotes rust and corrosion.

Unless all fuel has been drained from the fuel tank, leave the fuel valve lever in the OFF position to reduce the possibility of fuel leakage.

HELPFUL TIPS & SUGGESTIONS

Position the equipment so the engine is level. Tilting can cause fuel or oil leakage.

With the engine and exhaust system cool, cover the engine to keep out dust. A hot engine and exhaust system can ignite or melt some materials. Do not use sheet plastic as a dust cover. A nonporous cover will trap moisture around the engine, promoting rust and corrosion.

If equipped with a battery for an electric starter (QAE2 type), recharge the battery once a month while the engine is in storage. This will help to extend the service life of the battery.

Removal From Storage

Check your engine as described in the *BEFORE OPERATION* chapter of this manual.

If the fuel was drained during storage preparation, fill the tank with fresh gasoline. If you keep a container of gasoline for refueling, be sure that it contains only fresh gasoline. Gasoline oxidizes and deteriorates over time, causing hard starting.

If the cylinder was coated with oil during storage preparation, the engine may smoke briefly at startup. This is normal.

HELPFUL TIPS & SUGGESTIONS

TRANSPORTING

If the engine has been running, allow it to cool for at least 15 minutes before loading the engine-powered equipment on the transport vehicle. A hot engine and exhaust system can burn you and can ignite some materials.

Keep the engine level when transporting to reduce the possibility of fuel leakage. Turn the fuel valve lever to the OFF position.

TAKING CARE OF UNEXPECTED PROBLEMS

ENGINE WILL NOT START	Possible Cause	Correction
1. QAE2 electric starting: Check battery and fuse.	Battery discharged.	Recharge battery:
	Fuse burnt out.	Replace fuse (p. 46).
2. Check control positions.	Fuel valve OFF.	Move lever to ON.
	Choke OPEN.	Move lever to CLOSED unless engine is warm.
	Engine switch OFF.	Turn engine switch to ON.
3. Check fuel.	Out of fuel.	Refuel (p. 24).
	Bad fuel; engine stored without treating or draining gasoline, or refueled with bad gasoline.	Drain fuel tank and carburetor (p. 41). Refuel with fresh gasoline (p. 24).
4. Remove and inspect spark plug.	Spark plug faulty, fouled, or improperly gapped.	Clean, gap, or replace spark plug (p. 36).
	Spark plug wet with fuel (flooded engine).	Dry and reinstall spark plug. Start engine with throttle lever in FAST position.
5. Take engine to an authorized Honda servicing dealer, or refer to shop manual.	Fuel filter clogged, carburetor malfunction, ignition malfunction, valves stuck, etc.	Replace or repair faulty components as necessary.

ENGINE LACKS POWER	Possible Cause	Correction
1. Check air filter.	Filter element(s) clogged.	Clean or replace filter element(s) (p. 32–34).
2. Check fuel.	Bad fuel; engine stored without treating or draining gasoline, or refueled with bad gasoline.	Drain fuel tank and carburetor (p. 41). Refuel with fresh gasoline (p. 24).
3. Take engine to an authorized Honda servicing dealer, or refer to shop manual.	Fuel filter clogged, carburetor malfunction, ignition malfunction, valves stuck, etc.	Replace or repair faulty components as necessary.

TAKING CARE OF UNEXPECTED PROBLEMS

FUSE REPLACEMENT (QAE2 type only)

The electric starter relay circuit and battery charging circuit are protected by a 5-ampere fuse. If the fuse burns out, the electric starter will not operate. The engine can be started manually if the fuse burns out, but running the engine will not charge the battery.

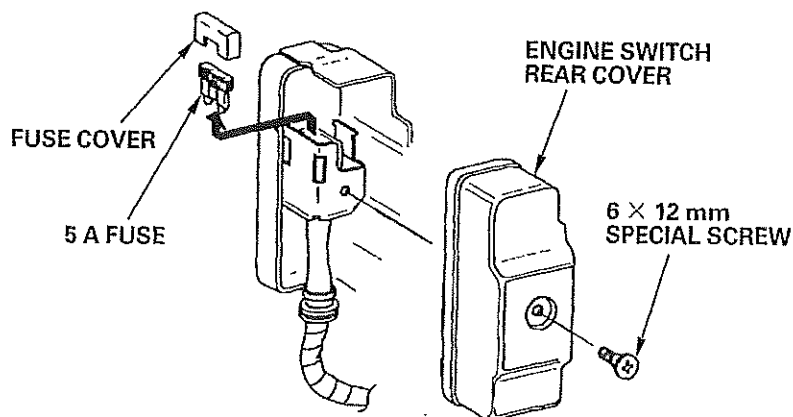
1. Remove the 6 × 12 mm screw from the rear cover of the engine switch box.
2. Remove the rear cover, and inspect the fuse.

If the fuse is burnt out, remove the fuse cover, then pull out and discard the burnt-out fuse. Install a new 5-ampere fuse, and reinstall the fuse cover.

NOTICE

Never use a fuse with a rating greater than 5 amperes. Serious damage to the electrical system or a fire could result.

3. Reinstall the rear cover. Install the 6 × 12 mm screw and tighten it securely.

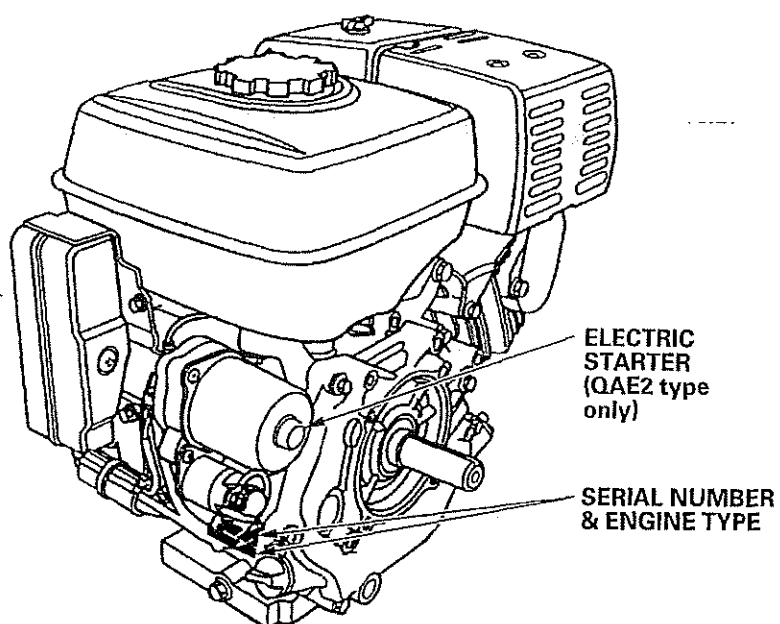


Frequent fuse failure usually indicates a short circuit or an overload in the electrical system. If the fuse burns out frequently, take the engine to a servicing Honda dealer for repair.

TECHNICAL & CONSUMER INFORMATION

TECHNICAL INFORMATION

Serial Number Location



Record the engine serial number in the space below. You will need this serial number when ordering parts, and when making technical or warranty inquiries (see page 59).

Engine serial number: _____

TECHNICAL & CONSUMER INFORMATION

Battery Connections for Electric Starter (QAE2 type only)

Use a 12-volt battery with an ampere-hour rating of at least 18 Ah.

Be careful not to connect the battery in reverse polarity, as this will short circuit the battery charging system. Always connect the positive (+) battery cable to the battery terminal before connecting the negative (−) battery cable, so your tools cannot cause a short circuit if they touch a grounded part while tightening the positive (+) battery cable end.

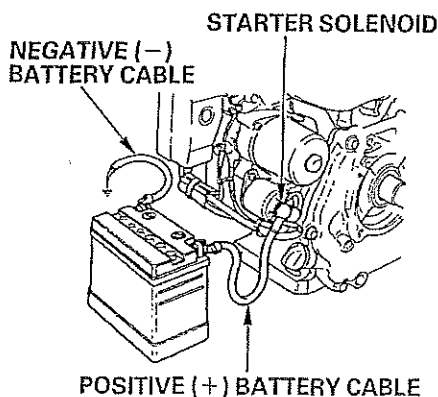
⚠ WARNING

A battery can explode if you do not follow the correct procedure, seriously injuring anyone nearby.

Keep all sparks, open flames, and smoking materials away from the battery.

WARNING: Battery posts, terminals and related accessories contain lead and lead compounds. **Wash hands after handling.**

1. Connect the battery positive (+) cable to the starter solenoid terminal as shown.
2. Connect the battery negative (−) cable to an engine mounting bolt, frame bolt, or other good engine ground connection.
3. Connect the battery positive (+) cable to the battery positive (+) terminal as shown.
4. Connect the battery negative (−) cable to the battery negative (−) terminal as shown.
5. Coat the terminals and cable ends with grease.



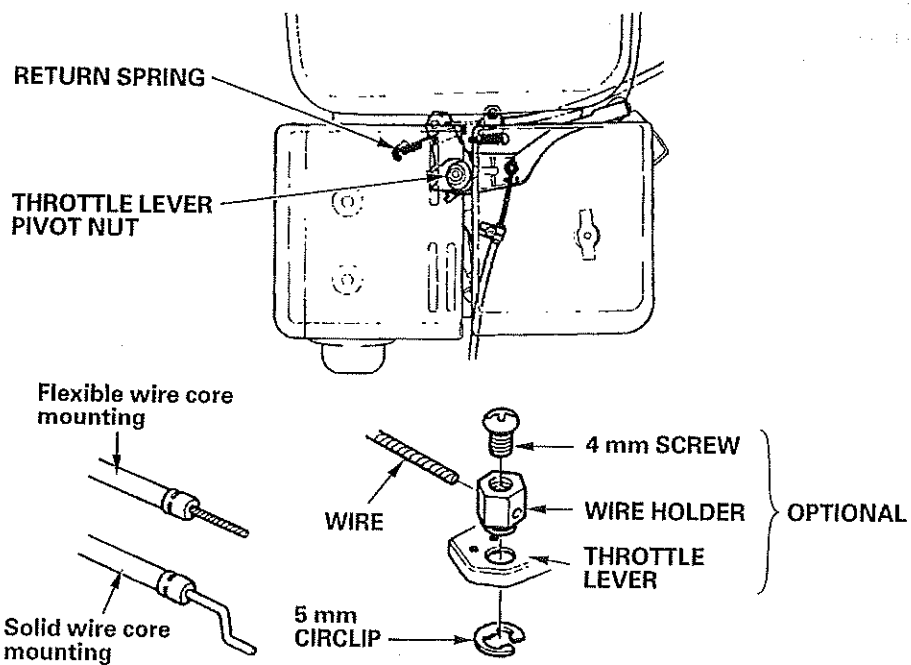
TECHNICAL & CONSUMER INFORMATION

Remote Control Linkage

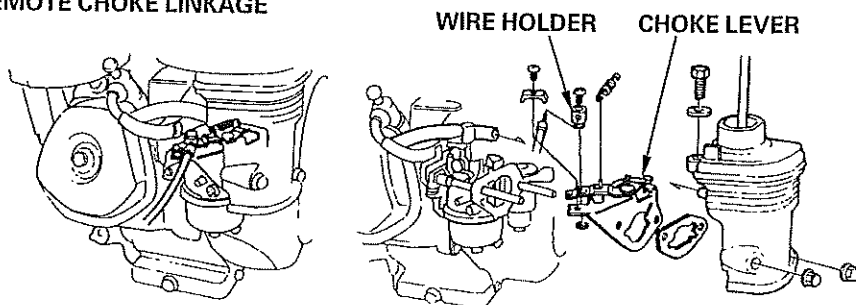
The throttle and choke control levers are provided with holes for optional cable attachment. The following illustrations show installation examples for a solid wire cable and for a flexible, braided wire cable. If using a flexible, braided wire cable, add a return spring as shown.

It is necessary to loosen the throttle lever friction nut when operating the throttle with a remotely-mounted control.

REMOTE THROTTLE LINKAGE



REMOTE CHOKE LINKAGE



TECHNICAL & CONSUMER INFORMATION

Carburetor Modification for High Altitude Operation

At high altitude, the standard carburetor air-fuel mixture will be too rich. Performance will decrease, and fuel consumption will increase. A very rich mixture will also foul the spark plugs and cause hard starting. Operation at an altitude that differs from that at which this engine was certified, for extended periods of time, may increase emissions.

High altitude performance can be improved by specific modifications to the carburetor. If you always operate your engine at altitudes above 5,000 feet (1,500 meters), have your servicing dealer perform this carburetor modification. This engine, when operated at high altitude with the carburetor modifications for high altitude use, will meet each emission standard throughout its useful life.

Even with carburetor modification, engine horsepower will decrease about 3.5% for each 1,000-foot (300-meter) increase in altitude. The effect of altitude on horsepower will be greater than this if no carburetor modification is made.

NOTICE

When the carburetor has been modified for high altitude operation, the air-fuel mixture will be too lean for low altitude use. Operation at altitudes below 5,000 feet (1,500 meters) with a modified carburetor may cause the engine to overheat and result in serious engine damage. For use at low altitudes, have your servicing dealer return the carburetor to original factory specifications.

TECHNICAL & CONSUMER INFORMATION

Oxygenated Fuels

Some conventional gasolines are being blended with alcohol or an ether compound. These gasolines are collectively referred to as oxygenated fuels.

To meet clean air standards, some areas of the United States and Canada use oxygenated fuels to help reduce emissions.

If you use an oxygenated fuel, be sure it is unleaded and meets the minimum octane rating requirement.

Before using an oxygenated fuel, try to confirm the fuel's contents. Some states/provinces require this information to be posted on the pump.

The following are the EPA approved percentages of oxygenates:

ETHANOL ——— (ethyl or grain alcohol) 10% by volume
You may use gasoline containing up to 10% ethanol by volume. Gasoline containing ethanol may be marketed under the name "Gasohol".

MTBE ——— (methyl tertiary butyl ether) 15% by volume
You may use gasoline containing up to 15% MTBE by volume.

METHANOL ——— (methyl or wood alcohol) 5% by volume
You may use gasoline containing up to 5% methanol by volume, as long as it also contains cosolvents and corrosion inhibitors to protect the fuel system. Gasoline containing more than 5% methanol by volume may cause starting and/or performance problems. It may also damage metal, rubber, and plastic parts of your fuel system.

If you notice any undesirable operating symptoms, try another service station, or switch to another brand of gasoline.

Fuel system damage or performance problems resulting from the use of an oxygenated fuel containing more than the percentages of oxygenates mentioned above are not covered under warranty.

TECHNICAL & CONSUMER INFORMATION

Emission Control System Information

Source of Emissions

The combustion process produces carbon monoxide, oxides of nitrogen, and hydrocarbons. Control of hydrocarbons and oxides of nitrogen is very important because, under certain conditions, they react to form photochemical smog when subjected to sunlight. Carbon monoxide does not react in the same way, but it is toxic.

Honda utilizes lean carburetor settings and other systems to reduce the emissions of carbon monoxide, oxides of nitrogen and hydrocarbons.

The U.S. and California Clean Air Acts

EPA and California regulations require all manufacturers to furnish written instructions describing the operation and maintenance of emission control systems.

The following instructions and procedures must be followed in order to keep the emissions from your Honda engine within the emission standards.

Tampering and Altering

Tampering with or altering the emission control system may increase emissions beyond the legal limit. Among those acts that constitute tampering are:

- Removal or alteration of any part of the intake, fuel or exhaust systems.
- Altering or defeating the governor linkage or speed-adjusting mechanism to cause the engine to operate outside its design parameters.

TECHNICAL & CONSUMER INFORMATION

Problems That May Affect Emissions

If you are aware of any of the following symptoms, have your engine inspected and repaired by your servicing dealer.

- Hard starting or stalling after starting.
- Rough idle.
- Misfiring or backfiring under load.
- Afterburning (backfiring).
- Black exhaust smoke or high fuel consumption.

Replacement Parts

The emission control systems on your Honda engine were designed, built, and certified to conform with EPA and California emission regulations. We recommend the use of genuine Honda parts whenever you have maintenance done. These original-design replacement parts are manufactured to the same standards as the original parts, so you can be confident of their performance. The use of replacement parts that are not of the original design and quality may impair the effectiveness of your emission control system.

A manufacturer of an aftermarket part assumes the responsibility that the part will not adversely affect emission performance. The manufacturer or rebuilder of the part must certify that use of the part will not result in a failure of the engine to comply with emission regulations.

Maintenance

Follow the maintenance schedule on page 23. Remember that this schedule is based on the assumption that your machine will be used for its designed purpose. Sustained high-load or high-temperature operation, or use in unusually wet or dusty conditions, will require more frequent service.

TECHNICAL & CONSUMER INFORMATION

Air Index

An Air Index Information hang tag/label is applied to engines certified to an emission durability time period in accordance with the requirements of the California Air Resources Board.

The bar graph is intended to provide you, our customer, the ability to compare the emissions performance of available engines. The lower the Air Index, the less pollution.

The durability description is intended to provide you with information relating to the engine's emission durability period. The descriptive term indicates the useful-life period for the engine's emission control system. See your *Emission Control Warranty* for additional information.

Descriptive Term	Applicable to Emissions Durability Period
Moderate	50 hours (0–65 cc) 125 hours (greater than 65 cc)
Intermediate	125 hours (0–65 cc) 250 hours (greater than 65 cc)
Extended	300 hours (0–65 cc) 500 hours (greater than 65 cc)

The Air Index Information hang tag must remain on the engine until it is sold. Remove the hang tag before operating the engine.

TECHNICAL & CONSUMER INFORMATION

Specifications

GX240/GX270

Length × Width × Height		14.0 × 16.9 × 16.1 in (355 × 430 × 410 mm)
Dry weight		55.1 lbs (25.0 kg)
Engine type		4-stroke, overhead valve, single cylinder
Displacement [Bore × Stroke]	GX240	14.8 cu-in (242 cm ³) [2.9 × 2.3 in (73 × 58 mm)]
	GX270	16.5 cu-in (270 cm ³) [3.0 × 2.3 in (77 × 58 mm)]
Max. output	GX240	8 PS (5.9 kW) at 3,600 rpm
	GX270	9 PS (6.6 kW) at 3,600 rpm
Max. torque	GX240	12.3 lbf-ft (16.7 N·m, 1.7 kgf·m) at 2,500 rpm
	GX270	14.1 lbf-ft (19.1 N·m, 1.95 kgf·m) at 2,500 rpm
Fuel consumption		0.51 lb/hph (313 g/kWh, 230 g/PSH)
Cooling system		Forced air
Ignition system		Transistorized magneto
PTO shaft rotation		Counterclockwise

GX340/GX390

Length × Width × Height		15.0 × 17.7 × 17.4 in (380 × 450 × 443 mm)
Dry weight		68.3 lbs (31.0 kg)
Engine type		4-stroke, overhead valve, single cylinder
Displacement [Bore × Stroke]	GX340	20.6 cu-in (337 cm ³) [3.2 × 2.5 in (82 × 64 mm)]
	GX390	23.7 cu-in (389 cm ³) [3.5 × 2.5 in (88 × 64 mm)]
Max. output	GX340	11 PS (8.1 kW) at 3,600 rpm
	GX390	13 PS (9.6 kW) at 3,600 rpm
Max. torque	GX340	17.4 lbf-ft (23.5 N·m, 2.4 kgf·m) at 2,500 rpm
	GX390	19.5 lbf-ft (26.5 N·m, 2.7 kgf·m) at 2,500 rpm
Fuel consumption		0.51 lb/hph (313 g/kWh, 230 g/PSH)
Cooling system		Forced air
Ignition system		Transistorized magneto
PTO shaft rotation		Counterclockwise

TECHNICAL & CONSUMER INFORMATION

GX240/GX270/GX340/GX390 Tuneup

ITEM	SPECIFICATION	MAINTENANCE
Spark plug gap	0.028—0.031 in (0.70—0.80 mm)	Refer to page: 36
Valve clearance	IN: 0.15 ± 0.02 mm (cold) EX: 0.20 ± 0.02 mm (cold)	See your authorized Honda dealer
Other specifications	No other adjustments needed.	

TECHNICAL & CONSUMER INFORMATION

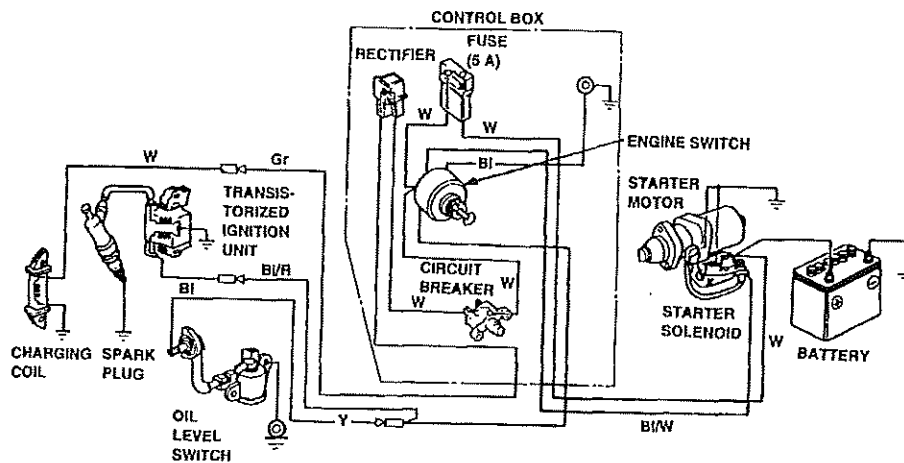
Wiring Diagrams

QAE2 Type With Oil Alert and Electric Starter

ENGINE SWITCH

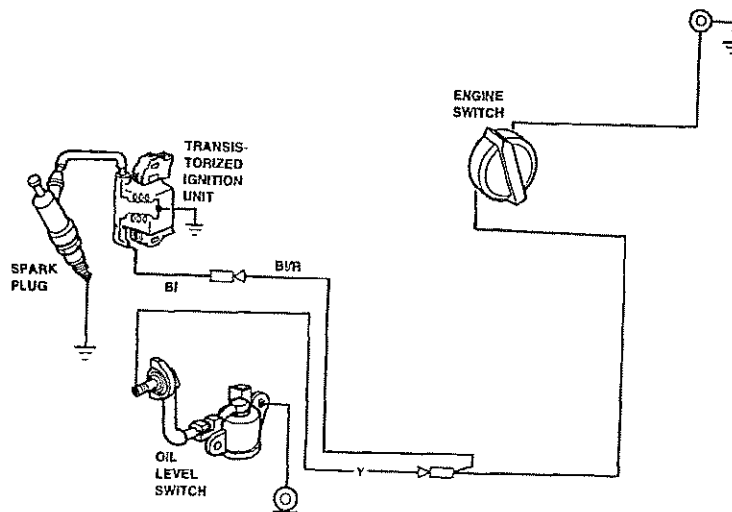
	IG	E	ST	BAT
OFF	○	○		
ON				
START			○	○

BI	BLACK	Gr	GRAY
Y	YELLOW	R	RED
W	WHITE	G	GREEN



Engine Types With Oil Alert and Without Electric Starter

BI	BLACK
Y	YELLOW
G	GREEN



TECHNICAL & CONSUMER INFORMATION

CONSUMER INFORMATION

Honda Publications

These publications will give you additional information for maintaining and repairing your engine. You may order them from your Honda engine dealer.

Shop Manual

This manual covers complete maintenance and overhaul procedures. It is intended to be used by a skilled technician.

Parts Catalog

This manual provides complete, illustrated parts lists.

TECHNICAL & CONSUMER INFORMATION

Warranty Service Information

Servicing dealership personnel are trained professionals. They should be able to answer any question you may have. If you encounter a problem that your dealer does not solve to your satisfaction, please discuss it with the dealership's management. The Service Manager or General Manager can help. Almost all problems are solved in this way.

If you are dissatisfied with the decision made by the dealership's management, contact the Honda Power Equipment Customer Relations Office. You can write to:

American Honda Motor Co., Inc.
Power Equipment Division
Customer Relations Office
4900 Marconi Drive
Alpharetta, Georgia 30005-8847

Or telephone: (770) 497-6400

When you write or call, please give us this information:

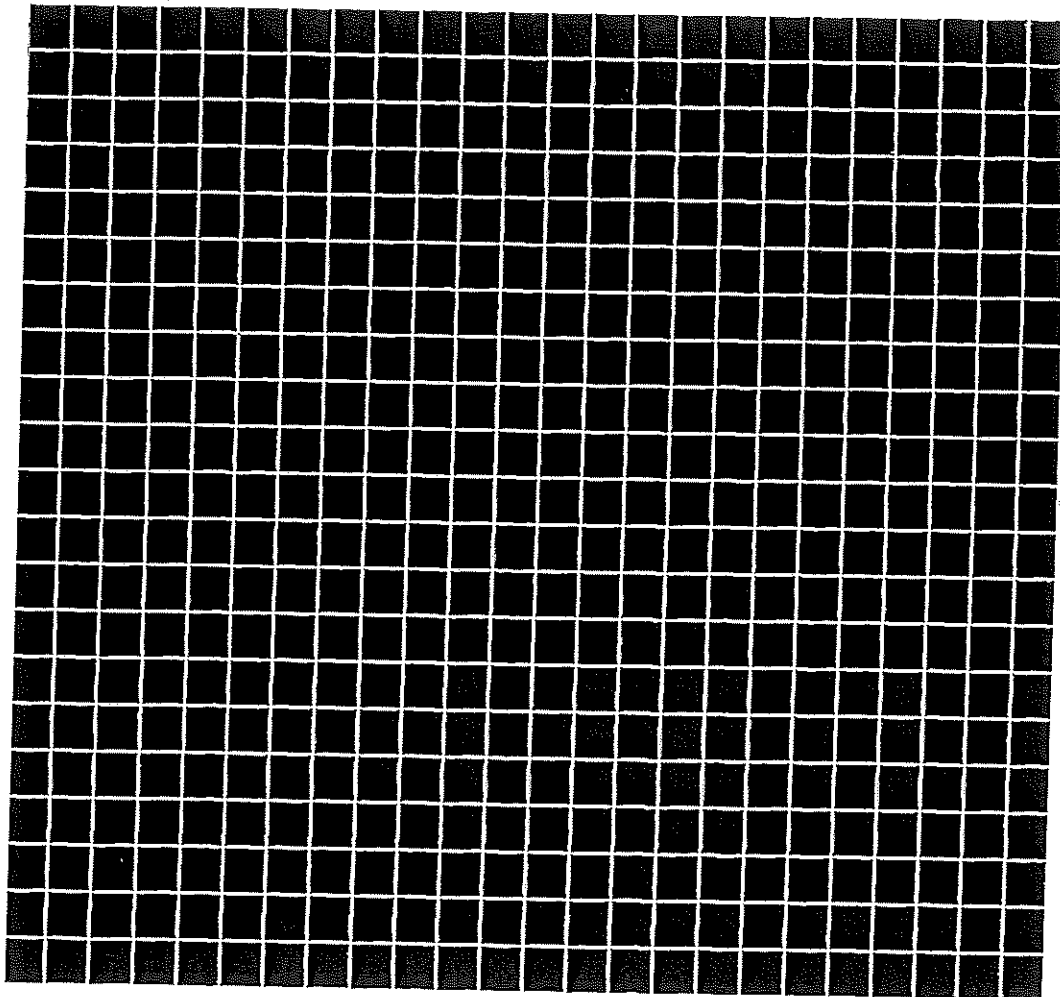
- Model and serial number (see page 47)
- Name of dealer who sold the engine to you
- Name and address of dealer who services your engine
- Date of purchase
- Your name, address and telephone number
- A detailed description of the problem

MEMO

QUICK REFERENCE INFORMATION

Fuel	Type	Unleaded gasoline with a pump octane rating of 86 or higher (page 25).
	Capacity	GX240/GX270: 1.59 US gal (6.0 ℓ , 1.32 Imp gal) GX340/GX390: 1.72 US gal (6.5 ℓ , 1.43 Imp gal)
Engine Oil	Type	SAE 10W-30, API SJ, for general use (page 28)
	Capacity	1.16 US qt (1.10 ℓ , 0.97 Imp qt)
Spark Plug	Type	NGK: BPR6ES , DENSO: W20EPR-U
	Gap	0.028—0.031 in (0.70—0.80 mm) (page 36)
Carburetor	Idle speed	1,400 ± 150 rpm (page 37)
Maintenance	Before each use	Check engine oil level. Check transmission oil level if applicable. Check air filter.
	First 20 hours	Change engine oil. Change transmission oil if applicable.
	Subsequent	Refer to the maintenance schedule on page 23.

HONDA
The Power of Dreams



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HONDA ENGINE S

Distributor's Limited Warranty

Honda General Purpose Engines

This warranty is limited to Honda general purpose engines distributed by American Honda Motor Co., Inc., Power Equipment Division, 4900 Marconi Drive, Alpharetta, Georgia 30005-8847.

PRODUCTS COVERED BY THIS WARRANTY:		LENGTH OF WARRANTY: (FROM DATE OF ORIGINAL PURCHASE)	
PRODUCT	APPLICATIONS	NONCOMMERCIAL/NONRENTAL	COMMERCIAL/RENTAL
GX & GXV Series Engines	All (1)	24 months	24 months (2)
GX22, GX25, GX31, GXH50 & GXV50, GS & GSV Series Engines	All	24 months	12 months/3 months
GC & GCV Series Engines	All	24 months	3 months (3)

1. Honda GXV140 general purpose engines are covered by this warranty for a period of 24 months for noncommercial/nonrental use and 12 months for commercial/rental use from the date of original retail purchase.
2. Honda GX and GXV general purpose engines installed in concession-type vehicles are covered by this warranty for a period of 3 months from the date of original retail purchase.
3. Honda GC/GS and GCV/GSV general purpose engines are not covered by this warranty when installed on concession type vehicles.

To Qualify for this Warranty:

The Honda general purpose engine must be purchased from a Honda general purpose engine dealer or distributor authorized to sell that product in the United States, Puerto Rico, or the U.S. Virgin Islands. This limited warranty applies to first retail purchaser and each subsequent owner during the applicable warranty time period.

What American Honda Will Repair or Replace Under Warranty:

American Honda will repair or replace, at its option, any part that is proven to be defective in material or workmanship under normal use during the applicable warranty time period. Warranty repairs and replacements will be made without charge for parts or labor. Anything replaced under warranty becomes the property of American Honda Motor Company, Inc. All parts replaced under warranty will be considered as part of the original product and any warranty on those parts will expire coincident with the original product warranty.

To Obtain Warranty Service:

You must take your Honda general purpose engine, or the equipment in which it is installed, together with proof of original retail purchase date, at your expense, to a Honda engine dealer or distributor authorized to sell that product in the United States, Puerto Rico, or the U.S. Virgin Islands, during their normal business hours. Many Honda engine dealers and distributors are listed in the yellow pages of the telephone directory under gasoline engines, lawn & garden equipment & supplies, etc.

If you are unable to obtain warranty service, or are dissatisfied with the warranty service you receive, take the following steps: First, contact the owner of the dealership or distributor involved; normally this should resolve the problem. However, if you should require further assistance, write or call the Power Equipment Customer Relations Department of American Honda Motor Co., Inc.

American Honda Motor Co., Inc.
Power Equipment Customer Relations Department
4900 Marconi Drive
Alpharetta, Georgia 30005-8847
Telephone: (770) 497-6400

EXCLUSIONS:

THIS WARRANTY DOES NOT EXTEND TO PARTS AFFECTED OR DAMAGED BY THE PRODUCT IN WHICH THE ENGINE IS INSTALLED, OR BY ACCIDENT AND/OR COLLISION, MISUSE, NEGLIGENCE, PARTS WORN BEYOND SERVICE LIMITS DUE TO NORMAL WEAR/NORMAL SERVICE LIFE, PARTS AFFECTED OR DAMAGED BY THE CONVERSION TO OR USE OF FUEL OTHER THAN THE FUEL(S) WHICH THE ENGINE IS ORIGINALLY MANUFACTURED TO USE, POOR OPERATION RELATED TO FUEL CONTAMINATION OR FUEL QUALITY, PARTS DAMAGED BY FUEL CONTAMINATION, THE INCORPORATION OF, OR USE OF, UNSUITABLE ATTACHMENTS OR PARTS, THE UNAUTHORIZED ALTERATION OF ANY PART OR ANY CAUSES OTHER THAN DEFECTS IN MATERIAL OR WORKMANSHIP OF THE ENGINE. USE OF THE HONDA GENERAL PURPOSE ENGINE FOR RACING OR COMPETITION WILL VOID THIS WARRANTY.

DISCLAIMER OF CONSEQUENTIAL DAMAGE AND LIMITATION OF IMPLIED WARRANTIES:

AMERICAN HONDA DISCLAIMS ANY RESPONSIBILITY FOR LOSS OF TIME OR USE OF THE ENGINE, OR THE EQUIPMENT IN WHICH THE ENGINE IS INSTALLED, TRANSPORTATION, COMMERCIAL LOSS, OR ANY OTHER INCIDENTAL OR CONSEQUENTIAL DAMAGE. ANY IMPLIED WARRANTIES ARE LIMITED TO THE DURATION OF THIS WRITTEN LIMITED WARRANTY. Some states do not allow limitations on how long an implied warranty lasts and/or do not allow the exclusion or limitation of incidental or consequential damages, so the above exclusions and limitations may not apply to you.

This warranty gives you specific legal rights, and you may also have other rights which vary from state to state.

American Honda Motor Co., Inc.
September 2003

HONDA

E N G I N E S

Distributor's Limited Warranty

Honda General Purpose Engines Accessories, Replacement Parts and Apparel

This warranty is limited to Honda Power Equipment parts, accessories and apparel when distributed by American Honda Motor Co., Inc., 4900 Marconi Drive, Alpharetta, Georgia 30005-8847.

PRODUCTS COVERED BY WARRANTY:	LENGTH OF WARRANTY: (FROM DATE OF ORIGINAL RETAIL PURCHASE)	
	NONCOMMERCIAL/NONRENTAL	COMMERCIAL/RENTAL
Accessories	12 months	3 months
Replacement Parts	6 months	3 months
Apparel	6 months	3 months

To Qualify for This Warranty:

1. The accessories, replacement parts, or apparel must be purchased from American Honda, or a dealer, distributor or distributor's dealer authorized by American Honda to sell those products in the United States, Puerto Rico, and the U.S. Virgin Islands.
2. You must be the first retail purchaser. This warranty is not transferable to subsequent owners.

What American Honda Will Repair or Replace Under Warranty:

American Honda will repair or replace, at its option, any Honda General Purpose Engine accessories, replacement parts, or apparel that are proven to be defective in material or workmanship under normal use during the applicable warranty time period. Anything replaced under warranty becomes the property of American Honda Motor Company, Inc. All parts replaced under warranty will be considered as part of the original product and any warranty on those parts will expire coincident with the original product warranty.

Accessories and replacement parts, installed by a dealer, distributor or distributor's dealer who is authorized by American Honda to sell them, will be repaired or replaced under warranty without charge for parts or labor. If installed by anyone else, accessories and replacement parts will be repaired or replaced under warranty without charge for parts, but any labor charges will be the responsibility of the purchaser. Apparel will be repaired or replaced under warranty without any charge.

To Obtain Warranty Service:

You must take the Honda General Purpose Engine accessory, replacement part, apparel or the Honda general purpose engine on which the accessory or replacement part is installed, and proof of purchase, at your expense, to any Honda General Purpose Engine dealer, distributor, or distributor's dealer in the United States, Puerto Rico, or the U.S. Virgin Islands who is authorized to sell that product, during the dealer's or distributor's normal business hours. If you are unable to obtain warranty service, or are dissatisfied with the warranty service you receive, take the following steps: First, contact the owner of the dealership or distributorship involved; normally this will resolve the problem. However, if you should require further assistance, write or call the Power Equipment Customer Relations Department of American Honda Motor Co., Inc.

American Honda Motor Co., Inc.
Power Equipment Customer Relations Department
4900 Marconi Drive
Alpharetta, Georgia 30005-8847
Telephone: (770) 497-6400

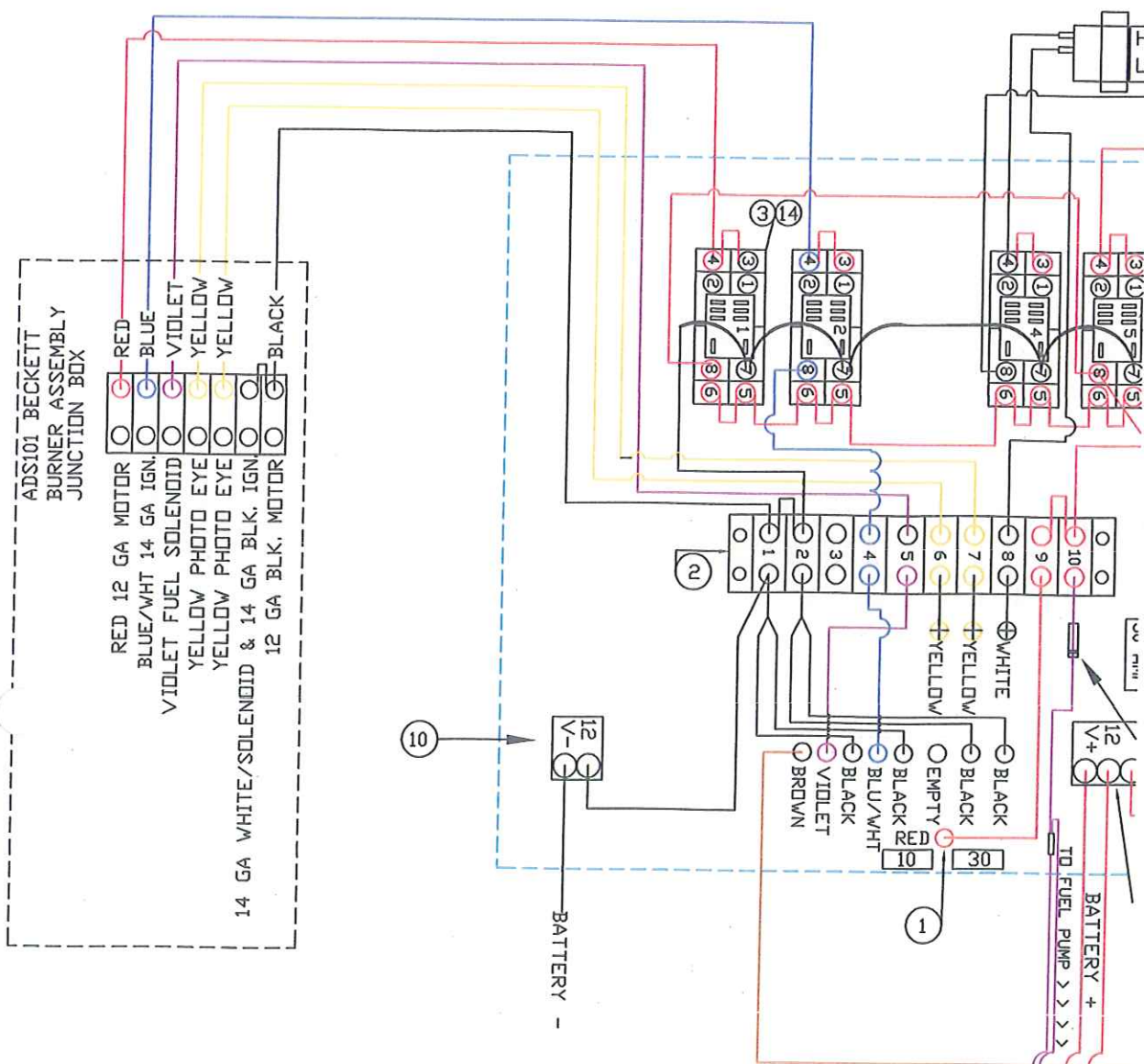
EXCLUSIONS:

THIS WARRANTY DOES NOT EXTEND TO ACCESSORIES, PARTS, OR APPAREL AFFECTED OR DAMAGED BY ACCIDENT AND/OR COLLISION, NORMAL WEAR, USE IN AN APPLICATION FOR WHICH THE PRODUCT WAS NOT DESIGNED OR ANY OTHER MISUSE, NEGLIGENCE, INCORPORATION OR USE OF UNSUITABLE ATTACHMENTS OR PARTS, UNAUTHORIZED ALTERATION, IMPROPER INSTALLATION, OR ANY CAUSES OTHER THAN DEFECTS IN MATERIAL OR WORKMANSHIP OF THE PRODUCT.

DISCLAIMER OF CONSEQUENTIAL DAMAGE AND LIMITATION OF IMPLIED WARRANTIES:

AMERICAN HONDA DISCLAIMS ANY RESPONSIBILITY FOR LOSS OF TIME OR USE OF THE PRODUCT, OR THE POWER EQUIPMENT ON WHICH THE PRODUCT IS INSTALLED, TRANSPORTATION, COMMERCIAL LOSS, OR ANY OTHER INCIDENTAL OR CONSEQUENTIAL DAMAGE. ANY IMPLIED WARRANTIES ARE LIMITED TO THE DURATION OF THIS WRITTEN WARRANTY. Some states do not allow limitations on how long an implied warranty lasts and/or do not allow the exclusion or limitation of incidental or consequential damages, so the above exclusions and limitations may not apply to you.

This warranty gives you specific legal rights, and you may also have other rights which vary from state to state.



ITEMS PER EACH CONTROL BOX

ITEM	QTY	PART #	DESCRIPTION
1	1	ASE7434U	ADC CONTROLER
2	1	ASE7527K91	TERMINAL STRIP
3	4	ASE69585K454	KP 10 RELAY
4	4	ASE7122K22	RELAY BASE
5	1	ASE227854APPC	LIMIT SWITCH
6	1	ASE18041101	CHROMALOX
7	1	ASE08001101G	GREEN LIGHT
8	1	ASE08001101R	RED LIGHT
9	1	ASE00PP6025	PUSH/PULL SWITCH
10	2	ASECONNECTOR	4 AWG CONNECTOR 2 POLE
11	1	ASE8110K4	30 AMP FUSE HOLDER
12	1	ASEDIODE	DIODE
13	1	ASE7563K45	DF CONTROL BOX
14	1	RLY9125ECG	DIN STRIP
15	1	ASECONNECTOR	4 AWG CONNECTOR 3 POLE
16	1	ASE	BACKUP ALARM

DIESEL FIRED ELECTRICAL BOX FOR 2 KETTLE WITH CHROMALOX THERMOSTAT TOM 11-01-2014

