The 7600 Tire Changer had its beginning in 1979 with the purchase of the Vulcan Power Mag tire changer line. The first production 7600s were slightly modified Vulcan changers. Since that beginning, the changer series has seen significant changes, but still retains the basic look of its predecessors. Some attempts were made to alter the original design using less costly materials, only to return to original parts and ideas. Today, two decades later, the 7600 remains part of the JBC product line and has proven to be a workhorse in the marketplace.

This manual incorporates current and past documents that have accumulated over the life span of the changer. The text and illustrations are combined to provide a history of changes and improvements that have made these changers the respected machines they are today.
Theory of Operation

Power to operate the 7600 and 7700 changer in both directions is achieved by using air over hydraulics, coupled with a large lever, some pivoting pins, and a rack and pinion setup.

Compressed air is stored in a surge tank. The surge tank supplies air on demand to the pneumatic-hydraulic cylinders via a 4-way valve. This operates the bead breaking and tire removal/installation functions of the changer. Air is also supplied to large and small dump valves to provide bead seating and inflation capabilities.

The dual power concept is unique in the industry. Both forward and backward strokes are fully powered. This is achieved by supplying air alternately to the upper or lower cylinder and using hydraulic oil as a link between the two. At rest, the upper cylinder has full air pressure on it, supplied by the normally open port of the four way valve. When the foot pedal on the four way valve is depressed, the normally open port is closed, and the normally closed port of the valve is opened. Compressed air in the upper cylinder is exhausted through a muffler on the four way valve. Concurrently, compressed air from the surge tank is applied to the bottom of the lower cylinder. This forces the lower cylinder piston upward. Hydraulic fluid in the top of the lower cylinder is forced through the 5/8" hose connecting the top of the lower cylinder and the bottom of the upper cylinder, pushing the upper cylinder piston upward. The lower cylinder moves the main lever, pulling the upper bead breaker downward while pulling the gear rack to the right (toward the upper bead breaker column). This turns a pinion gear rigidly attached to the center shaft, supplying power for bead removal or installation and for bead breakdown. The hydraulic fluid pushing the upper cylinder piston upward moves the lower bead breaker shoe upward, supplying power to break down the tire bead from the bottom of the tire at the same time. When the operator removes his foot from the four way valve pedal, the system returns to the rest position under full pressure.

Once the tire is installed on the rim and ready to inflate, the large and small dump
valves come into play. The large valve provides air to the bead seater ring. This ring directs a large volume of air into the tire cavity. This large air volume helps force the flexible sidewalls of the tire apart, bringing the beads into contact with the rim, temporarily sealing the bead against the rim. At the same time, the small dump valve opens and provides air to the valve stem of the tire for final bead seating and inflation.

Operation of the changer is controlled by two foot pedals, freeing the operators hands for handling the tire tool and the tire itself. Bead breaking shoes and tool rotation are controlled by the right-hand pedal; and inflation air flow is controlled by the left pedal. A pressure relief valve on the surge tank, set at 200 psi, is designed to prevent over-pressurizing the system, while a flow restrictor orifice is in line with the air gauge to protect it from damage. A maximum pressure air gauge is supplied on the surge tank for monitoring absolute system pressure on current machines. Early machines did not include this maximum pressure gauge.

Figure 1 helps illustrate operation of the tire changer when removing and installing tires. Become familiar with the components of the system. Power is supplied by compressed air. The compressor used should supply five cubic feet per minute (5 cfm) of compressed air at 120 to 180 psi for satisfactory results.

Illustrations are divided into four parts to help you understand the separate functions of the changer. Figure 1 shows the changer at rest. Note the points where the air system connects. Figure 2 shows the air routing necessary to create the changer forward stroke (counterclockwise rotation) of the center shaft and corresponding bead breaker action. The 4-way valve controls the air supply to and exhaust from the power cylinders. Notice that one end of each cylinder has an air line connected to output or exhaust ports on the 4-way valve. One air line connected to the input side of the 4-way valve. The two ports shown with no connections are exhaust ports (where the mufflers are installed).

Figure 3 and Figure 4 illustrate dump valve air routing to supply the inflation system. The left-hand pedal operates both valves. The small dump valve (for inflating tires) opens first, allowing full inflation volume and pressure to be supplied to the valve
stem. Pressing the pedal further opens the large dump valve, supplying maximum air pressure and volume to the bead seater ring while maintaining full pressure to the inflation hose. The blast of air from the bead seater ring aids in primary bead seating.

Center shaft rotation is controlled by the rack and pinion. The pinion gear is attached to the lower end of the center shaft. The center shaft is supported at the top by the shaft housing and a nylon. At the lower end, the shaft is supported by a DU bearing. Square key stock holds the pinion gear in position relative to the center shaft, and a castle nut holds the gear on the shaft. The pinion gear is driven by the rack, which is connected to the main lever by an idler bracket. The idler allows the rack to move horizontally as the lever travels in an arc. Depending on the when the unit was built, the rack will be held in mesh with the pinion gear by a roller, a block, a machined flat surface, or a nylon pad mounted to its back. This support keeps the rack in mesh with the pinion gear during its travel.

The following major hardware is attached directly to, or connected by pivot pins to the main frame of the machine:
Upper and Lower cylinders
Lower shoe arm weldment
Main lever 4-way valve
Large and small dump valves Column lever Surge tank Foot pedals Everything else is basically attached to the machines skin. Air lines are left suspended or held loosely in place by nylon ties. Accessories and tools are kept in the tool tray or on optional hangers at the end of the changer.
HISTORICAL PARTS DATA

Much of this manual concerns parts changes that have occurred over the life span of the product. Each section begins with the earliest part(s) used when FMC acquired the line and continues to present JBC production parts. Changes in function are noted within the text.

Bead Breaker Shoes

The earliest lower bead breaker shoe was Part Number 66225, and consisted of the shoe with four support arms welded to it. This was the basic Vulcan design lower shoe. Part Number 66103, was the first redesign, and had only two pivot arms welded to the radius shoe. In late 1980 this shoe was replaced by part number 66425. This redesign extended the shoe by 1/2", moving the contact edge closer to the tire. This part continues in production to the present. For a brief time this shoe was replaced by a removable lower shoe, Part Number 66696. The 66696 was replaced with the earlier 66425 after a short time, but the removable shoe is still available as an option, Kit # 66884.

The Lower shoe arm Part Number 66032, was redesigned after serial no. LA166-201 / LA234. The redesigned part accommodated a new shoe height adjuster screw and the 66696 removable shoe mechanism. The new part number was 66697. Older 7600s can be adapted to accept the removable lower shoe by installing a 66710 kit, which includes the shoe, shoe arm, threaded adjuster knob, and connecting hardware. With the addition of the threaded knob, a setscrew, and a nylon insert, a 66697 arm can replace a 66032 arm on any older 7600. Using the newer arm eliminates the need for the button height adapters.

The Upper shoe arm also evolved, starting with Part Number 66070, which changed to Part Number 66287 (same as 66070, but with a handle welded to the arm), and finally changing to Part Number 66488. The last change applies to all machines from serial no. 20,000. The redesign accommodated the addition of a guide pin, used in conjunction with a compression spring, Part Number 66330 to create tension on the
upper shoe. The latest upper bead breaker assembly, Part Number 66713, fits any changer. This is a standard service item and includes the latest upper shoe, upper shoe arm, spring, and guide pins in kit form.

The upper bead breaker shoe began as Part Number 66135, then changed to Part Number 66490 at the same time the upper shoe arm became Part Number 66488. These changes were effective beginning with machine serial number 20,000. Current production has added a handle to the upper shoe, and the Part Number is now 67403. This may be used as a replacement for 66490 shoes on all 7600s after serial number 20,000.

**Power Cylinder**

Three numbers have been used for 7" power cylinders since the start of manufacture. Part Number 66011, was the first, and is distinguished from the later cylinders by the one piece construction of the bottom plate and cylinder wall. Changers from serial 20,000 use D cylinder Part Number 66547 through February, 1993, and Part Number 67730 (upper cylinder assembly) and 67731 (lower cylinder assembly) from 2/24/93 on. These newest cylinders (or power pack Part Number 66548) may be used to replace a power pack in units prior to serial 20,000. When using the current power pack, the entire changer must be raised at least 5/8" to provide operating clearance for the lower cylinder. This may be done by using screws at each of the four mounting points of the frame to raise the machine. When elevating a unit that is lagged down, loosen the lag nuts, install 5/8" shims or spacers between the floor and the changer to raise it an adequate amount, then re-tighten the nuts. The following parts are recommended to raise free-standing units:

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1121513</td>
<td>5/8-11 hex nut</td>
</tr>
<tr>
<td>1100087</td>
<td>5/8-11x2&quot; hex head cap screw</td>
</tr>
<tr>
<td>1100247</td>
<td>5/8&quot; lockwasher</td>
</tr>
</tbody>
</table>

In late 1981 the piston and rod assembly was changed. The following change to
Part Numbers took place:
Piston from 66016 to 66481

Piston Rod Weldment from 66014 to 66482 "0" Ring Seal from 1185408 to 1101690
The piston and piston rod assembly were redesigned and the "0" Ring Seal replaced with a smaller one. The o-ring seal was relocated from the side of the piston rod to the end of the rod. Piston rods designed for the later seal have an o-ring groove cut in the end of the rod concentric with the O.D. of the rod. Use of this o-ring permits a more positive hydraulic seal, since obturation is created by simply tightening the 1/2 x 20 bolt securely.

If a 66481 Piston is to be used, you must use a 66482 piston rod weldment and 1101690 "0" ring with it. Either piston rod will fit with the 66016 piston but the 0-ring used must be matched with the piston. Apply Loctite 601 or equivalent to the 1/2x 20 bolt that holds the piston and rod together before assembling them.

4-Way Valve
Three four-way valves have been used. The four-way valve started as Part Number 66117, a rectangular aluminum block with a mounting bracket welded to the frame. This valve was replaced by a plastic valve, Part Number 66538, and Part Number 66524 support bracket, starting with serial 20,100. Shortly after that the 4-way valve reverted to # 66117, which was now mounted to the frame using a bracket, Part Number 66674. This bracket change was required to match up with the redesigned frame in use at that time, and permitted all air line hoses to lay within the frame for better routing. An interesting variant of this design had the four-way valve mounted on the opposite side of the frame from the foot pedal. This valve was actuated by a push rod attached to the valve with a roll pin. The foot pedal pushed the rod to actuate the valve.

Both the 66538 and 66117 four way valves were superceded by the 87165 four way
Valve in 1992. Between July, 1992, and September, 1994, this valve was combined with an air assist system to make functioning more positive. A kit, Part Number 67716 was created for use on changers built before July, 1992. If a changer experiences sluggish four way valve return it may be retrofitted with an air assist system using kit Part Number 67714.

**Dump Valves**

The original large and small dump valves, Part Numbers 66116 & 66115, were replaced for a time (between serial numbers 20,000 and 21,959) with a one piece plastic valve, Part Number 66537, and support bracket, Part Number 66523. Later units reverted to the original valves. A kit Part Number 66574 was built to replace the plastic valve. This kit is no longer available, but the valves used are the same as used in current production should repairs be required to one of these early units.

**Rack and Pinion**

A number of redesigns to the rack, pinion gear, and related parts have taken place over the life of these changers. Because of the stresses placed upon these components during use, the changers were redesigned several times. Some measure of repair was possible on older units to overcome wear problems. Some units were so worn that only frame replacement would restore the machine to proper function.

Earliest D-hole frame tire changers used a roller mounted to a pin to maintain the rack/pinion gear relationship. High stresses caused extreme wear, creating the need for a kit to replace the roller. This kit consisted of a steel square block that fit over the old shaft replacing the roller. This provided a positive guide for a redesigned rack included with the kit. This Kit, Part Number 66480, was intended to repair Vulcan Mag IV, and early 7600s with D-hole type frames, and the shaft attached at the bottom. A similar problem developed in later units in which the shaft extended down from the frame. Repair Kit No. 66496 was released to overcome this wear problem. In this repair the shaft is
completely removed and replaced with the kit. In any case of wear in the rack/pinion areas the pinion gear must be inspected carefully and replaced if excess wear is apparent.

The 66480 Kit included a special rack with a wear pad surface on the back of the rack. It consists of:

Roller Service Kit 66430
Rack Bearing Block 66477
Filler Block 66478
Rack Weldment 66479
Setscrews(2) 1/4-28 1102686

Roller Shaft Kit 66496 consists of:
Roller Shaft 66498
Shaft Support Plate 66497
Screw 1/2-13UNCx1" 1100054
Lockwasher 1/2" 1100245
Plain washer 1/2" 1107385
Nyliner 1" 66162
Roller 66292

**Tie Bar**

Three Tie Bars have been used. The first was Part Number 66074, which was used with machines with D-hole frames. This was isolated from the main lever by two nyliners. When the D-hole main frame was redesigned, the tie bar was redesigned and renumbered to 66383. No nyliners were used with this tie bar. The last change took place when the rack was changed to Part Number 66430. The tie bar Part Number was changed to 66428. This bar is used in current production machines.
Main Frames and Frame Kits

Because some wear problems were so severe that a kit could not repair them, rebuilt frames were made available for some time. The eventual complication of frame replacement soon brought about development of frame kits. Most wear problems were resolved by using a replaceable, oil impregnated wear pad Part Number 66501, and rack Part Number 66430. The only Main Frame Service Kit available today is Part Number 66668, which includes a 66587 main frame weldment to bring the changer up to today's standards. This Kit consists of:

Main Frame Weldment 66587 DU Bearing 66356
Foot Pedal 66586 Brass Street Tee 1101642
4-way valve support brkt. 66674 Straight Fitting 66327
4-way valve tip 66582 Lockwasher 1/4" 1100241
Rc11 pin 3/16 x 1-1/2" 1185232 Tank Hose 66556
Screw 1/4-20 x 3/4" HHC 1100805 Plastic Hose 3/8#1 985038
Plastic Tube-in Retainer 66386 Screw 1/4-20 x 1/2"HHC 1101501
Inflation Manifold Hose 66557
Main Lever Pin  Locators

The original 7600 upper shoe column (66039) had a piece of tubing welded to the base for a connecting pin to go through and connect it to the main lever. When the upper shoe column was redesigned to Part Number 66285, the tubular connection was eliminated. The new column used two holes bored near the bottom. Two spacers, Part Number 66334, and a pin, Part Number 66295, were added to connect the main lever and the upper shoe column. Later, when a material problem was spotted with the pivot pin used to connect the two, a 66404 Kit was developed as a retrofit. The kit consisted of:
(1) 5/8-11 x 6" grade 8 bolt
(2) 5/8" flat washers
(1) 5/8-11 lock nut

This kit replaced a defective pin with a strong nut and bolt, using the original spacers. A very limited number of changers were affected, including Vulcan Model IV, Serial Number 3380-3700, and FMC 7600s, Serial Numbers 10100 - 10215, inclusive.

Air Lines and Associated Fittings

Starting in July, 1988, all plastic airlines were replaced with rubber airlines. Barb fittings replaced the original brass fittings (66327 & 1101642) and hose clamps replaced tube-in retainers and the 1101659 Kwik Snap hose clamp used on the plastic line supplying the air gauge. A Rubber Hose Field Kit (67535) is available to completely convert units from plastic lines to current production rubber lines. Consult 7600 Parts Reference manual, Form No. 4271-7 or later for individual parts needs relative to the change over to rubber airlines from plastic. NOTE: a section in the back of this manual is devoted to special installation instructions related to the service kits, retrofit kits, and items like Travel Limiters, Filter Kits, and tubing kits. Most Kits have a copy of the instructions packed in with them. These instructions will help the technician become familiar with kit installation before going on site at a customers location.
External Skin

In March, 1996, the external appearance of the changer was modified using an abrasion resistant plastic upper skin. Because of differences in the frame, the new skin and cover cannot be retrofit on earlier changers. This resulted in a new changer model, the 7700. This changer works exactly the same as earlier units and requires the same troubleshooting procedures.

TROUBLESHOOTING

Troubleshooting tire changers requires a basic understanding of mechanical levers and gears, pneumatic systems, and hydraulics. All moving parts are either directly operated by air or indirectly affected by those that are. Anything that moves can slow the machine down or restrict its movements. To get the maximum efficiency from these changers, the air system must be tight, sufficient hydraulic fluid must be present, no air can be in the hydraulics, and pivoting parts must move freely. All metal-to-metal contact points should be lubricated per the Operators Manual. Remember these changers have no clutch. Whenever the right foot pedal is pressed, all of the moving parts are going to attempt to move. If one part cannot move properly, additional stresses are placed on the entire system until the foot pedal is relaxed. Because these systems develop some 3 tons of pressure per square inch, stresses developed may be quite high.

Leaks and Air Restrictions

Air leaks and restrictions tend to slow the machine down and cause it to lose power. Air leaks tend to be the least trouble to locate and easiest to fix, except when the leak is in one of the main cylinders, dump valves, or 4-way valve. Make certain the air system is tight before condemning a mechanical part. Inspect airlines for kinks and cuts, then squirt soapy water around the fittings to help spot leaks. Unusual motions
in the tire changer may be the result of faulty o-rings or seals in the four-way valve. Air to the main cylinders, and the exhaust from them, flows through this valve.

The inside spool of the 66117 four-way valve resembles a valve in an automatic transmission. The o-rings direct air flow to one secondary port while blocking flow to a second secondary port and opening an exhaust port. If the o-rings become worn or cut, odd changer actions may occur. More common is an accumulation of foreign matter from the air supply. The rings may deteriorate because of excessive moisture in the air system. Muffler may clog from debris, and can actually STOP a changer if they do not blow apart. Blown mufflers cause the unit to be out of OSHA compliance, so should be replaced as soon as possible. Some tire changers used a sintered brass muffler which would NOT blow apart. Mufflers of this type should be replaced with standard plastics, Part Number 59659, for better performance.

Most failures in the main hydropneumatic cylinders is due to failure in one of the seals or o-rings. This may also be caused by contaminates in the air supply. Cylinder problems may be solved in one of three ways. A 66350 cylinder rebuild kit is available to repair any of the 7" cylinders. The initial cost of these kits is low, but extensive tear down, reassembly, and bleeding of the power pack is required. Second, a complete new cylinder could be installed, but charging the system with hydraulic fluid and bleeding is still required. Finally, the 66548 Twin Power Pack may be replaced as an assembly. This is a drop-in set of new cylinders and line, complete with hydraulic oil. Replacing cylinders in this manner requires no bleeding and is the least labor intensive. This is the best method to use if a customer wants to repair the hydraulic system of his own changer.

Complete instructions for disassembly, re-assembly, and bleeding is contained in the service section of this manual. Read it thoroughly before attempting to rebuild or bleed a cylinder.
Shortened Stroke or Jerky Motion

If a changer operates with a shorter stroke than normal, the likely cause is a low hydraulic level between cylinders caused by an oil leak. Hydraulic oil may leak at hose connections, through the o-ring seals in the piston, or through a porous piston. Oil from any of these sources (except the hydraulic hose between the cylinders) will be seen coming out of the muffler that operates in conjunction with the leaking cylinder. As oil is lost, the stroke diminishes. The operator first notices a problem when the bead breaker shoes will not break beads in the usual manner. The shortened stroke likewise shows up when mounting or demounting a tire. BE SURE THE STROKE LIMITER IS NOT ENGAGED IF THE UNIT IS SO EQUIPPED.

A jerky motion is usually caused by air in the hydraulic system. When this condition is found, the repairman must first determine what has allowed air to intrude into the oil, and repair the fault. Normally, cylinder repair or replacement is necessary to rid the changer of this type of problem. Be prepared with proper parts and repair equipment before starting the repair. Sometimes air gets into the system when a customer attempts to add oil without knowing how the system works. The results are often empty cylinders and oil on all surrounding surfaces.

General Troubleshooting Guides

Complaint: JBC, FMC, or Vulcan tire changer that will not loosen the tire from the rim, stalls, or loses power.

Suggested action:

1. Extend the cylinder to its full height and check the stroke (6-1/2” for 7600 and Power-Mag IV; and 5-3/4” for the Auto-Mag III). If stroke is too short, check for leaks, add hydraulic oil as required, and bleed the system.
2. Check the air supply pressure. It should not be less than 120 psi.
3. Check for restrictions in the airlines to the cylinders.
4. Check condition of o-rings in the 4-way valve. Put a new set of rings in the valve if they are getting soft or tearing. Clean and lubricate the valve spool and o-rings with plain petroleum jelly. Recheck cycling.
Air Supply
Measure air pressure at the tire changer with a good pressure gauge - do not rely on built-in 000 compressor gauges. If air supply is above 120psi minimum, go to next paragraph. If air supply is not at least 120psi, adjust to a minimum of 120 - 180 psi. Recheck for proper function.

Blocked Air Lines
If the air supply is in the 120-180 psi range, disconnect the air line at the bottom of the lower cylinder. Connect a pressure gauge to the air line and verify the air pressure at that point is the same as the nominal pressure for the air supply when the foot pedal is pressed. If pressure is correct, repeat this check with the air line running to the top of the upper cylinder. (Be sure to bleed off tire changer air supply before hooking up the pressure gauge, or hold the foot pedal down completely while connecting the gauge. Check pressure when the foot pedal is released. If either or both air lines are 10 psi less than air supply, check the air lines for obstructions. Once located, remove obstruction and recheck air pressure.

Four-way Valve
If you have good air supply but do not have good pressure at the cylinders, and no restriction exists in the airlines, check air line coming into the four-way valve. If pressure is good, disassemble the four-way valve and check the o-rings on the valve spool. If the o-rings are damaged or brittle, replace them, clean and lubricate the valve, and retry (66117 valve). If this problem exists on the 87165 valve, clean and lubricate the valve and retry. If the problem still exists with the 87165 valve, replace the valve and retry.
PREVENTIVE MAINTENANCE

Standard PM service includes cleaning and lubricating the changer on a periodic basis. The following lubricants are recommended for this service:

Manufacturer Description

Franklin Oil Corporation MTS-1000

Franklin Oil Corporation H-80 Moly Grease

Dow Corning Molykote 165 Open Gear Lube

Dow Corning Molykote 299 Open Gear Lube

Dow Corning Molykote G-Plus Paste

Dow Corning Molykote G Paste

Recommended Hydraulic oils are:

Manufacturer Description

Esso Univis N42

Exxon Univis P32

Exxon Univis J26

Sun Oil 2105

Mobil Oil D.T.E. 25
Aside from the dump valves and 4-way valves, the main cylinders probably need more attention and take more care during repair than anything else in the changer. The following is a guide for bleeding the cylinders after any cylinder servicing or repair.

**Cylinder Bleeding**

The following instructions are equally applicable to any Vulcan or FMC 7600 tire changer, except for the difference in the stroke length (5-3/4" for Vulcan Auto-Mag III, and 6-1/2" for all others). It is important that the power pack is completely filled and free of air if maximum performance is to be obtained.

1. Fit air regulator between air supply and changer. Fully close regulator and bleed all air from surge tank.
2. Remove upper cylinder from the unit.
3. Remove pipe plug from filler tee on lower cylinder
4. Extend upper cylinder piston approximately 2". See the drawing #2 accompanying this write-up.
5. Turn upper cylinder upside down and keep vertical. Lift surge tank end of unit high enough that the top of the filler tee is highest point of the power pack (See #2 illustration)
6. Disconnect hydraulic line and fitting to upper cylinder. Fill cylinder with hydraulic fluid. (Use only recommended non-foaming hyd. oils). Care must be taken to keep dirt out of the system. Reconnect fitting and hydraulic line.

**THE SYSTEM IS NOW OVERFILLED THROUGH FILLER TEE**

8. VERY SLOWLY open regulator so that air is fed to changer. This will pressurize the upper cylinder, causing the piston to retract. Approximately 10psi is required to slowly move the piston. Excess fluid will be forced out of the cylinder through the hydraulic line and out of the filler tee. To avoid spillage, connect a hose to the top of the filler tee and collect the excess fluid in a container.
9. Let the piston retract slowly to within 1/8" from bottom of cylinder (see #3 illustration). Replace pipe plug on filler tee. A suitable shim (see #3 illustration) between piston end and cylinder end cover may be used to prevent the piston from bottoming out.

The power pack is now fully bled and can be replaced into the system. To check if properly filled, cycle the machine and observe the stroke (see #4 illustration).
Cylinder Rebuild

Cylinder rebuild kits are available for 7" cylinders only, Part Number 66350. Sufficient seals, wear rings, and 0-rings are supplied to do minor cylinder reconditioning. If the cylinder body, piston, or piston rod are damaged, they must be replaced at time of overhaul. Changers equipped with older one-piece 7" cylinders should have the complete power pack (66548) installed.