MOTREC

G-660

OPERATOR AND MAINTENANCE MANUAL
SPARE PARTS LISTS INCLUDED

SERIAL NUMBER : 1033835 & UP

Printed in Canada

One Year Limited Warranty

Effective April 25, 2005, MOTREC, Inc. (MOTREC) hereby warrants to the Original Retail Purchaser (Owner) that any of its vehicles shall be free from any defect in materials for a period of 90 DAYS while in the possession of such Original Retail Purchaser. This warranty IS NOT TRANSFERABLE to any subsequent Buyer.

The warranty period is extended to one year or one thousand (1,000) hours, which ever first occurs, on the electric motor, differential (parts that bathe in oil) and the electronic speed controller. MOTREC makes no warranty or representation with respect to the internal combustion engine, tires and batteries, since their respective manufacturers cover such parts. Accessories (light, gage, horn, etc), electrical contacts (switch, solenoid, contactor, relay), diodes & fuses, belts & pulleys, filters & spark plugs, lubricants, brake linings & shoes, brake drums & discs, seals, seats, trim and other items subject to wear are not included in this warranty; nor is any item that in MOTREC sole opinion, shows evidence of neglect, misuse, abuse, collision or alteration.

This warranty shall not apply to normal maintenance requirements as described in the User Manual, and to damages during shipment. The latter is the carrier's responsibility. No compensation will be allowed for delays.

To initiate warranty coverage on any MOTREC vehicle, the Dealer must complete and return the “Sales/Installation Report” to MOTREC within 30 days after delivery to the Original Retail Purchaser; or within 90 days after the delivery date to the Dealer, which ever occurs first. Failure to follow these procedures will result in considering the warranty coverage effective as of the shipment date from the factory.

The defective vehicle must be returned, at the Owner's expense, to an authorised MOTREC Dealer within 30 days after failure. The Owner will not be charged for parts and labour required for warranty repairs, which must be performed by an authorised MOTREC Dealer only. The vehicle will be returned at the owner’s expense. The Warranty Claim Forms must be completed and returned with the defective part(s) to MOTREC within 30 days after repair was done. No compensation will be allowed for damages caused by vehicle downtime.

It is the responsibility of the owner of the vehicle to make sure that the driver is properly trained and instructed in the safety features and operation of the vehicle, including vehicle stability, as required by OSHA and ANSI-B56. Operators shall read, understand and follow the safety and operating instructions in MOTREC Manual before driving the vehicle. Operators shall not be permitted to drive the vehicle unless a complete and adequate training has been provided. Driving a vehicle constitutes a hazard. The driver is responsible for the control of the vehicle while driving and must always evaluate and care for all peculiar situations that he or she may meet while driving. The driver assumes the inherent hazards related to this activity. The vehicle is designed for off-road use only. MOTREC disclaims any liability for incidental or consequential damages, to include, but not be limited to, personal injury or property damage arising from vehicle misuse, lack of maintenance or any defect in the vehicle.

It is the responsibility of the Owner of the vehicle to make sure that the service technicians are properly trained as required by OSHA and ANSI-B56. Service technicians shall read, understand and follow instructions in the MOTREC manual before servicing the vehicle. Only qualified and authorized personnel shall be permitted to maintain, repair, adjust and inspect the vehicle.

MOTREC prohibits, and disclaims responsibility for, any vehicle modification altering the weight distribution and stability, increasing the speed or affecting the safety of the vehicle. Such modifications can cause serious personal injury or property damage for which MOTREC disclaims any responsibility.

For Owners that are located outside North America, the warranty period starts the date of shipment from the factory, and the defective parts must be returned at the Owner's expense to MOTREC prior to warranty repair.

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INSTRUCTIONS

SAFETY WARNINGS FOR OPERATORS

FAILURE TO OBEY THE FOLLOWING SAFETY RULES MAY RESULT IN SEVERE INJURY.

It is the responsibility of the owner of this vehicle to train operators to ensure that they understand the operating characteristics of this vehicle, including training in vehicle stability, and obey the following safety rules and guidelines. Owner shall comply with OSHA and ANSI/ITSDF B56.8 & B56.9 Standards for vehicle use, safety rules, operator training and certification. Do not drive this vehicle unless you are a certified operator.

- Do not drive this vehicle under the influence of drugs or alcohol.
- Do not drive this vehicle on public roads and highways. This vehicle is designed to be driven in buildings.
- This vehicle can make sparks which can ignite inflammable materials. Never use the vehicle in hazardous areas where there are inflammable materials, explosive dust or fumes in the air.
- Never run the engine in a confined area and avoid inhaling engine poisonous fumes which contain CO.
- Have your vehicle inspected regularly by trained personnel, and cease operation if a malfunction occurs.
- Do not open motor compartment. Keep clear from moving, rotating(wheels, sheaves, etc) or lifting parts.
- Keep clear from hot parts of exhaust system.
- Never carry more passengers than number allowed for this vehicle. Wait until all occupants are seated and holding on before moving. Always keep all body parts inside vehicle. Keep both hands on steering wheel.
- Do not exceed the vehicle cargo load capacity and gross trailing weight capacity, rated for flat hard even surface. Different operating conditions such as loose terrain or ramps reduce vehicle capacity.
- Avoid loose, unbalanced or top-heavy loads to keep a good stability and prevent overturn. Do not load cargo that can fall off the vehicle. Do not carry cargo that is longer, wider or higher than this vehicle.
- Always depress slowly the accelerator for smooth acceleration. Avoid stunt driving or horseplay.
- Avoid sharp turns, always slow down before turning, to prevent vehicle overturn or trailer jack knife. Vehicle is more sensitive to overturn and jack knife when traveling on inclines or when carrying a heavy load.
- Always drive straight up and down the face of an incline, never across the face, to prevent overturn and trailer jack knife. Drive slower and start applying brakes sooner on inclines to adjust for longer stopping distance.
- Use extra care and drive slowly in reverse, in congested areas or on wet or slippery ground.
- Keep to the right under normal conditions. Maintain a safe distance from all objects.
- Slow down and sound the horn when approaching a corner or other blind intersections.
- Before leaving the vehicle, park on level ground flat surface, turn off all switches, set forward/reverse selector to neutral, set parking brake, remove the key. Do not park the vehicle on an incline.
- Use another driver to steer this vehicle while it is towed. Be sure the driver uses brakes when you slow or stop the towing vehicle. Do not exceed 5 MPH or carry any passenger while towing this vehicle.

OPERATING INSTRUCTIONS

It is the responsibility of the owner of this vehicle to ensure that the operator understands the operating characteristics of this vehicle, and obeys the safety instructions in this manual and ANSI/ITSDF B56.8 & 9 Standards. Do not drive this vehicle unless you are a certified operator as required by OSHA.

BEFORE TURNING ON KEYSWITCH

Set to neutral, set parking brake, check for visible damage, check brake pedal.

AFTER TURNING ON KEYSWITCH

Check safety devices: seat switch, reverse alarm, motion beeper, strobe light, and all other safety devices.

BATTERIES

Never open the battery compartment unless you have received proper training for battery maintenance.
Batteries emit explosive hydrogen gas that can be ignited by a spark or loose terminal. Battery acid causes severe damage to eyes or skin. Flush the contaminated area immediately with water. Park the vehicle in a well ventilated area for battery charging. Most battery chargers come with an electronic control that starts when the charger is plugged and stop when the battery is fully charged. To interrupt the charging cycle, disconnect the AC-plug, do not disconnect the DC plug.

BATTERY DISCHARGE INDICATOR

The green light moves from right to left as batteries are being discharged. When the green light is at the last position on the left the batteries must be recharged. A flashing light warns the operator that further discharge will damage batteries. See HOBBS indicator instructions.

EMERGENCY SAFETY DEVICE

The emergency push button or battery disconnect handle, when present, should only be used in case of emergency. Use the key switch for normal ON/OFF control.

KEYSWITCH

Depress brake pedal and turn the key switch clockwise for on position. Always turn off all switches, set the F/R selector to neutral, set the parking brake, remove the key before leaving the vehicle.

HORN

Depress the horn button on the steering column or handle bar.

F/R SWITCH

Three positions with neutral at center. Depress the front part of the rocker switch for forward direction. Depress the rear part of the rocker switch for reverse direction. Always set switch to neutral, turn off all switches, set the parking brake, remove the key before leaving the vehicle.

ACCELERATOR PEDAL

It is designed for right foot operation only, and controls the speed of the vehicle. Apply slowly.

FOOT BRAKE PEDAL

It is designed for right foot operation only. The brake force is proportional to the pressure on the pedal.

PARKING BRAKE

Pull handbrake lever to apply. Never park the vehicle on an incline. Always turn off all switches, set the F/R selector to neutral, set the parking brake, remove the key before leaving the vehicle.

VEHICLE CONTROLS (HYDROSTATIC)

It is the responsibility of the owner of this vehicle to ensure that the operator understands the operating characteristics of this vehicle, and obeys the safety instructions in this manual and ANSI/ITSDF B56.8 & 9 Standards. Do not drive this vehicle unless you are a certified operator as required by OSHA.

Fuel Tank

The fuel tank is located on the right (G-320HD, G-500) or rear (G-660). Do not remove the fuel cap while the engine is running. Do not fill the fuel tank to point of overflowing. Use clean, fresh, lead-free gasoline intended for automotive use. A minimum of 85 octane is recommended. Do not mix oil with gasoline.

Engine Oil

Never open engine compartment while engine is running. Before checking engine oil, stop engine. Avoid touching hot engine, muffler and exhaust parts.

Hydraulic oil tank

The hydraulic oil tank is located on the left side. Do not remove the oil cap while the engine is running. Do not fill the oil tank to point of overflowing. Use hydraulic oil meeting ISO VG-46

Oil sentry

When the red light on the instrument panel turns on, the engine oil pressure is too low, or engine temperature is too high. Therefore, the engine must be serviced to avoid serious damage.

Horn button

The horn button is located on the steering column.

Park brake lever

To actuate the parking brake, depress the brake pedal and pull up the hand lever located between the front seats. Never park on an incline. Always set the parking brake before leaving the vehicle.

Accelerator and brake pedals

The accelerator and brake pedals operate the same way as the pedals of an automobile. Depress the accelerator pedal with the right foot to speed the vehicle up and release it to slow down. Depress the brake pedal with the right foot to reduce the vehicle speed.

Forward/Reverse Selector

Shift only when the vehicle is not moving and engine is at idle speed. Before leaving the vehicle, set the FWD/REV selector to NEUTRAL and set the parking brake.

Manual Choke

GAS ENGINE: before starting a cold engine, pull out the choke knob and depress the accelerator pedal halfway to the floor; as the engine warms up, push the knob in until the engine responds properly.
LPG ENGINE: before starting the engine, pull out the choke and depress the accelerator pedal halfway to the floor; while starting, after two seconds, push the knob halfway; as the engine warms up, push the knob in until the engine responds properly.

Key switch / starter

Before starting set the FWD/REV shifter to NEUTRAL, set parking brake, check for visible damage, check brake pedal. To avoid starter damage do not crank the engine continuously for more than 10 seconds at a time; wait 60 seconds before attempting to start again. Before moving check safety devices: reverse alarm, strobe light, motion beeper and all other safety devices. Before leaving vehicle, set FWD/REV shifter to NEUTRAL, set parking brake, remove key.

MAINTENANCE

SAFETY WARNINGS FOR SERVICE TECHNICIANS

FAILURE TO OBEY THE FOLLOWING SAFETY RULES MAIN RESULT IN SEVERE INJURY.

Owner shall comply with OSHA and ASME/ANSI B56.8 & B56.9 regulations for vehicle maintenance.

Only qualified and authorized personnel shall be permitted to maintain, repair, adjust and inspect carriers, vehicles, tractors, and batteries.

Maintenance operations must be made by properly trained service technicians.

Before any maintenance work, park the vehicle on a flat level surface, set the shift lever to park, turn off all the switches, remove the key, lift the wheels off the ground and secure with jack stands of adequate capacity.

Keep clear from moving parts such as tires, sheaves, drive shaft and engine.

Keep clear from hot parts of exhaust system.

Avoid increasing engine RPM and vehicle speed to prevent accident and severe injuries.

Follow the maintenance instructions applicable to the type of repair, maintenance, or service.

Always wear a face shield and gloves when working around batteries. Use insulated tools to avoid sparks that can cause battery explosion and acid splashing. Use two counteracting tools, double-wrench technique, when disconnecting or tightening terminals on the battery to avoid damaging battery posts.

Keep cables and wires clear from mechanical and rubbing action. Make sure cable covering is free from cutting or visible damage.

Before replacing a fuse or circuit breaker, identify the cause of failure and repair.

Always ensure the integrity of the warning labels. If they suffered damage and are not readable, replace them promptly. The following images depict the dashboard and general security warning labels:

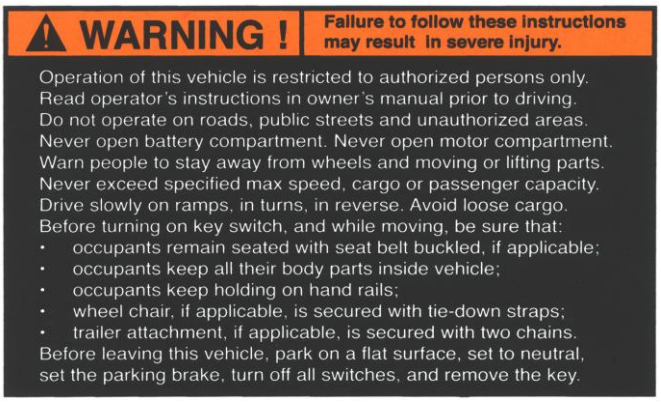
DECALS AND LABELS

! CAUTION !

The images included in this section depict the decals/markings installed on the vehicle. It is of the utmost importance that theses decals/markings remain unaltered and readable. Else, the sticker or the part baring the marking has to be replaced.

Dashboard security warning label:
5100000002

General security warning label:
5100000001

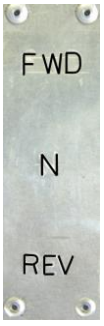


When an emergency push button is installed, this label is required (located under push button): # 3109800006

When a disconnect handle is installed, this label is required (located in front of handle):
4800012J

Respectively, key switch markings, forward/reverse selector markings and light switch marking:

266211



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PREVENTIVE MAINTENANCE SCHEDULE - MOTREC I.C. UNITS

! WARNING ! Read safety instructions before maintenance operations to avoid severe injury.
! WARNING ! Maintenance operations must be made by properly trained service technicians. Follow OSHA and ANSI B56 regulations.

Change engine oil after first 8 hours of use. S/N: _____ Hour Meter reading: _____

	ESTIMATED TIME (MINUTES)					
PERIOD DESCRIPTION	SHIFT START	100H	200 H	1000 H	YEAR	CHECK
Stop engine, check engine oil level.	**3**					
Check vehicle for visual damage	**2**					
Examine floor around and beneath unit for signs of transmission oil, differential oil, brake fluid leaks.	**2**					
Turn steering, check for hard steering, excessive free play, or unusual sound when turning.	**1**					
Check accelerator for free & smooth movement, and automatic spring-return to stop.	**2**					
Shift in neutral, before starting engine.	**1**					
Check reverse alarm, horn, strobe light.	**2**					
Check brake pedal travel and parking brake for secure hold. Start slowly and check service brake.	**2**					
Check tire pressure, see pressure rating on tire		**5**				
Check transmission & hydraulic oil level, if appl.		**5**				
Check radiator coolant level, if applicable.		**2**				
Check master cylinder fluid level (DOT 3)		**2**				
Check brake pedal travel		**1**				
Turn front wheels straight, check steering play		**1**				
Check parking brake, requires 75 lbs. force to apply		**1**				
Check brake lines and drive for leaks		**5**				
Check fuel pipe, hose, clamps for damage & leaks		**5**				
Check radiator fan belt, CVT belt, if applicable		**3**				
Service air filter, check intake pipe & clamps		**5**				
Check muffler, exhaust pipe, clamps, spark arrester		**5**				
Air cooled engines only, **change engine oil**		**20(X)**				
Water-cooled engines only, **change engine oil**			**X(20)**			
WARNING LABELS & MARKINGS			**2**			
Inspect wheel bearings and king pins for play			**8**			
Inspect steering suspension linkages & frame.			**10**			
Check pedal & master cylinder linkages for wear			**10**			
Check service brake linings and linkages for wear			**15**			
Check Spark Plugs			**20**			
Change Oil Filter			**20**			
Change air filter			**10**			
Clean radiators and engine shrouds			**20**			
Lubricate the vehicle			**5**			
Service fuel filter, LP vaporizer & regulator				**20**		
Check engine valve clearance & seats				**40**		
Check ignition wires, tighten all nuts and bolts				**20**		
Change differential oil, transmission oil & filter				**20**		
Clean & repack front hubs				**20**		
Flush/change brake fluid					**30**	
Flush/change radiator coolant, if applicable					**30**	
TOTAL TIME (MINUTES)	**15**	**60**	**120**	**120**	**60**	

OIL GRADE CHART

Vehicle system	Oil grade	Note
KOHLER engine		
Above +32°F	10W-30	
Below +32°F	5W-30	
KUBOTA engine		
Above 77°F	30 or 10W-30 or 10W-40	
+32°F to 77°F	20 or 10W-30 or 10W-40	
Below +32°F	10W or 10W-30 or 10W-40	
Hydrostatic transmission	ISO VG46	
Brakes	DOT 3	DMVSS116 standard

HYDRAULIC & PARKING BRAKES

Revision 2008-02-06

DRUM BRAKES

Remove brake drums and check lining wear. Replace shoes and springs if the lining thickness is 1/16" (2mm) or less. Turn the brake adjustment to reduce the clearance between lining and drum. Wheels must turn free when the pedal is released.

DISC BRAKES

Check pad linings. Replace pads if lining thickness is 1/16" (2 mm) or less.

PARKING BRAKE

Replace cables and stoppers if cable play exceeds 1/8" (4mm).
Wheels and/or differential pinion must turn freely when the parking brake is released.
On pinion brake, use spacers at pad fixed ends to reduce space between pads and pulley to 1mm.
To install new cables and stoppers:
-insert the new cable through the hand lever end;
-pull the cable out from the brake assembly end;
-insert the stopper on the cable and leave a maximum play of 1mm;
-for a two-cable system, make sure that cable length is the same at hand lever end;
-tighten ¼-ncx3/4 grade-5 bolt in stopper at 8 LbFt (11NM) torque;
-cable must extend 1.5" (4cm) out of the cable stopper, cut cable excess.

Once cable play has been checked and/or adjusted, turn the knob on the brake lever until a force of 75 Lbs or 34 kg is required on the handle to set the parking brake.

BRAKE PEDAL

If the brake pedal becomes soft or spongy, air may have entered the hydraulic system and the brake system has to be bled:

1. fill the master cylinder with brake fluid (DOT-3);
2. bleed front callipers one at a time by having someone applying a steady pressure on the brake pedal, and close the bleeder before allowing the brake pedal to return to up position;
3. fill the master cylinder with brake fluid (DOT-3);
4. bleed rear wheel brakes one at a time, following the same procedure;
5. fill the master cylinder with brake fluid (DOT-3);
6. clean every fitting and line, remove traces of oil;
7. apply a continuous pressure on the brake pedal for about five minutes ;
8. Finally, inspect brake lines and fittings for leaks ;

FRONT AXLE AND STEERING

! CAUTION !

Before maintenance, turn off all switches, set to neutral, set parking brake, remove the key, and raise the front end of the vehicle supporting it with two jack stands of adequate capacity

STEERING INSPECTION

– Check tire inflation pressure, suspension components, tie rods straightness, tie rod ends play (wear), play (wear) in wheel bearings, kingpins and bushings.

REPLACING & ADJUSTING THE STEERING GEAR

– Remove the pitman arm;
– The steering box makes 6.5 turns, center the steering gear (3.25 turns from either side);
– Align the front wheel straight. Install the pitman arm.

TOE-IN ADJUSTEMENT

– With the wheels in straight forward direction, measure the inside (left to right) distance between the front tires, at the front and rear of the tires;
– Turn the rear tie rod until the distances are equal and tighten the two lock nuts on the tie rod.

REMOVING & GREASING OF FRONT HUBS, required once-a-year

– Remove dust cap and cutter pin, unscrew nut, remove hub;
– Inspect bearings and races for wear and replace worn bearings;
– Replace the seal;
– Pack the hub with wheel bearing grease and re-assemble.

ADJUSTING FRONT HUBS

– Tighten spindle nut to 30 ft-lb to seat the bearing and back off the nut to the next slot;
– Install a new cutter pin and the dust cap.

HYDROSTATIC PUMP – PORTS AND ADJUSTING SCREWS

1	MACHINE RPM START-UP ADJUSTING SCREW Turn CW to increase RPM
2	POWER LIMITER ADJUSTING SCREW Turn CW to increase power
3	MINIMUM CHARGE PRESSURE ADJUSTING SCREW Turn CW to increase pressure
4	CHARGE PRESSURE ADJUSTING SCREW Turn CW to increase pressure
P1	CHARGE PRESSURE INTAKE
M1	HIGH PRESSURE SIDE A
M2	HIGH PRESSURE SIDE B

Safety Precautions

To insure safe operations please read the following statements and understand their meaning. Also refer to your equipment owner's manual for other important safety information. This manual contains safety precautions which are explained below. Please read carefully.

WARNING
Warning is used to indicate the presence of a hazard that *can* cause *severe* personal injury, death, or substantial property damage if the warning is ignored.

CAUTION
Caution is used to indicate the presence of a hazard that *will* or *can* cause *minor* personal injury or property damage if the warning is ignored.

NOTE
Note is used to notify people of installation, operation, or maintenance information that is important but not hazard-related.

For Your Safety!
These precautions should be followed at all times. Failure to follow these precautions could result in injury to yourself and others.

WARNING

Accidental Starts can cause severe injury or death.

Disconnect and ground spark plug leads before servicing.

Accidental Starts!
Disabling engine. Accidental starting can cause severe injury or death. *Before working on the engine or equipment, disable the engine as follows: 1) Disconnect the spark plug lead(s). 2) Remove battery cables (remove negative (-) lead first). Reconnect negative (-) lead last when reconnecting battery.*

Before disconnecting the negative (-) ground cable, make sure all switches are OFF. If ON, a spark will occur at the ground cable terminal which could cause an explosion if hydrogen gas or LP/gasoline fuel vapors are present.

WARNING

Rotating Parts can cause severe injury.

Stay away while engine is in operation.

Rotating Parts!
Keep hands, feet, hair, and clothing away from all moving parts to prevent injury. Never operate the engine with covers, shrouds, or guards removed.

CAUTION

Electrical Shock can cause injury.

Do not touch wires while engine is running.

Electrical Shock!
Never touch electrical wires or components while the engine is running. They can be sources of electrical shock.

WARNING

Hot Parts can cause severe burns.

Do not touch engine while operating or just after stopping.

Hot Parts!
Engine components can get extremely hot from operation. To prevent severe burns, do not touch these areas while the engine is running–or immediately after it is turned off. Never operate the engine with heat shields or guards removed.

California Proposition 65 Warning

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

Safety Precautions (Cont.)

⚠ WARNING

Explosive Fuel can cause fires and severe burns.

Stop engine before filling fuel tank.

Explosive Fuel!

LPG *is extremely flammable and is heavier than air and tends to settle in low areas where a spark or flame could ignite the gas. Do not start or operate this engine in a poorly ventilated area where leaking gas could accumulate and endanger the safety of persons in the area.*

To insure personal safety, installation and repair of LPG fuel supply systems must be performed only by qualified LPG system technicians. Improperly installed and maintained LPG equipment could cause fuel supply system or other components to malfunction, causing gas leaks.

Observe federal, state and local laws governing LPG fuel, storage, and systems.

– Continued in next column –

Gasoline *is extremely flammable and its vapors can explode if ignited. Store gasoline only in approved containers, in well ventilated, unoccupied buildings, away from sparks or flames. Do not fill the fuel tank while the engine is hot or running, since spilled fuel could ignite if it comes in contact with hot parts or sparks from ignition. Do not start the engine near spilled fuel. Never use gasoline as a cleaning agent.*

⚠ WARNING

Carbon Monoxide can cause severe nausea, fainting or death.

Do not operate engine in closed or confined area.

Lethal Exhaust Gases!

Engine exhaust gases contain poisonous carbon monoxide. Carbon monoxide is odorless, colorless, and can cause death if inhaled. Avoid inhaling exhaust fumes, and never run the engine in a closed building or confined area.

⚠ WARNING

Explosive Gas can cause fires and severe acid burns.

Charge battery only in a well ventilated area. Keep sources of ignition away.

Explosive Gas!

Batteries produce explosive hydrogen gas while being charged. To prevent a fire or explosion, charge batteries only in well ventilated areas. Keep sparks, open flames, and other sources of ignition away from the battery at all times. Keep batteries out of the reach of children. Remove all jewelry when servicing batteries.

Before disconnecting the negative (–) ground cable, make sure all switches are OFF. If ON, a spark will occur at the ground cable terminal which could cause an explosion if hydrogen gas or LP/gasoline fuel vapors are present.

Congratulations – You have selected a fine four-cycle, twin cylinder, air-cooled engine. Kohler designs long life strength and on-the-job durability into each engine...making a Kohler engine dependable...dependability you can count on. Here are some reasons why:

- Efficient overhead valve design and full pressure lubrication provide maximum power, torque, and reliability under all operating conditions.
- Dependable, maintenance free electronic ignition ensures fast, easy starts time after time.
- Kohler engines are easy to service. All routine service areas (like the dipstick and oil fill, air cleaner, spark plugs, and carburetor) are easily and quickly accessible.
- Parts subject to the most wear and tear (like the cylinder liner* and camshaft) are made from precision formulated cast iron. Because the cylinder liner* can be rebored, these engines can last even longer.

  *CH25 engines have POWER-BORE™ Cylinders. These cylinders are plated with nickel-silicon to give increased power, virtually permanent cylinder life, superior oil control, and reduced exhaust emissions. These cylinders cannot be rebored.
- Every Kohler engine is backed by a worldwide network of over 10,000 distributors and dealers. Service support is just a phone call away. Call 1-800-544-2444 (U.S. & Canada) for Sales & Service assistance.

To keep your engine in top operating condition, follow the maintenance procedures in this manual.

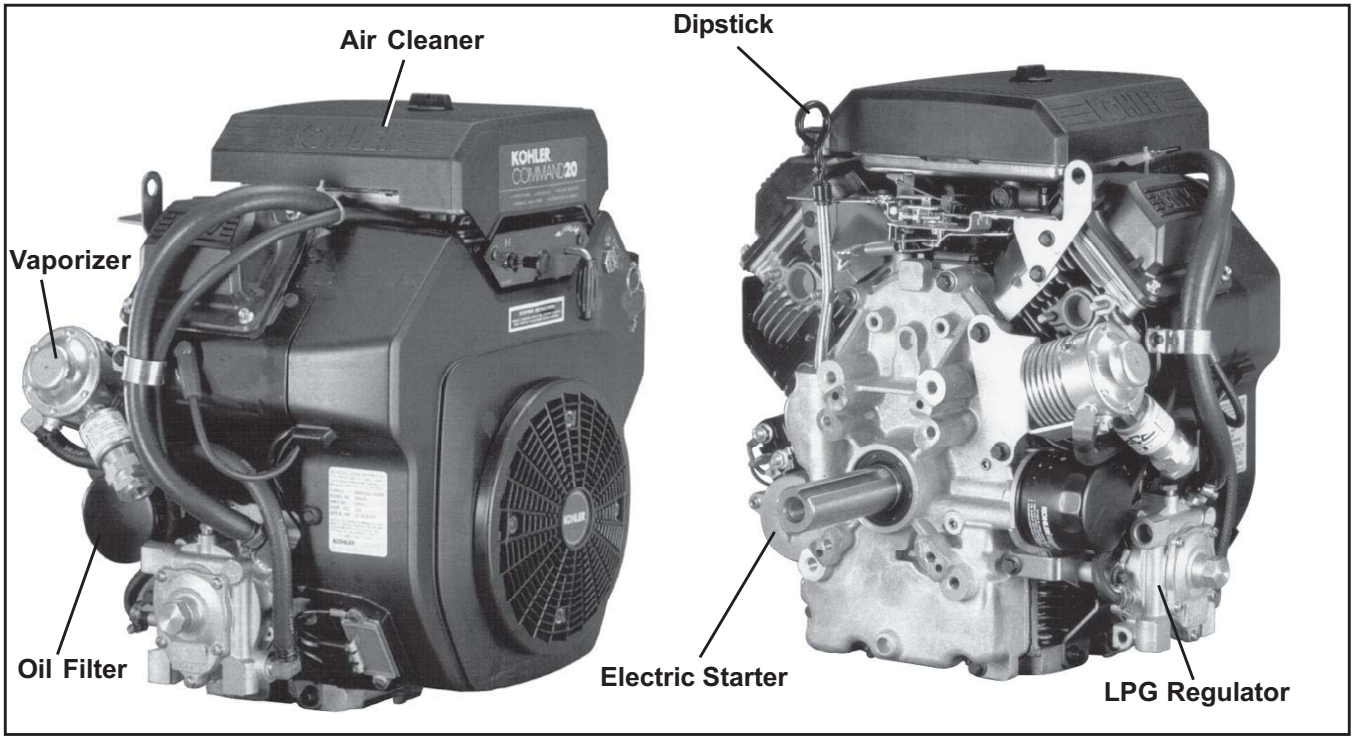


Figure 1. Typical Command Horizontal Shaft LP Gas Fueled Engine.

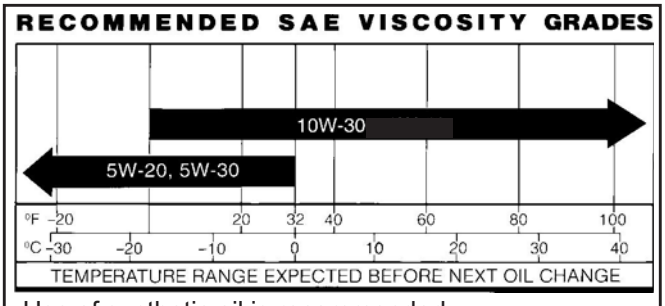
Oil Recommendations

Using the proper type and weight of oil in the crankcase is extremely important. So is checking oil daily and changing oil regularly. Using oil that is incorrect or dirty can cause premature engine wear and failure.

Synthetic oil is recommended for use in LPG-fueled engines because there is less oxidation or thickening, and deposit accumulation on intake valves is substantially reduced. Conventional petroleum-based oil may be used, but valve service will be required every 500 hours to remove the accumulated deposits. Dual-fueled engines can use conventional oil without requiring special/additional valve service.

Oil Type

Use high quality, oil of **API (American Petroleum Institute) service class SG, SH, SJ or higher.** Select the viscosity based on the air temperature at the time of operation as shown in the following table.



Use of synthetic oil is recommended.

Figure 2. Viscosity Grades Table.

NOTE: Using other than service class SG, SH, SJ or higher oil or extending oil change intervals longer than recommended can cause engine damage.

A logo or symbol on oil containers identifies the API service class and SAE viscosity grade. See Figure 3.

Figure 3. Oil Container Logo.

Refer to "Maintenance Instructions" beginning on page 8 for detailed oil check, oil change, and oil filter change procedures.

LPG Engines

LPG Fuel Recommendations
Liquefied Petroleum Gas (LPG) from an appropriate LP fuel tank (supplied separately) is required to operate this engine.

WARNING: Pressurized LPG!
Fuel tanks are filled under pressure and should be handled with care. To prevent tank damage which could endanger the safety of the operator or persons in the area, do not drop or drag tanks on any surface. Use a hand truck when moving, or tilt the tank on its footring in a position slightly off vertical and roll it.

Avoid personal contact with LPG fuel to prevent frostbite. See a physician if frostbite occurs.

WARNING: Explosive Fuel!
LPG is extremely flammable and is heavier than air and tends to settle in low areas where a spark or flame could ignite the gas. Do not start or operate this engine in a poorly ventilated area where leaking gas could accumulate and endanger the safety of persons in the area.

LPG fuel consists primarily of propane, although the fuel supplier may sometimes mix other gases with propane.

Fuel tanks must be filled only by persons qualified in the handling of LPG. Tanks are filled by weight and should not be overfilled (never to more than 80 percent of total capacity). An air space must be present in the tank to allow fuel to expand.

Tanks must be removed from equipment before filling.

Fuel Type
This engine is certified to operate on Liquefied Petroleum Gas (LPG).

Dual-Fuel Engines

Dual-fuel engines are designed to operate on either LPG or gasoline. For LPG operation, the above information and warnings apply. For gasoline operation, the following information and warnings apply.

Fuel Recommendations

WARNING: Explosive Fuel!
Gasoline is extremely flammable and its vapors can explode if ignited. Store gasoline only in approved containers, in well ventilated, unoccupied buildings, away from sparks or flames. Do not fill the fuel tank while the engine is hot or running, since spilled fuel could ignite if it comes in contact with hot parts or sparks from ignition. Do not start the engine near spilled fuel. Never use gasoline as a cleaning agent.

General Recommendations
Purchase gasoline in small quantities and store in clean, approved containers. A container with a capacity of 2 gallons or less with a pouring spout is recommended. Such a container is easier to handle and helps eliminate spillage during refueling.

Do not use gasoline left over from previous season, to minimize gum deposits in your fuel system and to insure easy starting.

Do not add oil to the gasoline.

Do not overfill the fuel tank. Leave room for the fuel to expand.

Fuel Type
For best results, use only clean, fresh, **unleaded** gasoline with a pump sticker octane rating of 87 or higher. In countries using the Research method, it should be 90 octane minimum.

Unleaded gasoline is recommended as it leaves less combustion chamber deposits. Leaded gasoline may be used in areas where unleaded is not available and exhaust emissions are not regulated. Be aware however, that the cylinder heads may require more frequent service.

Gasoline/Alcohol blends
Gasohol (up to 10% ethyl alcohol, 90% unleaded gasoline by volume) is approved as a fuel for Kohler engines. Other gasoline/alcohol blends are not approved.

Gasoline/Ether blends
Methyl Tertiary Butyl Ether (MTBE) and unleaded gasoline blends (up to a maximum of 15% MTBE by volume) are approved as a fuel for Kohler engines. Other gasoline/ether blends are not approved.

Engine Identification Numbers

When ordering parts, or in any communication involving an engine, always give the **Model, Specification, and Serial Numbers** of the engine.

The engine identification numbers appear on a decal (or decals) affixed to the engine shrouding. Include letter suffixes, if there are any.

Record your engine identification numbers on the identification label below (Figure 4) for future reference.

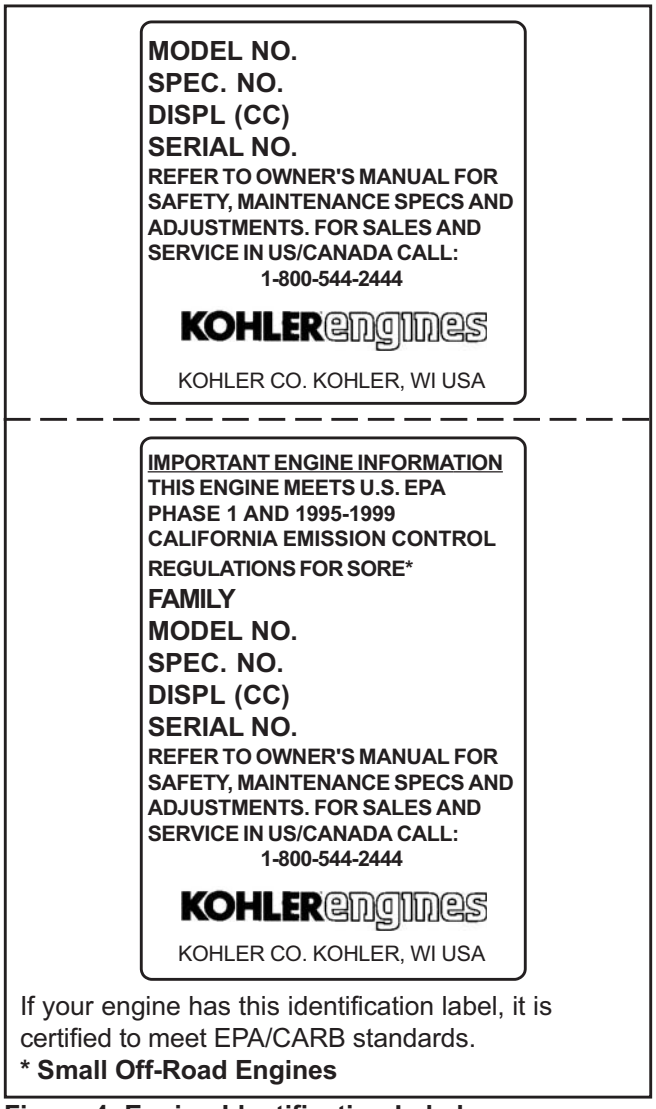


Figure 4. Engine Identification Labels.

Model Designation

Model CH20S for example: C designates Command engine, H designates horizontal crankshaft, and 20 designates horsepower. Model TH16S for example: T designates Twin engine, H designates horizontal crankshaft, and 16 designates horsepower. A letter suffix designates a specific version as follows:

Suffix	Designates
S	Electric Start

Operating Instructions

Also read the operating instructions of the equipment this engine powers.

Pre-Start Checklist

- Check oil level. Add oil if low. Do not overfill.
- Check fuel gauge on LPG tank. Tanks should be filled to a specific weight. To insure safety and proper fuel system operation, tanks must not be overfilled.
- Check fuel lines, regulator, and other system components for leaks. Do not start engine until leaks are eliminated.
- Check cooling air intake areas and external surfaces of engine. Make sure they are clean and unobstructed.
- Check that the air cleaner components and all shrouds, equipment covers, and guards are in place and securely fastened.
- Check that any clutches or transmissions are disengaged or placed in neutral. This is especially important on equipment with hydrostatic drive. The shift lever must be exactly in neutral to prevent resistance which could keep the engine from starting.

WARNING: Lethal Exhaust Gases!

Engine exhaust gases contain poisonous carbon monoxide. Carbon monoxide is odorless, colorless, and can cause death if inhaled. Avoid inhaling exhaust fumes, and never run the engine in a closed building or confined area.

Though LPG burns more efficiently and emits less carbon monoxide than gasoline, some carbon monoxide is produced. Avoid inhaling exhaust gases – especially over prolonged periods of time. Do not allow engine to run unattended.

Cold Weather Starting Hints

1. Be sure to use the proper oil for the temperature expected. See Figure 2 on page 4.
2. Disengage all possible external loads.
3. Set speed control at part throttle position.
4. Be sure the battery is in good condition. A warm battery has much more starting capacity than a cold battery.

Starting

1. Place the throttle control **midway** between the **"slow"** and **"fast"** positions. Place the choke control into the **"on"** position. See Figure 5 (Command Series shown). On dual-fueled engines, place the three-position fuel control switch in the **gasoline** position (engine **must** be started and run on gasoline for 1 minute to heat up oxygen sensor).

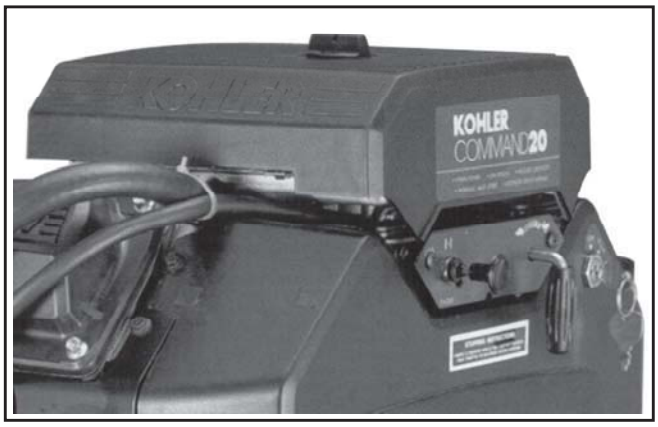


Figure 5. Optional Engine Mounted Throttle and Choke Controls.

2. Slowly turn the fuel valve on the LPG (propane) tank to full open position. For ''gasoline only'' operation on dual-fuel units, leave valve closed.

3. Start the engine by activating the key switch. Release the switch as soon as the engine starts. Return choke to **"off"** position after engine starts. On a cold engine, it may be necessary to leave choke partially on until engine begins to warm up. Dual-fuel engines must be allowed to warm up on gasoline for at least 1 minute. To switch to LPG operation, move the three-position switch to the LPG position.

   NOTE: Do not crank the engine continuously for more than 10 seconds at a time. If the engine does not start, allow a 60 second cool down period between starting attempts. Failure to follow these guidelines can burn out the starter motor.

   NOTE: If the engine develops sufficient speed to disengage the starter but does not keep running (a false start), the engine rotation must be allowed to come to a complete stop before attempting to restart the engine. If the starter is engaged while the flywheel is rotating, the starter pinion and flywheel ring gear may clash, resulting in damage to the starter.

If the starter does not turn the engine over, shut off starter immediately. Do not make further attempts to start the engine until the condition is corrected. Do not jump start using another battery (refer to "Battery" on page 8). See your Kohler Engine Service Dealer for trouble analysis.

NOTE: Upon start up a metallic ticking may occur (Command Series only). This is caused by hydraulic lifter leakdown during storage. Run the engine for 5 minutes. The noise will normally cease in the first minute. If noise continues, run the engine at mid throttle for 20 minutes. If noise persists, take the engine to your local Kohler Service outlet.

Stopping

LPG-Only Engines

1. Turn fuel valve on LPG tank to full closed position and allow the engine to continue running until it runs out of fuel. Turn ignition switch to **"off"** position.

Dual-Fuel Engines

1. Dual-fuel engines may be stopped any of three ways:

   a. When operating on LPG, one method is the same as described above for LPG-only engines.

   b. LPG operation can also be stopped by moving the three-position fuel control switch to the **"off"** position and letting the engine run out of fuel. Turn off ignition switch. If engine will not be restarted for some time, also close fuel valve at LPG tank.

   c. To stop the engine from gasoline operation, it should be running between half and full throttle. Move the three-position fuel control switch and/or the ignition switch to the **"off"** position.

   In an **emergency**, move the throttle control to **stop** or turn the ignition switch off.

   NOTE: Backfiring may occur when using the emergency stop method!

Battery

A 12 volt battery is normally used. Refer to the operating instructions of the equipment this engine powers for specific battery requirements.

If the battery charge is not sufficient to crank the engine, recharge the battery (see page 12).

Operating

Angle of Operation

This engine will operate continuously at angles up to 25°. Check oil level to assure crankcase oil level is at the “F” mark on the dipstick.

Refer to the operating instructions of the equipment this engine powers. Because of equipment design or application, there may be more stringent restrictions regarding the angle of operation.

NOTE: Do not operate this engine continuously at angles exceeding 25° in any direction. Engine damage could result from insufficient lubrication.

Cooling

NOTE: If debris builds up on the flywheel screen or other cooling areas, stop the engine immediately and clean. Operating the engine with blocked or dirty air intake and cooling areas can cause extensive damage due to overheating.

WARNING: Hot Parts!

Engine components can get extremely hot from operation. To prevent severe burns, do not touch these areas while the engine is running–or immediately after it is turned off. Never operate the engine with heat shields or guards removed.

Engine Speed

NOTE: Do not tamper with the governor setting to increase the maximum engine speed. Overspeed is hazardous and will void the engine warranty. The maximum allowable high speed for these engines is 3750 RPM, no load.

Maintenance Instructions

Maintenance, repair, or replacment of the emission control devices and systems, which are being done at the customers expense, may be performed by any* non-road engine repair establishment or individual. Warranty repairs must be performed by an authorized Kohler service outlet.

*For safety and health reasons, many states require special licensing or certification for servicing LPG fuel systems. Check local and state regulations before choosing a repair establishment to perform fuel system repairs.

WARNING: Accidental Starts!

Disabling engine. Accidental starting can cause severe injury or death. *Before working on the engine or equipment, disable the engine as follows: 1) Disconnect the spark plug lead(s). 2) Remove battery cables (remove negative (-) lead first). Reconnect negative (-) lead last when reconnecting battery.*

Before disconnecting the negative (-) ground cable, make sure all switches are off. If on, a spark will occur at the ground cable terminal which could cause an explosion if hydrogen gas or LP/gasoline fuel vapors are present.

Maintenance Schedule

These required maintenance procedures should be performed at the frequency stated in the table. They should also be included as part of any seasonal tune-up.

Frequency	Maintenance Required
Daily or Before Starting Engine	• Check fuel gauge on propane (LPG) tank. Fill gasoline tank (dual-fuel units only). • Check oil level. • Check air cleaner for dirty[1], loose, or damaged parts. • Check air intake and cooling areas, clean as necessary[1].
Every 25 Hours	• Service precleaner element[1].
Every 100 Hours	• Replace air cleaner element[1]. • Change oil. • Remove cooling shrouds and clean cooling areas[1]. • Check oil cooler fins, clean as necessary (if equipped). • Check spark plug condition and gap.
Every 200 Hours	• Change oil filter.
Annually or Every 300 Hours	• Replace spark plugs.
Annually or Every 500 Hours	• Check all lines (high pressure/vacuum) including fittings for leaks. • Have electric starter serviced[2]. • Have lock-off/filter serviced[3]. • Have combustion deposits removed if using non-synthetic oil (not on dual-fuel engines). • Drain regulator of accumumulated fuel deposits.
Every 1500 Hours	• Have regulator disassembled, cleaned, and reset[3].

[1]Perform these maintenance procedures more frequently under extremely dusty, dirty conditions.
[2]Have a Kohler Engine Service Dealer perform this service.
*[3]Must be performed by an Authorized Kohler Engine Dealer or qualified LP personnel **only**.*

Check Oil Level

The importance of checking and maintaining the proper oil level in the crankcase cannot be overemphasized. Check oil **BEFORE EACH USE** as follows:

1. Make sure the engine is stopped, level, and is cool so the oil has had time to drain into the sump.

2. To keep dirt, debris, etc., out of the engine, clean the area around the dipstick before removing it.

3. Remove the dipstick; wipe oil off. Reinsert the dipstick into the tube and press all the way down.

4. Remove the dipstick and check the oil level.

   The oil level should be up to, but not over, the “F” mark on the dipstick. See Figure 6.

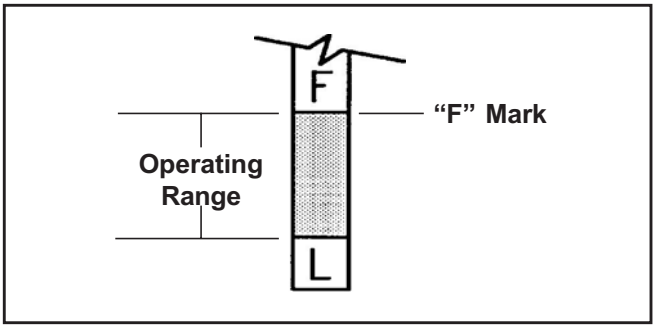


Figure 6. Oil Level Dipstick.

5. If the level is low, add oil of the proper type, up to the “F” mark on the dipstick. (Refer to “Oil Type” on Page 4.) Always check the level with the dipstick before adding more oil.

   NOTE: To prevent extensive engine wear or damage, always maintain the proper oil level in the crankcase. Never operate the engine with the oil level below the “L” mark or over the “F” mark on the dipstick.

Oil Sentry™

Some engines are equipped with an optional Oil Sentry™ oil pressure switch monitor. If the oil pressure decreases below an acceptable level, the Oil Sentry™ will either shut off the engine or activate a warning signal, depending on the application.

NOTE: Make sure the oil level is checked **BEFORE EACH USE** and is maintained up to the "F" mark on the dipstick. This includes engines equipped with Oil Sentry™.

Change Oil and Oil Filter

Change Oil

Change oil after every **100 hours** of operation. Refill with service class SG, SH, SJ or higher oil as specified in the "Viscosity Grades" table (Figure 2) on page 4.

Change the oil while the engine is still warm. The oil will flow freely and carry away more impurities. Make sure the engine is level when filling, checking, and changing the oil.

Change the oil as follows (see Figure 7):

1. To keep dirt, debris, etc., out of the engine, clean the area around the oil fill cap/dipstick before removing it.

2. Remove one of the oil drain plugs, oil fill cap, and dipstick. Be sure to allow ample time for complete drainage.

3. Reinstall the drain plug. Make sure it is tightened to **13.6 N·m (10 ft. lb.)** torque.

4. Fill the crankcase, with new oil of the proper type, to the "F" mark on the dipstick. Refer to "Oil Type" on page 4. Always check the level with the dipstick before adding more oil.

5. Reinstall the oil fill cap and tighten securely. Reinstall dipstick.

   NOTE: To prevent extensive engine wear or damage, always maintain the proper oil level in the crankcase. Never operate the engine with the oil level below the "L" mark or over the "F" mark on the dipstick.

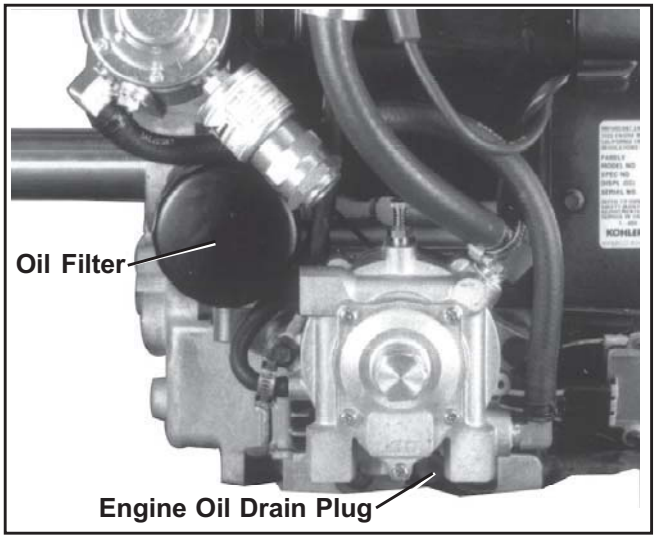


Figure 7. Oil Drain Plug and Oil Filter.

Change Oil Filter

Replace the oil filter **at least every other oil change (every 200 hours of operation).** *Always use a genuine Kohler oil filter, Part No. 12 050 01.*

Replace the oil filter as follows:

1. Drain the oil from the engine crankcase by removing one of the drain plugs and allowing ample time for complete drainage.

2. Before removing the oil filter, clean the area around the oil filter to keep dirt and debris out of the engine. Remove the old filter. Wipe off the surface where the oil filter mounts.

3. Place a new replacement filter in a shallow pan with the open end up. Pour new oil of the proper type in through the threaded center hole. Stop pouring when the oil reaches the bottom of the threads. Allow a minute or two for the oil to be absorbed by the filter material.

4. Put a drop of oil on your fingertip and wipe it on the rubber gasket.

5. Install the new oil filter onto the filter adapter. Turn the oil filter clockwise until the rubber gasket contacts the mounting surface, then tighten the filter an additional **1/2 turn**.

6. Reinstall the drain plug. Make sure it is tightened to **13.6 N·m (10 ft. lb.)** torque.

7. Fill the crankcase with new oil of the proper type to the "F" mark on the dipstick.

8. Test run the engine to check for leaks. Stop the engine, allow a minute for the oil to drain down, and recheck the level on the dipstick. Add more oil as necessary so the oil level is up to but not over the "F" mark on the dipstick.

Service Precleaner and Air Cleaner Element

This engine is equipped with a replaceable, high density paper air cleaner element. Some engines are also equipped with an oiled, foam precleaner which surrounds the paper element. See Figures 8 and 9. (Command Series shown.)

Figure 8. Air Cleaner Housing Components.

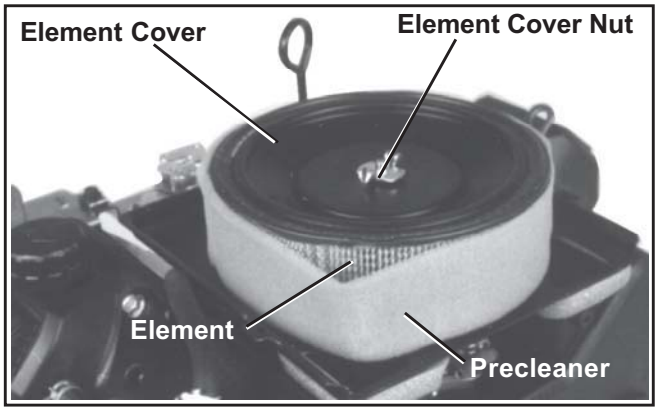


Figure 9. Air Cleaner System Components.

Check the air cleaner **daily or before starting the engine.** Check for a buildup of dirt and debris around the air cleaner system. Keep this area clean. Also check for loose or damaged components. Replace all bent or damaged air cleaner components.

NOTE: Operating the engine with loose or damaged air cleaner components could allow unfiltered air into the engine causing premature wear and failure.

Service Precleaner

If so equipped, wash and reoil the precleaner every **25 hours** of operation (more often under extremely dusty or dirty conditions).

1. Loosen the cover retaining knob and remove the cover.
2. Remove the precleaner from the paper element.
3. Wash the precleaner in warm water with detergent. Rinse the precleaner thoroughly until all traces of detergent are eliminated. Squeeze out excess water (do not wring). Allow the precleaner to air dry.
4. Saturate the precleaner with new engine oil. Squeeze out all excess oil.
5. Reinstall the precleaner over the paper element.
6. Reinstall the air cleaner cover. Secure cover with the cover retaining knob.
7. When precleaner replacement is necessary order genuine Kohler parts.

Service Paper Element

Every **100 hours** of operation (more often under extremely dusty or dirty conditions) replace the paper element.

CH18-22	CH25	TH16,18
24 083 02	24 083 05	28 083 02

1. Loosen the cover retaining knob and remove the air cleaner cover.
2. Remove the element cover nut, element cover, and paper element/precleaner.
3. Remove the precleaner (if so equipped) from the paper element and service as instructed above.
4. Do not wash the paper element or **use pressurized air,** as this will damage the element. Replace a dirty, bent, or damaged element with a genuine Kohler element. Handle new elements carefully; do not use if the sealing surfaces are bent or damaged.
5. When servicing the air cleaner, check the air cleaner base. Make sure it is secured and not bent or damaged. Also check the element cover for damage or improper fit. Replace all damaged air cleaner components.

   NOTE: Before air cleaner reassembly make sure rubber seal is in position around stud. Inspect, making sure it is not damaged and seals with the element cover.

6. Reinstall the paper element, precleaner, element cover, element cover nut, and air cleaner cover. Secure cover with cover retaining knob.

7. When element replacement is necessary order genuine Kohler parts.

CH18-22	CH25	TH16,18
24 083 02	24 083 05	28 083 04

Clean Air Intake/Cooling Areas

To ensure proper cooling, make sure the flywheel screen, cooling fins, and other external surfaces of the engine are kept clean **at all times.**

Every **100 hours** of operation (more often under extremely dusty, dirty conditions), remove the blower housing and other cooling shrouds. Clean the cooling fins and external surfaces as necessary. Make sure the cooling shrouds are reinstalled.

NOTE: Operating the engine with a blocked flywheel screen, dirty or plugged cooling fins, and/or cooling shrouds removed, will cause engine damage due to overheating.

Ignition System

This engine is equipped with an electronic CD ignition system. Other than periodically checking/replacing the spark plugs, no maintenance, timing, or adjustments are necessary or possible with this system.

In the event starting problems should occur which are not corrected by replacing the spark plugs, see your Kohler Engine Service Dealer for trouble analysis.

Check Spark Plugs

Every **100 hours** of operation, remove the spark plugs, check condition, and reset the gap or replace with new plugs as necessary. **Every 300 hours or annually** replace the spark plugs. Replacement spark plugs are Kohler Part No. 12 132 02 (Champion® type RC12YC) for TH16,18 and Kohler Part No. 25 132 05 (Champion® type RC78PYP) for CH18-25. Equivalent alternate brand plugs can also be used.

1. Before removing the spark plug, clean the area around the base of the plug to keep dirt and debris out of the engine.

2. Remove the plug and check its condition. Replace the plug if worn or reuse is questionable.

   NOTE: Do not clean the spark plugs in a machine using abrasive grit. Some grit could remain in the spark plug and enter the engine causing extensive wear and damage.

3. Check the gap using a wire feeler gauge. Adjust the gap to **0.76 mm (0.030 in.)** by carefully bending the ground electrode. See Figure 10.

4. Reinstall the spark plug into the cylinder head. Torque the spark plug to **24.4/29.8 N·m (18/22 ft. lb.)**.

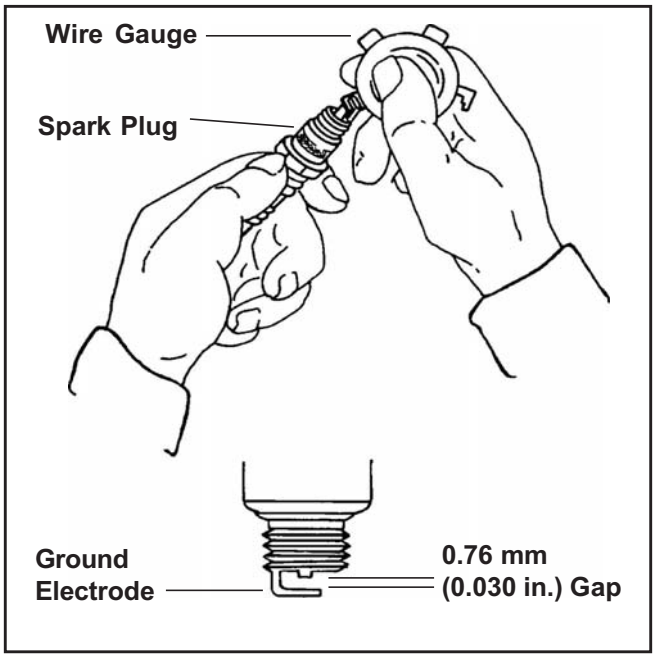


Figure 10. Servicing Spark Plug.

Battery Charging

WARNING: Explosive Gas!

Batteries produce explosive hydrogen gas while being charged. To prevent a fire or explosion, charge batteries only in well ventilated areas. Keep sparks, open flames, and other sources of ignition away from the battery at all times. Keep batteries out of the reach of children. Remove all jewelry when servicing batteries.

Before disconnecting the negative (–) ground cable, make sure all switches are OFF. If ON, a spark will occur at the ground cable terminal which could cause an explosion if hydrogen gas or LP/gasoline fuel vapors are present.

Charging of battery should be performed as outlined by the original equipment manufacturer (OEM) in their operator's manual.

Fuel Filter

The filter of the LP fuel system is an integral part within the lock-off/filter assembly. All service relating to the lock-off/ filter is to be performed by an authorized Kohler Engine Service Dealer or qualified LP personnel only. Servicing of filter is recommended every 500 hours. The gasoline system (dual-fuel only) has an in-line fuel filter. Periodically inspect the filter and replace when dirty. Use a genuine Kohler filter, Part No. 24 050 02.

Carburetor Troubleshooting and Adjustments

In compliance with government emission standards, the carburetor and the regulator are calibrated and preset to deliver the correct fuel-to-air mixture to the engine under all operating conditions and cannot be adjusted, except for low idle speed. Carburetor servicing is to be performed by an authorized Kohler Engine Service Dealer only. See Figure 11.

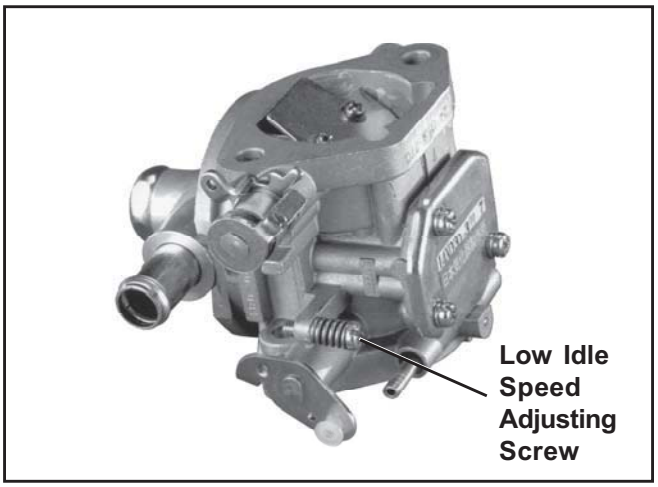


Figure 11.

LPG Regulator

In compliance with government emission standards, the regulator is preset at the factory to provide the proper supply of fuel. No adjustment or resetting of regulator is to be made. All service relating to the regulator must be performed by an authorized Kohler Engine Service Dealer or qualified LP personnel only.

Over time, fuel deposits can accumulate inside the regulator. Draining of these deposits is recommended every 500 operating hours, or annually, whichever comes first.

Every 500 hours/annually drain regulator:

1. Turn fuel supply valve off, run engine out of fuel, and turn off ignition switch.

2. Disconnect and ground the spark plug leads.

3. Remove the 1/8" pipe plug from the bottom of regulator and drain any accumulated deposits. See Figure 12.

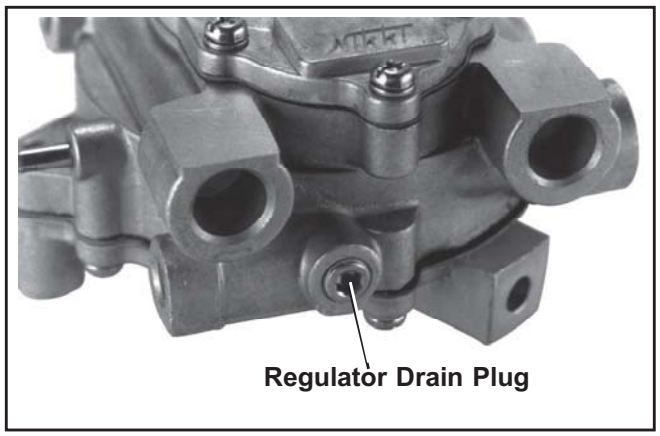


Figure 12.

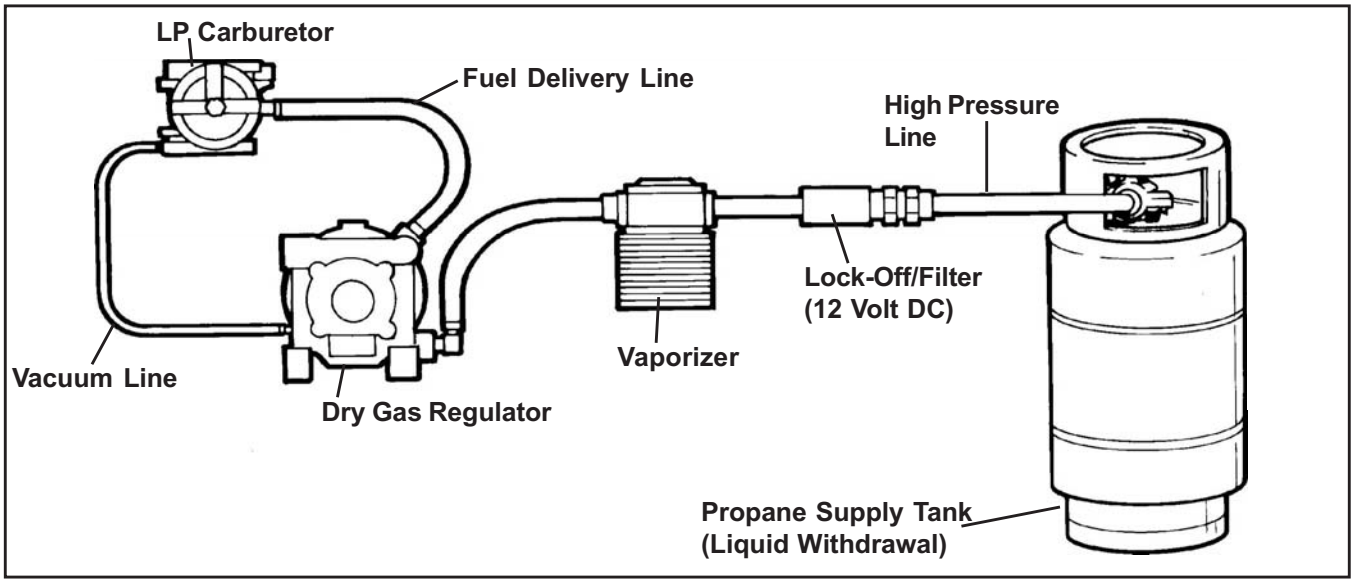


Figure 13. Schematic Showing Components of LP System.

4. Reinstall plug using teflon pipe sealant (not teflon tape) on threads and tighten securely. If required, a replacement plug is available as **Kohler Part No. X-75-23.**

Every 1500 Hours:
Complete cleaning through disassembing, servicing, and resetting of regulator at 1500 hour intervals is recommended. As all adjustments and settings must be reset using specific test equipment, this must be performed by an **authorized Kohler Engine Service Dealer or qualified LP personnel only.**

Lock-Off/Filter Assembly

This opens, closes, and filters the liquid fuel flow from the supply tank before reaching the vaporizer. Servicing, if required, is to be performed by an authorized Kohler Engine Service Dealer or qualified LP personnel only. See Figure 13.

Vaporizer

The vaporizer changes the Liquified Petroleum (LP) from the supply tank to a gaseous/vapor state. Other than keeping the body clean, no maintenance, adjustment, or servicing is required. See Figure 13.

Leakage Check/Testing

Every 500 hours or annually. With LPG tank valve fully opened, engine not running, turn key switch **"on."** Check all LPG system connections and lines for leaks using soapy water. Any leakage must be corrected **before** restarting engine. Have service performed by an authorized Kohler Engine Service Dealer or qualified LP personnel only.

Troubleshooting - Fuel Related

If engine problems are experienced that appear to be fuel system related, check the following areas before seeking service assistance.

- Make sure the LPG tank is properly filled (never to more than 80 percent of total capacity). An air space must be present in the tank to allow fuel to expand.
- Make sure the air cleaner element is clean and all air cleaner element components are fastened securely.
- Check for loose, kinked, or cracked vacuum lines causing regulator not to open.
- Check to make sure the fuel valve on LPG tank is fully open.
- Check gauge on LPG tank to make sure pressure is sufficient to open the regulator.
- For problems with the gasoline system (dual-fuel), check that there is adequate fresh fuel in the tank, the fuel valve at the tank (if so equipped) is open, the fuel tank cap is properly vented, the lines are not kinked or blocked, and that the in-line filter is not dirty or restricted.

If after checking the items listed above, the engine is hard to start, runs roughly, or stalls at low idle speed, qualified fuel system servicing may be necessary. Contact your nearest authorized Kohler Engine Service Dealer for further assistance.

Troubleshooting

When troubles occur, be sure to check the simple causes which at first may seem too obvious to be considered. For example, a starting problem could be caused by an empty fuel tank. Some common causes of engine troubles are listed in the following table.

Do not attempt to service or replace major engine components, or any items that require special timing or adjustment procedures. Have your Kohler Engine Service Dealer do this work.

Possible Cause / Problem	No Fuel	Improper Fuel	Dirt In Fuel Line	Dirty/ Restricted Lock-off Fuel Filter	Dirty Flywheel Screen	Incorrect Oil Level	Engine Overloaded	Dirty Air Cleaner	Faulty Spark Plug	Dirty/ Restricted Regulator
Will Not Start	•		•	•	•	•	•	•	•	•
Hard Starting	•	•	•	•	•	•	•	•	•	•
Stops Suddenly	•		•	•	•	•	•	•		•
Lacks Power		•	•	•	•	•	•	•	•	•
Operates Erratically		•	•	•	•		•	•	•	•
Knocks or Pings		•		•	•		•		•	•
Skips or Misfires		•	•	•	•			•	•	•
Backfires			•	•				•	•	•
Overheats		•	•	•	•	•	•	•		•
High Fuel Consumption								•	•	

Storage

When the engine is not in use, use the following storage procedure. Federal, state, or local laws governing short term LPG fuel tank storage may also apply. Follow the applicable storage laws.

1. Clean the exterior surfaces of the engine.

2. Change the oil and filter while the engine is still warm from operation. See "Change Oil and Oil Filter" on page 10.

3. Turn valve on LPG tank off and run engine until the fuel system is empty. Turn ignition key switch off. Separate LPG tank from the unit and store separately in an area designated for safe LPG tank storage. On dual-fuel units, the gasoline fuel system must be completely emptied, or the gasoline must be treated with a stabilizer to prevent deterioration. If you choose to use a stabilizer, follow the manufacturer's recommendations, and add the correct amount for the capacity of the fuel system. Fill the fuel tank with clean, fresh gasolin. Run the engine for 2-3 minutes to get stabilized fuel into the carburetor. Close fuel shut-off valve when unit is being stored or transported.

4. Remove the spark plugs. Add one tablespoon of engine oil into each spark plug hole. Install the plugs, but do not connect the plug leads. Crank the engine two or three revolutions.

5. Store the engine in a clean, dry place. Store the fuel tank in a designated safe LPG storage area at all times when not in use.

Parts Ordering

The engine Specification, Model, and Serial Numbers are required when ordering replacement parts from your Kohler Engine Service Dealer. These numbers are found on the identification plate which is affixed to the engine shrouding. Include letter suffixes if there are any. See "Engine Identification Numbers" on page 6.

Always insist on genuine Kohler parts. All genuine Kohler parts meet strict standards for fit, reliability, and performance.

Major Repair

Major repair information is available in Kohler Engine Service Manuals. However, major repair generally requires the attention of a trained mechanic and the use of special tools and equipment. Your Kohler Engine Service Dealer has the facilites, training, and genuine Kohler replacement parts necessary to perform this service. For Sales & Service assistance call 1-800-544-2444 (U.S. & Canada) or contact your Kohler Engine Dealer or Service Distributor, they're in the Yellow Pages under Engines-Gasoline.

Specifications

Model:	CH18-22	CH25	TH16	TH18
Bore: inches (millimeters)	3.03 (77)	3.27 (83)	2.87 (73)	2.95 (75)
Stroke: inches (millimeters)	2.64 (67)	2.64 (67)	2.44 (62)	2.56 (65)
Displacement: cubic inches (cubic centimeters)	38.1 (624)	44.0 (725)	31.7 (520)	35.0 (574)
Power (@3600 RPM): horsepower (kilowatts)	20* (14.9)	25* (18.4)	16* (11.9)	18* (13.4)
Max. Torque: ft. lbs. (N·m) @RPM	32 (44) @2500	39.5 (54) @2400	26.2 (35.5) @2500	29.5 (40) @2500
Compression Ratio:	8.5:1	9.0:1	7.8:1	8.4:1
Weight: lbs. (kilograms)	90 (41)	94 (43)	90 (41)	90 (41)
Oil Capacity (w/filter): U.S. quarts (liters)	2.1 (2)	2.1 (2)	1.5 (1.4)	1.5 (1.4)
Lubrication:	⊢— Full Pressure w/full Flow Filter —⊣		⊢— Pressure w/full Flow Filter —⊣	

*Horsepower ratings are established in accordance with Society of Automotive Engineers – Small Engine Test Code – J1349 GROSS. Kohler Co. reserves the right to change product specifications, design, and standard equipment without notice and without incurring obligation. A horsepower reduction of approximately 10 percent may be expected with the operation and use of LPG as fuel.

LIMITED 2 YEAR COMMAND/OHC ENGINE WARRANTY

We warrant to the original consumer that each new Command/OHC engine sold by us will be free from manufacturing defects in materials or workmanship in normal service for a period of two (2) years from date of purchase, provided it is operated and maintained in accordance with Kohler Co.'s instructions and manuals.

Our obligation under this warranty is expressly limited, at our option, to the replacement or repair at Kohler Co., Kohler, Wisconsin 53044, or at a service facility designated by us of such parts as inspection shall disclose to have been defective.

EXCLUSIONS:
This warranty does not apply to defects caused by casualty or unreasonable use, including faulty repairs by others and failure to provide reasonable and necessary maintenance.

The following items are not covered by this warranty:

Engine accessories such as fuel tanks, clutches, transmissions, power-drive assemblies, and batteries, unless supplied or installed by Kohler Co. These are subject to the warranties, if any, of their manufacturers.

WE SHALL NOT BE LIABLE FOR SPECIAL, INDIRECT, INCIDENTAL, OR CONSEQUENTIAL DAMAGES OF ANY KIND, including but not limited to labor costs or transportation charges in connection with the repair or replacement of defective parts.

ANY IMPLIED OR STATUARY WARRANTIES, INCLUDING WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE, ARE EXPRESSLY LIMITED TO THE DURATION OF THIS WRITTEN WARRANTY. We make no other express warranty, nor is any one authorized to make any in our behalf.

Some states do not allow limitations on how long an implied warranty lasts, or the exclusion or limitation of incidental or consequential damages, so the above limitation or exclusion 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.

TO OBTAIN WARRANTY SERVICE:
Purchaser must bring the engine to an authorized Kohler service facility. For the facility nearest you, consult your Yellow Pages or write Kohler Co., Attn: Engine Warranty Service Dept., Kohler, Wisconsin, 53044.

ENGINE DIVISION, KOHLER CO., KOHLER, WISCONSIN 53044

KOHLER CO.
FEDERAL AND CALIFORNIA EMISSION CONTROL SYSTEMS
LIMITED WARRANTY
UTILITY AND LAWN AND GARDEN ENGINES

The U.S. Environmental Protection Agency (EPA), the California Air Resources Board (CARB), and Kohler Co. are pleased to explain the Federal and California Emission Control Systems Warranty on your utility/lawn/garden equipment engine (herein engine). For California, engines produced in 1995 and later must be designed, built and equipped to meet the state's stringent anti-smog standards. In other states, new 1997 and later model year engines must be designed, built and equipped, at the time of sale, to meet the U.S. EPA regulations for small non-road engines. The engine must be free from defects in materials and workmanship which cause it to fail to conform with U.S. EPA standards for the first two years of engine use from the date of sale to the ultimate purchaser. Kohler Co. must warrant the emission control system on the engine for the period of time listed above, provided there has been no abuse, neglect or improper maintenance.

The emission control system may include parts such as the carburetor or fuel injection system, the ignition system, and catalytic converter. Also included are the hoses, belts and connectors and other emission related assemblies.

Where a warrantable condition exists, Kohler Co. will repair the engine at no cost, including diagnosis (if the diagnostic work is performed at an authorized dealer), parts and labor.

MANUFACTURER'S WARRANTY COVERAGE
Engines produced in 1995 or later are warranted for two years in California. In other states, 1997 and later model year engines are warranted for two years. If any emission related part on the engine is defective, the part will be repaired or replaced by Kohler Co. free of charge.

OWNER'S WARRANTY RESPONSIBILITIES
(a) The engine owner is responsible for the performance of the required maintenance listed in the owner's manual. Kohler Co. recommends that you retain all receipts covering maintenance on the engine, But Kohler Co. cannot deny warranty solely for the lack of receipts or for your failure to assure that all scheduled maintenance was performed.

(b) Be aware, however, that Kohler Co. may deny warranty coverage if the engine or a part has failed due to abuse, neglect, improper maintenance or unapproved modifications.

Continued on next page.

(c) For warranty repairs, the engine must be presented to a Kohler Co. service center as soon as a problem exists. Call 1-800-544-2444 for the names of the nearest service centers. The warranty repairs should be completed in a reasonable amount of time, not to exceed 30 days.

If you have any questions regarding warranty rights and responsibilities, you should contact Kohler Co. Engine Service at 1-920-457-4441.

COVERAGE

Kohler Co. warrants to the ultimate purchaser and each subsequent purchaser that the engine will be designed, built and equipped, at the time of sale, to meet all applicable regulations. Kohler Co. also warrants to the initial purchaser and each subsequent purchaser, that the engine is free from defects in materials and workmanship which cause the engine to fail to conform with applicable regulations for a period of two years.

Engines produced in 1995 or later are warranted for two years in California. For 1997 and later model years, EPA requires manufacturers to warrant engines for two years in all other states. These warranty periods will begin on the date the engine is purchased by the initial purchaser. If any emission related part on the engine is defective, the part will be replaced by Kohler Co. at no cost to the owner. Kohler Co. is liable for damages to other engine components caused by the failure of a warranted part still under warranty.

Kohler Co. shall remedy warranty defects at any authorized Kohler Co. engine dealer or warranty station. Warranty repair work done at an authorized dealer or warranty station shall be free of charge to the owner if such work determines that a warranted part is defective.

Listed below are the parts covered by the Federal and California Emission Control Systems Warranty. Some parts listed below may require scheduled maintenance and are warranted up to the first scheduled replacement point for that part. The warranted parts are:

- Oxygen sensor (if equipped)
- Intake manifold (if equipped)
- Exhaust manifold (if equipped)
- Catalytic muffler (if equipped)
- Fuel metering valve (if equipped)
- Spark advance module (if equipped)
- Crankcase breather
- Ignition module(s) with high tension lead
- Gaseous fuel regulator (if equipped)
- Electronic control unit (if equipped)
- Carburetor or fuel injection system
- Fuel lines (if equipped)
- Air filter, fuel filter, and spark plugs (only to first scheduled replacement point)

LIMITATIONS

This Emission Control Systems Warranty shall not cover any of the following:

(a) repair or replacement required because of misuse or neglect, improper maintenance, repairs improperly performed or replacements not conforming to Kohler Co. specifications that adversely affect performance and/or durability and alterations or modifications not recommended or approved in writing by Kohler Co.,

(b) replacement of parts and other services and adjustments necessary for required maintenance at and after the first scheduled replacement point,

(c) consequential damages such as loss of time, inconvenience, loss of use of the engine or equipment, etc.,

(d) diagnosis and inspection fees that do not result in eligible warranty service being performed, and

(e) any add-on or modified part, or malfunction of authorized parts due to the use of add-on or modified parts.

MAINTENANCE AND REPAIR REQUIREMENTS

The owner is responsible for the proper use and maintenance of the engine. Kohler Co. recommends that all receipts and records covering the performance of regular maintenance be retained in case questions arise. If the engine is resold during the warranty period, the maintenance records should be transferred to each subsequent owner. Kohler Co. reserves the right to deny warranty coverage if the engine has not been properly maintained; however, Kohler Co. may not deny warranty repairs solely because of the lack of repair maintenance or failure to keep maintenance records.

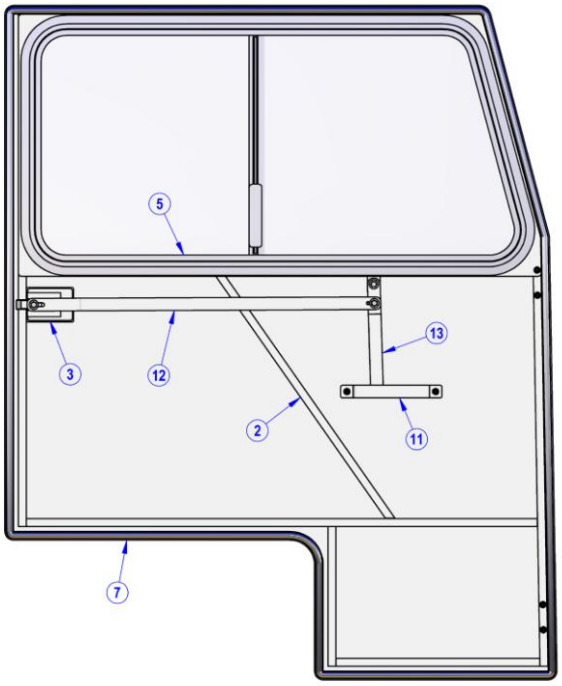
Normal maintenance, replacement or repair of emission control devices and systems may be performed by any repair establishment or individual; however, **warranty repairs must be performed by a Kohler authorized service center.** Any replacement part or service that is equivalent in performance and durability may be used in non-warranty maintenance or repairs, and shall not reduce the warranty obligations of the engine manufacturer.

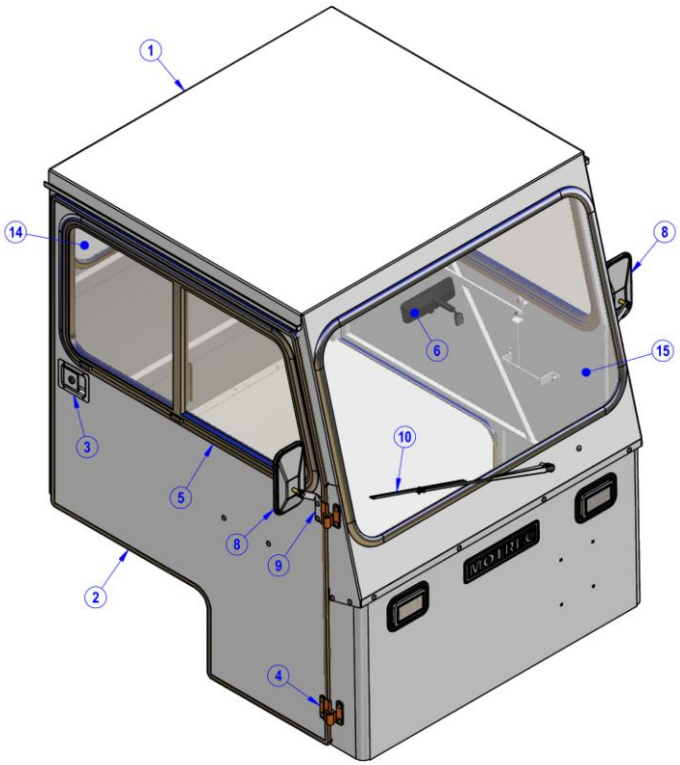
SPARE PARTS

BODY

REF.	*PART NO*	*DESCRIPTION*
1	2364320008	FRAME FOR WINDSHIELD
	2367300002	WINDSHIELD, SAFETY GLASS
2	1005003	BUCKET SEAT
3	2803300008	LEFT PASSENGER HANDLE
	2803300009	RIGHT PASSENGER HANDLE
4	2330661008	MOTOR COMPARTMENT COVER, LEFT
	2330661003	MOTOR COMPARTMENT COVER, RIGHT
5	4809015	ANCHORAGE HOOK
6	2332661003	DECK COVER PLATE – 48” WIDE VEHICLE
	2332661005	DECK COVER PLATE – 54” WIDE VEHICLE
7	300022	LRD WHEEL
8	2311000006	RUBBER BUMPER
9	2182660005	FRONT PROTECTOR – 48” WIDE VEHICLE
	2182660002	FRONT PROTECTOR – 54” WIDE VEHICLE

CAB

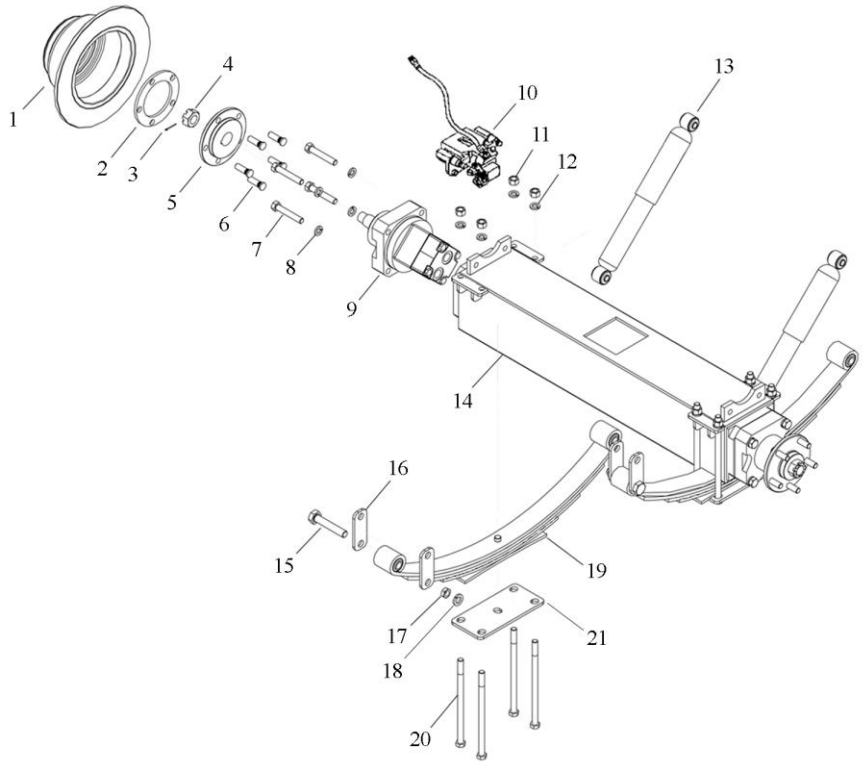




REF	*PART NO*	*DESCRIPTION*
1	2360661002	STEEL CAB
2	2360661003	RIGHT DOOR
	2360661004	LEFT DOOR
3	2803000003	PADDLE LATCH
	2366320015	DOOR LATCH
4	2365000001	RIGHT HINGES KIT
	2365000002	LEFT HINGES KIT
5	2367660002	RIGHT DOOR GLASS
	2367660001	LEFT DOOR GLASS
6	2801000002	REAR VIEW MIRROR
7	2802000001	TRIM DOOR

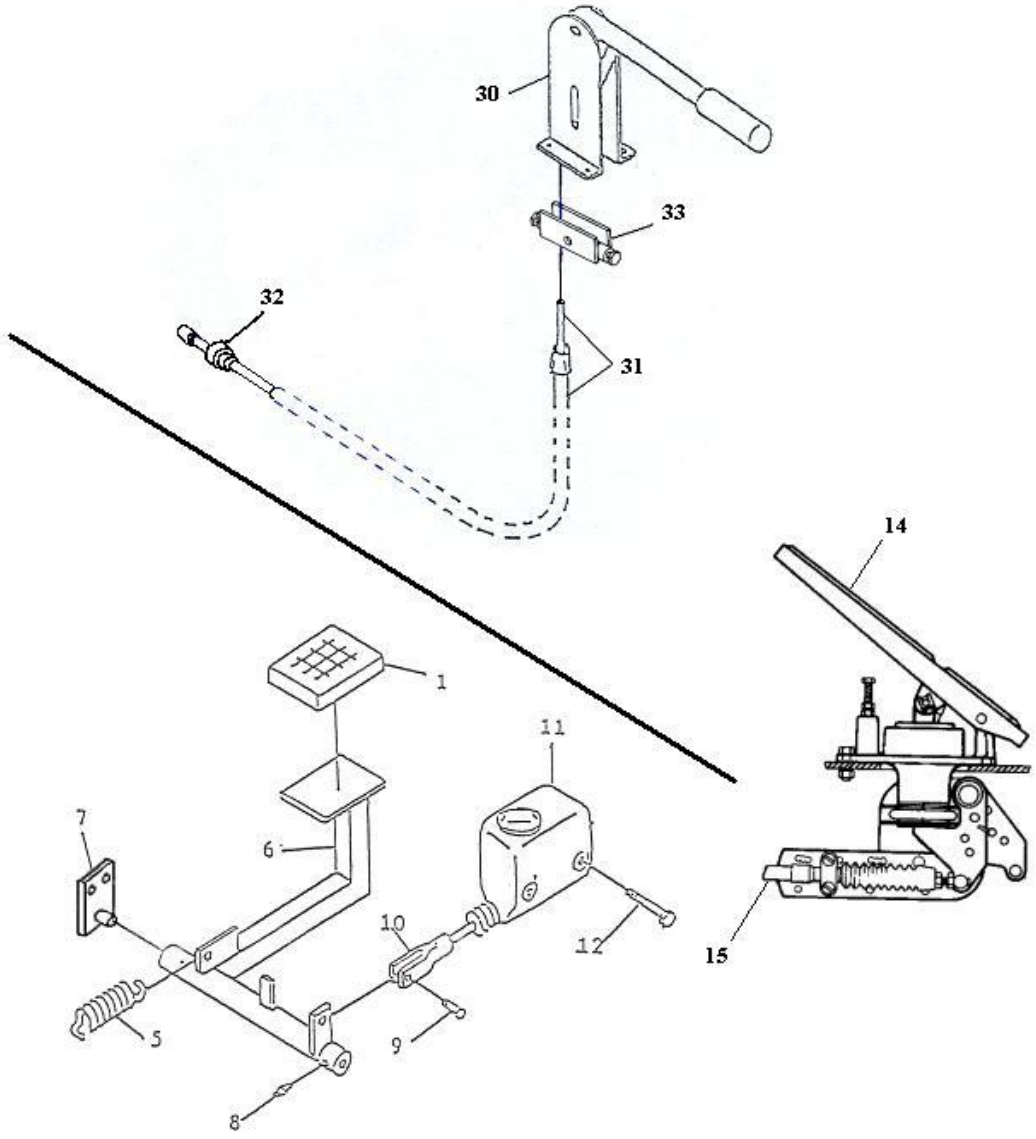
REF	*PART NO*	*DESCRIPTION*
8	2801000001	SIDE MIRROR
9	2399000014	SIDE MIRROR BRACKET
10	3113000002	WIPER MOTOR
	2800000002	WIPER
	2800000001	ARM
11	2366320001	DOOR HANDLE
12	2366660001	DOOR HANDLE BAR
13	2366320003	DOOR LEVER
14	2367300001	REAR GLASS
15	2367300002	WINDSHIELD

HYDROSTATIC DRIVE, REAR AXLE AND SUSPENSION



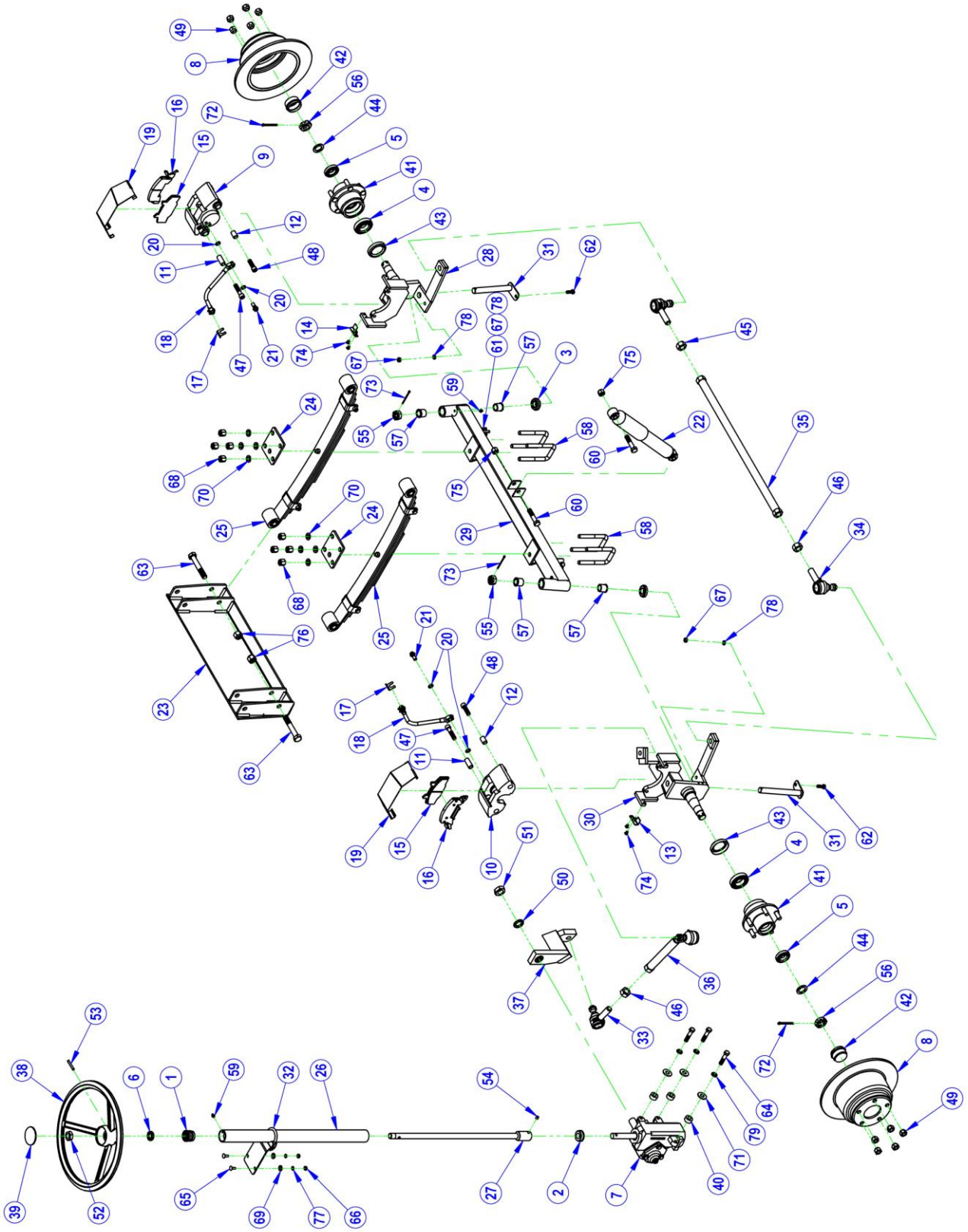
REF.	*PART NO*	*DESCRIPTION*
1	2120236001	DISC
2	5007001	SPACER
3		COTTERPIN
4	2910322001	CASTELLATED HUB NUT
5	2224322001	HUB, 2000 LBS CAPACITY
	2224501002	HUB, 3000 + LBS CAPACITY
6	2820007	STUD ½ NF X 1 3/4
7		BOLT ½ NF X 2 ½
8		LOCK WASHER ½
9	Call Factory	HYDRAULIC MOTOR
10	5016002	RIGHT CALIPER
	5016003	LEFT CALIPER
	5016004	L/R PAD SET
11		NUT ½ NF
12		LOCKWASHER ½
13	242621	SHOCK ABSORBER
14	Call Factory	HOUSING
15		BOLT 5/8-NC X 3 ½
16	2182320002	SHACKLE LINK
17		NUT 5/8-NC
18		LOCKWASHER
19	2192320002	LEAF SPRING
20		BOLT ½ NF X 9 ½
21	2185322001	MOUNTING PLATE, 2000 LBS CAPACITY
	2185501001	MOUNTING PLATE, 3000 + LBS CAPACITY

BRAKE CONTROLS



REF	*PART NO*	*DESCRIPTION*	*QTY*	*REF*	*PART NO*	*DESCRIPTION*	*QTY*
1	242800	RUBBER	1	14	6685001	ACCELERATOR PEDAL	1
5	242816	SPRING	1	15	CALL FACT.	ACCELERATOR CABLE	1
6	2131501001	LEVER	1				
7	262807	PIVOT	2	30	3616013	8 in. HANDBRAKE LEVER	1
8	242817	LUBRICATING FITTING	1	31	2129000003	CABLE	2
9	2910000028	CLEVIS PIN 3/8 X 1-3/32	1	32	5016001	CABLE STOP	2
10	2910000015	YOKE	1	33	2130330001	CABLE RETAINER	2
11	362805	MASTER CYLINDER	1				
12		BOLT 3/8-NC X 3	2				

FRONT ASSEMBLY

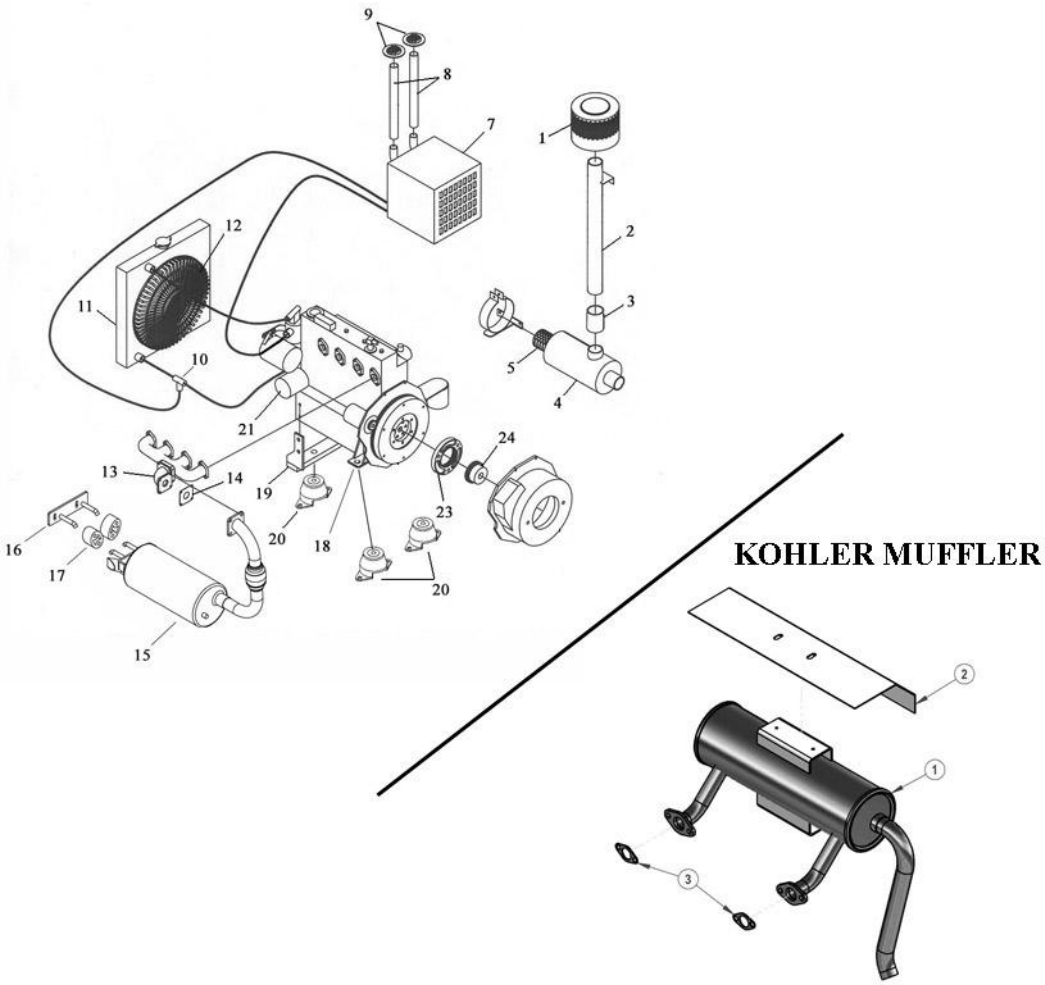


REF	*PART NO*	*DESCRIPTION*
1	2100300002	BUSHING
	2100300001	BUSHING WITH OIL SEAL
2	2100300003	BUSHING
3	2103250001	THRUST BEARING
4	2103300001	TAPER BEAING
5	2103300002	TAPER BEAING
6	2104300004	OIL SEAL
7	2117250001	GEAR
8	2120236001	DISC
9	481431	RIGHT CALIPER
10	481430	LEFT CALIPER
11	2121000005	BUSHING, LONG
12	2121000006	BUSHING, SHORT
13	2122300001	LEFT CALIPER SUPPORT
14	2122300002	RIGHT CALIPER SUPPORT
15	2128280001	PADS
16	2128280001	PADS
17	2129000001	CLIP
18	2134000001	FLEX. HOXE
19	2139000001	CALIPER PROTECTOR
20	2139000002	WASHER
21	2139000003	BOLT
22	2180240002	SHOCK ABSORBER
23	2182660002*	SHACKLE LINK
	2182660005**	SHACKLE LINK
24	2185660001	PLATE
25	2192606001	LEAF SPRINGS
26	2200300002	TUBE
27	2200300003	SHAFT
28	2201360002	LEFT SPINDLE
29	2201660001*	AXLE BEAM
	2201660006**	AXLE BEAM
30	2201660010	RIGHT SPINDLE
31	2205250001	KING PIN
32	2206300003	STEERING SUPPORT, BOLT PATTERN 2 3/8”
	2206320001	STEERING SUPPORT, BOLT PATTERN 2 1/4”
33	2207000001	ROD END, LEFT HAND
34	2207000002	ROD END, RIGHT HAND
35	2207660001*	REAR TIE ROD
	2207660003**	REAR TIE ROD
36	2207660005	FRONT TIE ROD
37	2207660011	ARM
38	2208240001	STEERING WHEEL
39	2208240002	COVER
40	2219250001	SPACER

REF	*PART NO*	*DESCRIPTION*
41	2224300002	HUB
42	2229300001	DUST CAP
43	2229300002	OIL SEAL
44	2229300003	SPINDLE WASHER
45	2910000005	NUT, LEFT HAND
46	2910000006	NUT, RIGHT HAND
47	2910000017	BOLT, LONG
48	2910000018	BOLT,SHORT
49	2910000019	WHEEL NUT
50	2910000020	LOCK WASHER 7/8
51	2910000021	JAM NUT 7/8-NF
52	2910000022	JAM NUT 3/4-NF
53	2910000023	SPRING PIN ¼ X 1 3/4
54	2910000024	SET SCREW 5/16-NC
55	2910300001	CASTELLATED NUT 3/4-NF
56	2910300002	CASTELLATED NUT 1-UNEF
57	2914364001	BUSHING
58	2916000001	U-BOLT
59	2930000012	GREASE FITTING
60		BOLT 1/2-NC X 2 1/2
61		BOLT 5/16-NC X 1 1/4
62		BOLT 5/16-NC X 1
63		BOLT 5/8-NC X 4
64		BOLT 7/16-NC X 2
65		CARRIAGE BOLT 1/4-NC X 3/4
66		NUT 1/4-NC
67		NUT 5/16-NC
68	2910000041	HEAVY NUT 1/2-NF
69		FLAT WASHER 1/4
70	2910000042	FLAT WASHER 12mm
71		FLAT WASHER 7/16
72		COTTER PIN 3/16 X 2
73		COTTER PIN 7/64 X 2
74		MACHINE SCREW 1/4-NC X 3/8
75		NYLON NUT 1/2-NC
76		NYLON NUT 5/8-NC
77		LOCK WASHER 1/4
78		LOCK WASHER 5/16
79		LOCK WASHER 7/16

* 54” Wide Frame
** 48” Wide Frame

ENGINES MUFFLER & MOUNTING



KUBOTA ENGINES PARTS LIST

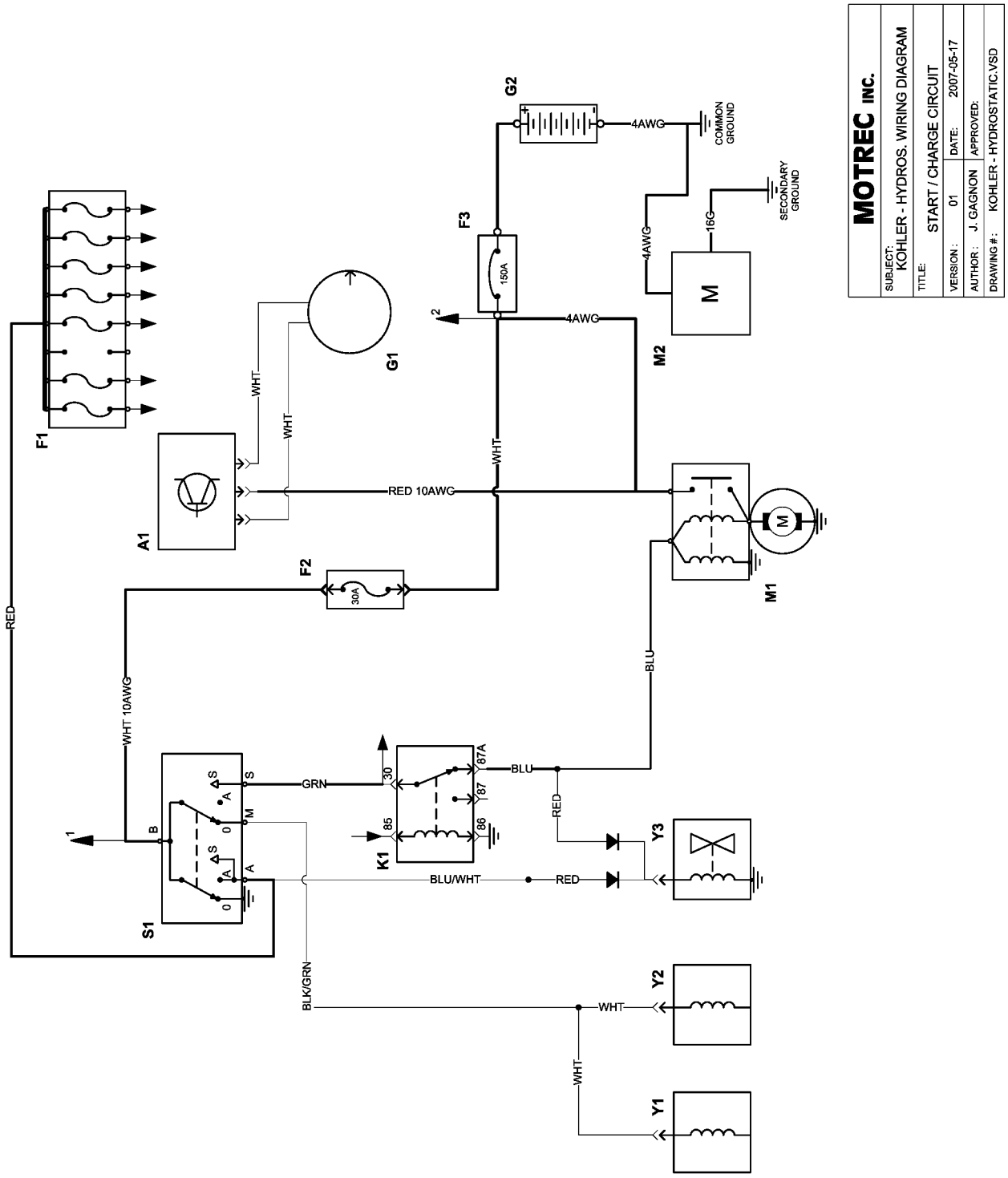
REF	*DESCRIPTION*	*PART #*	*REF*	*DESCRIPTION*	*PART #*
1	TURBO PRECLEANER	6650001	12	ELECTRIC FAN	3129501004
2	TURBO PRECLEANER HOLDER	*	13	90° DEGRES EXHAUST	1E01912192
3	FLEX COUPLING	*	14	EXHAUST GASKET	*
4	AIR CLEANER	2169501033	15	CATALITIC MUFFLER	*
5	AIR FILTER	*	16	MUFFLER HOLDER	2169661022
7	HEATER	6690002	17	RUBBER MOUNT MUFFLER	2169501026
8	HOSE	*	18	ENGINE SUPPORT - REAR	*
	HOSE ADAPTOR - HEATER	2819501002	19	ENGINE SUPPORT – FRONT	*
9	DIFFUSER	6690001D	20	RUBBER MOUNT	*
10	FITTING	2819501007	21	OIL FILTER	*
11	RADIATOR	2169501036	23	ENGINE COUPLING	*
	RESERVE TANK - PRESTONE	2604501002	24	PUMP COUPLING	*

KOHLER ENGINE PARTS LIST

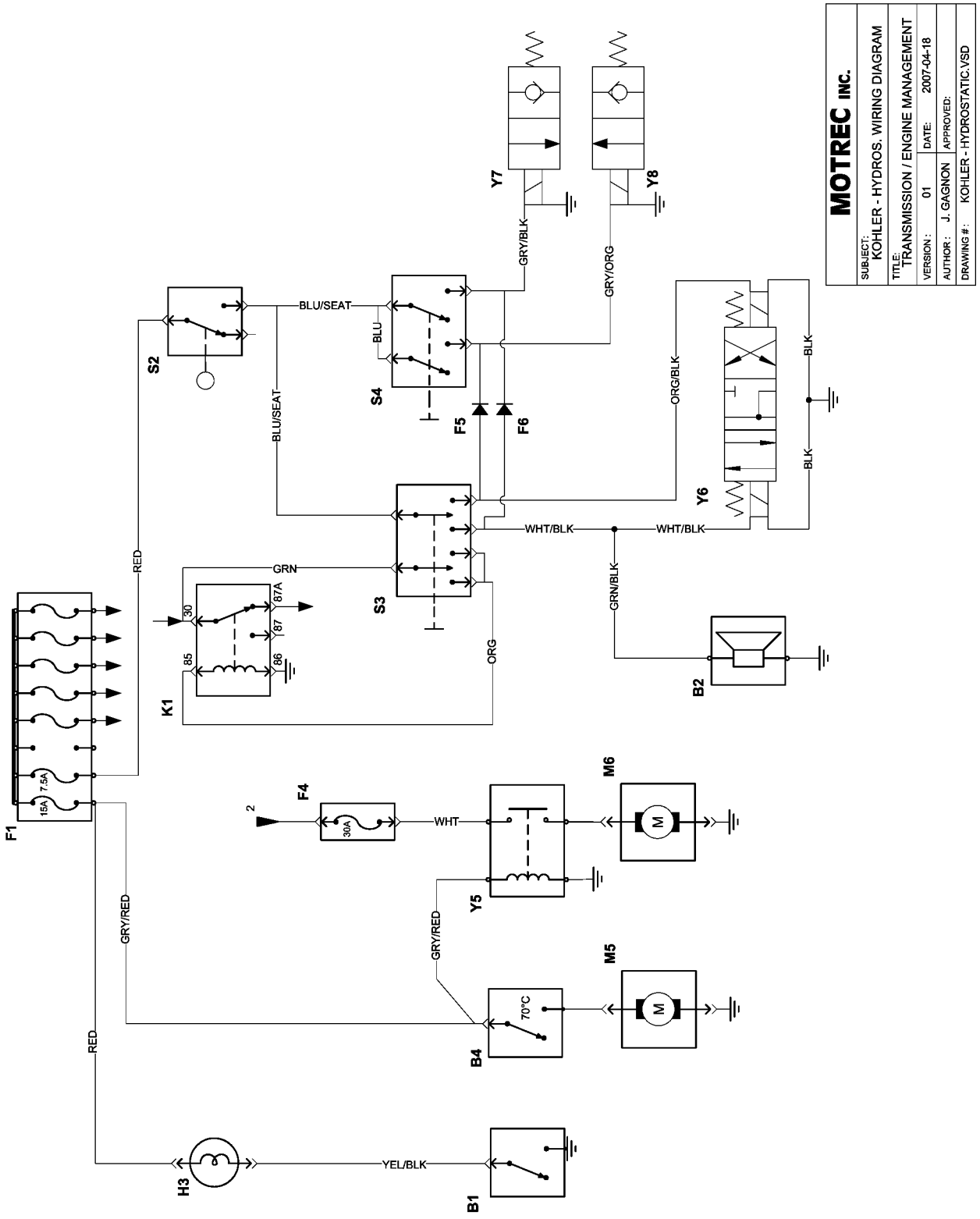
REF	*DESCRIPTION*	*PART #*	*REF*	*DESCRIPTION*	*PART #*
1	MUFFLER	2157320001	20	RUBBER MOUNT	*
2	HEAT SHIELD	2169322002	21	OIL FILTER	*
3	GASKET	*	23	ENGINE COUPLING	*
5	AIR FILTER	*	24	INSERT	*
12	ELECTRIC FAN	3129322001			
18	ENGINE SUPPORT – REAR	*			
19	ENGINE SUPPORT – FRONT	*			

* CALL FACTORY

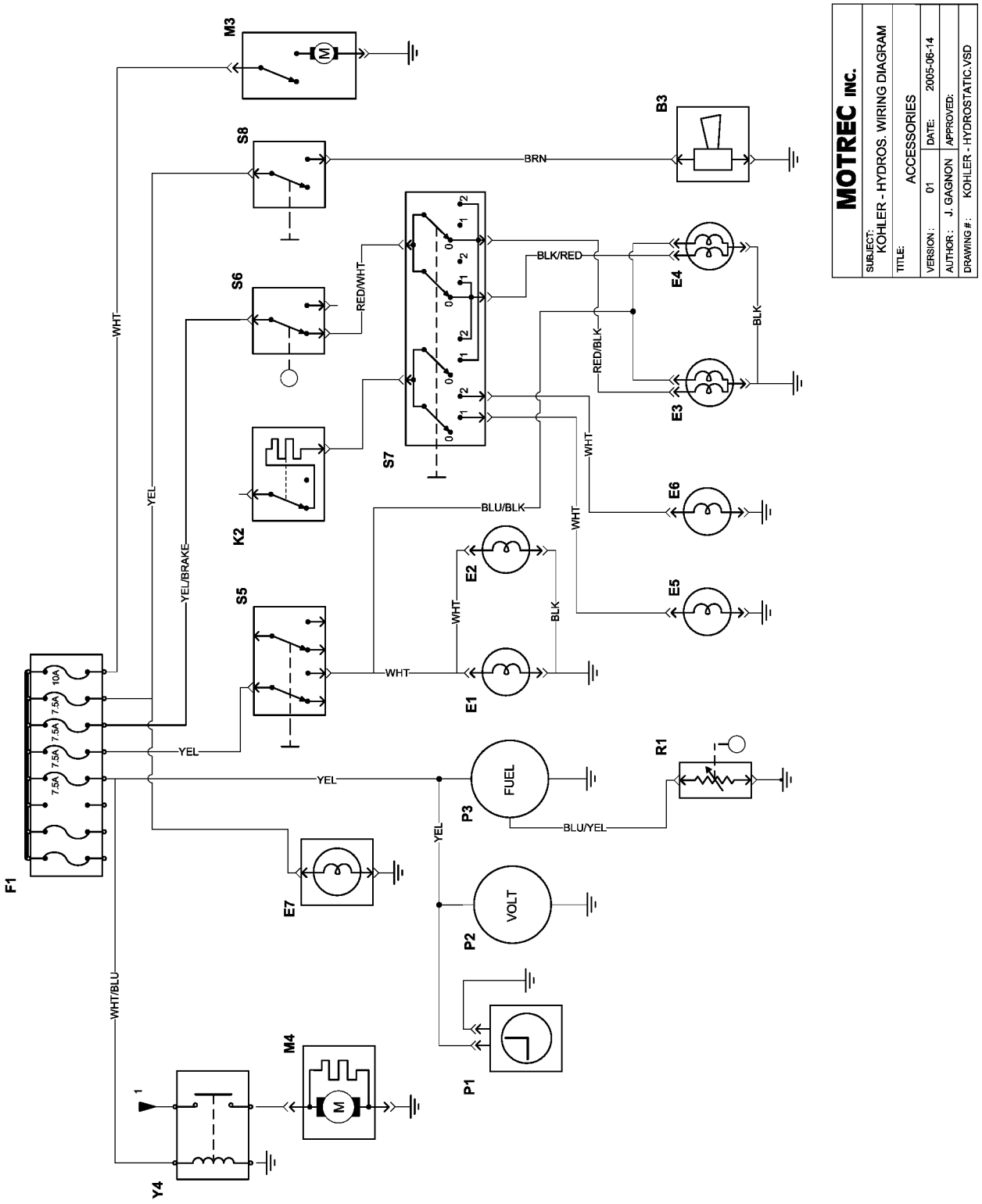
ELECTRICAL DIAGRAM – KOHLER START / CHARGE CIRCUIT



ELECTRICAL DIAGRAM – KOHLER TRANSMISSION / ENGINE MANAGEMENT



ELECTRICAL DIAGRAM – KOHLER ACCESSORIES

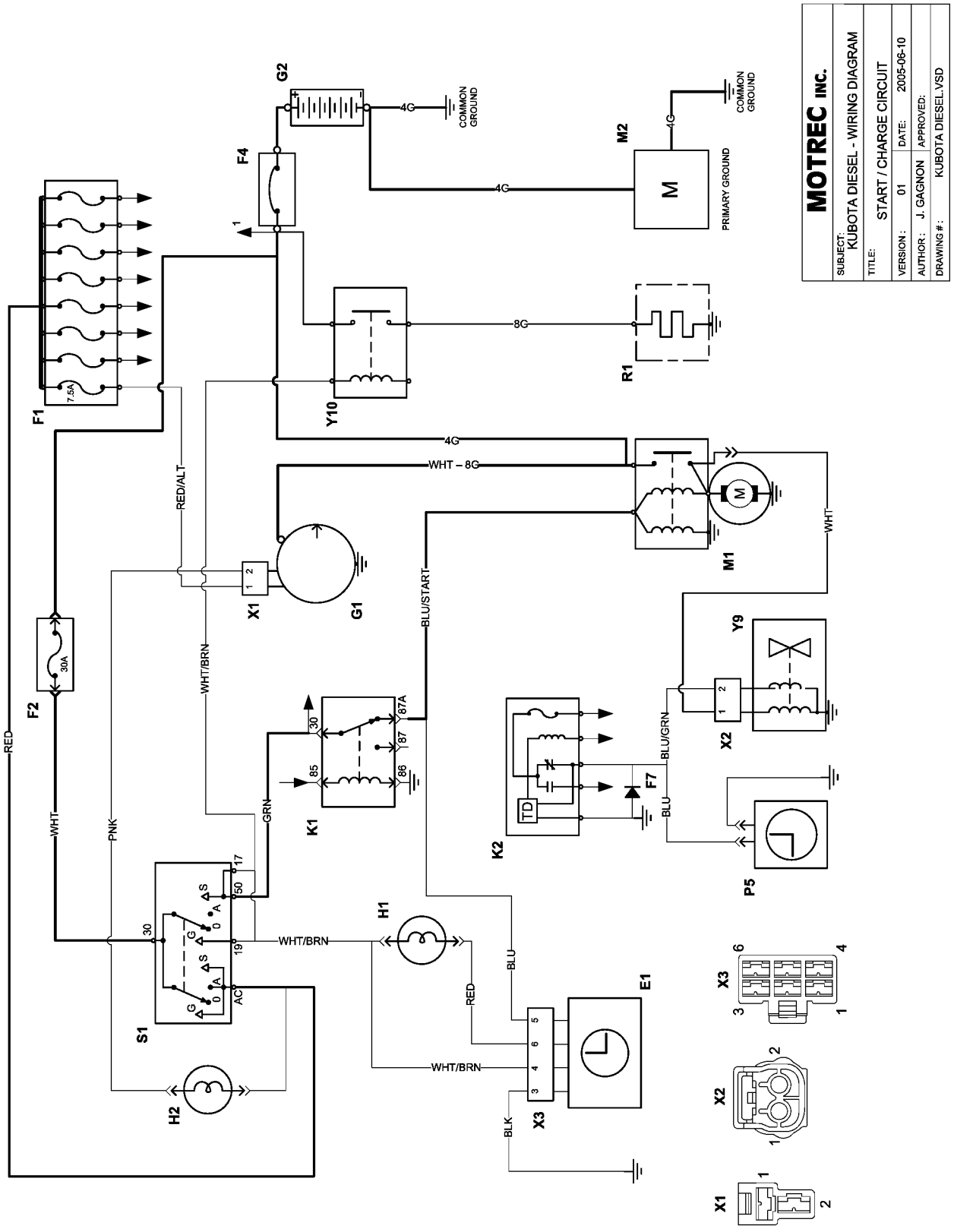


PARTS LIST

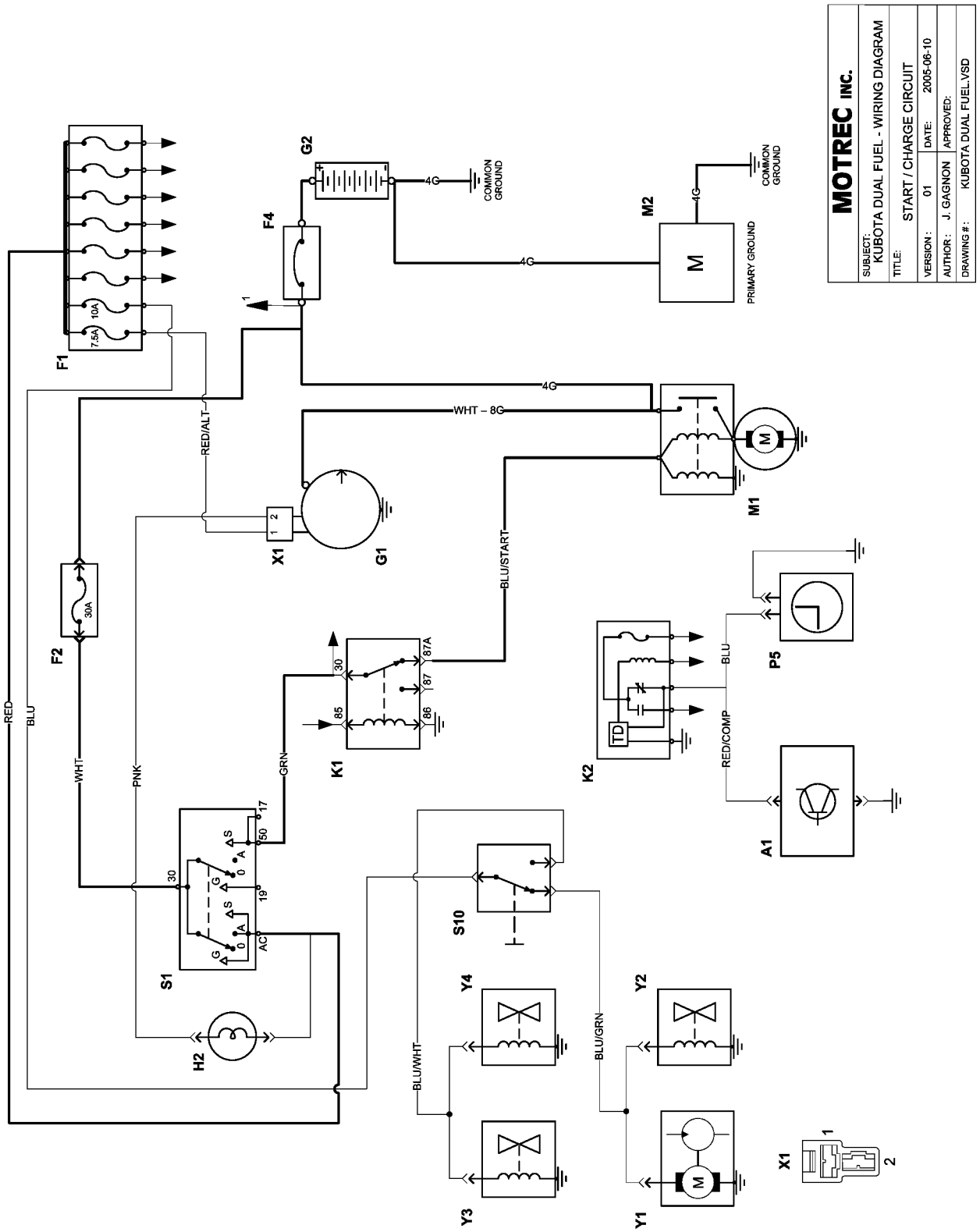
NO	DESIGNATION	REF	QTY
A1	VOLTAGE REGULATOR	-	1
B1	OIL SENTRY SWITCH	-	1
B2	REVERSE ALARM	*	1
B3	HORN	*	1
B4	THERMOSTATIC SWITCH, OIL COOLER	4190501004	1
E1-E2	HEAD LAMP	*	2
E3-E4	TAIL/BRAKE LIGHT	*	2
E5-E6	SIDEMARKER	*	2
E7	STROBE LIGHT	*	1
F1	AGC FUSE HOLDER	5069005	1
F2	IN-LINE FUSE HOLDER	3118321006	1
F3	CIRCUIT BREAKER	3107000001	1
F4	IN-LINE FUSE HOLDER	3118321006	1
F5-F6	DIODE	367012	2
G1	ALTERNATOR	-	1
G2	BATTERY	-	1
H3	PILOT LAMP	246212	1
K1	RELAY 12V, START INTERUPT	3069010	1
K2	FLASHER RELAY	3064004	1
M1	STARTER	-	1
M2	ENGINE	-	1
M3	WIPER MOTOR	*	1
M4	CAB HEATER 100W	*	1
M5	OIL COOLER FAN	3129501004	1
M6	ENGINE FAN	3129322001	1
P1	HOUR METER	3069008	1
P2	VOLTMETER	3069007	1
P3	FUEL GAUGE	686203	1
R1	FUEL SENDER	686207	1
S1	IGNITION SWITCH	686205	1
S2	SEAT SWITCH	3109000003	1
S3	FORWARD / REVERSE SELECTOR	266211	1
S4	FREEWHEEL SWITCH	55017	1
S5	HEADLIGHT SWITCH	1269004	1
S6	BRAKE SWITCH	246207	1
S7	TURN SIGNAL SWITCH	246050	1
S8	HORN BUTTON	*	1
Y1-Y2	PICK-UP COIL	-	2
Y3 (GAS)	CARBURATOR SOLENOID	-	1
Y3 (PROP.)	LPG SHUT-OFF VALVE	-	1
Y4	HEATER SOLENOID	246101	1
Y5	OIL COOLER SOLENOID	246101	1
Y6	HYDRAUSTATIC DISTRIBUTOR	-	1
Y7-Y8	FREEWHEEL VALVE	SV16-23	2
	FREEWHEEL BLOCK KIT	4110501003	1

* Consult Motrec Illustrated Parts

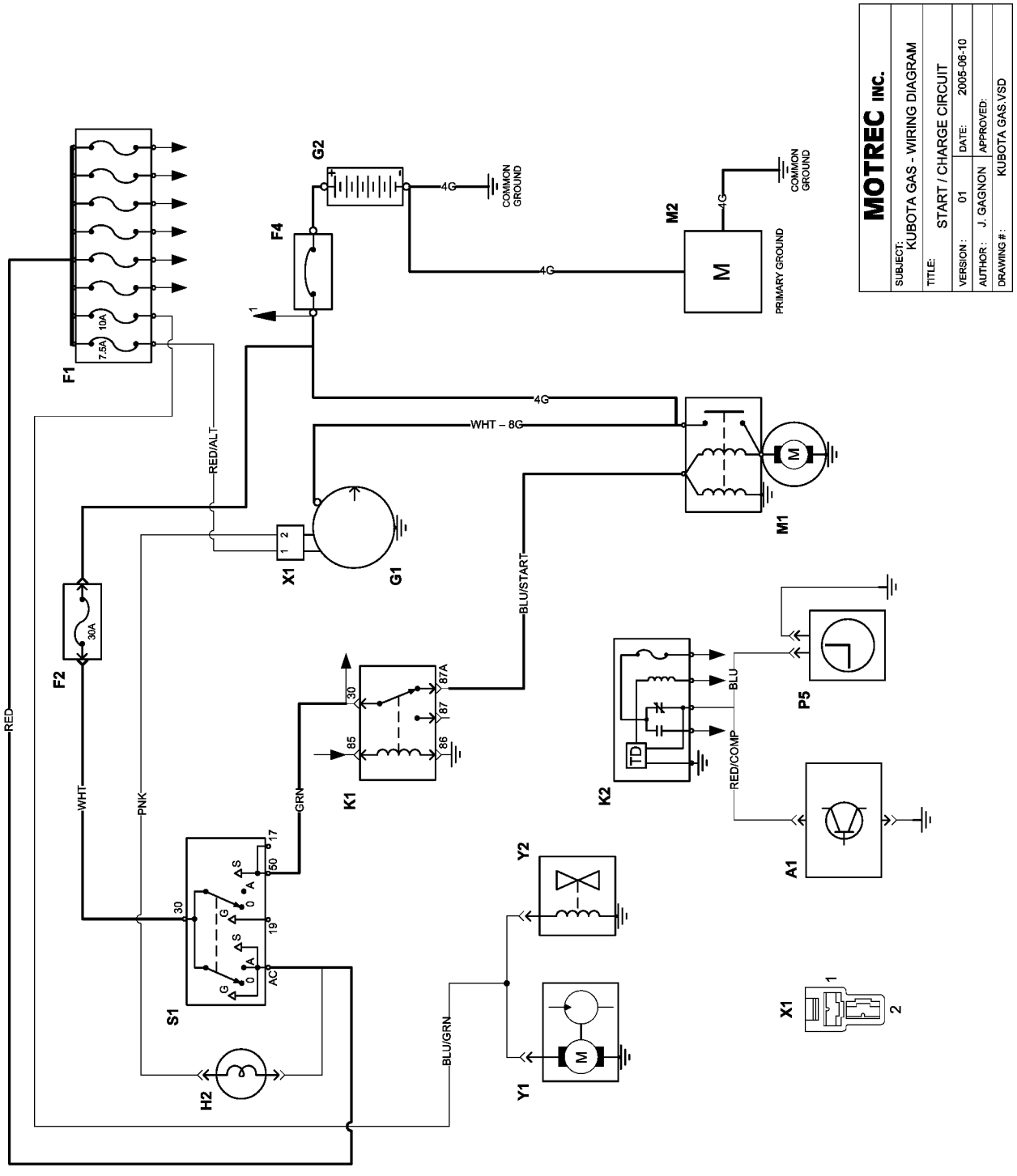
ELECTRICAL DIAGRAM – KUBOTA DIESEL START / CHARGE CIRCUIT



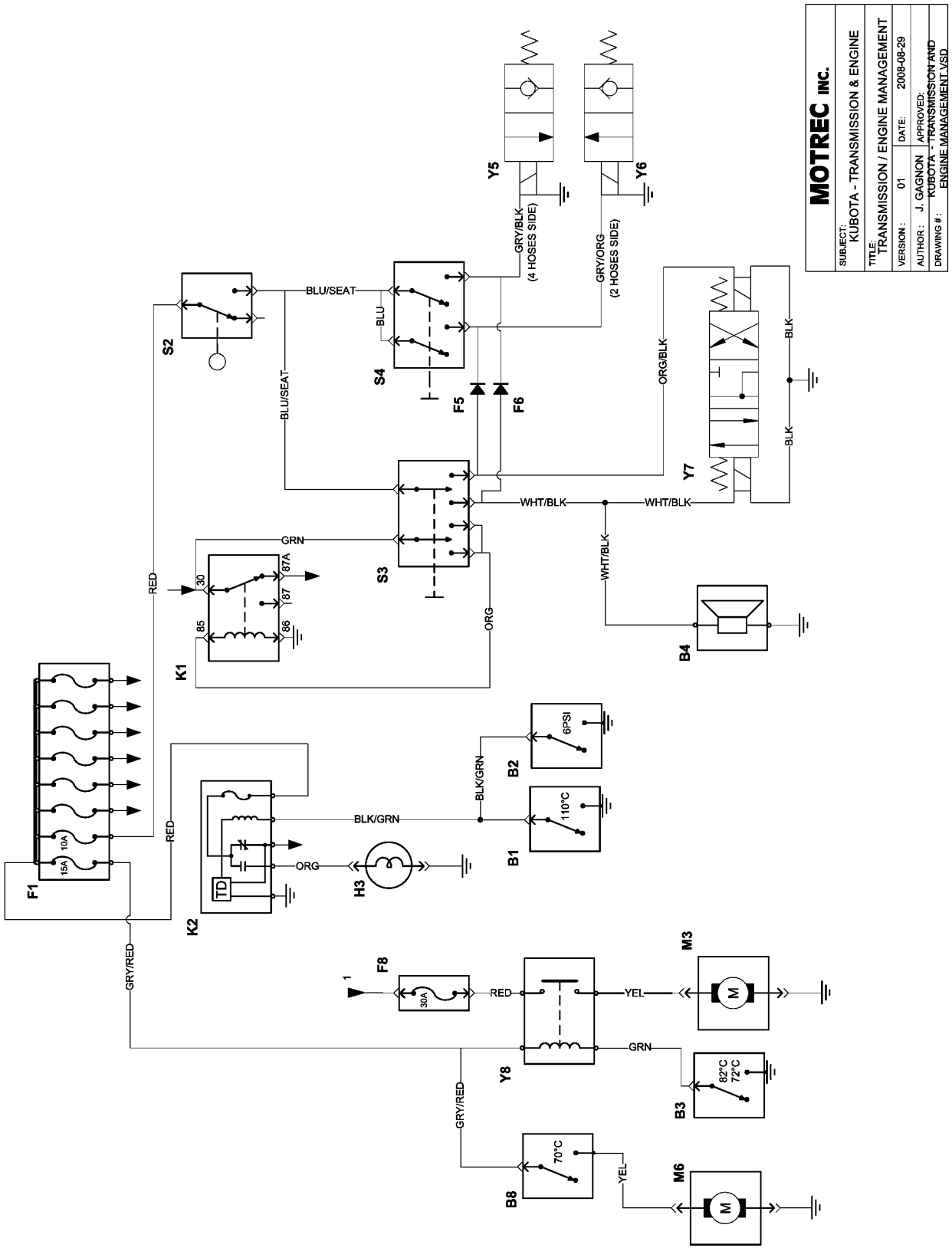
ELECTRICAL DIAGRAM – KUBOTA DUAL FUEL START / CHARGE CIRCUIT



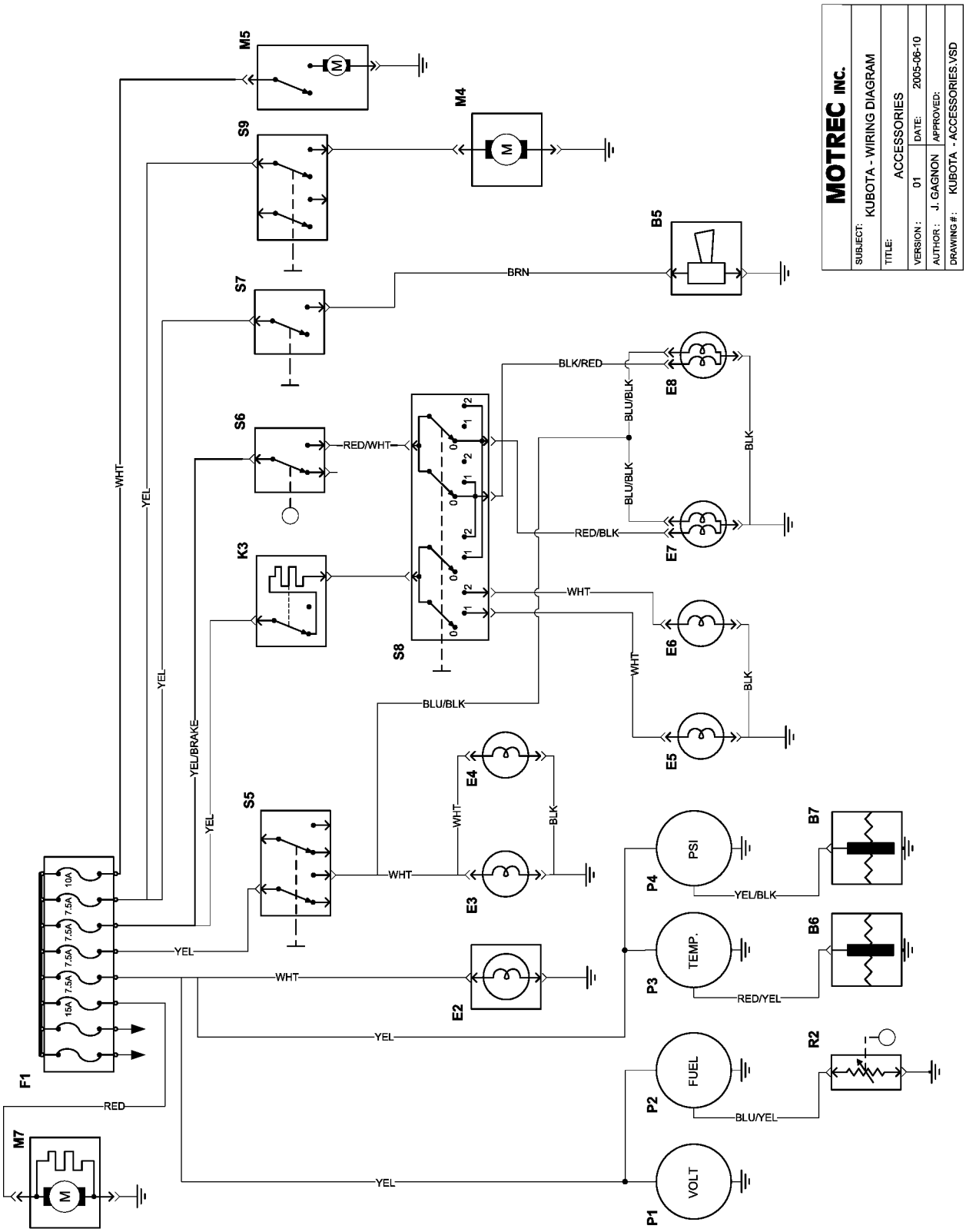
ELECTRICAL DIAGRAM – KUBOTA GAS START / CHARGE CIRCUIT



ELECTRICAL DIAGRAM – KUBOTA TRANSMISSION / ENGINE MANAGEMENT



ELECTRICAL DIAGRAM – KUBOTA ACCESSORIES

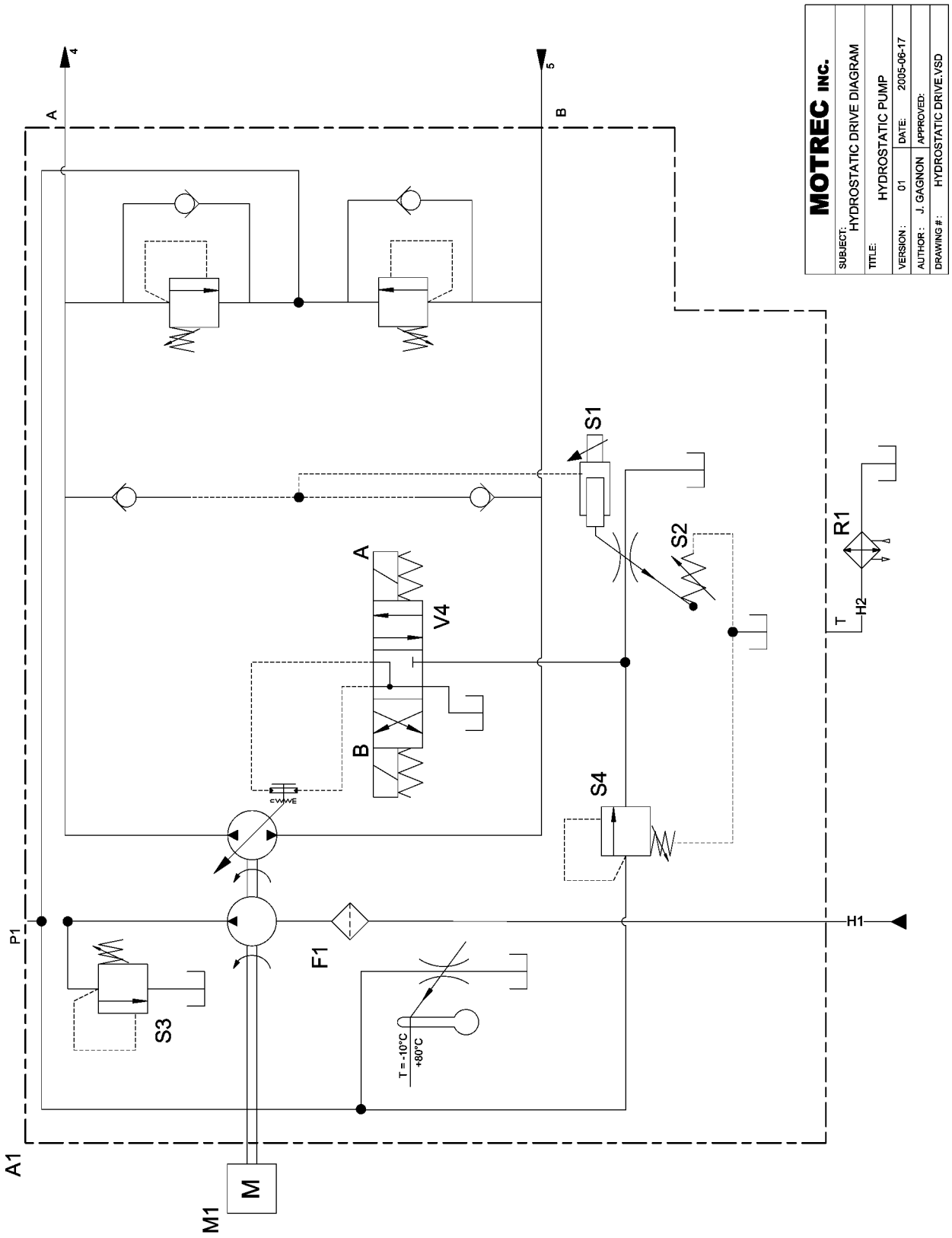


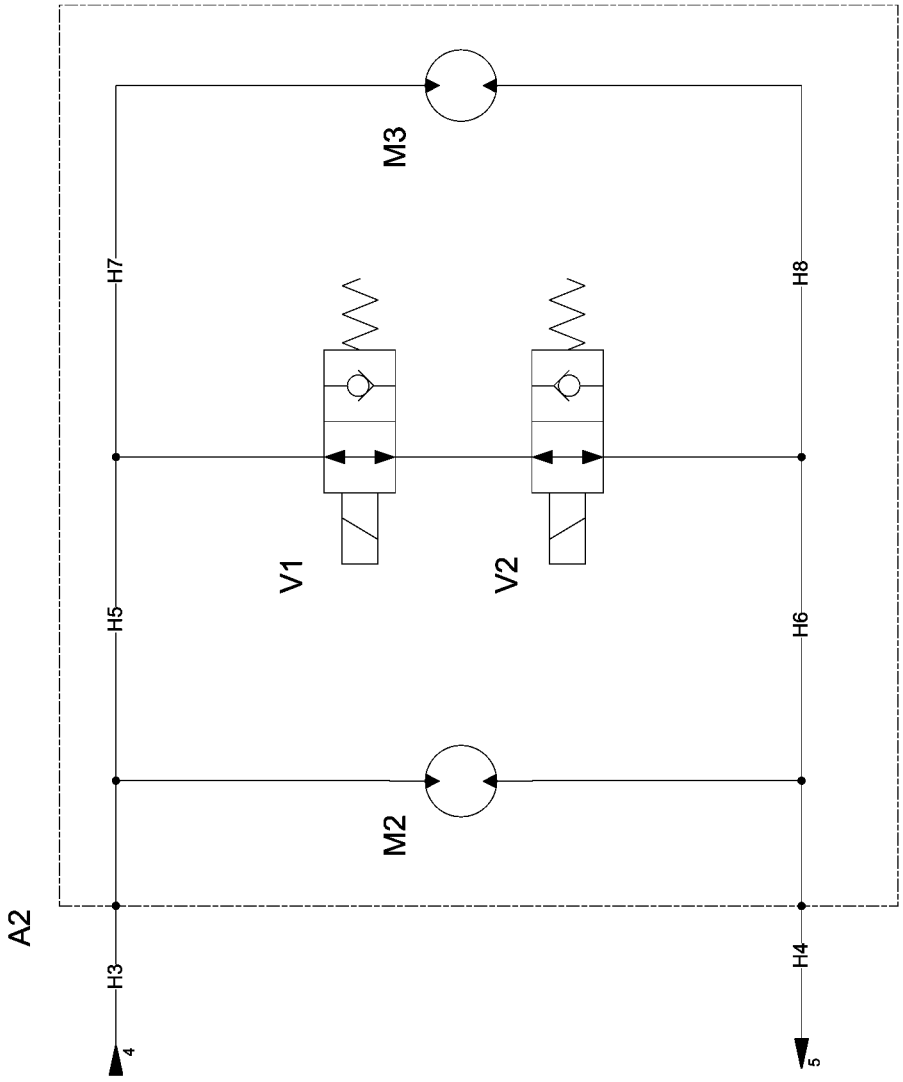
PARTS LIST

NO	DESIGNATION	REF	QTY
A1	ENGINE CONTROLLER	-	1
B1	EMERGENCY TEMPERATURE SWITCH	3109449001	1
B2	EMERGENCY PRESSURE SWITCH	3109501001	1
B3	THERMOSTATIC SWITCH, RADIATOR	3109501004	1
B4	REVERSE ALARM	*	1
B5	HORN	*	1
B6	COOLANT TEMPERATURE SENDER	3108449004	1
B7	OIL PRESSURE SENDER	3108501002	1
B8	THERMOSTATIC SWITCH, OIL COOLER	4190501004	1
E1	GLOW PLUG TIMER	-	1
E2	STROBE LIGHT	*	1
E3-E4	HEAD LAMP	*	2
E5-E6	SIDEMARKER LAMP	*	2
E7-E8	TAIL/BRAKE LIGHT	*	2
F1	AGC FUSE HOLDER	5069005	1
F2	IN-LINE FUSE HOLDER	3118321006	1
F4	CIRCUIT BREAKER	3107000001	1
F5-F7	DIODE	367012	2
F8	MAXI FUSE HOLDER	3118501006	1
	MAXI BLADE FUSE 30A	3118501005	1
G1	ALTERNATOR	-	1
G2	BATTERY	-	1
H1	GLOW PLUG LAMP	-	1
H2	CHARGE LAMP	246212	1
H3	EMERGENCY LAMP	246212	1
K1	RELAY 12V, F/R INTERRUPT	3069010	1
K2	TIMER DELAY SW., SHUT DOWN	3129449001	1
K3	FLASHER RELAY	3064004	1
M1	STARTER	-	1
M2	ENGINE	-	1
M3	RADIATOR FAN	3129501004	1
M4	CAB HEATER FAN	6690002	1
M5	WIPER MOTOR	*	1
M6	OIL COOLER FAN	-	1
M7	CAB HEATER	*	1
P1	VOLTMETER	3069007	1
P2	FUEL GAUGE	686203	1
P3	TEMPERATURE GAUGE	3108449003	1
P4	OIL PRESSURE GAUGE	3108501003	1
P5	HOUR METER	3069008	1
R1	GLOW PLUGS	-	1
R2	FUEL SENDER	686207	1
S1	IGNITION SWITCH		1
	FOR GAS / DUAL FUEL ENGINE	3109449002	1
	FOR DIESEL ENGINE	3109501005	1
S2	SEAT SWITCH	3109000003	1

S3	FORWARD/REVERSE SELECTOR	266211	1
S4	FREEWHEEL SWITCH	55017	1
S5	HEADLIGHT SWITCH	1269004	1
S6	HORN BUTTON	*	1
S7	BRAKE SWITCH	246207	1
S8	TURN SIGNAL SWITCH	246050	1
S9	CAB HEATER SWITCH	55017	1
S10	FUEL SELECTION MODE	5069003	1
Y1	FUEL PUMP	-	1
Y2	CARBURATOR FUEL VALVE	-	1
Y3	CARBURATOR LPG VALVE	-	1
Y4	LPG SHUT-OFF VALVE	-	1
Y5-Y6	FREEWHEEL VALVE	SV16-23	2
	FREEWHEEL BLOCK KIT	4110501003	1
Y7	HYDRAUSTATIC DISTRIBUTOR	-	1
Y8	COOLING FAN SOLENOID	246101	2
Y9	DIESEL SOLENOID VALVE (ENGINE)	-	1
Y10	GLOW PLUG SOLENOID	246101	1
X1	ALTERNATOR CONNECTOR	-	1
X2	FUEL VALVE CONNECTOR	-	1
X3	GLOW PLUG TIMER CONNECTOR	-	1

HYDRAULIC DIAGRAM





MOTREC INC.			
SUBJECT:	HYDROSTATIC DRIVE DIAGRAM		
TITLE:	FREEWHEEL MANIFOLD		
VERSION :	01	DATE:	2005-06-17
AUTHOR :	J. GAGNON	APPROVED:	
DRAWING # :	HYDROSTATIC DRIVE.VSD		

PARTS LIST

NO	DESIGNATION	REF	QTY
A1	HYDROSTATIC PUMP	4160322001	1
A2	FREEWHEEL MANIFOLD	4110501003	1
R1	OIL COOLER	4190501003	1
S1	MACHINE START-UP ADJ. SCREW		
S2	POWER LIMITER ADJ. SCREW		
S3	CHARGE PRESSURE ADJ. SCREW		
S4	MIN. CHARGE PRESSURE ADJ. SCREW		
V1-V2	FREEWHEEL SOLENOID	SV16-23	2
V4	HYDROSTATIC VALVE		
M2-M3	HYDRAULIC MOTOR	Contact manuf.	2
M1	ENGINE	-	1

MOTREC ILLUSTRATED ACCESSORIES

Strobelight, polemount
Amber 12-80V: 3116000001
Red 12-80V: 2469001
Blue 12-80V: 3690008

Strobelight, cab mount
Amber 12-48V: 3116250001
Red 12-48V: 3069026
Blue 12-48V: 3069014
Amber 72-80V:3116720001
Red 72-80V: 3116720002
Blue 72-80V: 3116720003

Amber turn lamp
12V: 3111000022
Bulb 12V: 3069021
Multi-LED amber turn lamp
Round Light: 3111000010
Grommet: 3111000008
Plug: 3111000009

Red Tail/Brake light
Grommet: 3269001
Plug: 246012A
12V : 2469021
24V : 2469022

Red Tail/Brake light
** Model EE **
Assembly: 3111000030
Housing: 3111000027
Plug: 3111000029
12V : 3111000028

Red Tail/Brake light
Housing: 3069012R
Bulb 12V: 3117240001

Back-up lamp
Grommet: 3269001
12V: 3669012
24V: 3669012A

Clear lamp
12V: 3069012
Bulb 12V: 1269008

Pedestral head lamp
12V: 3111240001
Bulb 12V: 2569001B
Bulb 24V: 2169001B

Headlight
Left: 3111480003
Right: 3111480004
Bulb H/L: 3111480006
Bulb Turn: 3111480008
Bulb Mark: 3111480007

Headlight
Left: 3111480003
Right: 3111480004
Bulb H/L: 3117480001
Bulb Turn: 3117480003
Bulb Mark: 3117480002

Turn signal switch
246050

Multi-LED Red Tail/Brake
Light: 3111000006
Grommet: 3111000008
Plug: 3119000009

Multi-LED Back-up
Light: 3111000007
Strobe light: 3111000013
Grommet: 3111000008
Plug: 3119000009

Red Tail/Brake light
12V: 386002

Horn button VIP
2208224002

Horn button, column mount
3109000011

Horn button, dash mount
266210

Horn button 3109250001

Horn
12V: 246003
24V: 246013

Analog Voltmeter

12V :	3069007
24V :	2469002
36-48V :	3669002

HOBBS Gauge

24V:	2469026
36V:	3069038
48V:	4869037

DC-DC converter, 10A

12-48V:	3069019

DC-DC Converter, 25A

12-48V:	3124000002
72-80V:	3124880001

DC-DC Converter, 300W

24V:	3124224001
36-48V:	3124280001
72-80V:	3124880001

CONNECTOR:3124280002

Wiper motor

12V:	3113000001
24V:	486211

Wiper arm 2800000001

Wiper blade

14” Blade:	2800000002
18” Blade:	2800000003

Pantograph wiper arm 246233A

Pantograph wiper blade 246233

Cab heater

12V:	3103300001
36V:	3669008
48V:	4869020

12V Dome light 3669006

12V Fan 3669013

Limit switch 3109000029

Headlamp 12V:3111250007

Headlamp

12V:	3111300001
Bulb 12V:	3111300002

Red Pilot light

12V:	246212
Bulb 12V:	246212B

Back-up alarm or
Motion beeper

12-48V :	3100000001
72-80V :	3105720001

12-24V Adjustable ECCO: 3100000002

12-48V Adjustable PRECO: 3100000004