Chapter 3

Hydraulic System Troubleshooting

BIPPMF01 (Published) Book specs- Dates: 20060905 / 20060905 / 20060927 Lang: ENG01 Applic: PPM

3.1. How the Single Stage Press Hydraulic System Works

The focus of this document is single stage press hydraulic circuitry and how the hydraulic components function during the various parts of the operating cycle. Refer to the electrical schematic manual—particularly the schematics on microprocessor inputs and electrical valves, and to the programming and operating information in the reference manual for a better understanding of the control logic.

Notice 48: Understand the press servicing hazards—Before performing press maintenance, review document BIPPMS01 “Safe Servicing...”

single stage press—a press extractor that squeezes water from successive batches of wet goods at one pressing position (versus a two stage press that first lightly presses the goods at one position, then fully presses them at another). Pressing leaves the batch of goods compressed into a “cake” that must be subsequently broken apart by basket rotation in a dryer.

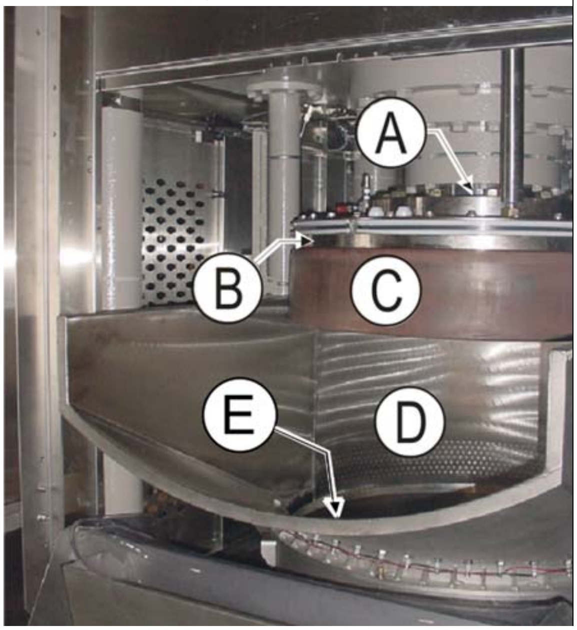
cake—a load of goods in a batch laundering system (typically a tunnel system) that has been compacted together by a press extractor into a cake shape. Cakes are moved from the press to dryers via shuttle conveyors designed especially to move (and possibly store) such cakes.

press code—a programmable sequence of one or more operating steps that the press uses to process a particular type of goods. Pressing characteristics that can be specified for a step include pressure, how long the pressure is applied, maximum step duration (regardless of programmed pressure) and whether the ram rises at the end of a step. The press code also provides a choice of motions the press will use to dislodge the cake at the end of the cycle.

The major components used to press the goods and shape the cake are shown in Figure 34.

Figure 34: Major Press Components

Viewing Load End of Press



Legend

A. Ram—large hydraulic cylinder that provides the pressing force.

B. Platen—round plate attached to the ram cylinder rod.

C. Diaphragm—flexible, water-filled rubber membrane attached to the platen. In this view, the ram, platen and diaphragm are in the up position.

D. Receiving chute and can—a metal assembly that moves down and up hydraulically (shown in the down position) and is used to guide the incoming wet goods into the press and shape the cake.

(E). Not seen are the press bed on which the cake is formed and integral conveyor, which moves the cake out of the press once the can and ram are raised out of the way.

3.1.1. The Pumps and Related Components

The machine uses two hydraulic pumps: a recirculation pump and a pressure pump. The recirculation pump is part of the oil cooling and filtering system. Pressure for can and ram operation is provided by the pressure pump. The pressure pump and its related control components are shown in Figure 35 and include:

variable displacement piston pump (see Notice **49** **)**—a hydraulic pump with multiple pumping pistons whose displacement (stroke), and consequently, output, vary with the back pressure applied to a control port on the pump. This back pressure is determined by the valve position of the external proportional valve.

proportional valve—an electrically operated, modulating hydraulic valve used to vary the oil pressure in a small hydraulic line in proportion to a varying voltage. The voltage read by this valve is produced by a microprocessor controller peripheral board called a DBET card.

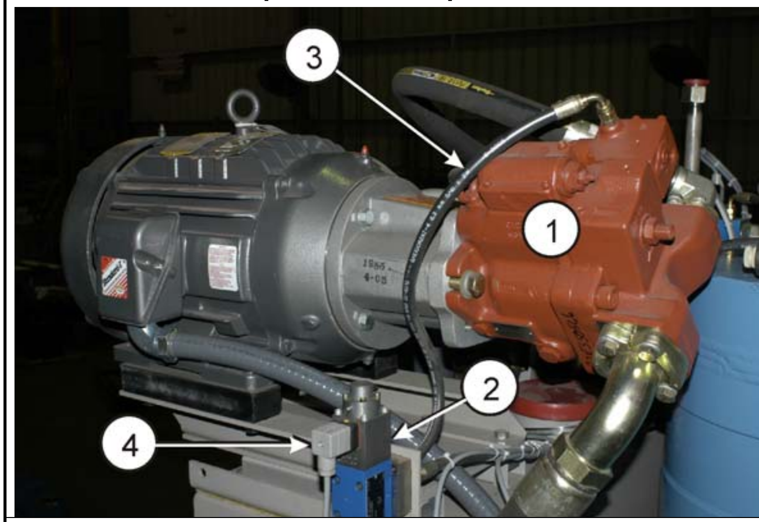
DBET card—an electronic circuit board that interprets data from the machine's microprocessor controller (through a D/A peripheral board) to produce a variable voltage. The microprocessor controller uses a pressure transducer to monitor actual hydraulic pressure.

pressure transducer—a sensing device that produces variable voltage in proportion to pressure. This voltage is converted to digital data that the controller interprets as a pressure value.

Notice 49: Pressure pump should not be field-repaired—Because of its complexity, service personnel are advised not to attempt internal repairs to the pressure pump. Take the pump to an authorized service center for your brand of pump (Kawasaki or Rexroth).

Figure 35: Pressure Pump and Related Control Components

Components on Top of Press



Legend

1. Pressure pump (variable displacement piston pump)
2. Proportional valve
3. Hydraulic line from proportional valve to pump control port
4. Electrical feed from DBET card

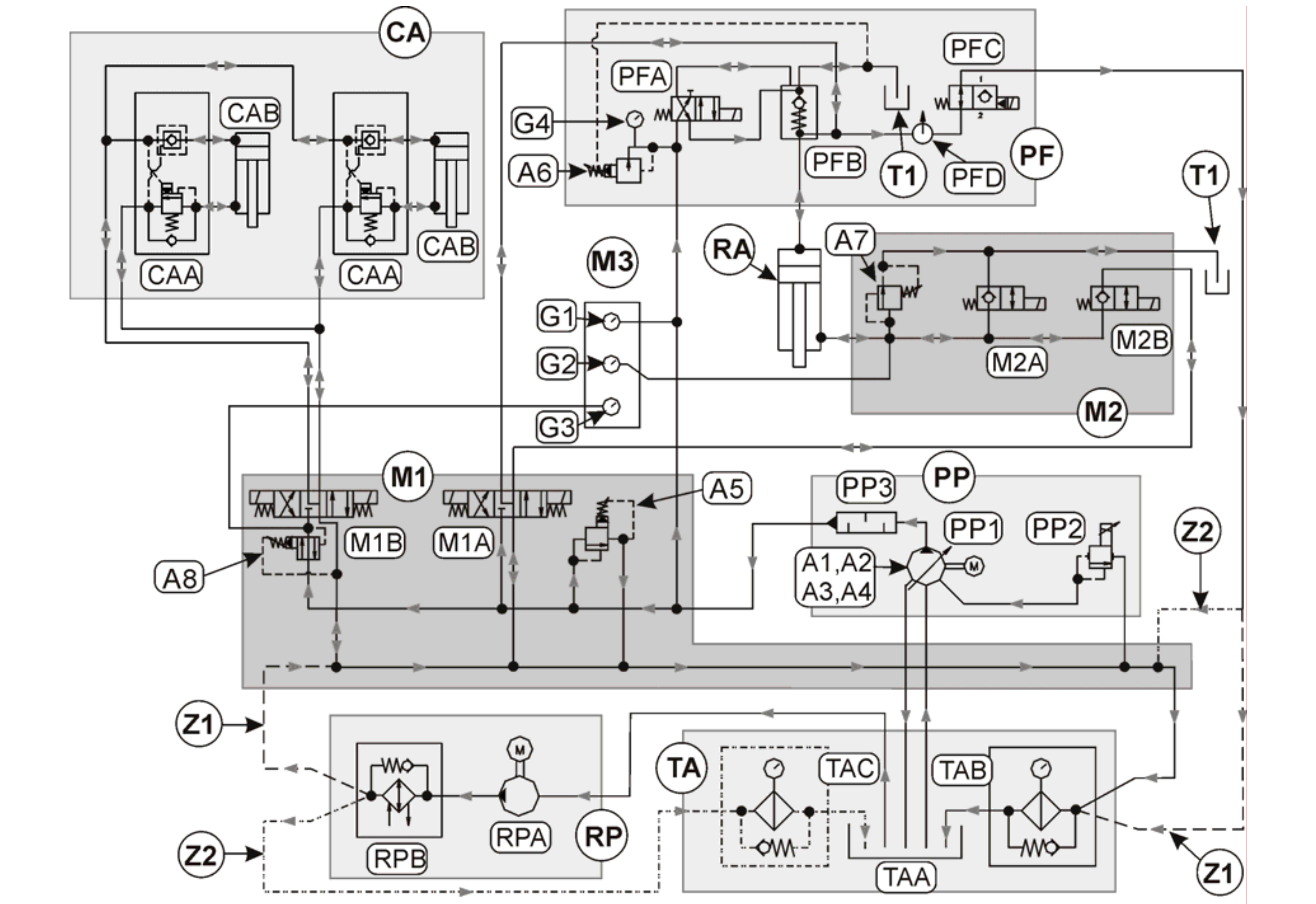
DBET Card in Control Box

3.1.2. The Hydraulic System and How It Functions During Operation

The single stage press hydraulic schematic is shown in Figure 36. Following the schematic are descriptions of the various parts of the operating cycle and what the hydraulic system does during each part. Items referenced in the explanations are those shown on the schematic.

Figure 36: Single Stage Press Hydraulic Schematic

Schematic



Legend

CA. Can hydraulics below top plate: counter-balance valves (CAA) and can cylinders (CAB)—See BMP980017 “Counterbalance Valves and Fittings” and BMP010009 “Receiving Chute and Can” for parts information.
M1. Manifold with ram directional valve (M1A), can directional valve (M1B), system relief valve (A5) and can pressure regulator (A8)—See BMP010006 “Main Press Manifold” for parts information.
M2. Manifold with poppet valves 1 (M2A) and 2 (M2B) and ram relief valve (A7)—See BMP010006 “Main Manifold.”
M3. Gauge cluster with system pressure gauge (G1), ram pressure gauge (G2) and can pressure gauge (G3).
PF. Pre-fill pilot valve (PFA), pre-fill valve (PFB), bypass valve (PFC), pre-fill pressure regulator (A6) and pre-fill pressure gauge (G4)—See BMP010004 “Pre-fill Valve Fittings” for parts information.
PP. Pressure pump (PP1), proportional valve (PP2), optional suppressor (PP3) and pump adjustments, including idle pressure (A1), compensator (A2), stage 1 horsepower (A3) and stage 2 horsepower (A4)—See BMP010003 “Hydraulic Main Pump Assembly” and BMP010001 “Proportional Valve” for parts information.
RP. Recirculation pump (RPA) and oil cooler (RPB)—See BMP010008 “Oil Recirculation Cooler and Fittings.”
RA. Hydraulic ram—See BMP010011 “Hydraulic Ram and Diaphragm” for parts information.
TA. Tank (TAA) and filter (TAB). Additional filter–MP1Axxxx models only (TAC)—See BMP010005 “Hydraulic Tank Assembly.” for parts information.
T1. To tank (not through filter)
Z1. This piping applies to models with prefix MP16 only.
Z2. This piping applies to models with prefix MP1A only

While the machine is running (idling and operating), the recirculation pump (RPA) and oil cooler (RPB) run to keep the hydraulic oil cool and filtered. The path that oil takes when recirculating varies with model type (MP16xxxx (Z1) or MP1Axxxx (Z2)). This, and the extra oil filter (TAC) used by MP1Axxxx models, are the only schematic differences between these models.

3.1.2.1. Idling (waiting to load)—While the press, with power on, is waiting for a load, it remains at idle pressure (minimum system pressure) with these conditions in effect:

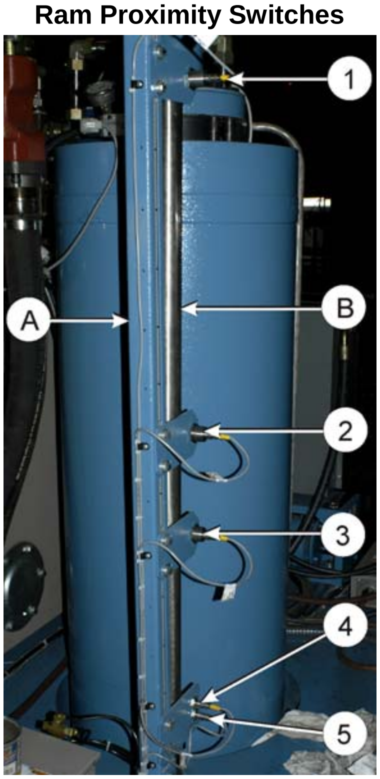
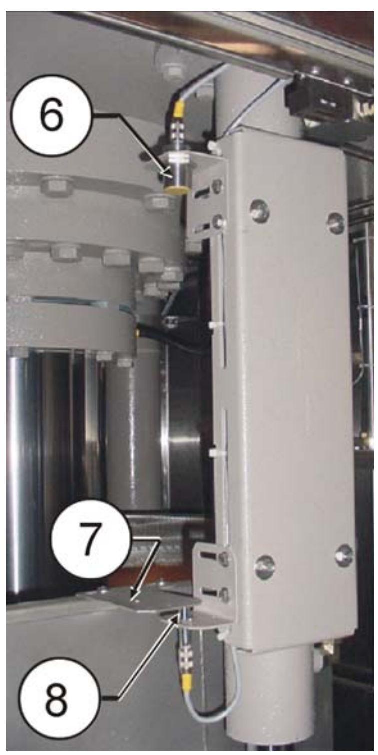
- The pressure pump (PP1) runs, providing approximately 400 psi (28 bar) pressure (idle pressure) as controlled by the idle pressure adjustment (A1—see caution statement 50). The small volume of oil flowing from the pump returns directly to the tank (TAA) via the pump's case drain (see Note 7).
- The ram is up (confirmed by the ram full up proximity switch— Figure 37).
- The can rests on the press bed (confirmed by the can at bottom proximity switches— Figure 37), but the can cylinders are not pressurized.
- The can directional valve (M1B) is centered, so no oil flows to the can cylinders, but the ram directional valve (M1A) is spooled to the raise ram position so that idle pressure will help hold the ram up.

Note 7: The pressure pump has two oil lines to the tank—a large suction line and a small case drain return.

CAUTION 50 : Risk of machine malfunctions and damage—The various pressure adjustments (items with prefix "A" in the hydraulic schematic) are set at the Milnor factory. Indiscriminate changes to these settings will likely result in impaired performance, malfunctions and/or damage and can void the warranty.

- Do not attempt to change hydraulic pressure settings except in strict compliance with document BIPPMT02 "Setting Single Stage Press Pressures."

Figure 37: Ram and Can Proximity Switches

Ram Proximity Switches	Can Proximity Switches	Legend
		**A.** Proximity switch mounting post **B.** Ram guide rod (serves as switch target) **1.** PXST "Ram full up" **2.** PXSM "Ram inside can" **3.** PXSU "Ram at unload" **4.** BXSL "Ram at low" **5.** PXSB "Ram full down" **6.** PXCT "Can at top" **7.** Proximity switch target **8.** One of two switches: PXCB1 and PXCB2 "Can at bottom"

3.1.2.2. Loading—The empty press is ready to receive a load when the ram is fully up and the can is fully down, as in Figure 34. During loading, a batch of goods discharged from the washer slides down the receiving chute and into the can. Now, and throughout processing, the can must be held firmly against the bed to prevent the load from causing the can to shift. This occurs as follows:

- The proportional valve opens the amount specified by the *can valve setting* configure decision to produce about 800 psi (55 bar) on the pump side of the directional valves.
- The can directional valve (M1B) spools to the can down position (coil B energized), providing oil to the can cylinders (cap end) and **remains in this position throughout loading and pressing.** As pressure on the pump side of the proportional valves rises during pressing, pressure not exceeding 800 psi is maintained in the can down hydraulic circuit by the can pressure regulator (A8—see caution statement **50**). The regulator valve, along with a check valve within each can counterbalance valve assembly (CAA), also prevents oil pressure within the can cylinders from escaping back through the can down circuit.

3.1.2.3. Ram "Free-fall"—Following the configured *loading time* delay, the ram descends by gravity, lowering the diaphragm into the can (see Note 9). The following conditions permit this:

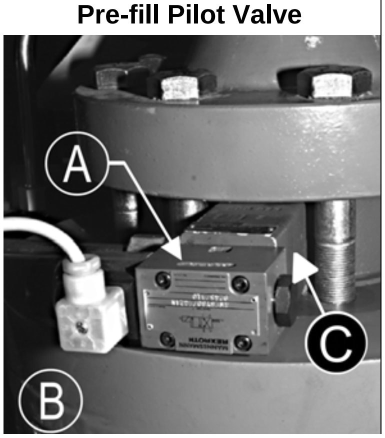
- The ram directional valve (M1A) spools to the ram down position (coil B energized), permitting oil to flow into the ram cylinder (cap end). Although this does not account for the majority of oil filling the cylinder, some oil is pumped in at this time.
- The pre-fill pilot valve (PFA and Figure 38) energizes (valve opens) providing oil pressure to the pre-fill valve actuator. This opens the pre-fill valve (PFB), if it was not already pulled open by suction. The falling ram draws a large volume of oil directly from the tank into the cylinder by suction, through the pre-fill piping and pre-fill valve (see Figure 38).
- Both electrically operated poppet valves (M2A and M2B—see Note 8) energize, permitting oil pushed from the rod end of the ram to quickly return to the tank. Poppet valve #2 (M2B) returns oil through the ram directional valve while valve #1 (M2A) goes directly to the tank.
- The normally open bypass valve (PFC) remains open, acting as a pressure regulator to prevent ram pressure from exceeding about 200 psi (14 bar) during most of the ram's descent. This protects against the rare instance when the diaphragm meets with resistance before it is fully contained by the can (usually the result of an accidental double load).

Note 8: The poppet valves have two positions: When de-energized, the valve permits oil to flow into, but not from the ram cylinder rod end. When the valve is energized, oil can flow in either direction.

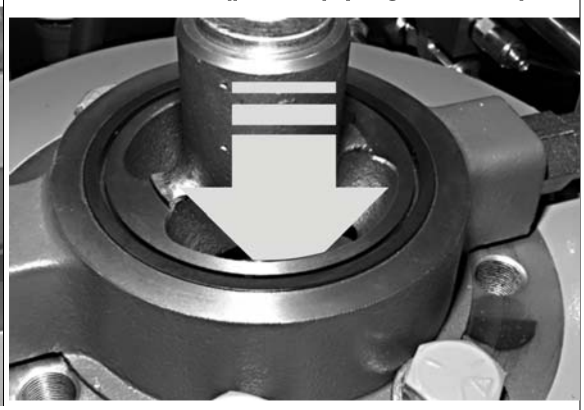
Note 9: For proper "free-fall", a set of ram cylinder seals must be maintained at the correct tightness, as explained in BIPPMM13 "Adjusting Ram Shaft Seal Tightness."

Figure 38: Pre-fill Pilot Valve and Pre-fill Valve

Pre-fill Pilot Valve



Pre-fill Valve (pre-fill piping removed)



Legend

A. Pre-fill pilot valve
B. Ram
C. Pre-fill valve

3.1.2.4. Preparing to press (pre-fill valve closed, bypass valve permitted to close)—The pre-fill valve and bypass valve must both close, as follows, to permit additional pressure:

- When the diaphragm descends below the ram inside can proximity switch (see Figure 37 and Note 10), this causes the pre-fill **pilot** valve to close. However, the pre-fill valve is held open by the flow of oil through it, so it does not necessarily close immediately.
- The pre-fill valve closes when the ram meets resistance from the goods and the flow of oil into the cylinder slows sufficiently.
- When the diaphragm descends past the ram at unload proximity switch (see Note 10), the bypass valve is permitted to close. As long as the diaphragm is below ram at unload, this valve will close when pressing pressure is commanded and open when pressure is released.

Note 10: If the descending ram is jammed by goods that did not slide completely into the can, the ram inside can proximity switch will not make, and the pre-fill valve will remain open. This protects against further damage by venting pressure to the tank.

3.1.2.5. Processing (extracting)—All of the hydraulic valves that enable high pressure in the ram function according to the press code (see definition at the front of this document and Note 11 below) and the pressure transducer that provides actual pressure data to the microprocessor. These valves include the proportional valve (PP2), ram directional valve (M1A), bypass valve (PFC), and poppet valves (M2A and M2B).

Note 11: If the *Check for ram at low position?* configure decision is affirmed and the ram descends to the ram at low proximity switch (see Figure 37), the pressure specified in the *Max bar at ram low position* configure decision overrides that specified by the press code. If the current press code is not an “empty load” and the ram descends to the ram full down switch (see Figure 37), pressure ceases and an error occurs.

Maximum system pressure, which varies with model, is limited by the pump compensation pressure adjustment (A2), the system relief valve (A5) and other factors (see caution statement **50**). As the ram pressurizes, the diaphragm must distribute the pressure by conforming to the shape of the goods. During processing, the following conditions exist:

- The pre-fill valve remains closed.
- The can down circuit remains pressurized, holding the can against the bed.

3.1.2.6. Discharging—During discharge, both the can and the ram eventually rise to fully up (as confirmed by the can at top and ram full up proximity switches (see Figure 37). How they move depends on which of two end codes is programmed for the current press code: One end code moves the can and ram more forcefully to dislodge the cake; the other moves them more gently to preserve the cake shape, as appropriate for goods type (see reference manual for more on end codes). The following functions occur at various times, depending on end code:

- The bypass valve, which opened when pressing ceased, remains open, ensuring minimum pressure in the ram cylinder (cap end).
- The ram directional valve (M1A) spools to the ram up position (coil A energized), permitting oil to flow through the check valve of de-energized poppet valve #2 (M2B) and into the rod end of the ram cylinder.
- The pre-fill pilot valve (PFA) energizes (valve opens), providing oil pressure to the pre-fill valve actuator and opening the pre-fill valve (PFB). This allows a large volume of oil to flow quickly from the ram through the pre-fill valve and piping, directly to the tank. When this occurs depends on the end code.
- The can directional valve spools to the can up position (coil A energized) permitting oil to flow through the counterbalance valves and into the rod end of the can cylinders (see Supplement 2). Depending on end code, the ram will rise slowly to fully up, or rise quickly to the ram at unload proximity switch position.

- The pressure pump and proportional valve function to pressurize the rod end of the ram (ram up circuit) to a pressure not exceeding 1500 psi (103 bar), as limited by the ram relief valve (A7—see caution statement 50) and the rod end of the can cylinders (can up circuit) to a pressure not exceeding 800 psi (55 bar), as limited by the can pressure regulator (A8).

Once the can is fully up and the ram is either fully up or at least at the unload position (depending on end code), the cake is discharged in the following sequence:

1. The discharge door opens.
2. The belt runs forward until the discharge end photo eye is blocked and cleared, plus the greater of either two seconds or the configured *belt run time after discharge* value.
3. The discharge door closes.
4. The can is lowered to the bed.

The press is ready for the next load when the can is fully down and the ram is fully up.

Supplement 2

How the Can Assembly is Susceptible to Damage

The can is susceptible to damage primarily from three conditions: 1) some part of the load chute and can assembly meets an obstruction, 2) the diaphragm is manually lowered through the raised can, 3) the can cylinders are not functioning in unison.

The first condition typically results when goods become jammed between the can and ram or between the can and press bed. The machine provides two forms of protection for this:

- If the microprocessor sees more than a three second delay between the two can at bottom proximity switch inputs, it will stop the machine and issue an error.
- The bushings that connect the load chute and can assembly to the can cylinder rods are designed to slip on the rod in the event of a severe jam. Should this occur, the bushings must be re-seated and the bolts properly torqued, as explained in document BIPPMM09 “Servicing a Misaligned (“Jammed”) Can Assembly.”

The second condition, which can also damage the diaphragm, applies to manual operation and is addressed by the following precaution for operators and service technicians.

Notice 51 : Risk of Damage and Misalignment—Moving the ram through the bottom of the can will cause the diaphragm to forcefully rub against the can, possibly causing damage. This does not occur in automatic operation.

- If the maintenance work necessitates placing the can up and the ram down: 1) lower the can onto the press bed, 2) lower the diaphragm onto the press bed, 3) raise the can.
- If goods become jammed between the ram and can, withdraw the ram through the **top** of the can. Attempting to push the ram through the bottom will only jam the goods tighter.

If can misalignment does occur, the corrective action is the same as for condition 1, above.

The counterbalance valves (CAA) address the third condition. These valves are intended to ensure that the can remains level as it travels. They are adjusted at the factory and do not normally need subsequent adjustment. However, if the can appears to travel in a jerky, or uneven motion, and can misalignment, as explained above is ruled out, these valves may need adjustment. Contact Milnor Technical Support.

— End of BIPPMF01 —

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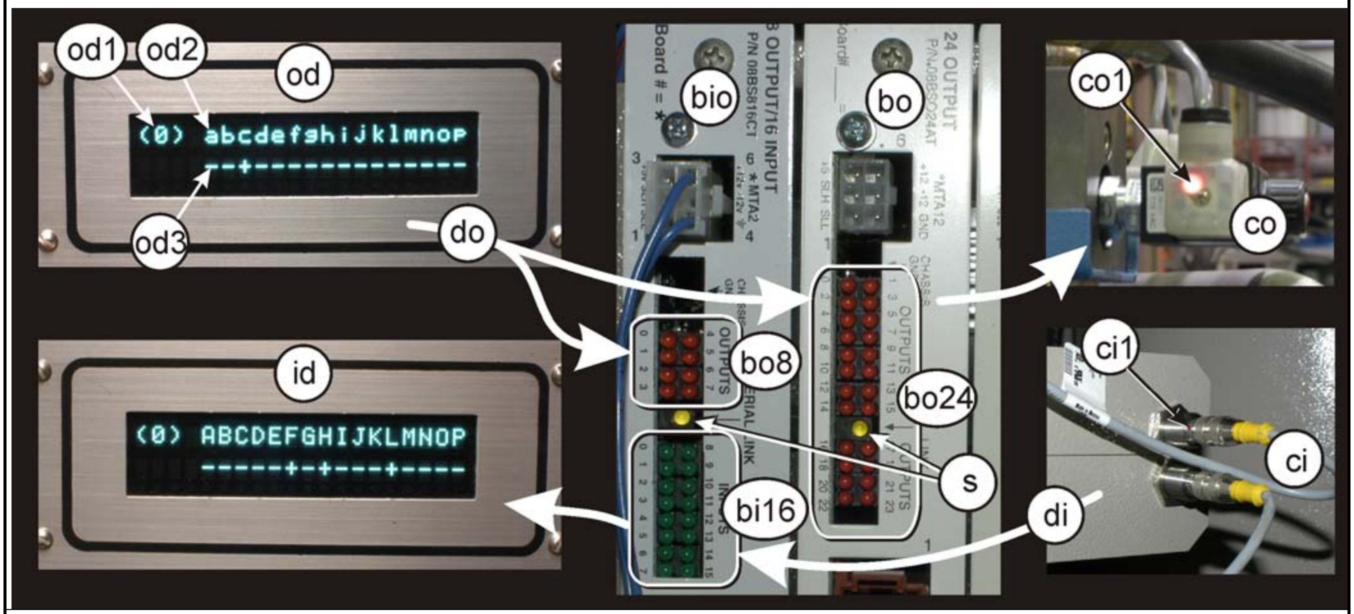
3.2. Onboard Troubleshooting Aids for Digital Outputs and Inputs

Milnor machines with Mark V microprocessor controllers and 2-line displays provide visual aids such as those shown in Figure 39, for troubleshooting digital (on/off) output and input circuits. Milnor machines with other types of controllers and displays provide similar features. These aids indicate the current on/off state at various locations in the circuit.

Figure 39: Troubleshooting Aids

On/Off State Indicators



Legend

bio. Input/output board. These are designated BIO-1, BIO-2, etc., for the first, second, etc. I/O board on the machine.
bi16. Sixteen (16) green LED's (zero (0) through 15)–one per input. LED illuminates when input is made.
bo. Output board. These are designated BO24-1, BO24-2, etc., for the first, second, etc. output board on the machine.
bo8. Eight (8) red LED's (zero (0) through 7)–one per output. LED illuminates when output relay is energized.
bo24. Twenty four (24) red LED's–one per output on this board. The outputs are numbered zero (0) through 23.
ci. Electrical components that provide input signals (proximity switches shown).
ci1. LED on proximity switch–illuminates while switch contacts are made. Only certain components provide an LED.
co. Electrical component controlled by an output signal (electrically operated valve shown).
co1. LED on electric valve actuator–illuminates while valve is actuated. Only certain components provide an LED.
di. Direction of input signals.
do. Direction of output signals
id. Input display on controller–shows 16 inputs (identified with upper case letters A through P)
od. Output display on controller–shows 16 outputs (identified with lower case letters a through p)
od1. Display page number. Additional outputs will be on page 1, 2, etc.
od2. Output “a” (on this page)
od3. Output “a” on/off value. A dash (-) means not actuated. A plus sign (+) means actuated.
s. Yellow serial link light–Must blink when machine is on. Otherwise, board is not communicating with processor.

3.2.1. How To Use the Troubleshooting Aids

Use these aids as a quick check of circuit function and integrity. **Observing proper safety precautions** (see safety manual) you can monitor outputs and inputs while the machine is operating or test outputs in *Manual* mode. Observe circuit function at the following locations:

1. **microprocessor display**—See the reference manual for instructions on viewing inputs and outputs, and on testing. When you invoke this capability, data similar to that shown on the left side of Figure 39 will appear on the display. Confirm that an output occurs at the expected time. Confirm that an input signal from a component on the machine reaches the controller (e.g., test for an open) or that an input is not seen at the wrong time (e.g., test for a short).
2. **I/O boards**—The boards (center of Figure 39) are typically located in the machine's low-voltage control cabinet. The machine will have whatever combination of boards is needed to handle all digital outputs and inputs. Tags inside the cabinet door identify each board and the circuit functions assigned to the numbered outputs and inputs (numbers printed next to the LED's) on each board. Confirm that an output signal from the controller actuates the output relay on the board. Confirm that an input signal from a component on the machine reaches the board or that an input is not seen at the wrong time. The yellow serial link light is also very useful. If it ceases to blink, the board has lost serial communication with the processor. If the machine contains at least two boards of this type, make a note of the board addresses, as set on the rotary switches on the boards. Then swap the boards, giving each board the address of the board it replaces. If the problem (the LED that's not blinking) moved with the board, the board is bad. Otherwise, there is a problem with the board to board connections.
3. **electrical components**—As shown on the right side of Figure 39, electrical components that provide input signals to the microprocessor, such as proximity switches, may have an LED on the component to indicate it's on/off state. Verify that components are functioning. Similarly, components controlled by digital outputs, such as electrically operated valves, may have an LED to indicate whether the component is energized. Verify that an output signal from the controller reaches the component.

3.2.2. Caveats

These troubleshooting aids have the following characteristics and limitations:

- You cannot determine the position of an output or input on an I/O board from its position on the controller display, or the reverse. Nor do these positions correlate to circuit connector and pin numbers, wire numbers, etc. Ensure that you know which display page/position and board/LED the circuit to be checked corresponds to, as follows:

  Display page and position—Tables in the reference manual (usually under troubleshooting) list outputs and inputs and their positions on these displays.

  Board location in card cage—This is shown on a tag inside electric box door (tag also shown in schematic manual).

  Position on board—This is shown on a tag inside electric box door (tag also shown in schematic manual).

  Circuit description—Circuit logic, connector and pin numbers, wire numbers, etc. are provided in the schematic manual.

- Some input circuits connect to the controller directly on the processor board (direct inputs). Currently processor boards do not provide LED's for these inputs. If you cannot find an input listed on the electric box tag that identifies the I/O board positions, suspect that this is a direct input. Verify this on the electric schematic for this circuit. Any such input will connect to the processor board via a connector designated 1MTA38 or 1MTA39.
- The troubleshooting aids do not fully replace traditional electrical troubleshooting. For example, if you suspect there is a problem with a proximity switch, you can quickly deduce from the LED's that there is an open in the wiring between the switch and the I/O board. However, you will need to use traditional means to pinpoint the break. “Milnor's Guide to Basic Troubleshooting” (MXUUUU01) provides guidance on using test equipment.

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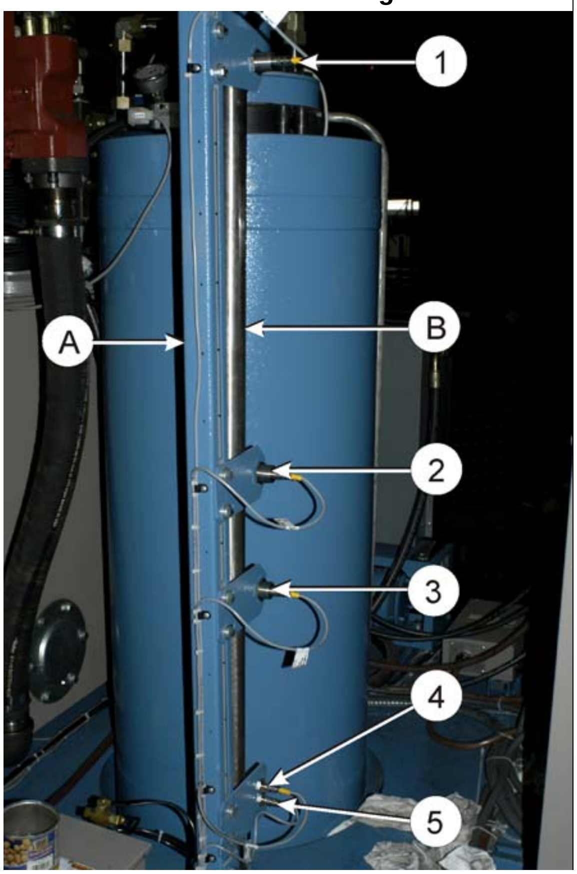
3.3. About the Ram Proximity Switches, Mounting Post, and Guide Rod

Milnor® single stage press models use several proximity switches to detect and report to the microprocessor controller, the position of moving components such as the can and ram. The switch positions are set at the factory and, with the exception of the five proximity switches that detect ram position, do not normally need to be field checked. The ram proximity switches are located on a mounting post on top of the machine next to the ram guide rod, which serves as the switch target (see Figure 40). Both the switch mounting post and the guide rod are removed for shipment and must be re-installed on site. These components must be properly positioned and the switches tested to ensure proper function.

In Figure 40, the ram proximity switches (items 1 through 5) are identified by their functional labels (see “Inputs” in the schematic manual) and the operational conditions they are associated with.

Figure 40: Ram Proximity Switches, Related Components and Switch Functions

Switches on Mounting Post	Legend
	**A.** Proximity switch mounting post **B.** Ram guide rod (serves as switch target) **1.** PXST “Ram full up”—The ram is approximately at its upper mechanical limit of travel. **2.** PXSM “Ram inside can”—The descending diaphragm has started to enter the full circle of the receiving chute where the free-falling ram must now begin to apply pressing pressure. **3.** PXSU “Ram at unload”—The diaphragm is just completely inside the full circle of the receiving chute. At discharge, the ram parks at this position so that the discharging cake has clearance, but if the cake is stuck in the can, the ram will push it out when the can rises. **4.** PXSL “Ram at low”—The ram has descended farther than it could have if the press had a full load. Hence, the controller assumes a partial load and reduces pressing pressure. **5.** PXSB “Ram full down”—The diaphragm is approximately one inch above the bed; the lowest position the ram can travel in automatic operation without risking component damage.

This procedure uses the *Manual* mode (manual operation) as explained in the reference manual. It requires two technicians—one to check and adjust the switch positions and the other to operate the press controls. Both technicians must understand press safety and be able to clearly communicate with each other.

3.3.1. Installing the Guide Rod and Switch Mounting Post and Setting the Switch-to-target Gap

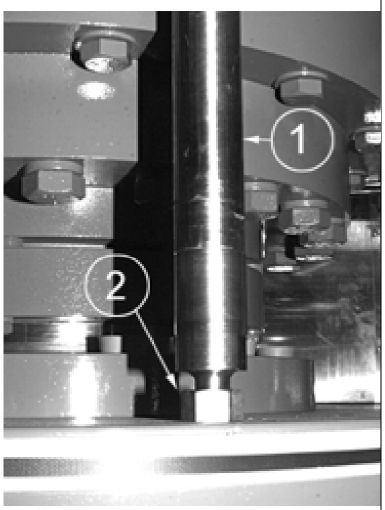
When the guide rod is installed at the factory for testing, it is threaded as far as possible into the platen. Repeat this on site, as shown in Figure 41, to avoid any change in switch actuation resulting from the rod protruding slightly farther.

Install the switch mounting post in its bracket (weldment) as shown in Figure 41 and tighten down. The post has fairly negligible play within the bracket. However, make sure that each switch horizontally aligns with the target (guide rod) and the switch-to-target gap is approximately:

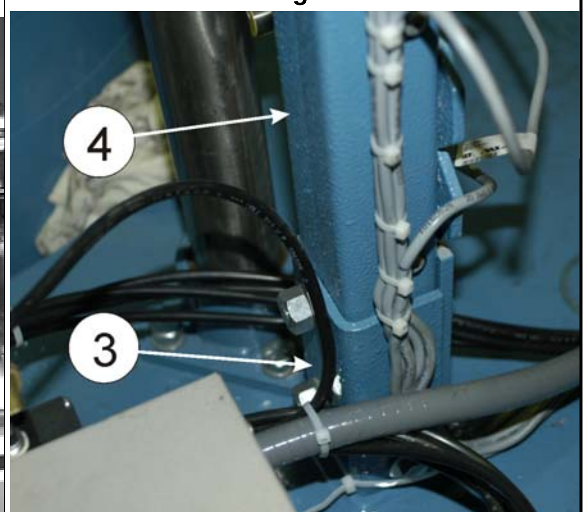
PXST, PXSM, and PXSU (larger switches) = 0.2" (5 mm)
PXSL and PXSB (smaller switches) = 0.13" (3 mm)

Figure 41: Installing the Guide Rod and Switch Mounting Post

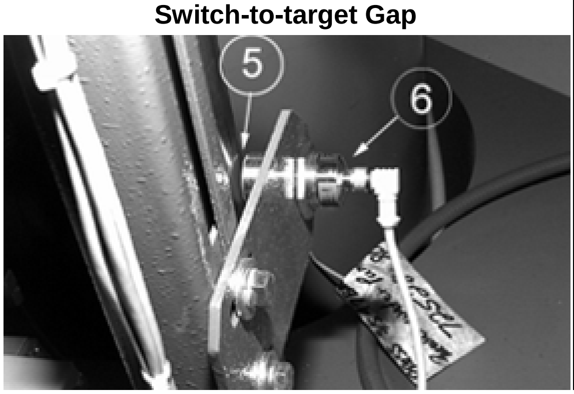
Guide Rod Seated in Platen



Switch Mounting Post Installed



Switch-to-target Gap



Legend

1. Guide rod—threaded as far as possible into platen
2. Locking nut
3. Mounting post bracket (weldment)
4. Switch mounting post
5. Switch-to-target gap
6. Lamp illuminates when switch is made.

3.3.2. Checking and Setting the Switch Vertical Positions

Whether the press is newly installed or has been in operation, the press must be functional and have a properly filled diaphragm (see Note 12) before the proximity switch vertical positions can be checked. These checks and adjustments require two technicians: one works on top of the machine to make the adjustments and the other operates the controls in *Manual* mode.

Note 12: Refer to documents BIPPMM03, “Installing the Milnor Diaphragm in the Single Stage Press” and BIPPMM10 “How to Fill and Maintain the Diaphragm” for diaphragm instructions.

WARNING 52: Crush and Sever Hazards—The can and ram move independently. During operation these components move without warning. These components can also drift down with power off. Any of several closing gaps will crush or sever body parts.

- Proceed only if a qualified service technician, knowledgeable in press manual operation.
- Use the door interlock bypass key switch in strict compliance with the instructions.
- Install the safety supports and lockout/tagout power before reaching into, or working under the can or ram.
- Ensure that personnel and obstructing equipment are clear of the press before operating it or returning to manual operation.
- Ensure that personnel and equipment are clear before operating the machine.
- Be prepared to use emergency stop switches.

CAUTION 53: Multiple Hazards—Various components above the press top plate move or become hot or energized. Hydraulic piping may leak. Working area is tight and may be slippery. When maintenance work necessitates getting on top of the press:

- Ensure only qualified service personnel perform top-of-press work.
- Identify and stand clear of components that move (such as the diaphragm rod) or become hot (such as the pump and motor).
- Use safe, appropriate equipment for getting on and off of the machine.
- Ensure solid footing and guard against slippery surfaces. Wash surfaces with detergent.

Notice 54: Risk of Damage and Misalignment—Moving the ram through the bottom of the can will cause the diaphragm to forcefully rub against the can, possibly causing damage. This does not occur in automatic operation.

- If the maintenance work necessitates placing the can up and the ram down: 1) lower the can onto the press bed, 2) lower the diaphragm onto the press bed, 3) raise the can.
- If goods become jammed between the ram and can, withdraw the ram through the top of the can. Attempting to push the ram through the bottom will only jam the goods tighter.

3.3.3. PXST “Ram full up”

This is the only ram proximity switch that is functional in *Manual* mode; that is, the switch stops ram travel even if commanded up manually. The switch is properly set if it stops ram movement just as the ram reaches it's upper mechanical limit. If this occurs before the upper mechanical limit is reached, you cannot tell by sound or movement, how far away the ram is from it's mechanical limit. However, assuming the switch bracket is near the top of the post, it is sufficient to verify that the ram does not reach its upper mechanical limit without actuating the switch.

Start with the can down and the ram up.

1. Lower the ram a few inches.
2. While one technician observes PXST, the other slowly raises the ram.
3. If the switch lamp illuminates, the switch is properly set. If the ram mechanically stops without actuating the switch:
   a. Move the switch as far up the switch post as possible.
   b. While one technician commands the ram up to hold it against its mechanical stop, the other slowly moves PXST down just until the switch lamp illuminates.

c. Secure the switch at this position.

3.3.4. PXSM “Ram inside can” and PXSU “Ram at unload”

These two switches are checked and set is similar fashion. Start with the can down and the ram up. To adjust PXSM:

1. One technician observes PXSM and signals the other technician when the switch lamp extinguishes. The other technician slowly lowers the ram and stops when signaled.
2. Observe the diaphragm position. If the bottom edge of the diaphragm is one to two inches (25 to 51 mm) inside the full circle of the receiving chute, as shown in Figure 42, the switch is properly set. If not:
   a. Move the ram to the position shown in Figure 42.
   b. Move the switch up on the post then slowly lower it just until the switch lamp extinguishes.
   c. Secure the switch at this position.

Figure 42: Where Ram Should Begin to Apply Power (PXSM)

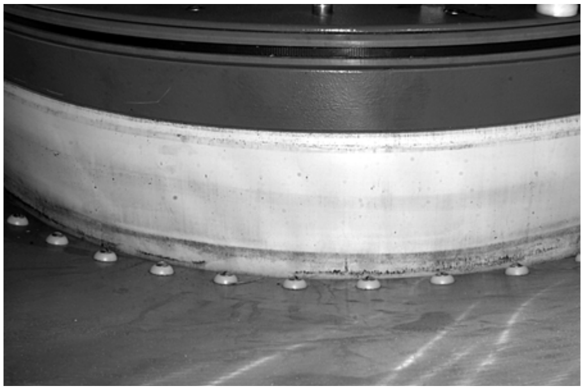
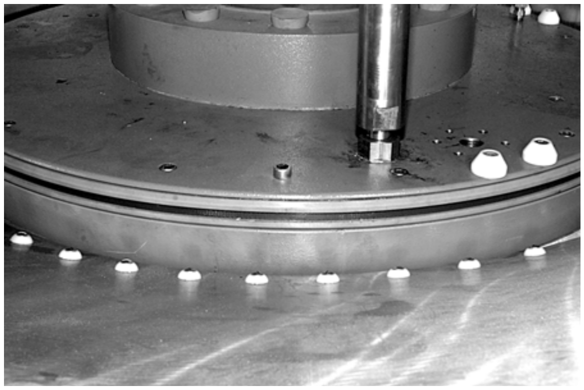


Figure 43: Where Ram Should Park for Unload (PXSU)



Use the same technique to check and set PXSU. The proper diaphragm position is when the diaphragm is just fully inside the full circle of the receiving chute, as shown in Figure 43.

3.3.5. PXSL “Ram at low” and PXSB “Ram full down”

PXSL and PXSB are set at the same time because their mounting brackets abut each other, as shown in Figure 44. PXSB is set first, then PXSL is simply placed above PXSB, with their brackets touching.

PXSB is properly set if, when the ram descends, this switch de-actuates (switch lamp extinguishes) when the diaphragm is one inch (25 mm) above the press bed, as shown in Figure 45.

CAUTION 55: Risk of diaphragm damage and poor extraction—The PXSB (“Ram full down”) setting and the diaphragm water level, together, greatly affect both diaphragm life and machine performance. PXSB set too low and/or an overfilled diaphragm is likely to severely shorten diaphragm life. PXSB set too high and/or an under-filled diaphragm will impede extraction, especially with partial loads.

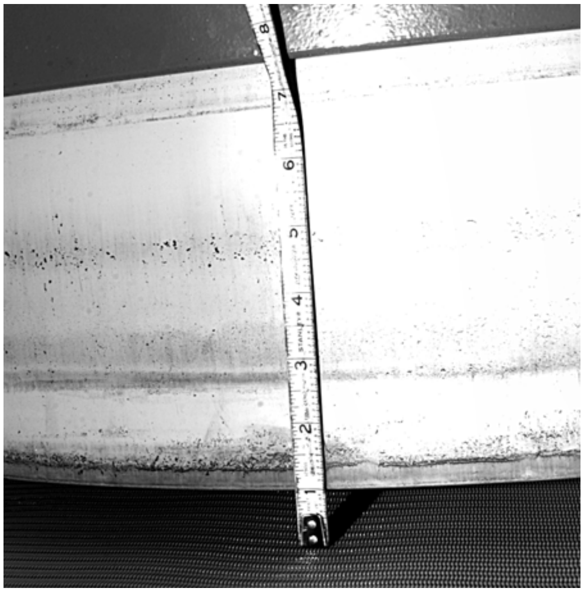
- Maintain the specified diaphragm-to-bed clearance.
- Maintain a properly filled diaphragm (see Note 12).

Start with the can up (safety stands installed) and the ram down.

1. Raise the ram about six inches (about 150 mm).
2. One technician observes PXSB and signals when the switch lamp extinguishes. The other technician slowly nudges the ram down and stops when signaled.
3. Lockout/tagout power and measure the diaphragm-to-bed gap. If this measures one inch (25 mm) as shown in Figure 45, the switch is properly set. If not:
    a. Lower the diaphragm onto the press bed and release the controls.
    b. Move PXSL out of the way by raising it about six inches (about 150 mm).
    c. Move PXSB to a position exactly one inch (25 mm) above where the top of the guide rod is currently.
    d. Secure the switch at this position.
    e. Test this position by repeating Item 1 through Item 3 several times. Adjust the switch position if necessary.
    f. Once PXSB is secured, move PXSL down until the PXSB and PXSL brackets are touching and secure it in this position.

Figure 44: PXSL and PXSB With Abutting Brackets

Figure 45: PXSB Diaphragm-to-Bed Clearance



— End of BIPPMM02 —

BIPPMT01 (Published) Book specs- Dates: 20060905 / 20060905 / 20060927 Lang: ENG01 Applic: PPM

3.4. Troubleshooting Ram Malfunctions

This document applies to Milnor® single stage press models with prefixes MP1603, MP1604, MP1A03, and in part, to older MP1601 and MP1602 models. Use this guide if your machine exhibits one of the following symptoms **for no apparent reason** (e.g, the problem cannot be associated with recent servicing):

- Ram will not go down or goes down slowly
- Ram will not go up or goes up slowly
- Ram drifts down at idle
- Neither ram nor can will move

- Little or no extraction
- Commanded pressure not achieved or achieved slowly

Notice 56: Understand the press servicing hazards—Before performing press troubleshooting, review document BIPPMS01 “Safe Servicing...”

3.4.1. What You Should Know Before Troubleshooting

1. These procedures are intended only for qualified service technicians with a knowledge of hydraulic systems. For safety and, in most cases, necessity, two technicians are required.
2. If you are not thoroughly familiar with the press hydraulic system, review document BIPPMF01 “How the Single Stage Press Hydraulic System Works,”.
3. For convenience, kit KYSSTRBLSH is available from Milnor. This provides fittings and other components for use in the test procedures explained in Section 3.4.3 “Functional Tests”.
4. The press has several pressure adjustments which are set at the Milnor factory and not normally readjusted on site. With the few exceptions mentioned herein, pressure adjustments are not a solution when troubleshooting these symptoms. For those few exceptions, comply carefully with document BIPPMT02 “Setting Single Stage Press Pressures.”
5. Often, the first indication of a ram problem will be an error condition and accompanying message such as “E03 Ram Not Fully Raised”. Consult “Troubleshooting” in the reference manual for more information, such as which proximity switch caused the error.

3.4.2. Troubleshooting Procedures

For an overview of symptoms, components and possible causes of ram malfunctions, see Table 6 on the next page. Experienced troubleshooters may wish to use this table as a quick reference. Detailed troubleshooting steps for each symptom follow the table. Some troubleshooting steps require test procedures to be performed. These tests, which are provided in Section 3.4.3, are also helpful for general servicing and preventive maintenance.

Table 6: Ram Symptoms and Causes Cross-reference

Functions and Related Components*	Ram will not go down	Ram goes down slowly	Ram will not go up	Ram goes up slowly	Ram drifts down at idle	Neither ram nor can will move	Little or no extraction	Pressure not achieved or achieved slowly	Stuck valve	Clogged/dirty	Worn/leaking	Open circuit (never on)	Short (never off)	Internal damage	Mis-adjusted	Bad coil	Comments
Pressurize system																	
• Pressure pump						o	o	o						o	o		
• Pressure pump motor						o						o		o			
• System relief valve								o							o		
Control pressure																	
• Proportional valve							o	o	o			o		o			
• Proportional (DBET) card							o	o				o		o	o		
• High resolution D/A board							o	o				o		o			
Sense pressure																	
• Pressure transducer							o	o				o	o	o			
• A/D board							o	o				o		o			
Enable ram rod-side flow																	
• VEPP1 poppet 1 actuator	o	o										o				o	
					o								o				
• Poppet valve 1	o	o	o		o				o	o	o			o			
• VEPP2 poppet 2 actuator	o	o										o				o	
					o								o				
• Poppet valve 2	o	o	o		o				o	o	o			o			
• Ram relief valve			o	o						o	o				o		
Enable ram pressurization																	
• VERDB bypass actuator							o						o				
• Bypass valve							o		o	o	o			o			
• Ram piston seals			o	o	o		o	o			o						
• Ram shaft seals	o	o													o		
Enable ram direction																	
• VERL lower ram (coil B)	o						o					o				o	
			o										o				
• VERR raise ram (coil A)			o		o							o				o	
	o												o				
• Ram directional valve	o		o				o		o					o			
Enable quick fill and exhaust																	
• VERS pre-fill pilot actuator				o			o						o				
• Pre-fill pilot valve		o					o		o					o			
• Pre-fill valve		o		o			o		o					o			

** This column groups related electrical and mechanical components under the function they collectively perform.

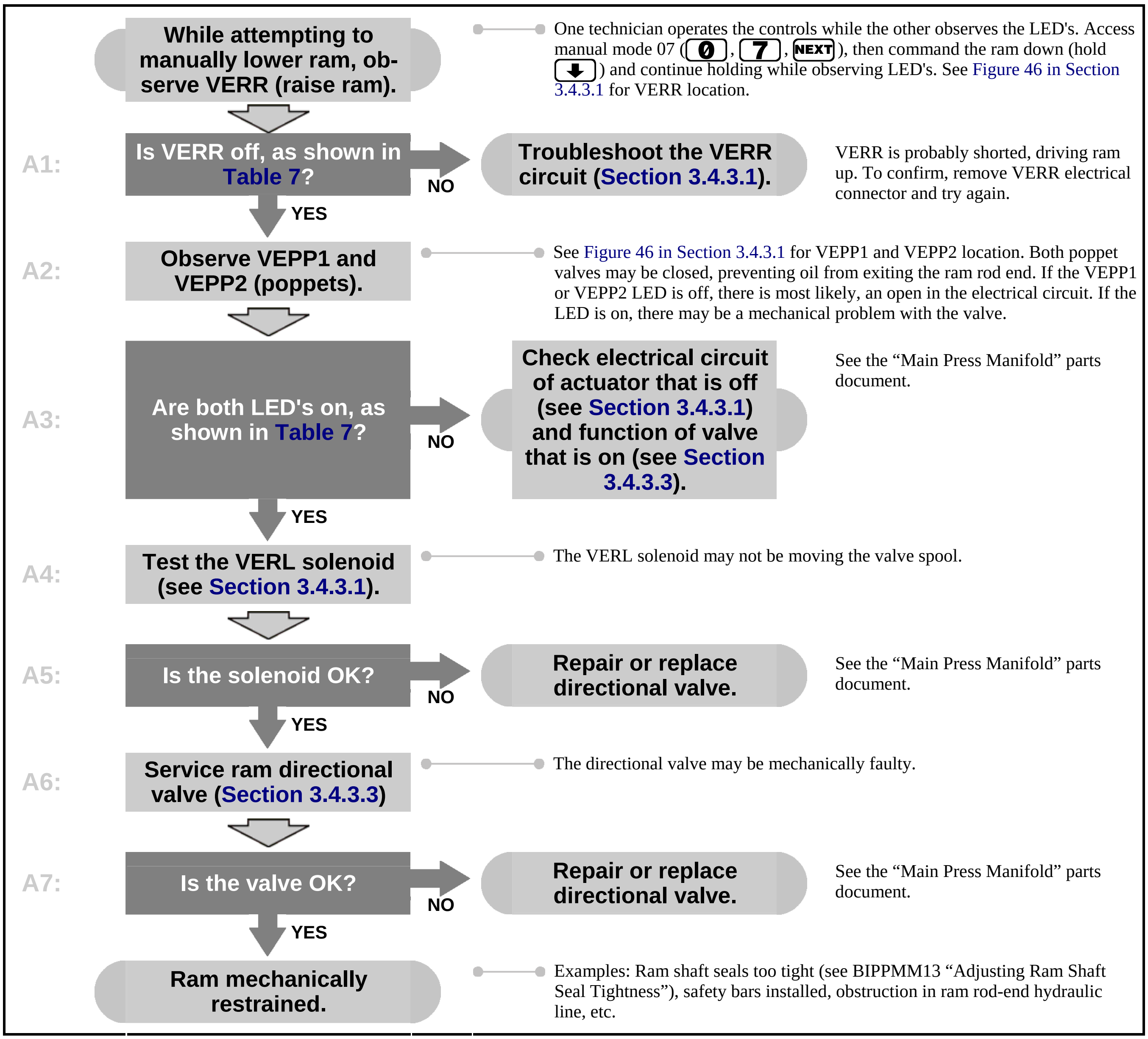
3.4.2.1. Ram Will Not Go Down or Goes Down Slowly

—Table 7, referenced in the charts below it, shows the on/off state of the electrically operated hydraulic valves during ram descent.

Table 7: Valve Actuation Sequence for Ram DOWN (observe LED's on actuators)

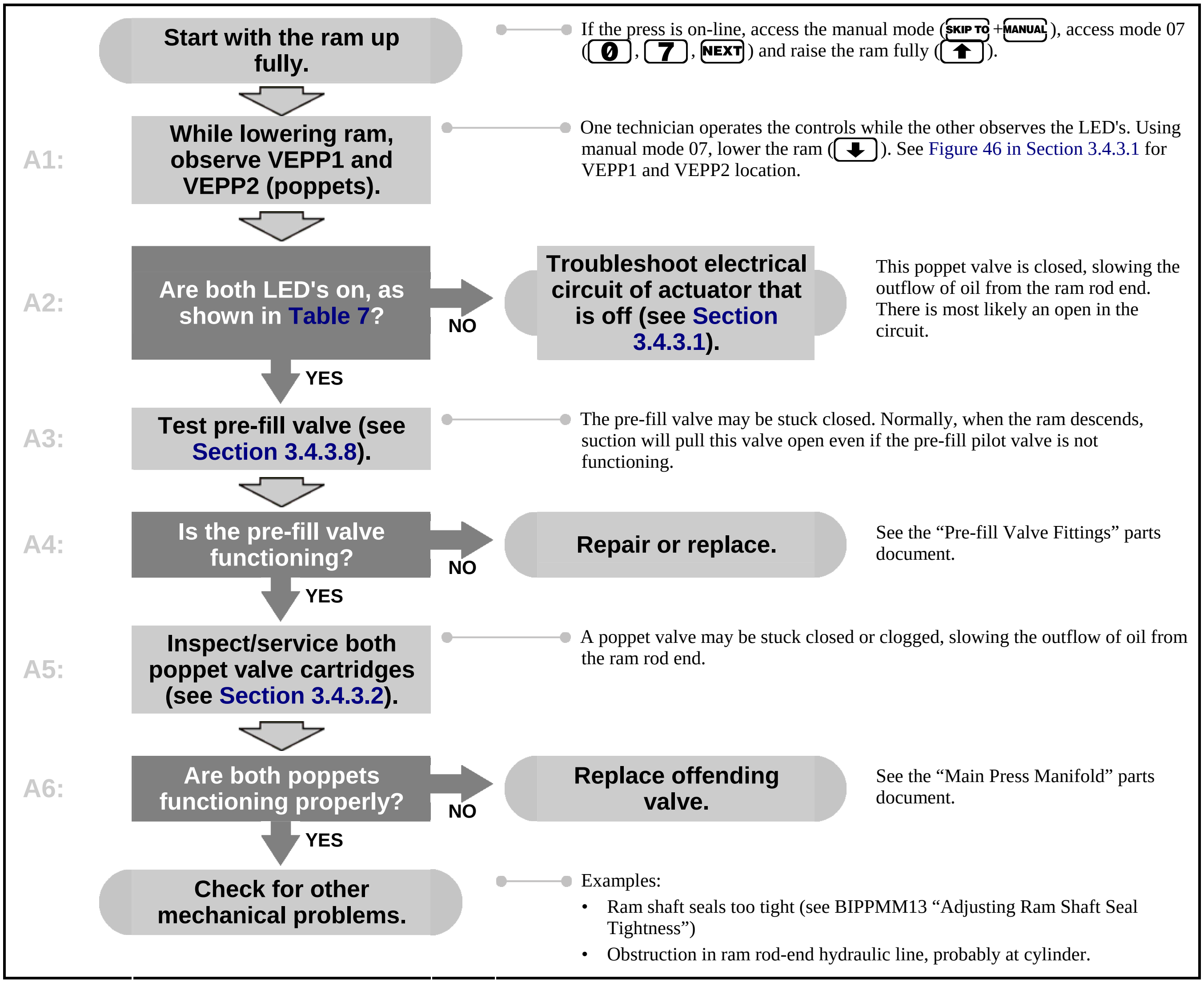
When During Travel	VERDB "ram down bypass"*	VERS pre-fill	VERL lower ram	VERR raise ram	VEPP1 poppet #1"	VEPP2 poppet #2
1. Start (full up)	off	on	on	off	on	on
2. Ram in can (1/2 down)	off	off	on	off	on	on
3. Ram at unload (2/3 down)	on	off	on	off	on	on
4. End (lowest position)	on	off	on	off	on	on
* The ram down bypass valve is open when VERDB is off and closed when on.						

Chart 5: Ram Will Not Go Down (two technicians required)



Perform the following troubleshooting if the ram descends significantly slower than it did previously, resulting in longer cycle times.

Chart 6: Ram Goes Down Slowly (two technicians required)



3.4.2.2. Ram Will Not Go Up or Goes Up Slowly—Table 8, referenced in the charts below it, shows the on/off state of the electrically operated hydraulic valves during ram ascent.

Table 8: Valve Actuation Sequence for Ram UP (observe LED's on valve actuators)

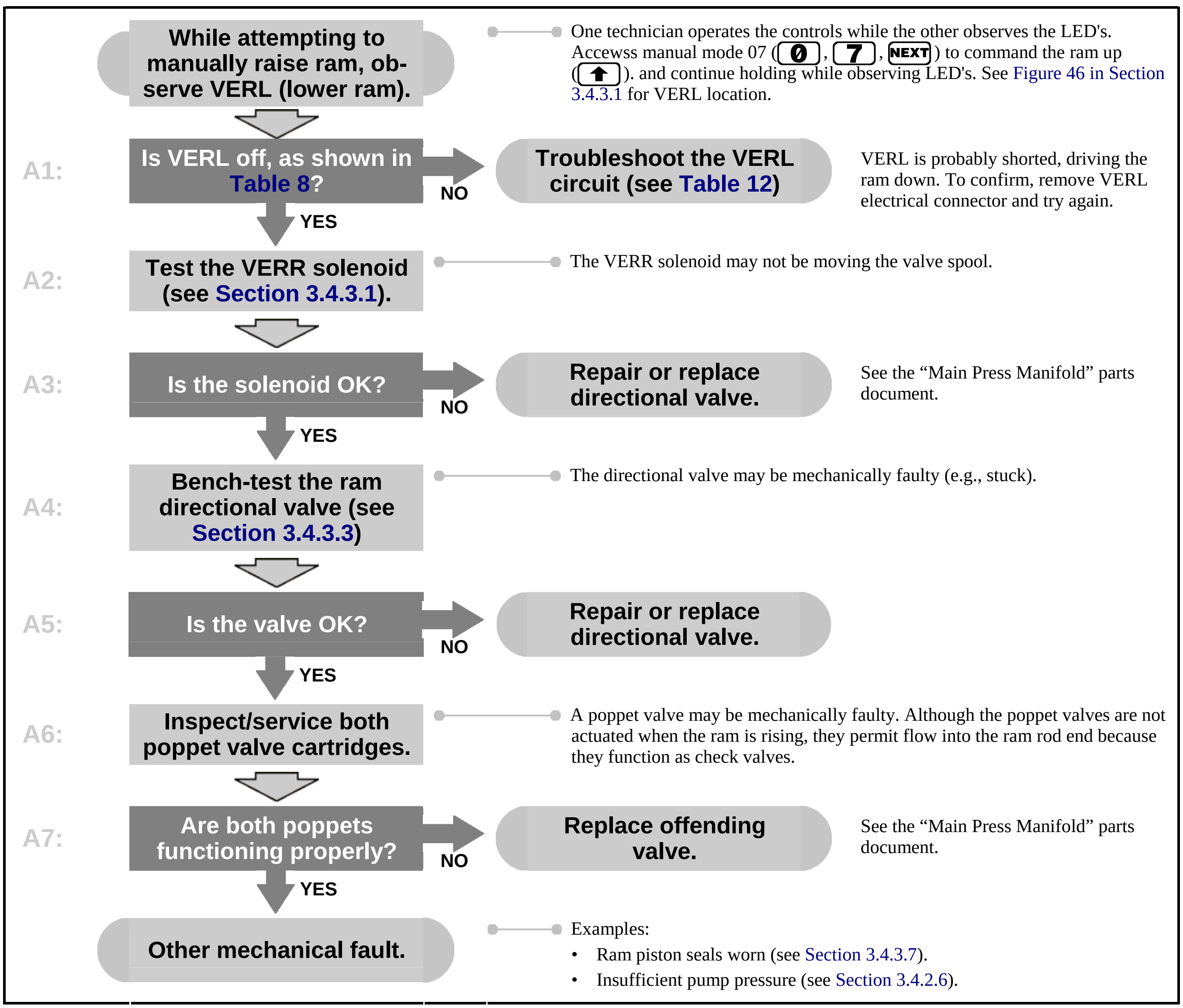
When During Travel	VERDB ram down bypass*	VERS pre-fill	VERL lower ram	VERR raise ram	VEPP1 poppet #1***	VEPP2 poppet #2***
1. Start (lowest position)	off	on**	off	on	off	off
2. Ram at unload (1/3 up)	off	on	off	on	off	off
3. End (full up)	off	off	off	off	off	off

* The ram down bypass valve is open when VERDB is off and closed when on.

** When the ram is manually raised, this valve is on at this time. In automatic operation, the timing of valve operation depends on the end code used.

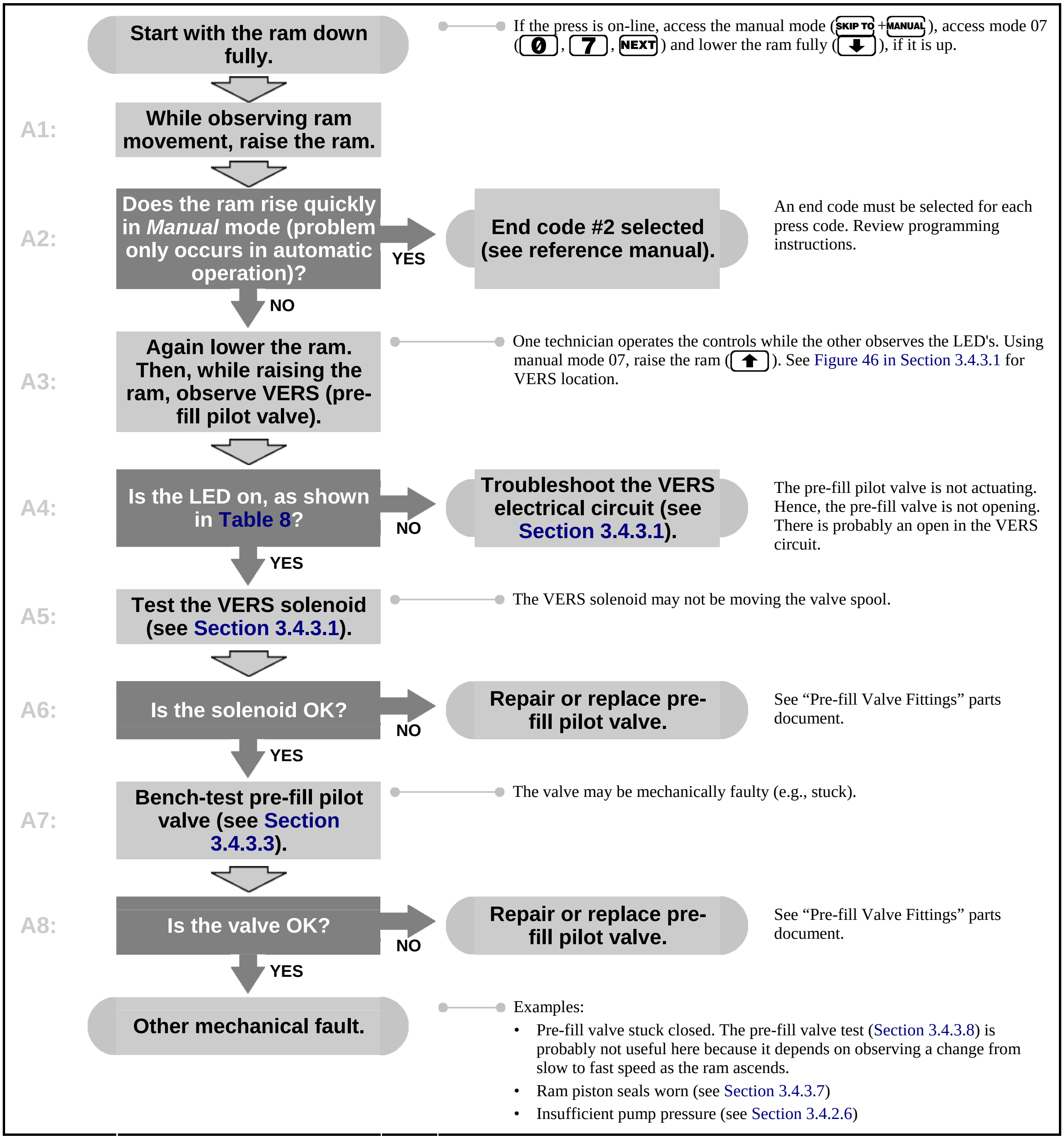
*** Although the poppet valves remain off during ram up, they permit oil to enter the ram rod side because they are always open in this direction.

Chart 7: Ram Will Not Go Up (two technicians required)



Perform the following troubleshooting if the ram ascends significantly slower than it did previously, resulting in longer cycle times.

Chart 8: Ram Goes Up Slowly (two technicians required)

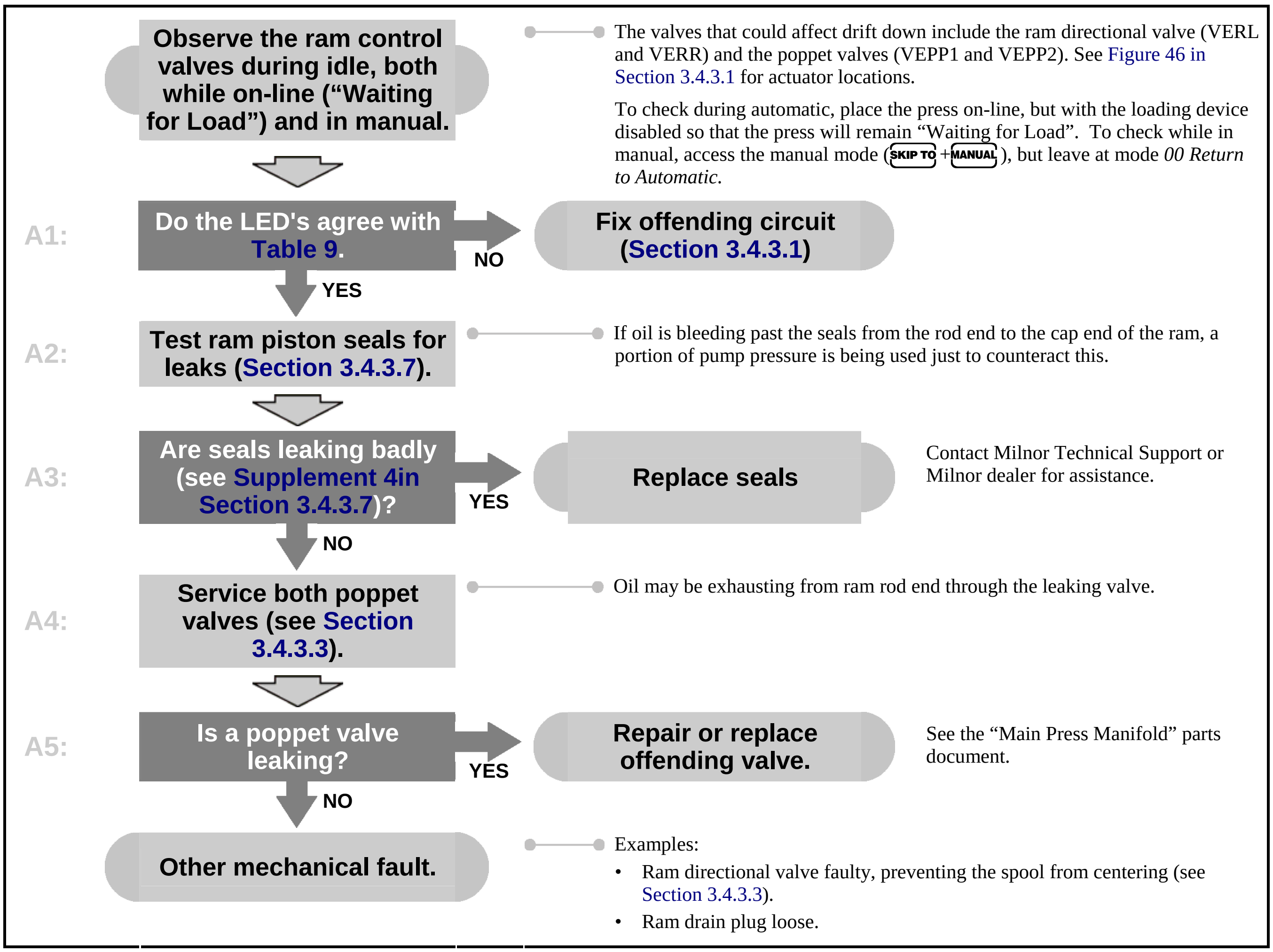


3.4.2.3. Ram Drifts Down at Idle—Referring to Table 9, when the press is idling in manual mode, all ram control valves are off. When it is idling in automatic and “Waiting for Load”, all except VERR are off. In the latter case, VERR holds the ram directional valve in the “raise ram” position so that idle pressure will help counteract any tendency to drift down.

Table 9: Valve State During Idle

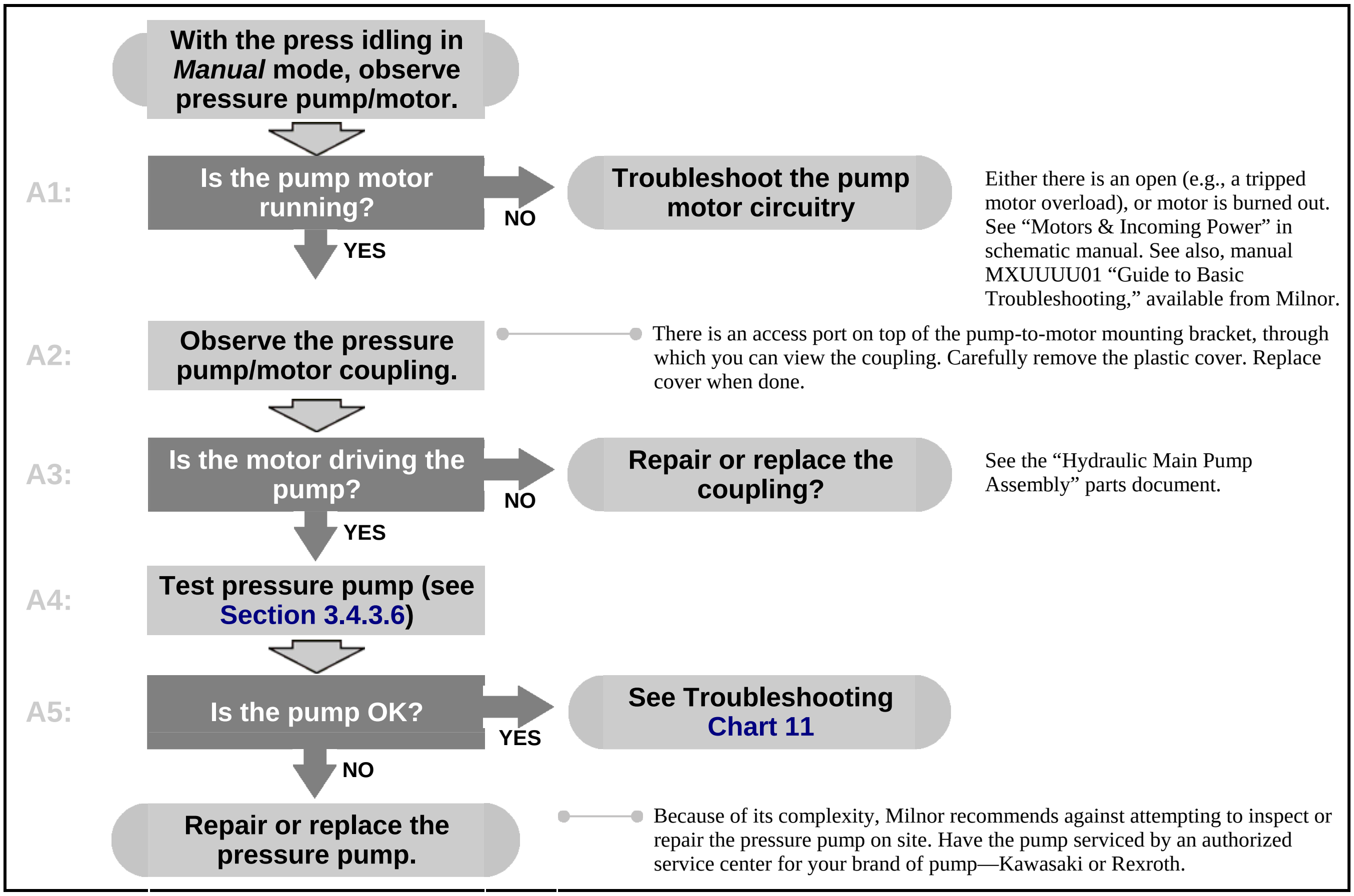
Type of Idle	VERDB "ram down bypass"*	VERS pre-fill	VERL lower ram	VERR raise ram	VEPP1 poppet #1"	VEPP2 poppet #2
Automatic ("Waiting for Load")	off	off	off	**on**	off	off
Manual	off	off	off	off	off	off
* The ram down bypass valve is open whrn VERDB is off and closed when on.						

Chart 9: Ram Drifts Down at Idle



3.4.2.4. Neither the Ram Nor Can Will Move—When functioning properly, the pressure pump will begin producing approximately 400 psi as soon as the *Start* switch (①) is pressed and while idling. Idle pressure is sufficient to raise/lower the can and ram. If neither the ram nor can can be made to move in *Manual* mode (other than ram descent), this likely indicates that the pressure pump is producing llittle or no pressure.

Chart 10: Neither the Ram Nor Can Will Move



3.4.2.5. Little or No Extraction—Perform this troubleshooting if the press cycles successfully, but extraction substantially does not occur, as indicated by:

- press cycle time increases to maximum, causing tunnel hold time to increase
- drying times increase drastically
- cakes appear wet or can be pulled apart easily and pieces feel wet

Table 10: Valve States During Pressing (observe LED's on valve actuators)

When	VERDB ram down bypass*	VERS pre-fill	VERL lower ram	VERR raise ram	VEPP1 poppet #1	VEPP2 poppet #2
While manually pressing	on	off	on	off	on	on
During automatic operation (during production)	**	off	**	**	**	**
* The ram down bypass valve is open when VERDB is off and closed whrn on.						
** These valves open and close according to the press code.						

Chart 11: Little or No Extraction (two technicians required)

Test for midrange pressure (see Section 3.4.3.10)
— If the press can achieve mid-range pressure, the pressure pump, proportional valve and related control circuitry are likely OK.

A1: Does press achieve mid-range pressure?
- NO → **Go to B1**
- YES ↓

If yes, pressure is escaping from the ram down hydraulic circuit. If no, the pressure pump is producing minimal pressure.

A2: While manually pressing goods, observe VERL.
— If the press is empty, allow a load to transfer in. One technician operates the controls while the other observes the LED's. Access manual mode 09 (0, 9, NEXT) and press the goods (hold ↓). See Figure 46 in Section 3.4.3.1 for VERL location.

A3: Is LED illuminated, as shown in Table 10?
- NO → **Troubleshoot VERL circuit (Section 3.4.3.1).** Ram directional valve is not receiving signal to move to ram down position. This will not prevent the ram from descending, but it will prevent the ram cylinder from pressurizing.
- YES ↓

A4: While manually pressing, observe VERDB & VERS.
— See Figure 46 in Section 3.4.3.1 for VERDB and VERS locations.

A5: Is VERDB on and VERS off, as shown in Table 10?
- NO → **Fix offending circuit (see Section 3.4.3.1)** If either valve is open, this will vent pressure, preventing the ram from achieving high pressure.
- YES ↓

A6: Test the bypass valve (see Section 3.4.3.9).
— If this valve is stuck open, this will prevent pressure from exceeding about 400 psi. Refer to Figure 46. The bypass valve consists of an integral pilot solenoid and cartridge that operate a larger cartridge within the manifold.

A7: Is the bypass valve functioning?
- NO → **Service both cartridges (see Section 3.4.3.2).** See Section 3.4.3.2 and "Pre-Fill Valve Fittings" parts document.
- YES ↓

Note 13: The problem is not a burned out solenoid (see Note 14 below).

A8: Test the pre-fill valve (see Section 3.4.3.8)
— If this valve is stuck open, this will prevent pressure from exceeding about 200 psi.

A9: Is the pre-fill valve functioning?
- YES → **Ram directional valve probably faulty** Valve internal components stuck or damaged. See Section 3.4.3.3. and "Hydraulic Schematic" parts document.
- NO ↓

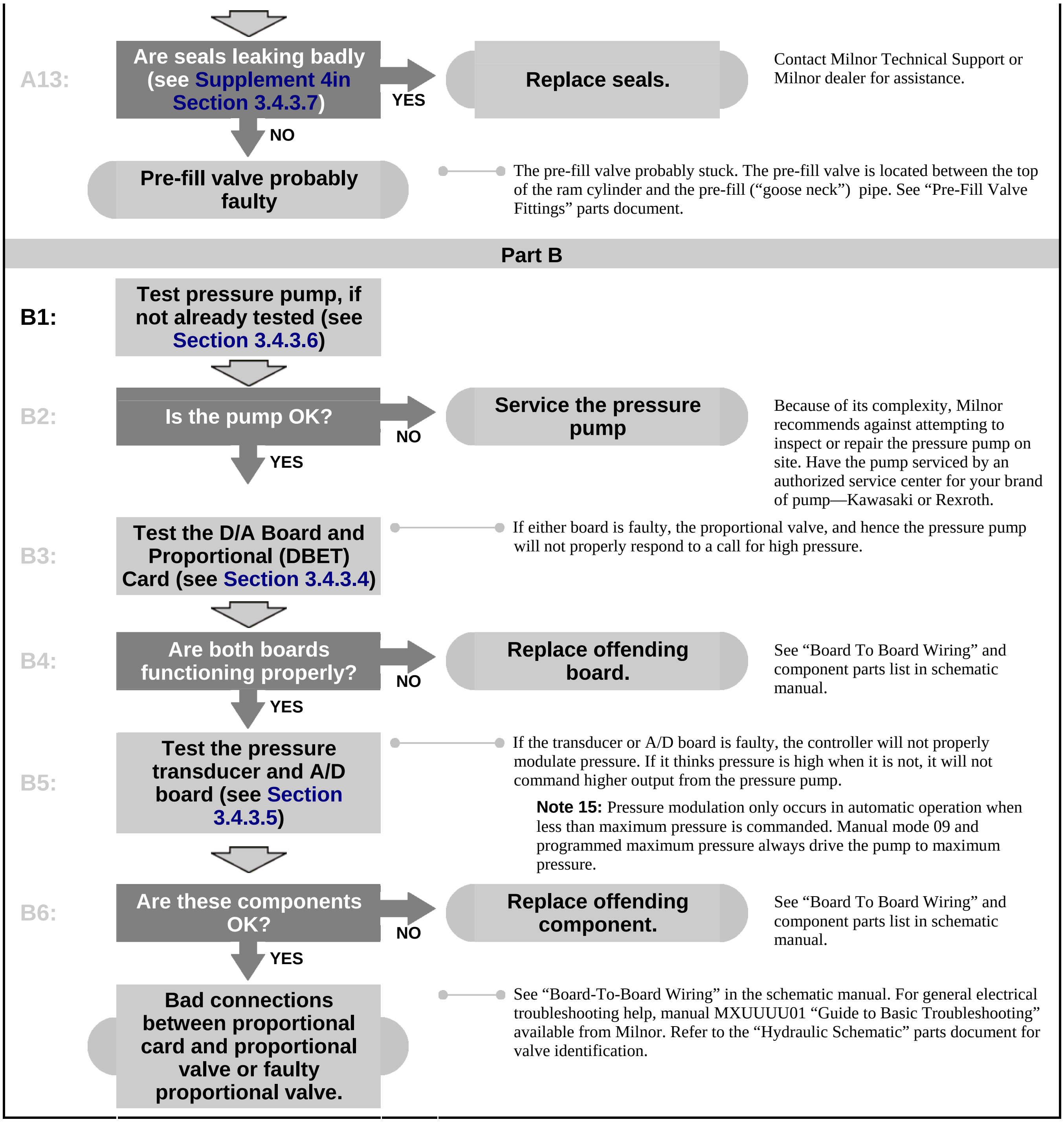
A10: Bench test the pre-fill pilot valve (Section 3.4.3.3).
— Valve internal components may be stuck or damaged.

Note 14: It is not necessary to test the solenoid because the solenoid holds the valve open against spring pressure. If the solenoid were bad, this would not cause the valve to remain open.

A11: Is the pre-fill pilot valve functioning?
- NO → **Repair or replace pre-fill pilot valve.** See "Pre-Fill Valve Fittings" parts document.
- YES ↓

A12: Test ram piston seals for leaks (see Section 3.4.3.7).
— If oil is bleeding past the seals from the rod end to the cap end of the ram, a portion of pump pressure is being used just to counteract this. Another typical symptom of this problem is drifting down of the ram during idle (see Section 3.4.2.3 "Ram Drifts Down at Idle")

Chart 11: Little or No Extraction (two technicians required)



3.4.2.6. Commanded Pressure Not Achieved or Achieved Slowly—Perform the following troubleshooting if the press approaches, but cannot achieve the pressure(s) called for by the press codes (up to rated pressure, as listed in Table 11 below), or takes significnatly longer to achieve pressure (see also Supplement 3 below). This is usually accompanied by an increase in press cycle time, which causes tunnel hold time to increase. If pressure is not achieved, drying times will likely increase.

Table 11: Applicable Milnor® Single Stage Press Models and Pressure Ratings

Model Prefix	Rated (Maximum System) Pressure - psi (bar)	
	Pump (Gauge) Pressure	Diaphragm Pressure
MP1603	4600 (317)	508 (35)
MP1604	4350 (300)	725 (50)
MP1A03	4600 (317)	580 (40)

Supplement 3

About Impaired Pressing

Impaired pressing—the inability of the press to achieve, or quickly achieve **rated** pressure.

Impaired pressing should be rectified if it is serious enough to affect the machine's operating performance (see reference manual) or increase drying times. A small reduction in the maximum achievable pressure will do neither if the pressures specified in all press codes are below the pressure at which the problem is evident. If the machine can quickly achieve any **programmed** pressure, correcting a minor impairment is not likely to provide useful benefits.

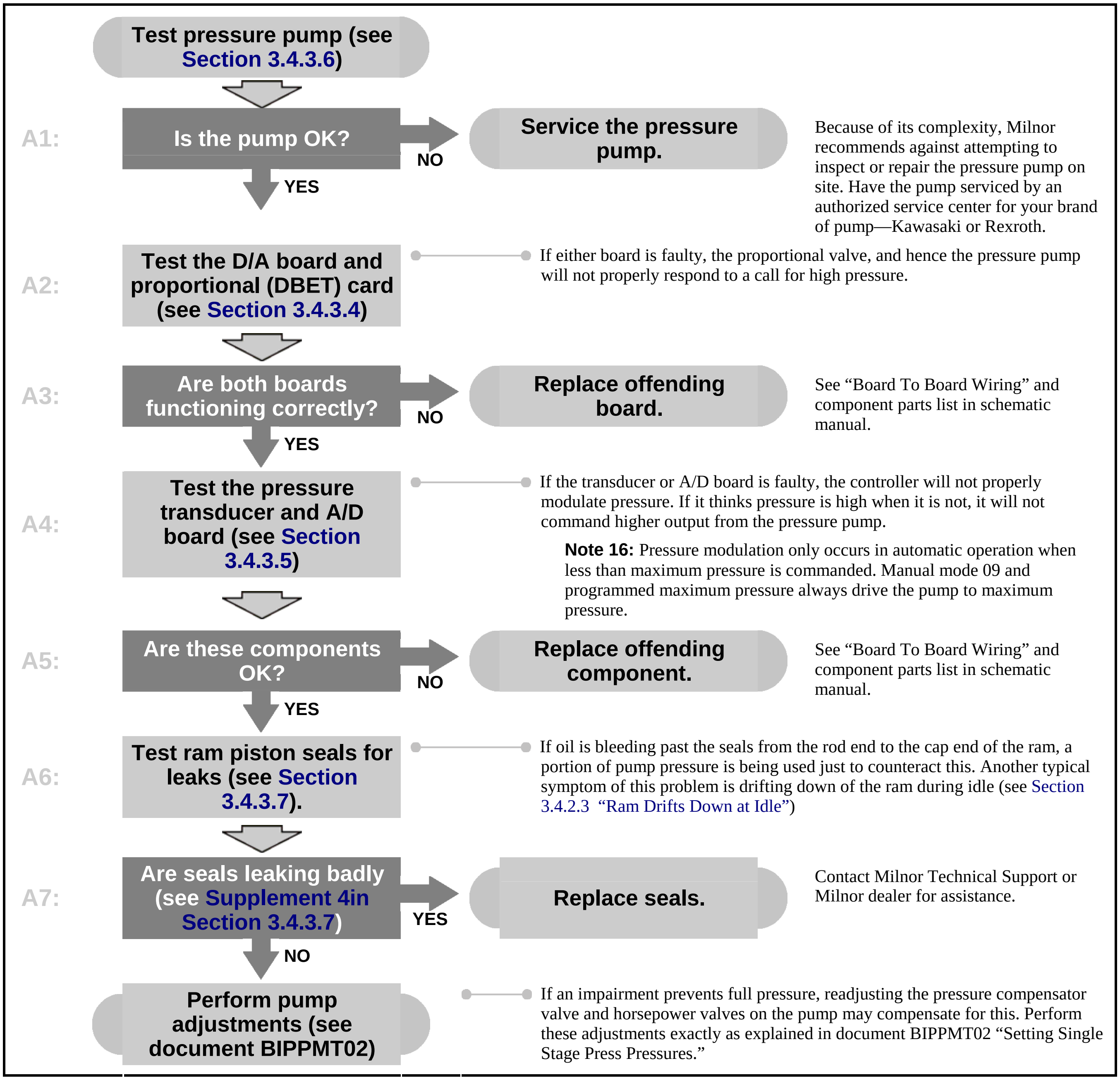
Impaired pressing can only be determined from an accurate pressure reading. Neither reduced operating performance nor increased drying times necessarily indicate a pressure problem. These can result from numerous causes such as changes in goods types, load sizes, and/or press codes, none of which relate to the machine's ability to achieve pressure. Nor is there an error condition that signals impaired pressing. If the pressure called for by the press code is not achieved, the step will end at the programmed maximum time (see reference manual) and processing will continue.

For the most accurate pressure reading, observe the system pressure gauge (top gauge on the gauge cluster). The three displays that show pressure (normal run display, viewing analog input..., and manual function 09 *Pressurize Ram*, which get their data from the pressure transducer, are approximate, and the first two display diaphragm pressure. Only manual function 09 displays approximate pump pressure.

Pressing can be impaired by a malfunctioning component or bad pressure setting. If it can be determined at the outset that a pressure setting is the likely cause, do not perform these procedures. Instead, refer to document BIPPMT02, "Setting Single Stage Press Pressures." Two situations that can cause pressure settings to fall out of adjustment are:

1. **"breaking in" a new press**—The maximum achievable pressure may **gradually** decline during the first few months of operation, as hydraulic components such as seals are "broken in." In this instance, adjust the pressure settings to restore full pressing capability.
2. **major hydraulic component replacement**—This is especially true for the pressure pump. Four adjustments are located on the pump itself and may be mis-adjusted on the replacement pump. Always check pressures in accordance with document BIPPMT02 following this type of servicing.

Chart 12: Commanded Pressure Not Achieved or Achieved Slowly

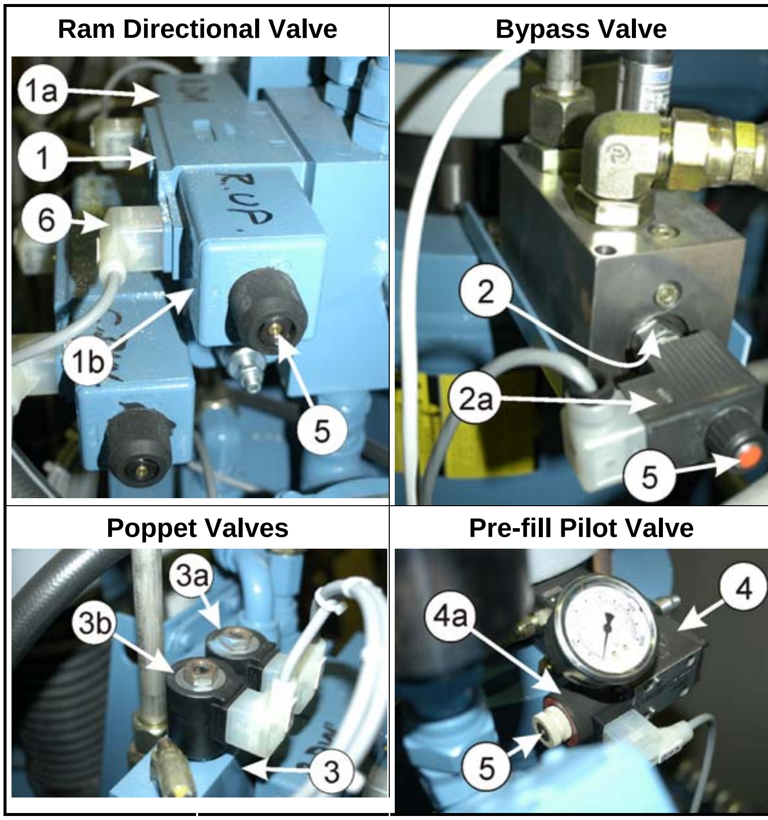


3.4.3. Functional Tests

3.4.3.1. How to Check Electric Valve Actuator Circuits and Test the Solenoids

—The six electrically operated, ram hydraulic valves and their actuators are identified in Figure 46. Useful information about the actuator electrical circuits is provided in Table 12.

Figure 46: Ram Electrically Operated Hydraulic Valves



Legend

- **1.** Ram directional valve on MP16xxxx models. MP1Axxxx models, use a similar, electric valve to hydraulically operate a larger capacity directional valve.
- **1a.** VERL actuator (lower ram)
- **1b.** VERR actuator (raise ram)
- **2.** Bypass valve (cartridge)
- **2a.** VERDB actuator (ram down bypass)
- **3.** Poppet valves (cartridges)
- **3a.** VEPP1 actuator (poppet1)
- **3b.** VEPP2 actuator (poppet2)
- **4.** Pre-fill pilot valve (directional valve)
- **4a.** VERS actuator (pre-fill)
- **5.** Mechanical actuator
- **6.** Connector with LED (typical)

Table 12: Digital Outputs for Ram Functions (electric valves)

Function	Output Display		I/O Board				Wire #	Controlled Components	
	Page	Position	Board #	LED #	Connector	Pins		Actuator	Valve
Lower ram	0	c	BIO-1	2	1MTA5	17-8	30	VERL (lower)	Ram directional valve (coil B)
Raise ram	0	d	BIO-1	3	1MTA5	16-7	31	VERR (raise)	Ram directional valve (coil A)
Pre-fill	0	a	BIO-1	0	1MTA5	19-10	28	VERS	Pre-fill pilot valve
Poppet #1*	0	h	BIO-1	7	1MTA5	11-1	37	VEPP1	Poppet valve #1
Poppet #2*	1	b	BO24-1	9	1MTA13 1MTA14	10 1	38	VEPP2	Poppet valve #2
Ram down bypass	1	f	BO24-1	13	1MTA14	14-4	27	VERDB	Bypass valve

*** The poppet valves, which operate simultaneously, open to allow flow into and out of the ram rod end.**

Check circuit function by observing the on/off state of any actuator at three locations: the output displays, the LED's on the I/O boards, and the LED's on the actuator electrical connector (see also BIUUUT04 “Onboard Troubleshooting Aids for Digital Outputs and Inputs”).

All of the electrically operated hydraulic valves except the poppet valves have mechanical actuators (see Figure 46). Assuming you have determined that the electrical circuit is functioning properly (the LED on the valve actuator illuminates when it should), use the mechanical actuator to determine if the problem with a valve is due to a non-functioning solenoid. Observing warning statement 57 , carefully press the mechanical actuator (with a tool, if necessary) when you see the LED illuminate. If the valve functions properly, the problem is with the solenoid.

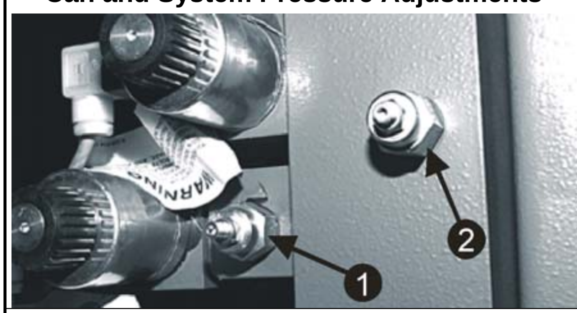
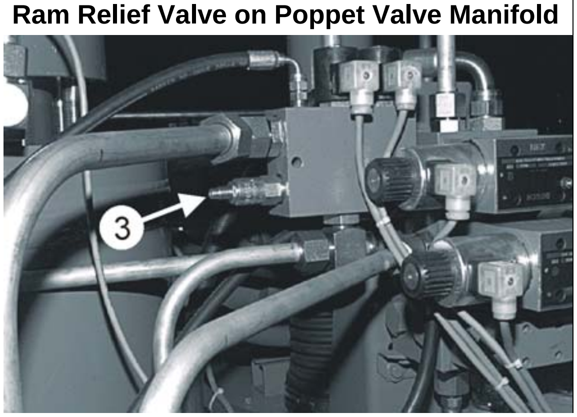
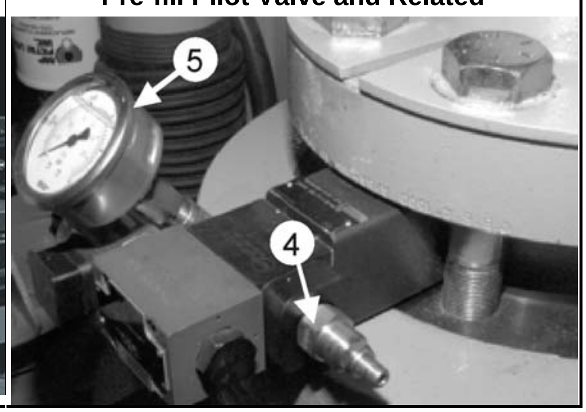
WARNING 57 : Crush Hazards—Hydraulic valve mechanical actuators bypass the safety of the electrical controls. Depressing a mechanical actuator may cause immediate movement.

- Use extreme caution when operating a hydraulic valve mechanically.

The bypass valve and poppet valves use removable cartridges that can be inspected and serviced as explained in Section 3.4.3.2, below. The directional valves can be removed and bench tested, as explained in Section 3.4.3.3.

3.4.3.2. How to Inspect and Service Hydraulic Valve Cartridges—Several easily removable hydraulic valve cartridges are used on the press. These are of various designs, depending on their function: operational valve, pressure relief valve, or pressure regulator. The pressure relief valves and pressure regulators are identified in Figure 47. A cartridge can malfunction as a result of contamination (e.g., metal shaving) in the hydraulic fluid, or damage (e.g., worn seals). Additionally, a relief valve or pressure regulator can be improperly adjusted. Cartridges are designed to be inspected, cleaned, and seals replaced, but not rebuilt. With care, pressure relief and pressure regulator cartridges can often be removed, serviced and replaced without changing their adjustment.

Figure 47: Pressure Relief Valves and Regulators

<table>
<tr><th>Can and System Pressure Adjustments</th><th>Legend</th></tr>
<tr><td></td><td>1. Can pressure regulator
2. System relief valve
3. Ram relief valve
4. Pre-fill pilot pressure regulator
5. Pre-fill pressure gauge</td></tr>
<tr><th>Ram Relief Valve on Poppet Valve Manifold</th><th>Pre-fill Pilot Valve and Related</th></tr>
<tr><td></td><td></td></tr>
</table>

1. Secure the can and ram by lowering them completely or installing the safety stands/bars. Then lockout/tagout power.

2. Each cartridge has a large integral mounting nut. Additionally, pressure relief/regulator cartridges have a smaller lock nut for locking down the setting and a hex socket (Allen) screw for adjusting the pressure setting. Remove the cartridge by turning the mounting nut only.
3. Inspect the cartridge for dirt and wear. If components such as seals appear worn or damaged, Milnor recommends replacing the cartridge. A seal kit may be available from a third party, but this can be done afterward and the old cartridge retained as a spare. If the cartridge appears serviceable, clean it as follows:
   a. Carefully remove obvious particles then submerge the cartridge in clean mineral spirits.
   b. Through the nose of the cartridge, manually operate the working parts several times. Use a piece of plastic tubing (see Figure 48) to avoid damaging sensitive components such as screens. If possible, do this with the cartridge submerged in the mineral spirits.
   c. **Pressure relief/regulators only:** If you must back off on the adjustment screw for effective cleaning, hold the cartridge in a vice, loosen the lock nut, and turn the adjustment screw with a hex head (Allen) screw. **However, once you change the pressure setting, you will need to reestablish the proper setting using the procedures in document BIPPMT02 "Setting Single Stage Press Pressures", after re-installing.**
   d. Use clean (filtered) compressed air to blow dry the cartridge.
4. Dip the dry cartridge in clean hydraulic oil then reinstall.

Figure 48: Operating Valve Cartridge

Figure 49: Bench-testing a Directional Valve

3.4.3.3. How to Bench Test Directional Valves—Assuming you have determined that the valve actuator circuit is functioning properly (the LED on the actuator illuminates when it should), you can bench test a directional valve as follows:

1. **Secure the can and ram by lowering them completely or installing the safety stands/bars. Then lockout/tagout power.**
2. Remove the valve actuator electrical connector(s). Make sure to mark connectors as needed for proper replacement.
3. Remove the valve housing by removing the four mounting bolts.
4. Allow oil to drain from the valve. Remove any seals or o-rings that might otherwise fall off.
5. Carefully clamp the valve to a bench or hold in a vice for inspection. You can:
   - Visually inspect for damage, contaminants, worn seals, etc.
   - Check valve functioning. Press the mechanical actuator(s), looking for spool movement.
   - Blow air into the "P" port (see Figure 49) and, while depressing the actuator, verify that the air exits the proper port ("A," "B," or "T"), or at least moves from port to port.
6. When re-installing the valve, use care to keep the valve clean, replace all seals, and match up electrical connectors properly.

3.4.3.4. How to Test the D/A Board and Proportional (DBET) Card Analog Output—

The pressure pump sends oil to the proportional valve via a small hydraulic control line. When the proportional valve is fully open (maximum oil flow through the control line), the pump produces **minimum** pressure; that is, about 400 psi (idle pressure). When the proportional valve is fully closed (no oil flow through the control line), the pump produces **maximum** pressure; that is, full rated pressure as listed in Table 11 in Section 3.4.2.6. As the voltage supplied by the proportional (DBET) card to the proportional valve **increases**, the valve **closes.** The proper relationship among output board values, valve position and pump output at each end of the range is summarized in Table 13.

Table 13: Relationships Among Pump Control Components at Each End of Range

D/A Board (digital counts)	D/A Board Output (VDC)	Proportional (DBET) Card Output (millivolts)	Proportional Valve Position	Pressure Pump Output
0000	0 (zero) VDC	0 (zero) millivolts	fully open	minimum (idle pressure)
4095	10 VDC	16 millivolts	fully closed	maximum (rated pressure)

Chart 13: How to Test the D to A Board and Proportional (DBET) Card Analog Output

Start with the ram down and a full load of goods

If the press is empty, permit aload of goods to transfer in, then access the manual mode (SKIP TO + MANUAL).

A1: **While manually pressing the goods, take voltmeter reading across DBET card, pins 28C and 30C.**

The proportional (DBET) card is shown at left. See "Board to Board Wiring" in schematic manual. Access manual mode 09 (0, 9, NEXT) and apply press pressure (hold ⬇) while reading voltage.

A2: **9 to 10 VDC?**

NO → **D to A board or related circuitry faulty.**

This is the voltage that must be supplied by the high resolution D to A board (BDA-1) to the DBET card (BPC-1) when full pressure is commanded.

YES ↓

A3: **While manually pressing the goods, take voltmeter reading across DBET card, pins 20C and 22C.**

See "Board to Board Wiring" in schematic manual. Access manual mode 09 (0, 9, NEXT) and apply press pressure (hold ⬇) while reading voltage.

A4: **12 to 20 millivolts?**

NO → **Proportional card or related circuitry faulty.**

This is the voltage that must be supplied by the DBET card to the proportional valve when full pressure is commanded.

YES ↓

Tip: Although 12 to 20 millivolts is an acceptable range, the optimum value is 16 millivolts. Adjust the maximum pressure potentiometer (labeled GW) on the DBET card to achieve this value, as explained in BIPPMT02 "Setting Single Stage Press Pressures."

D to A board, proportional card and related circuitry OK.

3.4.3.5. How to Test Pressure Transducer and A/D Board Analog Input—The pressure transducer data is used by the controller 1) to show pressure on the controller display and 2) to maintain (modulate) programmed pressure (see Note 17). If you manually press a load of goods using manual mode *09 Pressurize Ram*, displayed pressure should match system gauge pressure. The proper relationship among transducer, A/D board, and pressure values, at each end of the range, for the two types of transducers in current use (see Note 18), is shown in Table 14.

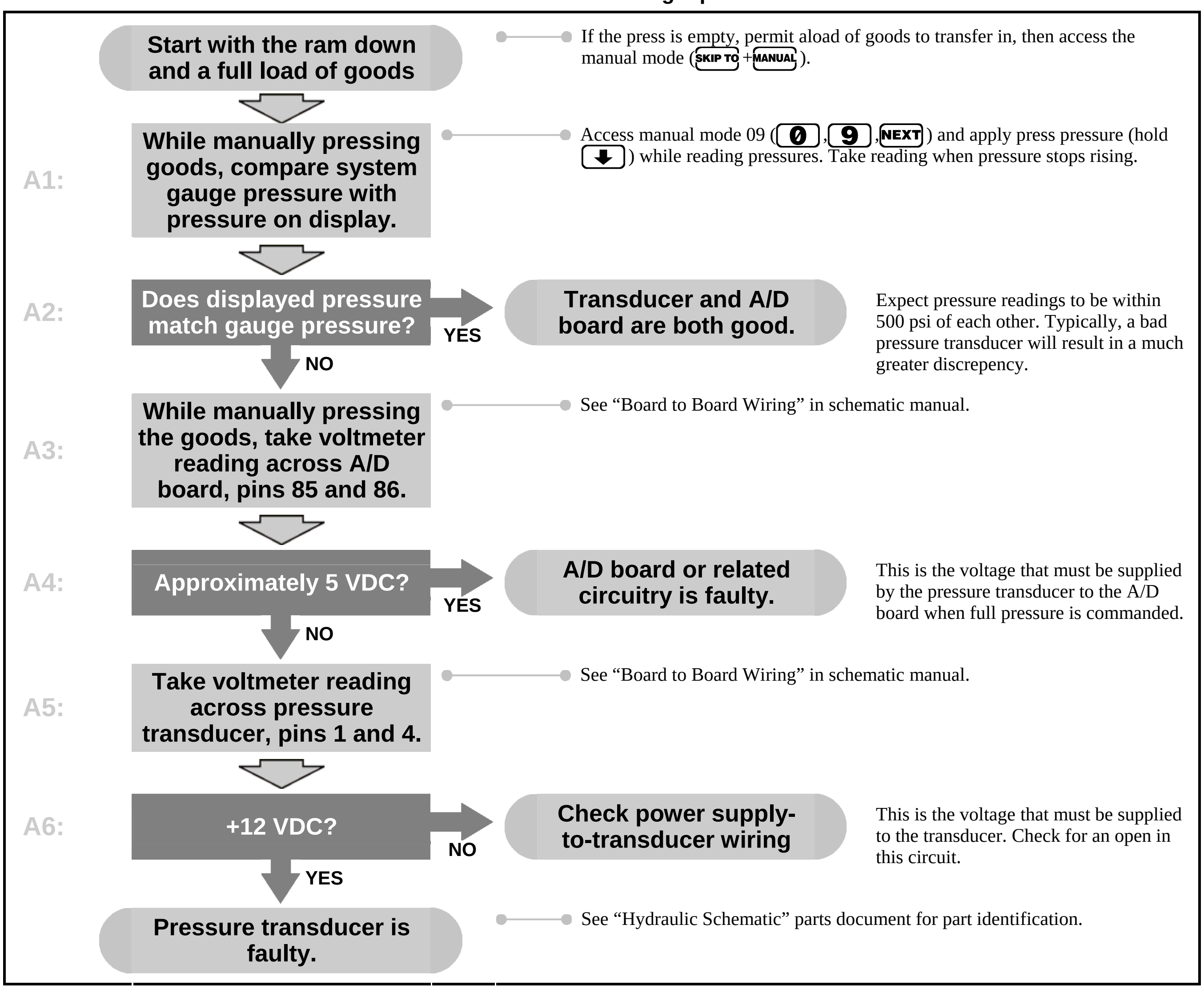
Note 17: The pressure transducer is in the ram down circuit so it only supplies data during ram descent and pressing. Commanding full pressure with manual mode *09*, drives the pump to maximum (no modulation).

Note 18: The *Pressure Sensor Zero Offset* configure decision adjusts for the type transducer installed. Do not use this configure value to attempt to “calibrate” displayed pressure with gauge pressure.

Table 14: Relationships Among Pressure Sensing Components at Each End of Range

Pressure Transducer Output (VDC)		A/D Board (digital counts)	System Pressure (psi)
0 (zero)-based type	0.1 (zero)-based type		
0 VDC	0.1 VDC	0000	0 (zero) psi
5 VDC	5.1 VDC	4095	5000 psi

Chart 14: How to Test Pressure Transducer and A/D board Analog Input



3.4.3.6. How to Test the Pressure Pump—For the press to achieve and maintain commanded pressure while pressing goods, the pressure pump, **along with several other components**, must function properly. Some of the other components are the proportional valve and related electronics, the pressure transducer and related electronics, and the ram piston seals. Use this procedure to test the pressure pump independent of all other components.

Chart 15: Pressure Pump Test

Lockout/tagout power.

A1: Plug the pressure pump control port.

The port to be plugged is circled at left. Use a -4 (1/4") o-ring base plug (supplied in kit KYSSTRBLSH). It is not necessary to cap the hose end, but tape over it for cleanliness. This simulates a fully closed proportional valve.

A2: Restore power and start machine (⊘, ①)

Allow the machine to remain in *Manual* mode, selection *00 Return to Automatic*. The system should immediately go to full pressure without the need to press a load.

A3: Compare system pressure with rated pressure.

Observe the system pressure gauge (top gauge on gauge cluster). See Table 11 “Applicable Milnor® Single Stage Press Models and Pressure Ratings” in Section 3.4.2.6 for the rated pressure for your machine.

A4: Is rated pressure achieved?

- YES: **Pump OK. Lockout/tagout power. Reconnect hose. Done**
- NO: go to A5.

A5: Service the system relief valve per Section 3.4.3.2 then recheck pressure.

This ensures that the system relief valve is functioning properly, in the event that it is contaminated or damaged. This is very unlikely because, with proper adjustment, this valve never opens.

A6: Is rated pressure achieved?

- YES: **Pump OK. Lockout/tagout power. Reconnect hose. Done.**
- NO: go to A7.

A7: Set system relief valve to maximum (5000 psi) then recheck pressure.

This ensures that the system relief valve is not venting pressure before the full pressure is achieved. It is very difficult to open the valve (turn clockwise) under pressure, but easy to close (turn counterclockwise) under pressure. Stop machine (⓪), turn adjustment screw full clockwise, then start machine (①). See also document BIPPMT02 “Setting Single Stage Press Pressures”.

A8: Is rated pressure achieved?

- NO: **Pressure pump needs servicing.**
- YES: go to A9.

A9: Reset system relief valve

With the machine running (①), one person turns the adjustment screw counterclockwise while another watches the system pressure gauge. Turn just until pressure falls below rated. With the machine stopped (⓪), make 1/2 clockwise turn of the adjustment screw then tighten the locking nut.

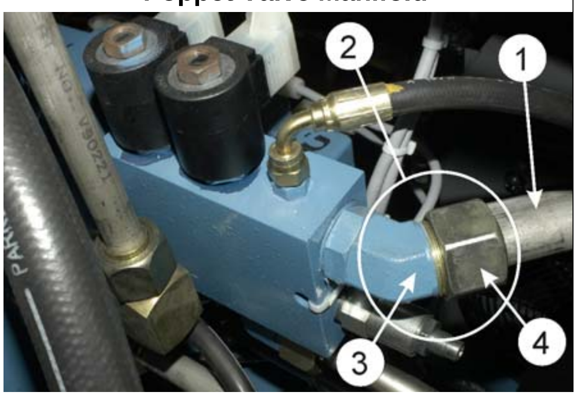
Pump OK. Lockout/tagout power. Reconnect hose. Done

3.4.3.7. How to Test the Ram Piston Seals—As the ram begins pressing a load of goods, the goods compress, and the ram piston moves down slightly, oil in the rod side of the ram exits through the rod-side tubing. As the goods are compacted and ram movement decreases, this flow of oil should decrease. If the flow increases, this indicates that a significant amount of oil is leaking past the piston seals as pressing pressure increases. Test this as follows:

1. Permit a load of goods to transfer into the press, but immediately take the the machine off line. The can will be down and the ram up.
2. Lower the ram (*manual mode 07*) just until the diaphragm is resting on the goods.
3. Lockout/tagout power to the machine.
4. Referring to Figure 50, modify piping as follows (cap and hose are provided in kit KYSSTRBLSH):
   a. Disconnect the ram rod-end (ram up) tubing at the poppet valve manifold.
   b. Cap the manifold connector.
   c. Connect a hose to the disconnected tubing. Run the other end of the hose into a bucket.
5. Restore power and, while observing the flow of oil into the bucket, call for pressure (*Manual mode 09*). If flow decreases as the goods are pressed, the piston seals are good. If it increases, the seals may need to be replaced. However, see Supplement 4.
6. Lockout/tagout power and restore the permanent connections.

Figure 50: Where to Disconnect Tubing to Test Ram Piston Seals

Poppet Valve Manifold



Legend

1. Hydraulic line to ram cylinder rod end
2. Disconnect here.
3. Cap this side.
4. Connect hose this side.

Supplement 4

About Ram Piston Seal Replacement

A certain amount of seal leakage is normal. Ram piston seal replacement is a major service procedure requiring expertise and heavy lifting equipment. Before proceeding with this servicing, evaluate the costs and benefits. As a general rule, avoid this servicing until:

1. all other possible causes are ruled out, and
2. maximum achievable pressing pressure is unacceptable.

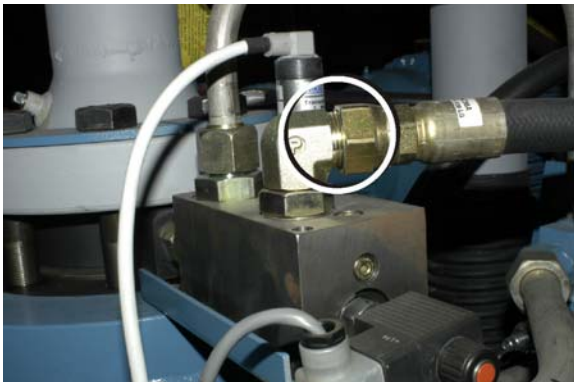
3.4.3.8. How to Test the Pre-fill Valve—In a properly functioning press, when the ram rises, the pre-fill valve opens to speed ascent by permitting a large volume of oil to exhaust through the large pre-fill pipe. If the pre-fill valve closes in mid-ascent, the ram will slow down considerably. The following procedure uses this observation to verify that the prefill valve is working:

1. Unscrew the electrical connector for the pre-fill pilot valve actuator (VERS), so that it can be quickly unplugged, but leave it electrically connected.
2. Lower the ram and can fully if they are up (*Manual mode 02*).
3. Call for ram up (*Manual mode 07*).
4. While the ram is rising, unplug the VERS connector. If the ram's speed slows noticeably, the pre-fill valve, and indeed, the pre-fill hydraulic circuit and the pre-fill pilot valve are working. If not, there is a problem with this system.
5. Replace and secure the VERS connector.

3.4.3.9. **How to Test the Bypass Valve** —The bypass valve remains open except when pressing pressure is called for to prevent ram pressure from exceeding about 200 psi at all other times. If this valve is stuck open, the ram cannot pressurize. If you have determined that the bypass valve electrical circuit is functioning properly by observing the LED on VERDB (VERDB actuates to **close** this normally open valve), you can test this valve for a mechanical problem as follows:

1. Lockout/tagout machine power.
2. Disconnect the bypass valve-to-tank return line at the fittings indicated in Figure 51. Cap the valve side and plug the hose end to simulate a closed bypass valve (cap and plug are provided in kit KYSSTRBLSH).
3. Restore power. If there are no goods in the press, permit a load of goods to transfer to the machine then take the machine off line.
4. Attempt to press the goods using *Manual Mode 09*. If high pressure is achieved (as indicated by the system pressure gauge), the bypass valve is not functioning properly.
5. Lockout/tagout power and reconnect the permanent hose connection.

Figure 51: Bypass Valve: Where to Disconnect Hose



3.4.3.10. **How to Test for Mid-range Pressure**—This test is part of troubleshooting "Little or No Extraction (no error)," but may be helpful in other situations as well. If the ram is permitted to drive against its upper mechanical limit of travel, ram relief pressure (displayed on the middle gauge on the gauge cluster) should rise to that set on the ram relief valve.

1. Lower the diaphragm onto the press bed.
2. Disconnect the electrical cable to the ram up proximity switch. This is the top switch on the proximity switch mounting plate (see document BIPPMM02 “About the Ram Proximity Switches...”)
3. Raise the ram fully and continue to command ram up once the ram stops at its upper limit.

4. While continuing to command ram up, observe the ram pressure gauge (middle gauge on the gauge cluster).
5. After reading the pressure, lower the ram (diaphragm to the press bed and reconnect the ream up proximity switch.

The specified ram relief valve setting is 1500 psi. If a ram pressure gauge reading of 1200 psi or higher is obtained, it is unlikely that "Little or No Extraction..." is caused by faulty pressure pump.

— End of BIPPMT01 —

BIPPMT02 (Published) Book specs- Dates: 20060905 / 20060905 / 20060927 Lang: ENG01 Applic: PPM

3.5. Setting Single Stage Press Pressures

This document supersedes document IIFUUC02 for all single stage press models with the Kawasaki pump (see IIFUUC02 for the older Rexroth pump). Once set at the factory, pressures do not normally need readjustment unless a major component (e.g., pressure pump) is replaced.

Although these procedures are straightforward, unanticipated problems resulting in costly damage can arise. Personnel must have an in-depth knowledge of hydraulic systems and be familiar with manual operation of the press.

Notice 58: Understand the press servicing hazards—Before performing press maintenance, review document BIPPMS01 “Safe Servicing...”

Table 15, which follows, describes the components that may need adjusting. Table 16, following it, specifies the values to be used. The rows in Table 15 correspond to those in Table 16.

Table 15: List of Adjustments

Adjustment Component	What It Does	Means of Adjusting
Full system pressure (no single adjustment)	Determines maximum programmable pressing pressure.	See four items with asterisk (*) below.
Idle pressure valve	Controls idle (also called standby or minimum) pressure (system pressure while the operating press is idle)	Hex socket screw and locking nut on pump
*** Pump pressure compensator valve**	Limits system pressure once its set point (full system pressure) is achieved.	Hex socket screw and locking nut on pump
1st stage horsepower valve (torque limiter)	Limits motor amperage draw at predetermined midrange (1st stage) and high (2nd stage) pressures by adjusting pump operating characteristics (see Note 19).	Adjustment nut and locking nut on pump
*** 2nd stage horsepower valve (torque limiter)**		Hex socket screw and locking nut on pump
*** System relief valve**	Bleeds off pressure exceeding permissible full system pressure.	Hex socket screw, locking nut on manifold
Pre-fill pilot pressure regulator	Regulates pressure exceeding that permitted for the pre-fill pilot valve.	Hex socket screw, locking nut on valve
Ram relief valve	Bleeds off pressure exceeding that permitted on rod end of ram cylinder.	Hex socket screw, locking nut on manifold
Can pressure regulator	Regulates pressure exceeding that permitted for can cylinders.	Hex socket screw, locking nut on manifold
*** Proportional valve maximum pressure pot.**	Calibrates the DBET card with proportional valve to ensure full valve closure.	Adjustable pot on DBET card
Proportional valve ramp up potentiometer	Sets how fast the proportional valve closes (swash plate moves to increase output).	Adjustable pot on DBET card
Proportional valve ramp down potentiometer	Sets how fast the proportional valve opens (swash plate moves to decrease output).	Adjustable pot on DBET card

Note 19: The horsepower adjustments enable the pump to maintain the maximum permissible load on the motor (full load amperage) as flow decreases and pressure increases (destroke), to ensure that the motor does not stall, but full pressure is achieved.

Table 16: Adjustment Specifications

<table>
<tr><th rowspan="3">Adjustable Condition</th><th colspan="4">Specification (Kawasaki pump only)</th><th rowspan="3">Means of Measuring</th></tr>
<tr><th colspan="2">MP1603 (35 bar)</th><th rowspan="2">MP1604 (50 bar)</th><th rowspan="2">MP1A03 (40 bar)</th></tr>
<tr><th>low flow</th><th>high flow</th></tr>
<tr><td>Full system pressure</td><td>4600 psi</td><td>4600 psi</td><td>4350 psi</td><td>4600 psi</td><td>See four adjustments with an asterisk (*) below</td></tr>
<tr><td>Idle pressure</td><td colspan="4">400 psi</td><td rowspan="2">Observe system pressure (top) gauge</td></tr>
<tr><td>*Pump compen-sation pressure</td><td>4600 psi</td><td>4600 psi</td><td>4350 psi</td><td>4600 psi</td></tr>
<tr><td rowspan="2">1st stage horsepower (amperage draw)</td><td colspan="4">Achieve full load amperage rating on motor nameplate (+/- 3%) while ram relief pressure at:</td><td rowspan="2">Ammeter measurement while ram relief pressure is lowered to value shown</td></tr>
<tr><td>1200 psi @ 60 Hz
1350 psi @ 50 Hz</td><td>625 psi @ 60 Hz
750 psi @ 50 Hz</td><td>825 psi @ 60 Hz
985 psi @ 50 Hz</td><td>880 psi @ 60 Hz
1060 psi @ 50 Hz</td></tr>
<tr><td>* 2nd stage horsepower (amp. draw)</td><td colspan="4">Achieve full load amperage rating on motor nameplate (+ 5% / -0%) while system pressure is 300 to 400 psi below rated full system pressure.</td><td>Ammeter measurement while system pressure is lowered to value shown</td></tr>
<tr><td>* System relief pressure</td><td colspan="4">Rated full system pressure plus 1/2 clockwise turn of the adjustment screw</td><td>Observe system pressure gauge then 1/2 CW turn</td></tr>
<tr><td>Pre-fill pilot max. pressure</td><td colspan="4">2000 psi</td><td>Observe pre-fill pressure gauge (near valve)</td></tr>
<tr><td>Ram relief pressure</td><td colspan="4">1500 psi</td><td>Observe ram relief pressure (middle) gauge</td></tr>
<tr><td>Can maximum pressure</td><td colspan="4">800 psi</td><td>Observe can relief pressure (bottom) gauge</td></tr>
<tr><td>* Proport. valve max. pressure</td><td>4600 psi</td><td>4600 psi</td><td>4350 psi</td><td>4600 psi</td><td>Observe system pressure gauge</td></tr>
<tr><td>Proport. valve ramp up rate</td><td colspan="4" rowspan="2">minimum setting
(This control must have no effect on valve or pump operation.)</td><td rowspan="2">Measurement not needed</td></tr>
<tr><td>Proport. valve ramp down rate</td></tr>
</table>

3.5.1. Preparations, Precautions and Tips

3.5.1.1. **Two technicians are needed.**—One technician operates the controls and monitors the pressure gauges. The other performs the adjustments, which are located on top of the machine.

CAUTION 59 : Multiple hazards—Various components above the top plate move or become hot or energized. Hydraulic piping may leak. Working area is tight and may be slipery. When maintenance work necessitates getting on top of the press:

- Ensure that only qualified service personnel perform top-of-press work.
- Identify and stand clear of components on top of the machine that move (such as the diaphragm rod) or become hot (such as the pump and motor).
- Use safe, appropriate equipment for getting on and off of the machine.
- Ensure solid footing and guard against slippery surfaces. Wash surfaces with detergent.

3.5.1.2. Be prepared to load goods.—Several adjustments, starting with the 2nd stage horsepower adjustment, must be done with a full load of wet goods in the machine. All other adjustments except for the last (set can pressure), which should be done with the machine empty, may be done with the machine loaded or empty.

Notice 60: For safety and convenience—Avoid manually loading goods.

- If the service procedure must be performed with goods in the machine, permit the press to accept a load of goods automatically, then take the machine off-line.
- If it becomes necessary to manually load or adjust goods, use extreme caution. Always follow the published safety precautions (see safety manual).

3.5.1.3. Have needed materials on hand.—Tools will likely include:

- Ammeter and voltmeter
- Small, flat blade screwdriver
- Hex head (Allen) wrench set
- Closed-end wrenches (various sizes)
- -4 (1/4") O-ring base plug (for the pump control port)

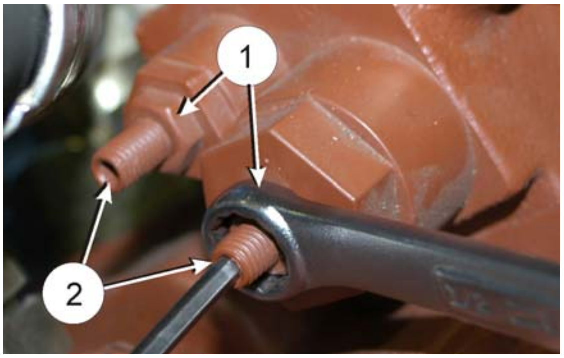
Notice 61: Troubleshooting, not covered here, may be required—This procedure provides minimal troubleshooting and assumes that, aside from the need for adjustment, the press pressure components are functioning properly. If you encounter problems not covered here, refer to the detailed troubleshooting procedures, elsewhere, or contact Milnor technical support. Additional equipment will be needed if more in-depth troubleshooting is required.

Tip: You will need to refer to the pump motor full rated amperage when setting motor horsepower (amperage draw). Write down this value as stated on the motor nameplate.

3.5.1.4. Get the gist of the procedure.—The overall procedure is summarized in Section 3.5.2. Each adjustment is explained in a flow chart. Read the left side of the chart for an overview of the adjustment steps. The right side provides details.

All pressure adjustment components are similar to those shown in Figure 52 below.

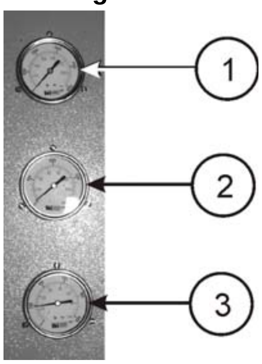
Figure 52: How Pressure Adjustments Are Made

Typical Adjustment Components (idle pressure (left) and pump compensation pressure (right) adjustments shown)	Legend
	**1. Locking nut**—Turn counterclockwise to unlock before adjustment; turn clockwise to lock after adjustment. **2. Adjustment screw (hex socket (Allen) screw)**—Turn counterclockwise to lower pressure; turn clockwise to raise pressure.

Tip: Most pressure adjustments can be made with pressure applied, so that when an adjustment screw is turned, the pressure gauge moves dynamically. An exception is the system pressure relief valve. This valve can be opened (turn counterclockwise) to lower the pressure with pressure applied, but it is difficult, if not impossible, to close (turn clockwise) to raise the pressure with full pressing pressure applied.

All pressures (except pre-fill pilot pressure) are read on the pressure gauges shown in Figure 53. All pressure specifications are in pounds per square inch (abbreviated psi herein).

Figure 53: Where Most Pressures are Read

Gauge Cluster	Legend
	**1. System pressure gauge**—used in setting idle pressure, pump compensation pressure, 1st and 2nd stage motor horsepower (amperage draw), proportional valve maximum pressure, and system relief pressure. **2. Ram relief pressure gauge**—used in setting ram relief pressure and 2nd stage horsepower (amperage draw) **3. Can relief pressure gauge**—used in setting can relief pressure

Tip: It is likely that certain components will already be correctly adjusted. Check first for proper adjustment before changing the adjustment.

3.5.1.5. **Adhere to the adjustment order.**—This procedure explains the adjustments in the most efficient order. Each subsequent adjustment assumes that certain conditions were verfied and settings were made in previous adjustments. All adjustments should be done, and they should be performed in the order listed.

Tip: Performing only certain adjustments or changing the adjustment order risks leaving certain components improperly adjusted. If you must perform the adjustments differently than presented here, see the prerequisites for each adjustment listed in Section 3.5.2 “Summary of Adjustments”.

3.5.1.6. **Ensure minimum ramp rates**—These are not part of the adjustment procedure, but it is important to ensure that they are set to the minimum value, as explained below.

Chart 16: Ensure Minimum Ramp Rates

A1:

Power on (⊛). Remain in *Manual*.

All mechanical adjustments will be performed with the machine in *Manual* mode.

Ensure proportional valve ramp rates are at minimum (see Table 16).

The proportional valve ramp up and ramp down potentiometers on the DBET card, are circled at left. The adjustment screws have no mechanical limits of travel. Turn each screw twenty (20) turns **counter**clockwise. This ensures that these controls have no effect on valve or pump operation.

Done

3.5.2. Summary of Adjustments

With preparations completed...

Prerequisites for all adjustments: Pump and motor functioning properly

A1: Set idle pressure (Section 3.5.3)

Prerequisites:

1. Proportional valve controls functioning properly or controls bypassed (by disconnecting the electrical feed to the valve)
2. Proportional valve mechanically functioning (i.e., fully open)

A2: Set pump compensation (full) pressure (Section 3.5.4)

Prerequisites:

1. Proportional valve bypassed (by plugging the pump control port)
2. System relief valve temporarily set to maximum pressure (5000 psi)
3. 1st and 2nd stage horsepower (amperage draw) properly set

Notice 62: The horsepower adjustments are factory-set and not likely to need major adjustment. On this assumption, pump compensation pressure is set first. However:

- **be aware that if the horsepower settings are significantly out of adjustment, the motor may quickly stall or overheat, in which case, it should be shut down immediately.**
- **the pump compensation pressure and horsepower adjustments are interdependent and may need to be repeated until the specified settings are achieved.**

A3: Set 1st stage motor horsepower (amperage draw) (Section 3.5.5)

Prerequisites:

1. Pump compensation pressure already set or attempted.
2. System relief valve remains sey to maximum pressure (5000 psi).
3. Max pressure pot. bypassed (by temporarily adjusting to highest setting).
4. Ram relief pressure temporarily set to the lower, specified pressure at which 1st stage motor horsepower (amperage draw) should be set..
5. Ram up prox switch disabled and ram pressing against upper limit of travel

A4: Set 2nd stage motor horsepower (amperage draw), system relief pressure, and pre-fill pilot valve relief pressure (Section 3.5.6)

Prerequisites for all:

1. Max pressure pot. remains bypassed (adjusted to highest setting).
2. Ram relief pressure remains temporarily set to lower pressure.
3. Goods loaded in press and ram pressing against load.

Additional prerequisites for 2nd stage motor horsepower adjustment:

1. Compensator valve bypassed by setting system relief valve lower.
2. 1st stage horsepower already adjusted (because it affects 2nd stage setting).

Additional prerequisite for system relief pressure adjustment: horsepower properly adjusted.

A5: Set proportional valve maximum pressure (Section 3.5.7)

Prerequisites:

1. Goods loaded in press and ram pressing against load
2. Pump compensation pressure already adjusted
3. 1st and 2nd stage horsepower already adjusted
4. Proportional valve functioning properly

A6: Set ram relief pressure (Section 3.5.8)

Prerequisites:

1. Configured ram valve setting bypassed
2. Horsepower already adjusted (to avoid running motor above rated amperage)
3. Ram up prox switch disabled and ram pressing against upper limit of travel

A7: Set can pressure (Section 3.5.9)

Prerequisites:

1. Press empty of goods
2. Configured can valve setting bypassed
3. Can up prox switch disabled and can pressing against upper limit of travel

Done

3.5.3. Set Idle Pressure

Start the machine (①)

In a properly functioning machine, idle pressure is controlled by the idle pressure valve. However, a malfunctioning proportional valve will typically prevent the system from falling to idle pressure.

A1: Is the pump motor energized (running)?
- NO: Go to B1
- YES: continue

A2: Adjust the idle pressure valve to 400 psi (see Table 16).

The idle pressure valve adjustment, located on the pump, is circled at left. To adjust, loosen the locking nut then turn the adjustment screw. Observe the system pressure gauge to determine which direction to turn the screw.

A3: Is idle pressure achievable?
- YES: Lock down setting. Stop machine (⓪). Go to next adjustment.
- NO: continue

To lock down the valve setting, tighten the locking nut.

A4: Bypass the proportional valve electrical controls by disconnecting the electrical feed to the valve. Try again to adjust the idle pressure valve.

Unscrew and remove the proportional valve electrical connector, as shown at left. In a properly functioning system, as voltage to the proportional valve increases (from zero to 16 millivolts), the valve closes and the pump swash plate tilts away from vertical. Hence, zero voltage (open circuit) opens the valve completely, returning the swash plate to vertical and minimizing pump pressure.

A5: Is idle pressure achievable?
- NO: Go to C1
- YES: continue

A6: Troubleshoot proportional valve controls.

Go to A2

If a disconnected electrical feed achieves idle pressure, the problem is with the proportional valve controls. Refer to detailed troubleshooting elsewhere. Typical problems are:

1. Incorrect wiring between DBET card and valve.
2. Bad DBET card.

Part B

B1: Troubleshoot the motor control circuitry.

Go to A2

If the motor does not energize when *Start* (①) is pressed, a replacement motor or component of the motor control circuitry was improperly wired or it is bad. Refer to detailed troubleshooting elsewhere.

Part C

C1: Troubleshoot the proportional valve and motor/pump.

Go to A2

If a disconnected electrical feed does not achieve idle pressure, the problem is probably mechanical. Refer to detailed troubleshooting elsewhere. Some possible problems are:

1. Stuck proportional valve.
2. Motor running backwards (replacement motor improperly phased in).
3. Malfunctioning pump.

3.5.4. Set Pump Compensation (Full System) Pressure

Lockout/tagout power

This procedure will set the first of four components that affect full pressure:

1. **Pump pressure compensator valve**—Adjusted here.
2. **2nd stage horsepower valve**—Adjusted later, but may affect this setting.
3. **System relief valve**—Adjusted later. Bypassed here.
4. **Proportional valve max. pressure potentiometer**—Adjusted later. Bypassed here.

A1: **Bypass the proportional valve by plugging the pump port that sends oil to this valve**

The port to be plugged is circled at left. Plugging this port simulates a fully closed proportional valve (maximum pressure) and facilitates adjustment of the compensator valve. It bypasses any possible problems with the proportional valve and—because it is not necessary to pressurize the ram cylinder—it also bypasses any possible problems with the pre-fill valve and cylinder (e.g., leaking seals).

It is not necessary to plug the hose end, but tape over it for cleanliness.

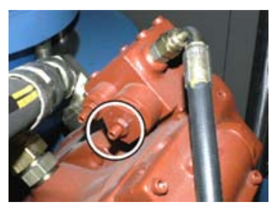
A2: **Temporarily set the system relief valve to maximum (5000 psi)**

The system relief pressure adjustment is circled at left. Loosen the locking nut then turn the adjusting screw full clockwise. This sets the pressure-limiting effect of this valve far above any other adjustments it could otherwise affect.

A3: **Restore power and start machine (⊛, ①)**

The system immediately goes to full pressure without the need to press a load.

A4: **Adjust pump compensation pressure as needed to achieve specified full system pressure (see Table 16)**



The pump pressure compensator valve adjustment, located on the pump, is circled at left. To adjust, loosen the locking nut then turn the adjustment screw. Observe the system pressure gauge to determine which direction to turn the screw. See Table 16 for the specified full system pressure value.

A5: **Is full system pressure achievable?**

NO: **Continue at left, but repeat this adjustment after setting 2nd stage horsepower (Section 3.5.6)**

Observe the system pressure gauge. If full pressure is not achieved, 2nd stage horsepower may be improperly set, interfering with this setting. These inter-dependent adjustments must be repeated until the proper settings are achieved.

YES:

A6: **Lock down the compensator setting**

With the compensator valve adjustment screw properly set, tighten the locking nut.

Lockout/tagout power, reconnect hose then restore power. Proceed to the next adjustment.

Leave the system relief valve set to maximum pressure for the next adjustment.

Notice 63: Troubleshooting May Be Required—The remaining adjustments will be made with proportional valve function restored and ram cylinder (or can cylinders) pressurized. The specified settings can only be achieved if the machine is otherwise, functioning properly. Some possible impediments to proper adjustment are covered herein. If you encounter a problem not explained here, refer to detailed troubleshooting elsewhere.

3.5.5. Set 1st Stage Horsepower (amperage draw)

Power off ( )

A1: Disable the ram up proximity switch

This is the top switch on the prox switch mounting post. Disconnect the screw-type electrical connector (see at left). This permits pressure to be sustained as long as the ram is pressing against its upper mechanical limit.

A2: Start machine (,). Bypass the proportional valve max. pressure pot. by setting it to maximum

The proportional valve max. pressure adjustment, located on the DBET card, is circled at left. The adjustment has no mechanical limits of rotation. To ensure the maximum value, turn the screw twenty (20) clockwise turns.

A3: Command and maintain *Ram Up*

In *Manual* mode, raise the ram (7, ↑). Maintain ram up force by holding ↑ even after the ram reaches its upper mechanical limit, **and for the following adjustment, except where stated otherwise.**

A4: Is system pressure higher than idle?

NO → **Go to B1**

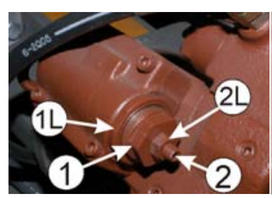
YES ↓

Observe the system pressure gauge. System pressure should be substantially higher than 400 psi (idle pressure).

A5: While maintaining *Ram Up*, set ram relief pressure as specified for setting 1st stage horsepower (see Table 16)

The ram relief valve adjustment is circled at left. Loosen the locking nut then turn the adjustment screw. Observe the ram relief pressure gauge (middle gauge on the gauge plate) to determine which direction to turn the screw. See Table 16 for the specified value. Re-tighten locking nut to lock down setting.

A6: While maintaining *Ram Up*, adjust 1st stage horsepower to the motor's rated amperage (see motor and Table 16)



The horsepower adjustment, located on the pump, is shown at left. Loosen outermost locking nut 1L then turn adjustment nut 1. (Items 2 and 2L are for 2nd stage adjustment.) One person measures the motor amperage while the other turns the adjustment nut. Re-tighten locking nut to lock down setting.

A7: Power off (,). Restore ram up prox switch function, then restore power ( ).

To restore prox switch function, reconnect the switch wiring.

Leave the proportional valve max. pressure adjustment at maximum and ram relief pressure at the lower setting.

Proceed to the next adjustment

Part B

B1: Release *Ram Up* and troubleshoot the proportional valve

If system pressure remains at or near idle pressure, there is a problem with the proportional valve or related hardware. Some possible problems:

1. Max pressure potentiometer not set properly (to maximum)
2. Incorrect wiring between the DBET card and valve
3. Bad DBET card
4. Proportional valve stuck open

Go to A5

3.5.6. Set 2nd Stage Horsepower (amperage draw), System Relief Pressure and Pre-fill Pilot Pressure

Chart 21: Set 2nd Stage Horsepower (amperage draw), System Relief Pressure and Pre-fill Pilot Relief Pressure

Load wet goods (full load)

Machine safeties will not permit pressing without a load. If the press is not already loaded, load it now (see Section 3.5.1.2 “Be prepared to load goods.”). The press must be loaded for most of the remaining procedures.

A1: **Apply and maintain pressing pressure**

In *Manual* mode, lower the ram (9, ↓). **Maintain pressure by holding ↓ throughout the following adjustments, except where stated otherwise.**

A2: **Is system pressure at or near specified full pressure?**

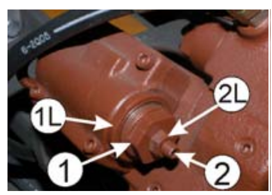
NO → **Go to B1**

YES ↓

A3: **While pressing, bypass the pump pressure compensator valve by lowering system relief pressure to 400 psi below full pressure.**

The system relief pressure adjustment, which was previously set to its highest setting, is circled at left. For example, if full pressure for your machine is 4600 psi, lower to 4200 psi (observe system pressure gauge). Turn the adjustment screw counterclockwise to lower pressure. If you overshoot, release pressure, turn clockwise, then, with pressure applied (↓) continue turning counterclockwise.

A4: **While pressing, adjust 2nd stage horsepower to the motor's rated amperage (see motor nameplate and Table 16)**



The horsepower adjustment, located on the pump, is shown at left. Loosen small locking nut 2L then turn adjustment screw 2. (Items 1 and 1L are for 1st stage adjustment.) One person measures motor amperage while the other turns the adjustment screw. Re-tighten the locking nut to lock down the setting.

A5: **With pressure released, return system relief pressure to maximum**

Release ↓. Loosen the system relief valve locking nut, then turn the adjustment screw full clockwise.

A6: **While pressing, lower system relief pressure just until it matches full system pressure.**

While holding ↓, slowly open the system pressure relief valve (turn counterclockwise) just until system pressure begins to drop, then release pressure. Remember that it is possible to open this valve (turn counterclockwise) while maintaining pressure, but not to close it.

A7: **With pressure released, set system relief pressure 1/2 CW turn above full pressure (see Table 16) and lock down.**

Release ↓. Turn the adjustment screw 1/2 clockwise turn (as specified in Table 16) then tighten the locking nut.

A8: **While pressing, set pre-fill pilot pressure to 2000 psi (see Table 16)**

The pre-fill pilot pressure gauge (1) and adjustment (2) are shown at left. Loosen the locking nut then turn the adjustment screw. Observe the gauge to determine which direction to turn the screw. Tighten the locking nut to lock down the setting.

Chart 21: Set 2nd Stage Horsepower (amperage draw), System Relief Pressure and Pre-fill Pilot Relief Pressure

Proceed to the next adjustment.

Leave the proportional valve max. pressure adjustment at maximum and ram relief pressure at the lower setting for the next adjustment.

Part B

B1: **Troubleshoot the ram hydraulic circuitry and components.**

If the system does not approach full pressure, refer to detailed troubleshooting elsewhere. Some possible problems are:

- Bypass valve not closing. LED on valve must be illuminated, as shown at left.
- Pre-fill valve stuck open
- Pre-fill pilot valve not functioning.
- Ram cylinder seals leaking.

Go to A3

3.5.7. Set Proportional Valve Maximum Pressure

With the machine running (①)...

Goods remain in the machine from the previous procedure. Machine safeties will not permit pressing without a load. Also, the proportional valve max. pressure adjustment remains at maximum and ram relief pressure at the lower setting, from previous procedures.

A1: Apply and maintain pressing pressure.

In *Manual* mode, lower the ram ([9], [↓]). **Maintain pressure by holding [↓] throughout the following adjustment, except where stated otherwise.**

A2: Lower proportional valve max. pressure just until it matches full system pressure (see Table 16).

Previously, the max. pressure pot, circled at left, was adjusted to its highest setting. Carefully turn the adjustment screw counterclockwise just until system pressure begins falling below full pressure (see Table 16 for the specified value).

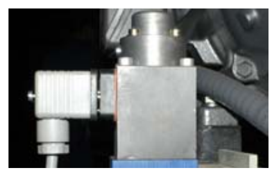
A3: Does max. pressure pot respond to adjustment?

YES → **Stop machine (⓪). Go to next adjustment.**

Leave the ram relief pressure at the lower setting for the next adjustment.

NO ↓

A4: Look for 16 millivolts across proportional valve coil



Separate the electrical connector from the valve, as shown at left, just enough to provide a gap for the voltmeter leads. **Reading must be taken with the coil in the circuit.** Read the voltage across the left and right prongs.

A5: Is the proper voltage achievable?

NO → **Go to B1**

YES → **Go to C1**

Part B

B1: Troubleshoot valve electrical controls.

→ **Go to A3**

If you cannot achieve 16 millivolts across the coil, the problem is electrical. Refer to detailed troubleshooting elsewhere. Some possible problems:

- Faulty wiring between the DBET card and the valve.
- Bad DBET card

Part C

C1: Troubleshoot proportional valve.

→ **Go to A3**

If you read 16 millivolts across the coil, the problem is mechanical. Refer to detailed troubleshooting elsewhere. Some possible problems:

- Proportional valve seals leaking.
- Proportional valve stuck open.

3.5.8. Set Ram Relief Pressure

Notice 64: Goods remain in the machine from the previous procedure. These are not needed for the remaining adjustments and may be removed. However, if this procedure is being done in the field, leave the goods in the machine for this adjustment.

Chart 23: Set Ram Relief Pressure

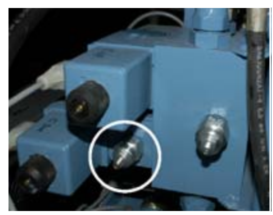
	Power off (⊗)	The ram relief pressure adjustment may be performed with goods in the machine or with the machine empty.
A1:	Disable the ram up proximity switch	 This permits pressure to be sustained as long as the ram is pressing against its upper mechanical limit of travel. The ram up prox switch is the top switch on the prox switch mounting plate. Disconnect the screw-type electrical connector, as shown at left.
A2:	Restore power (⊖). Record, then bypass the can and ram valve configure values by temporarily setting them to 4095 (maximum)	In *CONFIGURE* (this is selection 3 on the *Program* menu—see reference manual), go to the *CAN VALVE SETTING* decision, **write down its current value,** then change the value to 4095 (maximum = fully open). Do the same for the *RAM VALVE SETTING* decision. These will be returned to their previous values at the completion of the adjustments. This change bypasses these settings when making the following adjustments. In normal operation, the configure values control how fast the can or ram travels.
A3:	Start machine (①). Command and maintain Ram Up	In *Manual* mode, raise the ram ([7], [⬆]). Maintain ram up force by holding [⬆] even after the ram reaches its upper mechanical limit, **and for the following adjustment.**
A4:	While maintaining Ram Up, adjust ram relief pressure to 1500 psi (see Table 16)	 The ram relief pressure adjustment is circled at left. Loosen the ram relief valve locking nut then turn the adjustment screw. Previously, this component was set to a lower pressure and will probably need to be raised, but observe the ram relief pressure gauge (middle gauge) to determine which direction to turn the screw. Re-tighten the locking nut to lock down the setting.
A5:	Power off (⓪, ⊗), restore ram up prox switch function, then restore power (⊖).	To restore prox switch function, reconnect the switch wiring.
	Proceed to the next adjustment	Leave the can and ram valve configure values at their temporary settings.

3.5.9. Set Can Pressure

CAUTION 65: Risk of damage to machine or goods—This adjustment will be done with the can up. If goods remain in the machine, this will not prevent the can from being raised in *Manual* mode, but damage may occur when the can is lowered again.

- Place the machine on-line so that the machine can complete processing of this load. When this load is discharged from the press and before the next load enters, take the machine off-line (return to *Manual* mode) and perform the last adjustment, which follows.
- Never manually lower the can onto a load of goods.

Chart 24: Set Can Pressure

	Power off (⊗)	The can pressure adjustment should be performed with the machine empty of goods.
A1:	**Disable the can up proximity switch**	 The can up prox switch, located adjacent to one of the can cylinders, is shown at left. The prox switches have screw-type electrical connectors. Unscrew the connector. This permits pressure to be sustained as long as the the can is pressing against its upper mechanical limit of travel.
A2:	**Restore power and start machine (⊖, ⊕). Command and maintain *Can Up***	In *Manual* mode, raise the can (3, ⇧). Maintain can up force by holding ⇧ even after the can reaches its upper mechanical limit, **and for the following adjustment.**
A3:	**Adjust can pressure to 800 psi (see Table 16)**	 The can pressure valve adjustment is circled at left. Loosen the locking nut then turn the adjustment screw. Observe the can relief pressure gauge (bottom gauge) to determine which direction to turn the screw. Re-tighten the locking nut to lock down the setting.
A4:	**Stop the machine and power off (⓪, ⊗). Restore can up prox switch function, then restore power (⊖).**	To restore prox switch function, reconnect the switch wiring.
A5:	**Restore the can and ram valve configure values to their previous settings.**	In *Configuration* return the *CAN VALVE SETTING* and *RAM VALVE SETTING* configure decisions to their previous values (the values you wrote down). If this procedure is being performed in the field, the machine may now be placed on-line (returned to normal, automatic operation).
	Done	

— End of BIPPMT02 —