

## Diesel Power Unit

910172

## Operating and Maintenance Manual



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# Diesel Power Unit

## 910172

### Record of Changes

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## Section 1: Overview and Safety

### Diesel Power Unit Overview

Racine Railroad Products designs and manufactures equipment primarily for the repair and new construction of rail and railroad tie track maintenance.

Our product line focuses on rail fastening application/removal/adjustment equipment, other tie material (OTM) reclamation, wood and concrete railway tie repair, and tie plate handling/distribution.

The Racine Railroad Products Diesel Power Unit is designed to provide hydraulic flow and pressure for operation of H.T.M.A. Type I and Type II hydraulic tools.

The unit provides power for operation of Type I or Type II open center tools (5-10 gpm / 19-38 lpm @ 2000 psi / 140 bar). If equipped with the combined into one 10 gpm / 38 lpm circuit for operation of H.T.M.A. Type III tools.

**Note:** Not all power units can be equipped with the dual circuits or combiner kit.

#### General

The power unit is equipped with a

- 25 hp Kubota liquid cooled diesel engine (Final Tier 4 Emissions Standards)
- (3) 3-way, 2-position manually operated hydraulic selector valves
- Electric start with 12-volt battery and fan-cooled heat exchanger
- The fuel and hydraulic systems are self-contained with the required reservoir, filtration and level indicators.

#### Hydraulic System

- The hydraulic system consists of a hydraulic system fluid reservoir, filter assembly, single pump and a wide variety of controls. The filter element is a 10-micron cellulose type element.
- The filter housing has a pressure bypass valve to divert fluid directly to the tank in the event of a restricted flow.
- Hydraulic pumps will vary depending upon the capabilities of the power unit.
- Pressure hoses from the pumps are connected directly to a control module, which contains a relief valves, a control valves and a pressure return port.
- Optional control modules may contain additional valves, controls and ports

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## Warranty Terms and Conditions

### Warranty Period

Each new machine and new parts of our manufacture are warranted against defects in material and workmanship for one year from the date of shipment from our factory.

When contacting customer service for factory parts, service or warranty support please provide the:

- Racine Railroad Products Model
- Serial Number
- Any locally assigned identification

### Vendor Parts Warranty Period

Other equipment and parts used, but not manufactured by Racine Railroad Products, Inc., are covered directly by the manufacturer's warranty for their products.

### Warranty Parts and Service

We will repair or replace, without charge, F.O.B. factory, Racine, Wisconsin, USA, any part Racine Railroad Products manufactures which is proven to be defective during the warranty period.

Material claimed defective must be returned, if requested, to the factory within 30 days from the date of the claim for replacement. Ordinary wear and tear, abuse, misuse and neglect are not covered by this warranty. Depending upon the circumstances, we may provide technical assistance and/or technical service support, without charge, to assist in the correction of warranty related problems.

### Non-Warranty Parts and Service

Material damaged through normal wear and tear, abuse, misuse and/or neglect are not covered by our warranty and should be ordered directly from our Customer Service.

**Note:** Parts for models that are no longer in production may not be available.

### Non-Warranty Parts Orders

When placing a parts order please provide the following information:

- Company Name and Billing Address
- Purchase Order Number and Issuing Authority
- Shipping Address
- Special Handling Instructions
- Contact Phone Number
- Machine Model and Serial Number
- Part Numbers and Quantities Being Ordered

**Note:** *Please use Racine Railroad Products part numbers when ordering parts.* Racine Railroad Products part numbers are shown in the parts lists and drawings of this manual and have only six (6) numbers.

Any part number with other than six numbers (e.g. contains alpha-numeric characters) is a Vendor Part Number and **not** a Racine Railroad Products part number

## Safety Information

**Important:** Read the operating instructions and pre-start procedure thoroughly before operating the power unit.

For safe installation and operation of this equipment, carefully read and understand the contents of this manual. Improper operation, handling, or maintenance can result in equipment damage and personal injury.

Only trained and authorized personnel should be allowed to operate this machine. In addition, all personnel at the worksite (gang) should be aware of the safety concerns and their individual responsibilities prior to working this machine.

Please read and comply with all the safety precautions in this manual **before** operating this machine. Your safety is at risk.

## Safety Terms



**DANGER** indicates a hazardous operating procedure, practice, or condition. If the hazardous situation is not avoided death or serious injury will occur.



**WARNING** indicates a hazardous operating procedure, practice, or condition. If the hazardous situation is not avoided death or serious injury could occur.



**CAUTION** indicates a potentially hazardous operating procedure, practice, or condition. If the hazardous situation is not avoided moderate or minor injury could occur.

## Machine Use and Safety Precautions



**Failure to follow safety precautions when operating this equipment can result in serious injury or death to the operator or other persons in the area. Observe the following precautions whenever you are operating, working on or near this equipment.**

**Do not** use this machine for other than its intended purpose.

**Do not** make any modifications without authorization or written approval from Racine Railroad Products. Replace all Racine Railroad Products and OEM parts with genuine Racine Railroad Products and OEM parts. Using non-OEM parts may compromise the safety of the machine.

**Do not** wear loose clothing, jewelry, radio belts, etc., when operating, working on or near this equipment. They can be caught in moving parts and may result in severe injury.

**Always** wear appropriate personal protective clothing when operating this equipment: e.g. Orange safety vest, hard hat, safety glasses with side shields, hearing protection, steel-toed safety boots, leather gloves, dust respirator, etc.

**Always** lift heavy objects with the knees and legs, not the arms and back.

**Always** operate this equipment from the operator's station.

**Always** keep hands, arms, feet, head, clothing, etc., out of the operating area and away from all rotating or moving components when operating, working on or near this machine.

**Always** make sure that all guards, covers, belts, hoses and operating components are in good working order and that all controls are in the appropriate position before starting the engine.

**Always** make sure that all safety equipment (e.g. fire extinguishers, first aid kits, locking and safety devices) are installed properly and are in good working order. **Do not operate the machine until unsafe conditions have been corrected.**

**Always** operate the engine only in a well-ventilated area and make sure that the air filters, air filter covers, and muffler are in good condition.

**Always** keep the machine clean and free of debris. Operate the machine in a safe and responsible manner. Exercise caution when fueling, working on or near rotating or moving components, hot components and fuel systems. Be aware of potential fire hazards and prevent sparks, exhaust, etc., from starting fires on the machine and/or work area.

**Always** comply with all instructions provided on any decals or placards installed on the machine and with any relevant amplifying information provided in this manual or other general operating procedures.

**Always** shut off the engine and set the parking brake when leaving this machine, even if for a short time.

**Always** shut off the engine. Make sure that all controls are in a safe position and install all appropriate locking and safety devices before doing any of the following:

- Lubricating
- Adjusting
- Installing Tooling
- Making Repairs
- Performing Service

**Always** comply with all Lock Out / Tag Out Procedures and other safety procedures established for the local work environment.

Inspect safety decals and replace when they become unreadable or are damaged.

## Specifications

- 25 hp Kubota liquid cooled diesel engine (Final Tier 4 Emissions Standards)
- 0-3000 psi Pressure Gauge
- (3) 3-way, 2-position manually operated Hydraulic Selector valves
- 7-gallon Fuel Tank
- 9-gallon Hydraulic Reservoir
- 10-micron Element Return Line Filter
- Electric Start with 12-volt Battery
- Fan-Cooled Heat Exchanger
- Flow Divider 50/50 %

## Hydraulic Oil

***It is imperative that the hydraulic reservoir is filled with “Premium Quality” hydraulic oil, (approximately, 9-gallons).***

***The reservoir must be filled before power unit is started.***

***Be certain that the oil being used is filtered as it is being put into the reservoir.***

***The hydraulic oil should have anti-wear characteristics, excellent rust protection and contain additives to protect against foaming.***

Use hydraulic oil supplied with the following characteristics:

- **Viscosity Index 101**
- **Grade 32**
- **@ 100° F. it has a viscosity of 156**
- **@ 210° F. it has a viscosity of 43.7**

***It is extremely important that the oil, even new oil from a container be filtered prior to installing into the reservoir.***

Cross-referencing to other manufacturers the following oils can be substituted. (The system will operate with most high quality, petroleum base hydraulic oil.)

- **Gulf Harmony 32A**
- **Shell Tellus 32**
- **Texaco Rando H.D. 32**

Use a 10-Micron element filter. The higher viscosity oil lends to reducing operating temperature, because it helps increase the volumetric efficiency of the pump. If the viscosity is too high the pump will be subjected to poor mechanical efficiency.



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### **Desirable Properties of Hydraulic Fluid**

**Proper Viscosity:** Choose a viscosity high enough to provide good sealing and proper lubrication, but not too high to cause significant pressure drops, loss of efficiencies or high power consumptions.

**Good Lubricity:** Choose oil that has good lubricity, which is the ability to carry heavy loads while maintain low frictional properties.

**High Viscosity Index:** The measure of the degree of change in the viscosity of fluid as change in temperature occurs. High index is the less the oil will thin when the temperature increases and low index the less the oil will thicken when temperature decreases.

**Stable & Non-degrading:** Fluid should be thermal and shear stable and should resist breakdown from oxidation and bacteria.

**Low Compressibility:** Compressibility is important when oil is subjected to higher pressure. High compressibility results in lower efficiency and higher apparent viscosity characteristics.

**Low Foaming:** Low foaming is critical to performance. Excessive foaming can cause cavitation of the pump and premature wear

**High Heat Transfer:** An important aid to remove heat generated in normal pumping and use of hydraulic fluids.

**Good Demulsibility:** Demulsibility is the ability to resist emulsification and allow for separation and removal of water.

**Non-corrosive & Rust Inhibitors:** Oils that are compatible with hydraulic components. Should contain effective rust inhibitors.

**Low Vapor Pressure:** Assists in preventing cavitation and high wear rates of the hydraulic pump.

**Cleanliness:** Extremely important to use clean and non-contaminated hydraulic oil. With extremely tight tolerances built into pumps any contamination could destroy a pump. Even new oil should be filtered before using. A 10-Micron Medium is recommended.

## Section 2: Setup and Operation

**Note:** It is extremely important that the pump is not started until oil is in the system. As the warning tag indicates operating a pump even for a brief time will result in damage.

1. Remove oil breather cap and fill reservoir to the point that the oil level is approximately 1" from the top of the tank, (approximately 9-gallons).

2. Replace oil breather cap when tank has been properly filled. Wipe up any oil that might have spilled.

**Note:** Before proceeding to Step 3, Make sure that the engine has been properly serviced and fueled. Refer to *Kubota Engine Manual*.

3. Fill the diesel fuel tank.

4. Serviced with the proper oil level in the reservoir, the Kubota Engine can be jogged but not started.

- Repeat the jogging a few times and then stop.

### Jogging the Engine

For initial start-ups the power unit should be allowed to run a couple of minutes before it is allowed to build system pressure.

1. Start the engine (See engine manual for proper starting of the engine).

**Note:** An adjustable veneer style throttle controls the engine that has been factory set at 1200 rpm for low idle and 3450 rpm top speed.

The engine speed is what determines the amount of flow from the pump. If the rpms are set too low there will be less flow and possibly not enough torque to support the pump's demand. If the engine is overloaded it will shut down. Throttle positions are to be maintained in the Factory Preset Range.

Maximum speed is 3450 rpms which will produce 10 gpm.

The engine speed is controlled by pre-determined stops. When the veneer throttle is completely pushed in the engine will be operating at 1200 rpms. When the veneer throttle is completely pulled out the engine speed will be approximately 3450 rpms.

Make sure that the hydraulic circuit is properly plumbed and adequate so that the reservoir does not run out of oil. Depending on what the power unit is plumbed to it could lower the reservoir level considerably.

## Setup and Adjustments

Power Unit is completely assembled and set up with a Manual Adjustable Flow Control Valve and an Adjustable Relief Valve.

Proper plumbing connections must be provided prior to starting the engine and engaging the Adjustable Flow Control Valve, otherwise the pressure will build immediately and dump over the relief valve setting causing excessive heat to be dumped into the system.

**Note:** The Power Unit is capable of operating at 2000 psi. It is extremely important that the pressure hoses used for power beyond the power unit are rated for 3000 psi or greater value.

The Adjustable Flow Control Valve (locate at the control manifold block) has been factory set at 2000 psi.

**Note:** The power unit is equipped with three 3-way, 2-position manually operated hydraulic selector valves. Proper plumbing connections must be provided before starting the engine and engaging the Hydraulic Selector Valve.

Open-center type valves must be used downstream when using any additional valves.

1. Properly connect the appropriate pressure hose to the *pressure work ports* (male quick couplers) based on the flow circuit that is installed in the *hydraulic selector valves*.
  - Connections are made using the supplied quick couplers.
2. Properly connect appropriate pressure hose to the *return line port* (female quick couplers) installed below the main hydraulic selector valve on the right side of the power unit.
  - Connections are made using the supplied female quick coupler.



**The Adjustable Flow Control Valve should be in the OFF position before starting the power unit and before connecting or disconnecting pressure hoses.**

**If the Adjustable Flow Control Valve is in the ON position when starting the power unit, a tremendous load on the engine will occur and most like the load will be too great to start the engine.**

3. After the engine is set at the correct speed and the hoses are connected, rotate the Adjustable Flow Control Valve counter-clockwise to the required operating flow (see decal on machine).

### Adjustable Flow Control Valve

The Adjustable Flow Control Valve is in the OFF position when completely turned clockwise.

The valve must be in the OFF position when either connecting or disconnecting the pressure hoses.

- Turn the valve counter-clockwise two clicks to set it at 5 gpm.
- Turn the valve counter-clockwise four clicks to set it at 10 gpm.

### Hydraulic Systems

The Racine Hydraulic power unit is equipped with one 10 gpm (40 lpm) circuit.

If the power unit is used in cold weather, preheat the hydraulic fluid by running power source at low engine speed. Fluid temperature should be at or above 50° F (10° C) before use when using recommended fluids. Using too thick of fluid may result in tool damage.

Check the power system type. The power unit may be used with open or closed center systems.

Check hydraulic hoses for cracks, leakage and damage. If the hoses or couplers show any of these wear characteristics, replace them before operating the tool.



**Never attempt to locate leaks with your hands, personal injury may occur from the pressure system.**

Use a calibrated flow meter and pressure gauge to check the hydraulic power source for 10 gpm (38 lpm) at 2000 psi (400 bar).

- The system's relief valve has been factory tested and pre-set at 2000 psi. Do not exceed the 2000 psi setting.
- The hydraulic system's back pressure should be less than 250 psi (17 bar) measured at the tool end of the operating hoses. All systems checks should be made at minimum operating temperatures.
- The hydraulic fluid cooling system should limit maximum fluid temperature to 160°F (70° C) at the maximum expected ambient temperature.
- The minimum cool capacity should be 5 hp (3.73kW) at a 60° F (33° C) difference between ambient temperature and fluid temperature.
- A minimum of 25-micron filtration is required for the hydraulic system. For cold weather startup and maximum dirt holding capacity a filter element sized for 25 gpm (12 l cpm) is recommended.

### Hose Recommendations

**Recommended hose size:** .500 inch (12 mm) I.D. up to 50 ft (15 m) long

**Recommended hose size:** .625 inch (16 mm) I.D. up to 100 ft (30 m) long

The hoses are recommended for the hydraulic fluids specified above at normal oil temperatures of 100° – 130° F (38° – 54° C).

**Note:** Avoid the use of quick disconnects to attach multiple hose lengths, use full size steel pipe couplings.

## Hydraulic Hose Connections

Wipe quick couplers with a clean lint free cloth before connecting them.

Connect hoses from power source to the tool. It is recommended to connect the return hoses first and disconnect last to minimize or avoid trapping pressure within the tool.

When connecting the quick couplers, the flow should run from male coupler to female coupler. The female coupler on the tool is the inlet. Quick couplers are marked with an arrow to show flow direction.

Turn on the hydraulic circuit at the power source.

**Note:** When possible, connect the free ends of uncoupled hoses to prevent pressure build up in the hoses. The sun can also increase pressure in the hoses and make connecting difficult

Make sure the pressure hose is connected to the pressure port and the return hose connected to the return port. Pressure port is at the position and return port is at the position



**Do not attempt to reverse a tool by hooking the pressure hose to return port of the tool. Reversing the hoses can cause severe damage to equipment.**

### Single Circuit Flows Up to 10 gpm

Plumb the hose and tool per the Hose Installation figure below. The numbers represent the couplings called out in the illustration.

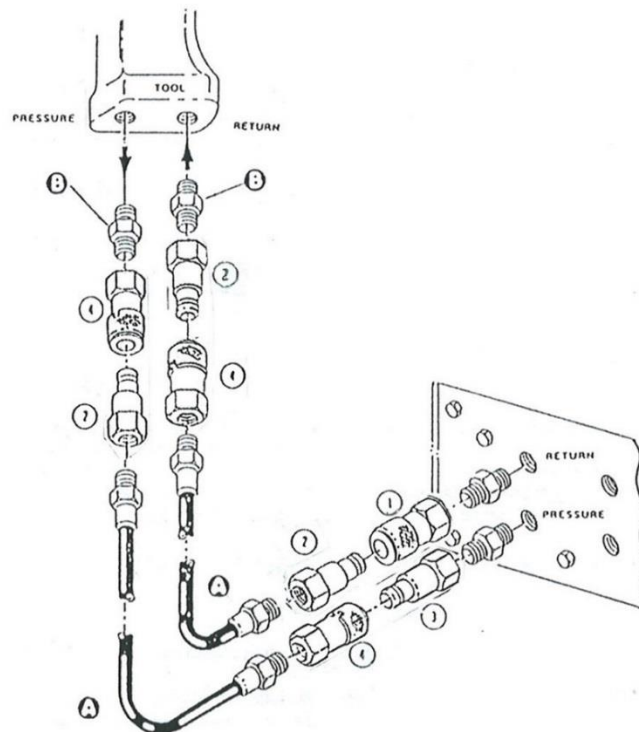
The power unit must be plumbed to an open center valve.

1. H.T.M.A.  $\frac{3}{8}$ -inch Female Quick Acting Coupler with  $\frac{3}{4}$ -16 O-ring thread.
2. H.T.M.A.  $\frac{3}{8}$ -inch Male Quick Acting Coupler with  $\frac{1}{2}$ -inch NPT thread.

**Note:** At the tool, this may be H.T.M.A.  $\frac{3}{8}$ -inch Female Quick Acting Coupler with  $\frac{3}{8}$ -inch NPT thread.

3. H.T.M.A.  $\frac{3}{8}$ -inch Male Quick Acting Coupler with  $\frac{3}{4}$ -16 O-ring thread.
4. H.T.M.A.  $\frac{3}{8}$ -inch Female Quick Acting Coupler with  $\frac{1}{2}$ -inch NPT thread.

**Note:** At the tool, this may be  $\frac{3}{8}$ -inch Male Quick Acting Coupler with  $\frac{3}{8}$ -inch NPT thread.



**Hose Installation**

## Pre-Operation Checks



It is extremely important that the pump is not started until oil is in the system. Power Units are shipped without oil, operating a pump even for a time will result in damage.

### Hydraulic Oil

The reservoir must be filled before power unit is started. Be certain that the oil being used is filtered as it is being put into the reservoir.

1. Remove the oil breather cap and fill reservoir to the point that the oil level is approximately 1-inch from the top of the tank, (approximately 9-gallons). Refer to the Sight / Level /Temperature Gauge on the end of the reservoir to determine when the reservoir is full.
2. Replace oil breather cap when tank has been properly filled. Wipe up any oil that might have spilled.

### Engine Crankcase Oil Level

Check that the engine oil level is full.

Serviced with the proper oil level in the reservoir, the engine can be jogged, but not started. Repeat the jogging a few times and then stop.

### Fuel Level

Always fill the tank before starting the engine. Use clean, fresh, diesel fuel. The fuel tank holds approximately 7 gallons.

Jog the engine without starting, to prime the pump before starting.

**Note:** Purchase fuel in quantity that can be used within 30 days.

### Battery

Check the electrolyte level in each battery cell. The level should never be below the top of the plates.

If the level is low, add distilled water. The level is correct when filled to the bottom of the split ring in each cell.

### Hydraulic Connections

Pressure and return hoses are connected to the ports at the control panel.

The pressure return ports are marked per the labels. When installing couplers, the pressure port receives the male coupler and the return port receives the female coupler.

The hoses can then be connected directly to the couplers. Couplers are available through your Racine Railroad Products dealer.

## Start Up

Once the proper oil has been put in the reservoir and the engine has been properly serviced the engine can be started.

### Adjusting the Pressure

1. Loosen the hex jam nut at the base of the adjusting screw.
2. Rotate the adjusting screw changes the system pressure.
  - a. To **decrease the system pressure**, turn the adjusting screw **counter-clockwise** to desired pressure setting and then tighten the jam nut to lock it in place.
  - b. To **increase the system pressure**, turn the adjusting screw **clockwise** to desired pressure setting and then tighten the jam nut to lock it in place.

Note: The system's relief valve has been factory set and tested at 2000 psi (maximum pressure). Do not exceed the 2000 psi rated pressure.

## Start Up

For initial start-ups allow the power unit to run a couple of minutes to build system pressure and to allow the engine speed to increase to the pre-determined maximum speed of 3000 rpms.

1. Make sure the flow control circuit is set at **0** or **OFF**.
2. Lift the throttle knob up slightly, then turn the ignition key to start the engine.

Allow the engine to run at low speed until the engine and hydraulic circuits are warm.

## Selector Valves

The power unit is equipped with three manual 3-way, 2-position selector valves. Push *in* the spools on the selector valves to the OFF position. In the OFF position, the flow passes through all the valves and is directed back into the reservoir.

- Use the hydraulic selector valve to direct and pressurize a circuit from the power unit.
- It is considered an ON/OFF circuit valve. ON is out. Off is in.
- **Pull out** the round black selector valve handle to direct and pressurize the work port of the selector valve. When the handle is pulled out, flow and pressure capabilities are in the circuit.
- **To shut OFF the flow**, push in the round black selector valve handle.

## 5 gpm Selector Valve

The two selector valves in the center of the power unit control a 5 gpm circuit. Either one or both 5 gpm circuits can be used at the same time.

- Pull *out* all the spools on the selector valves to the ON position and to start the engine.
- The main selector valve (10 gpm) must be in the OFF position when using the 5 gpm circuits.
- Connect the return line hoses to the return female quick couplers on the right side of the power unit, below the 10 gpm male quick coupler.

### 10 gpm Selector Valve

The selector valve on the right side of the power unit controls the 10 gpm circuit.

- Pull *out* the spools on the 10 gpm selector valve to the ON position and to start the engine.
- The two 5 gpm circuits must be off (pushed *in*) when using the 10 gpm circuit.

### Hydraulic Circuit

Make sure that the hydraulic circuit is properly plumbed and adequate so the reservoir does not run out of oil. Depending on what the power unit is plumbed to it could lower the reservoir level considerably.

### Fan-Cooled Heat Exchanger

The Power Unit is equipped with a Fan-Cooled Heat Exchanger.

The setting cannot be changed on the thermostat. The thermostat will be provided power when the engine is started.

The temperature setting for the heat exchanger to come on is 122° F.

### Cold Weather Start Up

1. Move the choke control to the CHOKE position.
2. Place throttle at 1/3 Full position.
  - If the engine does not start, remove air cleaner to check choke. The choke must be fully closed, if not, see adjustments.
3. Turn the ignition key to start the engine. Repeat if necessary with the choke off and the throttle control in FAST position.
4. Operate engine with choke off and throttle in slow to medium position.
  - Use short starting cycles, 15 seconds per minute, to prolong starter life. Extended cranking can damage the starter motor.

### Tool Operation

1. Start the engine as specified above.
2. Turn the hydraulic circuit to the **ON** position or a flow setting to start the fluid flowing to the tool.



**Do not connect two tools when running in combine mode.**

**Note:** When you leave this equipment, even for a short time, shut off the hydraulic motor and disengage the hydraulic supply hoses.



### Shutdown

Always return the Adjustable Flow Control Valve to the OFF position before disconnecting a pressure hose. There will be no flow at the quick coupler.

1. Pull the throttle lever to low speed.
2. Return the hydraulic circuit to the **OFF** position or **0** flow.
3. Turn the ignition key to **OFF**.
4. Disconnect the hydraulic hoses and store in a suitable area.

### Emergency Procedures

In the event of any malfunction, **immediate shut-off the hydraulic power source** and correct the problem.

## Section 3: Maintenance

### Maintenance

Periodic inspection of all fasteners should be done as a routine precautionary procedure.

Service and maintain the Kubota engine per the Maintenance scheduled as outlined in the *Kubota Engine Owner's Manual*.

Practice routine periodic inspection of the condition of hydraulic hoses and fittings. A failure of hydraulic hose can be very hazardous, frequent inspection for damage is good practice.

Check hydraulic oil reservoir level periodically. Proper oil level is approximately 1"-1 ½" from the top of the reservoir.



**Do not perform maintenance on the power source while the motor is running or when the hoses are connected. Allow the unit to completely cool down.**

### Adjusting the Pressure

The system's relief valve has been factory tested and pre-set at 2000 psi. Do not exceed the 2000 psi setting.

1. Loosen the hex jam nut at the base of the adjusting screw.
2. Change or adjust system pressure by rotating the adjusting screw.
  - To **decrease system pressure**, turn the adjusting screw counter-clockwise to desired pressure setting and then lock it in place by tightening the jam nut.
  - To **increase system pressure**, turn the adjusting screw clockwise to desired pressure setting and then lock it in place by tightening the jam nut.

## Hydraulic System Maintenance

Hydraulic system includes a return line filter. Routine inspection is necessary to determine when to replace filter element.

A clogged filter element should be replaced instead of trying to get extended life out of it. There are too numerous factors to consider in giving an element, projected life. The life of the element varies with the amount of contaminants or dirt introduced into the system. The amount of dirt introduced into the circuit varies from hour to hour and day to day. We therefore recommend frequent inspections.

1. Observe the following for maximum performance and service life from the hydraulic system.
  - Always use the correct hydraulic fluid.
  - Always keep the hydraulic system and fluids clean.
  - Keep water out of the fluid.
  - Keep air out of the lines, air is indicated by the hydraulic system overheating and foam at the hydraulic tank breather. Tighten all suction line fittings and clamps.
  - Hydraulic system wear is noted by increasing heat during tool operation, reduce tool performance and eventual system breakdown.

Remove condensed moisture from hydraulic fluid. Condensation is a frequent problem with cool mobile hydraulic circuits. This condition occurs in moist or cold climates. When warm air in the reservoir tank draws moisture from the cooler outside air, water accumulates in the tanks.

Approximately once each week (less often in hot dry weather) take a small sample from the bottom of the hydraulic tank by removing the 1/2-inch N.P.T. drain plug.

If clear water appears, drain the tank until clean oil starts to show. If fluid is milky, allow unit to settle for about 48 hours before draining.

1% water in a 2000 psi/140 bar hydraulic can cause a 25% increase in wear rate.

**Note:** Operate the unit with fluid temperature at 50° F to 140° F (10° C to 60° C) for improved seal and hose life, maximum efficiency and operator comfort.

2. Check suction hose from the hydraulic tank to the pump inlet to see that it is not kinked and that the clamps are secure. This will reduce the risk of pump cavitations and sucking air into the system. All pump fittings must be tight.
3. Check hydraulic unit for loose lines, fittings, leaks, etc., through the entire hydraulic circuit.

Escaping fluid under pressure can have sufficient force to penetrate skin, causing serious personal injury. Before disconnecting lines, be sure to relieve all pressure. Before applying pressure to the system, be sure all connections are tight, and that lines and hoses are not damaged.

Fluid escaping from a very small hole can be almost invisible. Use a piece of cardboard or wood rather than hands to search for suspected leaks.



**WARNING**

**Do not attempt to locate pin hose leaks with your bare hands. Pinhole leaks can penetrate the skin.**

**If injured by escaping fluid, see medical attention immediately. Serious infection or reaction can develop if proper medical treatment is not administered immediately.**

5. Change hydraulic filter.

For maximum filter element performance: consistently connect the hose ends together when detached from the tool and wipe off contaminants before connecting quick disconnects.

To replace the filter element:

- Stop the engine and unscrew the cover from the filter housing.
- Carefully remove the element and filter barrel from the housing minimizing agitation.
- The filter barrel is equipped with a sump area at the bottom and needs to be thoroughly cleaned prior to reinstalling.

**Filter:** Use a 10-micron filter with built in 25 psi bypass check. Contact RRP to get the correct replacement element.

6. Fill the hydraulic tank by removing the filter cap. The tank is full when oil reaches the notch in the dipstick

**Do not** use engine oils or transmission fluids other than petroleum-based hydraulic fluids.

Use the recommended fluids. These fluids will flow easier when cold, will allow water to settle for draining and will prevent wear at high pressure and cold temperature during tool use.

### Engine Maintenance

See the engine maintenance manual for requirements.

## Testing and Trouble Shooting

Periodically test the hydraulic system and engine to make sure that the power unit is operating at peak efficiency. Performing the recommended test will help to isolate problems that may exist in the engine and hydraulic system.

- Start the engine and listen for any unusual sounds.
- Check the engine fuel and cooling systems for leaks before performing any tests.

### Testing the Hydraulic Circuit

If the unit is equipped with two hydraulic circuits, test them individually using the circuit tester. Test each hydraulic circuit as follows.

1. Set the hydraulic circuit to the **OFF** or **0** flow position.
2. Connect the hydraulic hoses to the appropriate connectors on the control panel for the circuit you are testing. Connect a hydraulic tester to the opposite end of the hoses. Make sure the flow direction is correct.
3. Start the engine and allow the hydraulic fluid to warm to about 100° F (38° C).
4. Open the tester restrictor valve (fully open). This represents minimum load.
5. Set the applicable hydraulic circuit to the PUMP ON position for the flow being tested. Push the throttle lever for maximum engine speed.
6. Check the flow rate and pressure on the tester gauges.
  - Record the flow and pressure.
  - The flow should be slightly over the unit (or port's) rated flow. The pressure gauge will indicate tool back pressure.

7. Position the engine throttle lever to produce 1/4 to 3/4 gpm (1-3 lpm) more than the rated flow. With the engine at this speed, slowly close the restrictor valve on the tester while observing the flow and pressure gauges.
8. As the hydraulic system relief valve begins to crack (open) and bypass fluid through the valve, the flow rate will begin to drop.
  - At this time, the pressure in the system should be between 2100 and 2200 psi (148 and 155 bar).
9. Repeat Step 2 through Step 8 for the second circuit.

Note: If internal circuit wear is present, the cause should be determined.

Most circuit wear is caused by poor maintenance. Proper maintenance is essential for preventing problems. Always keep hydraulic circuits clean.

### Adjusting the Hydraulic Circuit Relief Valve

If the pressure is not as specified, the hydraulic circuit relief valve must be adjusted or replaced.

- There is a relief valve for each hydraulic circuit. Adjust or replace the relief valve for the ports at the circuit being tested.
- Turn the adjustment clockwise to increase the pressure setting.
- Always set the pressure by turning the screw in (upping the pressure). If you go past the setting back out the screw and reset.

### Analyzing Hydraulic Flow

During Steps 3 through Step 8 (listed above) the engine should hold nearly constant speed.

A drop in the flow by more than 1.2 gpm (4.5 lpm) of that recorded in Step 6 would indicate wear inside the hydraulic flow. This can be analyzed as follows:

- If the pressure stabilizes between 2100 and 2200 psi (148 and 155 bar) and the flow rate begins to drop, the relief valve is opening and the system is operating properly.
- If the flow rate gradually decreases while system pressure increases, the pump or control valves may be worn.

### Other Checks

Check the following and correct as required.

- Proper hydraulic fluid
- Dirt or water in the hydraulic fluid
- Clogged return filter
- Air leaks in circuit
- Damaged pump-suction hose

## Testing the Engine

When performing the following test with both circuits operating, the hydraulic oil may overheat. Perform these tests as efficiently as possible to reduce overheating.

At higher altitudes or during humid/hot weather conditions, the engine power may decrease below normal, causing smoke. This condition is normal because cold, dense air (for efficient combustion) is not being provided. If this occurs often, consult your Racine Railroad Products dealer for power unit modifications.

1. When the engine and hydraulic fluid are warm, set the appropriate circuit to ON or the flow being tested.
  - Close the tester restrictor valve for 0 flow on the tester flow gauge.
  - At this time, the circuit relief valve should be open (by passing fluid).
  - Record the pressure.
2. Set the circuit to OFF or 0 flow and connect the hoses to the other circuit.
  - Remove hoses from the first circuit.
3. Open the tester restrictor valve and set the second circuit to ON.
  - Leave the lever for the first circuit OFF.
4. Close the tester restrictor valve.
  - Adjust the relief valve on circuit so the system pressure is below 2000 psi (140 bar) by the same amount as the pressure recorded in Step 4 (above) was above 2000 psi (140 bar).
5. Set the first circuit to OFF.
6. Adjust the relief valve on the circuit to the pressure recorded for the first circuit in Step 4.
7. Shut down the engine and disconnect the hoses.

## Troubleshooting

If the symptoms of poor performance develop, the following charts can be used as a guide to isolate the problem. When diagnosing faults, review the recommended maintenance procedures given. Perform the hydraulic and engine tests given in this section.

Problem	Possible Cause	Correction
<b>Starter will not crank engine.</b>	Engine working against the hydraulic pump pressure.	Make sure the circuit switches are OFF.
	Batter discharge or not properly connected.	Check the condition of the battery, cable connections, etc. Replace battery.
	Starter defective.	Inspect starter. Replace as necessary.
	Ignition switch or solenoid switches defective.	Replace as necessary.
<b>Engine cranks but will not start.</b>	Water in fuel.	Empty water sediment trap. Bleed injectors per engine manual.
	Cold start no functioning.	Check the current to the spark plugs on cold start units. Repair circuit or place spark plugs a required.
	Inadequate compression.	Check for clogged air cleaner, valves seated, cylinder compression loss. Repair as required,
<b>Engine runs but hydraulic circuit will not drive.</b>	Tool not connected to power unit.	Connect tool. Check couplers.
	Hydraulic fluid reservoir low.	Check and fill as required.
	Tool hoses blocked.	Remove obstruction.
	Too hoses incorrectly connected to circuit fittings.	Check that the tool hose goes from the top port tool pressor or the IN port and from the tool return or OUT the port to the lower port, both ports on the same side of the manifold.

## Maintenance Schedule

Maintenance Operation	8 hours or daily	25 hours or every season	150 hours or every season	500 hours or every season	1000 hrs or every season
<b>Engine</b>					
Check / Fill Oil Level	X				
Change Oil			X Note 1		
Change Oil Filter				X	
Service Air Filter Pre-Cleaner		X Note 2			
Service Air Filter Cartridge				X Note 2	
Inspect spark arrester, if equipped			X		
Clean cooling system				X Note 2	
Replace spark plugs					X
Replace in-line fuel filter					X
Check Valve Clearance					X
<b>Hydraulic System</b>					
Check fluid level	X				
Check fluid for condensation		X Note 3			
Change oil and filter			X	X	X
Inspect hydraulic system for leaks	X				
*	Change oil after 8 hours, then every 50 hours or every season				
<b>Note 1</b>	Change oil every 25 hours when operating under heavy load or in high temperatures				
<b>Note 2</b>	Clean more often under dusty conditions or when airborne debris is present. Replace air cleaner parts if very dirty.				
<b>Note 3</b>	Check more often if temperatures (ambient) changes quickly over a short period of time.				

Dispose of consumable items (filters, oil, etc.) in a responsible manner.