MID AMERICA MOTORWORKS

PART NUMBER
119-020

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Brake Bleeder Kit and Vacuum/Pressure Pump

WARNING!
These pumps are not approved for use with combustible materials such as gasoline, kerosene or diesel fuel. Serious injury or damage may occur if pump is used with these fluids.

CAUTION! TO AVOID PERSONAL INJURY AND/OR VEHICLE DAMAGE:
While some precautions are specified in this manual, and should be noted to avoid personal injury or vehicle damage, it is not possible for these cautions to cover all conceivable ways in which service or testing might be done, or possible hazardous consequences of each way, nor could Mid America Motorworks possibly know or investigate in all such ways. It is therefore the responsibility of anyone using this manual and product to satisfy him or herself completely that neither personal safety nor vehicle safety will be jeopardized by the service methods selected. Any such injury or damage is entirely the user's responsibility. This device is not to be used in any manner on the human body.

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How Is Vacuum Measured?
Vacuum is commonly measured in inches of Mercury ("Hg). It may also be measured in centimeters of Mercury (cm Hg) and kilo pascals (kPa). Atmospheric pressure will support a column of Mercury in a manometer gauge about 30 inches high or about 76cm high. This is barometric pressure in Hg, which varies as the weather changes. Vacuum readings in "Hg are really negative pressure readings. For example, 30"Hg vacuum would be a complete vacuum. Half of a complete vacuum would be 15"Hg. A gasoline engine at idle usually pulls about 16–22"Hg vacuum. On deceleration, because the throttle is closed, the vacuum will increase. The pump will pull about 25"Hg as indicated on its vacuum gauge, which is calibrated in both "Hg and kPa.

What is Vacuum?
Put simply, vacuum is empty space and may exist as either a total or partial vacuum. Vacuum does not, of itself, create power. Rather, power for vacuum devices depends on the presence of atmospheric pressure. The atmosphere exerts a pressure of 14.7 pounds per square inch (psi) on everything at sea level. If a portion of the air is removed from one side of a diaphragm (partial vacuum), the atmospheric pressure will exert a force on the diaphragm. The force is equal to the pressure difference times the diaphragm area. Generally, the less air (greater vacuum) in a given space, the more the atmosphere tries to get in and the more force is created.

The Pump
The vacuum pump is an extremely versatile service tool that can be used to test a variety of automotive systems and perform a number of useful tasks. Though the pump has obvious uses for testing various vacuum motors, control valves and vacuum sources, its applications don't end there. Almost any part or system that requires proper sealing, pressure or vacuum to operate can be tested. It can also be used to transfer fluids and bleed brakes.

The Vacuum/Pressure Pump consists of the following parts:

1. Vacuum/Pressure Gauge: A 2 1/2" gauge calibrated in PSI, BAR and inches of mercury (inHg)
2. Barb Fitting: For attachment of the supplied hose. It can also be directly attached to vehicle vacuum lines or components.
3. Vacuum/Pressure Release Collar: The external collar on the pump slides back and forth on the pump body. The forward position is for vacuum. The rearward position is for pressure. Moving the collar from one position to the other will release stored pressure or vacuum to the atmosphere.
4. Handles: Comfort grip handles are designed so that they can be easily squeezed together to create vacuum or pressure.
5. Pump Body: Includes piston, cylinder and valve assembly.

Using the pump

The vacuum pump is simple to use. In most cases, the pump is either attached directly to a component, used in place of a vacuum line or connected into a vacuum circuit with a tee connector. The pump can be operated as a test instrument in three ways:

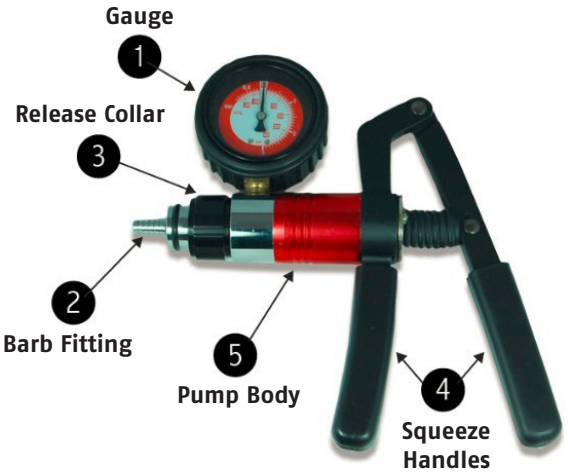
1. To test vacuum, position the Release Collar forward. Squeeze the handle with your hand, as in clenching your fist. Continue strokes until desired vacuum is indicated on the gauge.
2. The pump can be connected to a vacuum circuit and used to measure existing vacuum, just as any vacuum gauge would be used. When used this way, do not pump the handle or incorrect readings may result.
3. The pump can also be used as a pressure pump by moving the Release Collar to the rearward position. Squeezing the handle will apply air pressure to a connected line. Repeated strokes increases pressure.

Proper Care

Your pump is a sturdily built, precision test instrument. Handle it carefully! Don't drop the handle, as the gauge accuracy may be affected. Don't lay it on the hot engine manifold or expose it to direct flame. Avoid letting fluids enter the pump itself. If using as a fluid pump, use the included reservoir. Proper care for the pump will give you years of trouble-free service.

Lubrication

The factory installed lubricant is silicone oil and should provide long service. If you find it necessary to lubricate your pump, use silicone oil. Do not use petroleum based fluids or spray lubricants (WD-40, motor oil, etc.). These will damage your pump. Do not use solvent such as carburetor cleaner or brake cleaner sprays in the pump mechanism.



Brake Bleeding
Many brake systems feature Anti-Lock functions and electronic controls. Many of these systems use a pressure electric pump to keep the system pressurized. When bleeding or servicing, these systems require special procedures and cautions. Always observe the following precautions when servicing anti-Lock brake systems:

- ALWAYS wear safety goggles when servicing high pressure brake systems.
- ALWAYS depressurize the ABS system prior to adding fluid or attempting service or repair.
- Unless instructed by the manufactures procedure, NEVER open a bleeder valve or loosen a hydraulic line while the ABS system is pressurized.
- ONLY use recommended brake fluids. Do not use silicone based brake fluids in ABS equipped vehicles. You should also never mix silicone based fluids with traditional brake fluids such as DOT 3, etc.
- ALWAYS refer to an appropriate repair manual for additional information on all brake systems.

Depressurizing ANTI-LOCK Brake Systems
Always refer to the vehicle owner's manual or appropriate service manual for additional information on the depressurizing procedure. The procedure will work on most Anti-Lock brake systems. Ensure ignition switch is in the OFF position or disconnect the negative battery cable. Pump the brake pedal 25-40 times. Once a noticeable change is felt; continue to pump the pedal a few additional times. This should eliminate most system pressure. Open the fluid reservoir or brake lines carefully. Top off reservoir fluid and reconnect battery cable when finished.

Bleeding ANTI-LOCK Brake Systems
Always refer to the vehicle owner's manual or appropriate service manual for manufacturer's brake bleeding procedure. The front brakes on most Anti-Lock brake systems may be bled in the conventional manner. Most hydraulic pump/pressure accumulator units are fitted with a bleeder valve, which must be bled when the system has lost fluid or is being replaced. Some vehicles require that the system be pressurized when the rear brakes are bled. Various Asian, European and domestic manufactures use bleeding procedures that require specialized equipment.

Brake Line Bleeding
Most low and soft pedal problems are caused by air in the hydraulic lines, which requires bleeding of the hydraulic system. By using the pump with brake bleeding accessories, the system can be bled easily. Follow a wheel-to-wheel sequence beginning with the wheel closest to the master cylinder. The kit provides a simple, clean, and quick method for bleeding the fluid lines

in the automotive brake system. The creation of vacuum in the reservoir jar causes fluid to be drawn into the reservoir jar. It should be noted that a tiny stream of bubbles may be noticed in the hose after all of the air is bled from the lines. This is caused by air seeping around the threads of the loosened bleeder fitting and being drawn back through the fitting by the suction of the pump. Once the air is removed from the system these tiny bubbles will in no way jeopardize the bleeding operation, since they are present only in the fitting and do not enter the system. If you wish, you can put grease or Teflon tape around the threads of the fitting to eliminate most of the bubbles.

The correct brake bleeding procedure follows:

STEP 1.
Always make certain that the master cylinder reservoir is filled and that a new supply of clean brake fluid of the proper type is on hand to top off the reservoir, as the fluid level drops during bleeding. Make sure that all the bleeding fittings are clean prior to beginning the bleeding procedure.

STEP 2.
Bleed the hydraulic system in the following order:

A) Master cylinder bleeder fittings, if equipped. (If installing a new or rebuilt master cylinder, follow the bench bleeding procedure that follows.)

B) Bleeder fittings on the combination valve, if equipped.

C) Wheel cylinders and calipers in succession, beginning with the wheel closest to the master cylinder, and working to the farthest one.

NOTE: Wheel balancing sequence varies among manufacturers. Follow manufacturer's recommended sequence (if known). Procedure given in this article specifies to begin bleeding wheel closest to the master cylinder. Regardless of sequence used, always ensure all air is purged from system.

STEP 3.
Slip 1½" of tubing between the pump and the lid of the reservoir jar at port marked "To Pump"

STEP 4.
Attach 3½" plastic hose to the bottom of the cap (if not already attached).

STEP 5.
Affix at least a 12" piece of tubing to the other reservoir jar port. Be certain that the cover of the reservoir jar is secure, but don't over tighten.

STEP 6.
Select the appropriate adapters. The snap-over adapters (L-shaped) are different sizes (small, medium, large). They should fit snugly over the brake bleeding fitting in order to seal properly. The tapered adapters fit inside the thru-hole of fitting and will generally seal well when inserted tightly with a pressing and twisting motion. Attach adapter to the reservoir hose. Position the Release Collar in the forward (Vacuum) position.

STEP 7.
Place wrench on brake bleeding fitting: attach adapter and pump assembly and pump 10-15 times. NOTE: If bubbles coming out of the fitting are very small and even in size, the air is probably coming from within the system. It is not necessary to eliminate these bubbles, as they do not affect brake operation.

STEP 8.
Open fitting slightly, only enough for fluid to enter jar (usually ¼ to ½ turn).

STEP 9.
After evacuating about 2" of fluid into the jar, tighten fitting. Keep master cylinder full. Repeat all previous steps on all remaining wheels. If fluid is not drawn into the jar after opening the fitting make certain the lid of the jar is tight. You will not be able to produce the necessary vacuum in the jar if the lid does not fit securely. Occasionally some dirt will get into the brake line, in which case the pump may not be totally effective. If this happens, have someone press the brake pedal once.

OTHER USES OF THE VACUUM/PRESSURE PUMP

The vacuum pump can be used for a variety of automotive testing and diagnosis tasks. Examples are listed below:

1. Engine mechanical testing, such as testing of engine vacuum. Testing intake and exhaust valves, testing manifolds and manifold gaskets for leaks, etc., air/fuel mixture, cylinder leakage, turbocharger waste gate, and mechanical and electric vacuum pumps.
2. Testing of vacuum-operated mechanical components, including transmission modulators, heater and air conditioner doors, cruise control modulators, headlight doors, etc.
3. Fuel system testing, such as fuel tank testing, and testing of fuel lines, pumps and pressure regulators.
4. Ignition system testing, such as distributor advance mechanisms, spark delay valve testing, vacuum delay valve testing, etc.
5. Emission control system testing, such as EGA valves. PCV valves, ported vacuum switches, thermostatic air cleaners, exhaust heat control or heat riser valves, back pressure transducer valves, etc.

GENERAL USAGE INSTRUCTIONS
The vacuum pump is most often used as a vacuum pump or test instrument. The pump may be connected to a component with the provided vacuum line, connected directly to the component itself, or connected to an exiting vacuum line directly or with the provided tee connector.

TO CREATE VACUUM:
Move the collar to the forward position (away from the handles). With the pump connected to the appropriate component or vacuum line, simply squeeze the moveable handle of the pump with your hand. Continue the squeezing motion until the gauge reads the desired level of vacuum.

TO CHECK VACUUM:
With the pump connected to the appropriate component or vacuum line, read the measured amount of vacuum at the gauge (engine running). Do NOT pump the handle, as this will cause an in correct reading.

RELEASING VACUUM
Slide the collar rearward (toward the handles) to release vacuum. This allows air to enter the system, relieving the vacuum.

PRESSURE:
Move the collar to the rear position (toward the handles). With the pump connected to the appropriate component, simply squeeze the moveable handle of the pump with your hand. Continue the squeezing motion until the gauge reads the desired level of pressure.

TO CHECK PRESSURE:
With the pump connected to the appropriate component or vacuum line, read the measured amount of pressure at the gauge. Do NOT pump the handle, as this will cause an incorrect reading.

RELEASING PRESSURE:
Slide the collar forward (away from the handles) to release pressure.

TROUBLESHOOTING AUTOMOTIVE VACUUM SYSTEMS
An automotive vacuum system consists of a vacuum source, lines, hoses and fittings, and vacuum units or components. This system must be free from leaks. If leaks occur, the air/fuel mixture of the engine may be changed by the additional air entering the engine. This may result in poor engine performance and lead to damage to the engine internal components over time.

Trouble with vacuum system can most often be determined to be one of the following problems:

1. **Leaks:** Leaks occur in hoses, connectors, tees, diaphragms and valves. Most often the leak occurs at the end of the vacuum line where it attaches to a component. The hose becomes hard at the hose end and splits, no longer sealing the connection. Often cutting off a small piece at the hose end will temporarily solve the problem. The hose should eventually be replaced.
2. **Blockage:** Blockage occurs when vacuum lines are pinched or full of foreign material, when vales are clogged or stuck, or when some other problem occurs that prevents air from flowing. Clearing the line and/or freeing up stuck valve should solve the problem.
3. **Failed component:** A visual inspection of vacuum devices can be important to determining their correct operation. It is important to have manufacturer's service information available to determine the location and proper function of vacuum components. Often tests are provided that will allow you to determine whether a component is leaking, has failed, or is functioning properly.

ENGINE MECHANICAL CONDITIONS

Reading the gauge on the vacuum pump can help diagnose a variety of engine conditions. With the pump connected to the appropriate component or vacuum line, read the measured amount of vacuum at the gauge (engine running). Do NOT pump the handle, as this will cause an incorrect reading. In order to put the vacuum gauge to good use, we must understand how it works and what the reading can tell us. A vacuum gauge measures the difference of pressure in the intake manifold and the actual atmospheric pressure. Vacuum is a pressure that is below atmospheric pressure. For instance, zero on your vacuum gauge would represent 14.7 psi at sea level. As the engine is cranked, the piston of each cylinder will increase manifold pressure. A cylinder that is not sealing properly will not produce sufficient compression pressures. We need to raise combustion chamber pressures and the resulting temperatures for reliable ignition. An engine in good mechanical condition, depending on its size will typically develop somewhere between 17 and 21"Hg at 1,000 rpm.

Low Vacuum: A low steady vacuum reading at idle could indicate a problem with an external vacuum leak. Another cause could be late ignition or valve timing. If adjusting the ignition to specification does not increase the vacuum gauge reading, the valve timing should be checked.

Cranking: During cranking speeds, we should develop between 3 to 5"Hg with the throttle closed. This is a good test for an engine that will not start. A reading of zero would indicate there is an internal problem. A quick test here can save a lot of diagnostic time.

Base Idle: A quick test to see if the base idle screw of a fuel-injected vehicle has been tampered with is to hook up your vacuum gauge to ported vacuum on the throttle body at idle. There should be almost zero vacuum.

Restricted Exhaust (Catalytic Converter): When the engine is unable to exhale properly, a positive pressure will develop inside the cylinder each time the exhaust valve opens. This increases inside the manifold as the intake valve opens. The end result is lower manifold vacuum. Run the engine at 1,000 rpm and record the vacuum reading. Increase engine speed slowly to 2,500 rpm. Exhaust backpressure, depending on the amount of restriction, will increase with engine rpm. If the vacuum reading at 2,500 rpm should drop more than 3"Hg from the reading taken at 1,000 rpm, the exhaust system is most likely restricted.

Worn Piston Rings: When piston rings are sealing properly, manifold vacuum will increase above a normal level whenever the throttle is quickly snapped closed. The closed throttle with high piston speed will create a large pressure differential in the intake manifold. If rings are worm out, the gauge should drop to zero, then rise to 22"Hg when the throttle is rapidly depressed and then released.

Air/Fuel (Idle) Mixture: An air/fuel mixture that is too rich or too lean creates lower than normal vacuum, often fluctuating.

Late Valve Timing: When cam timing is off, vacuum will float between 8-15.5"Hg at idle. This can happen after a timing belt change if the belt is installed incorrectly.

Valve Seating: An intake valve that is not seating properly will cause a momentary drop in manifold vacuum. As the pressure in the cylinder starts to rise, it will leak past the intake valve. This will result in a large pressure increase in the intake manifold. These pressures will cause the needle on the vacuum gauge to drop 1-2"Hg each time the cylinder fires. An exhaust valve that is not seating properly will dilute the incoming mixture and cause a misfire. The vacuum gauge will display a lower manifold vacuum without any fluctuation.

Broken Valve Spring: If the valve stays open too long as the result of a broken spring, a positive pressure is created. This can be seen on the vacuum gauge as substantial needle fluctuations each time the valve attempts to seat.

Sticking Valve: A sticking valve will cause the needle to drop each time the offending valve hangs open. This is similar to a leaking valve, except that the vacuum reading will not drop at regular intervals.

Head Gasket Leak: When the head gasket is leaking, engine vacuum will float between 5-19.5"Hg.

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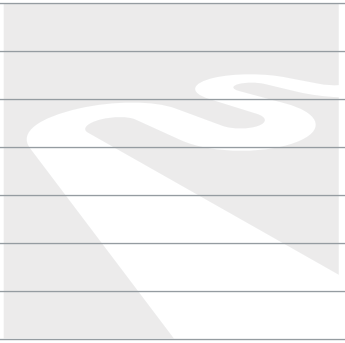

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