Air Hammer
Operators Manual
36-3000 and 36-5000

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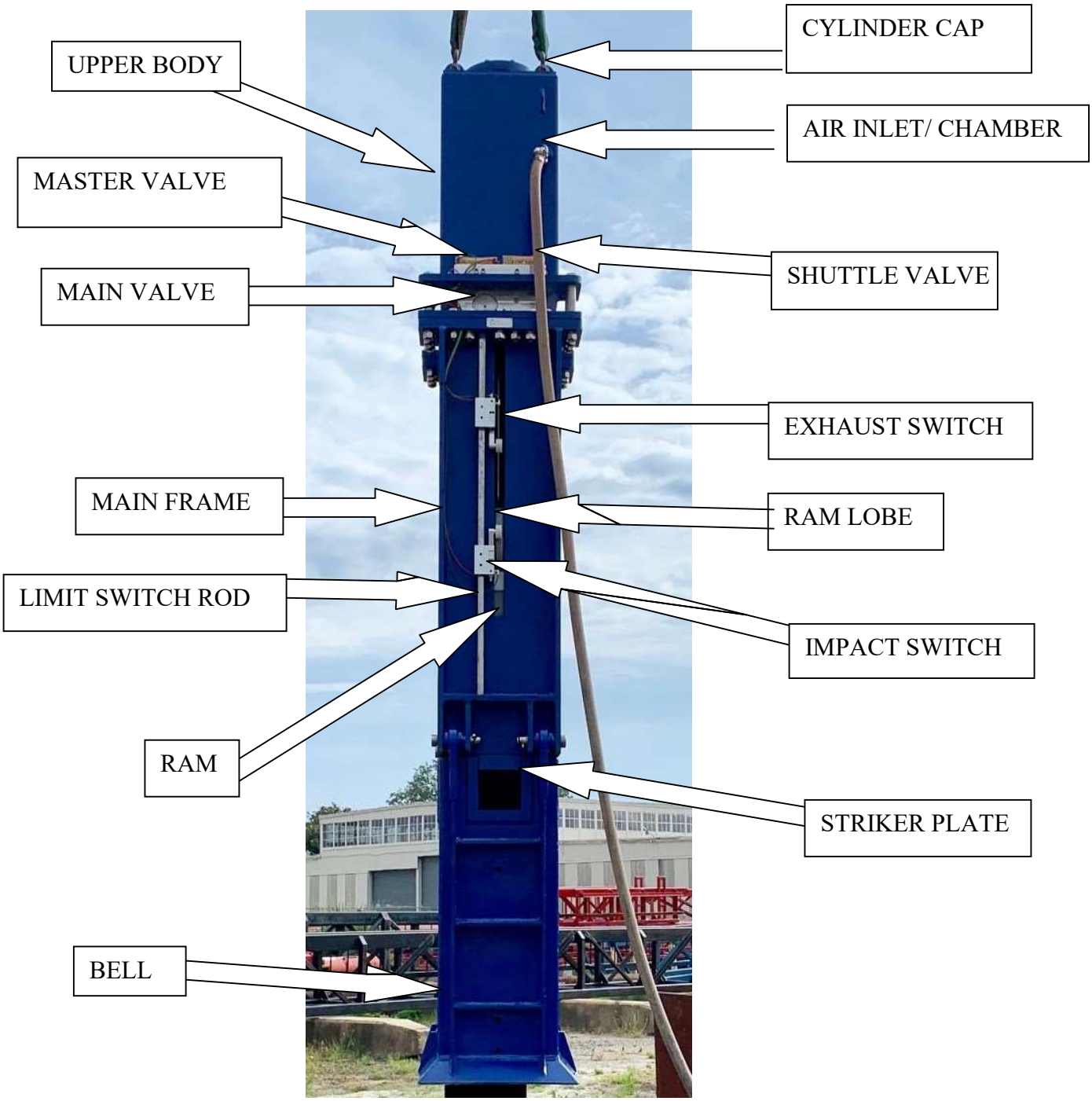
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1. Introduction

The Pile Master air hammer is a compressed air powered pile driving hammer designed for superior efficiency and light overall weight. The ram is a lead filled free fall drop weight for maximum “dead blow” energy transfer, and the hammer body is durably constructed in 3 main sections; an interchangeable bell at the bottom, a main frame housing the ram in the center, and upper body housing the cylinder and air chamber at the top. Sandwiched in between the main frame and the cylinder housing is the main valve block, which is ported directly into the air chamber and cylinder for maximum air supply. The hammer can drive wooden, steel, or concrete piles “free hang” with an extended bell, guided in leads with an extended or standard bell, or drive sheeting with sheet pile adapters in place of a bell.

2. Specifications

Hammer Model:	24-900	24-2500	36-3000	36-5000
Ram Wt. (lbs.)	900	2500	3000	5000
Energy@ Max Stroke (ft lbs.)	1800	5000	9000	15000
Striker Plate Travel	5 ½”	5 ½”	5 ½”	5 ½”
Recommended CFM (rated@ 125PSI/8.62 Bar)	185	185	375	375
Max Blows per min. (@ max stroke)	60	55	50	45
Hammer Wt. (lbs.)	2300	5100	6200	10200
Overall Height w/ Extended Bell	130”	146”	178”	202”
Overall Height w/ Short Bell	109”	125”	157”	181”
Width w/o Lead Guides	17”	24”	24”	24”
Lead Guide Dimensions	20” x 8 ½”	20 x 8 ½”	20” x 8 ½”	20” x 8 ½”
Depth (Front to Back w/o Switch Guards)	20”	25”	25”	25”
Bell I.D.	15 ¼”	16 ¼”	16 ¼”	16 ¼”
Bell I.D. w/ 1” Inserts	13 ¼”	14 ¼”	14 ¼”	14 ¼”
Bell I.D. w/ 2” Inserts	11 ¼”	12 ¼”	12 ¼”	12 ¼”
Bell I.D. w/ 3” Inserts	9 ¼”	10 ¼”	10 ¼”	10 ¼”
Short Bell Working Depth	15”	15”	15”	15”
Extended Bell Working Depth	36 ½”	38”	38”	38”
21” Lead Guide Weight (lbs.)	200	200	200	200

3. Principles of Operation

Operation of the Pile Master air hammer is very simple. Compressed air supplied to the hammer through a throttle valve/ oiler fills the upper chamber of the hammer and from there is distributed to the valves. The master valve delays the air supply to the shuttle valve until minimum operating pressure is reached. The "impact switch" is triggered when the ram is down causing the shuttle valve to direct air to the main valve shifting it to the ram raise position. Upward travel of the ram triggers the "exhaust switch" allowing the shuttle valve to vent the main valve air and shift the main valve to the exhaust/ram drop position. The falling ram will then trigger the impact switch at impact, and the pressure build-up in the cylinder will be completed shortly after the ram has transferred all of its energy into the pile. The cycle will continue to repeat itself until the supply of air to the hammer is shut off.

4. Start-up: Using the Hammer

Note: Always run Compressor and hammer only in well ventilated areas. Keep clear of the exhaust port on the hammer!

1. For initial start-up on the hammer, first inspect the hammer for any damaged, or loose components (check regularly when in use), and see to it no contamination/dirt is in the air hoses or fittings before hooking up the hoses. The oiler is in-line from the compressor to hammer and arrows on the oiler should be pointed toward hammer. The hammer should be resting down on the pile in position to drive....

2. First start the air compressor with the ball valve (on/off) handle in the open position, and the gate valve closed -

3. Slowly open the gate valve and observe stroke and blows per minute. About 50 blows per minute at full stroke should net maximum energy and speed. When set properly use the ball valve to start and stop and leave the gate valve at pre-set. Minor adjustments to the gate valve with changes to temperature and humidity may be necessary.

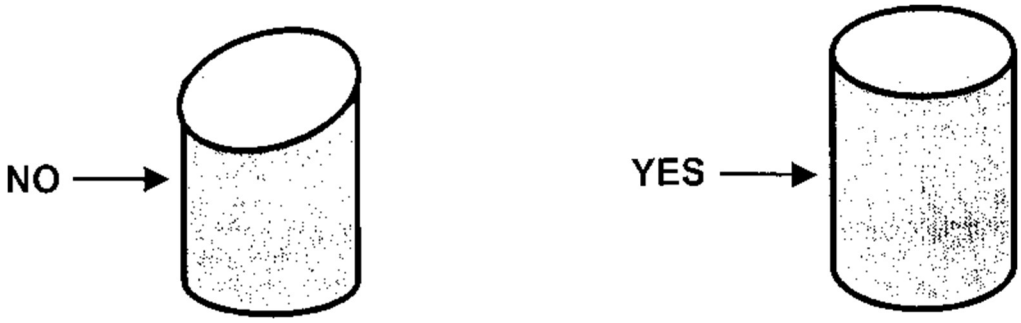
As with all pile driving hammers, never stand near or under the hammer! Inspect for loose bolts and components regularly.

Do not allow the hammer to overstroke or "rack", as this results in damage to the hammer. Industry standards regard 20 blows to the last inch of driving as ultimate refusal.

Driving a pile in excess of 20 blows to the inch voids warranty!

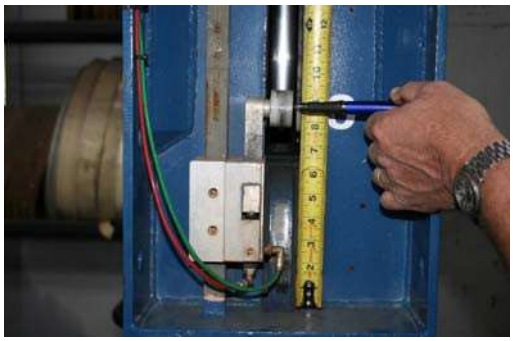
Always allow hammer to follow the pile down, which ensures the striker plate is up at impact. If the ram hits the striker plate when it is below the top of its slots, damage to the base will occur.

Before driving make sure the piles have a flat surface at the pile butt and the pile is centered in the base. Inserts can be added to the base for centering smaller diameter piles. Driving uneven or small piles off center will damage the hammer, and voids warranty.

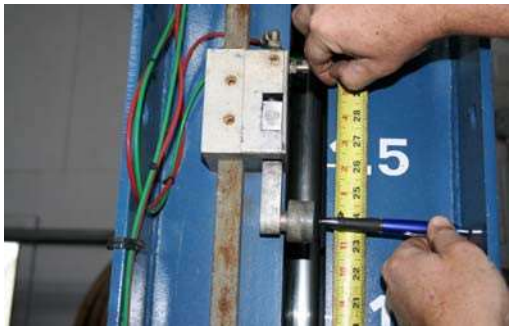


Center of wheel measurements are made from the plate of the frame closest to the impact valve.

Model	Lower Valve	Upper Valve
24-900	8 ½”	18”-30”
24-2500	22”	31”-42”
36-3000	22”	30”-52”
36-5000	16.5”	25”-46”



Center of wheel height for the impact valve to the bottom plate should be about 22” for the 36-3000, and 16.5” for the 36-5000.



The maximum height for the exhaust valve varies due to the condition of the air compressor. Positioning the exhaust valve too high could result in loss of performance.

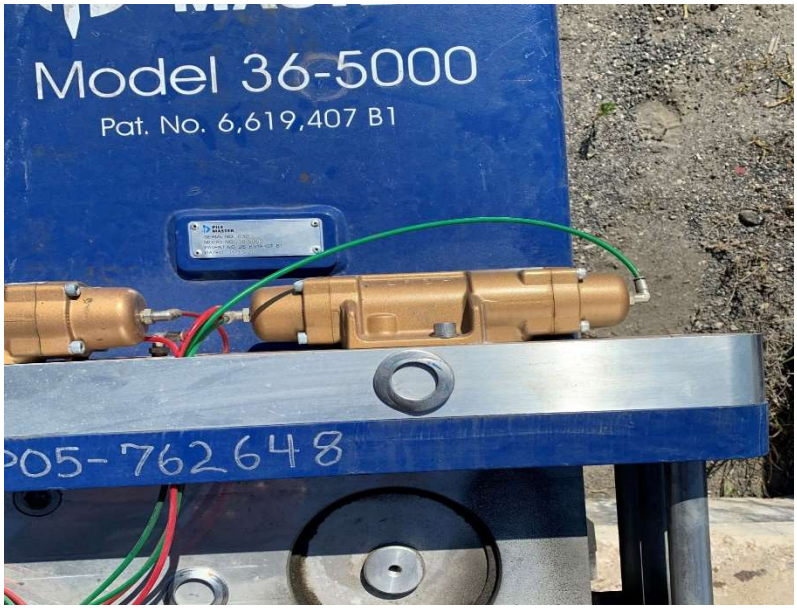
Note switch wheel position.

Note plate position.

A 3/16” hex key is used on the set screws to adjust the height on the exhaust valve.

We have preset the lower switch, (impact) for optimum energy. The upper, (exhaust) switch may need to be positioned higher for longer stroke or lower for shorter stroke. Shorter strokes allow for greater blows per minute. The stroke may vary with air compressor volume and pressure. Use 2-inch hose for the 36- 3000 and 36-5000. Length of hose and number of fittings will also affect performance. All air hose fittings require safety pins. If a hose leaks or fails, shut off immediately!

The “master valve” prevents the hammer from operating until at least 30 psi air pressure is available. (The master valve is on the left side on the 36-3000 and 36-5000)



The “shuttle valve” operates the main valve from the impact/exhaust switch signals. (The shuttle valve is on the right side on the 36-3000 and 36-5000 – note the green tubes)

Oiler/ Throttle Valve with Water Separator

A small standard screw driver is used to adjust the “oiler” to 1 drop per 4 blows.
- Adjust while hammer is running.
- Do not over tighten!
(If the needle breaks off in the oiler body it cannot be extracted, and the oiler will have to be replaced)

KilFrost can be added by removing the bowl to fill it, or through the fill plug on top.

The KilFrost level can be observed through the sight glass on the bowl.

The bowl can be removed by pressing the thumb tab and turning the collar on the bowl.

The water separator should be drained regularly with the petcock on the bottom. This varies depending on humidity. Check every day.

The throttle/ gate valve can be set to control excess air going to the hammer.

The ball valve serves as the On/off switch.

Closing off the supply of air to the hammer with the ball valve simultaneously vents the air already in the hammer for a safe stop.

5. Operation of Major Components:

Master Valve

The master valve is the first component to activate when the hammer receives air at start-up. It operates like a sequencing valve by preventing the main valve from receiving control pressure until the pressure has built up about 30 PSI; enough to quickly move the main valve from "exhaust" to "ram raise" position. By moving the main valve quickly into position, a bypass stall is avoided at start-up. When the hammer reaches operating pressure the master valve will remain open and will not cycle again until the air supply to the hammer is shut off and pressure in the air chamber drops below 10 PSI.

Shuttle Valve

The shuttle valve is the control, or pilot for the main valve. The shuttle receives air signals from the limit switches and shifts as needed to either direct air into the main valve to shift the main valve against its spring pressure to the "ram raise" position, or vent the air at the main valve allowing its spring to shift the main valve back to the "ram drop" position. Facing the hammer, the right port receives the signal from the impact switch to raise the ram, and the left port receives the signal from the exhaust switch to drop the ram on all models.

Limit Switches

The impact and exhaust switches control the shuttle valve by alternately supplying signal pressure to one side of the shuttle valve while the other side is vented. The red tubing supplies constant pressure to the switch valves which direct pressure into the green signal tubes when activated, and vent the green tubes when released by the moving ram. The green tube from the impact switch will go to the right-side shuttle valve port facing the hammer. Think "Ram Raise Right" to help remember.

Main Valve

The main valve is a 2-position valve held in the exhaust/ram drop position by a spring, and shifted to the ram raise position against the spring pressure by air supplied by the shuttle valve as directed by the impact switch signal. The valve is ported directly to the upper air chamber on the spring side of the spool, the cylinder in the center, and is open to the atmosphere (exhaust port) on the air-shift side. When the "spool" is held in the exhaust position by the spring it seals off the air supply from the air chamber while opening the cylinder to the exhaust port. When the valve shifts, the port to the air chamber is opened while the exhaust port is closed directing air into the cylinder causing the ram to raise. When the shuttle valve vents the air to the main valve, it returns to its start position allowing the ram to freefall.

Cylinder

The cylinder is a chrome lined steel tube sealed in the cylinder housing with O-rings. The aluminum piston seals along the cylinder with a pair of cast iron rings, and is secured to the threaded end of the chromed cylinder rod with large washers and a locknut. The cylinder is vented at the top and open to the center port of the main valve at the bottom where the air controlled by the main valve will enter to raise the ram, or exhaust to drop the ram.

Ram

The lead filled “free fall” ram is pinned to the cylinder rod at the top, has wear pads on all four sides where it is guided in the hammer frame, and a cam lobe on the upper front that activates the switches for automatic operation. The bottom of the ram is radiused to reduce lateral forces at impact, and transfers the impact energy through the striker plate to the piling. The lead core allows the ram to be smaller, but more importantly provides a “dead blow” for more efficient energy transfer.

Striker Plate and Bell

The striker plate provides the transfer of energy to the pile while minimizing damage. The plate is contained by the bell slots and bears the weight of the entire hammer, except during impact to the piling. The bell is pinned to the hammer frame, and keeps the hammer aligned and centered on the pile. The bell can accommodate inserts to help maintain proper alignment on smaller diameter piling.

6. Adjustments:
   (MJV-3 adjust protocol)

MJV-3 Mini Valve

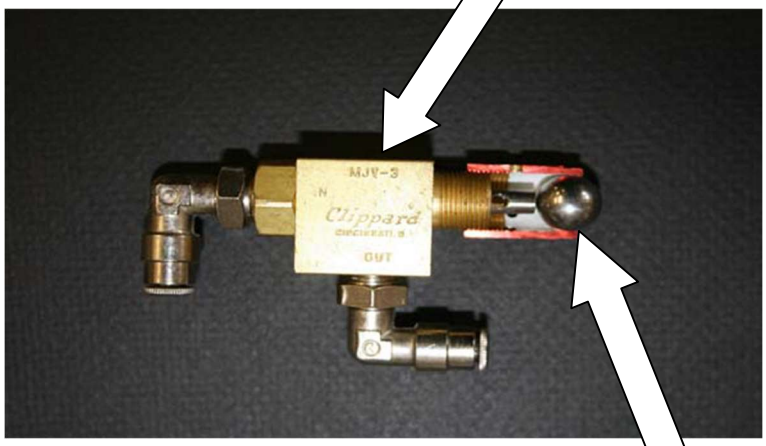


Figure A

MBA-1 Ball Actuator
(cut-away shown)

Thread MBA-1 onto MJV-3 until the ball stops moving, but No Farther. (Fig. A). The poppet must not be depressed. The ball should be able to spin slightly, but not rattle.
Next align the closest flats on the threaded retainer. The slight turn of the threaded retainer either direction will not be a problem for the poppet.

The poppet valve is now ready to be installed in the limit switch housing. Pull the aluminum arm until it bottoms out in the housing, then slide the valve in until the ball is fully depressed against the arm with the threaded retainer touching the arm. (See figures B&C).

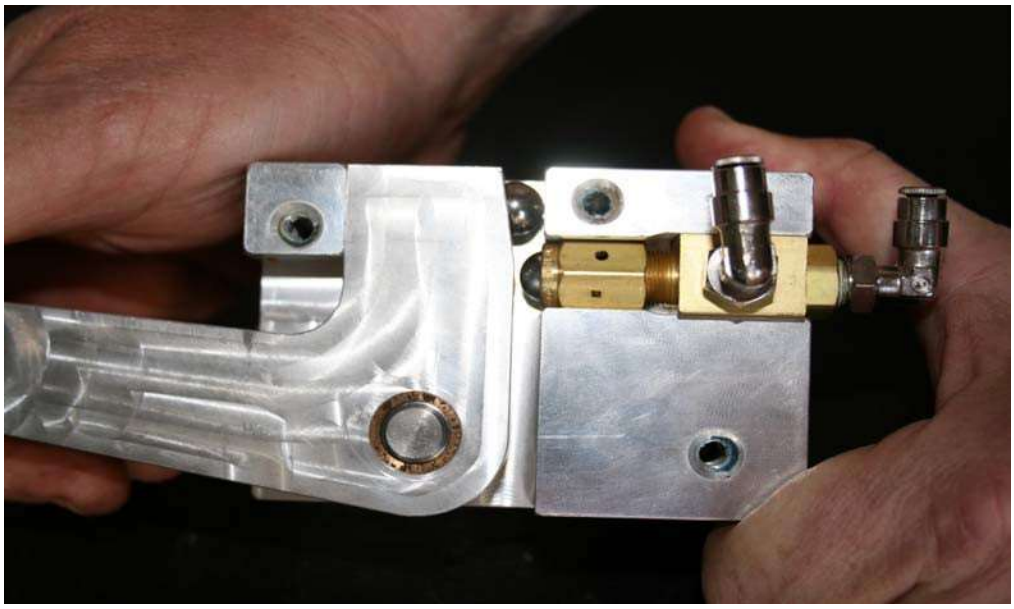


Figure B (cover plate removed)

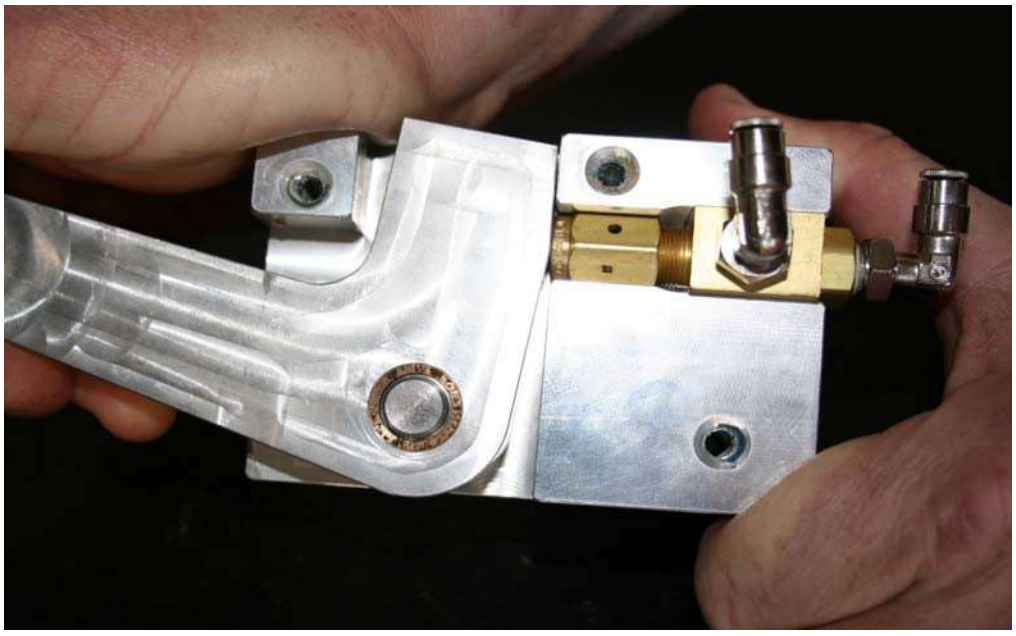


Figure C (note that the MBA-1 retainer is flush with the body and just touching the arm)

Hold the valve in position and tighten the set screw. The valve is now properly set for full actuation without being damaged. Note that on some older hammers the MJV-3 valve may need to be adjusted farther in than normal for the hammer to operate properly.

The limit switch assemblies are mounted to the switch bar via a sandwich mount and secured in place with 2 set screws each. The vertical adjustment on the “impact switch” is critical, but the vertical positioning of the “exhaust switch” is variable to a point; placing the exhaust switch too high will cause a loss of hammer performance and efficiency.

The 36-3000 and larger hammers all use 2 ½ inch O.D. nylon wheels. The wheels in use on hammers built before 2007 may vary. So, check the measurements when ordering parts.

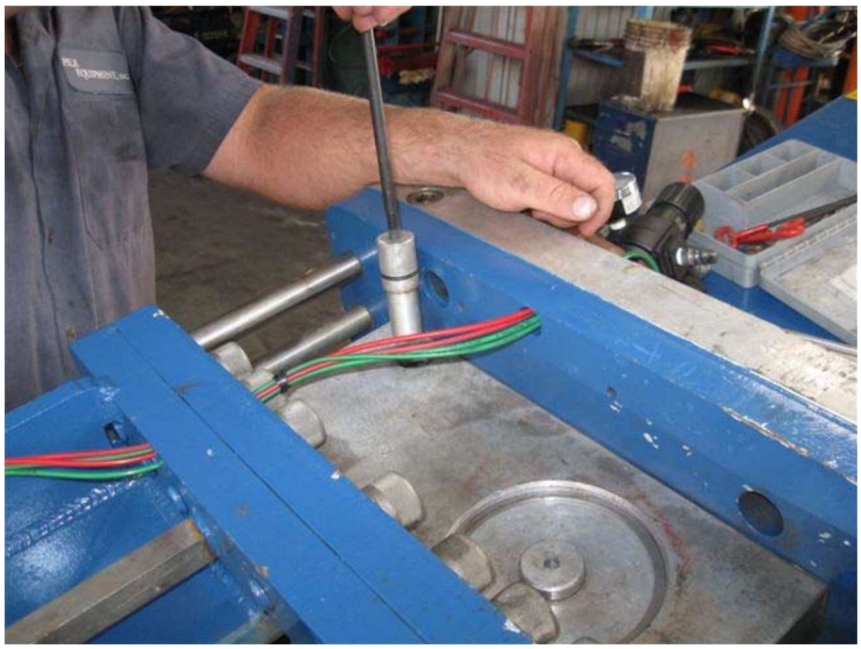
Regulator Valve Test Kit:

90-7710- NAPA ¼” regulator w/ air fitting
36-3000 valve test plug
0017- 3/8” x 9” Socket Head Cap Screw (Modified)
1” pipe w/ adapters to air fittings
5/8” Hex key
3/16” Hex key

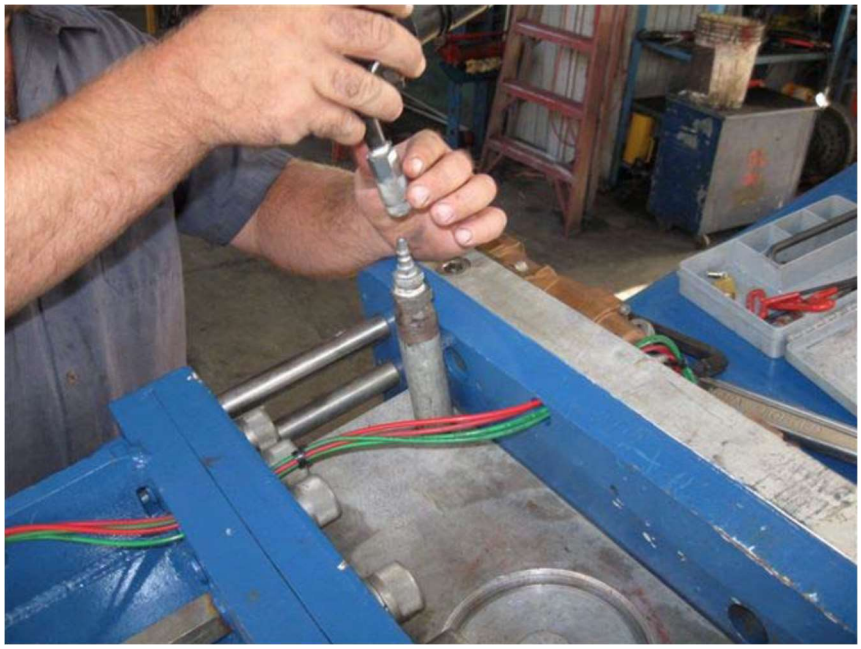
7. Test Protocol:

For testing the air control system, the hammer must first be positioned in a safe and easily accessible manner. Preferably laid down on blocks. Next, the limit switches need to be checked that neither one is in contact with the cam lobe on the ram. If so, then the activated switch can be moved on the valve mount bar until it is free from contact with the cam lobe. When testing is complete, make sure the valves are in proper position before the hammer is put back into service.

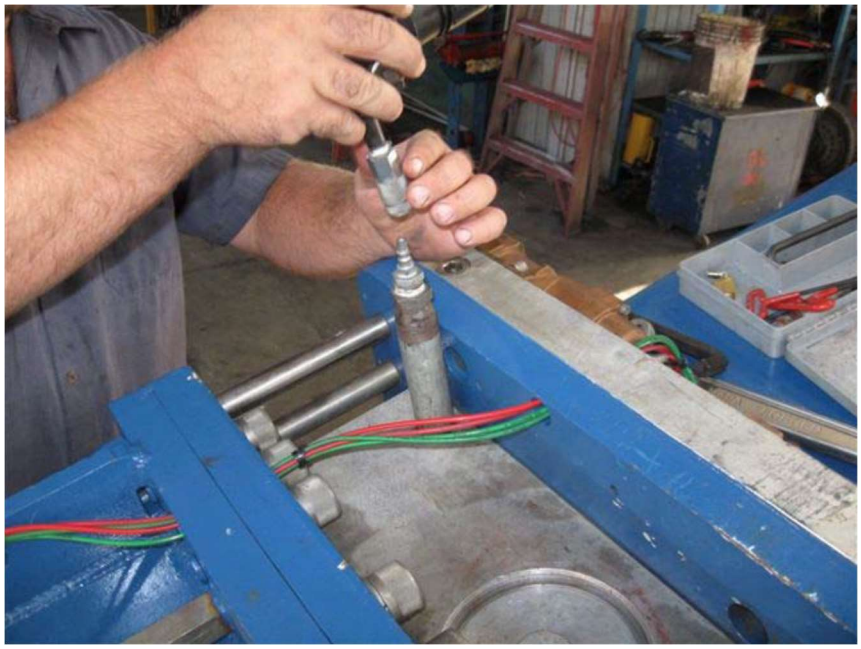
On the front of the hammer, the main valve block has a pipe plug to the left of the main valve cover. The plug seals the cross bore connecting the air chamber to the master/shuttle valve manifold, and must be removed for testing the valves.



Insert the test plug into the air supply cross bore, and thread the pipe adapter in place of the pipe plug. The test plug will prevent the air chamber and cylinder from receiving air, allowing the entire valve system to be tested without the risk of the ram moving.



Connect the regulator to an air supply (air compressor or shop air), and zero out the regulator. Plug the regulator into the adaptor that is threaded into the cross-bore port.



The system is now ready to be tested. Try to limit background noises to make the testing easier.

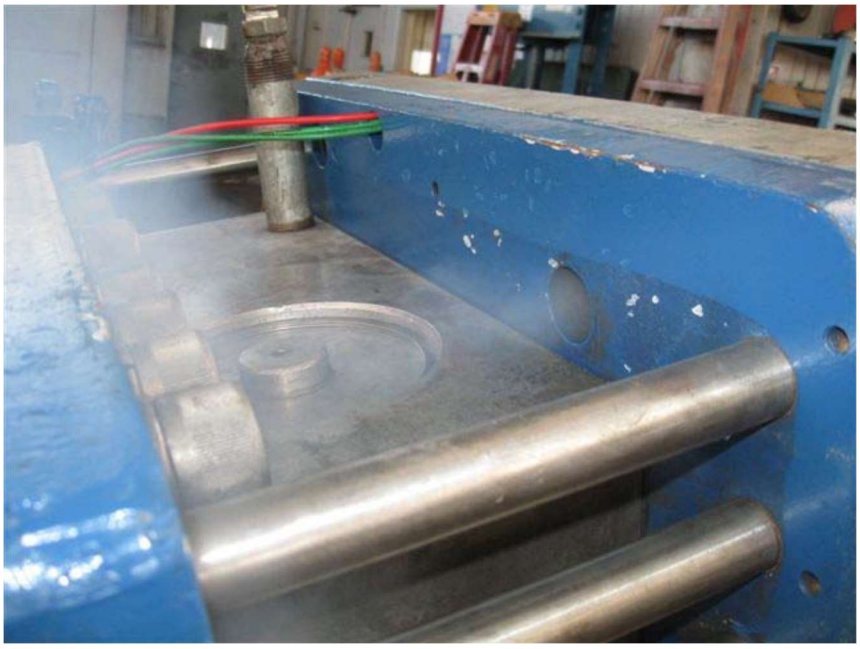
Slowly increase the air pressure from the regulator while manually activating the impact switch. When the pressure exceeds 40 PSI the master valve should open allowing air to the shuttle valve, which should already be shifted to the ram raise position by the impact switch signal.

By looking into the exhaust port, the main valve can be seen, and will move about 1/2” (see note 1).

Stay clear of the exhaust port when the hammer is in use due to the severe risk from the exhaust blast! Using the test plug is the only way the main valve can be safely observed!

Release the impact valve, and you should hear the impact valve vent a small amount of air (see note 2).

Next activate the exhaust switch.



The shuttle valve should respond to the reverse signal and vent the air holding the main valve in position.

The main valve should return to its starting position, (see note 3), as a small blast of air is detected from the small exhaust port below the shuttle valve (see note 4). Release the exhaust valve and it too should release a small amount of air identical to the impact valve (see note 5). Repeatedly activate the impact and exhaust switches alternately to observe proper function of the system. Any leaks detected must be corrected before the testing can be completed. However…
Notes:

1... if the main valve begins to shift below 30 PSI or as soon as air begins to build up, the master valve will need to be disassembled, cleaned with light oil and retested, since it may be stuck open…. if that does not correct the problem, then the master valve will need to be replaced.

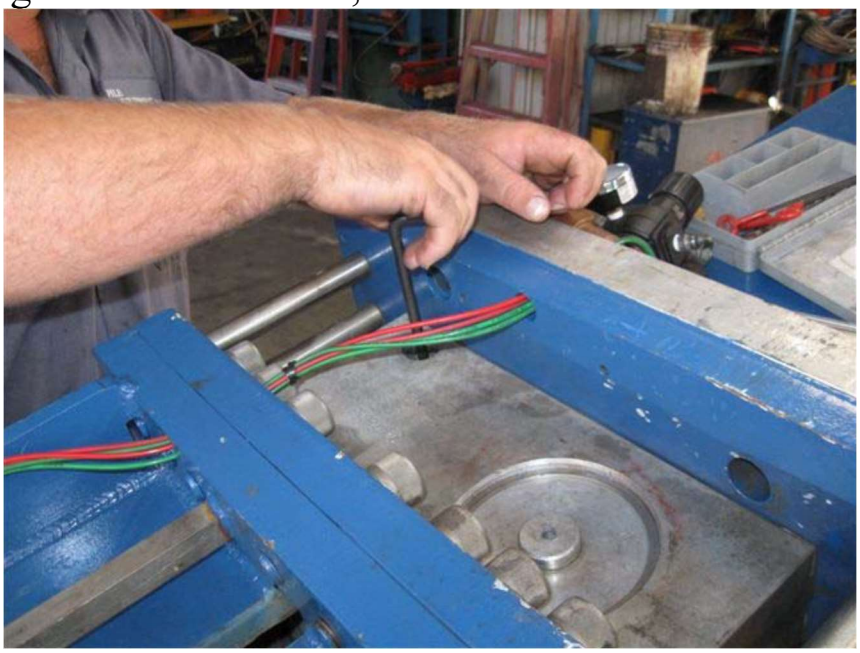
2… if the impact valve fails to vent, then the ball actuator may be clogged with dirt, the valve stem may be stuck, or the valve may be out of adjustment. (see section 6). The green tube can be removed to check that the valve is sending signal air when activated, but the tube must be in place to determine if the valve is venting properly.

3… if the main valve fails to move properly it will need to be disassembled to check for possible broken spring, or broken main valve bolt, and to clean and lubricate the air piston end of the spool. Replace seals if needed.

4… if the main valve does not respond as described then the shuttle valve may be sticking (sometimes the shuttle valve will respond sluggishly before sticking completely), and will need to be disassembled and cleaned with light oil or replaced. Check that it is receiving proper signals from the limit switches. Sometimes improperly adjusted limit switches can cause slow or sluggish performance from the hammer.

5… if the exhaust valve fails to vent, then it will need to be cleaned and/or readjusted. (see section 6). Like the impact valve, the green tube can be removed to check for proper signal flow.

When testing is successful, activate the impact switch one last time and back off the regulator pressure. When the pressure drops below 10 PSI the small exhaust port below the master valve should vent gently and the main valve return to its starting position. This confirms that the master valve is closing as it should. If not, refer to #1 of this section.



Remove the regulator and pipe fitting adapter. A long 3/8” bolt is used to extract the test plug. Replace the pipe plug, and the hammer is ready to drive pile.
The hammer will not run if the test plug is not removed!

8. Troubleshooting

A. Ram will not raise – little or no air venting:

1. Little or no air getting to hammer; Check that throttle valve (gate valve) is open, check that ball valve(s) is/are open. Check air compressor for pressure and flow.
2. Impact switch not activating; Check for proper function and adjustment, make sure it has not slipped below proper start position. Also, make sure the hammer is resting fully on the striker plate. Failure to keep hammer on the pile as it drives will damage the base and other parts of the hammer. Adjust, clean or replace switch if needed. (See section 6)
3. Exhaust switch is stuck; Check that the arm is not damaged or jammed, check return spring, check that the MJV-3 valve is not jammed/ clogged with dirt. Clean and reassemble, replace if needed. Check for proper adjustment. (See section 6)
4. Shuttle valve stuck/not shifting; Remove the valve, disassemble and clean with light oil. Check O-rings, replace if needed.
5. Foreign object has ram jammed in main frame; Separate upper housing from main frame and block upper housing to prevent it from falling on personnel. Pry out foreign object, and reassemble.
6. Master valve not opening; Check that it has not come loose on manifold, check O-rings to manifold, check that signal tube is not kinked, cut or broken. Disassemble valve and clean with light oil- replace if needed.

Note: If the ram is jammed from one of the ram wear plates, then the jam will have to be freed, the ram removed from the main frame and the frame pressed back to its original dimensions and checked for cracks. The frame is built from mild steel, and no special techniques will be needed to grind out and weld cracks. Severe damage may require replacement of the frame. The wear plates will come out of position again and wedge against the ram if the main frame is damaged from off center or out-of-parallel driving.

Troubleshooting

B. Ram will not raise- Air venting from exhaust port:
   1. Master valve stuck open; Disassemble and clean with light oil, replace if needed.
   2. Main valve stuck/ jammed or seals damaged; Disassemble main valve, check for foreign objects caught in valve, clean valve body and valve parts. Reassemble with new seals and lubricate with light oil.
   3. Main valve spring broken; Remove valve plug left of exhaust port and replace spring.
   4. Main valve bolt broken; Follow instructions for B-2 above and reassemble with new bolt.

C. Ram will not raise- Air venting out top vents:
   1. Most likely piston rod or ram rod pin is broken; The rod will break if the piston is allowed to run loose, so the piston may need to be replaced as well. A severely damaged base can also cause a broken rod by allowing the piston to bottom out. Replacing the piston rod requires full disassembly of hammer.
   2. Worn out/ Broken piston rings; Remove cylinder cap, piston nut and washer. Remove piston and large washer from piston rod. Replace rings, making sure to stagger ring gaps and lube. Reassemble large washer, piston, washer and nut to piston rod. Torque nut to specifications.

D. Hammer runs slow:
   1. Air supply inadequate/ restricted; Check throttle valve (gate valve) adjustment, check ball valve(s), check air compressor flow/pressure output. Is compressor big enough for the hammer? Check the hose size; 1" dia. hoses for 24" stroke hammers and 2" hoses for 36" stroke hammers. Note that inadequate air to the hammer can cause "cyclic" strokes; short, long, short, long every other stroke as the hammer runs ahead of the available supply.
   2. Exhaust switch set to high; Lower the exhaust switch per the switch set chart in section 6.
   3. Main valve not shifting out of ram raise position; (Note that air will be venting out the upper cylinder slots and not the exhaust port)
      a. Impact switch stuck in triggered position; Remove MJV-3 valve, remove ball actuator, clean and

reassemble, replace if needed. Refer to section 6 for adjustment. Check that aluminum arm is not stuck, clean and lubricate if needed.

b. Exhaust switch is not activating; remove, clean and readjust per section 6. Note that on some older hammers the MJV-3 valve in the limit switch housing may need to be adjusted further in than normal for the hammer to work properly.
c. The green or red tubing to the limit switches cut, kinked, or broken; Inspect the tubes and fittings. Replace as needed.
d. Shuttle valve stuck in ram raise position; Remove, disassemble and clean with light oil. Reassemble and mount with new O-rings. Replace valve if needed.
e. Main valve vent plugged; The original plug for the main valve vent had a perforated cover to allow proper venting and a standard pipe plug cannot be used in its place. Remove any obstruction in the vent hole.

4. One of the limit switches out of adjustment (see section 6), but all components functioning as they should.

E. <u>Hammer runs erratic:</u>
1. Low air supply; see D-1
2. Limit switches out of adjustment; refer to section 6. Note that some earlier hammers or hammers with excess wear or a bent switch mount rod may require the MJV-3 valves to be set further in than normal to run properly.
3. The hammer is not “keeping up” with pile; Ensure that the hammer body is resting on the striker plate with each blow. Holding up on the hammer, or failing to keep up with the pile <u>will</u> damage the hammer, and could cause down time, void of warranty, or costly repairs!

F. <u>Hammer stops suddenly:</u>
1. Impact switch slipped out of position; Raise switch back into position and tighten set screws. (Refer to the switch setting chart in section 6)
2. Exhaust switch stuck in triggered position; Check that the aluminum arm is not jammed. Disassemble and clean up damage and grease lightly. Check that the return spring is not broken or damaged. Remove the MJV-3 valve, remove ball actuator, clean and reassemble. Replace if necessary.

(Refer to section 6 for adjustment)

3. Nylon wheel/ cam follower failure on impact switch; Limit switches will not work without the white nylon wheel on the black cam follower. If any of these parts are damaged or missing, they must be replaced.
4. Piston rod broken; See C-1.
5. Main Valve Stuck: See B-2.

G. Hammer "out of control" over-stroking and jumping up off the pile:

1. Too much air going to the hammer; Stop the hammer immediately and restart with the throttle valve closed. Slowly open the throttle valve until the hammer reaches the desired stroke. Note that over-stroking will damage the hammer in short order, and must be brought under control as soon as possible. Note, the hammer cannot be safely operated without the throttle valve/ oiler in line!

H. Hammer hits one or more blows after air to the hammer is shut off:

1. The "muffler" on the three- way ball valve on the throttle valve/ oiler is plugged with silt or sludge; Since this is a recurring problem with the old-style mufflers, remove the muffler and replace it with new style. If the new style muffler should become clogged, it can be removed, cleaned with a mild solvent, blown out and reinstalled.
2. Standard ball valves are being used to control hammer; This is a serious safety hazard! The throttle valve/ oiler with a three- way ball valve must be used in line to the hammer. The inability to immediately vent the air chamber on the hammer could lead to a serious risk to personnel and equipment!

I. Bolts coming loose, switches slipping on rod:

1. Bolts and set screws not properly tightened; Properly tighten any loose fasteners… If the problem persists…
2. Driving conditions excessively hard; Severely hard driving will lead to excessive wear and damage to the hammer. The driving criteria needs to be reexamined to determine if the job requires a larger hammer. Driving past practical refusal (10 blows per inch) could void warranty! Or….
3. Driving conditions excessively soft; "Running" piles or the failure to keep up with the pile will cause a lot of damage to

the hammer including possibly breaking the piston rod. The crew needs to be instructed on the importance of keeping up with the pile, and the exhaust switch may need to be lowered to reduce stroke. Otherwise a smaller hammer may need to be used to do the initial driving.

J. Ram sticks and stays up after air is shut off:

1. Attachments bolted to main frame pressing the frame into the ram; This is normally only seen in the older thin framed hammers. Remove the attachments and straighten them to eliminate the interference.
2. Foreign object has ram jammed; refer to A-6 of this section.
3. Main frame interfering with ram due to external impact damage; The upper body and the ram will need to be removed from the frame. The frame will then need to be pressed out to restore it to its original dimensions, check for cracks. (Refer to A-6)

K. Ram raises to the top and stays up when air supplied to hammer. Drifts down as air vents from ball valve at shut off; (Only hammers with new style non slotted cylinders and vented cylinder caps)

1. Main valve not shifting out of ram raise position; see D-3.

Note:

Several symptoms listed in this section could also be a result of cold weather. The ever- present moisture in the air hammer may make pile driving impractical during freezing weather conditions due to ice forming in the valves.

The use of oil in the “oiler” can also cause problems, since oil and the inherent moisture in the hammer will create an emulsion (goo) that will clog the small signal tubes etc. Some lubricants, such as ATF (Automatic Transmission Fluid) will negatively react to the o-rings and seals in the hammer causing a cascade of valve failures, and must NOT be used in the oiler/ throttle valve!

9. Maintenance & Storage:

Introduction:

It is important to understand that for a pile driving hammer, "extreme duty" is just another day at the office. Pile drivers are unique machines that have an inherently harsh service life. During normal use of the hammer several components will require regular maintenance, and some parts will need periodic replacement. This is particularly true in coastal and marine environments where corrosive salts are added to the naturally dirty and wet conditions on site. Increased maintenance is all that is needed to keep the hammer reliable in these adverse conditions, however reliability cannot be guaranteed if the hammer is being abused.

The same is true for the hammer and all of its components when it comes to storage. The best storage conditions are going to be indoors. If a shed or shop are not available, a tarp can be used to cover the hammer and protect it from sun and weather provided it can "breathe" enough to keep the hammer dry. A plastic tarp over the hammer that reaches to the ground can hold in a lot of moisture and make things worse.

A. Cylinder, Piston and Rod:

The chrome lined cylinder will require no maintenance, but the piston rings will benefit from a periodic spray of light oil into the cylinder, since very little lubrication is deposited onto the cylinder wall from the air supply. It is recommended to spray some light oil into the upper cylinder vent holes via the perforated plate at the top air chamber opposite the hose connection.

The piston and rod normally last a very long time, but hard driving may shorten their service life. The most important thing to do is check the piston nut regularly. First lay the hammer down, and raise the bell end of the hammer up until the ram slides to the top of the frame. Lay the hammer down level and remove the cylinder cap. The piston will now be easily accessible for inspection and torqueing the nut. The nut should be torqued to approximately 330 ft. lbs. for the 24-900 etc. and 600 ft. lbs. for the 36-3000 and 36-5000. If the piston runs loose for any length of time the rod will eventually break, and both the piston and rod will need to be replaced.

During light and periodic use, the piston nut will need to be checked no less than once a month. During production driving the nut will need to be checked no less than once a week, depending on the duration and hardness of the driving. Remember to spray some light oil into the cylinder before the cylinder cap is put back on the hammer.

B. Main Valve:

The main valve is a very simple and reliable mechanism, but it, like the rest of the hammer, is exposed to moisture and potential contamination. Any contaminants that get into the hoses, oiler, or hammer can end up on the air piston side of the main valve where it will be trapped. Because of the constant wet and dirty conditions, it is advisable to disassemble, clean and lubricate the main valve with light oil each time the piston nut is checked. Once a month during light use, and once a week during hard use. If the jobsite conditions are less harsh than average, the air piston side cap can be removed, the chamber wiped out and sprayed with light oil without full disassembly every other time the nut is checked. It is recommended to spray a small amount of light oil into the main valve vent holes next to the exhaust port at the start of each shift.

C. Limit Switches:

The limit switch assemblies with the heavy-duty aluminum arm and body, with the nylon roller on a cam follower have proven to be very durable and reliable. The MJV-3 poppet valve is well protected by the switch body, but it is not immune to contamination, corrosion, or fine sand/silt. Keep the aluminum arm and return spring well lubricated, and remove the poppet valve for cleaning as needed. Replace if necessary. Refer to the adjustments section for proper installation. Try to keep the hammer in dry storage when not in use.

D. Master Valve:

The master valve is basically a zero-maintenance component, but can malfunction due to the inherently harsh conditions. If the master valve does fail (see troubleshooting), the valve can be disassembled and cleaned with light oil. If that does not fix the problem, simply replace the valve.

E. Shuttle Valve:

The shuttle valve is just like the master valve when it comes to maintenance and repair. Keep in mind that all the components on the hammer will last longer and be more reliable if the hammer can be kept in a dry storage between jobs.

F. Bell and Striker Plate:

The bell and striker plate are maintenance free, however the bell is prone to wear and can be damaged in certain driving conditions. Very hard driving can cause localized wear in the slots where the striker plate rides, and it can develop fatigue cracks in extreme cases. The bell is fabricated from mild steel, so weld repairs are pretty basic. The most damaging to the bell would be any circumstance where the striker plate can bottom out in the slots during impact; very soft driving, a running or broken pile, and holding up on the hammer while driving. Repeated bottoming out of the striker plate will damage the bell, and eventually the piston and rod. Grind out (bevel) and weld any cracks that appear in the bell, and replace bent pins and damaged pin bushings as needed. Chronic cracking is an indication of a serious problem with the driving conditions or the way the hammer is being handled.

The striker plate takes all of the beating the hammer dishes out, but will normally last as long as any component on the hammer. If the tabs on the plate become worn down, they can be built-up and ground back to the original dimensions. If the plate develops a crack it must be replaced.

G. Ram:

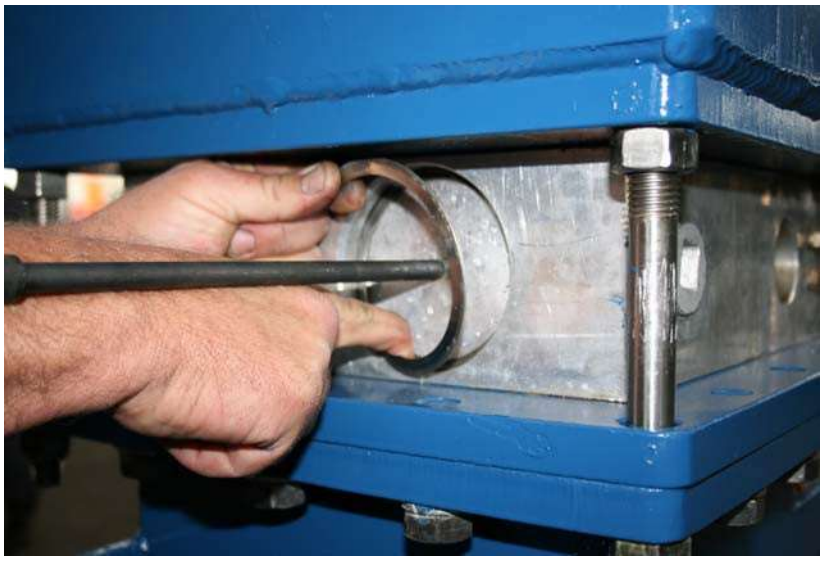
The ram, guided by the nylon wear pads, should last for the life of the hammer. Once a year the upper housing and frame should be separated so the wear pads, the cylinder rod connecting pin, and bushings can be inspected. These parts are very durable, but over the life of the hammer some parts may need to be replaced. If the ram should develop any cracks, it should be returned to the dealer for repair or replacement. Do Not grind or weld on the ram. The ram is lead filled, and should not be repaired in the field because of the risk of exposure to lead.

H. Frame and Upper Housing:

The frame contains the ram and supports the entire hammer on the striker plate tabs between blows and when stopped while on top of a pile. Because the ram is guided by nylon pads, the frame normally fares better than the bell under most driving conditions. The contact area where the frame rests on the striker plate can wear and deform especially during very hard driving, but can be built up fairly easily. Normally the only repairs needed on the frame are a result of excessively hard driving, soft driving, or damage from collisions or impacts with other objects. Fatigue cracks can be ground out and welded up with standard AWS welding techniques. (See also the troubleshooting section).

9. Maintenance (cont.); Main Valve Disassembly:

Using two standard screwdrivers, start by gently prying out the spiral retaining ring on the valve plug to the right of the exhaust port.

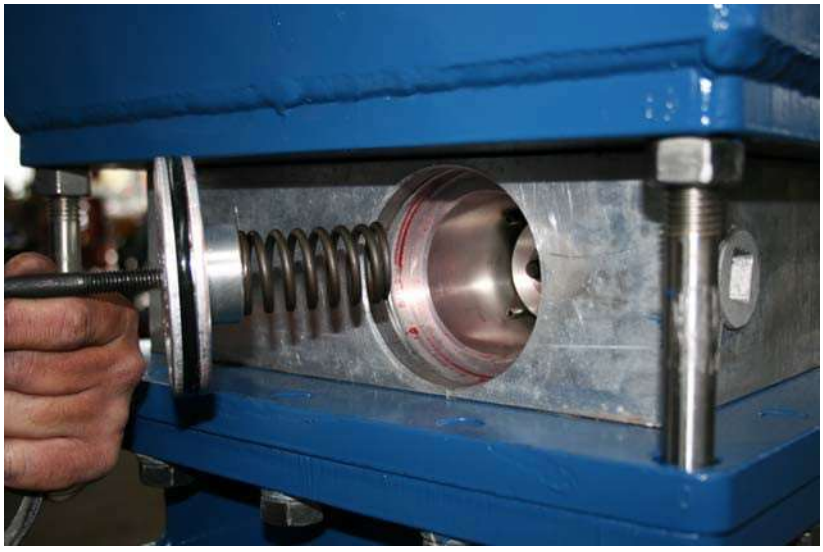


Work the retaining ring out while pulling the free end toward the center. The retaining ring can easily bend if it is not carefully removed, and might then be ruined.

With the spring compression tool in place on the valve plug to the right of the exhaust port (with the ¾" bolt in the center of the plug), tighten the tool only enough to relieve the pressure on the retaining ring.

The retaining ring can then be safely removed as described in the first two pictures.

When the tool is fully retracted, the spring pressure will be relieved enough to allow safe removal of the plug and spring. Use both hands to control the tool when you unhook it from the tie rods! Note: use caution when dealing with the 36-3000 spring. It is very strong and can forcibly eject the plug if not held firmly during disassembly by the spring compressing tool.



Using a 3/8-inch bolt (a spare 3/8 x 9 s.h.c.s. main valve bolt works well) pull the plug out. The plug may need to be “walked” out. The spring in this picture was glued to the plug prior to installation. Note: use caution when dealing with the 36-3000 and 36-5000 spring. It is very strong and can forcibly eject the plug if the plug is not held firmly during disassembly.

The spring was glued with Loctite to make reassembly easier.

Repeat the process shown in Fig. 9.1 and 9.2 for the air piston side of the main valve, which is to the left of the exhaust port.

The air piston plug does not have spring tension behind it, and may be slightly harder to remove. Be sure to clean the bore outside the retaining ring groove before trying to pull the plug. It may be necessary to sand down corrosion or build-up to make removal easier.

The main valve spool is now ready to be disassembled.

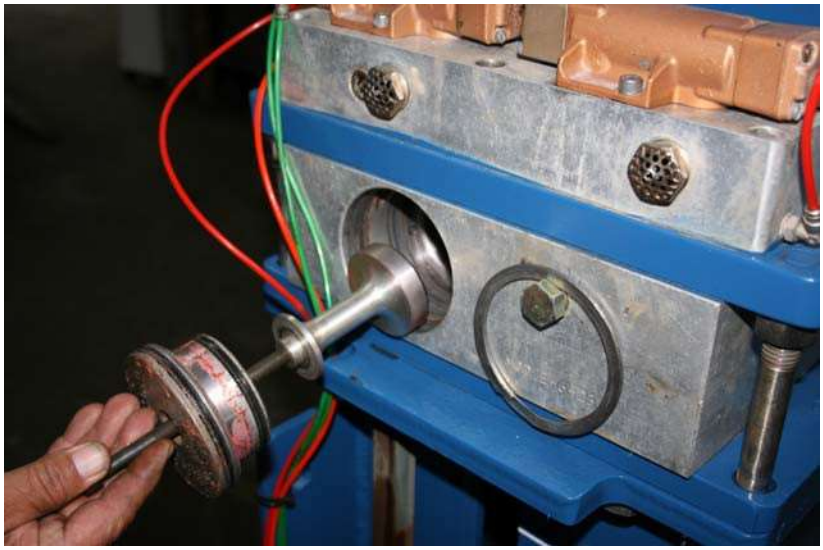
A 3/8-inch hex key (allen wrench) is used on the socket head at the air piston end of the valve.

A 3/4-inch socket with extension is used on the nut at the spring end.

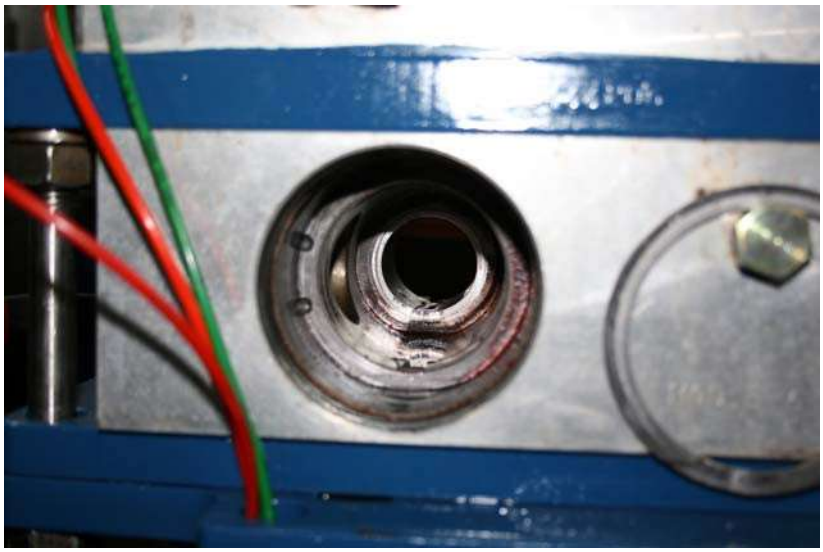
Disassembling the spool should be a one-man job.

With the nut and washer off, the poppet with seal and stem can be removed.

The ratchet handle can be used to gently push the remainder of the spool out the other side.



The air piston, push rod, and seal can now be removed and cleaned up.



The inside of the main valve needs to be cleaned out, inspected for damage or wear, and lubricated prior to reassembly.

The complete valve spool (with the spring being held in place with RTV silicon).

The seal is easily removed, and can often be turned around one time before it needs to be replaced.

The piston O-rings are easily replaced, and must be well lubricated before reassembly. It is best to reverse, or replace both seals at the same time.

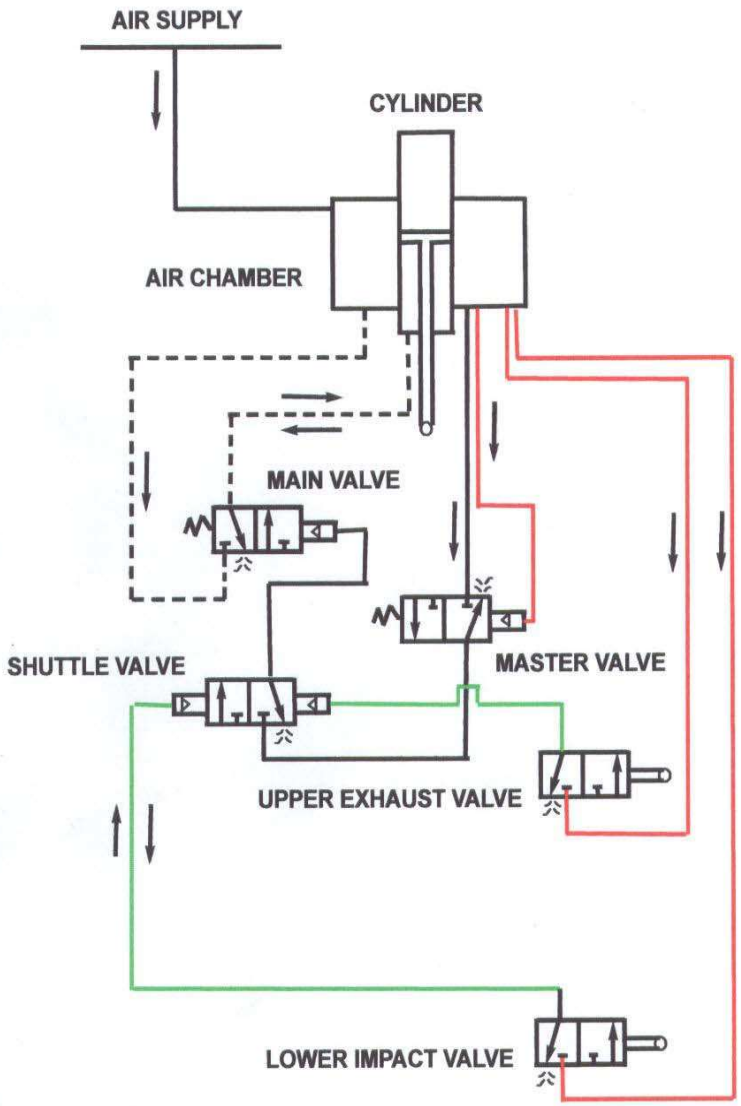
Reassemble the spool in the main valve body in the reverse order of disassembly. The spiral retaining rings need to be greased (it makes a big difference the next time they need to be removed!), and carefully walked back into the grooves with a screw driver. The retaining ring on the spring side goes in easier if a second man holds the plug in while the first man installs the ring!

Maintenance Schedule

	Daily	Weekly	Monthly	Annually	As Needed
Lightly lube cylinder Check piston nut	X	X	X	X	
Disassemble and Clean main valve Lube Main Valve	X	(x)	X	X	
Disassemble limit switch valves, clean and adjust	*			X	X
Clean and Lube master valve	*		X	X	X
Clean and Lube shuttle valve	*		X	X	X
Housing, Frame, Ram, Bell, Striker Plate, Pins, Bolts, Tubing, etc.	*				X

Note:

Inspect- *
Service/ Repair- X
Depending on conditions- (x)



Pilemaster Schematic