Kem-O-Kleen ®

Operator Training Manual

* Machine Familiarization*

Unique Industries
Denver, CO

Order Toll Free: (800) 274-4121
Colorado: (303) 425-0100
Fax: (303) 425-3356
www.kem-o-kleen.com

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Welcome

Welcome to the family of Kem-O-Kleen operators. For over four decades, Kem-O-Kleen has been the standard for Masonry Cleaning and Concrete Etching. Technology and design so unique it is patented. Every year we continue to incorporate the latest in technology, design and manufacturing, making a great product even better. There is no better product or solution on the market.

To get the most productivity and quality from your machine, take the time to learn how it works and how to operate it. This summary will help you get started. More detailed and necessary information is in your Owner's Manual. Please take the time to read both of these documents. In addition, we are always ready to assist over the phone and you can reach us toll free at (800) 274-4121 (8 AM to 5 PM Mountain Time).

This training manual has been developed to introduce a new owner or operator to the mechanics of this machine. It requires more than an hour and includes a lot of practical information the manufacturer has learned from experience. Understanding this information and the information in the Owner's Manual will help eliminate problems later. Study this machine and learn it well and it will work well for you.

Be sure to keep this manual for new operators you will want to train in the future.

So let's start. To get the most from this manual, read it while you are near your Kem-O-Kleen and can see the items described first hand.

1. THE WATER HEATER

a. Your machine is equipped with a diesel-fueled hot water heater. Hot water will greatly increase the efficiency of your work. The burner is set to increase the ambient temperature of water by 100° F to approximately 165° on a typical day.

b. If the burner does not light, the first item to check is the transformer. It generates 10,000 volts and will give you a real jolt so use a plastic handled tool when testing it. Open the transformer by laying it back from the burner housing, exposing two spring terminals. Plug in the electric cord to a 110-volt circuit or toggle the switch on a 12-volt burner. Place the plastic handled tool across the terminals on the transformer. On a 12-volt transformer you will need to cover the electric eye. This looks like a black tube, about an inch long on the bottom of the transformer. A wide electrical arc should nearly cross the distance between the two terminals. If there is a weak arc, or no arc, then the transformer is bad and needs replacing.

c. The burner fan should turn freely. If it is hard to turn, the electric motor may have worn or have dirty bearings and needs to be replaced. Alternatively, the burner's fuel pump may be sticking or seized and needs to be replaced. In either circumstance, additional damage could result if the burner is not repaired.

d. The secret to maintaining the fuel pump is to keep the fuel clean. There is a fuel filter that cleans the fuel and separates water from it before it reaches (and lubricates) the fuel pump. This filter should be inspected, drained, and replaced as necessary.

Condensation may cause water to settle at the bottom of the fuel tank. Also, the fuel drum may contain water and rust, which can be pumped into the fuel tank. A drain plug in the bottom of the tank permits easy flushing out of the fuel tank.

If you run out of diesel fuel during operation, an air lock may develop in the fuel pump, preventing the burner from lighting after the fuel tank is filled. With the electric motor turning the fuel pump, open the air bleeder valve on the rear side of the pump until fuel starts to flow freely, releasing the trapped air. Tighten the valve and the burner should light. See your Owner's Manual Trouble Shooting Guide for additional information.

e. Water temperature is regulated by the size of the fuel spray nozzle at the tip of the fuel spray gun assembly, located inside the burner housing. To remove, open the transformer cover, loosen the copper tube from the fuel gun spray assembly, loosen the round retaining nut located just behind the copper tube connection point and carefully maneuver the tube/ignitor assembly without force, or the porcelain electrodes may crack. The electrode assembly tips should be 1/8" to 3/16" apart and 1/8" in front of the tip of the fuel spray nozzle. If the tips are too close to the nozzle they will arc to the nozzle instead of between the tips, causing the burner to be slow in lighting. Contact points between the transformer and the burner must be clean. The porcelain electrodes should not be cracked and the electrode tips must not touch metal. The electrode tips must be centered directly in front of the fire ring deflector to insure that the burner lights properly.

f. The air intake shutter located near the fuel pump should be properly adjusted at the factory (approx. between the 4 and 6 index number on the burner). If it is closed too tightly there will not be enough oxygen allowed inside the heat chamber to burn all the fuel. This results in black smoke being emitted from the exhaust chimney or flame-out. If the air shutter is opened too wide, air will rush past the fuel spray nozzle and could blow the fuel spray mist too far away from the electrode spark. That, in turn, prevents the burner from lighting. This results in white smoke being emitted from the exhaust chimney.

g. Low voltage is the only thing that causes electric motors on 110-volt models to heat up. Stringing light gauge electric cord 200 feet or more may result in a loss of 20 or 30 volts. If volts drop below 90, the electric motor will heat up and pop the thermal reset button on the motor. After it cools off, press the red button in to reset. Use a heavier electric cord. A 12-gauge cord should be sufficient. Keep it out of water and do not operate a second machine from the same cord.

2. THE BURNER ELECTRICAL CIRCUIT OVERVIEW

When the machine is running, water flows through the flow switch, located on the outlet side of the unloader valve in front of the water pump. The water pushes an internal magnet causing the switch to close, completing the circuit to the fuel solenoid. This, in turn, allows fuel to pass from the fuel pump and enter the burner combustion chamber for ignition.

3. THE FLOW SWITCH (P/N 6-106) AND PRESSURE SWITCH (P/N 6-610)

The function of the flow switch and pressure switch is to turn the burner on and off. They are wired in series. When the trigger gun is opened, water flows through the system, the water flow pushes a magnet in the flow switch closing the flow switch. The pressure switch is mounted into a port on the unloader and senses pressure in the unloader body. When the trigger gun is opened, the unloader moves out of by-pass mode and pressure builds in the body from about 200 psi up to 3000 psi. Once the pressure passes 600 psi, the pressure overcomes a spring in the pressure switch and a plunger moves closing a switch in that device. Once both switches are closed, the burner should light. When the operator shuts off the spray gun and water stops flowing, the flow switch magnet returns to its original position, opening that switch and the pressure drops in the unloader body, opening the second switch, and shutting off fuel supply to the burner. The flow and pressure switch can be checked by disconnecting the two bullet connectors located about eight inches back from the flow switch and enclosed in the black wire loom. Turn the engine on and touch the two male connectors, on the wires leading to the back of the machine together. If ignition occurs when manually completing the circuit, but not otherwise, then the either the flow switch or the pressure switch needs replacement. DO NOT KEEP THE BURNER IGNITED FOR MORE THAN A FEW SECONDS TO AVOID CREATING STEAM (EXCESSIVE PRESSURE) IN THE COIL. The problem device may be isolated by removing the white jumper wire which connects the flow switch and pressure switch together. Then plug the male connectors into one device and test if burner ignites with machine running and when trigger is pulled. Then check the other device. Checking both devices will positively identify which device, or whether both devices, are bad.

On rare occasions, it can be stuck in the "on" (closed circuit) mode. When the burner is operating and the wand is off, cool water is no longer circulating through the coil. As a result, the hot water will expand into steam and begin building pressure within seconds. Pressure is trapped in the lines from the outlet side of the pump to the wand tip. This pressure increases as the steam builds up. When the pressure reaches the pressure relief valve setting, this valve will open, allowing the steam to escape. Hotter water will also reach the aquastat, which will open the circuit when it senses temperature above 180 degrees. When the aquastat switch opens, it breaks the circuit and shuts off the burner. IN THE EVENT OF THIS SORT OF SWITCH FAILURE, THE MACHINE SHOULD BE SHUT OFF IMMEDIATELY AT THE FIRST SIGN OF MALFUNCTION AND THE SWITCH REPLACED.

4. THE AQUASTAT (P/N 6-003)

The aquastat is mounted on the outlet side of the coil underneath the machine and monitors water temperature during operation. It is closed as long as the water temperature remains below 180° F. If temperatures exceed 180° F the aquastat will break the circuit to the fuel solenoid and prevent fuel from entering the combustion chamber. The aquastat should be removed from the machine every six months and scale removed from inside the mounting hole.

The aquastat may shut off heat on hot days from time to time. Continue to operate the unit and the aquastat will reset itself automatically.

5. THE SAFETY RELIEF VALVE (P/N pv5000)

This valve is mounted on the outlet side of the coil on the bottom of the machine and will discharge at just over operating pressure (discharge pressure is adjustable with an allen-head screw inside the valve – for replacement parts, contact Unique Industries for the correct pressure setting procedure). When hot steam builds up pressure in the coils due to a malfunction, this will be the point of relief in the water pressure system since all hoses are wire braid and would require over 9,000 psi to rupture. If the valve releases, turn-off the burner and continue to run water through the machine for about 10 minutes or until wand feels cool to the touch. Correct the malfunction that caused the pressure to build immediately or call Kem-O-Kleen for assistance with troubleshooting. Do not stand behind the machine when the machine is hot. The Safety Valve will reset automatically. Some units may be equipped with a blow-out disk instead of a pv5000, which must be replaced in the event of a blow-out.

Every six months, the safety relief valve should be removed and inspected to insure that no debris has lodged in front of it which might affect its operation. Be sure to clean the plumbing forward of the safety valve, to remove any additional accumulated debris.

6. THE COIL

Three pancakes of coiled, double strength butt-weld pipe force the fire inside the combustion chamber to pass around the pipes. Inside the pipe, water which is being pumped through the interior of the pipe, absorbs the heat from the pipe. The pipe maintains moderate temperature resulting from the continuous cooling from the water passing through. The pipe and ultimately the water absorb most of the heat before it escapes from the exhaust. The pipe will not rust from the inside because oxygen is required for metal to rust.

7. THE ENGINE

Before starting the engine, go through the daily check list on the label located on the Coil and Tank Assembly above the unloader. Open the vent on the gas cap of the fuel tank. To start the engine, apply the choke in cooler weather and open the throttle slightly. Once the engine is warm, set the choke to the run position and increase the throttle to full rpm, then back it off slightly. One hard pull on the starting rope, or a couple of cranks if the engine is electric start, will start the engine.

Level the machine to assure the engine is properly lubricated and the fuel tank is positioned properly relative to the engine (having the front of the unit low will cause the engine fuel pump to work harder and ultimately shorten its life).

The air filter should be cleaned or changed periodically. The fuel tank vent should be closed when transporting the machine or vibration may cause a small amount of fuel to leak through the cap.

An engine under hard use may eventually require a valve adjustment. If the engine pushes water pressure up to a certain level then coughs or backfires that may be a sign that it is time to adjust the valves to regain full compression and operating pressure.

DO NOT POUR GAS INTO GAS TANK WITH THE ENGINE RUNNING!

8. THE MONO-FLOW VALVE (P/N 3-302)

This spring loaded valve, located above the acid tank on the black rubber hose, allows air to go into the acid tank from the air compressor but prevents acid fumes from returning to the air compressor. Fumes from the acid tank traveling back to the compressor will shorten compressor life.

Daily simple mono-flow valve check - To check the operation of the valve, listen

for a hum every day as you pressurize the chemical tank, or grasp the mono-flow valve and a vibration should be felt.

To check the valve for seepage shut off the engine. The air pressure gauge will show nearly 40 psi. Seal the mono-flow valve by opening the petcock at the top of the air compressor. The air pressure gauge will show zero pressure, which means there is now uneven pressure at the mono-flow valve. Nearly 40 psi on the acid tank side forces the ball to seal tightly in the valve and insures acid fumes will not leak past the valve. Shut the engine off. Close the petcock at the air compressor, the air pressure gauge should continue to read zero. If the gauge shows a slow an increase in pressure, then the mono-flow valve is leaking fumes and needs to be rebuilt or replaced.

ALWAYS RELEASE THE PRESSURE ON THE TANK BEFORE SERVICING THE MONO-FLOW VALVE. Rebuilding the mono-flow valve requires removing the hex shaped cap and replacing the Black Spring (P/N 3-313) and inspecting and replacing, if necessary, the ball (P/N 3-310). The hex cap should be wrapped with 20-25 turns of Teflon tape and screwed back into the lower housing. Do not screw the cap in all the way - there should be approximately 3/8" of thread covered with the Teflon tape still visible (this allows sufficient room for the ball to travel inside the housing).

9. THE AIR COMPRESSOR

The two major causes of compressor failure are: 1) low or dirty oil causing bearing failure, 2) Acid fumes corroding the compressor head from an improperly maintained mono-flow valve.

Air pressure will fail to build if either the petcock on the compressor, or the ball valve at the rear of the tank are not closed, or if the filler cap on the tank is not tight. Air pressure may also fail to build if the air release pop-off valves (P/N 3-911) in the plumbing assembly on the side of the compressor head are not adjusted or functioning properly.

Air release pop-offs can be adjusted by loosening the lock nut. Turning the cap inward will increase pressure. Set loosen one valve and continue unscrewing the cap until the pressure gauge reads 38 to 39 psi and tighten the lock nut. Repeat this process with the second valve until the pressure is reading 35-36 psi and tighten the second valve's lock nut. Pop-offs can be set lower if desired. DO NOT SET THE POP-OFF VALVES ABOVE 40 PSI. Replacing the pop-off valves after six months of use is recommended.

Use non-detergent 30-weight oil in the air compressor. Drain by loosening the horizontal (smaller) plug. Fill by reinstalling the horizontal plug and removing the 45degree plug (larger). With the machine level, fill the compressor as much as possible (until oil starts to overflow) and replace the 45 degree plug. Always use 30W NON-DETERGENT Oil in the Air Compressor.

10. THE WATER PUMP

Use NON-DETERGENT 30-weight oil in the water pump. The oil level is checked by viewing the sight glass, or removing the oil fill plug/dipstick located on the top of the pump. Make certain that the pump is horizontally level.

If water gets into the crankcase, the oil will turn a caramel to whitish color and the "oil level" will rise. This condition is caused by a seal failure or a cracked plunger and the part must be replaced. It is important to deal with this promptly because the water reduces the lubricating properties of the oil and will cause accelerated pump wear in the crankcase section. Seal replacement is fairly involved, requiring removal of the pump head and ceramic plungers. If you are not comfortable performing this sort of repair, you can replace the pump, or send it in to Unique Industries for inspection and rebuild.

Sources of pressure drops: A pressure drop can be associated with a clogged water screen (filter assembly located under the coil and tank assembly. Check the clear bowl for signs of debris, or remove bowl. The filter screen can generally be rinsed and reused.

It can also be associated with a clogged nozzle. Remove and inspect the nozzle; you should be able to see daylight when looking through the orifice. If clogged, clear the debris with a small solid wire.

When a sudden drop in pressure occurs, it can be due to debris lodged in the check valves or a broken check valve. Check valves are located under the six large hex nuts in the pump head assembly. Remove the hex nuts and remove/inspect the valves for debris or cracks. All the stainless steel disks should be fully seated against the valve cage base. Clean any debris and reinstall the check valve. Cracked or worn check valves must be replaced.

A gradual drop in pressure can also be associated with worn packing seals. If the seals are worn out, they need to be replaced with a new packing seal kit. To replace the seals, the pump head must be removed by removing the bolts holding it to the crankcase and slipping the head forward with no need to remove the attached hoses. Most repairs can be at the pump head with no need to go into the crankcase housing. If you are not comfortable performing this sort of repair, you can replace the pump, or send it in to Unique Industries for inspection, rebuild and full functional test.

Water pressure will slowly drop as the orifice in the stainless steel spray nozzle at the wand tip is eroded/enlarged. Adjustment of the unloader valve (silvery bolt on top of valve) can restore normal operating pressure to a point. After that, the nozzle must be replaced and the unloader valve reset.

See your Owner's Manual for more details about pump repairs, maintenance and operation.

11. THE UNLOADER VALVE (P/N 5-500 for K-3003 or P/N 5-510 for K-3007)

The function of the unloader valve, located on the front of the drive train, in front of the water pump, is to bypass (unload mode) water from the pump to the recirculation tank when the operator quits spraying water. The is pressure in all hoses on the outlet side of the unloader valve is reduced from 3000 psi to approximately 200 psi, an additional safety feature. The flowing water keeps the pump head cooled, extending seal life. Without water in the reservoir, the pump head would heat up within seconds, potentially causing pump damage.

When the wand is turned on, the unloader valve closes (load mode) and water pressure builds up through the entire hose system from the pump head to the spray nozzle at the wand tip. Operating pressure may be adjusted by turning the adjusting nut located on the unloader or by using a larger nozzle.

12. CONDENSATION

Condensation can occur in the diesel fuel tank (or in the source tank for diesel fuel). The fuel water separator, located below the burner assembly, should mitigate this. Exceptional condensation can be removed by opening the drain plug on the bottom of the diesel fuel tank.

Condensation can also occur in the gasoline tank. If the engine is running poorly, this may be the cause. Check by disconnecting the fuel line at the fuel pump on the side of the engine. Rub a few drops of fuel between your fingers. If it does not feel oily and has only a weak gasoline smell, there is water in the line and tank. Drain tank and line, and then replace with fresh fuel. In extreme cases, the carburetor fuel bowl may need to be drained (open drain screw on carburetor to drain).

13. WATER LEAKS

Leaks are usually easily spotted. Most occur around joints between hoses and fittings. Leaks in the coil usually occur due to the coil rupturing from freezing and are easily noticed by water dripping/draining from underneath the machine. Most joint leaks are repaired by re-taping the joints with Teflon tape. Fittings should be inspected for cracks when removed for re-taping. Ruptured coils can sometimes be welded, but generally have to be replaced. Water hose leaks may be repaired, even on the job, by using re-usable mender kits sized for your hoses and available from Unique Industries.

14. ACID LEAKS

ANY ACID LEAKS SHOULD BE REPAIRED IMMEDIATELY. Release tank pressure and drain the acid from the machine. For leaking fittings, remove fitting where leak occurs and wrap nine wraps of white Teflon tape around the threads to seal the leak. If the fitting is cracked, replace the fitting.

Hose leaks can be repaired using an acid hose mender kit (P/N 5-130).

The acid tank filler cap should be tightened only by hand, so it can be removed without a wrench. Re-wrap the filler pipe threads with Teflon tape from time-to-time to maintain the seal with the cap. Unique industries offers a 2' ball valve for use on the acid tank fill pipe (P/N 2-314).

Store acid drums away from the machine and flush out the hand operated acid transfer pump (P/N 3-030) with water after each use to increase its life span. Keep machine up-wind from the cleaning area to prevent acid drift from corroding the metal, electrical connections, and being drawn into the engine, compressor, and burner. Wash down the wand, hoses and machine with fresh water after each use.

15. ANTI-FREEZE

When the temperature may drop below 32 degrees, the only safe way to protect against freeze damage is to run anti-freeze through the entire system. Remember, if you are trailing the unit, wind chill effect can lower the temperature the machine may experience temperatures below freezing even if ambient temperature is just above 32 degrees. Water freezing inside the machine can cause a great deal of damage. Freezing water expands causing tremendous pressure. Freezing may split the coil, warp the pump head, rupture plumbing fittings and split pressure hoses, among other things. To antifreeze your Kem-O-Kleen:

a. Open the ball valve on the pump and drain the recirculation tank almost entirely To anti-freeze 200 ft of hose, 5 gallons of anti-freeze (or windshield washer fluid rated to prevent freezing to -20 degrees) must be placed in the reservoir (recirculation tank). Start the machine. Squeeze the trigger gun and the water pump will force anti-freeze through the pump head, unloader, coil and 200 feet of hose. When it comes out the end of the wand (nozzle) release trigger gun. Open the ball valve on the water pump to briefly let anti-freeze run through it. On a related note, also open the ball valve on the wash-down hose after shutting off the water supply to the machine, to release any trapped water to prevent it from freezing and cracking the valve housing.

Now, your Kem-O-Kleen is protected with anti-freeze.

Test the anti-freeze periodically since it will weaken with each recycle.

b. When preparing to use the machine, the anti-freeze maybe recovered for re-use. Empty any antifreeze in the recirculation tank (use ball valve on side of pump) into a 5 gallon container. Connect your Kem-O-Kleen to a garden hose and turn water on, filling the recirculation tank. (Optional - place a toothpick in the wand spray nozzle tip.) Start the machine then open the drain valve located just after the trigger gun and hold drain over your 5 gallon container. Squeeze trigger and drain until water comes through. Close the drain on the wand. Now, you have saved the anti-freeze and are ready to clean.

c. An anti-freeze reminder posted on the machine's tank assembly.

16. MACHINE WASHDOWN

Wash down the machine with water after each day's use to remove any acid drift. The wand and some of the hose have been near the wall and exposed to acid. These should be washed with special attention. **DO NOT WASH DOWN THE HOT ENGINE.**

17. WRAPPING THE HOSE ON THE MACHINE

The hose should be alternated with one wrap over (around the two horns) and one wrap under (forming a loop where the wand-end of the hose is under the loop, and dropping the loop over the horns). This prevents the need to continually rotate the wand to wrap and unwrap the hose, so that the hose is not twisted. A hose reel option is available for your K-3003 Kem-O-Kleen (P/N 1-650)

18. PREVENTIVE MAINTENANCE.

Keep the machine operating at maximum efficiency by maintaining all proper adjustments. Increased production and lower overall maintenance costs will result from this special attention. See Owner's Manual for additional Preventive Maintenance instructions.

19. DESIGN

Design Features: The machine is built so that it can be removed from the trailer. The complete machine with trailer will go through a 5-foot door. It is

designed so that any worn part can be replaced without dismantling the machine. Product improvements are designed to be retro-fittable whenever possible. Your Kem-O-Kleen can be adapted to any type of cleaning job by changing chemicals in the chemical tank (contact Unique Industries to check compatibility of active ingredients with the machine, if in question.). Water goes through the pump before it is heated lengthening pump life. The combustion chamber is separated from the fuel tank by a water tank. The water tank has a ceramic insulation firewall between it and the combustion chamber. The engine is mounted away from the fuel tank. The acid tank filler neck is mounted away from the burner and electrical cords and switches. The combustion chamber is totally insulated inside the chamber. The air compressor pulley is floating in the drive train belts to prevent stress on the compressor and mounting flange. Long life, high quality materials and components are used exclusively.

20. SAFETY RULES

Safety rules are posted on the machine and in the Owner's Manual. Following the safety rules will help protect the operator and the machine.

This is an introduction and general summary of part of the information found in the Owner's Manual. To understand the mechanics of this machine, you must read the Owner's Manual. Operate the machine a few days and read it again. You will soon understand how it works. Spare part identification can be found in the Parts Manual.

Included in your Owner's Manual are helpful hints on how to clean masonry and etch precast concrete with your machine. All Kem-O-Kleen manuals are available on-line at www.kem-o-kleen.com , contact Unique Industries for Access Keys to download manuals. In addition, links to manufacturer sites for Engine Owners and Service Manuals are also available at the Kem-O-Kleen site.

If you have any questions regarding your Kem-O-Kleen machine call us at 800-274-4121. We welcome your suggestions and questions.

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