Installation, Operation and Service
for
VR70 and VR140
Underhood Air Compressors

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 installation and maintenance. Do not attempt to install or maintain these systems if you do not have the appropriate mechanical training, knowledge and experience.

Follow all safety precautions and standard shop practices for mechanical work.

These instructions are a general guide and do not contain detailed information for installation. You must refer to the installation manual for each specific application. If you have difficulty with an installation or with service, contact VMAC.

To order parts, contact your VMAC dealer. Your dealer will ask for the VMAC serial number, part number, description and quantity.

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Part 1: Safe Work Practices

Safety is an important factor in any work site. Safe work practices produce better results, keep yourself and other workers protected from injury and maintain a good work environment. Working with compressed air introduces additional hazards in addition to the general hazards that exist in the work place. At VMAC, we are concerned about the safety of the people who install, service and use our products.

Safe work habits reduce injuries. We recommend the following general practices when installing or servicing any of our products:

1. Follow sound, recognized shop procedures relating to fire safety. This includes fire prevention practices and evacuation rules. Know the location and operating procedures for fire extinguishers.
2. Before beginning work on a truck, ensure that it cannot roll or move during the installation or repair procedures. Make sure that the transmission is in park, the park brake is fully engaged and the wheels are securely blocked.
3. If you are raising the truck to work underneath, ensure that the truck is adequately supported using approved metal floor stands or properly arranged wooden bridging. Never work under any truck supported only with a jack. If the truck is on a hoist, ensure that the hoist is capable of holding the weight of the truck and that all safety catches are in place.
4. Use all required personal protective equipment. Depending on the work situation, this may include approved safety footwear, hearing protection and eye protection.

Compressed Air Safety

1. Always wear primary eye protection when working with compressed air. In addition, you may want to wear a face shield if the possibility exists that there may be a lot of dirt or dust disturbed when the air is released.
2. Never use compressed air to clean your coveralls or clothing. Air directed at clothing can cause dirt particles to move fast enough to puncture skin.

3. Rapidly moving air exerts incredible force. It can cause physical damage and puncture your skin. If air enters your bloodstream, you will die.
4. Before attempting any component removal or system service, always make sure that the system has been blown-down and that no compressed air is contained anywhere within the system.
5. Compressed air contains oil vapor. Avoid breathing the air from the system.

Truck Safety

1. Never operate a VR compressor system unless the truck transmission is in PARK (automatic) or in NEUTRAL (standard) and the truck park brake is fully engaged. The compressor system increases engine speed during operation. Failure to follow this procedure could result in damage, injury or death.
2. The park brake safety switch and drive disable safety switch are included in the system to maintain safety during operation. Do not bypass or disconnect any of these safety devices.
3. Keep your hands and clothing clear of moving belts and pulleys on the engine.

Part 2: Compressor Basics

Screw compressors (Figure 2.1) operate by trapping air between the meshed screws and reducing the volume of the air as it moves from the inlet to the outlet side of the screws.

The matching screws do not have the same number of lobes. The requirements of the system will determine the combination of lobes. A 4+6 system provides average pressure and volume. A 6+8 system will provide high pressure and lower volume while a 3+4 system will provide higher volume and lower pressures.

Screw compressors can be designed like the lobe compressor, where the screws never touch and are bearing supported and gear driven. These are called "dry" compressors and do not require lubrication for the screws. They do require bearing lubrication and timing of the drive gears.

Another design uses the drive screw to turn the driven screw, or a gear drive with the screws touching. These compressors require oil mist or lubrication to prevent wear.

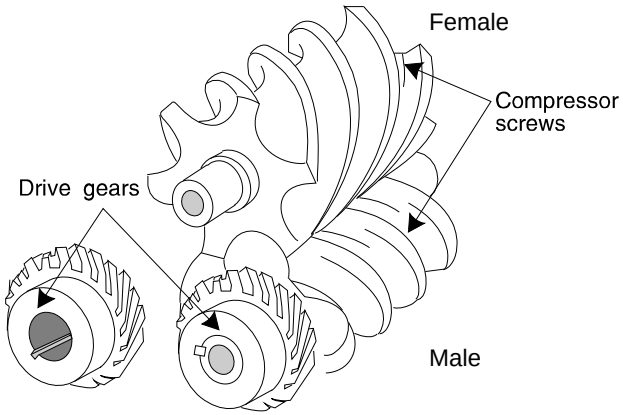

Figure 2.1 Typical screw compressor

Compressor Ratings

Compressors are rated according to:

- type of compressor
- free air delivery
- maximum rated operating pressure
- normal pressure operating range
- operating ambient temperature range at sea level
- air discharge outlet quantity and size

A typical mobile compressor might be rated as follows:

- oil flooded single stage rotary screw type compressor
- 70 cfm
- 175 psig
- 70 - 125 psig
- -20°F to 125°F
- 3/4 inch outlets

Part 3: System Components

The VR system is a compact, efficient, state-of-the-art compressor system designed to fit on a truck without interfering with the operation or use of the truck. It does not occupy any of the valuable work-space and there are no large holding tanks.

The components in a typical VR system include:

- mounting bracket
- compressor
- belt drive system
- tank and tank mounting brackets
- oil cooler
- hoses and lines
- control system and wiring

The VR compressor is belt-driven from the engine crankshaft. The drive system for the compressor is separate from the OEM belt drive system and uses a specially machined drive pulley that mounts on the engine crankshaft, along with the OEM pulley. The compressor is mounted on the engine using a specially-fabricated bracket.

System component location, type and attachment will vary with each application, as will line lengths and mounting. Always check the installation manual for the specific application.

In most cases, no additional parts or accessories are required, but in some instances, you may need to install extra protection for lines or additional truck protection, such as custom skid pans or other devices.

Each system is engineered and designed for a specific application and cannot be adapted for use on other applications. Before you attempt to install a VR system, you must verify that it is the correct kit for the truck.

VR compressor systems also include all necessary replacements for OEM components that might be required, including items such as intercooler tubes, mount brackets, lines or hoses.

Mounting Bracket

The mounting bracket for the VR compressor (Figure 3.1) is designed to provide all of the necessary mounting points originally located on the OEM bracket that it replaces.

It is fabricated to hold the compressor and, as required, the OEM power steering pump, air conditioning compressor and other OEM components such as belt idlers or tensioners.

The bracket is fastened in place using existing OEM threaded locations on the engine block. This means that you do not have to create any additional mounting locations or perform any fabrication for mounting accessories, unless the truck is equipped with after-market products which are not normally found on a production truck.

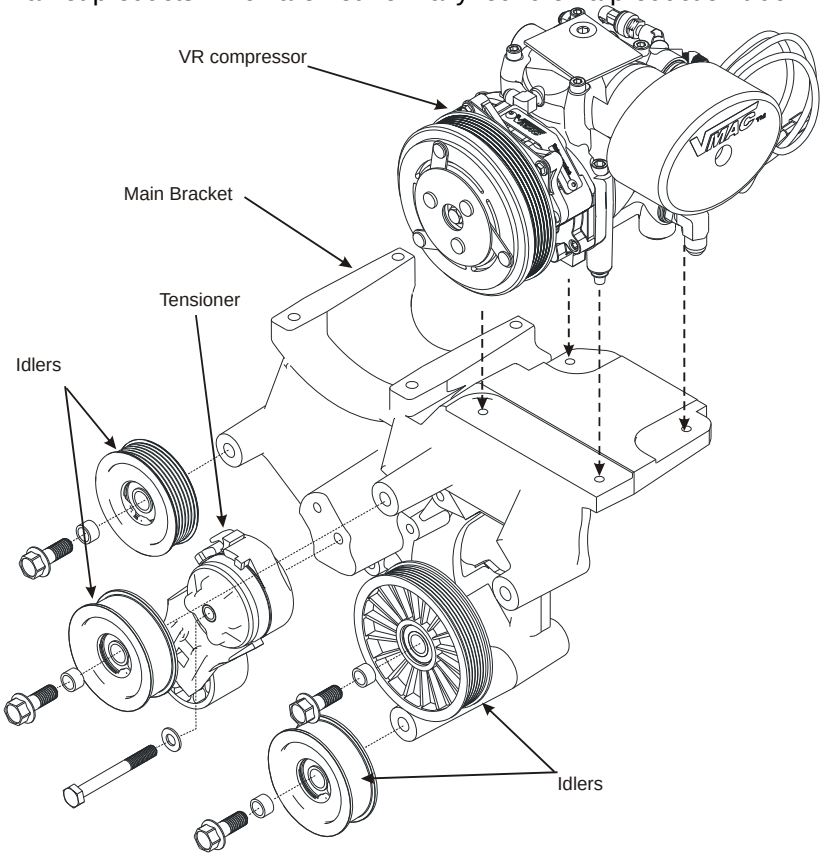

Figure 3.1 Typical main bracket

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Compressor

The compressor (Figure 3.2) is a flooded-lobe rotary screw model. It is driven from the engine crankshaft using an electrically activated magnetic clutch assembly and a flat, multi-V drive belt. The compressor is cooled and lubricated using synthetic oil.

The main components include the:

- electromagnetic clutch assembly
- housing which contains the compressor screws
- gear case with gears
- inlet control valve with filter
- assorted fittings and attachments

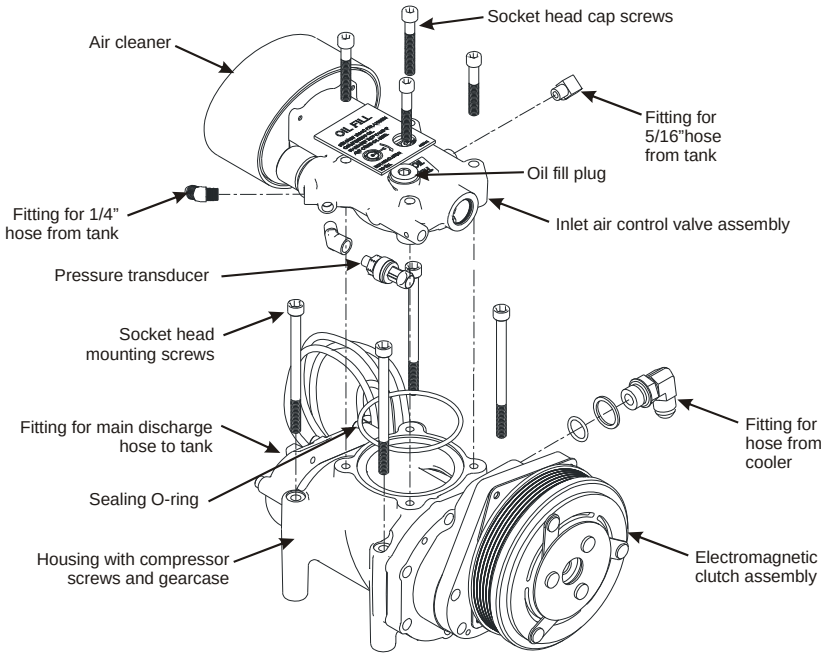

Figure 3.2 Typical compressor assembly

Electromagnetic Clutch

The electromagnetic clutch assembly provides a method of connecting and disconnecting the drive from the compressor. When the engine of the truck is running, the compressor clutch idles, with the outer drive disconnected from the compressor drive shaft.

When the operator selects the “ON” position with the control unit, electricity is applied to an electromagnet which is firmly attached to the front of the compressor housing with socket head cap screws.

The resulting magnetic field attracts a metal plate on the outer drive unit to a matching surface attached to the input shaft. The magnetic attraction is strong enough that the outer unit will turn the input shaft on the compressor.

To function correctly, the clutch assembly must receive at least 12 volts. If the voltage at the clutch is less than 12 volts, the clutch surfaces will slip. Because the electromagnetic clutch is a dry-type clutch, it will be severely damaged if it slips and will have to be replaced.

Engaging the compressor while there is pressure in the system will also cause the clutch to slip because the compressed air in the housing prevents the screws from turning. If you are using the system at intervals instead of continuously, allow system pressure to reduce before attempting to engage the compressor.

Housing and Components

The compressor housing (Figure 3.3) holds the two compressor screws. The screw shafts are supported by high-speed bearings. The gear case contains reduction gears which increase the speed of the drive screw, providing high speed operation to achieve the desired volume and pressure requirements of the system. The main gear is also supported by high-speed bearings.

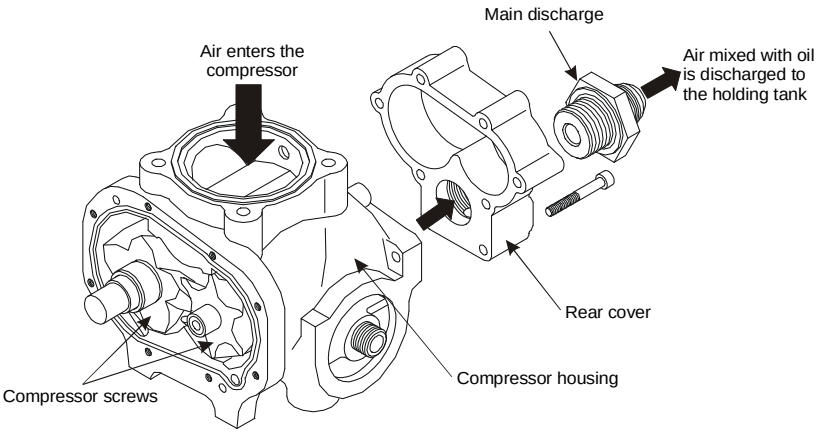

Figure 3.3 Typical housing and gears

The housing covers and the gear case are attached to the housing with socket head cap screws. They are sealed using O-ring style gaskets. The front outer gear case housing has a metal-case lip seal on the drive gear input shaft. The rear housing cover holds the main discharge line fitting.

When the clutch is engaged, the engine drives the input gear, which turns the output gear and the male drive screw. The drive screw then turns the female screw.

Air enters the compressor past the inlet control valve, and is compressed between the two screws. The compressor screws are lubricated with specially-blended synthetic oil, which acts as a seal between the screws and the housing. This oil also lubricates the gears and bearings in the housing.

Compressed air is discharged from the bottom of the screws into the housing and out of the main discharge port. The discharged air also contains a considerable amount of oil, which is removed from the air at the tank.

The compressor housing also contains a temperature sensor. This sensor indicates when the temperature of the system exceeds specifications by illuminating a warning light on the control panel. If the temperature becomes too high, it will disconnect the drive clutch, preventing operation until the system cools.

If the system continuously overheats, you should determine why and correct the problem. Never bypass or disable the temperature sensing device as it may result in system damage.

The compressor housing, screws, bearings, gears and covers are a non-serviceable item. This is a precision-engineered and machined assembly. The only easily-serviceable item on the assembly is the input shaft seal, located on the front cover behind the drive clutch.

Air Inlet Control Valve

The air inlet control valve (Figure 3.4) controls the amount of air that enters the compressor. When the compressor is not operating, spring pressure holds the flat, circular poppet valve against the machined seat.

When the control switch is turned on, the electromagnetic clutch engages and the compressor screws begin to turn. Atmospheric air pressure forces the poppet valve open against the spring pressure and allows air to enter the compressor intake.

As the compressor operates, pressure in the tank begins to increase. The increase in pressure is signaled to the inlet control valve through the pressure control line. This pressure increase is applied to the pressure regulator valve.

As the pressure increases, the regulator valve begins to move off its seat and pressure is applied to the piston on the opposite end of the poppet valve shaft. As the pressure on the piston increases, it assists the spring on the poppet shaft in gradually closing the poppet valve and reducing the amount of air entering the compressor.

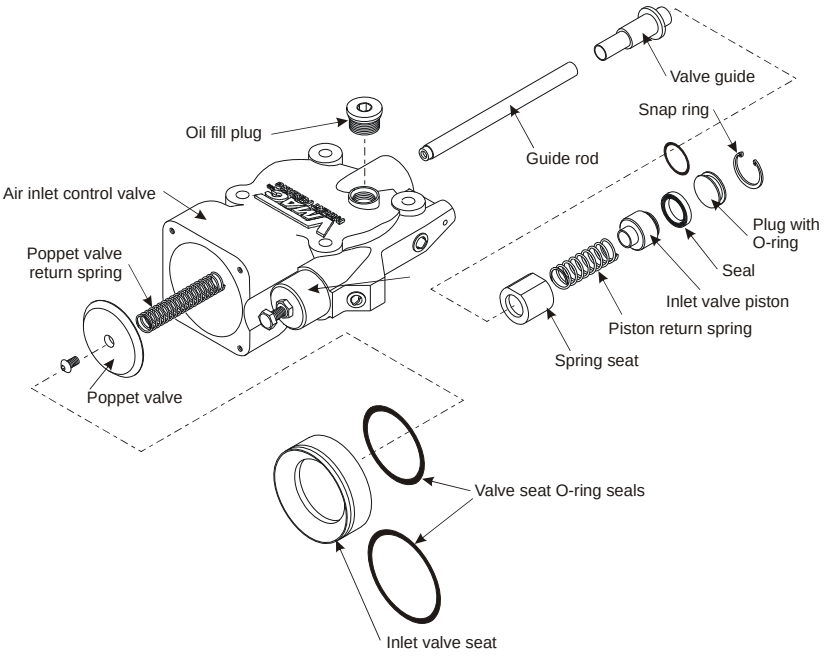

Figure 3.4 Typical air inlet control valve

The pressure regulator determines the amount of air pressure that is applied to the control piston. This permits the pressure to build up quickly in the tank. As the pressure increases, the regulator applies more pressure to the piston to close the valve even further.

The system also changes engine speed to control output. Engine speed is controlled by an electronic throttle control or a pneumatic throttle control.

When an air tool is connected to the system and starts operating, the sudden reduction in air pressure signals the electronic or pneumatic control to increase engine speed. This reduction in pressure also acts on the pressure regulator, allowing the poppet valve to open.

If the air draw requirements are continuous, the pressure regulator and compressor will operate in an attempt to maintain maximum pressure. The poppet valve position is automatically adjusted by spring and air pressure to regulate the intake air flow and maintain the required air flow and pressure. Engine speed is also regulated to meet the air flow requirements.

When the pressure in the system reaches the maximum pressure setting of the regulator, the poppet valve is closed and engine speed is reduced to about 1,000 RPM. The electromagnetic clutch is still engaged and the compressor is turning at minimum speed. To prevent damage to the compressor, the scavenge line provides minimal air return from the tank into the top of the compressor through the inlet control valve.

Some parts of the inlet control valve can be serviced. If the control valve is damaged or does not operate properly and the permissible service does not correct the problem, contact VMAC for repair or replacement options.

Assorted Fittings and Attachments

The compressor and air inlet control valve contain fittings and attachments for connecting lines, electrical connectors and for mounting.

The rear cover on the compressor housing has a threaded fitting in the discharge cavity for the main discharge line to the tank. There is also a fitting on the compressor housing where oil is returned to lubricate the screws and bearings.

The air inlet control valve has fittings for the pressure control line and the oil scavenge line from the tank. It also contains a pressure regulator and a pressure switch

Belt Drive System

The compressor is driven by the engine crankshaft, using a specially constructed drive pulley that usually bolts onto the OEM crank pulley. The belt has either 6 or 8 ribs and is routed around pulleys mounted on the main bracket. Tension is controlled by a spring-loaded tensioner.

Tank and Tank Mounting Brackets

The tank is designed to fit along the frame of the truck. It is very compact and light-weight. The tank is protected by the frame member and the cab or box. The tank may be mounted on either the passenger side or the driver side of the truck.

Tank mount styles (Figure 3.5) vary with different applications. Some tank brackets fasten directly to the frame with hex head cap screws, nuts and washers through existing holes in the frame. Other styles use cable clamping straps which wrap over the frame with a frame backing strap and an L-shaped tank support bracket.

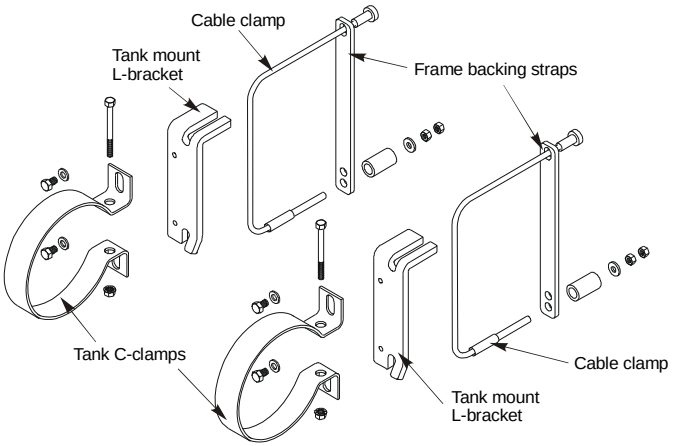

Figure 3.5 Typical tank mount

The tank is secured to the brackets with a wrap-around C-clamp or a split saddle-type clamp.

Regardless of the method of fastening the tank to the mounting bracket, it is important that the tank be mounted securely, oriented in the correct position and situated precisely to allow proper routing of the lines. Tank brackets are designed to maintain the tank in a level position relative to the truck frame.

The tank on the VR system is different from the conventional air receiver on most compressors. While a standard, reciprocating piston compressor receiver stores air and removes most of the moisture, the VR tank has different functions. Because the rotary screw compressor can supply high volumes of air on demand, storing large volumes of compressed air is unnecessary.

The tank is used to remove contaminants and oil from the air before it is delivered to the tool. It also assists in removing some of the heat from the air-oil mixture by dissipating it through the metal housing.

The coalescing filter element provides a major role in removing contamination and oil from the air. This filter element must be replaced at recommended service intervals.

The scavenge tube draws oil from the tank and returns it to the compressor air inlet valve. This ensures a minimum air flow when the compressor is idling and the poppet valve is closed. This prevents damage to the inlet control valve. The filter screen on the pickup tube must be checked and cleaned or replaced at recommended service intervals.

The tank contains all necessary line fittings, a pressure relief valve and a sight glass for checking oil level. There is a drain plug in the tank for changing compressor oil. The system oil filter is located on the front of the tank.

All VR tanks are pressure-tested for performance and safety before being shipped.

Oil Cooler

The oil cooler (Figure 3.6) is a very important part of the system. As the air is compressed, heat is developed. Some of the heat is dissipated through the compressor housing, tank and lines, but the majority of the heat is absorbed by the oil.

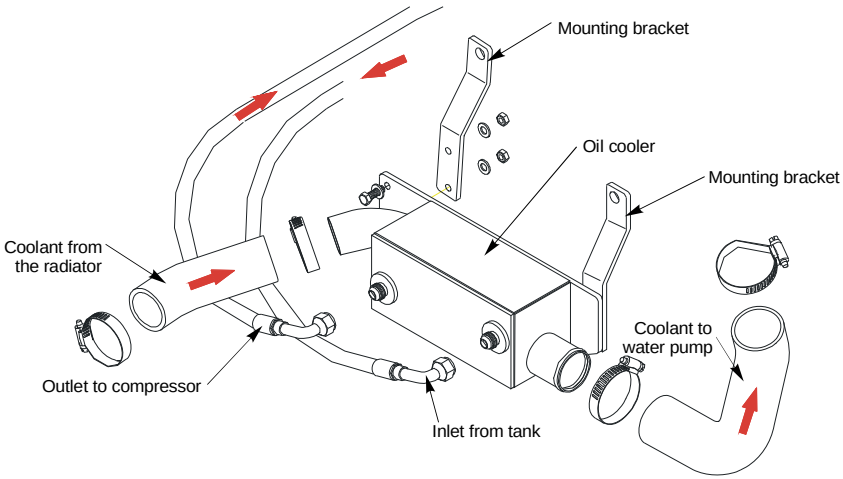

Figure 3.6 Typical oil cooler

Once the oil is separated from the air in the tank, it is returned to the compressor through the oil cooler. The oil cooler is a liquid-to-liquid cooling system which uses the engine cooling system to remove the excessive heat from the oil.

All VR oil coolers are tested for efficiency and are designed to provide the optimum operating temperature for the oil. The coolers are designed to fit easily into the cooling system and provide efficient operation without affecting the function of the engine cooling performance.

Oil and air from the compressor flow to the tank through the main discharge line. This oil is hot because of the energy transfer in the compression process. Hot oil from the tank flows to the inlet side of the oil cooler and flows through the oil tubes in the cooler.

Engine coolant flows in the opposite direction around the oil tubes. As the engine coolant flows past the oil tubes, heat is removed from the oil. The oil flows out of the cooler and back to the bottom of the compressor, where the process repeats.

It is very important that you connect the cooler lines exactly as indicated in the installation manual to ensure that the flow of compressor oil and engine coolant are opposite. This opposite flow maintains optimum cooling of the oil.

The oil cooler is a non-serviceable item. If it is damaged or leaks, it should be replaced. The cooler should be cared for as part of the cooling system. Maintain the correct coolant levels and flush along with the rest of the system.

If any portion of the compressor system is damaged and there is any possibility that the cooler may have metal particles or other contamination, flush the cooler with clean oil before operating the system with replacement components.

Hoses and Lines

The hoses are easy to identify because the hose size is exclusive to each portion of the system. All of the hoses are high-pressure with swaged fittings. The size identification is as follows:

- 3/4 inch or larger is the main discharge from the compressor
- 1/2 or 5/8 inch hoses return oil from the tank to the cooler and back to the compressor
- 5/16 inch hose is the oil scavenge to the inlet control valve
- 1/4 inch hose is the pressure control line to the inlet control valve

All of the hoses are equipped with end fittings that are selected during the design process to best fit each application. These lines may have straight fittings, 45 or 90 degree fittings or they may use swivel fittings for the most accurate fit. Hoses are sized in length to provide the optimal fit without being too long or too short and all of the hoses are tested for quality.

Control System and Wiring

The VR system controls compressor operation, engine speed and provides for safe operation in all situations. Components may vary with different applications. A typical system includes the:

- operator control box
- electronic switching box
- interface connector
- engine speed controller
- temperature and pressure sensors

Operator Control Box

The control box (Figure 3.7) provides convenience in operating the system. There are different styles of control unit, but the functions remain the same. The control box contains an ON/OFF rocker switch, operation light, overheat light and an hour meter.

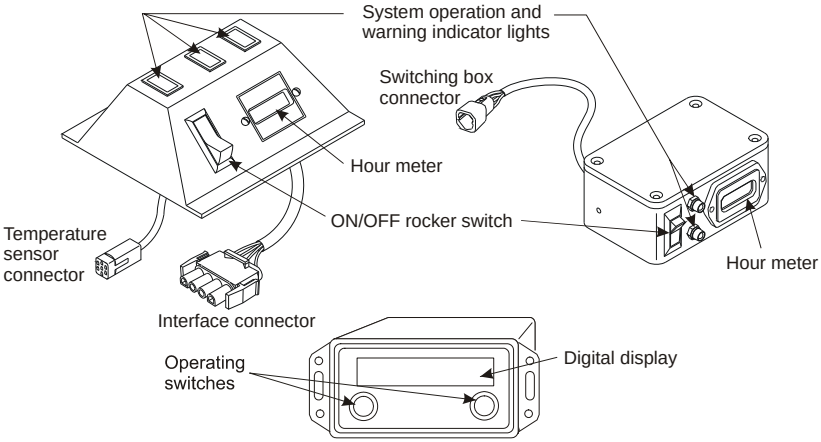

Figure 3.7 Typical control boxes

The control box is normally mounted inside the cab in a location that is easy to reach, can be seen readily, but is situated away from possible damage.

To operate, the transmission must be in PARK (automatic) or NEUTRAL (manual) and the park brake must be firmly engaged. Once these conditions have been met, the rocker switch is moved to the ON position, the operation light illuminates and the system begins to operate.

Note that once the system is activated, engine speed will increase and then gradually decrease as pressure increases. The control unit is a non-serviceable item. If it is defective or damaged it must be replaced.

Electronic switching box

The electronic switching box (Figure 3.8) performs all of the electrical functions in the system. It contains the necessary elements to turn the compressor switch on and off, route power and act as an interface between system components.

The electronic switching box is normally mounted under the dash. As with the control unit, the switching box is a non-serviceable item.

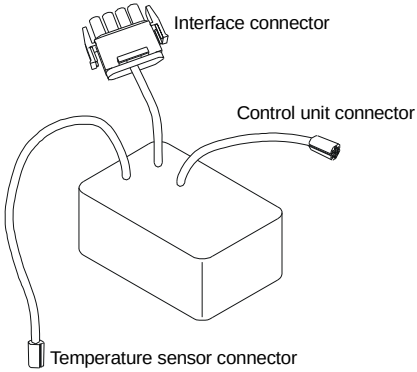

Figure 3.8 Typical switching box

Interface connector

The interface connector (Figure 3.9) provides a convenient method of attaching individual wires to different portions of the system and to the truck power supply and ground.

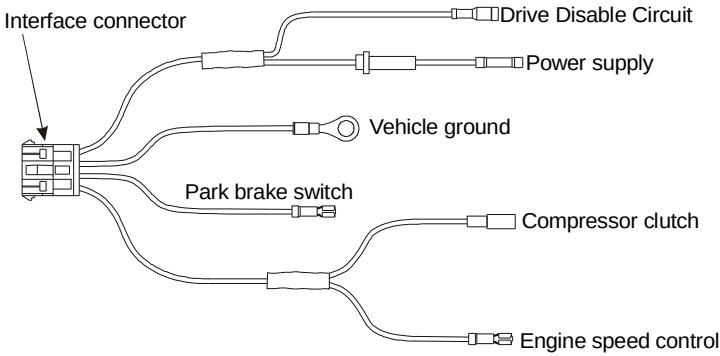

Figure 3.9 Typical interface connector

Although most of the connections from the interface connector are the same throughout all of the systems there may be some variation in wiring with each individual system application.

Always check the wiring diagram in the installation manual of each system for the correct connections.

The interface connector provides for a system ground, power supply, control connection to the compressor clutch and connection to the engine speed controller.

For safety, the interface connector also provides for a Drive Disable Circuit (on trucks with an automatic transmission) and a connection to the OEM emergency brake light switch. This ensures that the system will only operate if the park brake is applied and the automatic transmission is in PARK.

The Drive Disable Circuit has different wiring for different OEM applications. Always check the wiring information in the installation manual for the correct connections.

Engine speed controller

The engine speed controller is an important component used to regulate compressor performance. Used in conjunction with the pressure regulator, the engine speed controller can be adjusted to change operational conditions. You cannot accurately set system pressure and flow simply by changing the setting pressure regulator.

Method of control may be electronic (Figure 3.10) or pneumatic (Figure 3.11), depending on the application.

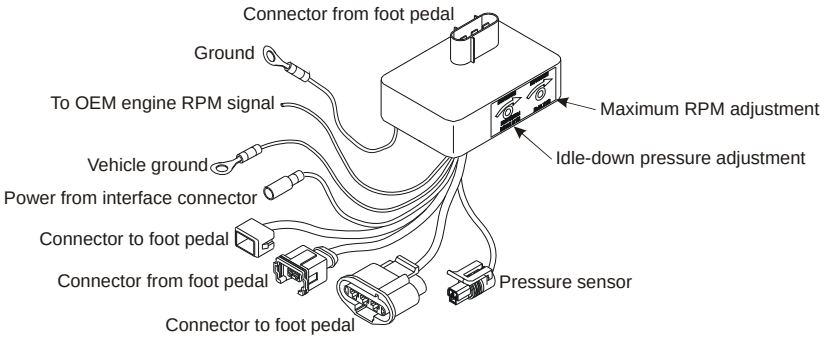

Figure 3.10 Typical electronic controller

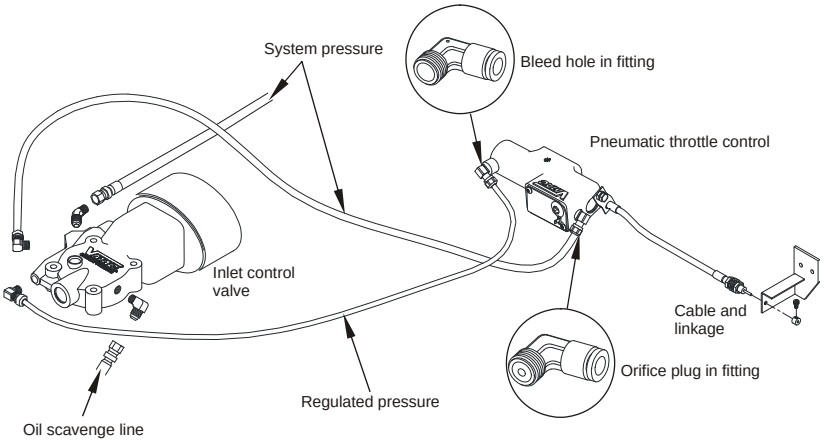

Figure 3.11 Typical pneumatic controller

Engine speed is controlled by the amount of fuel delivered to the cylinders. This is achieved by using an engine control computer. When the operator presses on the foot pedal, an electronic signal is sent to the computer, indicating the relative position of the foot pedal, ranging from idle to wide open. There is usually no mechanical connection between the foot pedal and the engine. This signal is used to determine the amount of fuel which relates to engine speed.

The VR electronic engine speed controller is connected between the engine control computer and the electronic foot pedal. It receives an engine speed signal from the crankshaft position sensor or other OEM sensor that provides accurate information directly related to engine speed.

When the operator switches the VR control panel to the ON position, the electronic speed controller sends a signal to the engine control computer to increase engine speed to a preset value. At the same time, the compressor clutch is engaged and the system begins to pump air.

As pressure increases, the pressure sensor on the inlet control valve sends a signal to the electronic engine speed controller, indicating that it should start reducing engine speed. When pressure reaches the maximum setting, engine speed is reduced.

The electronic engine speed controller is adjustable. There are two settings, maximum engine speed and idle-down pressure. Changing the maximum engine speed will affect the amount of air being delivered by the system. Changing the idle-down pressure will affect the pressure at which the RPM increases. If you change maximum engine speed, you must also reset the idle-down setting. Adjustments must also be made to the pressure regulator for accurate control.

The electronic control unit is not serviceable. If defective, it must be replaced.

Some trucks have mechanical linkage connecting the foot pedal to the inlet valve on the engine. The only electronic connection relating to throttle position is the throttle position sensor, so a pneumatic engine speed controller is used on these trucks.

When the operator turns the control unit switch to the ON position, the electromagnetic clutch engages and a signal is sent to the pneumatic controller. The controller opens the throttle using a cable attached to the OEM throttle linkage. The engine speed increases to a preset value and the system begins to operate.

As pressure increases, the pneumatic controller senses the change in tank pressure and regulated pressure through poly-tubes connected to the inlet control valve. As these pressure values change, a piston inside the controller moves the cable, reducing the engine speed in proportion to the pressure changes.

When system pressure reaches maximum, the engine speed controller will have returned the throttle to the idle position.

Linkage attachments and cable adjustments vary with different trucks and engines. Always check the appropriate installation and owner manuals for the correct attachments and adjustment.

The pneumatic engine speed controller is adjustable, but not serviceable. If the unit is defective, it must be replaced.

System Flow

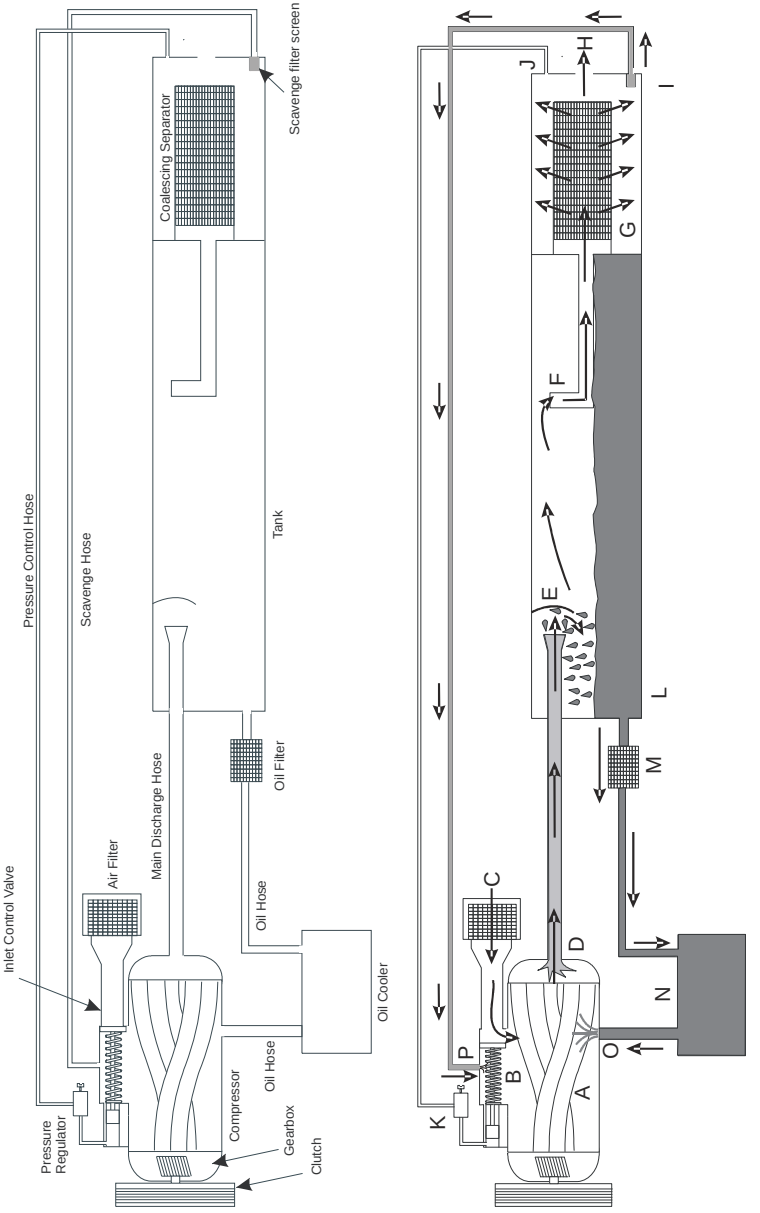

Figure 3.12 System components and operation

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When the operator moves the switch on the control box to the “ON” position, compressor clutch engages and the throttle control increases engine speed. The belt drive turns the clutch assembly, which turns the compressor screws (A) using gears in the front housing.

A low pressure is created above the compressor screws and, aided by atmospheric pressure in the inlet, forces the poppet valve (B) open against spring pressure, allowing air to enter through the air filter (C) and into the upper part of the compressor body.

Air is rapidly moved from the top of the compressor body to the bottom by the screws (A) and an air-oil mixture is discharged from the rear housing (D) to the tank (L) through a hose.

In the tank (L) virtually all of the oil is removed from the air through centrifugal action and a baffle (E). The air continues through a tube (F) and into the coalescing separator (G) where the remainder of the oil is removed and collects on the bottom of the tank. The clean air is supplied to air tools through the tank outlet (H).

If there is no demand for air, the pressure in the tank will rise rapidly. This pressure is signaled to the piston on the inlet control valve poppet valve (B) through the pressure regulator (K) and to the throttle control through either a pressure sensor (electronic control) or a pneumatic throttle control (mechanical control). This signal tells the throttle control to reduce engine speed. This reduction in compressor speed and the increase in pressure behind the poppet valve piston assists the spring in closing the poppet valve (B) and the compressor goes into an idle mode.

The remaining oil under the coalescing separator is drawn off through a filter screen (I) and the scavenge line to the inlet valve of the compressor (P). During idle mode, this oil also provides sufficient lubrication to the compressor screws to maintain a sealing layer of oil between the surfaces of the two screws.

Air pressure in the tank forces the oil from the tank (L) through a pickup tube into the oil filter (M) to remove dirt and other contaminants. It then travels through the oil cooler (N), where the temperature is reduced.

From the cooler, the oil is returned to the compressor and injected (O) as an atomized mist directly between the rotors. The oil carries away contaminants and dissipates most of the heat created during the air compression process. The air-oil mixture leaving the compressor is very hot and will lose some heat to the air through the hoses and tank, but most will be removed by the cooler.

Part 4: Installing a System

The VR kit is a complete package. All of the necessary parts and pieces are included in each kit. You will require your own tools and a few minor items, such as Loctite, electrical tape and any extras that you might want to add, such as additional line protection or more nylon ties and insulated clamps. You will also need to supply your own outlet fittings and connections. For example, you might want to route flexible or steel line to the back of the truck and install a quick connector that is easily accessible for connecting tools.

The following tips and procedures will make the installation process smooth and error-free. Our procedures are based on experiences in the design and development process, our own installations and feedback from installers like yourself who have found better ways to get the job done right. We encourage you to provide us with your valuable experiences so that we can constantly improve our installation and operational documentation manuals.

You must have the installation manual from the kit before beginning the installation.

Before you start

Before you begin to install the system on the truck, there are some steps you should take to ensure that the installation process is as trouble-free as possible.

1. Open the packing boxes and locate the large envelope that contains the documentation. This includes an owner's manual, installation manual and other documents.
2. Accurately identify the truck make, model, production year and engine type. Also determine if the truck has air conditioning and if there are any other after-market products attached to the engine or frame that could interfere with the installation.
3. Match the identification that you have made on the truck with the application information on the kit documentation. Make sure that the application is exactly correct. For example, if you have a 2005 Ford F350 with a V10 engine and air conditioning but the kit states that it will fit a 1997-2000 Ford E350 with a V8 and without air conditioning, you will have problems because the components will not be correct.

Recording information

Remove the compressor and tank from their individual packing. Locate the installation manual in the documentation package and open it to the inside back cover, where the warranty registration form is located. You should photo-copy this form once you have filled in all the information. That way you will always have a permanent record of the necessary numbers in the back of the manual.

1. Record the serial number from the VMAC tag fastened to the compressor housing on the appropriate line on the warranty form.
2. Locate the envelope which contains the VMAC system serial number plate and application instructions in the package.
3. Record the serial number from the plate on the appropriate line on the warranty form.
4. Make sure that the rest of the warranty form is filled-in correctly.
5. Copy the form and mail or fax the form to VMAC. You can also complete the registration online at www.vmacair.com.

Tips for a smooth installation

The installation process should start with some preparations that will make the job easier and faster.

1. Remove all of the components from their packing and identify them. All kits contain an illustrated parts list showing the parts that have been included in the kit.
2. Read the installation instructions before beginning, even if you have installed many kits. Products and procedures change on a regular basis, as more research and development find more efficient or effective methods of producing and installing the components.
3. If you have installed many kits, you will be able to quickly browse through the instructions and spot the changes. This procedure will reduce your frustration when you cannot make the components fit the way they did on previous installations.
4. If this is one of your first installations, it will make the job easier because you will be more familiar with the process.

5. Pressure-wash or steam-clean the frame rails under the cab where the tank will fit, the area where the cooler will mount and the engine, if it is very dirty. This will ensure that the components fit correctly without interference.
6. You may find it easier to complete the installation if you raise the truck on a hoist or with a floor jack. If you use either of these devices, make sure that you take care of your personal safety and use approved floor stands or blocking devices under the truck. Also make sure that the truck wheels are blocked so that it cannot roll.
7. Locate a container that is large enough to hold all of the coolant from the engine and radiator.
8. Always use Blue Loctite on fasteners as indicated in the installation instructions or in situations where fasteners may vibrate loose.

Installing the Components

The installation procedure should occur as a series of planned events. As each event is completed, all of the tasks required for a good installation will also be completed. By following this procedure for every installation you will ensure that there are no loose fasteners, fittings or missing components.

The installation manual that is shipped with the kit is designed so that you can check off each step, further ensuring that you do not miss any important items.

Getting ready

Once you have familiarized yourself with the installation procedures, you can begin. An organized procedure will follow these steps:

1. Installing the tank and lines.
2. Removing OEM components.
3. Installing the bracket and compressor.
4. Installing the cooler.
5. Installing and connecting the control components.
6. Completing and verifying the installation.

You may find that in some installations, the procedures are not in this exact order. For example, in some applications you may be instructed to install the bracket and compressor before the tank.

After you have installed a number of systems, you will establish your own sequence of events that are easier for you.

While we encourage you to find the best approach for yourself, we also caution you to always make sure that the procedure in the installation manual has not been changed to reflect upgrades or modifications to components. One of the most common reasons for installation and operation problems is failure to read the documentation that is included in each kit.

You will have to drain the cooling system before you begin, as you will be removing OEM cooling hoses. You can install the tank and lines while the cooling system drains. By the time you have completed the tank installation, the cooling system will be empty and, if the engine was hot, it will have cooled considerably.

1. Installing the Tank and Lines

The tank is designed to be mounted onto the frame using the special brackets. Every kit contains accurate documentation that shows the position of the tank on a specific application. You may find that in your application, there may be slight differences from the pictures shown in the installation manual.

The brackets and tank can be adjusted along the frame as required to ensure that the lines reach all of the other components correctly and are not stretched tight or too loose and hanging down. Of all the components in the system, the tank is the only one that can be adjusted. All of the others are fixed in position.

The following information can help make the tank installation easy and accurate:

1. Make sure that you know how the mounting brackets assemble. Some kits may provide additional parts for different models. For example, in the kit which fits the GMC CK2500, CK3500 and HD3500 trucks, there are three backing strap brackets, three retaining cables and four spacers.
2. The documentation information indicates which combination is to be used on each different frame size. Knowing this before-hand makes installation easier.
3. Make sure that the tank is correctly mounted on the brackets with the sight-glass forward and the “THIS SIDE UP” arrow pointing up. This is very important, because if the tank is not positioned correctly, the system will not work correctly and could become damaged.

4. Be careful that the brackets or the straps do not trap and damage any OEM wiring, speedometer cables, air lines or other components. In most cases, these items have been identified in the installation manual because they have been encountered during design. It is very common to find variations in truck design and manufacture that will place components in different locations than on the truck which was used during the design process.
5. If you are working alone, it is a good idea to use floor stands to support the tank while you connect the brackets. Although the tank is not very heavy, it can often be difficult to hold the tank in position and install the retaining devices.
6. Make sure that the brackets fit snug against the frame and do not encounter bolt heads, rivets or welds that will cause them to move or distort when tightened.
7. When you tighten the brackets in place, particularly when using the style that have cables, be careful not to over-tighten the cables. This can stress the threads and cables and may also stress the frame rail. Always remember to install the second locking nut on the cables.
8. Never assume that a filter or line fitting is properly tightened. All tank fittings have been tightened and the tank has been tested, but if there are lines attached, always check to make sure that they are tight. In some cases, you may have to leave the line fittings loose at the tank so that you do not have to twist the line to make it fit the cooler or compressor fittings.
9. Line routing should follow the most accessible route to the engine compartment without exposing the lines to damage from hot exhaust manifolds, moving parts or road exposure.
10. During operation, the lines will change dimension slightly, as pressure increases and decreases. Make sure that the lines are secured, but not stretched, bent tight or kinked so that they can move slightly.

2. Removing OEM components

Before you can install the kit, there are some preparations that you must perform. These include the removal of OEM parts and components. The components that must be removed vary with each application. Generally, these will include:

- battery cables
- upper and lower radiator hoses
- fan and fan shroud
- OEM drive belt and idlers
- power steering pump pulley
- OEM crankshaft pulley
- air cleaner boxes and ducting
- turbocharger ducting
- heater hoses
- block coolant fittings
- OEM power steering, alternator and air conditioning brackets
- OEM clips and fasteners
- OEM cab trim, fittings and covers

Some of the OEM components will be installed back on the truck after the installation is complete. Other components will not be used. You should store those components in a secure place, as they will be required if the VR system is removed from the truck. Do not dispose of these components.

Some OEM components, such as radiator hoses, may be modified for use with the VR system. If the system is removed from the truck, these components will have to be replaced.

In some applications, you will need special tools, such as a proper power steering pulley tool or other OEM tools.

3. Installing the bracket and compressor

The installation of the bracket and compressor is relatively straight-forward, but there are some procedures that can make the installation easier.

1. After removing the necessary OEM components, fit the bracket in position and make sure that it fits flush with the mounting points. Watch for small items such as exhaust manifold gaskets that stick out, raised casting ridges, the edge of a valve cover or other items that will interfere with the fit. The installation manual normally addresses these issues, but because of manufacturing variations, you should always check before fastening.

2. Incorrect fit will affect drive belt alignment with the crankshaft pulley which will result in premature belt failure or cause the belt to continuously fly off the pulleys.
3. Always check the torque on the idler and tensioner fasteners. If instructed, remove them, apply Loctite and torque them to specifications.
4. We recommend that you always torque fasteners to specifications, but circumstances occur where you may not be able to reach the fastener with a torque wrench. In these cases, make sure that the fastener is adequately tightened, but not over-tightened.
5. Always thoroughly clean the inside of the OEM crankshaft pulley before installing the VR pulley to make sure that the fit is not affected. If there is any contamination inside the OEM pulley, the VR pulley could tighten out-of-line or could be damaged when the fasteners are torqued.
6. Always check the alignment of the crankshaft pulley, compressor pulley, idlers and tensioners to make sure that they line up correctly. If there is any doubt, use a straight-edge.
7. When installing the studs in the compressor housing, always use Loctite and make sure that the studs are installed with the notched end in the housing. This helps to hold the studs in place and prevents loosening from vibration.
8. In some applications, the bracket mounting fasteners must be installed in a specific sequence or you will not be able to get them all in place. Make sure that you check the installation instructions for these sequences.
9. After routing and attaching the lines from the tank to the compressor, make sure that you tighten the fittings at both the compressor and the tank.
10. Do not use teflon tape on any fittings unless specifically directed.

4. Installing the cooler

The oil cooler has been designed to mount as close to the coolant source as possible without interfering with other OEM components. Every attempt has been made to use existing frame or body holes, but you will occasionally have to drill additional holes for full support.

1. Use sound, safe shop practices when drilling holes in truck components. Be careful that you do not drill holes into components that may be behind the panel.

2. When cutting OEM hoses, always follow the measurements indicated in the installation manual. In most cases, hoses that are part of the kit are attached to the cooler before shipping to make installation easier.
3. Always make sure that the coolant flows through the cooler in the opposite direction of the oil. Follow the connection procedures as indicated in the manual.
4. After attaching the lines to the cooler, make sure that fittings on both ends of the lines are tightened securely.
5. Always check all hose clamps to make sure that they are correctly positioned and tightened.

5. Installing and connecting the control components

Procedures for installing and connecting the pneumatic engine speed control are different than for the electronic engine speed controller. Some electrical connections, such as the power source connections, ground connections and emergency brake connections are the same. There are also different procedures for automatic and manual transmission trucks. Make sure that you read and understand the connections and that you use the wiring diagram in the installation manual.

1. Make sure that all wiring and components are securely fastened in place and will not interfere with truck operation. In addition to being a potential hazard, loose wiring and components can be damaged.
2. Make sure that all wiring connections are protected from weather damage. If a connection is made externally, protect it with a shrink sleeve or electrical tape.
3. Always make sure that the safety features (emergency brake connection and the drive disable circuit) are installed. These safety features are included to prevent injury or death. When the VR70 system is engaged, engine speed increases. If the transmission is left in gear and the system is engaged, the truck will move suddenly.
4. Always check the voltage at the clutch connector when the system is engaged. If voltage at the connector is less than 12 volts, the clutch will slip and be destroyed.
5. On trucks using the electronic controller, make sure that the foot pedal connections are inserted into the connections firmly and completely. If they are not correctly installed, the engine will not respond to the foot pedal.

6. Make sure that wiring which is routed under trim panels will not be damaged by hold-down screws or sharp body edges when the trim is replaced.
7. Secure all underhood wiring and, if necessary, protect the wiring with plastic loom.
8. Be careful when tapping into OEM wiring. Make sure that you select the correct wire and insulate the connections properly.
9. Make sure that the power source is only hot when the truck key is in the ON position.

6. Completing and verifying the installation

When you have completed the installation of the components, you must complete the installation by filling the system with the supplied lubricant and replacing most of the OEM components that you removed in preparation for installation.

When you fill the system with oil, turn the compressor using the cap screw in the center of the clutch as you pour the oil in through a small funnel. Make sure that you allow sufficient time for the oil to settle into the tank. Check the sight glass regularly as you add oil so that you achieve the correct level. After you operate the system for the first time, allow the oil to settle and check it again to make sure that it is correct.

Replace OEM parts, such as the air cleaner box, ducting, turbocharger tubes, battery cables. If the system has a pneumatic controller, make sure that the throttle bracket and cable will clear any OEM covers that might fit over the assembly. The installation manual will identify any situations where parts of covers might need to be cut-away.

Before starting and operating the system for the first time, verify that you completed the installation correctly. Check all fasteners and fittings to make sure that they are tight. Check the routing of lines and electrical wiring. Make sure that wires, lines and hoses are secure and away from potential damage or interference with truck operation. Make sure that the main discharge line is not higher at any point than the compressor.

Generally, you should inspect your own installation with a critical eye, looking for potential areas where you either missed tightening a hose clamp or installing a security fastener. If you establish a habit of checking your own installations carefully, you can avoid operating problems or damage to the system or the truck.

The first operating cycles of the system are the most important. During this period you have to carefully observe the system to make sure that there are no problems or malfunctions. You should also read and record engine speed, cut-in and cut-out pressures and other information so that you have base-line measurements that you can use later if you have to diagnose problems.

The system is adjusted at the factory to deliver 50 CFM, but you may need to change those adjustments so that the system meets the requirements for your specific application. You can adjust it to achieve 70 CFM, but call Technical Support before attempting this adjustment. Making the right adjustments at this time can prevent problems later.

Preparing to operate

Before you start the system, you must install a connector into the outlet of the system. Depending on your application, this could include a right-angle adapter and quick-connect or could be a flexible line that runs to a remote location.

We recommend that you purchase the factory test device (part number A700052) with an orifice size of 3/16 inch for the VR70 and 1/4 inch for the VR140 or you can construct a device as shown in Figure 4.1 and install this into the tank outlet so that you can control and monitor system operation.

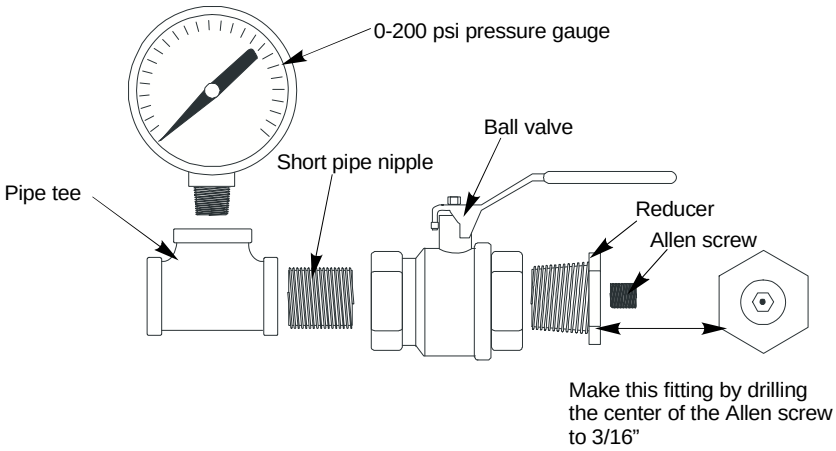


Figure 4.1 Typical test device

If you use a solid plug rather than a reducer, you must drill out the inside of the plug (Figure 4.2), as a straight, small hole through the solid plug will not provide proper operational simulation..

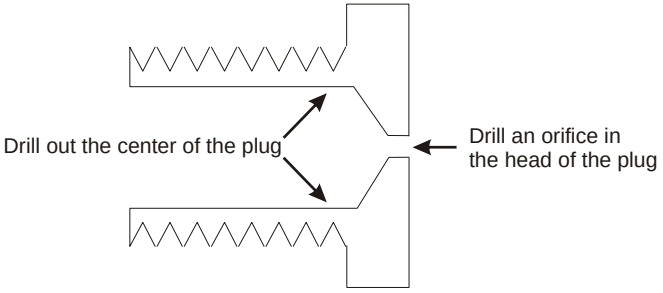


Figure 4.2 Drilling the orifice

Once you have installed the test device and have verified that the installation is complete, you are ready to start the system for the first time.

Starting the System

The following procedures are recommended for starting and inspecting all systems:

1. Make sure that the truck is within 15 degrees of level (Figure 4.3).

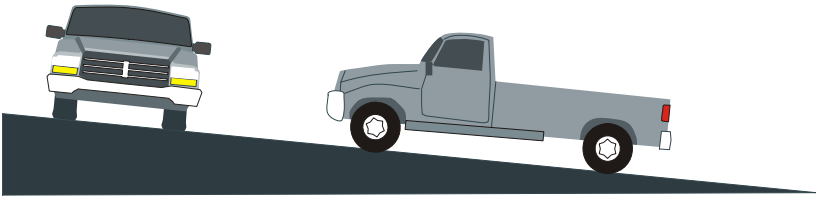


Figure 4.3

2. Sit in the driver's position and firmly engage the park brake.
3. Make sure that the transmission is in PARK (automatic) or NEUTRAL (manual).
4. Start the engine and allow a few minutes for the idle to stabilize.

Follow the operating instructions in the installation manual. The test sequences will vary with different applications.

5. Note the RPM of the engine if the truck has a built-in tachometer.
6. Note the pressure on the gauge when the engine speed begins to reduce.
7. Note the pressure on the gauge when the system returns to idle.

8. While the system idles, do an inspection tour. Check the following:
    - drive belt, idlers and tensioners to make sure that the belt runs true and straight
    - lines and hose to make sure that the fittings are not leaking
    - oil cooler and engine cooling system to make sure that there are not leaks
    - coolant level in the cooling system as the engine warms up to operating temperature
    - lines and fittings at the tank for leaks
    - VR filter for leaks
    - any unusual vibration or grinding noises
9. Once you are satisfied that everything is operating normally and that the engine cooling system level is correct, open the valve on the test attachment.
10. Watch the gauge and record the pressure at which the engine speed increases.
11. Open the ball valve on the test tool and observe the engine tachometer. Engine speed should increase to about 1,800 - 2,200 RPM.
12. Close the air valve slowly to allow the system pressure to rise.
13. Once the system pressure is at maximum, slowly open the ball valve on the test tool until the pressure on the gauge begins to drop. Engine speed should start to ramp-up when air pressure drops to approximately 140 PSI.
14. Continuously check for any leaks or other possible problems, such as the over-heat light illuminating.
15. Operate the system for about one hour if possible; fifteen minutes at 2,000 RPM, then slowly begin to close the valve, allowing the engine speed to reduce until you finish with about fifteen minutes at idle.
16. When you are satisfied that the system operates correctly, turn the rocker switch to the OFF position. Listen carefully to hear that the automatic blow-down functions properly..
17. Turn the engine off.
18. Wait a few minutes to allow the oil to drain back into the tank. This is a good time to do a final inspection of the installation and to check for leaks and line security.
19. Check the oil level at the tank. If necessary, add oil.

If the system is to be used with a tool which has specific flow and pressure requirements that are not adequately met by the factory settings, you will have to adjust the system with the tool in place and operating. The system operates most efficiently at 150 psi; if you are using tools that require a lower operating pressure, install a pressure regulator.

Adding Accessories

If you decide to add an additional air tank (receiver) to the system or if the truck already has an air receiver (Figure 4.4) and you are upgrading the compressor, you should consider the following requirements:

1. When installing a secondary air receiver in the system, ensure that the secondary receiver inlet is NOT at the bottom of the tank, but is located as high as possible on the tank. If the inlet is on the bottom of the tank, moisture will condense out of the air and flow back into the VR tank, causing damage to the system.
2. Install a one-way check valve in the line between the VR tank and the secondary receiver to prevent pressure in the secondary receiver from flooding the VR system. If there is pressure in the system when the switch is turned ON, the compressor will stall, the clutch will slip and suffer damage.

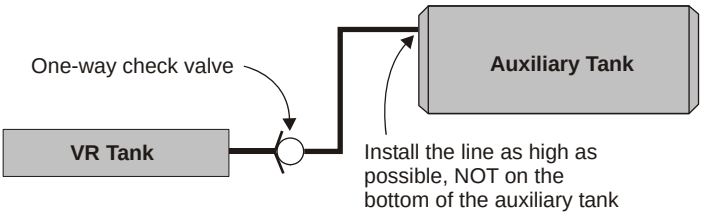
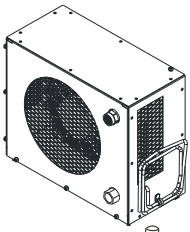


Figure 4.4 Auxiliary receiver

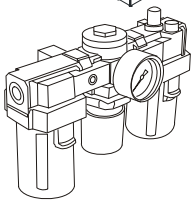
Use a check valve any time that you are connecting a storage tank, air dryer or any other major component after the VR tank.

The following accessory products for your VR compressor system are available from VMAC.



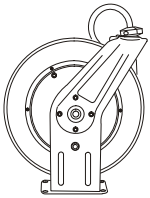
Eliminator Aftercooler

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



Filter Regulator Lubricator

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

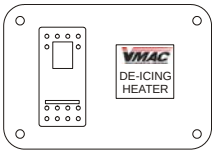


Hose Reel

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

Air Receiver Tank

Thirty-five gallon capacity in a compact tank, complete with fittings and a gauge.



De-icer Kit

Insulated rope heater prevents freezing of lines and regulator.

Service Kits

Using OEM service products will extend the life of your system. Includes oil, filters, seals and O-rings. 200 hour and 400 hour service interval kits are available

Part 5: Adjusting the System

The VR system output is controlled by both the pressure regulator on the inlet control valve and by engine speed. The system is adjusted at the factory for average requirements. You may find instances where the demand for air exceeds the output of the compressor or that the pressure is insufficient for the application. You may also find situations when the air supply is too great or the pressure is too high. When these situations occur, you will have to adjust the system.

Adjustment Precautions

To prevent damage to the system and to avoid an unsafe situation, you should observe the following precautions:

1. The tank contains a pressure relief valve that is set to activate when system pressure exceeds 200 psi. If you only adjust the pressure regulator, you can easily exceed this setting. If the pressure relief valve opens, it could result in rapid oil loss, which may damage to the system.
2. When adjusting engine speed, never exceed 2,600 engine RPM, as this will over-speed the compressor and will cause damage.
3. Always determine the requirements before making adjustments. If there is insufficient air pressure developed in response to high demands, check engine speed before attempting to adjust the regulator.
4. Before attempting any adjustments, always make sure that the system is at operating temperature and that the oil level is correct.
5. If you are operating the system in sub-zero climates, allow the engine to run for approximately 15 minutes after reaching operating temperature before operating the VR system. This will allow the VR oil cooler to transfer some engine heat to the compressor oil in the system. It will also allow the VR compressor to absorb some heat from the engine.

Adjusting the Pressure Regulator

The pressure regulator is adjusted to limit maximum pressure to a safe level. Because pressure and flow are related, this adjustment is also very important for optimum performance. You cannot accurately adjust system flow by using the pressure regulator.

Throttle controls are set at the factory to approximately 2,000 RPM. Adjustment of the throttle to provide the required airflow for specific tools can be achieved by following these setup instructions.

Do not exceed 2,600 RPM when running the compressor.

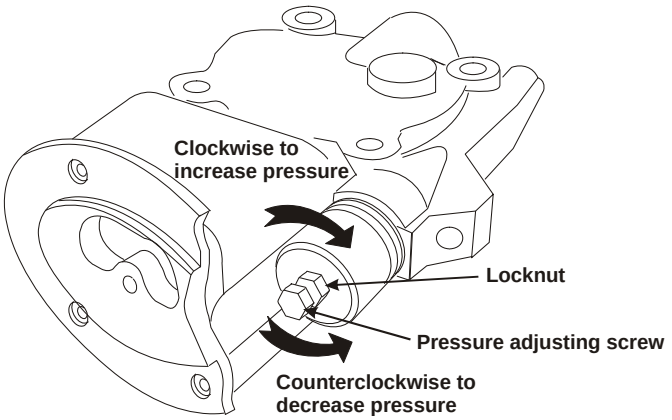
Attempting to change flow by adjusting only the pressure regulator can raise system pressures high enough to activate the 200 PSI relief valve on the air/oil tank. This will result in rapid air loss.

1. Install the test tool in the tank outlet with the ball valve closed.
2. Make sure that the oil level is correct and the system is at operating temperature.
3. Operate the system until it reaches full pressure. Observe the pressure on the gauge.
4. Loosen the adjusting screw lock nut on the regulator.
5. Pressure can be adjusted within a range of 145-175 PSI, depending on your requirements. The system functions best at 150 PSI.

Prolonged operation above 175 PSI may damage the pressure regulator.

Never adjust the pressure cutout to exceed 175 PSI. 200 PSI will result in activation of the pressure relief valve at the air/oil tank. Rapid air loss will occur which can cause component damage, injury, or death.

6. Rotate the adjustment bolt clockwise to increase pressure. Rotate counterclockwise to decrease pressure. Tighten the lock nut (Figure 5.1).



The inner filter plate is shown removed for illustration purposes only.
This is a factory installed part and must NOT be removed during system setup.

Figure 5.1 Pressure regulator adjustment

7. Open the ball valve to allow air to flow and pressure to drop. Engine speed should increase. Close the valve and observe the pressure to make sure that the adjustment is correct.

Adjusting Engine Speed

If insufficient airflow is developed under high demand conditions, check engine RPM.

When the inlet control valve is wide open, approximately thirty engine revolutions are required to produce one cubic foot of air flow from the VR70 compressor and fifteen for the VR140 compressor.

The Throttle Control or Pneumatic Throttle Controller is adjusted at the factory to provide good results without adjustment in most typical, compressor applications. Some applications may require adjustments to provide the necessary airflow and pressure.

Engine RPM adjustments must be made so that the amount of air delivered by the system matches the requirements of the tools or equipment that you will be using.

Airflow and system pressure are related. If airflow demands on the system are low, operating pressure will remain high. If airflow demands are high, operating pressure will reduce. By making adjustments to the engine speed while operating a specific tool, you will achieve optimum performance.

If you must set up a system without knowing the demands on the system, you can make engine speed adjustments by using an orifice in the outlet to simulate tool use. Figure 5.2 shows a system testing and adjustment tool, (VMAC part # A700052) that you can use to simulate different operating situations. Install this tester to the tank output fitting before making any changes.

Use the correct orifice for the VR70 or VR140 system. These orifices are different and must be used for the correct application.

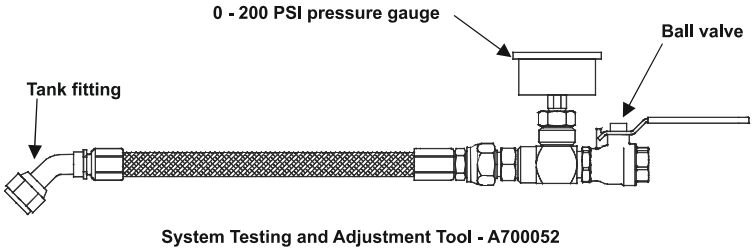


Figure 5.2 Test tool

Adjusting the Electronic Controller

1. Place the manual transmission in neutral or the automatic transmission in park and fully apply the park brake.
2. Make sure that the engine is at operating temperature.
3. Operate the air compressor system until the oil is warm.
4. Open the ball valve on the test tool and observe the engine tachometer.
5. Turn the maximum RPM adjustment screw clockwise to increase engine speed and counterclockwise to decrease maximum engine speed (Figure 5.3).

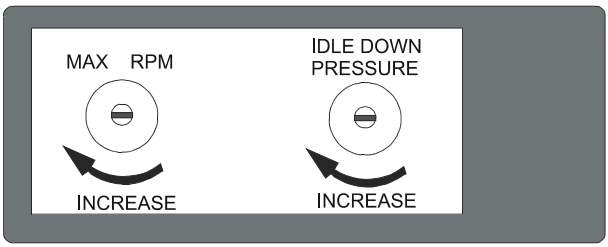


Figure 5.3 Electronic controller adjustment

The best throttle setting should provide approximately 50 CFM for the VR70 and 120 CFM for the VR140.

Count the number of turns when adjusting in case you have to return it to the original setting.

Do not exceed 2,600 RPM. If the speed does not change when you turn the screw, the system is not at maximum output. Remove all orifices from the outlet to allow full flow at maximum engine speed.

6. Close the air valve slowly to allow the system pressure to rise.
7. Once the system pressure is at maximum, slowly open the ball valve on the test tool until the pressure is approximately 10 PSI below maximum. Engine speed should start to ramp-up when air pressure drops to approximately 140 PSI.
8. Adjust the “Idle Down Pressure” up or down so that the engine speed just starts to climb at approximately 10 PSI below maximum system pressure, The adjustment for idle-down pressure must be turned clockwise to increase pressure or counterclockwise to reduce pressure (Figure 5.4).

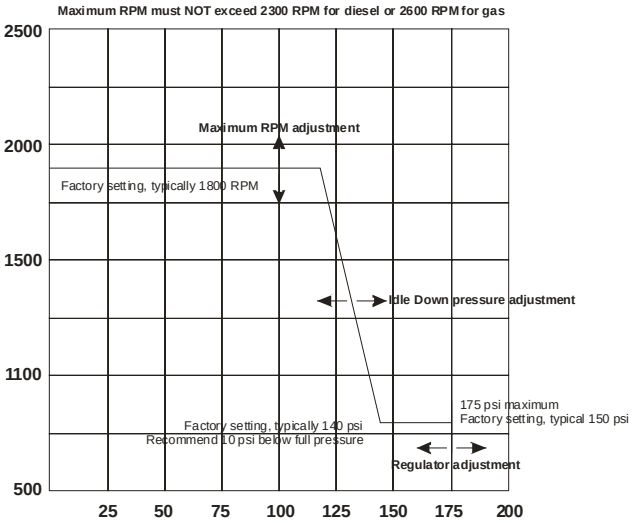


Figure 5.4 Operational graph

Adjusting the Pneumatic Controller

The throttle controller is preset at the factory for most applications but individual settings may be needed subject to air requirements.

Before starting the engine, check the measurement between the throttle lever arm and the cable nipple (Figure 5.5). This should be adjusted according to the recommendations in the appropriate installation manual. Typical setting is approximately 1/4 inch.

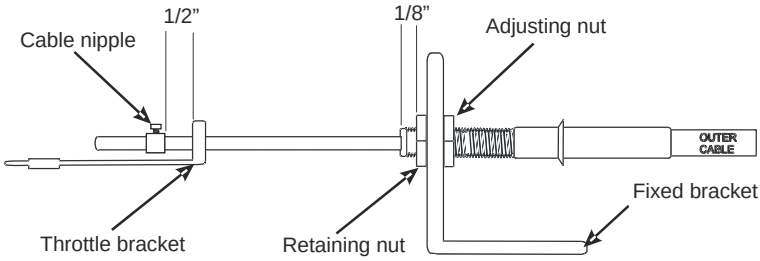


Figure 5.5

The distance between the cable nipple and the throttle lever arm determines the amount that the throttle will open when the controller operates. Less than the recommended setting will result in higher maximum RPM, while more than the recommended setting will result in lower maximum RPM. This can be regarded as the coarse adjustment for the upper engine speed setting.

Idle down pressure is the system pressure above, which the throttle begins to progressively back off on engine speed. No adjustment of this parameter is required because the idle down function of the throttle is slaved off of the regulator output.

Once you have determined that the cable nipple spacing is correct, you can perform the necessary adjustments. Follow this procedure to determine system settings:

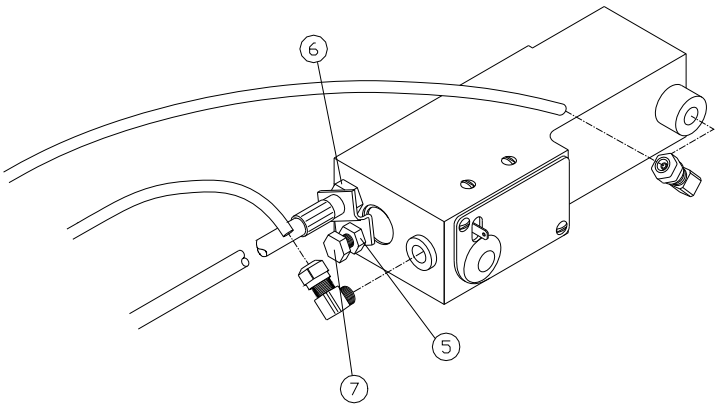
1. Install either the system test device or attach the appropriate tool to the system. If you are using the tool for making adjustments, always install a pressure gauge after the tank outlet so that you can observe system pressures.
2. Operate the truck and the VR system until they are both at operating temperature.
3. Allow system pressure to rise until engine speed returns to idle. Note the maximum pressure on the gauge with the engine at idle.

4. Operate the air tool or open the valve on the test device to allow pressure to drop and the engine speed to increase. Observe the engine speed while the maximum demand for air is placed on the system. This is the adjusted engine speed on the controller.
5. Allow system pressure to increase while observing engine speeds and pressure. At approximately 20 PSI below maximum pressure, engine speed should begin to reduce (roll off) and will reach base idle at maximum pressure. This is the maximum system cut-out pressure.
6. Operate the air tool or open the valve on the test device while watching system pressure. Engine speed should start to increase (ramp up) when system pressure drops to approximately 145 PSI.

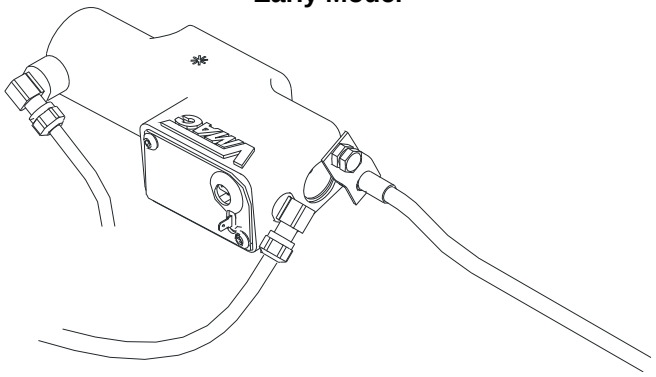
To fine-tune the engine speed (Figure 5.6):

1. On early models, loosen lock nut #5. On later models, this has been replaced by an adjusting screw.
2. Increase the RPM limit by turning adjusting nut #6 clockwise (or the screw on later models).
3. Reduce the RPM limit by turning adjusting nut #6 counter-clockwise (or the screw on later models).
4. Tighten the locknut.
5. Close the air valve slowly to allow the system pressure to rise.
6. When the pressure has reached approximately 20 PSI below the maximum operating pressure, the engine speed should start to roll off and should reach the lower limit.

Recommended setting is 900 RPM for diesel engines and 1,000 RPM for gasoline engines.



Early Model



Later Model

Figure 5.6 Fine-tune controller adjustment

You can fine-tune the upper RPM settings by following these steps:

1. Place the manual transmission in neutral or the automatic transmission in park and fully apply the park brake.
2. Operate the system so that it is pressurized and at operating temperature.
3. Open the ball valve and observe the RPM.
4. To adjust the maximum RPM limit (Figure 5.7):
    - loosen the locknut (5) on the engine end of the throttle controller cable
    - increase the upper RPM limit by turning the adjusting nut (6) counter-clockwise
    - decrease the upper RPM limit by turning the adjusting nut clockwise

5. Tighten the locknut.
6. Close the air valve slowly to allow the system pressure to rise.
7. When the pressure has increased to approximately 30 PSI below the maximum pressure set at the regulator, the engine speed should start to roll off and should reach the lower limit.
8. When the air valve is opened slowly the pressure should drop approximately 20 PSI below the maximum pressure set at the regulator. Engine speed should start to increase.

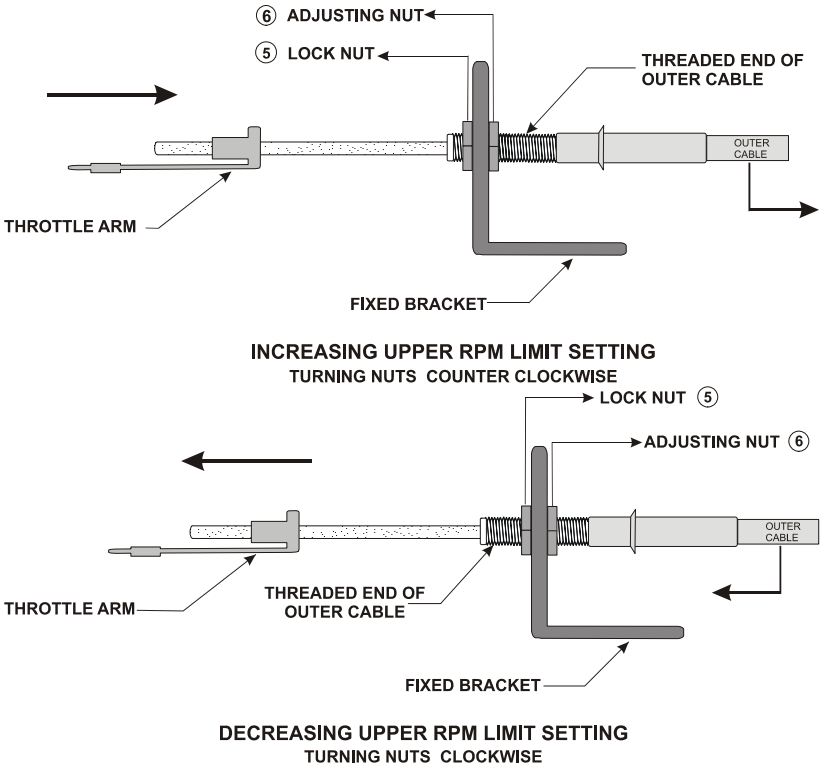


Figure 5.7 Fine-tune cable adjustment

Improper adjustment of these setting can cause the engine to stall if a demand for air is suddenly placed on the system.

Check the throttle controller inner cable and attachment to the throttle linkage to ensure it does not foul or jam the usual operation of the throttle linkage, which could cause the throttle to jam open when driving.

Part 6: Maintaining the System

The VR compressor contains no reed valves or other easily fouled or fatigue-prone components. Although this makes the system more reliable, organized maintenance practices will increase the life expectancy of the compressor system and maintain operation within the manufactured parameters. VMAC has recommended service intervals for their system that is based on actual testing and performance. The VR system requires regular maintenance that includes:

- inspecting and replacing the drive belt
- changing system oil
- changing filters
- cleaning filter screens

During the warranty period you must follow the maintenance schedule and only use original VMAC replacement parts to maintain the system and the warranty. Periodic maintenance service kits are available from VMAC.

The most critical aspect of compressor operation is proper air filtration. Contamination entering the intake can cause severe, rapid damage to roller bearings, gears and rotors in the compressor.

Never operate the truck, the compressor or even allow the truck to remain parked without the recommended air filter and cover installed on the compressor.

Periodic Maintenance

Good maintenance practices should follow the 3M system. These are:

- management
- materials
- machinery

Management means that you keep accurate, up-to-date records of the maintenance schedule, perform the maintenance on schedule and keep records of any problems or corrections that occurred during that maintenance period.

Materials means that you never attempt to perform a scheduled maintenance without the appropriate replacement parts on hand so that there is minimal interruption and no long down-time. Attempting

a full service without the approved oil or without the right filters will only delay the process.

Machinery means that you observe the manufacturer's recommended intervals for service and parts replacement, that reflect both the requirements of the system and good maintenance practices.

The maintenance schedule for the system is shown in the following table. The hours shown on the table are those displayed on the control panel read-out. Service should be performed at the lesser of the two intervals, which ever occurs first. Following this procedure will ensure optimum performance and long life from the VR system.

PROCEDURE	SERVICE INTERVAL
Inspect the drive belt	50 hours or 6 months
Replace the air filter, oil filter and change oil	200 hours or 6 months
Replace coalescing separator element and scavenge screen filter	400 hours or 1 year

These service intervals are based on normal operation. Common sense and good maintenance practices will indicate whether these procedures should occur more frequently. For example, if the truck is continuously operating in an extremely dusty environment, the air filter and belt should be inspected more frequently. Since the compressor draws in large quantities of air during operation, the filter may become plugged and will affect operation.

Inspecting the Drive Belt

Periodic inspection of the drive belt is necessary to identify potential problems before they cause failure or damage. While VMAC recommends a 50 hour interval, if the operating environment is severe, you should inspect the belt more frequently.

Check the belt carefully for signs of glazing, missing portions of the ribs or damage to the edges or surface. If there is damage, it may indicate a problem with pulley alignment or improper use by the operator. Installing a new belt will not correct the problem, it will just result in damage to the new belt.

A belt that is heat-damaged indicates that the belt is slipping on the compressor or crankshaft pulleys. This may be caused by a defective tensioner or by the operator engaging the compressor while there is pressure in the system. This can cause the compressor clutch to stall and the belt will slip. If the tensioner is

applying sufficient pressure and is maintaining belt tension correctly, talk to the operator and find out how they are using the system. Inspect the idlers, pulleys and tensioner for damage. Any component that shows chips, cracks or other physical damage should be replaced.

If the belt is damaged or worn along the edges, it could indicate an alignment problem. If this occurs, check the alignment of all pulleys, idlers and tensioners with a straight edge. If there is an alignment problem, check all system fasteners to make sure that they are tight. Also check for cracking or damage on the mounting bracket and at the compressor.

Inspecting and Replacing the Air Filter

Proper air flow into the compressor is vitally important for good performance. If the filter becomes plugged, the compressor will not be able to meet the demands and will probably overheat. While VMAC recommends that you replace the filter every 200 operating hours or twice a year, you should replace the filter more frequently in severe operating conditions, where it could become contaminated more quickly.

To check the filter, follow this procedure:

1. Make sure that all air pressure has been vented from the system.
2. Clean the area around the compressor and filter cover.
3. Remove the filter cover retaining nut, the cover and the filter element.
4. Immediately cover the opening of the compressor with a clean, dry cloth or with masking to prevent contamination from entering the compressor. Do not operate the truck or the compressor until the filter and cover have been installed.
5. Clean the inside of the filter cover with a clean, dry cloth. If necessary, you can use solvent to clean the inside of the cover.If you use solvent, make sure that you rinse the cover with water and dry it thoroughly before installing it on the compressor. Solvent fumes entering the compressor could ignite during the compression process, causing an explosion.
6. Examine the filter carefully for contamination. Place a trouble-light on the inside of the filter and rotate it over the light while examining the element. The amount of light that shines through the element is a good indicator of how much air can pass through the element. If the light is dim or blocked, air will not be able to get through.

7. If the filter is dirty, remove the cloth or masking and install a new filter. Do not attempt to wash or blow the filter element clean. These are not serviceable filters, they must be replaced. Using compressed air to clean a filter element will damage the material and allow contamination to enter the system.
8. Replace the cover and the cover nut. Be careful not to over-tighten the nut.

Complete Maintenance of the VR System

Complete system maintenance should be performed once each year or every 400 system operating hours, which ever occurs first. Again, as with previous service items, you may have to service more frequently in severe operating conditions.

Complete maintenance not only includes replacing oil and filters, it also includes a complete inspection of the system. This will ensure that the system continues to provide optimum performance and will extend the life expectancy of the components.

For best results, follow these steps for servicing:

1. Perform a complete pre-service inspection of the system.
2. Replace the air filter
3. Drain the oil from the system
4. Replace the oil filter
5. Replace the coalescing separator and clean or replace the scavenge filter
6. Fill the system with oil and check operation

Performing a pre-service inspection

Inspect the system carefully and check the following:

- look for leaks at the compressor, cooler, tank, filter and line fittings
- check the compressor and bracket to make sure that they are tight and secure
- check the cooler to make sure that it is tight and secure
- check the tank brackets and tank mounting to make sure that they are not loose
- check all fasteners for evidence of motion or vibration loosening
- examine all the lines for evidence of rubbing, chafing or other environmental damage

- using the appropriate tools, check all the line fittings to make sure that they are tight
- check electrical connections for security
- check all wiring for security and damage
- check the control units to make sure that they are secure

If you discover any problems, perform the necessary repairs to prevent further damage. Protect all wiring, lines, connections and fittings as required. Tighten any loose fasteners and replace any damaged fasteners or components.

Replacing the Air Filter

Follow the procedures outlined previously for air filter replacement.

Draining Oil from the System

The oil should be drained from the system before changing filters or cleaning the scavenge filter. Make sure that you have a suitable container that will hold approximately 2 gallons (US) before you begin. When draining the oil, follow this procedure:

1. Make sure that all air pressure is vented from the system. If there is any pressure in the system, you could be injured when you remove the drain plug.
2. Place the drain container under the tank below the drain plug.
3. Using the correct tool, remove the drain plug from the tank.

   Be careful when draining the tank. If the system was operated recently, the oil may be very hot and can cause burns.
4. Clean the drain plug threads and inspect them for damage.
5. Clean and inspect the threads in the tank.
6. Install and tighten the drain plug securely.

Replacing the Oil Filter

Clean lubricating oil is vital for efficient operation and for preventing damage to components. Replacing the oil filter at regular intervals will help keep contaminants out of the compressor and the rest of the system. When replacing the oil filter, remember to:

- make sure that there is no pressure in the system
- use a proper filter wrench
- never over-tighten the filter
- check the oil level after operating the system
- check for oil leaks after service

To replace the oil filter, follow this procedure:

1. Clean the area around the filter to prevent contamination.
2. Remove the filter by turning it counter-clockwise. Make sure that you drain the oil from the filter into a suitable container and dispose of the filter and oil according to local regulations.

   Before you dispose of the filter, check to make sure that the threaded nipple did not unscrew with the filter. If the nipple is in the filter rather than in the compressor, tank or remote mount, remove it carefully to prevent thread damage and replace it in its original location.
3. Check the sealing surface on the compressor, tank or remote mount to make sure that it is clean and smooth.
4. Apply a light coating of compressor oil to the gasket on the new filter.
5. Spin the filter on the threaded nipple until the gasket contacts the seat.
6. Tighten the filter an additional ¾ to 1 full turn to provide a good seal.

Replacing the Coalescing Separator and Scavenge Filter

To perform this part of the service, you must remove the back cover on the tank. Before attempting to replace the coalescing separator and scavenge filter, always make sure of the following:

- there is no pressure in the system
- the oil has been drained from the tank
- the back of the tank has been cleaned to prevent contamination
- be careful of hot oil

When these conditions have been met, follow this procedure:

1. Clean the back of the tank to prevent contamination.
2. Disconnect the air outlet line, 1/4 inch and 5/16 inch lines from the back of the tank.
3. Remove the bolts holding the discharge cap from the back of the tank and remove the cap and small spring, if equipped.

To prevent damage to the tank, remove all of the bolts completely while holding the discharge cap firmly in place as the coalescing separator element is spring-loaded against the discharge cap.

4. Remove the coalescing separator element, large spring (and on the VR140, the spring plate) from inside the tank. Discard the coalescing separator element.
5. Remove and discard the O-ring seal and the rear cap seal.
6. Wipe out the inside of the tank

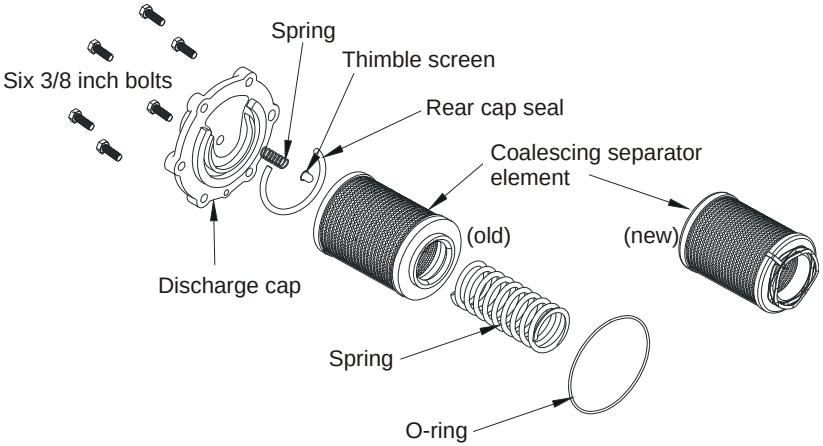


Figure 6.1 Typical VR70 System

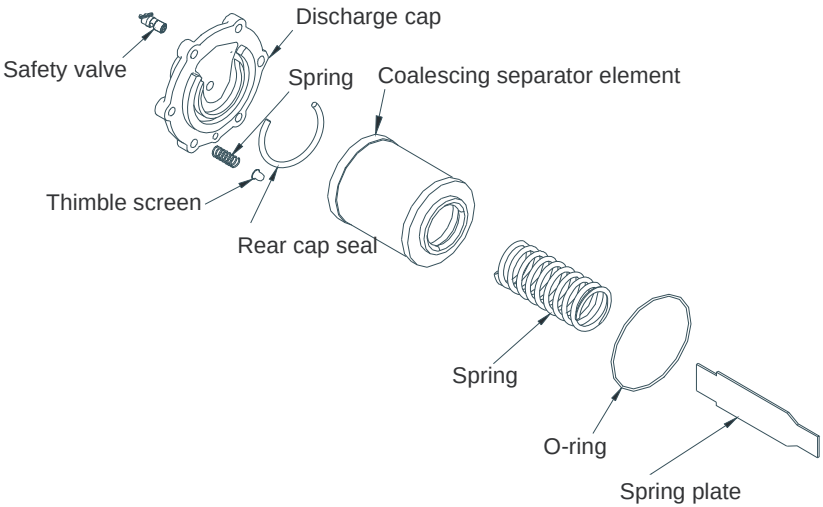


Figure 6.2 Typical VR140 System

7. If the tank has a small spring and thimble screen, the screen can be removed by carefully pushing it out of the oil scavenge hole from the inside of the tank.

8. If the system does not have a small spring, the scavenge screen will be located inside the tank coalescing chamber and is retained by a small screw.
9. Check the thimble screen or scavenge screen for contamination or damage. If contaminated, clean as necessary and blow out with compressed air. If damaged, replace the thimble screen or scavenge screen.

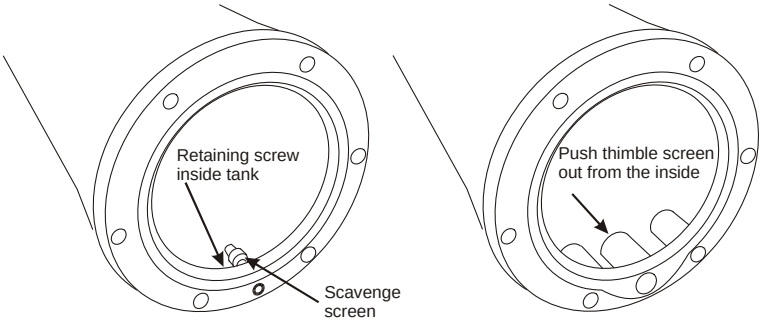


Figure 6.3 Scavenge Filter and Thimble Screen

If you use solvents for cleaning, thoroughly rinse the parts with hot water to remove all solvent residues.

10. Install new O-rings (including the small O-ring for tanks with the internal scavenge screen) and rear cap seal.
11. Thoroughly clean the large spring and the spring plate on VR140 systems. Remove any rust or contaminants.
12. Install the large spring (with spring plate on 140 systems – tapered end away from the filter) and a new coalescing separator element. Make sure that the spring is in place, as it holds the coalescing separator element tight against the rear cap seal.

The large spring also prevents electrostatic buildup by grounding the coalescing separator element. If the spring is not installed, an electric arc may occur, which could result in an explosion, potential tank rupture or fire.

The coalescing separator element service kit may include a wave-type spring (Figure 6.1). Replace the large coil spring with the wave spring and discard the coil spring.

13. Install the discharge cap and torque the bolts to specifications.
14. Install the lines on the back of the tank.
15. Remove the filler plug from the air inlet control valve.
16. Pour compressor oil into the oil filler hole on the inlet control valve using a funnel.
17. Turn the compressor clutch clockwise to speed the fill process.
18. Allow five minutes for the oil to drain into the tank, then check the level at the sight glass at the front of the tank. Continue adding oil until the level is correct.
19. Install the fill plug in the inlet control valve and tighten it securely.

Filling the System With Oil

1. Remove the fill plug from the inlet valve on the compressor.
2. Using a funnel, pour oil into the compressor while turning the compressor in a clockwise direction using the hex head cap screw at the center of the compressor clutch assembly.
3. At regular intervals, check the oil level at the sight-glass until it reaches the specified level.
4. Replace the fill plug or the inlet control valve.
5. Perform a quick inspection of the system to make sure that all lines are on and tight and that the filter is tight.

Completing the Service

1. Place the manual transmission in neutral or the automatic transmission in park and fully apply the park brake.
2. Start the engine and allow it to reach operating temperature.
3. Turn the compressor switch on the control unit to the “ON” position, allow the system to pressurize and return to preset base idle speed.
4. Turn the compressor switch on the control unit to the “OFF” position.
5. Allow the system to settle for five minutes, and then check the oil level through the sight glass. The level must be between the minimum and maximum level indicators.
6. Check for oil leaks.

Part 7: Diagnosing Problems

Good diagnostic procedures are based on a sound understanding of how the system operates and using an organized method of locating the problem quickly and accurately. This can be achieved by:

- asking the operator precise questions to assist in determining the problem
- operating the equipment yourself so that you can accurately pinpoint the possible problem
- determining potential causes for the problem through your understanding of how the system operates, before any disassembly or testing is performed
- isolating the problem using accurate testing according to correct, recognized testing and inspection procedures
- performing proper repairs using the correct procedures and the OEM replacement parts
- performing proper post-repair testing to make sure that the repairs are effective

Never perform any type of test that could be potentially harmful to yourself, the operator, other people or to the equipment.

When performing electrical testing, follow the procedures that are outlined in the troubleshooting chart. Always use good electrical testing equipment and, for accurate diagnosis, refer to the electrical diagram in the original installation manual.

System engineering and design is subject to change. Never assume that the procedures and wiring circuitry remains the same.

The problems, possible causes and suggested test and repair procedures listed in this section are based on situations that have been identified by the VMAC design engineers and through information from Help-Line records. Generally, operational problems fall into the following categories:

1. Compressor operation problems
    - does not run
    - frequent shut-down
    - engine stalls on activation
    - belt squeals
    - clutch slips and is damaged

2. Engine speed problems
   - too high
   - too low
   - stays at base idle
   - will not return to base idle
3. Air delivery and pressure problems
   - too high
   - too low
   - frequent relief valve operation
4. Oil problems
   - excessive oil in the air
   - oil blows out of the air filter on shut-down
   - oil drips from the clutch after shut-down
5. Electrical problems
   - fuse blows continuously
   - intermittent operation
   - no response from truck throttle

The following troubleshooting charts list the most common problems, recommended tests and solutions for the problems.

If you have difficulty with diagnosing a problem, call Technical Support for assistance.

1. COMPRESSOR OPERATION PROBLEMS		
Problem	**Possible Cause**	**Solution**
When the switch on the control panel is moved to the “ON” position, nothing happens	Drive belt missing	Check the VR drive belt. If it is missing, check pulley alignment before installing a new belt. Also check all pulleys and idlers for damage.
	The compressor clutch does not engage	Check for 12 Volts at the clutch.
System shuts down frequently	Low oil level is causing high temperatures	Check the oil level after letting the system stand for a few minutes. Add oil until it is at the correct level, then test the system again.
	Ambient temperatures are too high	The oil may not be cooled sufficiently because of high air temperatures. Check the truck cooling system for an overheat condition. You may have to provide a cool-down interval by allowing the system to idle at regular intervals. This will help to maintain operational temperatures.
	Compressor oil is not being cooled sufficiently	Check the truck cooling system for proper operation. Make sure that coolant hoses have not become pinched or obstructed, preventing good coolant flow.
	Defective temperature probe	Call Tech Support.
Engine stalls on activation of the system	There is residual air pressure in the system	If there is air pressure in the system, it will create a sudden load on the engine before the throttle control can increase engine speed. Always make sure that the system is not pressurized before activating the compressor.

1. COMPRESSOR OPERATION PROBLEMS, CONTINUED		
Problem	**Possible Cause**	**Solution**
Engine stalls on activation of the system, continued	The compressor or clutch is damaged	Make sure that the system has no residual pressure by venting the tank. Remove the drive belt and spin the outer part of the compressor clutch. It should spin freely. Using a socket and ratchet on the center bolt on the compressor clutch, turn the compressor clockwise. If the compressor will not turn, it has internal damage.
	The throttle control is not increasing engine speed	Call Tech Support.
Belt squeals on startup	There is residual air pressure in the system	Residual air pressure in the system will cause the compressor to stall. Vent air pressure and test again.
	There is insufficient belt tension	The belt tensioner may be damaged and is not applying sufficient tension to the belt. Compare the tension of the VR belt with the OEM belt or test the tension with an approved tension gauge. If the belt seems too loose, replace the tensioner.
	The drive belt is damaged	If the belt is cracked, glazed or is missing pieces, replace the belt.
System is very noisy during operation	Defective idler or tensioner bearings.	Locate the source of the noise and replace the appropriate part.
	Compressor is damaged.	If the noise is coming from the compressor, replace the unit.
	Truck hood is open.	Noise levels can be reduced by closing the hood while operating the compressor.

1. COMPRESSOR OPERATION PROBLEMS, CONTINUED		
Problem	**Possible Cause**	**Solution**
Clutch slips and is damaged	Insufficient voltage to the clutch	If the clutch does not receive battery voltage, there will be insufficient magnetism developed and the clutch will not engage correctly. This will cause instant destruction of the matching surfaces, as they are not lubricated and cannot withstand the friction.
2. ENGINE SPEED PROBLEMS		
Problem	**Possible Cause**	**Solution**
Engine speed is too high	Incorrect adjustment of the throttle control	The cable nipple is not positioned correctly or The electronic control is not adjusted correctly. Follow the procedures in *Part 1: Adjusting the VR System*.
Engine speed is too low	Incorrect adjustment of the throttle control	The cable nipple is not positioned correctly or The electronic control is not adjusted correctly. Follow the procedures in *Part 1: Adjusting the VR System*.
Engine stays at base idle	The throttle control is not increasing engine speed	Call Tech Support.
Engine will not return to base idle WARNING: The engine must be returned to base idle before you attempt shut-down. Disconnect the necessary linkage or connections to return to base idle.	Throttle operation has interference	On pneumatic throttle controls, check the operation of the throttle
	Throttle control not functioning correctly or is defective	Check for proper operation. Call Tech Support.

3. Air Delivery or Pressure Problems		
Problem	**Possible Cause**	**Solution**
Air pressure is too high	Incorrect regulator settings	Follow the procedures in *Part 1: Adjusting the VR System*.
	Defective regulator	If adjusting the regulator does not have any affect on pressure and engine speed is correct, replace the regulator.
Air pressure is too low	Insufficient air flow or incorrect regulator settings	Follow the procedures in *Part 1: Adjusting the VR System*.
	Defective regulator	If engine speed settings are correct and adjusting the regulator has no effect on pressure, replace the regulator.
Frequent relief valve operation	Air pressure is too high	Follow the procedures in *Part 1: Adjusting the VR System*.
	Defective relief valve	If pressure settings do not exceed 200 psi, replace the relief valve.
4. Oil Problems		
Problem	**Possible Cause**	**Solution**
Excessive oil in the air	Operating angle of the truck is excessive.	Maintain a level operating position no greater than 10 degrees from the horizontal
	Oil level is too high	Check the oil level at the tank and drain sufficient oil to correct the level.
	Coalescing element is defective	Follow the repair procedures to replace the coalescing element.
	Scavenge line is plugged	Clear scavenge line.
Oil blows out of the air filter on shut-down or the air filter is always wet with oil	Shutting down the engine before returning to idle.	Turn the compressor off FIRST and allow the engine to return to idle.
Oil drips from the clutch after shut-down	Clutch seal is damaged.	Follow repair procedures to replace the clutch seal.

5. Electrical Problems		
Problem	**Possible Cause**	**Solution**
Fuse always blows	Incorrect fuse	Recommended fuse is 20 Amps. Check the blown fuse to make sure that it was a 20 Amp fuse. If a 20 Amp fuse blows repeatedly DO NOT replace it with a larger fuse. Call Tech Support.
	System electrical problems	Call Tech Support.
Intermittent operation	Poor wiring connections	
	Faulty control unit or throttle control	
	Defective temperature probe	
	Defective pressure transducer	
No response from the truck throttle	Faulty connections between the electronic throttle controller and the foot pedal	Remove all of the connectors. Visually check the condition of the pins and sockets. Insert the connectors firmly, making sure that the latches on the connectors close.

Part 8: Repairing the System

Most of the VR components are considered non-repairable, in that they are precision machined and assembled or factory welded and sealed. These components must be replaced. Most repairs will involve the replacement of lines, fittings or complete assemblies. These repairs are relatively straight-forward and follow the sound mechanical practice. The procedures listed here are performed on the compressor. These include:

- replacing the clutch assembly
- replacing the shaft seal
- replacing the poppet seat O-rings

Repair precautions

Observe the following relating to the repair of the VR system:

1. The compressor and gearbox are manufactured and assembled as an integral unit. With routine maintenance and correct use, no service or repairs to the internal components of the compressor unit will be required for the life of this product. The compressor is precisely balanced and machined. Disassembly and repair of this unit is not recommended and will void the warranty.
2. Hoses are selected, assembled and tested to withstand the pressures, temperatures and special fluid in the system. They should not be repaired under any circumstances. They should be replaced with VR hoses, as these are manufactured to meet the specific requirements of the system..
3. The tank is manufactured and tested for operation and safety. It should not be welded, drilled or repaired in any manner, with the exception of replacing bolt-on or threaded components. If the tank is damaged, it must be replaced.
4. The compressor control unit, pneumatic throttle control and the electronic throttle control are manufactured and tested as complete components. These components cannot be repaired. If they do not function correctly, they must be replaced.
5. If the compressor mounting bracket is broken or damaged, it should be replaced. Performing repairs on this bracket may affect the alignment of components, resulting in addition component damage.

6. If an idler pulley, crank pulley or compressor pulley is damage or broken, replace it with the recommended VMAC replacement part.
7. Always use recommended VMAC parts and compressor oil. The system has not been tested with alternate products. Using different parts may affect performance or damage to components.

Replacing the compressor clutch

If the magnetic compressor clutch does not function correctly, first check to ensure that the wiring connections are in good condition and that there is voltage at the connection to the clutch. Use recommended electrical test procedures when performing voltage tests to prevent damage to electronic control components. The testing procedure for determining the cause of failure can be found in the troubleshooting section.

Removing the clutch

1. Depress the automatic belt tensioner and remove the drive belt.
2. Remove the 5/16 inch NF hex head cap screw and thick washer from the center of the front face of the clutch. This fastener has right-hand threads.
3. Thread a 5/8 inch hex head cap screw firmly into the threads in the center of the clutch hub.
4. Tap the head of the bolt with a hammer to dislodge the clutch from the shaft.
5. Remove the clutch hub and pulley assembly. Do not lose the woodruff key.
6. Disconnect the wire connector between the clutch and the wiring harness.
7. Remove the four hex head cap screws and the four serrated lock washers holding the clutch stator in place on the front of the compressor gearbox.
8. Remove the clutch stator.

Installing a new clutch

1. Clean the mounting surface on the front of the compressor.
2. Install the new clutch stator on the compressor.

3. Align the mounting holes, apply Loctite and install the four hex head cap screws and serrated lock washers. Tighten the screws (torque to 12 ft-lbs).
4. Clean the compressor clutch hub. Make sure that the woodruff key is in place.
5. Install the clutch hub over the compressor shaft. Make sure the clutch rotates free without rubbing on the stator.

Make sure the thick washer is on the 5/16 inch NF hex head cap screw and thread the cap screw in to retain the clutch hub. Tighten the fastener.

6. Connect the clutch stator wire to the harness connector.
7. Install the drive belt.

Checking the repair

Place the standard transmission in neutral or the automatic transmission in park and apply the park brake.

1. Start the engine and allow the idle to stabilize.
2. Turn the compressor switch on the control unit to the “ON” position.
3. Check to make sure that the compressor and the clutch are operating correctly.
4. Turn the compressor switch to the “OFF” position and turn off the engine.
5. Wait for a few minutes to allow the oil to drain into the tank, then check the oil level to make sure it is correct.

Replacing the shaft seal

The shaft seal should only be replaced if there is evidence proving that the seal is leaking. If there is continually oil coating the center of the clutch or dripping from the front of the compressor, the seal should be replaced. There is also a possibility of damage to the input shaft if the leak is extreme. Always check the surface of the shaft. If it is damaged, a new seal will not stop the leak. Also remember that seal failure is most often caused by excessive heat, contamination or failure of associated components, such as bearings.

Removing the seal

1. Depress the automatic belt tensioner and remove the drive belt.
2. Remove the 5/16 inch NF hex head cap screw and thick washer from the center of the front face of the clutch. This fastener has right-hand threads.
3. Thread a 5/8 inch NC hex head cap screw firmly into the threads in the center of the clutch hub.
4. Tap the head of the bolt with a hammer to dislodge the clutch from the shaft.
5. Remove the clutch hub and pulley assembly. Do not lose the woodruff key.
6. Disconnect the wire connector between the clutch and the wiring harness.
7. Remove the four hex head cap screws and serrated lock washers holding the clutch stator in place on the front of the compressor gearbox.
8. Remove the clutch stator.
9. Remove the seal retainer with the proper pin wrench. Do not use “alternate” tools as this can cause damage to the seal retainer.
10. Press the seal out of the retainer using the correct tools.

Installing a new seal

1. Clean the retainer. Press the new seal into the seal retainer. Be sure not to cock the seal or damage it during installation.
2. Clean the outer surface of the gearbox housing. Clean and dry the threads in the gearbox housing.
3. Install a new Viton O-ring.
4. Apply one drop of Loctite 242 (blue) to seal retainer threads and gear case threads.
5. Install the seal retainer and tighten it with the pin wrench.
6. Install the stator on the compressor.
7. Align the mounting holes, apply Loctite blue and install the four hex head cap screws and serrated lock washers.
8. Tighten the screws (torque to 12 ft-lbs).

9. Clean the compressor clutch hub. Make sure that the woodruff key is in place
10. Install the clutch hub over the compressor shaft.
11. Make sure the thick washer is on the 5/16 inch NF hex head cap screw. Apply Loctite blue to the cap screw. Thread the cap screw in to retain the clutch hub and tighten the fastener.
12. Connect the clutch stator wire to the harness connector.
13. Install the drive belt.

Testing the repair

Place the standard transmission in neutral or the automatic transmission in park and apply the park brake.

1. Start the engine and allow the idle to stabilize.
2. Turn the compressor switch on the control unit to the “ON” position.
3. Check to make sure that the compressor is operating correctly. Allow the compressor to operate for 10 to 15 minutes.
4. Turn the compressor switch on the control unit to the “OFF” position and shut-down the engine.
5. Allow the truck to stand for a few minutes to allow the oil to flow back into the tank, then check the level at the sight glass on the tank to make sure that it is correct.
6. Check for oil leaks at the clutch. Make sure to check for leaks again after a few hours of operation.

Replace the poppet seat O-ring

1. If the system has just been operated, allow at least 10 minutes so that all air pressure can vent.
2. Clean the area around the compressor and the filter cover to prevent contamination.
3. Remove the filter cover retaining nut, the filter cover and the filter element.
4. Loosen the jam nut and remove the air filter anchor post.
5. Remove the four socket head cap screws holding the inner filter plate.
6. Remove the filter plate and the O-ring.

7. Remove the four hex head cap screws holding the inlet valve body to the compressor.
8. Remove the inlet valve and immediately cover the opening on the compressor.
9. Carefully push the poppet valve from the inlet valve body using a wooden dowel from the inside of the valve body.
10. Remove the O-ring from the inlet valve seat.

Installing a new O-ring

1. Install a new O-ring in the valve seat.
2. Carefully insert the poppet seat so you do not damage the new seal.
3. Replace the inlet valve seal in the compressor housing.
4. Install the inlet valve on the compressor, install and torque the four socket head cap screws.
5. Install a new O-ring and replace the inner filter plate.
6. Align the holes in the plate with those in the inlet valve body, then insert and tighten the four socket head cap screws.
7. Install the air filter anchor post and the jam nut. Tighten the jam nut, but do not over-tighten.
8. Check and replace the air filter if it is contaminated.
9. Install the air filter and cover.