Installation and User's Manual
RAPTAIR MF Multifunction Diesel Drive

Continued on next page.

VMAC – *Vehicle Mounted Air Compressors*
Toll Free: 1-800-738-8622 Local: 1-250-740-3200
Fax: 1-250-740-3201

Document #1930264
Installation and User's Manual for VMAC System D600007
RAPTAIR-MF Multifunction Diesel Drive

Changes and Revisions

Version	Revision Details	Revised by/date	Approved	Implemented
A	ENGINEERING RELEASE	MH 15 May 2015	JR/RD 08 Jun 2015	09 Jun 2015

Notice: Manuals and products are subject to change without notice

Trademarks

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Important Information

The information in this manual is intended for certified VMAC installers who have been trained in installation procedures and for people with mechanical trade certification who have the tools and equipment to properly and safely perform the installation. Do not attempt this installation if you do not have the appropriate mechanical training, knowledge and experience.

Follow all safety precautions for mechanical work. If you have difficulty with the installation, contact VMAC.

The VMAC warranty form is located at the back of this manual. This warranty form must be completed and mailed or faxed to VMAC at the time of installation for any subsequent warranty claim to be considered valid.

To order parts, contact your VMAC dealer. Your dealer will ask for the VMAC serial number, part number, description and quantity. To locate your nearest dealer, call 1-800-738-8622.

1.0 General Information

1.1 Foreword

Read this manual before beginning the installation so that you can understand the requirements. This will help ensure the successful installation and proper operation of the RAPTAIR MF.

This manual provides maintenance, repair and troubleshooting instructions for the RAPTAIR-MF Multifunction Diesel Drive. Proper and regular servicing provides continued high performance and long life. For more information contact VMAC.

KEEP THIS MANUAL WITH THE RAPTAIR MF UNIT FOR USER REFERENCE

1.2 Warranty Registration

The VMAC warranty form is located at the back of this manual. This warranty form must be completed and mailed or faxed to VMAC at the time of installation for any subsequent warranty claim to be considered valid.

1.3 Important Safety Notice

The information contained in this manual is based on sound engineering principles, research, extensive field experience and technical information. Information is constantly changing with the addition of new models, assemblies and service techniques. If a discrepancy is noted in this service manual, contact VMAC prior to initiating or proceeding with service. Current information may clarify the issue. Any person with knowledge of such discrepancies who performs service and repair assumes all risks.

Only proven service procedures are recommended. Anyone who departs from the specific instructions provided in this manual must first assure that their safety and that of others is not being compromised and that there will be no adverse effects on performance or the operational safety of the equipment.

VMAC will not be held responsible for any liability, injuries, loss or damage to individuals or to equipment as a result of the failure of any person to properly adhere to the procedures set out in this manual or standard safety practices. Safety should be your first consideration in performing service operations. If you have any questions concerning the procedures in this manual or require any more information on details that are not included in this manual, please contact VMAC before beginning repairs.

Torque Specifications

STANDARD GRADE 8 NATIONAL COARSE THREAD								
Size	1/4	5/16	3/8	7/16	1/2	9/16	5/8	¾
Foot-pounds (ft-lb)	9	18	35	55	80	110	170	280
Newton meter (N•m)	12	24	47	74	108	149	230	379

STANDARD GRADE 8 NATIONAL FINE THREAD					
Size	3/8	7/16	1/2	5/8	¾
Foot-pounds (ft-lb)	40	60	90	180	320
Newton meter (N•m)	54	81	122	244	434

METRIC CLASS 10.9					
Size	M8	M10	M12	M14	M16
Foot-pounds (ft-lb)	19	41	69	104	174
Newton meter (N•m)	25	55	93	141	236

1.4 Safety Messages

This symbol is used to call your attention to instructions concerning your personal safety. Watch for this symbol; it points out important safety precautions, it means, “Attention, become alert! Your personal safety is involved”. Read the message that follows and be alert to the possibility of personal injury or death. Be alert; your safety is involved. While it is impossible to warn about every conceivable hazard, let good common sense be your guide.

This symbol is used to call your attention to instructions on a specific procedure that if not followed may damage or reduce the useful life of the compressor.

This symbol is used to call your attention to additional instructions or special emphasis on a specific procedure.

1.4.1 Safety Precautions

Read this information before operating the compressor for the first time. Follow the information and procedures in this manual for operation, maintenance and repair. Observe the following items to reduce the chance of personal injury or equipment damage.

Follow all safety precautions for mechanical work. Moving fan belts and fan blades are an extreme hazard. Stay clear of all moving parts when the system is operating. Only qualified personnel should perform maintenance and repair on system components and only while the system is properly shut down.

Proper service and repair are important to the safety of the service technician and the safe, reliable operation of the equipment. Always use genuine VMAC replacement parts; do not use any substitutes.
The procedures described in this service manual are effective methods of service and repair. Some procedures may require the use of tools specially designed for a specific purpose. Anyone using a replacement part, service procedure or tool must first determine that neither their safety nor the safe operation of the equipment will be compromised by the replacement part, service procedure or tool selected.

This manual contains various warnings, cautions and notices that must be observed to reduce the risk of personal injury during service or repair and the possibility that improper service or repair may damage the equipment or render it unsafe. *Be aware that it is impossible to warn of all the possible hazardous consequences that might result from failure to follow these instructions.*

1.4.2 Fire and Explosion Hazards

Fire in the compressor can cause an explosion and flame projection. Should this occur, there is potential for serious injury or death.

Vaporized oil propelled by high-pressure air is an explosive mixture.

You must observe the following when operating the compressor:

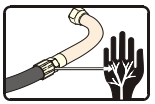
- Constant vigilance is necessary around high-energy equipment
- Be attentive for unexplained changes in operation parameters and record any changes
- Never bypass or disable the temperature sensors
- Never expose the tank or compressor to extreme heat
- Ensure that the air entering the compressor is free of flammable vapors

1.4.3 Personal Hazards

Follow all safe work practices. Wear the appropriate safety equipment.

Do not breathe the compressor air. Vaporized oil is a respiratory hazard.

Always use the appropriate personal protective equipment, particularly eye and hearing protection when operating air-powered equipment.



The compressor system is under sufficient pressure that a leak could force the air/oil mixture through the skin directly into your bloodstream. This could cause serious injury or death.

Never adjust or attempt to make any repairs to the system while the engine is running. Components and hoses under pressure could fail and cause serious injury or death.

Never perform maintenance procedures on the system until the compressor has been shut down for at least 5 minutes to ensure the system is fully depressurized. After 5 minutes open the discharge valve to ensure the system is depressurized. Failure to depressurize the system could cause parts to separate explosively. Flying parts could cause serious injury or death. Air/oil mixture could be sprayed out with sufficient force to penetrate the skin, which could cause serious injury or death.

The engine, exhaust and the compressor system get very hot during operation, contact with the components or the oil can cause serious burns. Allow sufficient time for the system to cool before performing service.

Components and hoses under pressure could separate suddenly, fly out and cause serious injury or death. If equipped, the auxiliary air tank must be drained before servicing any components in the compressor system.

1.4.4 Pressure regulator and/or lubricator

The compressor can produce air pressures up to approximately 175 PSI (1200 kPa). It is the responsibility of the user to know the pressure and air flow requirements of the tools powered by the air compressor system. An appropriate air pressure regulator and lubricator can be externally installed to the outside of the air supply valve. Failure to regulate the air pressure may cause damage to the tool.

1.4.5 Electrical Hazards and Grounding

Ensure the ground point connection is connected to the vehicle body/chassis to prevent shock hazards. Ensure the vehicle is properly grounded when operating the unit. Ground using a Green 10AWG AC rated wire to a minimum 3/8th inch post. The RAPTAIR-MF Multifunction Diesel Drive has an external ground post near the fuel lines.

The generator produces potentially lethal voltages and current. Modification of the generator system must never be attempted and any work on the electrical components must be done by a qualified electrician. Ensure any components attached to generator system meet the electrical regulations in the jurisdiction the unit is being used in.

1.4.6 DC Battery Jump Starting

Working near Lead-acid batteries is dangerous. Batteries may generate explosive gasses during regular operation. Lead-acid batteries may explode if exposed to a spark. Set the current control knob output to 0% and select the desired voltage before connecting jumper cables to the battery.
Never attempt to jump-start a frozen battery.
Never over-charge a battery.

1.5 Specifications and Components

The Raptair-MF Diesel Drive consists of a Kubota D902 24hp 900cc 3-cyl diesel engine belt driving a 45CFM air compressor. To increase functionality you can add a 10kW 3-phase generator, a 12-24-36-48V battery booster and charger, a 300A DC CV/CC welder, a clutched SAE A Port (PTO) capable of a maximum 20 hp hydraulic pump or equivalent load, or a (5,8,10) GPM @ 3000psi hydraulic pump

1.5.1 Air compressor

The VMAC air end is an oil flooded, rotary screw compressor driven by a serpentine belt through a 12V clutch. Compression occurs when inlet air (at normal atmospheric pressure) enters a chamber where it is trapped between the rotating rotor lobes. A lubricated pitch line provides sealing. As the lobes mesh, they reduce the volume of the air, compressing it to the desired pressure.

The air end clutch is electronically controlled and is automatically disengaged when the engine RPM drops below a set point to ensure that the generator frequency is maintained within the acceptable range. ***PTO loads are not controlled or directly monitored.***

Air pressure in the reservoir tank is maintained when compressor switch is in the on position and is monitored to determine when the compressor needs to engage to top up the tank.

The system comprises of two-stage air/oil separation. The first separation stage consists of a separation tank with internal baffles which perform mechanical separation. The second stage uses a special separation element which delivers dry air to the outlet. The second stage is a spin-on type coalescing filter.

Air pressure regulation is achieved with an electro-mechanical inlet valve settable through the Display box. The system pressure is pre-set at 150 psi but can be increased up to 175 psi. Do not unnecessarily increase the pressure setting as the compressor load increases with system pressure and will limit the power available to run other loads before the system disengages the compressor.

To adjust the pressure, refer to section 7.4.6, and use a Filter Regulator Lubricator (FRL) to set the final tool pressure.

The compressor is protected by a paper-type replaceable air filter and a spin-on type oil filter.

Safety features include:

- 200 PSI relief valve in separation manifold
- blow-down valve to discharge system pressure on shutdown
- temperature safety sensors in compressor oil, separation manifold and engine coolant

Do not disable or bypass the over-temperature shutdown circuits. Failure of the shutdown system could result in equipment damage, injury or death.

A liquid-to-liquid cooler maintains operating temperatures in an optimal performance range which increases system durability and reduces the temperature of the compressed air.

1.5.2 Generator Option

The generator produces both AC and DC power. The AC portion of the generator produces 3 phase power. Each leg of the generator goes through the 30A 3 phase breaker. Two of the legs go through a 20 A breaker and to 120V GFCI receptacles found on the panel of the generator. One leg goes to a 240V 30A plug. There is also a 3 phase plug that is capable of transmitting the full power of the generator.

The generator switch disables the AC and DC output of the generator and will shut off any plugs on the unit.

1.5.3 Welder/Battery Boost/Charger

The welder is capable of producing 300A DC. There is a thermal switch inside the generator to protect against thermal damage. If the thermal switch is tripped the light will illuminate on the user panel that is indicated as “welder alarm”. If the DC thermal switch is tripped the generator will continue to produce AC power.

The welder selection dial performs the following functions:

- Weld Mode: This setting produces CC output for stick welding
- 48V: This is a CV mode that could be used to power a MIG pack. Use the current control dial to limit the amount of current.
- 36V: CV mode. Use the current control dial to limit the amount of current.

- 24V: CV mode used for jump starting or charging 24V DC systems. Use the current control dial to limit the amount of current.
- 12V: CV mode used for jump starting or charging 12V DC systems. Use the current control dial to limit the amount of current.

Before connecting jumper-leads to a battery for jump-starting, set the current knob to 0% and the voltage to the desired setting.

If connecting unit to equipment for battery boost or charge ensure proper voltage setting is selected before connecting cables. Improper voltage selection could damage equipment. Also ensure cables are rated for 300A.

1.5.4 PTO Port Option

The Raptair-MF Multifunction Diesel Drive has provisions for an optional SAE-A-port power take off under the starter on the exhaust side of the engine. This is able to power up to a 20HP load through a serpentine belt and a 12V clutch. Typically this is fitted with a hydraulic pump and is customizable to your individual needs. Equipment connected to this must be capable of operating at the port speed of 2700 RPM. Shaft driven and high inertia loads may require special considerations; please contact VMAC Tech Support for details

Due to the many types of equipment that can be connected to the SAE-A-port, the Raptair Multifunction Diesel Drive controller is ***not*** able to monitor the load or control the equipment. The system will monitor the engine RPM and will deactivate the compressor if it falls below the low RPM threshold for proper generator frequency output.

When choosing equipment, care should be taken to determine the typical/expected load combinations and duty cycle of your specific needs so as to not overload the system, as the system may not be able to maintain air pressure in the reservoir tank.

See section 3.1.1 for PTO installation details

1.5.5 PTO Hydraulic Pump Options

- 5, 8, 10 GPM hydraulic pump @ 3500psi

2.0 Installation Requirements

The information in this section is very important for proper operation of the system. Read these requirements before beginning installation.

Before installing the RAPTAIR MF, examine the possible locations and consider the following factors when selecting a location:

- Hose lengths will be the shortest possible and a minimum number of 90 degree fittings will be used
- Oil level at the sight glass can be checked easily
- Sufficient clearance around the unit for good air circulation and effective cooling
- Can it be serviced easily without having to disconnect lines or remove and reposition the unit (service panel is accessible and can be removed).
- Protected from excessive exposure to the elements and possible incidental damage from other operations
- Away from heat sources such as engines, exhaust systems or other components that generate heat
- Not in a location where it will be exposed to high contamination levels, including combustible gases
- Exhaust can be routed away from coolers to open air and not orientated in a way that it will fill up with rain (or exhaust flapper installed).
- Ensure the RAPTAIR MF is grounded to the truck chassis/frame and the truck is properly grounded when using the generator.

2.1 Air Receiver Requirements

A reservoir tank is recommended and required for automatic shutdown of the air compressor system.

The reservoir tank needs to be a minimum of 5 gal and rated to 200 psi for the air compressor automatic shutdown to operate properly. A larger reservoir tank is recommended if possible to allow for longer and more frequent engine shutdown and less air pressure lag to the operator.

The RAPTAIR MF unloads the air pressure in the system, which minimizes fuel burn, equipment wear, enclosure temperature and noise, when compressed air is not being used.

If the plumbing downstream from the RAPTAIR MF is tight (has no leaks), a 5 gallon air receiver is adequate. If you use an auxiliary air tank with this system, the line to the auxiliary tank must be installed as high as possible (not in the bottom of the tank) to prevent water from clogging the line. Failure to observe these requirements will result in damage to the system.

A one-way check valve is built into the RAPTAIR MF tank. Do not install an additional check valve as this may cause undesirable operation.

2.2 Ventilation Requirements

During operation, the RAPTAIR MF can develop considerable heat,

Proper ventilation is vital for proper operation and to avoid damage to components.

Ensure there is a minimum of 6" (150mm) clearance between cooler grills on diesel drive units and any other components mounted on the vehicle. Also ensure there is a good supply of cool air to the service panel side of the unit, and good exhaust from the radiator side. Direct the diesel exhaust to vent to atmosphere and in a safe location.

The engine radiator fan pushes hot air from the unit. Cold air is drawn in through the service panel.

2.2.1 Top Mounting

This is the preferred mounting location. Placing the unit on top of the service body (Figure 2.2 -Mounting locations) provides the best access to ambient air and provides the best cooling. Maintain a minimum of 6” between the service panel and radiator to solid objects. Maintain a minimum of 2” to the other sides.

2.2.2 Enclosed Mounting

Enclosed mounting is not recommended for most applications due to the significant heat generated.

Ensure there will not be recirculation between the radiator output and the service side perforated panel.

Mounting the RAPTAIR MF in an enclosure (Figure 2.2 -Mounting locations) will limit access to ambient air, restrict the escape of hot air from around the unit and have an adverse effect on cooling. Make sure that adequate ventilation is provided so the cooling system will function properly (i.e. a pull-out drawer).

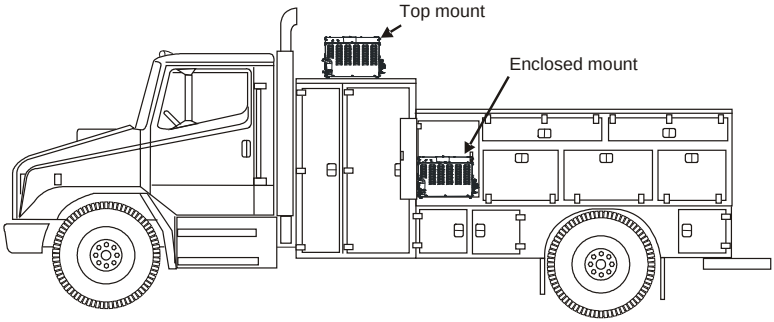


Figure 2.2 -Mounting locations

It is not possible to make absolute recommendations regarding ventilation because of the widely differing circumstances that are possible. Duty cycle, ambient temperature and enclosure shape are some of the important variables.

Ideal ventilation will provide good airflow through the unit with no restrictions. Cool ambient air ducted to the cooler and installing an exhaust fan to remove hot air is recommended.

Ensure exhaust from the diesel engine is routed in a way to prevent recirculation back into the unit.

3.0 Installing the RAPTAIR MF

3.1 Mounting the Diesel Drive Compressor System

☐ Locate a suitable mounting position for the RAPTAIR MF. Place the unit and check for clearances to any other objects.

☐ Determine suitable mounting bolt locations. There are holes predrilled in the mounting plates of the unit, but new holes can be drilled in any locations on these plates except where the vibration isolation mounts are located. Ensure there is a minimum of 4 bolts securing the unit (2 on each mount plate).

☐ Drill holes and secure the RAPTAIR MF to the truck. Use a minimum of 4 (2 in each plate) 1/2" (12 mm) bolts. Use bolts, washers and locknuts or Loctite.

☐ Connect a ground wire to the ground terminal found on the bottom of the generator side of the unit (beside the air outlet). Ensure this is connected to the vehicle, or sufficient ground point for safe operation. Consult with a certified electrician for safe grounding points if unsure.

Failure to connect sufficient electrical ground could cause severe injury or death. Ensure electrical connections are made in accordance with electrical guidelines in the operation jurisdiction.

☐ Remove the #12 cap from the air outlet, found on the bottom of the generator side of the unit. Connect to the air delivery system.

3.1.1 Optional PTO Equipment Installation

Ensure PTO equipment falls within power guidelines at 2700 RPM and is rated to a minimum of 2700 RPM.

☐ To install PTO equipment, remove the small service hatch on the exhaust-side panel.

☐ Ensure input shaft of PTO equipment can rotate freely before attached to PTO port.

☐ Attach PTO equipment to port following manufactures guidelines.

☐ Ensure any hoses or wires attached to PTO equipment are routed away from sharp edges or hot surfaces.

3.1.2 Optional Fuel tank installation

☐ The fuel tank will be installed on the generator side of the RAPTAIR MF

☐ Connect supply and return fuel lines from the RAPTAIR MF to the fuel tank using supplied hose clamps. The supply line is 5/16" and the return line is 3/16"

☐ Connect the fuel level sensor connector to the RAPTAIR MF harness.

3.1.3 Alternate diesel fuel supply

Always adhere to all relevant regulations when connecting to the vehicle's fuel system.

☐ If a larger fuel capacity is desired, an alternate supply can be used, such as the truck fuel supply (when a diesel truck is used).

☐ Connect supply and return fuel lines from the diesel drive to an auxiliary tank. The supply line is 5/16" and the return line is 3/16".

If the auxiliary fuel tank is located below the diesel drive unit a fuel priming pump is recommended in the supply line.

When plumbing into a truck diesel supply, avoid connecting the RAPTAIR MF fuel supply to the lowest point of the truck tank.

3.1.4 Exhaust system

It is required that the installer supply an adequate exhaust pipe to suit the needs of their application. The muffler is supplied with a 1-5/8" ID outlet.

When installing an exhaust pipe the following steps are to be followed:

☐ Connect a suitable 1-5/8" exhaust pipe with an exhaust clamp.

☐ Ensure that if the exhaust is pointing upwards there is a suitable flapper/cover to prevent water from entering the exhaust system.

☐ Ensure the exhaust pipe has suitable clearance and does not come in contact with anything.

☐ If extending the exhaust externally to the unit a **suitable flex coupling or flex pipe** must be used to prevent damage to the muffler and exhaust system of the unit.

4.0 Electrical Connections

There are five main electrical connections to the RAPTAIR MF:

- Display Panel Assembly - Key Switch, Display Box and PTO/GENSET/COMPRESSOR ON/OFF Switches
- Remote Start Wire
- Welder Control Panel
- (optional) Cold Climate kit – 110VAC Cold Climate Kit Heater Connection

4.1 LED Beacon Connection

The 2 LED beacons will illuminate in STANDBY mode to inform the operator that the RAPTAIR MF is able to restart when air-use is detected.

4.2 Display Panel Assembly Connections

To fully utilize the features of the RAPTAIR MF, the display panel with the key switch and display box should be mounted in a convenient location for the operator.

Mount the Display Panel inside the cab or a cabinet protected from extreme weather. The Display box is splash-proof, but not fully sealed. Ensure that it will not get kicked or hit by tools and equipment.

There are separate connectors for the Display box cable and the key switch in the same location as the “Air Discharge Port”. Pigtails have been provided with blunt cut wires for installer connection at the RAPTAIR MF and the Display Panel. The table below has recommended wire sizes for a typical installation. The size may need to be increased for long distance routings between the two components to avoid excessive voltage drops.

Display Panel Wire Description	Suggested Gauge
Display box connections (4 terminal connector)	18AWG
Key Switch – Supply Power – Red wire	14AWG
Key Switch – Return Power – Orange wire	14AWG
Key Switch – Run key – Yellow wire	18AWG
PTO/GENSET/COMPRESSOR switch connections (5 terminal connector)	18AWG

4.3 Welder Option Control Panel

The remote welder control panel has two supplied connections (about 8ft max length) required for operation: 14pin ribbon-cable connector and 2pin connector.

The mating connection points are located inside the Welder Control Panel. Mount the welder control panel inside a dry cabinet away from moisture.

4.4 Remote Start Wiring

The RAPTAIR MF has the ability to remotely start with a single wire interface to the Control Box. A blunt-cut yellow wire is located near the Control Box. With the key-switch in the RUN position, grounding the wire will enable the compressor system. Once the ground is interrupted, the control system will stop the engine.

Use a SPST (Single Pole Single Throw) switch, one terminal connected to the yellow remote-start wire and the other to the ground on the RAPTAIR MF.

4.5 Cold Climate Option

The 110VAC Cold Climate heaters are used to warm the engine and compressor system in cold weather conditions. A minimum 700W power inverter connected to the truck is required for heater usage or connected to external AC power prior to starting. Heaters should be run for 90 minutes prior to starting the system in cold conditions (time will vary depending on ambient temperature).

In cold weather the RAPTAIR MF needs to be connected permanently to the vehicle's battery (internal battery is not sufficient in extreme cold weather). Connections should be made to the external battery at the battery terminals. The diesel drive will charge the vehicle batteries while running. While the RAPTAIR MF is in the STANDBY state it will also monitor battery voltage and restart to charge the batteries if the battery voltage gets too low. These settings can be adjusted.

See Kubota engine manual for engine oil and fuel recommendations for cold climate operation.

5.0 Completing the Installation

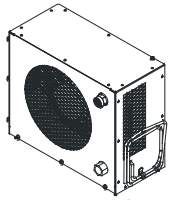
5.1 Before Operation Checklist

Make sure that the following have been completed before operating the RAPTAIR MF for the first time:

- ☐ Check the compressor oil level. The compressor has been filled to the correct level prior to shipping. Note that the oil is very clear and it is difficult to see the level.
- ☐ Check the engine coolant level
- ☐ Check the engine oil level
- ☐ Check fuel level
- ☐ Do a final inspection to make sure that all fasteners and connections are tight.
- ☐ Ensure ground point is connected
- ☐ Check that all hoses and wiring are secure and protected.

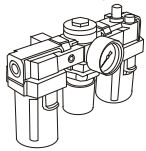
6.0 Accessory Products from VMAC

To order parts, contact your nearest VMAC dealer or contact VMAC directly at 250.740.3200 or 1.800.738.8622. Have the system serial number, a description of the part and the quantity. The following accessories are also available from VMAC.



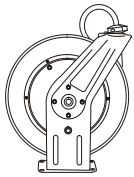
Eliminator Aftercooler- A800070

Removes up to 80% of moisture from compressed air. Quick installation, automatic drain and compact design



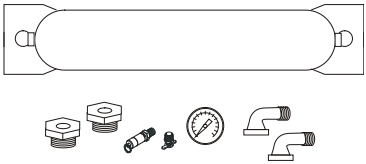
Filter Regulator Lubricator- A700151

Removes lubricants, water and dirt from the air stream. Adds atomized tool oil to lubricate tools. Reduces pressure for longer tool life.



Hose Reel- A700007

Secure, compact, retractable hose storage in a sturdy reel.



Air Receiver Tank

10 Gal. (w/o fittings) – A300046
10 Gal. (fittings incl.) – A300047
20 Gal. (w/o fittings) – A300043
35 Gal. (w/o fittings) – A300009
35 Gal. (fittings incl.) – A300010

Compressor Service Kits

Raptair MF, 200 HR – A500023
Raptair MF, 400 HR – A500024

Air compressor service kit includes oil, filters, seals and O-rings. 200 hour/6 month and 400 hour/12 month service interval kits are available

Diesel Engine Service kit - A500007

Kubota engine service kit will contain an engine oil filter, fuel filter, and 1.06 USG (4 liters) of 15W40 engine oil. First 50 Hour and Every 100 Hour Engine Service Kit available

7.0 Operating the RAPTAIR MF

7.1 Control System Features

- ☐ Starting and stopping the control system with the Display box, key switch or remote wire
- ☐ Load detection with Generator or PTO priority when running the compressor
- ☐ Automatic engine shutdown if no air use is detected
- ☐ Automatic engine restart with air-use, minimum air pressure, low engine or compressor temperature or low battery voltage
- ☐ Multiple adjustable system parameters for delays, pressures and restart options.
- ☐ Monitoring the compressor, engine coolant and manifold temperature probe connection and temperature range
- ☐ Monitoring air pressure sensor connection and over pressure
- ☐ Detection of engine under-speed, over-speed, running when not expected, no tach signal, starting error and low oil level
- ☐ Monitoring low battery voltage
- ☐ Low fuel level warning for Raptair MF fuel tank
- ☐ Air filter restriction warning
- ☐ Error and warning message logging (data-logging)
- ☐ Operator Compressor Servicing reminders (200 and 400 hours)
- ☐ Buzzer module to warn before engine start
- ☐ LED beacon module to identify when the unit is able to restart
- ☐ Hour meter

7.2 Control System Operation

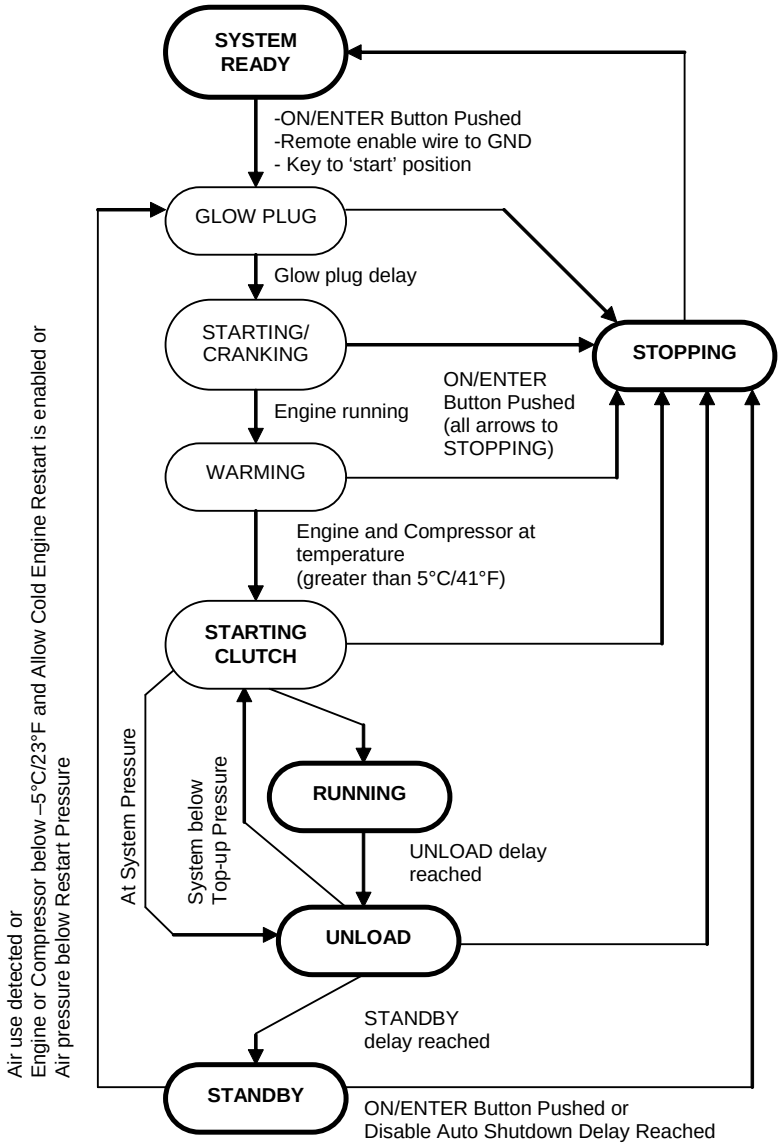


Figure 1 – Control System Flow Diagram

7.2.1 Control System Terminology

System State: SYSTEM READY

Compressor system is ready for operation and awaiting a start request. A start request can be made by:

- ☐ Pressing ON/ENTER from the Display Box
- ☐ Turning the key to the START position
- ☐ Grounding the Remote Start wire

System State: GLOW PLUG

Sets the initial delay for the glow plugs based on engine temperature (1 to 15 seconds).

The engine restart buzzer is enabled for 3 seconds then paused for 3 seconds before going into the next state to crank the engine. The glow plugs are enabled during the buzzer cycle and during engine cranking.

Temperature	Glow Plug Delay
Less than 20°C/68°F	15 seconds
Between 20°C/68°F and 40°C/104°F	Linear extrapolation from 15 seconds to 1 second
Greater than 40°C/104°F	1 second

System State: STARTING

The control system will attempt to start the engine.

The control system will allow the engine to attempt to start for 20 seconds. If the engine fails to start the control system will flag a starting error to the Display Box.

System State: WARMING

The control system will wait until the engine and compressor temperatures are above 5°C/41°F before loading the compressor system and going to the RUNNING state.

System State: STARTING CLUTCH

This state engages the compressor clutch to build air.

Each time the clutch is disengaged a delay is put in place to allow internal compressor pressure to drop. Once the delay is reached, the clutch is able to re-engage and the system to build air.

System State: RUNNING

When using an air tool, the control system should be in the RUNNING state.

If the air pressure stays above System Pressure minus Top-up Pressure, the Delay to-Unload timer will start counting down.

Once the timer reaches the delay time, the system will switch to the UNLOAD state.

If air pressure drops below System Pressure minus Top-up Pressure, the system will reset the Delay to Unload timer.

ie. (150 PSI – 10 PSI = 140 PSI)

If a low battery restart is triggered, the system will keep the Unload timer reset until the battery voltage is above the upper voltage threshold and has completed the low-battery restart timer duration.

The control system monitors engine load. It will disable the compressor system if the generator or PTO switches are enabled and engine speed drops below 3200RPM. Once the engine speed increases RPM, the compressor will automatically re-engage the clutch.

System State: UNLOAD

In UNLOAD mode, the control system will disable the compressor clutch.

To return to the RUNNING state, the control system calculates the air use rate of the air tool (PSI/second).

If the air use rate is above a preset value (HIGH AIR USE RATE) the system will detect that an air tool is used and will switch states.

The system will also return to the RUNNING state if pressure is below the Restart Pressure.

If the system continues to not detect air use, it will continue to count down the delay to STANDBY timer.

If the Delay To STANDBY timer has finished counting down, the system will go to STANDBY mode.

If the Genset or PTO switch is activated, the control system will not go into STANDBY mode.

System State: STANDBY

In STANDBY mode, the control system will shut down the engine as it has detected no further air use. The control system is still operating and able to restart with air-use. The LED beacon module is enabled to identify that the engine is able to restart.

When the LED beacon module is illuminated, the system (and engine) is able to restart when air-use is detected.

As with UNLOAD mode, to return to RUNNING mode the operator needs to dump air greater than the preset air rate values, this will restart the engine.

The system will also return to the RUNNING state if pressure is below the Restart Pressure.

If Allow Cold Engine Restart is enabled the engine will restart when it detects engine or compressor temperature is below –5°C/23°F. As with many settings, this can be disabled through the Control Box.

The Disable Auto Restart Delay setting will prevent the system from restarting the engine after a preset time once in the STANDBY state. This prevents the engine from restarting accidentally if left unattended.

If the Low Battery Restart is enabled, the system will restart if the battery voltage is below the Low Battery Threshold for more than 30 seconds.

If the generator or PTO switch is activated while the engine is in STANDBY, the engine will restart.

System State: STOPPING

When the control system is running and the ON/ENTER button on the Display Box is pressed, the control system will enter the STOPPING state.

The stop solenoid will engage for 10 seconds to allow the engine to shutdown and an additional 10-second delay to blowdown all internal pressure from the system.

After the stopping sequence has finished, the system will revert back to the READY state.

7.3 Starting and Stopping the RAPTAIR MF

7.3.1 Starting the System

- ☐ Check the oil level in the tank
- ☐ Check for any fluid leaks around the unit
- ☐ Ensure pneumatic equipment is securely connected and discharge valve is closed
- ☐ Turn the key switch to the RUN position
- ☐ Wait for the Display Box to finish going through the System Check. If there are no errors, the system will be in System Ready state
- ☐ Turn the key to the START position, hold for about 1 second then release or press the ON/ENTER button
- ☐ Display box should go into Glow Plug mode for 1 to 15 seconds then Starting mode where the engine will crank
- ☐ Once engine speed is stable, system will enter System Running mode and is ready for use
- ☐ Turn the Compressor switch to ON, the compressor clutch should engage and start to build air.

7.3.2 Stopping the System

- ☐ Press the Display box ON/ENTER button to stop the system
- ☐ The system will go into STOPPING mode for about 25 seconds
- ☐ Turn the key to the OFF position to fully power-off all electronics

NOTE

The key-switch can be used to shut down the system also. However, this will directly turn off power to the control system, and the system will have to go through its system check before being able to be restarted.

7.4 Display Box Messages

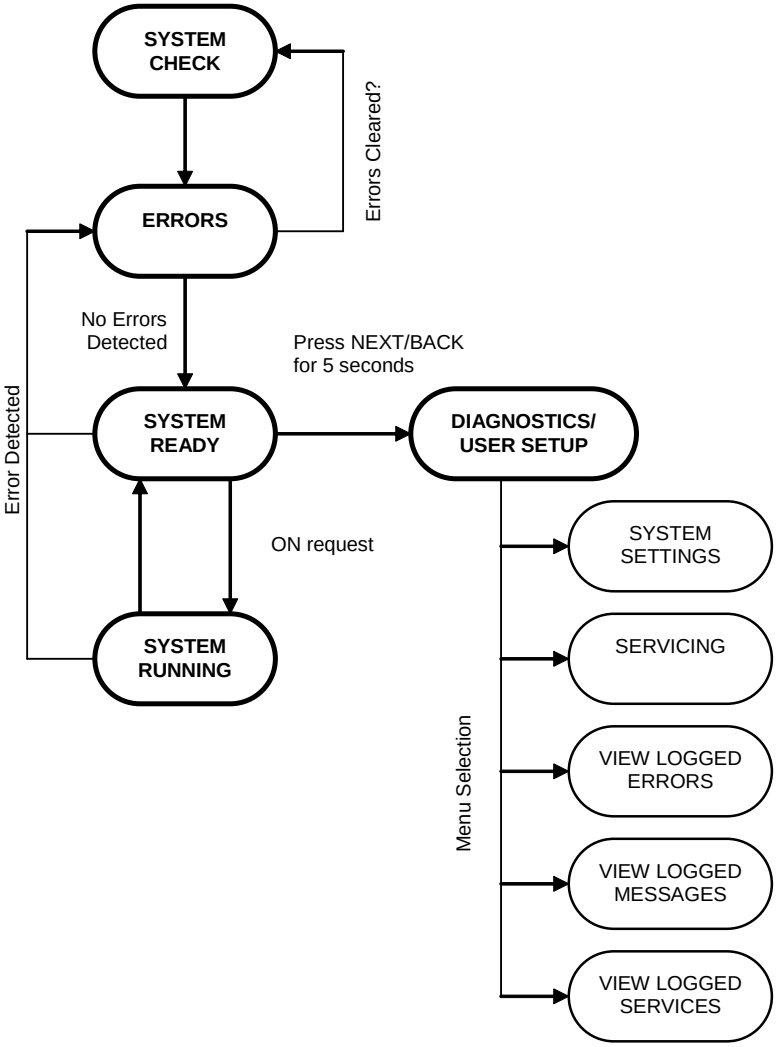


Figure 2 – Display Box Flow Diagram

7.4.1 System Check Menu

Ensure the pneumatic equipment is securely connected and turned off.

To power the control box and display box, turn the key switch from the OFF position to the RUN position.

Once powered, a system check is performed.

NOTE ***During the system check, both the WARNING and READY LEDs remain illuminated and 'SYSTEM CHECK' is displayed.***

If any errors are present the WARNING LED will flash on & off, the display will enter the ERRORS menu.

If no errors are present the system will go to SYSTEM READY menu.

7.4.2 System Ready Menu

NOTE ***If any messages are present, the WARNING LED will flash on & off and the messages displayed. The unit will run as normal when messages are present.***
If no messages are present, both the READY and WARNING LEDs will be off.

The SYSTEM READY menu will change between the following screens, SYSTEM READY, VMAC PH# 250 740 3200, VMAC WWW.VMACAIR.COM, HOUR METER xxxx.x

Pressing ENTER will initiate the start sequence (see Control System Operation). Once parameters are in the operating range the SYSTEM RUNNING menu is entered.

Pressing and holding both the BACK and NEXT buttons for approx. 5 seconds will bring up the USER SETUP menu.

7.4.3 System Running Menu

If any messages are present, the WARNING LED will flash on & off, the READY LED will remain on, and the messages will cycle on the display.

If no messages are present, the display will cycle through the SYSTEM RUNNING*, AIR PRESSURE, and TIME TO UNLOAD (* or current control state see Control System Operation).

Pressing the NEXT or BACK buttons in SYSTEM RUNNING menu will take the user to the additional information menu where specific information about the RAPTAIR MF sensors are displayed.

Pressing the ENTER or EXIT button will initiate the stopping sequence.

7.4.4 Stopping Sequence

To stop the RAPTAIR MF unit as detailed in section 7.3.2 the user can press the ENTER button at any point during operation, in addition,the user may also turn the key switch from the RUN position to the OFF position.

7.4.5 Additional Information Menu

The additional information menu for the display box allows the user to monitor specific information about the RAPTAIR MF unit. The parameters displayed are: air pressure, air rate, engine speed, engine temperature, compressor temperature, time to unload (or standby), and hour meter.

The user can scroll through the screens by pressing the BACK and NEXT buttons.

Pressing the EXIT button will return the display box to SYSTEM RUNNING menu.

The display box will return to the SYSTEM RUNNING menu after three minutes of no buttons being pressed by default.

Pressing the ENTER button will initiate the stopping sequence (see Control System Operation)

7.4.6 User Setup Menu

Details on adjustable parameters are summarized in Section 7.7.

User setup menu can only be reached from the SYSTEM READY menu by holding both the BACK and NEXT buttons for five seconds. This menu allows the user to define parameters of system operation. User defined parameters include:

- System Pressure
- Unload Delay
- Standby Delay
- Top-up Pressure
- High Air Rate
- Restart Pressure
- Allow Cold Engine Restart
- Disable Auto Engine Restart
- Allow Low Battery Restart
- Battery Restart Lower Threshold
- Battery Restart Upper Threshold
- Battery Restart Delay
- Factory Reset

Upon entering this menu the user will see information on how to navigate USER SETUP. Specifically the following:

- To scroll through the menu screens press BACK or NEXT.
- To enter or exit a menu screen press the ENTER or EXIT buttons respectively.

The user will then see USER SETUP on the display module

- Press ENTER to see the parameter screens

To return to SYSTEM READY menu press EXIT

SYSTEM PRESSURE
Allows setting of the maximum working pressure.

UNLOAD DELAY
Time delay to change states from RUNNING to UNLOAD.

STANDBY DELAY
This delay begins after the UNLOAD DELAY has expired. For example if UNLOAD DELAY is set to 5 minutes and STANDBY DELAY to 1 minute, it will take 6 minutes the RAPTAIR60 to go from RUNNING to STANDBY.

TOP-UP PSI
This parameter allows tank pressure to be close to system pressure. If pressure goes below SYSTEM PRESSURE minus TOP-UP PSI (ie. 150PSI – 10PSI = 140PSI) the inlet will open and fill to system pressure and reset the idle timer.

HIGH AIR RATE
Air rate is a change in time of pressure (PSI/seconds) used to monitor if an air-tool is being used. Setup of this parameter depends on the air tool and tank size.
A small tank using a large tool will have a large air-rate, if the tank size is increased the air rate will be lower.
This parameter allows a quick restart response when the system is in STANDBY rather than reaching the restart pressure to restart the system.

RESTART PRESSURE
This parameter is used to restart the system when pressure has gone below the set value in STANDBY.

COLD ENGINE RESTART
This will allow the engine to restart if temperature has dropped below a preset value in STANDBY.

DISABLE AUTO RESTART
Disable the engine from restarting in STANDBY after an adjustable time.

ALLOW LOW BATTERY RESTART
Allow to restart the engine from STANDBY if the voltage threshold is below BATTERY RESTART LOWER THRESHOLD for 30 continuous seconds.

BATTERY RESTART LOWER THRESHOLD
Low battery threshold for a restart request.

BATTERY RESTART UPPER THRESHOLD
After a low battery restart the system will stay in RUNNING until battery voltage is above the upper voltage threshold to start the BATTERY RESTART DELAY.

BATTERY RESTART DELAY
Delay to keep the idle timer reset so the battery will charge. A 2 minute delay is typical for a RAPTAIR battery, 5 minutes or greater for additional batteries (ie. truck batteries).

FACTORY RESET
All adjustable parameters will reset to factory settings.
Pressing ENTER on this screen will display CANCEL
Pressing NEXT will show CONFIRM RESET? Pressing BACK will display CANCEL again
Select the desired option and press the ENTER button

7.5 Automatic Shutdown and Restart

When an error is detected, the controls will automatically shutdown the system, show and log the error that caused the issue.

Also, the system will shutdown if no air use is detected, and it has idled for a preset amount of time. The system can be restarted by using a large amount of air for a short time (air rate) or dropping of air pressure below an adjustable value.

The LED beacon module will illuminate when the RAPTAIR MF is in STANDBY mode and is able to restart when air-use is detected.

The buzzer module will enable and alert the operator before the engine starts.

The system may automatically restart based on Air Usage Rate, Restart Pressure, engine or compressor temperature or low battery voltage.

7.6 Checking Messages and Errors

7.6.1 Errors

If an error is present, the RAPTAIR MF unit *WILL NOT* start the compressor until the error is cleared. When an error is present the WARNING LED will flash on/off and the screen will display 'ERRORS DETECTED' followed by the following list of errors. The user MUST scroll through ALL the displayed errors by pressing the NEXT button before the unit can re-try the start sequence.

ERROR MESSAGE TABLE

Error Code	Error Message Displayed	Cause
5	COMP TEMP SENSOR FAILED – OPEN	Temperature sensor on the compressor is unplugged or wire to control box has been cut.
6	COMP TEMP SENSOR FAILED – SHORT	Temperature sensor on the compressor is shorted.
7	COMP TOO COLD xx.x°F/xx.x°C	Compressor is too cold to start. The temperature is displayed.
8	COMP OVER TEMP xx.x°F/xx.x°C	Compressor is too hot to start. The temperature is displayed.
9	MANIFOLD TEMP FAILED – OPEN	Temperature sensor on the manifold is unplugged or wire to control box has been cut.
10	MANIFOLD TEMP FAILED – SHORT	Temperature sensor on the manifold is shorted.
11	MANIFOLD ERROR CHECK COALESCER	The coalescer should be checked. There is a possibility of a plug.
12	AIR PRESS SIGNAL VOLTAGE LOW	Low voltage reading on the air pressure transducer.
13	AIR PRESS SIGNAL VOLTAGE HIGH	Over voltage reading on the air pressure transducer.
14	AIR PRESS SENSOR TOO HIGH	Air pressure is too high to start the engine.
	AIR PRESSURE xxx.x PSI	If the previous error is present the air pressure is displayed.
34	ENGINE RPM NOT DETECTED	Engine RPM is not detected. Wire may be cut, tach sensor on bell-housing may be loose or fuel problem caused engine to stop suddenly.
35	ENGINE CRANK TIME OUT	The engine did not start during the crank cycle.
36	ENGINE OIL LOW	Oil level in the diesel engine is low.
37	ENGINE TEMP PROBE OPEN	Temperature sensor on the diesel engine is unplugged or wire to control box has been cut.
38	ENGINE TEMP PROBE SHORT	Temperature sensor on the diesel engine is shorted.
39	ENGINE TEMP TOO COLD TO START	The diesel engine is too cold to start.
40	ENGINE OVER TEMP	The diesel engine is too hot to start.
41	SERVICE PANEL OPEN	The service panel is open. It must be closed before the unit is run.
42	FUEL LEVEL LOW PLEASE RE-FILL	Fuel level for the diesel engine is low. It must be re-filled before the unit is run.
27	UNEXPECTED ENGINE OPERATION	Unexpected engine operation can have many causes. It is likely due to RPM detected during an OFF state.
-	DISPLAY CANBUS CONN ERROR	A CAN bus error between the Display box and Control box.
-	End of Errors OK to Retry?	End of errors screen. Pressing ENTER will try to restart the system.
52	ENGINE RPM UNDERSPEED	Engine speed went below 2000RPM for 3 seconds.

7.6.2 Warning Messages

Listed below are additional messages, which may be displayed. If a message is present, the red WARNING LED will flash on and off. These messages appear in both the SYSTEM READY and SYSTEM RUNNING menus.

WARNING MESSAGE TABLE		
Error Code	**Message Displayed**	**Cause**
29	AIR FILTER PLUGGED	Air filter is not working, or working incorrectly.
32	BATTERY VOLTAGE TOO LOW	The battery voltage is too low.
46	ENGINE RESTART DUE TO COLD	The engine has auto restarted due to the low internal temperature.
-	200HR/6MTH SERV DUE IN xx HOURS	This warning will show up 10 hours before the 200 hour service internal.
54	COMPRESSOR SERV 200HR/6MTH	The system is due for a service. This warning will show after every 200 hours of running the compressor. Clearing the compressor service reminder is required through the Diagnostic menu.
	400HR/12MTH SER DUE IN xx HOURS	This warning will show up 10 hours before the 400 hour service internal.
55	COMPRESSOR SERV 400HR/12MTH	The system is due for a service. This warning will show after every 400 hours of running the compressor Clearing the compressor service reminder is required through the Diagnostic menu.
-	ENGINE SERVICE 50 HOURS	Engine servicing required. See Section 8.6
-	ENGINE SERVICE 100 HRS/ENG. OIL	100 hour engine servicing required. See Section 8.6
-	ENGINE SERVICE 200 HRS/OIL+FILT	200 hour engine servicing required. See Section 8.6
58	ENGINE RESTART DUE TO LOW BATT	

7.7 Adjusting System Parameters

See section 7.4.6 for adjusting settings.
Below is a table of the adjustable settings accessible though the display box diagnostics section.

SYSTEM PARAMETER TABLE			
Setting	**Description**	**Adjustment**	**Default**
Unload Delay	Delay time to unload	0.5, 1, 2, 5, 10, 15, 30 minutes, Never	1 min
Standby Delay	Delay time to standby	1, 2, 5, 10, 15, 30 minutes, Never	5 min
System Pressure	Operating System Pressure	80 to 150PSI @ 5PSI increments	150PSI
Top-up Pressure	PSI below system pressure to allow inlet to open and build pressure	1 to 15PSI @ 1PSI increments	10PSI
High Air Use Rate	Air rate set-point for pressure-based restart condition	0 to -30PSI @ 0.5PSI increments	-3.0PSI/sec
Pressure Restart PSI	Air pressure set-point for pressure-based restart	80 to 150PSI @ 5PSI increments	120PSI
Allow Cold Engine Restart	Allow to restart the engine if engine is beginning to freeze	Enable/Disable	Enabled
Disable Auto Restart Delay	Timer for disabling automatic engine restart	Always, 30 min, 60 min, 120 min, Never	60 min
Allow Low Battery Restart	In Standby, allow the engine to restart based on low battery level	Enabled/Disabled	Enabled
Battery Restart Lower Threshold	Engine will restart if below this threshold for 30 seconds in Standby	10.0 – 14.0V @ 0.1V increments	12.1V
Battery Restart Upper Threshold	System will start duration timer if above value	10.0 – 15.0V @ 0.1V increments	12.8V
Battery Restart Duration	Once above Upper Threshold, stay running for duration to charge battery	1, 2, 5, 10, 15, 30 minutes	2 min

7.8 Cold Weather Operation

If the cold weather kit for the RAPTAIR MF is installed, plug in the kit as per section 4.5 to warm the engine and the compressor before operating.

Press the ON/ENTER button or turn the key to the START position. The Display box will display GLOW PLUG mode on the screen and delay starting the engine from 1 to 15 seconds, depending on the engine temperature. After this delay, the engine should start and run.

The control system will go into WARMING mode, monitoring the engine temperature and compressor temperature. Once both temperatures have warmed to a preset level, the system will enter RUNNING mode and build to full system pressure.

8.0 Routine Maintenance

Maintenance is a planned program, which provides an orderly series of service and inspection procedures, together with cleaning. A well-planned maintenance program lowers maintenance costs, reduces down time and can prevent possible accidents due to failed components.

VMAC RAPT AIR-MF MULTIFUNCTION DIESEL DRIVE

ENGINE AND COMPRESSOR MAINTENANCE CHECK LIST

MAINTENANCE ITEM	SERVICE INTERVAL			
	AFTER FIRST 50 HRS	EVERY		
		100 HRS	200 HRS	400 HRS
Change engine oil	■	▒		
Clean fuel filter		▒		
Replace engine oil filter	■		▒	
Replace air cleaner element				▒
Change compressor oil and replace compressor oil filter			▒	
Change compressor coalescing filter				▒

For a complete Engine Maintenance Check List, refer to the Kubota Diesel Engine Operator's Manual.
For compressor maintenance, refer to the RAPTAIR-MF Owner's Manual.

Figure 3 – Engine and Compressor maintenance check list

Shut down the RAPTAIR-MF Diesel Drive Compressor, wait for 5 minutes. After 5 minutes discharge all air to ensure the system is fully depressurized.

Torque Specifications

STANDARD GRADE 8 NATIONAL COARSE THREAD								
Size	1/4	5/16	3/8	7/16	1/2	9/16	5/8	¾
Foot-pounds (ft-lb)	9	18	35	55	80	110	170	280
Newton meter (N•m)	12	24	47	74	108	149	230	379

STANDARD GRADE 8 NATIONAL FINE THREAD					
Size	3/8	7/16	1/2	5/8	¾
Foot-pounds (ft-lb)	40	60	90	180	320
Newton meter (N•m)	54	81	122	244	434

METRIC CLASS 10.9					
Size	M8	M10	M12	M14	M16
Foot-pounds (ft-lb)	19	41	69	104	174
Newton meter (N•m)	25	55	93	141	236

8.1 Compressor Servicing and Maintenance Schedule

The following maintenance schedule should be adhered to, to assure good performance and long service life. The hours indicated are those displayed on the compressor hour meter. Service should be performed at the lesser of the two intervals, whichever occurs first.

Check the Illustrated Parts List for replacement part numbers or call VMAC.

Every time before start up

- Check the level of oil in the air/oil separator tank
- Check air supply lines are in good working order
- Check compressor and hoses for damage or wear
- Check after cooler drain collection bottle (if equipped)

Every 200 hours or 6 months as shown on the Display Box
(More frequently if used in dusty or extreme working conditions)

- Change compressor oil
- Change compressor oil filter
- Change compressor air filter

Every 400 hours or 12 months as shown on the Display Box

- Perform items in the 200 hour / 6 month service and
- Change coalescing filter

NOTE ***VMAC certified synthetic oil should be used. Failure to use this oil may result in damage to the compressor and may void the warranty. Contact your nearest VMAC dealer for oil or service kits. See our website www.vmacair.com to find a dealer location.***

8.2 Checking and Adding Compressor Oil

8.2.1 Check oil level in air/oil separator tank

The air compressor system holds 4 litres of oil, which includes enough to fill the oil filter. The filter holds 0.3 litres of oil. The compressor holds about 0.5 litres of oil.

☐ Check the level the oil has reached on the oil level sight glass.

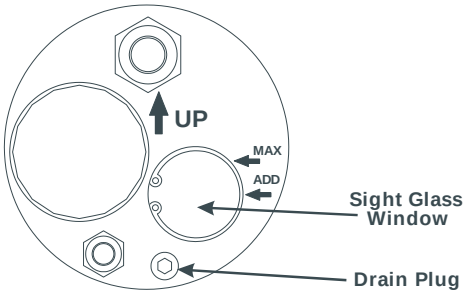


Figure 4 – Checking Compressor Oil Level

☐ Use a funnel inserted into the oil fill port on the air end (below the coalescing filter).

☐ Turn the compressor clutch clockwise as oil is poured into the funnel until the oil is at the top of the sight glass.

☐ Replace the cap on the oil fill port and tighten.

☐ Start the system following the start-up procedure in section 7.3.1.

☐ Allow the system to pressurize.

☐ Turn off the system using the shutdown procedure in section 7.3.2.

☐ Wait 5 minutes then drain the air fully to depressurize the system.

☐ Check for oil leaks.

☐ Repeat until the oil level sight tube shows the oil level in the air/oil separator tank is in the operational range.

8.3 Replacing the Air Filters

8.3.1 Engine Air Filter

Follow all safety precautions. For ease of service the engine air filter is located just under the roof of the RAPTAIR MF behind the service panel. The engine air filter is also equipped with a filter minder switch at the back, and is monitored by the control system.

- ☐ Clean loose dust and debris from the area around the filter cover to prevent contaminants from entering the system.
- ☐ Remove the air filter cover retaining clamps and the cover.
- ☐ Immediately cover the air intake with a clean cloth to prevent contamination entering the intake hose and compressor.

Do not use compressed air or perform any other tasks around the filter and cover until both are replaced. Never clean the filter element with compressed air, as this will allow some contaminates into the compressor system. Always replace the air filter element.

- ☐ Remove the filter element from the filter cover. Clean the inside of the cover with a clean, dry cloth.

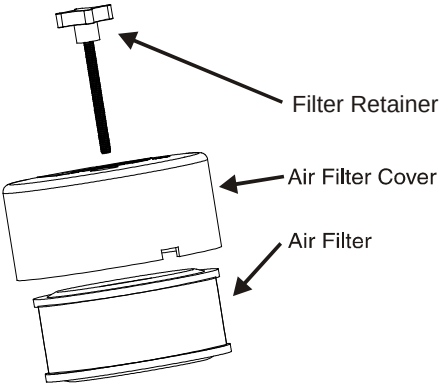
Do not use flammable solvents to clean the inside of the cover. If a solvent has been used rinse the cover thoroughly with water and dry it before installing the cover. Fire in the compressor can cause an explosion.

- ☐ Remove the cloth from the compressor air intake.
- ☐ Place the filter into the cover and secure it with the cover clamps.

8.3.2 Compressor Air Filter

- ☐ Clean loose dust and debris from the area around the compressor air filter cover to prevent contaminants from entering the system.
- ☐ Remove the air filter cover retainer and the cover.
- ☐ Immediately cover the compressor air intake with masking tape or a clean cloth to prevent contamination.
- ☐ Remove the filter element from the filter cover. Clean the inside of the cover with a clean, dry cloth.

Do not use flammable solvents to clean the inside of the cover. If a solvent has been used rinse the cover thoroughly with water and dry it before installing the cover. Fire in the compressor can cause an explosion.



☐ Remove the masking tape or cloth from the compressor air intake. The new VMAC filter is oval, make sure that the filter fits over the machined step on the intake housing.

NOTE ***Do not use compressed air or perform any other tasks around the filter and cover until both are replaced. Never clean the filter element with compressed air, as this will allow some contaminates into the compressor system. Always replace the air filter element.***

☐ Place the filter cover over the air filter and secure it with the cover nut.

8.4 Replacing Compressor Oil and Filter

8.4.1 Changing Compressor Oil

Follow all safety precautions.

☐ Clean debris and dust from the area around the drain plug in the bottom of the separator tank.

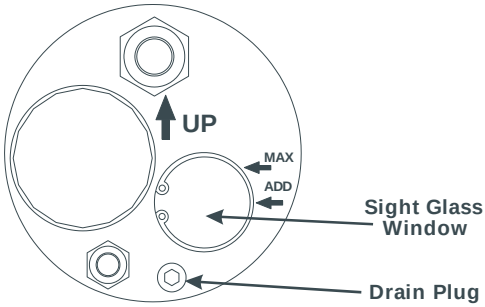


Figure 5 - Oil Filter and Drain Plug Location

☐ Use a drip tray to prevent oil from dripping onto the belt and/or battery and drain oil into a container that can hold at least 4 liters of oil.

NOTE ***Dispose of the oil in accordance with the Environmental Protection Laws in your location.***

☐ Remove and replace the oil filter at this time as noted in section 0.

☐ Clean debris and dust from the area around the oil fill port of the air/oil separator manifold to prevent contamination.

NOTE ***4 liters of VMAC certified oil is required to fill the system.***

☐ Unscrew and remove the oil fill port cap. Use a funnel inserted into the port and pour in the required amount of VMAC oil.

☐ Follow the oil level checking procedure in Section 8.2.1.

8.4.2 Changing Compressor Oil Filter

Follow all safety precautions.

☐ Clean debris and dust from the area around the air/oil separator tank and the filter to prevent contamination.

☐ Remove the filter by turning it counterclockwise using a suitable filter wrench.

Check the filter to make sure that the threaded nipple did not unscrew with the filter. If it is in the filter, remove it carefully to avoid thread damage, coat the threads that go into Separator Tank Base with a small amount of Loctite blue and install it into the Tank base.

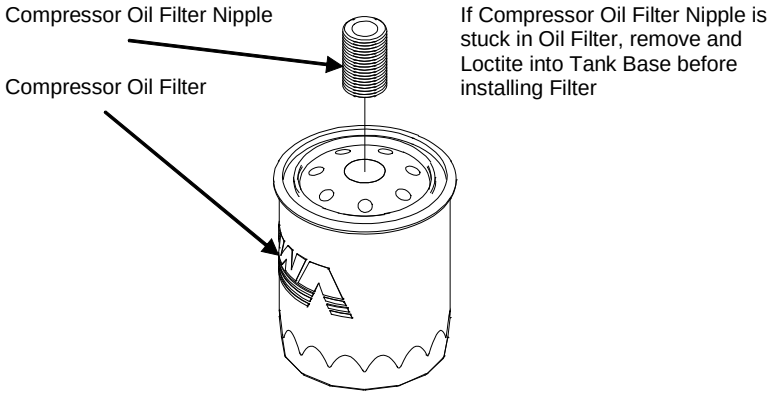


Figure 6 – Compressor Oil Filter

☐ Check the gasket-sealing surface of the air/oil separator tank for contamination, old gasket material or damage.

Make sure the new filter is a VMAC filter, part number 9200039. This oil filter is a high pressure oil filter, not an automotive oil filter, which will rupture under high pressure.

☐ Apply a thin coating of compressor oil to the filter sealing gasket.

☐ Spin the filter onto the threaded nipple until the gasket contacts the sealing surface of the air/oil separator tank.

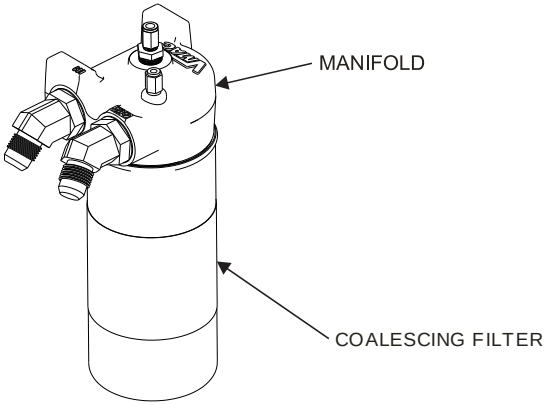
☐ Tighten the filter an additional 3/4 to 1 turn to seat the sealing gasket.

Never over-tighten the filter, as this may damage the seal or filter.

☐ Follow the oil level checking procedure in Section 8.2.1.

8.5 Replacing the Coalescing Filter

Follow all safety precautions.



NOTE ***Do not use a screwdriver punched into the side of the filter, as this practice can damage the scavenging tube and screen.***

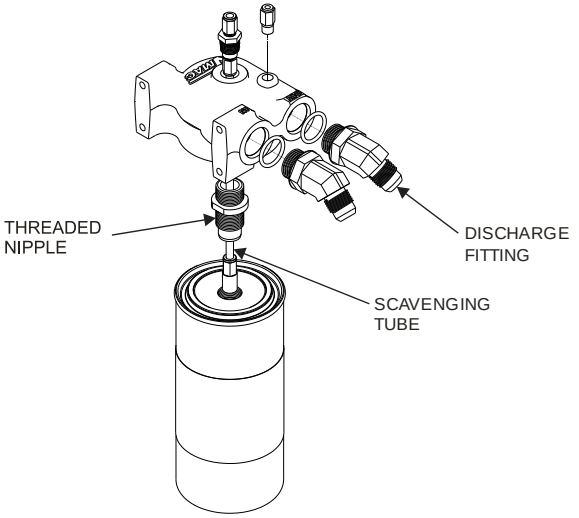


Figure 7 – Avoid Damaging the Scavenge Line

Check the filter to make sure that the threaded nipple did not unscrew with the filter. If it is in the filter, remove it carefully to avoid thread damage, coat the threads that go into manifold block with a small amount of Loctite blue and install it into the manifold block. Use caution when removing the filter so as to avoid catching the scavenge screen orifice on the bottom of the scavenge tube on the lip of the coalescing filter. This scavenge screen orifice is attached to the scavenge tube by a "push to connect" fitting, if the fitting has come off of the tube re-insert the tube into the fitting ensuring that the tube is fully engaged.

☐ Check the gasket-sealing surface of the manifold block for contamination, old gasket material or damage.

Make sure the new filter is a VMAC filter, part # 3600079. This is a high-pressure filter. Use of other filters not rated to the required pressure may cause the filter to rupture.

☐ Apply a thin coating of compressor oil to the coalescing filter sealing gasket and coat the end of the threaded nipple, as there is also an O-ring inside the coalescing filter.

☐ Spin the filter onto the threaded nipple until the gasket contacts the sealing surface of the manifold block.

☐ Tighten the filter an additional 3/4 to 1 turn to seat the sealing gasket.

Never over-tighten the filter, as this may damage the seal or filter.

☐ Check the oil level following the oil level checking procedure in Section 8.2.1.

8.6 Engine Maintenance

Refer to the Kubota Engine manual supplied with the RAPTAIR MF. (VMAC p/n: 1900919).

After first 50 hours
- Change engine oil
- Replace engine oil filter

Every 100 hours
- Change engine oil
- Clean fuel filter

Every 200 hours
- Change engine oil
- Clean fuel filter
- Replace engine oil filter

The Display Box will inform the operator when engine and compressor servicing is due. Refer to Section 7.6.2 for the Display box servicing message list.

Engine service reminders do not need to be cleared in the Display Box. Reminders will show 10 hours before and 10 hours after the engine service intervals.

8.6.1 Draining Engine Oil

☐ Locate the drain hose below the belt and remove from clamps to drain into container.

☐ Remove plug and drain the oil into a container large enough to hold at least 1-1/2 US Gallons (6 liters). After the oil has drained, replace the plug and secure hose back into clamps.

8.6.2 Adding Engine Oil

☐ Oil can be added using an accordion funnel with the engine's fill cap on the top of the engine.

8.7 Clearing Service Reminders

Perform appropriate compressor servicing as per section 8.0. Engine servicing reminders do not need to be cleared.

☐ Turn the key switch to the RUN position, do not start the unit.

☐ Enter Diagnostics mode in the Display Box by holding the NEXT and BACK button for 5 seconds.

☐ Use the NEXT button to scroll to the Servicing section. Press ENTER to the Servicing section. Press ENTER to confirm servicing is completed.

The system will only allow services to be logged when approaching the 200 hour or 400 hour service reminder time. The Display Box shows running time in (hours).($1/10^{th}$ hour).

9.0 Troubleshooting

Problem diagnosis for the compressor system should follow sound, recognized practice. Quick, accurate diagnosis of problems is possible by;

- ☐ Accurately identifying the problem by operating the system yourself, following safety practices
- ☐ Determining possible causes for the problem by understanding how the system operates
- ☐ Isolating the potential causes by accurate testing using the correct, recognized procedures
- ☐ Performing proper repairs using the correct procedures outlined in this manual and the recommended replacements parts
- ☐ Performing proper post-repair testing to ensure that the repairs were effective

When performing problem diagnostics, do not use test practices that are potentially harmful to the people involved, or the equipment.

Electrical testing should be performed according to the processes described in the troubleshooting charts and in conjunction with the manuals provided by VMAC.

Troubleshooting Table		
SYMPTOM	**POSSIBLE CAUSE**	**CORRECTIVE ACTION**
Frequent relief valve operation	Pressure control line plugged or frozen	Remove and clear the line
	System still at high pressure	Wait for system blow-down or bleed off all system pressure
	Defective relief valve	Replace the valve
Compressor does not run	High system pressure	system will not start with more than 10 psi system pressure
	High oil temperature	See “frequent over-temperature shut-down”
Frequent over-temperature shut-down	Low oil level	Check oil level with equipment on level ground
	Restricted oil lines	Check for kinked or pinched lines
	Plugged oil filter	Replace oil filter
	Cooler not functioning or plugged	Replace or clean oil cooler
	Engine cooling system failure (high engine temperature)	Correct problem
	High ambient temperatures	Reduce duty cycle
	Oil temperature sensor failure	Replace if defective
Excessive oil in the air	Coalescing separator failure	Replace element
	Clogged scavenge line screen	Clean or replace
	High oil level	Check oil level with equipment on level ground
	Operating angle in excess of 15 degrees from horizontal	Reduce operating angle
	Air operated equipment is faulty, or not correctly connected to supply valve	Test air operated equipment for proper operation and connect to supply valve
	Incorrect start-up/ shutdown procedures	Observe start-up/ shutdown procedures detailed in this manual.
Objectionable noise level	Excessive gear wear	Replace gearbox assembly

10.0 Warranty

10.1 Maintenance and Repair Records

System Installation

System ID number: _____

Compressor Serial Number: _____

System Installed by: _____

Address: _____

_____

Date Installed: _____

50 Hour Inspection

Date: _____

Performed by: _____

Address: _____

_____

Parts replaced: _____

or notes: _____

200 Hour or 6 month service

Date: _____

Performed by: _____

Address: _____

_____

Parts replaced _____

or notes: _____

400 Hour or 12 month service

Date: _____

Performed by: _____

Address: _____

_____

Parts replaced _____

or notes: _____

600 Hour or 18 month service

Date: _____

Performed by: _____

Address: _____

_____

Parts replaced _____

or notes: _____

800 Hour or 24 month service

Date: _____

Performed by: _____

Address: _____

_____

Parts replaced _____

or notes: _____

10.2 Part Replacement or Adjustment Record

Record #1

Date: _____

Performed by: _____

Part or Adjustment: _____

Reason: _____

Record #2

Date: _____

Performed by: _____

Part or Adjustment: _____

Reason: _____

Record #3

Date: _____

Performed by: _____

Part or Adjustment: _____

Reason: _____

Record #4

Date: _____

Performed by: _____

Part or Adjustment: _____

Reason: _____

Record #5

Date: _____

Performed by: _____

Part or Adjustment: _____

Reason: _____

Record #6

Date: _____

Performed by: _____

Part or Adjustment: _____

Reason: _____

Record #7

Date: _____

Performed by: _____

Part or Adjustment: _____

Reason: _____

Record #8

Date: _____

Performed by: _____

Part or Adjustment: _____

Reason: _____

10.3 VMAC Warranty

1 GENERAL PROVISIONS AND LIMITATIONS

1.1 VMAC Global Technology Inc. (hereafter ”VMAC”) warrants to each original retail purchaser (hereafter “Buyer”) of its new RAPTAIR MF Systems (hereafter “Product(s)”) from VMAC or its authorized Dealers that such Product(s) are, at the time of delivery to the Buyer, free of manufacturer defects in material and workmanship.

1.2 See Kubota manual for engine warranty.

2 NO WARRANTY IS MADE WITH RESPECT TO

2.1 Any Product(s) which have, in VMAC’s judgment, been subject to negligence, accident or improper storage, installation, application, operation or maintenance, or have been repaired or altered in such a way that affects the Product(s) adversely.

2.2 Components or accessories manufactured, warranted and serviced by others.

2.3 Damages caused from normal maintenance service and repairs and corrections with minimum action, such as adjustments and inspections, or replacement of items, such as service filters, belts, seals and service kits.

2.4 Consequential damages caused by Product(s) failure.

2.5 Any Product(s) if other than VMAC’s genuine components are used in the Product(s).

2.6 Normal wear and tear of Product(s).

3 WARRANTY PERIOD

3.1 The warranty period will commence upon installation of the Product(s). The returned warranty registration form marks the date of installation. If the warranty registration form has not been received by VMAC within 6 months from the date of installation of the Product(s), then the warranty period will be deemed to commence 30 days from date of shipment from VMAC. For the full warranty period to apply, installation of Product(s) must be completed within 36 months from the date of shipment of the Product(s) from VMAC.

3.2 The following components of Product(s) are warranted against manufacturer defects in materials and workmanship for a period of 24 months or 2,000 hours of operation, whichever expires first: Compressor, Brackets, Air/Oil Separator Tank and Oil Cooler.

3.3 All other components of Product(s), not listed in 3.2, are warranted against manufacturer defects in materials and workmanship for a period of 12 months or 1,000 hours of operation, whichever expires first.

3.4 Replacement components of Product(s) listed in 3.2, excluding VMAC factory rebuilt components, shall be warranted for the remainder of the original warranty period. If the original warranty period has expired, replacement components of Product(s) listed in 3.2 and purchased by Buyer, excluding VMAC factory rebuilt components, shall be warranted for a period of 12 months or 1,000 hours of operation, whichever expires first.

3.5 VMAC factory rebuilt components shall be warranted for a period of 6 months from date of shipment from VMAC.

3.6 Replacement components of Product(s) listed in 3.3, shall be warranted for the remainder of the original warranty period. If the original warranty period has expired, replacement components of Product(s) listed in 3.3 and purchased by Buyer, shall be warranted for a period of 12 months or 1,000 hours of operation, whichever expires first.

4 VMAC OBLIGATIONS

4.1 VMAC's obligation is limited to repairing or, at VMAC's option, replacing, during normal business hours at an authorized service facility of VMAC, any component, which in VMAC's judgment is proven to be defective as warranted.

4.2 VMAC's obligation is limited to Product(s) proven to be warranted. No liability is accepted for any consequential damages, injuries or expenses directly or indirectly related to Product(s) failure.

5. BUYER OBLIGATIONS

5.1 Buyer shall notify VMAC of the alleged defect within 10 days of initial discovery and return the allegedly defective component(s) within 30 days of initial discovery.

5.2 The Buyer must prepay all costs associated with the warranty claim and submit receipts and/or invoices to VMAC for evaluation.

5.3 If required by VMAC, the Buyer must return components claimed under this warranty to a facility designated by VMAC for evaluation, to establish a claim under this warranty.

5.4 Buyer shall maintain and service VMAC Product(s) in accordance with the VMAC Product(s) Owner's Manual.

6. WARRANTY REGISTRATION VALIDATION

6.1 A warranty registration form is provided to the Buyer with the Product(s). The form must be fully completed by the Buyer and returned to VMAC upon completion of the installation of the Product(s) to validate the warranty. Warranty registration can also be completed online on the VMAC website at http://www.vmac.ca/index.php?warrantyregistration. Warranty claims will not be processed unless VMAC has received a fully completed warranty registration form.

7. DISCLAIMER AND WARRANTY SERVICE

7.1 Any labor costs claimed in excess of VMAC's set rate and/or times are not provided by this warranty. If applicable, any labor costs in excess of VMAC rate schedules caused by, but not limited to, location or inaccessibility of the equipment, travel time or labor provided by unauthorized service personnel are not provided by this warranty.

7.2 This warranty is in lieu of all other warranties or obligations, express or implied. VMAC expressly disclaims all implied warranties of merchantability or fitness for a particular purpose.

7.3 Warranty claims must be pre-authorized by VMAC, and the components returned via prepaid freight using the designated "Returned Merchandise Authorization" number and form.