



## CALIFORNIA



#### **Proposition 65 Warning:**

Engine exhaust and some of its constituents, and some dust created by power sanding, sawing, grinding, drilling and other construction activities contains chemicals known to the State of California to cause cancer, birth defects and other reproductive harm.

#### Some examples of these chemicals are:

- Lead and lead-based paint.
- Crystalline silica from bricks.
- Cement and other masonry products.
- Arsenic and chromium from chemically treated lumber.

Your risk from these exposures varies, depending on how often you do this type of work. To reduce your exposure to these chemicals: ALWAYS work in a well ventilated area, and work with approved safety equipment, such as dust mask that are specially designed to filter out microscopic particles.

## **IMPORTANT!**

Read the operator's manual for safety instructions before you attempt to troubleshoot. Use extreme caution when troubleshooting power equipment. Never start or run power equipment inside a closed area, breathing exhaust fumes can kill.

Basically, a tool is an object that enables you to take advantage of the laws of physics and mechanics in such a way that you can seriously injure yourself.

This manual is intended to provide information and procedures to safely maintain and give a basic understanding of service techniques for the RX1510 series roller.

You must be familiar with the operations of the RX1510 series roller before attempting to troubleshoot or make repairs. Basic operating and maintenance procedures are described in the operation and parts manual supplied with the roller. Use the supplied manual to order replacement parts. If you are missing the operation and parts manual, please contact Multiquip Inc to order a replacement or you may visit our website at www.multiquip.com

For your safety and the safety of others carefully read, understand and observe all instruction described in this manual.

JUST BY READING THIS MANUAL DOES NOT MAKE YOU A SUBSTITUTE FOR PROPERLY TRAINED PERSONNEL. THE REPAIRS SHOULD ONLY BE ATTEMPTED BY QUALIFIED, TRAINED TECHNICIANS. EACH APPLICATION AND OPERATIONS OF THE MACHINE CAN CREATE ITS OWN SET OF CIRCUMSTANCES. NO MANUAL CAN COVER EVERY POSSIBLE SITUATION. WHEN IN DOUBT, ASK. THERE IS NO SUCH THING AS DUMB QUESTIONS. BE SAFE!!!!!!!



THE INFORMATION CONTAINED IN THIS MANUAL IS BASED ON RX1510CI ROLLER MANUFACTURED UP TO THE TIME OF PUBLICATION. MULTIQUIP INC. RESERVES THE RIGHT TO CHANGE ANY PORTION OF THIS INFORMATION WITHOUT NOTICE.

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## **SPECIFICATIONS**

	RX1510C24	RX1510C33				
Engine Make / Model	Lombardini / LDW 1003	Lombardini / LDW 1003				
Horse Power	20	20				
No. of Cylinders	3	3				
Engine RPM	3000	3000				
Fuel Type	Diesel # 2	Diesel # 2				
Fuel Capacity	6. gal. (23 ltr)	6. gal. (23 ltr)				
Eng. Oil Type	SAE 1	0W-30				
Eng. Oil Capacity	5.2 qt.	5.2 qt.				
Eng. Coolant	Water / Ethylen	e Glycol mixture				
Valve Clearance	Intake: .007 Exhaust: .007					
Hydraulic Oil	Tellu	Tellus 32				
Hydraulic Oil Capacity	11. gal (43 ltr)					
Battery	MQ Part # 50657VP					
Vibrations Per Minute - VPM	28	00				
Operating Weight	3.240 lb. (1470 kg)	3,373 lb. (1530 kg)				
Overall Length	75 inch (*	1912 mm)				
Overall Width	24 inch (630 mm)	33 inch (850)				
Overall Height	46. inch (	1175 mm)				
Articulation Angle (left and right)	30°:	± 5°				
Oscillation Angle (left and right)	8° =	± 5°				
Distance between Axles	39 inch (	(990 mm)				
Drum Diameter	20 inch (	(525 mm)				
Speed – Working Gear	16 m/min					
Speed – High Speed	38 m/min					
Grade ability w. / w/o vibration	50% /	/ 60%				

## **MAINTENANCE SPECIFICATIONS**

Roller Maintenance Operation	Daily	25 hrs.	75 hrs.	500 hrs.	1000 hrs.
- Check hydraulic oil level	•				
- Check cooling water level	•				
- Check for external damage	•				
- Clean control box / transmitter	•				
- Safety guard inspection	•				
- Check fasteners / engine mounts		•			
- Lubricate all lubrication nipples		٠			
- Service battery			•		
- Clean fuel tank					•
- Drive hub gears				•	
- Change hydraulic oil / filter					•

Engine Maintenance Operation	Daily	50 hrs.	75 hrs.	250 hrs.	500 hrs.	1000 hrs.	2500 hrs.
- Check engine oil level	•						
- Check fuel level	•						
- Check air filter (earlier if necessary)	•						
- Clean cooling water level	•						
- Fluid leak inspection (general)	•						
- Change engine oil (initial only)		•					
- Replace engine oil filter (initial only)		•					
- Change engine oil and filter			•				
- Replace fuel filter				•			
- Coolant hose inspection				•			
- Clean engine head and cylinder fins				•			
- Check valve clearance					•		
- Replace fan belt					•		
- Clean injectors and check pressure					•		
- Replace suction filter						•	
- Coolant replacement						•	
- Replace timing belt							•

## **TORQUE SPECIFICATIONS**

Tightening torque values for bolts with standard metric thread.

Strength classes for bolts with un-treated, un-lubricated surface, the bolt quality designated is evident on the screw heads.

#### 8.8 = 8G : 10.9 = 10K : 12.9 = 12K

The values result in a 90% utilization of the screw yield strength, in the case of a coefficient of friction

#### µ ges. = 0.14

Adherence to tightening torques is checked with a torque wrench. When using lubricants, the specified tightening torques do not apply

Bolt dimension	Tighte	ning torques	s ft-lb:
	8.8	10.9	12.9
M 4	3	3	4
M 5	4	7	7
M 6	7	11	13
M 8	18	26	33
M 10	37	55	61
M 12	65	91	108
M 14	101	145	173
M 16	156	221	264
M 18	213	303	361
M 20	304	426	513
M 22	413	559	695
M 24	524	798	885
M 27	774	1092	1308
M 30	1047	1482	1770

Bolt dimension	Tighte	ening torque	s Nm:
	8.8	10.9	12.9
M 4	3	5	5
M 5	6	9	10
M 6	10	15	18
M 8	25	35	45
M 10	50	75	83
M 12	88	123	147
M 14	137	196	235
M 16	211	300	358
M 18	290	412	490
M 20	412	578	696
M 22	560	785	942
M 24	711	1000	1200
M 27	1050	1480	1774
M 30	1420	2010	2400

## **SERIAL NUMBER LOCATION**

The roller Identification tag is located above the safety bar at the rear of the machine.



## **FREQUENCY CHANNEL SETTING**

The infrared transmitter and machine receiver is equipped with selectable addresses. The transmitter and receiver must be set to the same address in order to communicate properly. Up to ten addresses are available. Multiple machines can be operated by infrared simultaneously within the same work area.

The address selector on the transmitter is located behind a plug *(see "A" below)* which can be removed with a screwdriver. The address can be set with a small screwdriver by turning the arrow in the middle.



The receiver is located under the operating panel, the address selector on the receiver is located behind a plug (see "B" below) which can be removed with a screwdriver. The address can be set with a small screwdriver by turning the arrow in the middle. Set the same address as on the transmitter.



**NOTE**: The infrared transmitter and machine receiver addresses both come set from the factory on number 5.

## **INFRARED REMOTE OPERATION**

The remote control system features a low distance & far distance shutdown. During the shutdown mode the engine continues to run, however all driving functions are deactivated.



Low distance shutdown: "LDS" If the minimum distance between the transmitter and the receiver eye is less than 6 ft (2 meters) the machine will go into shutdown mode. The unit will come out of shutdown mode when the minimum distance has been attained.

Far distance shutdown: "FDS" The maximum distance between the transmitter and receiver eye depends on weather conditions and is approximately 65 ft to 75 ft (20- 24 meters) If the maximum distance is exceeded the unit will go into shutdown mode. The unit will come out of shutdown mode as soon as the unit becomes within the maximum distance.

## **COCKPIT DIGITAL DISPLAY ELEMENTS**

#### COCKPIT DIGITAL DISPLAY

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## **COCKPIT DIGITAL DISPLAY ELEMENTS**

The display consists of 6 digits and is tested when the ignition switch is turned to the ON position. The number 888888 should illuminate • example below. If not, the cockpit is defective and should be replaced.



Code:	Meaning:	Illuminates:
888888	Function test of the display	When switching the ignition ON.
505	<ul> <li>S: Stands for start function</li> <li>05: Address set on the receiver Box, (factory setting 05).</li> </ul>	<ul><li>When switching the machine ON.</li><li>During the starting procedure.</li></ul>
F	F: Stands for function	<ul> <li>During operation when function occurs.</li> <li>Always in combination with display F, for function and a numerical value.</li> </ul>
{	I: Stands for infrared transmitter	<ul> <li>Displays during infrared control operation.</li> <li>Always in combination with display F, for function and a numerical value.</li> <li>Function code numbers see page 11</li> </ul>
н	H: Stands for manual control	<ul> <li>Displays during manual control operation.</li> <li>Always in combination with display F, for function and a numerical value.</li> <li>Function code numbers see page 11</li> </ul>
E	E: Stands for error.	<ul> <li>When function has an error.</li> <li>Always in combination with a numerical value.</li> <li>Error code numbers see page 12</li> </ul>
Err	Err: Stands for error	<ul> <li>If error occurs.</li> <li>Error code numbers see page 12</li> </ul>
0.0	Operating hour meter.	<ul> <li>1 second after the function test displays (888888).</li> <li>Flashes alternating with the starting function S. – 05, until engine has started or the cockpit switches to stand-by mode.</li> </ul>

## **MANUAL CONTROL CODES**

- Code numbers are displayed from position 3 to 6.
- H stands for hand controller.
- Four digit code numbers are displayed in combination with 'F' (function) which will stand for driving and vibration.
- Four digit code numbers are displayed in combination with 'E' which stands for an error.
- 1-, 2-, or 4-digit numbers are displayed in combination with 'S' (starting function), dependent on the position of the ignition start switch and starting program.

Code number	Meaning
1	Fast gear on/off
10	Driving forward
100	Steering angle left
1000	large amplitude
20	Driving backwards
200	Steering angle right
2000	low amplitude
4010	Start
4100- 4400	Machine off



	Control mode:	Code number:	Meaning:
F	Н	4010	Start button is activated • Starting procedure is initiated
F	н	4020	The motor has started • Release start button
F	-	4050	This error appears, if the start button is released prematurely during the starting procedure. This function prevents the starter from engaging during multiple attempts of starting the engine, while the engine is still in motion.
F	н	4100	STOP procedure is initiated, the machine will not start and is waiting for the generator, speed control and oil pressure signal to stop.
F	Н	4200	STOP sequence is continued.
F	Н	4300	The hour meter is secured.
F	Н	4400	The hour meter reading is saved.

Example display function

• F H 1100 Driving left forward with vibration forward



## **INFRARED CONTROL CODES**

The function codes during operation in the cockpit are made from the individual function keys. Adding the code numbers will indicate the function codes Example display function

• F I 1100 Driving left forward with vibration forward

• I stands for infrared controller.

Code	Meaning
1	Fast gear on/off
10	Drums right forward
100	Drums left forward
1000	Vibration forward
20	Drums right backward
200	Drums left backward
2000	Vibration reverse
4010	Start
4100- 4400	Machine off / Transmitter off







Neutral position of the toggle switch "Start-Stop". This switching position is not indicated in the cockpit.

	Control mode:	Code number:	Meaning:
F	1	4010	Toggle switch 'start is activated • Starting procedure is initiated
F	I	4020	The motor has started • Release toggle switch
F	-	4050	This error appears, if the toggle switch is released prematurely during the starting procedure. This function prevents the starter from engaging during multiple attempts of starting the engine, while the engine is still in motion.
F	1	4100	STOP procedure is initiated, the machine will not start and is waiting for the generator, speed control and oil pressure signal to stop.
F	1	4200	STOP sequence is continued.
F	I	4300	The hour meter is secured.
F	1	4400	The hour meter reading is saved.

## **OPERATION CODES**

#### **DRIVING FUNCTIONS**

Display: FH (manual)	Display: FI (infrared)	Executed function:			
F H 0010	F I 0010	Driving	Right forward		
F H 0011	FI0011	Driving	Right forward		High Speed
F H 0020	F I 0020	Driving	Right reverse		
F H 0021	F I 0021	Driving	Right reverse		High Speed
F H 0100	FI0100	Driving	Left forward		
F H 0101	F I 0101	Driving	Left forward		High Speed
F H 0110	FI0110	Driving	Left forward	Right forward	
FH0111	FI0111	Driving	Left forward	Right forward	High Speed
F H 0120	F I 0120	Driving	Left forward	Right reverse	
F H 0121	F I 0121	Driving	Left forward	Right reverse	High Speed
F H 0200	F I 0200	Driving	Left reverse		
F H 0201	F I 0201	Driving	Left reverse		High Speed
F H 0210	F I 0210	Driving	Left reverse	Right forward	
F H 0211	FI0211	Driving	Left reverse	Right forward	High Speed
F H 0220	F I 0220	Driving	Left reverse	Right reverse	
F H 0221	F I 0221	Driving	Left reverse	Right reverse	High Speed

#### **VIBRATING FUNCTIONS**

Display: FH (manual)	Display: FI (infrared)	Executed function:		
F H 1000	F I 1000	Vibration forward		
F H 1010	F I 1010	Vibration forward	Driving right forward	
F H 1020	F I 1020	Vibration forward	Driving right reverse	
F H 1100	F I 1100	Vibration forward	Driving left forward	
FH 1110	F I 1110	Vibration forward	Driving left forward	Driving right forward
F H 1120	F I 1120	Vibration forward	Driving left forward	Driving right reverse
F H 1200	F I 1200	Vibration forward	Driving left reverse	
F H 1210	F I 1210	Vibration forward	Driving left reverse	Driving right forward
F H 1220	F I 1220	Vibration forward	Driving left reverse	Driving right reverse
F H 2000	F I 2000	Vibration reverse		
F H 2010	F I 2010	Vibration reverse	Driving right forward	
F H 2020	F I 2020	Vibration reverse	Driving right reverse	
F H 2100	F I 2100	Vibration reverse	Driving left forward	
F H 2120	F I 2120	Vibration reverse	Driving left forward	Driving right forward
F H 2200	F I 2200	Vibration reverse	Driving left forward	Driving right reverse
F H 2200	F I 2200	Vibration reverse	Driving left reverse	
F H 2210	F I 2210	Vibration reverse	Driving left reverse	Driving right forward
F H 2220	F I 2220	Vibration reverse	Driving left reverse	Driving right reverse

## **ERROR CODES**

Error Code:	Meaning:	Possible Cause:	Troubleshooting:
FErr 1	An unknown character was received.	Connection to the machine controller is physically interrupted, example: cable break or released contacts.	Check the wiring to the machine controller. Replace defective parts.
FErr 2	No signal has been received for a specific time from the machine controller.	The error indicates a cable break.	Check the wiring to the machine controller. Replace defective parts.
Err 1	Signal received from infrared transmitter, although manual control active.	The machine was started with the manual control box therefore operating the infrared control transmitter is not possible.	This error disappears, as soon as no signals are received via infrared.
	Signal received from	The machine was started with the	This error disappears, as soon as no signals are received manual control.
Err 2	manual control, although transmitter active.	operating the manual control box is not possible.	Machine must be operated with the infrared transmitter. Turn machine off and restart with manual control box.
Err 3	Valid infrared signal received, address is	Address of transmitter and receiver	Check and adjust the addresses between transmitter and controller.
	however incorrect.	do not agree.	Coordinate addresses of transmitter and receiver.
	Inclination indicator triggered.	Machine has tilted	Place machine upright.
Err 13	Control unit in incorrect position.	Example: Installation position of controller incorrect / incorrectly installed after repair or not fastened for test.	Check controller for position and fit and if necessary correct.
Err 21	Low distance shutdown activated. This error can only occur during active infrared control.	Operator is too near to the machine.	Increase distance between transmitter (operator) and machine.
<b>F</b> 00		Safety opening is actuated.	Unlatch safety yoke/deactivate.
Err 22	Satety opening is actuated.	No further errors or functions can be indicated on display with actuated safety yoke.	Unlatch yoke before beginning work (engine start).

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## HYDRAULIC OIL

The sight glass for the hydraulic oil level is located under the operating panel. The fill level should be within the sight glass.



#### ADDING HYDRAULIC OIL

Remove the oil filler cap *(see "A" below)* when system oil is cold. Under the oil filler cap is a return oil filter, remove filter and fill with hydraulic oil. The fill level should be within the sight glass.





## **ENGINE OIL**

- 1. Park the machine on flat ground.
- 2. Pull the dipstick out (see "A" below)
- 3. Wipe dipstick with a dry, fibre free rag.
- 4. Insert the dipstick up to the stop in its fixture.
- 5. Pull the dipstick out again and read the oil level. ► The oil level should be between the two markings on the dipstick.



Engine oil must be change after first 50 hours of operation and thereafter every 75 hours

- 1. Park the machine on flat ground.
- 2. Loosen the retaining clip 'A' to access the oil drain line 'AS'.
- 3. Prepare a container to collect engine with capacity of at least 1.5 gal.



- 4. Pull oil drain line 'AS' out enough to remove oil drain plug.
- 5. Secure the end of the hose fitting 'B' and carefully remove the oil drain plug 'C'





## **ENGINE COOLANT**

Work may only be carried out on the cooling system when the diesel engine has cooled down. The machine must be parked on a level ground. The cooling water level is examined directly at the radiator. The compensating tank only serves as a buffer in order to take up water during expansion by the thermal effect and keep it in the cooling circuit. The engine hood and the radiator hatch must be open, in order to check the cooling water level. The radiator must be completely filled. Coolant must be refilled, if the fill level is too low. A radiator anti-freezing agent must be used in frost endangered conditions. The radiator has been filled at the factory with a radiator anti-freezing agent/water mixture. This mixture is adjusted to a temperature resistance of up to -30°C.











- 1. Park machine on flat ground.
- 2. Loosen clip 'A retaining screw on the water drain line 'KS'
- 3. Prepare a container for water to be drained.
- 4. Unscrew clip 'B' and carefully remove drain plug 'C'
- 5. Open radiator cap and allow the cooling system to drain completely.

## BATTERY

New batteries from the factory come empty and need to be filled with acid. Initial filling of the battery requires sulfuric acid to be filled to level. Do not use any type of water for initial filling.

**RAMMAX** OEM battery is maintenance free according to \*\*EN/DIN. That means during normal operating temperatures and under correct operating voltage the battery acid will not need to be refilled.

Battery fluid is consumed in the case of deviation from standard conditions. The following among others is considered as a deviation from normal conditions:

- High or extreme outside temperatures.
- Demanding use of the machine.
- Continuous operation on extreme upward and downward gradients (just below the maximum grade ability).



NOTE: For maintenance fill with distilled water only!

It is advisable to check the battery fluid level in regular intervals. The service life is reduced substantially, if the battery is operated with low level fluid.

The battery terminals and cable clips must in particular be cleaned regularly and then generously greased with petroleum jelly.

#### CHECKING THE BATTERY FLUID LEVEL

WARNING: Battery acid is extremely caustic and can cause severe chemical burns if touched.

- 1. Using protective safety wear, disconnect battery terminals.
- 2. Open one of the sealing caps and check the fluid level.
- 3. Fill with distilled water if needed ► The fluid level must reach up to the marking.

WARNING
<ul> <li>Battery acid is extremely caustic and can cause severe chemical burns if touched.</li> <li>Do not let acid get on to hands or clothes.</li> <li>Immediately rinse the part concerned after contact with acid and consult a doctor.</li> </ul>

\*\*EN/DIN DIN: Deutsches Institut För Normung (*German Institute for Stadardisation*) EN: European Norms (*Standards*)

## ROLLER

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## **DRUMS AND STRIPPERS**

In order to remove drums the machine must be lifted with appropriate hoisting gear. Hoisting gear must have sufficient carrying capacity. The machine may only be lifted at the intended transport handle "KS'



- 1. Lift machine from the transport handle 'KS'.
- 2. Disassemble strippers 'A'.
- 3. Lift machine as far as necessary.
- 4. Loosen drum bolts 'BS' (DO NOT unscrew completely)!
- 5. Lower machine until drums are approximately 1 cm above ground.
- 6. Remove drums bolts.
- A. Before installing drums, clean the surface of the drum flange.
- B. When tightening drum bolts use cross pattern install method.
- C. Drum bolt torque specification 110 ft. Ib. (150 Nm)



Do not walk or stand under suspended loads. Do not

DANGER

Items can come loose and falls down!

leave any loose items on the machine.

Death by crushing!



#### **ADJUSTING THE STRIPPERS**

- Loosen all three bolts on the stripper 'AS' and push stripper toward drum.
- The distance from stripper to the drum must be at least 2 cm.
- Tighten bolts again.



### SUBSTRUCTURE

In some cases it may be necessary to raise the substructure, example: In order to change the eccentric gear oil it is necessary to raise the substructure. 0 Loosen hydraulic hoses at the substructure, hoses are fixed with clamps. Loosen hydraulic hoses at the main valve block (connector B1 and B2) 0 ۵ 6 6

- Using appropriate lifting device, lock the substructure at the ring bolt.
- Loosen the shock mount bolts on both sides of the substructures.



Multiquip Inc. ° RX1510CI ° Manual No. RX2009CD

#### SUBSTRUCTURE

**NOTE**: example shows raising the substructure up off the lower end, in order to remove the substructure completely, requires much more removal of electrical wiring, hydraulic fluid draining and hose removal, which is not shown. This type of procedure will require labeling components for reassembly.







### **ECCENTRIC GEAR OIL**

The gear housings are equipped with a drain hole '1' and a fill hole '2'



- Prepare an empty container with capacity minimum of ½ gal (2 ltr).
- Loosen and remove drain plug '1'.
- Loosen and remove filling hole plug '2'
- Allow all the oil to dump out the gear housing completely.
- Reinstall drain plug using NEW copper seal (never reuse old copper seals).
- Fill each gear housing with approx. 1 qt. of 15W-40 engine oil.

Operating the vibration function to warm up the oil prior will assist in oil draining.

**NOTE**: the opposite side of the shaft is a greased bearing. Grease with extreme pressure grade lube grease.

### SHOCK MOUNTS

A total of 12 shock mounts isolate vibration from lower drive and vibratory assembly. Inspect these mounts for cracking or softening. Replace when deterioration is noted. Failing shock mounts may lead damage to other components.









Using a belt filter tool will assist with removing and installation of substructure shock mounts (always use red Locktite ®)

## **HYDRAULICS**

<ul> <li>Hyd</li> <li>Hyd</li> <li>Hyd</li> <li>Hyd</li> <li>Dire</li> <li>Dire</li> </ul>	draulic Schematic draulic Hose Diagram draulic Hose Part Numbers rectional Valves rectional Valve Locator	29 30 31 32 33			
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#### **HYDRAULIC SCHEMATIC**



#### **HYDRAULIC HOSE DIAGRAM**



### **HYDRAULIC HOSE PART NUMBERS**

Hose part numbers are for the hydraulic hoses displayed on previous page.

DIAGRAM ID	PIECES	MQ PART NUMBER
1	1	3-67572
2	1	3-67573
3	1	3-67574
4	1	3-67575
5	1	3-67576
6	1	3-67577
7	1	3-67578
8	1	3-67579
9	1	3-67580
10	1	3-67583
11	1	3-67581
12	1	3-67582
13	1	3-18522
14	2	3-67584
15	2	3-67585
16	2	3-67586
17	1	3-67587
18	1	3-67588
19	1	3-67589
20	1	3-67590
21	1	3-67591

### MAIN HYDRAULIC VALVE BLOCK

#### SOLENOID PLUG CONNECTORS

The following can be used as a guide for the location of the numbered plug connectors on the main valve block.



### **DIRECTIONAL VALVES**

There are three different directional valves on the main block assembly. They all look similar to each other. The difference between them is the internal function of the valves and spring return.

The directional control valves WL4/04 consist of housing, a control spool with two centering springs and cylindrical operating solenoids.

The three-position directional valves are fitted with two solenoids and two springs. Two-position directional valves have either one solenoid and one return spring or two solenoids and a detent assembly.



#### **Technical Data**

Nominal size	6	Permissible rated voltage variation	DC: -10 +6%
Maximum flow	see p-Q characteristics		AU. ±10 /0
Max. operating pressure		Max. switching frequency	15000 1/h
at ports P, A, B	4641 psi (320 bar)	Switching time, on;	
Max. operating pressure		at $v = 98$ SUS (20 mm <sup>2</sup> /s)	DC: 30 50 ms
at port T	2320 psi (160 bar)		AC: 30 40 ms
Pressure losses	see Ap-Q characteristics	Switching time, off;	
Hydraulic fluid	Hydraulic oils of DIN 51254/25	at $v = 98$ SUS (20 mm <sup>2</sup> /s)	DC: 10 50 ms
	other Hydraulic fluids on request		AU. 30 701115
		Duty cycle	100 %
Fluid temperature range (NBR)	-22 +176 °F (-30 +80 °C)	Service life	10 <sup>7</sup> cycles
Ambient temperature range	+122 °F ( +50 °C)	Enclosure type to DIN 40.050	IP 65
Viscosity range	98 1840 SUS (20 400 mm²/s)		
Maximum degree of fluid	× ,	weight-valve with 2 Solenoids	3.52 LD (1.6 KG)
	Class 19/15 to ISO 1406		4.04 LD (2.2 Kg)
contamination	Therefore we recommend a filter with a retention rate $\beta_{10} \ge 75$ .	Mounting position	optional

### **DIRECTIONAL VALVE LOCATOR**

Identifying the directional valve functions



## ENGINE

	Fuel Shut Down Solenoid	
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#### ELECTRICAL

#### ENGINE MANUFACTURE

## **FUEL SHUT DOWN SOLENOID**

The fuel shutdown is normally closed. When energized by signal from receiver box 12V *DC* is delivered opening solenoid and allowing fuel delivery to fuel system. Unplugging the 12V *DC* terminal with engine running should result in engine shut down. The fuel solenoid will have an audible click when engaged. A simple 12V test light will determine if solenoid is functioning.





## **OIL PRESSURE SENSOR**

Oil pressure sensor will send a low oil signal to the receiver box in the event of low oil circumstance.

Confirm indication of low oil pressure by removing oil pressure sensor and installing mechanical oil pressure gauge to verify low oil pressure.



### **GLOW PLUG RELAY**

Timer relay provides the 15 second window for cold weather start. This timer protects glow plugs from failure by removing voltage to glow plugs and preventing over heat failure. Replace when necessary with relay of exactly the same values.







Relay Base



## THROTTLE CONTROL SOLENOID

The throttle control solenoid is controlled by the RPM control module (see next page)





In order to test the throttle control solenoid, apply 12 V *DC* direct battery voltage to the solenoid. Inverting the connections positive + and negative - will change the direction that the solenoid rod moves.



### **RPM CONTROL MODULE**

The RPM control module supplies voltage to the throttle control solenoid





#### CONTROL MODULE WIRES AND FUNCTIONS

PIN	WIRE COLOR	FUNCTION
1	RED	12V DC + Voltage input from (10 amp fuse see page 41- #4)
2	BROWN	12V DC + Voltage input from main frame ground lug
3	BLACK	Connected to throttle control solenoid thru (5 amp fuse see page 41- # 3)
4	BLACK	Connected to throttle control solenoid (connector wire #9)
5	BLUE	Connected to # 25 pin on receiver
6	GREEN	Connected to # 22 pin on receiver
7	PURPLE	Connected to # 21 pin on receiver

## THROTTLE CONTROL OVERVIEW

The engine is equipped with an electronically controlled throttle adjustment and consists of the following parts



The solenoid actuator motor pulls the engaging rod when the ignition is turned on. The adjusting lever for the fuel flow is set to maximum (full throttle).

#### LEGEND

- 11. Adjusting nut
- 12. Adjusting lever
- 13. Inbus screw
- 14. Throttle control solenoid
- 15. Engaging rod



### **ENGINE SPEED**



The stop screw limits the maximum engine speed 'A' and is held in place with a seal 'P'.

A reflective sticker has been attached to the flywheel at the factory this can be used with an infrared measuring unit to determine engine speed.



Example of infrared speed measuring unit



The seal is put in place at the factory to maximum speed specification. Tampering with any aspect of fuel delivery system by anyone other than certified technician for specific engine types can result in heavy E. P. A. fines.

Specification (3000 RPM's)

## ELECTRICAL

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#### **ENGINE MANUFACTURE**

### **FUSES**

There are four fuses mounted next to the main valve block located underneath the operating panel and one fuse next to the glow plug relay.

- 1. Green 30 amp fuse protects 12V *DC* from battery and supplies voltage thru 2 red wires to pins 1 and 2 on cannon plug at receiver logic box.
- 2. Red 10 amp fuse protects 12V *DC* from battery and supplies voltage thru 2 black wires to the slowdown module on terminal 1 and to the key switch terminal 30.
- **3.** Brown 5 amp fuse protects 12V *DC* from slowdown module black wire terminal 3 and supplies voltage to the number 2 pin at the throttle control solenoid connector.
- 4. Red 10 amp fuse protects 12V *DC* from the receiver to the slowdown module.
- 5. The large 80 amp fuse under the black plastic cover protects the 12V DC to the glow plugs.



### **ELECTRICAL SCHEMATIC**



### **ELECTRICAL DIAGRAM**

The following diagram shows components from electrical schematic in larger view and can be used as a guide with following components:



### **VOLTAGE REGULATOR**

When troubleshooting the electrical system on the VIPER walk behind roller, it may be necessary to bypass the regulator in the starting system in order to justify the regulator is at fault.

SYMPTOMS: Battery drainage, engine will not start, dash lamps stay on.

**INSTRUCTIONS**: Ensure battery is fully charged no less than 12.5V, disconnect the triangular female plug at the regulator, and install a jumper wire from battery ground to the triangular male plug (BLUE WIRE). Try starting, if machine starts – immediately disconnect the jumper wire and inspect faults are cured.

If regulator is suspect, remove jumper wire and bench test regulator, see next page.



**Engine Radiator** 

### **VOLTAGE REGULATOR BENCH TEST**





**NOTE**: If regulator is defective; before replacing, ensure alternator is functioning properly - inspect alternator wires for short to ground.

### **COCKPIT ASSEMBLY**

Cockpit MQ part # 3-68586





#### MANUAL CONTROL BOX WITH TETHER CABLE CONNECTOR

- **GROUND** this pin is negative ground when key is in the OFF position.
- **12 VOLT POWER** this pin has 12 volts *DC* when the key is in the ON position.
- **DIGITAL SIGNAL** this pin is the signal wire between manual control box and receiver box.

### **COCKPIT ASSEMBLY**



TERMINAL	LABEL	FUNCTION
15	HAND	Digital signal wire in and out to the manual control box.
17	12V DC	12V DC input from receiver when ignition switch is ON position
19	1.2V DC	Digital signal wire out to cockpit displays. 1.2V DC ± .5V
21	MASSE	Direct ground into cockpit and out to the manual box



#### **IGNITION SWITCH TERMINALS**

TERMINAL	FUNCTION
30	12V DC input to switch – direct from battery through 10 amp fuse.
15	12V DC accessory circuit - powers up receiver thru pin 18 on canon plug
50	12V DC starter circuit - manual start

#### INSPECTION

- With key in the OFF position verify 12V DC is present on terminal 30.
- When key is turned to the ON position the following events should occur:
  - o Ignition switch terminal (15) sends 12V DC to receiver box through terminal (18) on canon plug.
  - Verify receiver box supplies 12V *DC* back to cockpit through terminal (17).
    - If no voltage is present on terminal (17) receiver box is suspect (defective).
    - Verify receiver box is defective by testing cockpit.

#### **TEST COCKPIT**

- o Connect the manual control box with tether connector to the cockpit.
- Remove wire on terminal (17).
- Turn the ignition switch to the ON position.
- Use a jumper wire and apply 12V DC directly from battery into terminal (17).
- Observe the cockpit:
  - Cockpit display should illuminate.
  - LED's on manual control box should flash, indicating the cockpit is supplying power to the manual control box.

#### RECEIVER

The receiver cannot be field tested

Perform all other test to eliminate all other possible problems before replacing the receiver.



The receiver has rollover protection built into the circuit board. The rollover protector will shut the engine down if the machine reaches a 45° rollover angle.

**IMPORTANT**: Should rollover occur, do not restart the engine. Proper steps need to be taken to prevent damage when engine is restarted. Failure to take proper precautions after a rollover may result in severe engine damage.



### **CANON PLUG**

The cannon plug is the wire harness end plug. It is a twist lock and can be disconnected from the receiver box and used to troubleshoot a function failure.

Individual functions are indicated by the numerical designations on the plug. Individual hard wires carry the same numerical designation throughout the electrical system, (see page 56).

Using a jumper wire at the cannon plugs hot terminal pin, each mechanical function can be tested to determine if a problem exists where the function actuates.

Hard wire problems can be found by completing a continuity test using the appropriate pin on the cannon plug and same number at the terminal of the hard wire connection. Always check for proper ground when troubleshooting a problem. Many problems are caused by poor ground or failed hard wire connections.





### TRANSMITTER

Verifying transmitter LED activity can be done by viewing the front of the transmitter through a digital camera or other camera equipment with a view screen, such as a camera phone, video camera, or web cam. Most cameras are sensitive to infrared light that is invisible to human eyes.

While operating the transmitter functions, switch your camera equipment to capture mode. The emitted infrared lights will only be visible in this way.

If no LED's are visible, two possible causes:

- Transmitter solar charging system is defective (not working).
- Rechargeable battery is defective, (see next page).





## TRANSMITTER BATTERY

Transmitter Battery – with pigtail connector MQ part # 3-68334

Transmitter Battery – w/o pigtail connector MQ part # 3-68306

The battery voltage when fully charged is 3.6V DC

#### **BATTERY CHARGING**

- Place the transmitter in direct sunlight for 10 min.
- The start stop switch has to be in the stop position.
- If the solar charger is in question of charging, remove the battery connector plug from the board and test charger in direct sunlight.
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• Using a multi-meter (set on DC) check for voltage at the plug, should be  $(4.1V \pm .05)$ 









### **RECEIVER EYE**

LEFT Receiver Eye MQ part # 3-18524

RIGHT Receiver Eye MQ part # 3-18523

If the engine starts but there are no functions, check receiver eye (s).

- Unplug both receiver eyes and try operating with manual tethered controller.
  - $_{\odot}$  If unit functions; test by plugging in one eye at a time and retest functions.
- A receiver eye can fail with an open circuit or with a short by sending a bad signal to the receiver box.



Receiver eyes plug into the receiver



### **RECEIVER BOX / CANON PLUG LEGEND**







PIN #	WIRE COLOR	FUNCTION		CONNECTION
1	RED	12 V input power, direct from battery (30 amp) fuse		Battery voltage
2	RED	12 V input power, direct from battery (30 amp) fuse		Battery voltage
3	BLACK	Power output to pin # 3 on four way jumper plug, sends power to all of the following $\rightarrow$ $\rightarrow$ $\rightarrow$ $\rightarrow$	<ul> <li>pin 'A' black wire on regulator</li> <li>terminal 15 on glow plug relay</li> <li>pin # 1 on safety bar switch</li> <li>terminal 17 on back of cockpit</li> </ul>	4 pin connector
4	BLACK	Power out to starter solenoid at start up		Start circuit
5	BLACK	Power out to fuel solenoid to run		Power to run
6	BLACK	Forward travel		Solenoid # 4
7	BLACK	Reverse travel		Solenoid # 5
8	BLACK	Left steer		Solenoid # 1
9	BLACK	Right Steer		Solenoid # 2
10	BLACK	Hi vibration		Solenoid # 6
11	BLACK	Low vibration		Solenoid # 7
12	BLACK	Steering diverter – Power diverts to tank		Solenoid # 8
13	BROWN	Direct ground into receiver box		Ground
14	RED	Output power to # 4 (10 amp) fuse		Battery voltage
15	BLACK	To terminal 15 on back of cockpit		Digital signal
16	EMPTY	No function		No function
17	BLACK	Power out to hi speed		Solenoid # 3
18	BLUE	12 V power from terminal 15 on ignition switch		Accessory
19	BLACK	To terminal 19 on back of cockpit		Digital signal
20	BLUE	12 V power from terminal 50 on ignition switch		Start circuit
21	LILAC	To terminal 7 on RPM module		RPM module
22	GREEN	To terminal 6 on RPM module		RPM module
23	BLUE	To terminal B white wire on regulator		Regulator
24	BLUE	To terminal C blue wire on regulator		Regulator
25	BLUE	To terminal 5 on RPM module		RPM module
26	EMPTY	No function		No function
27	BLUE	Ground input from oil pressure switch O		Oil pressure switch
28	BLACK	To safety switch connector terminal 2 Safety		Safety switch
29	BLUE	To sensing device for engine water temperature		Engine water temp

### ENGINE MANUFACTURER'S CONTACT INFORMATION

For latest engine service manual visit the manufacture website listed below.



Kohler Engines	
Website	http://www.kohlerengines.com

# KOHLER, ENGINES



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