

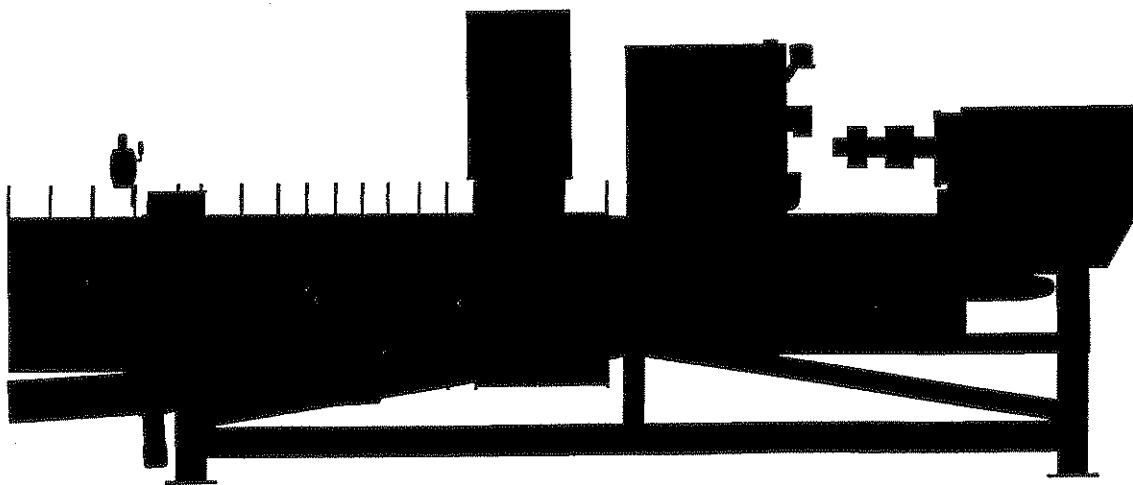


Model WE-4

water extractor

HYDRAULIC WATER EXTRACTOR

operator's
manual



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J. A. Freeman & Son, Inc. guarantees all new equipment manufactured by them to be free from defects in material and workmanship for 90 days or part thereof from date of delivery. The obligation under this warranty is limited to the replacement or repair at our Portland, Oregon factory or at a point designated by us of such parts that appear to us to have been defective in material or workmanship.

J. A. Freeman & Son, Inc. obligation under this warranty is limited to repairing or replacing at its option, any part that in J. A. Freeman & Son, Inc. judgement is defective when returned to the factory.

The provisions of this warranty shall not apply to any equipment which has been subject to misuse, negligence, alteration or accident, or which shall have been repaired with parts other than those obtainable through J. A. Freeman & Son, Inc.

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Note J. A. Freeman & Son, Inc. reserves the right to make improvements in design or changes in specifications without notice at any time, and without incurring any obligation to owners of units previously sold.



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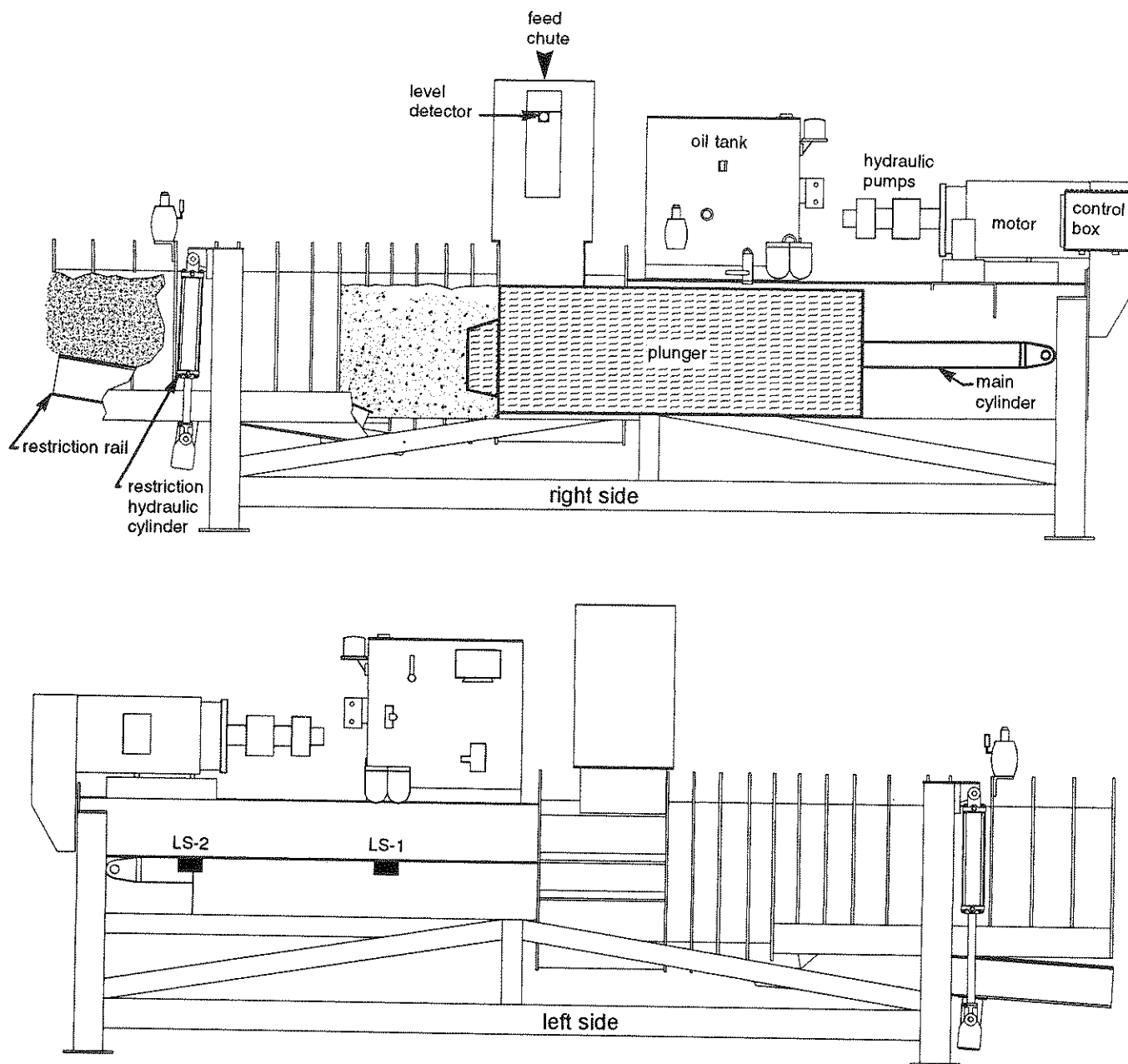


Fig. 1 WE-4 Water extractor

Drawings

Wiring diagram 24934E

Wiring installation 25178D

Electrical schematic 24935D

Hydraulic schematic 24610E

General arrangement 21857F

Equipment

Motor 40 hp

Hydraulic pump Sundstrand model
CPE035035RAM2AC+SNP2/04D3C06

Factory settings

- Time-delay relay: at "2" (≈ 3.5 sec)*
- Level detector mount bracket at second from bottom row of mounting holes, with mounting flanges down*
- Plunger system relief valve 3,500 psi
- Anti-plug plunger system pressure switch 2,500 psi*
- High-low plunger system unloader valve 1,000 psi
- Restriction system static relief valve 600 psi*
- Restriction system unloader valve 2,000 psi*

*Settings vary according to conditions

WE-4 Water extractor

Introduction

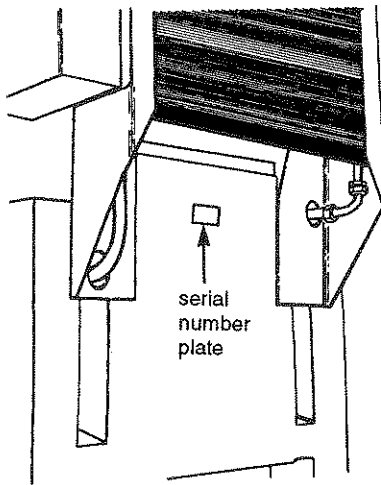


Fig. 2 Serial number plate

Automated water extraction The Freeman Water Extractor is an efficient, automated tool for extracting water from a continuously fed product. Product transport is eased with compaction and water removal. A wide variety of adjustments provide a machine to suit most products.

The plunger forces water from the product. A restriction system is activated only when the plunger is advancing. A control box switch allows the restriction rail control system to be bypassed so that pressure is applied continuously for setting pressures, testing, and troubleshooting.

Serial number location The serial number of your water extractor is necessary for correct ordering of replacement parts. The serial number plate is located below the oil cooler.

Replacement parts Genuine Freeman replacement parts should be used. Ensure prompt service by giving the dealer the (1) part description and part number, (2) model number, and (3) serial number.

Operational sequence

Operation The capacitive type level detector, acting with a time-delay circuit, provides correct feed volume and operational timing of the water extractor hydraulic system. The time-delay circuit allows the detector to trigger on the growing "product pile," rather than on product falling through the feed chute.

The level detector triggers the plunger to retract from its extended rest position when the product pile is detected (fig. 3). (The product pile has been building on the plunger top surface.) The retracting plunger allows the product pile to fall into the chamber. The plunger then extends to compress this product pile, while a new product pile builds on the plunger top surface.

1. START-UP At start-up the plunger is extended. Product falling through the chute falls onto the plunger top surface. Refer to the electrical schematic, 24778D:

- switch 1 (S-1) on (closed)
- switch 2 (S-2) automatic
- switch 3 (S-3) off
- limit switch 1 (LS-1) released (open)
- limit switch 2 (LS-2) released
- relay 1 (RL-1) released
- relay 2 (RL-2) released
- relay 3 (RL-3) released
- relay 4 (RL-4) released
- relay 5 (RL-5) released
- solenoid 1 (SOL-1) not energized
- solenoid 2 (SOL-2) not energized
- solenoid 3 (SOL-3) not energized
- pressure switch 1 (PS-1) open (pressure below activation setting)
- level detector (LV DET-1) open

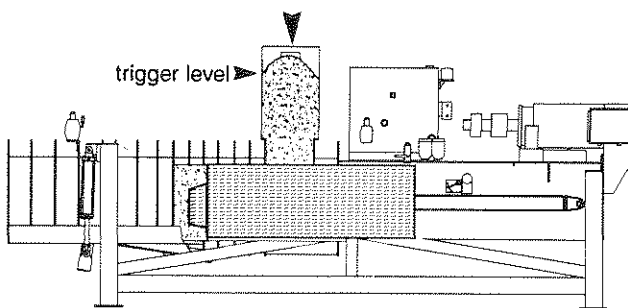


Fig. 3 The product pile is sensed by the level detector during the time the plunger is extended and at rest

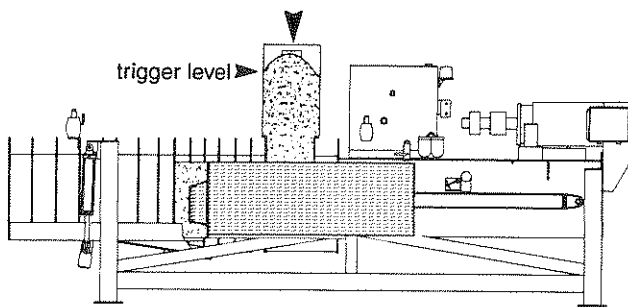


Fig. 4 Level detector triggers relay 2, plunger begins to retract

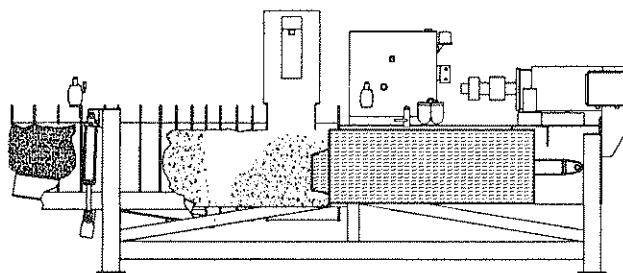
2. MATERIAL REACHES LEVEL DETECTOR Product falls into the feed chute and reaches the level of the level detector.

3. DELAY CIRCUIT TRIGGER Relay 2 (RL-2) has a delay circuit. Relay 2 (RL-2) is energized when the product is sensed by the level detector for a period of time that is equal to the adjusted delay of relay 2 (RL-2).

The energized relay 2 (RL-2) causes relay 1 (RL-1) to be set, and in turn solenoid 2 (SOL-2) is energized, causing the plunger to begin retracting (fig. 4).

After the plunger retracts a short distance, the plunger closes limit switch 1 (LS-1):

limit switch 1 (LS-1) closed (sets RL-4)
 relay 1 (RL-1) set (latched through LS-2 and RL-5)
 relay 2 (RL-2) set (product still seen by the level detector)
 relay 4 (RL-4) set
 solenoid 2 (SOL-2) energized (plunger retracting)



4. PRODUCT FALLS INTO CHAMBER The plunger retracts and the product falls into the chamber. The level detector switch then opens and relay 2 (RL-2) is released:

level detector open
 relay 2 (RL-2) released

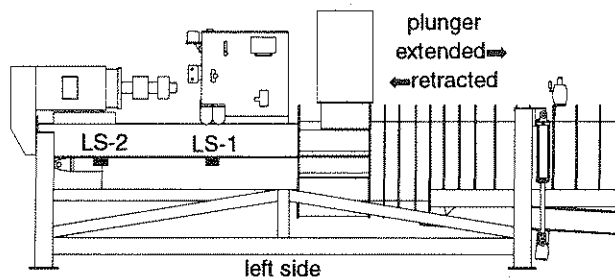


Fig. 5 Plunger fully retracted

5. PLUNGER FULLY RETRACTED When the plunger reaches full retraction (fig. 5) the plunger operates limit switch 2 (LS-2), which sets relay 5 (RL-5) to unlatch relay 1 (RL-1). This removes the energizing power to solenoid 2 (SOL-2) and energizes solenoid 1 (SOL-1) through relay 4 (RL-4), causing the plunger to reverse direction:

limit switch 2 (LS-2) operated
 relay 1 (RL-1) released
 relay 5 (RL-5) set
 solenoid 2 (SOL-2) not energized
 solenoid 1 (SOL-1) energized

6. LIMIT SWITCH 2 RELEASED The advancing plunger releases limit switch 2 (LS-2) and relay 5 (RL-5). The plunger continues to advance into the chamber, compacting the product, and providing a surface for the incoming product to fall upon (fig. 6):

limit switch 2 (LS-2) released
 relay 5 (RL-5) released

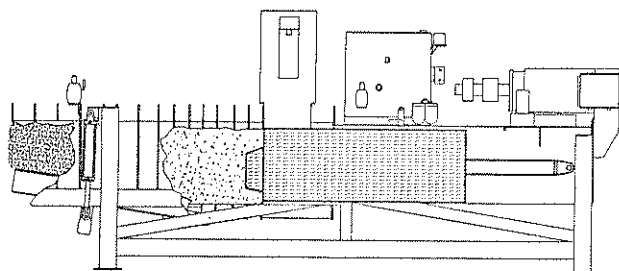


Fig. 6 Advancing plunger

7. PLUNGER STOPS The plunger stops at full extension when it passes beyond and releases limit switch 1 (LS-1), releasing relay 4 (RL-4) and removing the energizing power to solenoid 1 (SOL-1):

limit switch 1 (LS-1) released
 relay 4 (RL-4) released
 solenoid 1 (SOL-1) not energized

Restriction system description

Three operation modes There are three modes for controlling the restriction system:

•**Automatic normal operation** The automatic normal operation mode is controlled by the restriction system unloader valve. The restriction system unloader valve is pilot controlled by the plunger hydraulic pressure at a selected dewatering pressure point.

•**Automatic abnormal high-pressure operation** The automatic abnormal high-pressure operation is controlled by the restriction system anti-plug solenoid valve, which is energized by the restriction system pressure switch. The restriction system pressure switch is pilot controlled by the plunger hydraulic pressure.

•**Manual operation** The manual operation is controlled by the restriction system anti-plug solenoid valve. The restriction system anti-plug solenoid valve is operated with the ANTI-PLUG toggle switch.

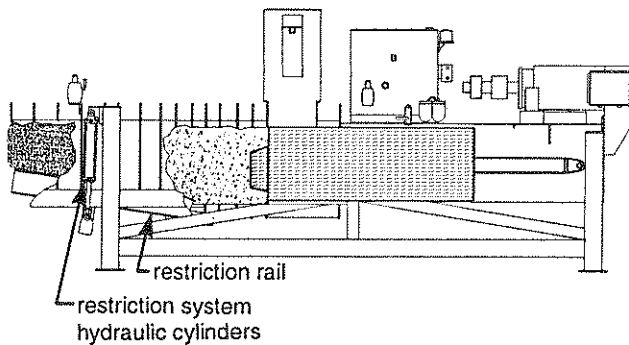


Fig. 7 Restriction rail applies upward force

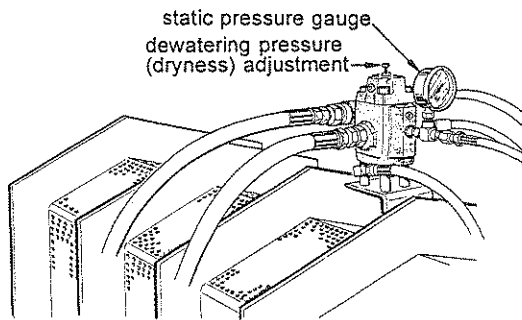


Fig. 8 Restriction system unloader valve and static pressure gauge

Restriction rail The restriction rail (fig. 7), provides a variable restriction (modulation) on the passage of product to the discharge. This restriction regulates the force required from the plunger to push the product toward the discharge. It is the compressing action of the plunger that forces the water from the product. The water is evacuated through the drain holes.

The restriction rail is located at the bottom of the discharge chute. The automatic restriction rail control system controls two hydraulic cylinders that operate the restriction rail. The restriction system unloader valve (fig. 8) controls the force applied by the plunger to the product (dewatering pressure), and is adjusted to obtain the desired water content of the discharged product.

The force requirement depends on the product's characteristics. The "freeness" and frictional characteristics are taken into account when adjusting the restriction system unloader valve setting. See the following RESTRICTION SYSTEM ADJUSTMENTS and PLUNGER SPEED sections.

Restriction system pressure switch Pressure switch PS-1 (see electrical schematic 24778D) is operated (closed) if the hydraulic oil pressure in the plunger system exceeds the pressure switch setting. This energizes solenoids 3 and 4 (SOL-3 and -4), forcing the restriction rail to open. Solenoids 3 and 4 can also be energized by placing the control box ANTI-PLUG control to ON. See the following UNPLUGGING section.

Mechanical installation

Anchor the base The water extractor location should allow efficient joining to the feed chute, and provide personal safety. Provide adequate space for servicing. Locate the discharge so the *product discharge falls free, with no backup of product.*

The water extractor should be located within a catchment to provide for water retention and effluent spray drainage. Use eight $\frac{3}{4}$ inch bolts through the foot pads to anchor the water extractor to a foundation of concrete or steel. Use shims to provide a level surface. See the general arrangement drawing 21857F.

Electrical connection

Power unit connection The 40 horsepower motor operates at 230 or 460 volts. At 230 volts, the motor is rated at 94 amperes at full load and requires 1 gauge copper wire for short wire runs. At 460 volts, the rating is 47 amperes at full load, requiring 6 gauge copper wire for short wire runs. Supply wires should be correctly sized to prevent the motor from stalling during machine operation and momentary overloads. See wiring installation drawing 25178D and wiring diagram 24770E.

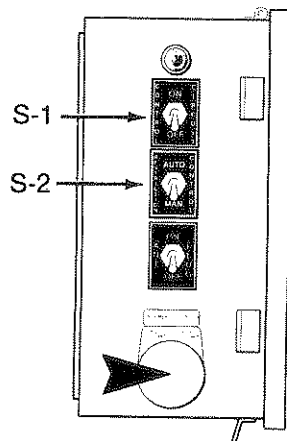


Fig. 9 Emergency motor stop

Motor power must be supplied through an external motor branch circuit disconnect and magnetic starter, incorporating a motor overload disconnect device. The motor branch circuit disconnect should have excess current prevention devices meeting the National Electric Code Table 430-152. Overload disconnects should be set to the motor's full load current rating.

Emergency motor stop and low oil shutdown The emergency motor stop switch and low oil shutdown float switch are connected to control box terminals 15 and 16. Connect the motor power to terminals 15 and 16 to place the switches in series with the motor control circuit.

⚠ Caution The emergency motor stop switch and low oil shutdown float switch connections must be made for operation of these safety devices.

Hydraulic system

Check oil level Remove the temporary oil reservoir shipping plug and replace with the included breather cap. Check the oil reservoir level, it should be within 3 inches of the tank top.

Low oil shutdown A float switch (connected to control box terminals 15 and 16) in the hydraulic tank shuts down operation if the oil level falls sufficiently to open the switch. See the preceding ELECTRICAL CONNECTION section.

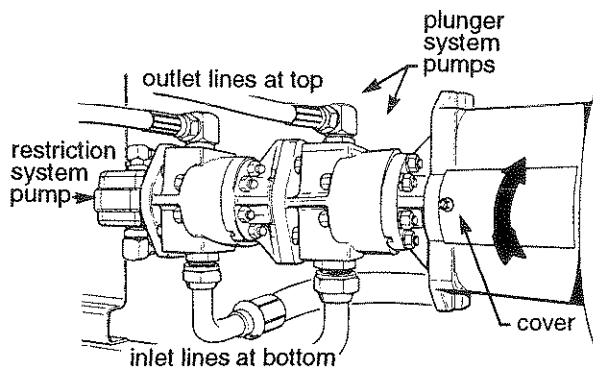


Fig. 10 Motor, two plunger system pumps, and restriction system pump

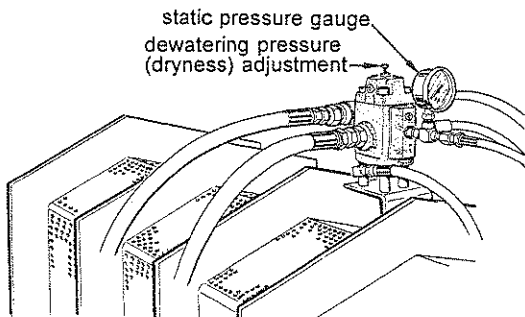


Fig. 11 Restriction system static pressure gauge

Filters and lubricants The dual filters should be changed along with the hydraulic oil. Reservoir capacity is 90 gallons. Oil change intervals vary according to actual operating conditions. Under normal conditions the oil should be changed after 12 months of operation. Remove the plug from the drain and connect to a container before opening the valve.

Use one of the following oil types:

- Antiwear hydraulic oil, 150-215 SSU at 100°F
- Automatic transmission oil
- 10-40 SAE engine oil

Check motor rotation Move the CONTROL CIRCUIT switch to OFF, RESTRICTION CONTROL switch to AUTO, and ANTI-PLUG switch to OFF (fig. 12, "automatic" setting). Remove the motor-pump coupler cover at the right side for viewing. Jog the motor to check for correct rotation. Note the motor shaft direction of rotation (facing the shaft end). Correct rotation is counterclockwise (fig. 10). Replace the cover.

Prime pumps The pumps must be primed when the hydraulic system is drained or an inlet line is removed. Slightly loosen the two outlet oil lines at the plunger system pumps (fig. 10). Run the motor (about 30 seconds) until all three hydraulic pumps are primed.

The plunger system pumps are primed when oil begins to flow from both loosened outlet lines. The restriction system pump (fig. 10) is primed (RESTRICTION CONTROL switch to MAN, fig. 12) when a restriction system hydraulic cylinder shaft begins to move, or there is a reading of pressure on the restriction system static pressure gauge (fig. 11). Be sure to tighten the lines.

⚠ Caution Do not let the motor run continuously before the pumps are primed.

Automatic and manual operation

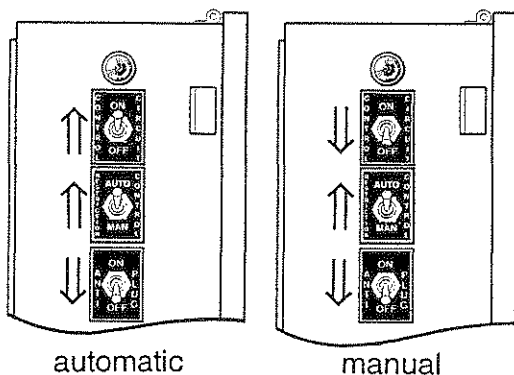


Fig. 12 Control box switch settings

Automatic operation Place the control box CONTROL CIRCUIT switch to ON and the RESTRICTION CONTROL switch to AUTO (fig. 12).

Note Keep the ANTI-PLUG switch in the OFF position unless unplugging the chamber. See the following UNPLUGGING section.

Manual operation Turn the control box CONTROL CIRCUIT switch to OFF, and keep the RESTRICTION CONTROL switch at AUTO (fig. 12).

To manually extend the plunger, press the control valve solenoid B button (fig. 13, right-hand solenoid on the control valve). To retract the plunger, press the solenoid button A (left side).

Level detector throughput adjustment

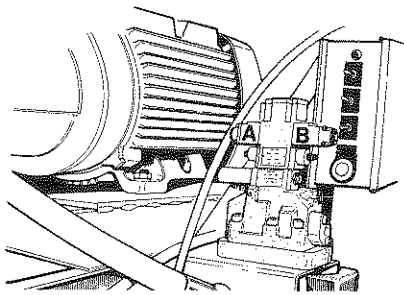


Fig. 13 Plunger direction control valve ("B" extends plunger)

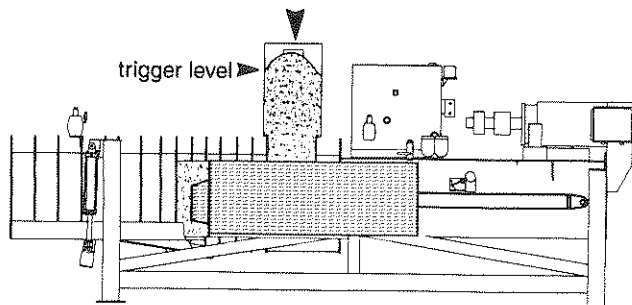


Fig. 14 Level detector triggers plunger retraction

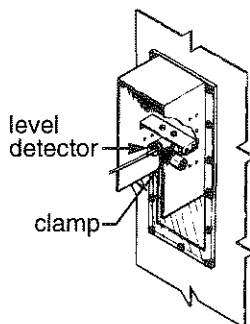


Fig. 15 Level detector

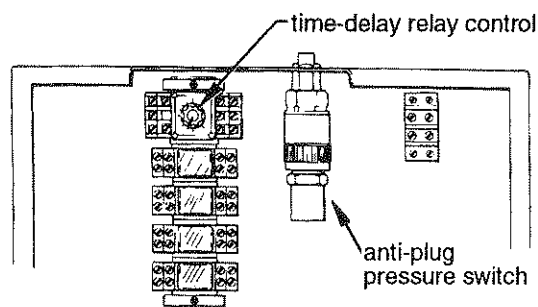


Fig. 16 Control box time-delay relay

Operation The capacitive type level detector, acting with a time-delay circuit, provides for correct feed volume and operational timing of the Freeman Water Extractor hydraulic system. The time-delay circuit allows the detector to trigger on the growing "product pile," rather than on product falling through the chute.

The level detector triggers the plunger to retract from its extended position when the top of the product pile is detected (fig. 14). (The product pile has been building on the plunger top surface.) The retracting plunger allows the product pile to fall into the chamber. The plunger then advances to compress this product pile, while a new product pile builds on the plunger top surface.

Detector conductivity check Place the control box RESTRICTION CONTROL switch to AUTO and the CONTROL CIRCUIT switch to ON (fig. 12, "automatic" setting). Turn on power to the water extractor.

Withdraw the level detector from the detector clamp opening (fig. 15). Check for operation (detector signal light on) by touching a finger to the front of the detector.

Replace the detector in the plastic detector clamp. Push the detector face against the window and turn the level detector to place the connection cable at the bottom. Tighten the two detector clamp screws.

Detector sensitivity adjustment The level detector sensitivity adjustment is first made without product in the chute, then with wet product. The final sensitivity adjustment is placed between the two without-product and with-product adjustments.

1. **PRESET TIME-DELAY RELAY TO "2"** Preset the control box time-delay relay control (fig. 16) to "2" (approximately 3.5 seconds delay). The "2" setting has a good chance of being the final setting.

2. **REMOVE COVER SCREW** The cover screw at the back of the level detector covers the sensitivity adjustment (fig. 17). Remove the cover screw and O-ring. The O-ring provides a seal against dirt and moisture.

Note The level detector sensitivity adjustment screw has no stop. The resistance change of this potentiometer occurs over approximately 16 turns.

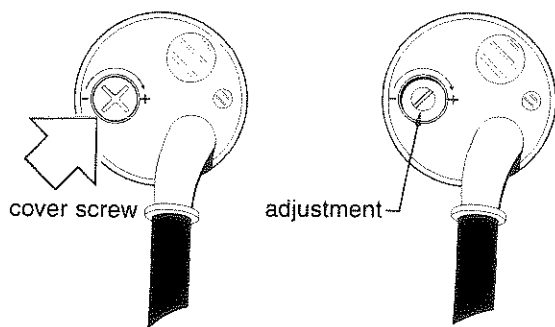


Fig. 17 Sensitivity adjustment

3. CLOCKWISE TO ON (EMPTY FEED CHUTE) Check that the feed chute is empty and the plexiglass window is clean.

Rotating the sensitivity adjustment (fig. 17) clockwise increases the detecting distance. Turn the exposed sensitivity adjustment clockwise (+ direction arrow on the detector) until the detector switch is turned on (detector light on). Note the position of the screwdriver slot.

4. ADD PRODUCT, COUNTERCLOCKWISE TO OFF Drop wet product into the chute until the material is in contact with the plexiglass to a level 2 or 3 inches above the detector. The detector light will turn on.

Rotating the sensitivity adjustment counterclockwise decreases the detecting distance. Turn the exposed sensitivity adjustment counterclockwise (- direction arrow on the detector), noting the number of turns, until the detector switch is turned off (detector light off). Note the position of the screwdriver slot. Record the number of turns difference between the on and off positions.

5. ADJUST BETWEEN ON-OFF Note the number of turns of the sensitivity adjustment screw between the preceding steps 3 (on) and 4 (off). Move the adjustment clockwise, halfway between the step 3 (on) and 4 (off) positions.

Note Stable detection will be achieved if the product being sensed provides at least 1.5 turns difference between the steps 3 (on) and 4 (off) positions.

6. REPLACE COVER SCREW Replace the cover screw and O-ring at the back of the level detector. The O-ring provides a seal against dirt and moisture.

Time-delay adjustment The time-delay adjustment and the detector vertical position affect throughput. The time-delay adjustment should be adjusted first, especially if the product is rapidly falling onto the top of the plunger. If the time delay is too short, the level detector will prematurely trigger the plunger retraction before the product pile has reached the detector level. This causes needless plunger cycling and reduced capacity.

Adjust the time-delay relay (fig. 16) for maximum load per plunger cycle. Start with the time-delay relay control at "2" (approximately 3.5 seconds).

If the time delay is too long the plunger will act as a shear when the product pile extends above the chamber. The plunger top cuts through the product that is pushed against the bottom of the main frame chute extension. Shearing causes accelerated wear, and a solid object can cause damage.

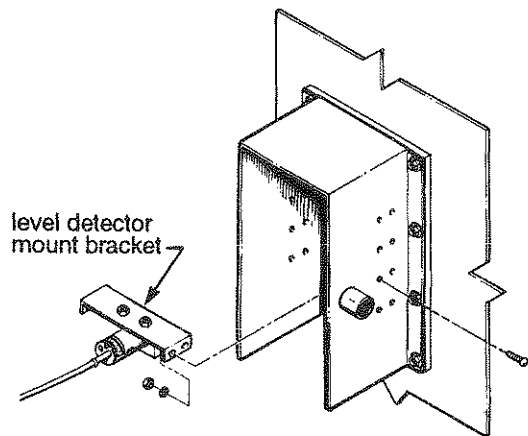


Fig. 18 Detector mountings

Level detector vertical position The level detector mount bracket arrives installed, with the mounting flanges down, to the second from the bottom row of mounting holes (fig. 18). The time-delay circuit and the level detector's vertical position must be adjusted for maximum throughput and no "shearing." Make small changes in the detector's vertical position to change the product pile size (up is more, down is less), providing a correct-size charge for the chamber:

- Mount the level detector mount bracket side flanges up or down.
- Move the detector and its plastic mount to the top or bottom of the level detector mount bracket.
- Mount the level detector mount bracket at any of the four rows of mounting holes.

Restriction system adjustments

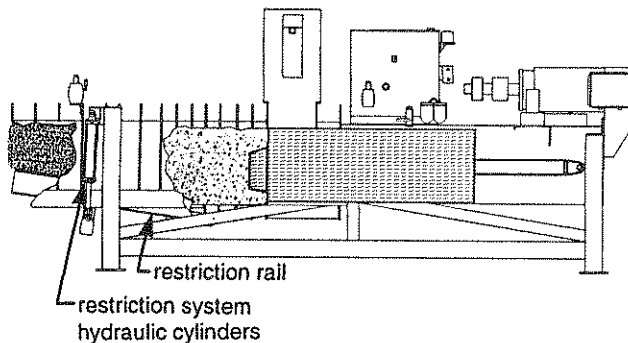


Fig. 19 Restriction rail applies upward force

Restriction control system description The Freeman WE-4 Water Extractor includes a solenoid valve that pressurizes the restriction rail only when the plunger is advancing. The restriction rail (fig. 19), provides a variable restriction on the passage of product to the discharge. This restriction regulates the force required from the plunger to push the product toward the discharge. It is the compressing action of the plunger that forces the water from the product and through the drain holes.

The automatic restriction rail control system controls two hydraulic cylinders that operate the restriction rail.

There are three restriction control system adjustments. The unloader valve (fig. 21) is the primary adjustment. After the restriction system unloader valve is adjusted, the anti-plug pressure switch is then set to be 500 psi above the adjusted unloader valve setting (see the following AUTOMATIC ANTI-PLUG SYSTEM section). The static relief valve is a secondary adjustment for applying plunger force that is appropriate to the product's characteristics (see the following STATIC RELIEF VALVE section).

Note Moving the control box switch from "AUTO" to "MAN" (fig. 20) allows the automatic restriction control system feature to be bypassed so that restriction is applied continuously for setting pressures, testing, and troubleshooting.

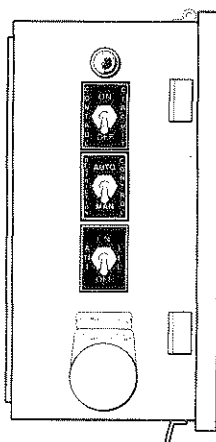


Fig. 20 Control box switches

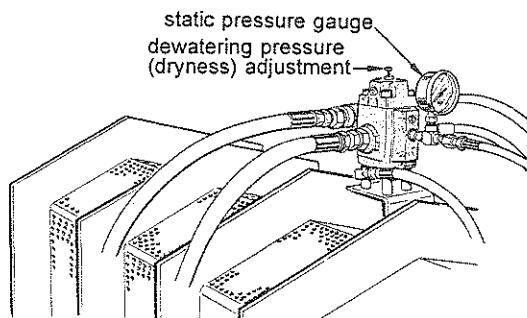


Fig. 21 Restriction system unloader valve and static pressure gauge

Unloader valve is primary dewatering control The restriction system unloader valve is the primary control (fig. 21) for applying plunger force appropriate for product characteristics. The unloader valve is set at the factory to 2,000 psi for water extraction from paper waste. The unloader valve adjustment range is 700 to 2,800 psi. Turning the unloader valve adjustment clockwise increases the plunger pressure on the product, making the processed product drier.

The restriction control unloader valve is opened for hydraulic fluid flow (unloaded) when the advancing plunger system reaches an adjusted pressure level, usually about 2,000 psi. This adjusted pressure level is known as the "dewatering pressure." (The pilot pressure from the plunger system operates the spool in the restriction unloader valve.)

Turning the unloader valve adjustment clockwise increases the pilot pressure requirement for unloading and increases plunger pressure on the product, making the processed product drier. Unloading relieves the static pressure that holds the restriction rail closed.

The time required for the rail to open is variable, depending on the speed of the plunger and the density of the product. In normal operation, variable unloading (modulation) occurs throughout the time (2 seconds minimum, depending on the plunger speed setting) the plunger is completing the final 17 inches of the compaction stroke.

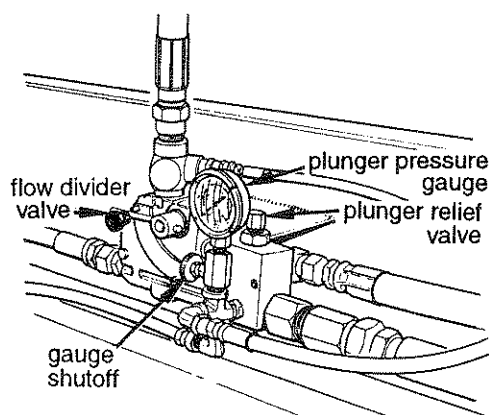


Fig. 22 Plunger system relief valve and gauge

Dewatering pressure adjustment The restriction system unloader valve setting, or dewatering pressure, is read on the plunger pressure gauge (fig. 22). Read the pressure while the plunger is advancing, at the instant that unloading occurs. The instant of unloading is signalled by a sudden drop in the pressure reading on the restriction system static pressure gauge (fig. 21). Several plunger strokes are required to "catch" the reading on the plunger pressure gauge at the instant the reading drops on the restriction system static pressure gauge.

After making an adjustment to the restriction system unloader valve (fig. 21), allow the plunger to go through at least 10 plunger strokes before judging the product's water content. Unloader valve adjustments are usually done on a trial and error basis due to differences in material being processed.

Note An unloader valve adjustment of 200 psi or more can require an anti-plug pressure switch adjustment.

The anti-plug pressure switch (PS-1) is set to be 500 psi above the dewatering pressure (the plunger pressure at which the restriction system unloader valve unloads). If the anti-plug pressure switch is set too low, the switch will operate before the unloader valve, causing poor restriction system regulation. See the following AUTOMATIC ANTI-PLUG SYSTEM section.

Unloader valve adjustment guide Make no more than one full turn change in the unloader valve pressure setting, then wait for a minimum of 10 plunger strokes before beginning to judge the effect of the adjustment.

Note It is normal for the restriction system static pressure to *occasionally* fall to 100 psi or even to 0 psi when the plunger is advancing.

•**No unloading occurs** If the restriction system static pressure does not drop (or increases) during a plunger stroke, then either the static pressure is set too low or the unloader valve is set too high.

•**No unloading, product too dry** If the product is too dry and unloading is *not* occurring, lower the unloader valve pressure setting by adjusting counterclockwise in increments of one full turn. Turning the unloader valve adjustment counterclockwise lowers the plunger pressure, increasing the processed product wetness. Wait for a minimum of 10 plunger strokes before beginning to judge the effect of the adjustment.

•**Unloading to 0 psi, product too wet** Increase the unloader valve pressure setting (dewatering pressure) to increase dryness. (See the following STATIC RELIEF VALVE section if the product is too dry and unloading is occurring.)

Automatic anti-plug system

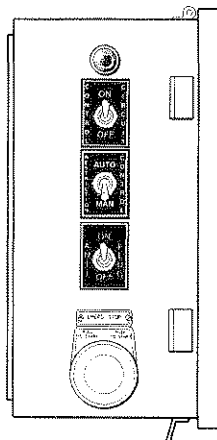


Fig. 23 ANTI-PLUG switch to ON

Operation The plunger system anti-plug pressure switch is closed if the plunger system pressure rises to the anti-plug pressure switch setting (500 psi above dewatering pressure). The closed switch sends line voltage to operate the restriction system anti-plug control valve (drawing 24610E). The operated restriction system anti-plug control valve then causes the closed restriction rail to move to the open position.

The solenoid operated restriction system anti-plug control valve can also be manually operated by moving the ANTI-PLUG switch to ON (fig. 23). The restriction rail moves from fully closed to open in about 9 seconds (see the following UNPLUGGING section).

Note An unloader valve adjustment of 200 psi or more can require an adjustment to the anti-plug pressure switch. The anti-plug pressure switch should be set to be about 500 psi above the unloader valve setting.

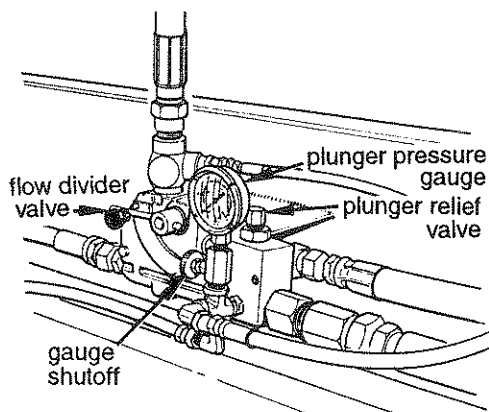


Fig. 24 Plunger system relief valve and gauge

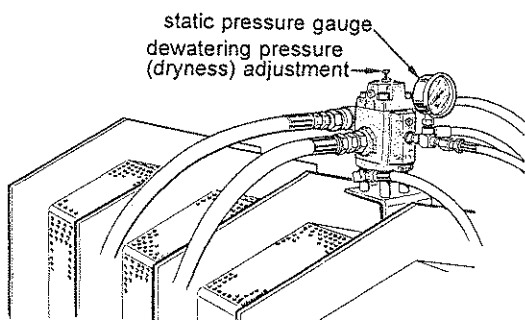


Fig. 25 Restriction system unloader valve and static pressure gauge

Adjustments to the unloader valve for a specific product's characteristics causes a change in the dewatering pressure. (The dewatering pressure is set at the factory to 2,000 psi for water extraction from paper waste.) A dewatering pressure adjustment of 200 psi or more can require an anti-plug pressure switch adjustment in order to maintain the recommended 500 psi differential.

If the pressure difference between the anti-plug pressure switch setting and the dewatering pressure (the unloader valve unloading pressure point) is set too low, the anti-plug switch will operate before the restriction system unloader valve, causing the anti-plug pressure switch to operate on each plunger cycle instead of operating with the restriction system unloader valve. In this situation the restriction rails will not be modulated as they would be when activated by the restriction system unloader valve, resulting in poor restriction system regulation and less than ideal results.

Anti-plug pressure switch adjustment The anti-plug pressure switch (PS-1) is set to operate 500 psi above the restriction system unloader valve setting (dewatering pressure).

1. RECORD DEWATERING PRESSURE The anti-plug pressure switch (PS-1) will be set to be 500 psi above the restriction system unloader valve setting (dewatering pressure).

The restriction system unloader valve setting, or dewatering pressure, is read on the plunger pressure gauge (fig. 24). Read the pressure while the plunger is advancing, at the instant that unloading occurs. The instant of unloading is signalled by a sudden drop in the pressure reading on the restriction system static pressure gauge (fig. 25). Several plunger strokes are required to "catch" the reading on the plunger pressure gauge at the instant the reading drops on the restriction system static pressure gauge.

⚠ Warning Pressure greater than 3,500 psi creates a hazard to personnel and can damage the hydraulic system.



Warning *Avoid high-pressure fluids.* Escaping fluid under pressure can penetrate the skin, causing serious injury. Keep hands and body away from pinholes and nozzles which eject fluids under high pressure. Use a piece of cardboard to search for leaks. If any fluid is injected into the skin, it must be surgically removed within a few hours by a doctor familiar with this type injury or gangrene can result.

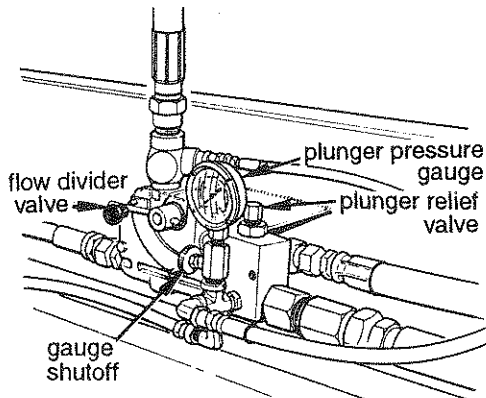


Fig. 26 Plunger system relief valve and gauge

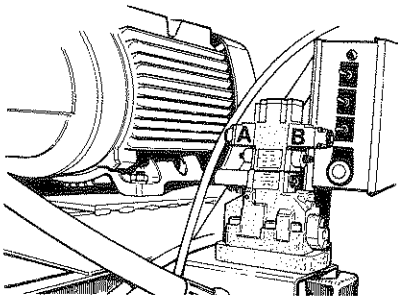


Fig. 27 Plunger direction control valve

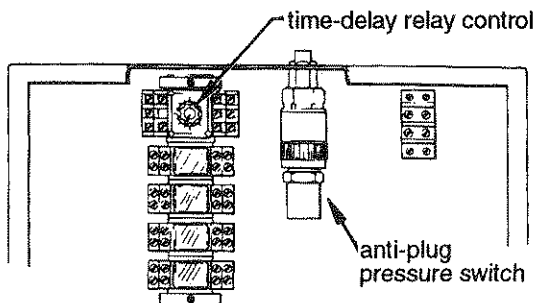


Fig. 28 Anti-plug pressure switch (PS-1) and time-delay relay (RL-2)

2. ESTABLISH REFERENCE PRESSURE The plunger relief valve is temporarily set to be 500 psi above the dewatering pressure to act as a reference for setting the anti-plug pressure switch.

The system pressure (plunger relief valve adjustment) will be returned to 3,500 psi after the anti-plug pressure switch is set to be 500 psi above the step 1 restriction system unloader valve pressure reading (dewatering pressure).

Remove the plunger system relief valve protective cap (fig. 26). Insert a $\frac{5}{32}$ inch hex wrench into the adjustment screw.

Ensure the control box CONTROL CIRCUIT switch is set to OFF. Press solenoid B button (fig. 27, right-hand solenoid) on the plunger direction control valve. The plunger will fully extend and then stall, and the plunger system pressure gauge (fig. 35) shows the system pressure. Note the system pressure (system pressure should be 3,500 psi).

Warning Pressure greater than 3,500 psi creates a hazard to personnel.

Caution An adjustment of the plunger system relief valve to over 3,500 psi will cause pump damage.

Note Depressing the solenoid button for more than 10 seconds can activate the motor overload device.

While pressing the solenoid B button, turn the hex wrench in the plunger system relief valve (fig. 26) counterclockwise (lowers pressure) until the plunger system pressure gauge shows 500 psi above the step 1 restriction system unloader valve pressure reading (dewatering pressure). Release the solenoid B button.

Note If a control valve solenoid button will not release, press the opposite-side button.

3. CONNECT VOLTMETER Open the control box and connect a voltmeter (120 V ac) to the two power connections (terminal 2 white wire and terminal 4 orange wire) that are connected to the restriction system anti-plug solenoid valve. See wiring diagram 24934E.

4. ADJUST ANTI-PLUG SWITCH Find the anti-plug pressure switch inside the control box (fig. 28). Use a $1\frac{1}{4}$ inch wrench to hold the anti-plug pressure switch from turning when making adjustments to the knurled part of the switch. The knurled part of the switch is turned clockwise (looking from below the switch) to increase the switch pressure setting.

Press solenoid B button (right-hand solenoid) on the plunger direction control valve (fig. 27). The plunger will fully extend and then stall, and the plunger system pressure gauge will show the reference pressure set in step 2.

While pressing the solenoid B button, observe the voltmeter. If the voltmeter indicates line voltage (120 V ac), turn the knurled part of the anti-plug switch clockwise until the voltmeter reads zero. Then slowly decrease (counter-clockwise adjustment) the pressure setting until the voltmeter again reads line voltage. Release the solenoid B button.

The anti-plug pressure switch is now set to operate at 500 psi above the dewatering pressure. The operation of the anti-plug pressure switch sends power to the restriction system anti-plug control valve, causing the restriction rail to open.

5. READJUST SYSTEM RELIEF VALVE TO 3,500 PSI

Depress the control valve solenoid B button (right). Turn the hex wrench at the plunger system relief valve (fig. 26) clockwise (increases pressure) until the plunger system pressure gauge shows 3,500 psi. Release the solenoid B button.

Warning Pressure greater than 3,500 psi creates a hazard to personnel.

Note An adjustment of the plunger system relief valve to over 3,500 psi will cause pump damage.

Remove the hex wrench from the plunger system relief valve pressure adjustment and replace the protective cap.

Static relief valve

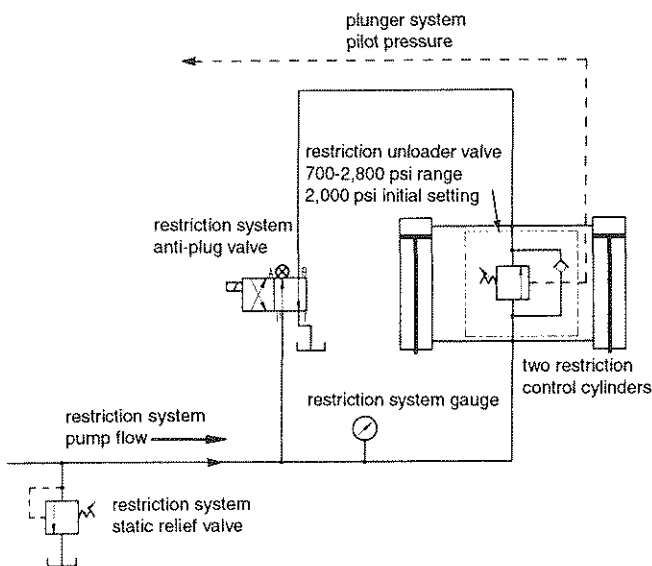


Fig. 29 Restriction system static relief gauge and valve (dwg 24610E excerpt)

Static relief valve is secondary processing adjustment

The restriction system static relief valve (drawing 24610E) pressure adjustment is a secondary adjustment for applying plunger force that is appropriate to the product's characteristics. A high-friction product typically requires a lower restriction system static relief valve pressure setting, and a low-friction product requires a higher pressure setting. See the following STATIC RELIEF VALVE ADJUSTMENT GUIDE.

Static relief valve adjustment Check for unloading before making an adjustment. A drop in the restriction system static pressure is *a/ways* indicated on the restriction system static pressure gauge (fig. 29) when unloading occurs. Unloading causes the restriction control system static pressure to fall, which relieves the restriction rail force on the material in the chamber. See the preceding RESTRICTION SYSTEM ADJUSTMENTS section for details of the unloading function.

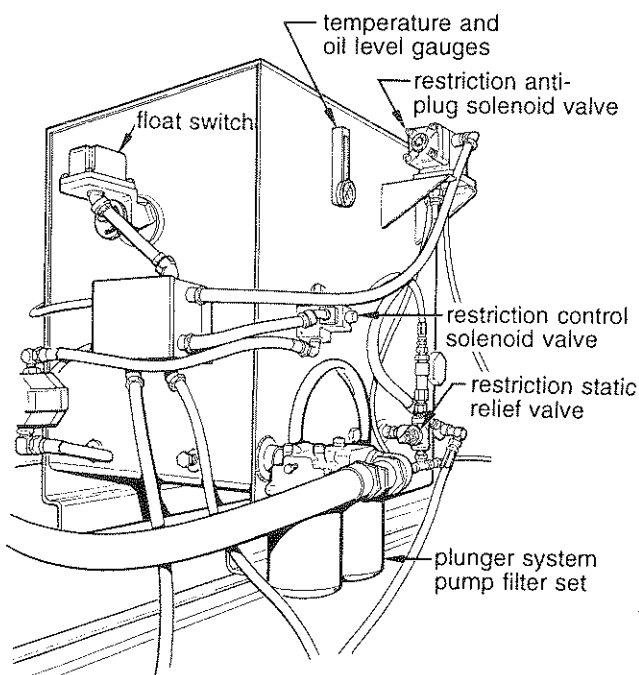


Fig. 30 Restriction system static relief valve

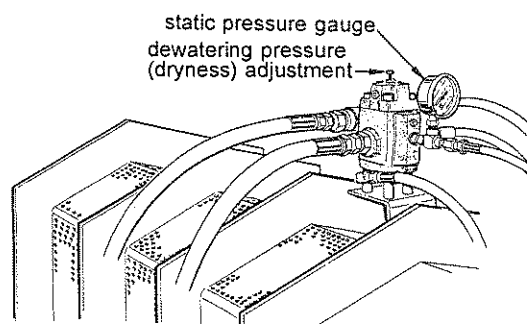


Fig. 31 Restriction system unloader valve and static pressure gauge

The restriction system static relief valve pressure should be adjusted to the lowest possible setting (as low as 400 psi) in accord with the product's characteristics. The static relief valve is set at the factory to 600 psi.

Remove the protective cap on the restriction system static relief valve and loosen the adjustment locknut (fig. 30).

Wait for the restriction cylinders to become fully retracted (up) before adjusting the static relief valve.

Use a screwdriver to adjust the static relief valve while viewing the static pressure gauge (fig. 31). Turning the static relief valve adjustment clockwise raises the static pressure. Turning the adjustment counterclockwise lowers the static pressure.

After making an adjustment, allow the plunger to go through at least ten strokes before judging the product's water content. Tighten the adjustment locknut when finished.

Static relief valve adjustment guide Make no more than a 100 psi change in the static pressure setting, then wait for a minimum of 10 plunger strokes before beginning to judge the effect of the adjustment.

Note It is normal for the restriction system static pressure to occasionally fall to 100 psi or even to 0 psi when the plunger is advancing.

•**Product too dry, static pressure falls to 0 psi on every plunger advance** Make no more than a 100 psi reduction in the static pressure setting, then wait for a minimum of 10 plunger strokes before beginning to judge the effect of the adjustment.

•**Product too wet, restriction system not unloading** Increase the static relief valve pressure setting by adjusting clockwise in increments of 100 psi (viewed on the restriction system static pressure gauge, fig. 31). Turning the static relief valve adjustment clockwise increases the force available for the restriction control unloader valve to use in controlling plunger pressure and product dryness.

•**Dry crust forms on product surface, preventing water passage through drain holes** With these conditions the product's inner wet material is pushed from the chamber with each plunger stroke, leaving an almost motionless crust barrier.

The dry crust formation can be eliminated by increasing the restriction system static relief valve setting to 1,500-2,000 psi. This higher static pressure setting crushes the crust, allowing passage of water through the drain holes.

Note There is an increased possibility of plugging if the static relief valve is left at the 1,500-2,000 psi setting and there is a change away from the "dry crust" product.

Plunger speed

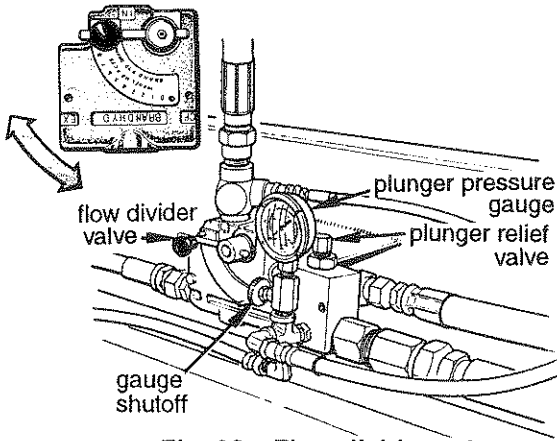


Fig. 32 Flow divider valve

Plunger speed adjustment A lower plunger speed, along with a restriction system adjustment, can be used for an unusually "fragile" product (high water content, short fibers, etc.). An adjustment to the flow divider valve (fig. 32) lowers the plunger speed in the low-speed mode (when plunger pressure is above 1,000 psi). In the high speed mode the plunger speed control has no effect. (The usual setting for the flow divider valve is for full plunger speed—set at the "10" position.)

The automatic restriction rail control system unloader valve is the primary adjustment for plunger force that fits the product's characteristics. See the preceding RESTRICTION SYSTEM ADJUSTMENTS section.

Note The flow divider valve has no effect on plunger speed while the plunger is moving with the pressure below 1,000 psi (high-speed mode). It is only after the pressure increases to more than 1,000 psi (low-speed mode) that plunger speed can be controlled by the flow divider valve.

Make a plunger speed adjustment if the product is still blowing out of the drain holes after making adjustments to the restriction rail control system unloader valve.

A change to the flow divider valve lowers the plunger speed (when pressure is above 1,000 psi) and should be considered only as a secondary or "last resort" adjustment for a "fragile" product. Lowering the plunger speed will increase processing time, but may be the only way to handle the fragile product.

After making an adjustment, allow the plunger to go through at least ten strokes before judging the product's water content.

Note If the flow divider valve is set too low there can be excessive oil heating. Adjust the flow divider valve to slow the plunger no more than is required.

Unplugging

Chamber plugging A chamber full of compacted material can stall the plunger. The plunger stalls at midstroke while pushing at 3,500 psi (oil pressure) until the motor overload device is tripped, removing power to the motor. Plugging normally occurs because of incorrect adjustment of the restriction rail control system unloader valve or the static relief valve. See the preceding RESTRICTION SYSTEM ADJUSTMENTS and STATIC RELIEF VALVE sections.

Anti-plug system operation The control box anti-plug switch energizes the anti-plug solenoid valve. The restriction system then opens the restriction rail, permitting the plunger to more easily discharge the product.

Unplugging steps There are three ways to unplug the chamber:

- ANTI-PLUG SWITCH** Use the ANTI-PLUG switch to open the restriction rail.
- CONTROL CIRCUIT SWITCH** Use the CONTROL CIRCUIT switch and the plunger direction control valve to cycle the plunger.
- MANUAL REMOVAL** Lock out the power and manually remove the material from the chamber.

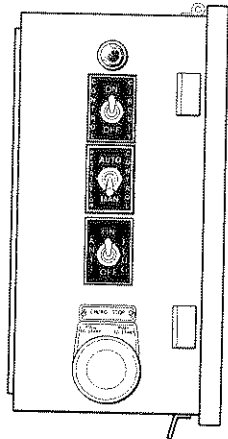


Fig. 33 ANTI-PLUG switch to ON

1. ANTI-PLUG ON Move the CONTROL CIRCUIT and ANTI-PLUG switch to ON (fig. 33). Allow the plunger to attempt to complete its stroke.

Note Proceed to the following steps if step 1 does not unplug the moisture extractor.

2. CONTROL CIRCUIT OFF Move the CONTROL CIRCUIT switch to OFF. (Keep the ANTI-PLUG switch to ON.)

3. RETRACT CYLINDER ≈6 IN Press the solenoid A button on the plunger direction control valve (fig. 34) until the plunger retracts by about 6 inches.

Note Depressing the solenoid button for more than approximately 10 seconds will activate the motor overload device.

4. CONTROL CIRCUIT ON Move the CONTROL CIRCUIT switch to ON. The plunger will extend.

5. REPEAT STEPS 2-4 AS REQUIRED Repeat steps 2 to 4, as required, to loosen the plugging material.

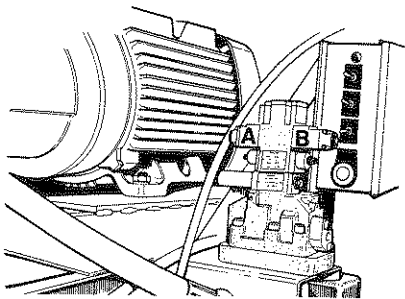



Fig. 34 Plunger direction control valve

6. HAND REMOVAL If repeating steps 2 to 4 does not break loose the plugging material, then the chamber must be manually cleaned. Move the ANTI-PLUG switch to ON to open the restriction rail. Stop the motor. Use high pressure water or hand tools to manually remove the plugging material.

 **Caution** Be sure to lock out power to the water extractor before manually cleaning the chamber.

Troubleshooting

Check unloading first Check for unloading before making an adjustment. A drop in the restriction system static pressure is *always* indicated on the restriction system static pressure gauge when unloading occurs.

Product too wet, unloading occurs If the product is too wet and unloading is occurring, increase the restriction unloader valve pressure setting if the peak plunger system pressure during the compaction stroke is below 2,500 psi.

Product too wet, no unloading, If the product is too wet and unloading is not occurring, increase the static relief valve pressure setting.

Product too dry, unloading occurs Decrease the restriction unloader valve pressure setting.

Product too dry, no unloading If the product is too dry and unloading is not occurring, lower the restriction unloader valve pressure setting.

Static pressure falls to 0 psi on every plunger advance

- Product too wet** Increase unloader valve setting.

- Product too dry** Reduce static restriction pressure.

Dry crust formation Increase restriction system static relief valve setting to 1,500-2,000 psi.

Adjustments don't seem to work Wait for a minimum of 10 plunger strokes before beginning to judge the effect of the adjustment.

Shearing Check the level detector vertical position, sensitivity adjustment, and time delay adjustment if shearing occurs (plunger top cuts through product). Shearing can also be caused by exceeding the water extractor feed rate capacity.

Plugging Plugging can be caused by a too-high adjustment of the restriction system unloader valve.

Plugging The plunger stalls at 3,500 psi and the motor overload device is tripped. This condition is usually caused by a too-high adjustment of the restriction system unloader valve.

Plugging There is an increased possibility of plugging if the restriction static relief valve is left at a 1,500-2,000 psi setting to accommodate a "dry crust" product and there is a change away from the dry crust product.

Plugging Plugging can be caused by a too-high restriction system static relief valve setting. Adjust the restriction static relief valve to the lowest possible setting (as low as 400 psi) in accord with the product's characteristics.

Jerky plunger movement Jerky plunger movement can be caused by air in the oil, defective plunger piston seals, intermittent solenoid valve action, and a defective pump. The jerky movement can also be the result of a "friction-slip-stick" phenomenon that can occur at some plunger advance speeds.

Slow plunger stroke A slow plunger stroke can be caused by an adjustment to the flow divider valve (considered as a secondary or "last resort" adjustment for a "fragile" product).

Slow plunger stroke A slow plunger stroke can be caused by air in the oil, a nonstandard size pump, worn or defective plunger piston seals, or a restriction in the hydraulic system. A restriction in the hydraulic system can be seen as high plunger system oil pressure during plunger movement.

The most likely source of air in the oil is in the line between the reservoir and the pump (fig. 35). A leak in this area is not obvious because no oil leaks out. A restricted filter will intensify this condition.

Shutdown Check the oil level for operation of the low oil level float switch, check for a tripped motor overload device, and check for operation of the emergency stop switch.

Restriction rail opens unexpectedly The restriction rail can open unexpectedly if it is triggered by solenoid 3 (SOL-3) as operated by the anti-plug pressure switch. The anti-plug pressure switch should be adjusted to operate at a pressure setting 500 psi above the dewatering pressure. See the preceding RESTRICTION SYSTEM ADJUSTMENTS section.

Excessive oil heating Flow control valve set too low. Heat exchanger fins covered. Defective hydraulic components.

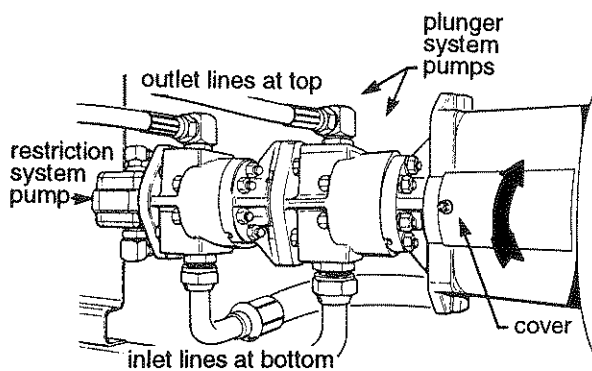


Fig. 35 Motor, two plunger system pumps, and restriction system pump

Initial (factory) settings

High-low system functions

A high-low hydraulic pressure system provides high capacity with low power consumption.

The plunger moves rapidly during plunger retract and the early part of the plunger extend cycle, when the system pressure is under 1,000 psi and both pumps are supplying oil to the plunger hydraulic system.

System pressure exceeds 1,000 psi during the later part of the extend cycle. The high-low unloader valve then directs oil from the second pump directly to the reservoir. The first pump continues to direct oil into the plunger hydraulic system.

The plunger is slowed during the later part of the extend cycle, but provides the force required to press water from the product.

The plunger system high-low valve adjustment controls the pressure point at which the second pump's flow is redirected to the reservoir.

Factory settings The following procedure sets all functions to the initial (factory) settings. These settings are appropriate to the Freeman Water Extractor model WE-4.

Caution The following procedures are to be done in sequence. Damage to the hydraulic system can result from not following the procedures accurately and completely.

Many factory settings are a starting point for adjustments that are required for a specific product. The restriction system static relief valve and unloader valve, and the plunger system speed adjustments are product-specific adjustments.

The automatic restriction rail control system unloader valve is the primary adjustment for the product's characteristics. The pressure requirement depends on the product's characteristics.

The "freeness" and frictional characteristics are taken into account when adjusting the restriction system unloader valve setting. Adjustments for product characteristics generally start with an adjustment to the restriction rail control system unloader valve.

Initial settings:

- Time-delay relay: at "2" (≈3.5 sec)*
- Level detector mount bracket at second from bottom row of mounting holes, with mounting flanges down*
- High-low unloader valve: 1,000 psi
- Plunger system relief valve: 3,500 psi
- Restriction static relief valve: 600 psi*
- Restriction unloader valve: 2,000 psi*
- Anti-plug pressure switch: 2,500 psi*

*Settings will vary according to conditions

Required tools:

- Hex wrench, $\frac{5}{32}$ inch, for adjusting plunger system relief valve
- Voltmeter, for measuring line voltage and restriction system control valve operation
- Pressure gauge, 5,000 psi, with adapter for $\frac{1}{4}$ inch O-ring port

Factory settings and checks

1. **CHECK HYDRAULIC OIL, FILTERS** Check the oil level in the reservoir, it should be within 3 inches of the tank top. Check the filters for tightness (fig. 36).
2. **GAUGE SHUTOFF OPEN** Check that the gauge shutoff is fully open (fig. 37, counterclockwise is open).
3. **FLOW DIVIDER VALVE OPEN** Check that the flow divider valve is fully open (fig. 37, "10" position).
4. **INSTALL GAUGE IN HIGH-LOW UNLOADER VALVE PORT** Stop the motor and remove the 1/4 inch O-ring port plug of the high-low unloader valve (fig. 36). Install a pressure gauge (5,000 psi) into the port opening. The pressure gauge is used in the following step 6 adjustment of the high-low unloader valve.
5. **SET CONTROLS, TURN ON POWER** Set the control box switches:
 - CONTROL CIRCUIT to OFF
 - RESTRICTION CONTROL to MAN (manual)
 - ANTI-PLUG to OFF

Turn on the main power and wait for the restriction cylinders to become fully retracted to the up position before continuing.

6. **REDUCE PLUNGER SYSTEM RELIEF VALVE SETTING** Reduce the plunger system relief valve setting to prevent dangerously high pressure due to a previous misadjustment. Remove the plunger system relief valve protective cap (fig. 37). Insert a 5/32 inch hex wrench into the adjustment screw. Turn the hex wrench counterclockwise several turns to lower the pressure. Leave the hex wrench in the adjustment screw.

Warning Pressure greater than 3,500 psi creates a hazard to personnel and can damage the hydraulic system.

Warning *Avoid high-pressure fluids.* Escaping fluid under pressure can penetrate the skin, causing serious injury. Relieve pressure before unhooking hydraulic or other lines. Tighten all connections before applying pressure. Keep hands and body away from pinholes and nozzles which eject fluids under high pressure. Use a piece of cardboard to search for leaks. If any fluid is injected into the skin, it must be surgically removed within a few hours by a doctor familiar with this type injury or gangrene can result.

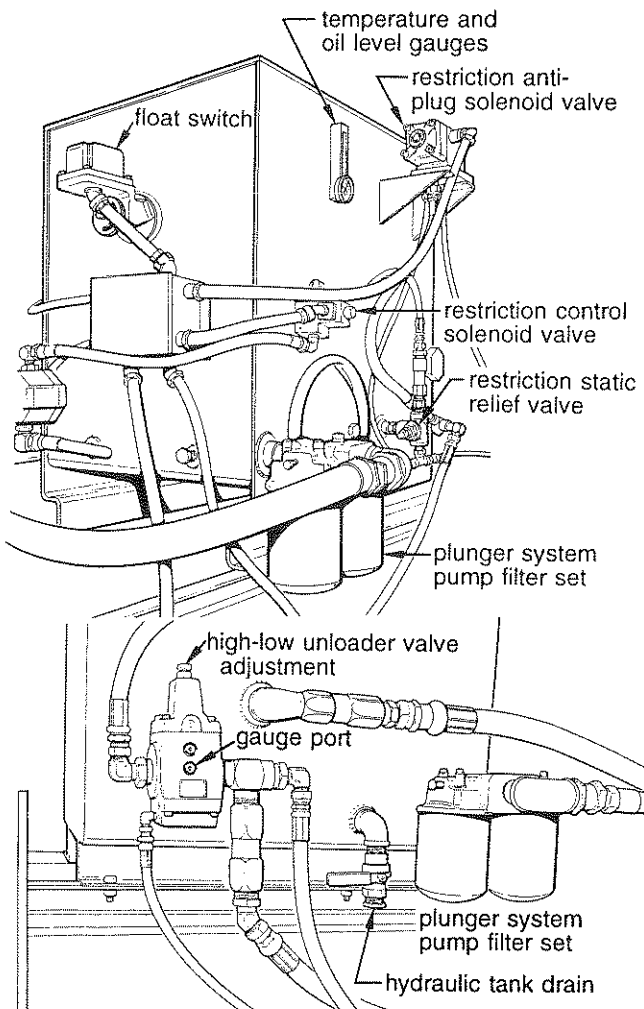
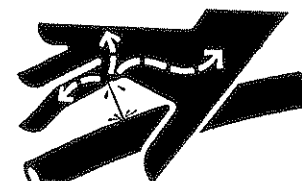


Fig. 36 Two plunger system filter sets

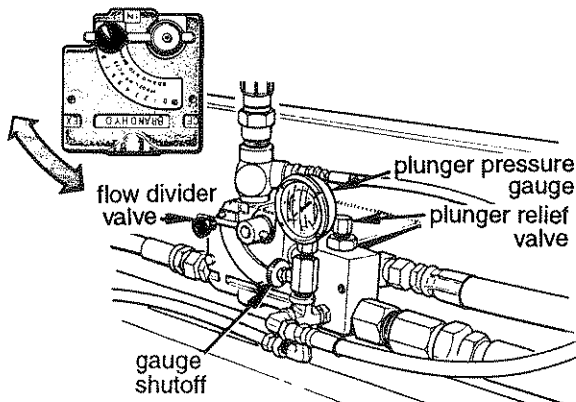


Fig. 37 Flow divider valve, plunger relief valve, pressure gauge, and gauge shutoff

Initial (factory) settings

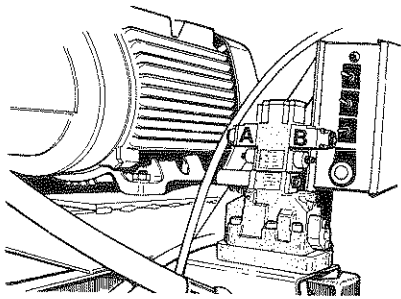


Fig. 38 Plunger direction control valve

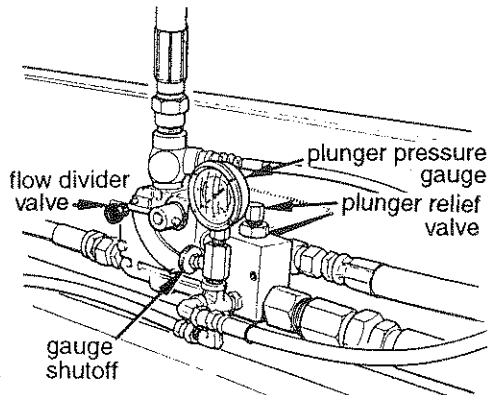


Fig. 39 Plunger system relief valve and pressure gauge

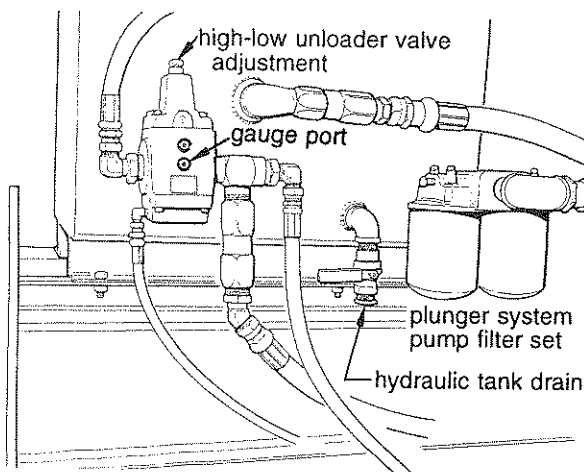


Fig. 40 High-low unloader valve adjustment

7. ESTABLISH 1,000 PSI REFERENCE PRESSURE

The plunger relief valve is temporarily set to 1,000 psi to act as a reference for setting the high-low unloader valve (step 8).

Ensure the control box CONTROL CIRCUIT switch is set to OFF. Press solenoid B button (fig. 38, right-hand solenoid) on the plunger direction control valve. The plunger will fully extend and then stall, and the plunger system pressure gauge (fig. 39) shows the system pressure.

Note Depressing the solenoid button for more than 10 seconds can activate the motor overload device.

While pressing the solenoid B button, turn the hex wrench in the plunger system relief valve (fig. 39) until the plunger system pressure gauge shows 1,000 psi. Turn the hex wrench clockwise to increase pressure, counterclockwise to lower pressure. Release the solenoid B button.

Note If a control valve solenoid button will not release, press the opposite-side button.

8. ADJUST HIGH-LOW UNLOADER VALVE

Two people are required for the high-low unloader valve adjustment. One person adjusts the unloader valve and the other person presses the solenoid B button on the plunger direction control valve.

Press solenoid B button (fig. 38, right-hand solenoid) on the plunger direction control valve. The plunger will fully extend and then stall at the 1,000 psi reference pressure while pressing the solenoid B button. Turn the plunger system high-low unloader valve adjustment (fig. 40) while observing the installed (at step 4) high-low valve gauge.

If the high-low valve adjustment is below 1,000 psi the gauge will read zero. If the adjustment is above 1,000 psi the gauge will read 1,000 psi. Turn the high-low valve adjustment counterclockwise until the gauge reads zero pressure. Now turn the adjustment slowly clockwise until the gauge reads the 1,000 psi reference pressure. Tighten the adjustment locknut.

The gauge can be removed when the settings are complete. A reminder is at step 20.

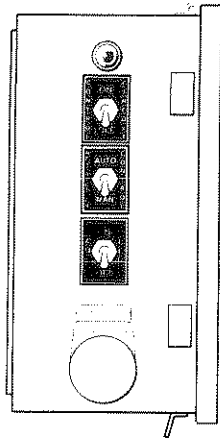


Fig. 41 Control box settings for static relief valve adjustment

9. ADJUST STATIC RELIEF VALVE TO 600 PSI

Check the control box switch settings (fig. 41) and that the restriction cylinders are fully retracted (up) before adjusting the restriction system static relief valve:

- CONTROL CIRCUIT to OFF
- RESTRICTION CONTROL to MAN (manual)
- ANTI-PLUG to OFF

Remove the protective cap on the restriction system static relief valve and loosen the adjustment locknut (fig. 42).

Wait for the restriction cylinders to become fully retracted (up) before adjusting the static relief valve.

Use a screwdriver to adjust the static relief valve to 600 psi while viewing the restriction system static pressure gauge (fig. 43). Turning the static relief valve adjustment clockwise increases the pressure. Tighten the adjustment locknut when finished.

10. ESTABLISH 2,500 PSI REFERENCE PRESSURE

The plunger relief valve is temporarily set to 2,500 psi to act as a reference for setting the anti-plug pressure switch (step 11).

Ensure the control box CONTROL CIRCUIT switch is set to OFF. Press solenoid B button (fig. 44, right-hand solenoid) on the plunger direction control valve. The plunger will fully extend and then stall, and the plunger system pressure gauge (fig. 45) shows the system pressure.

Note Depressing the solenoid button for more than 10 seconds can activate the motor overload device.

While pressing the solenoid B button, turn the hex wrench in the plunger system relief valve (fig. 44) clockwise (raises pressure) until the plunger system pressure gauge shows 2,500 psi. Release the solenoid B button.

Note If a control valve solenoid button will not release, press the opposite-side button.

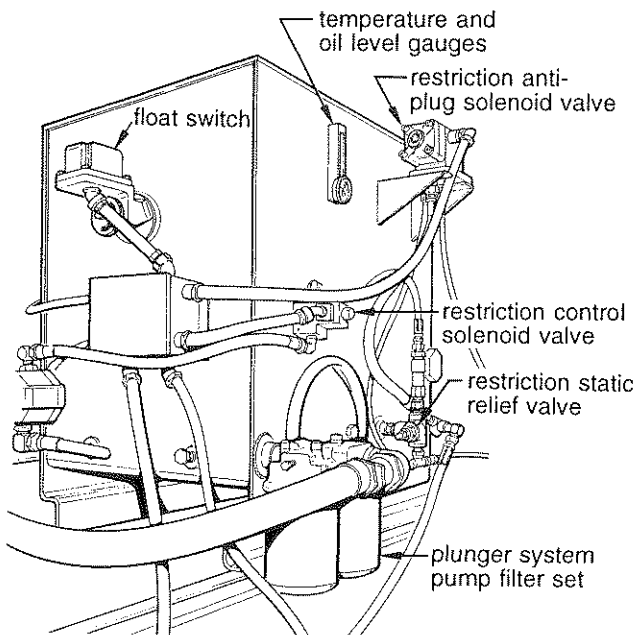


Fig. 42 Restriction system static relief valve

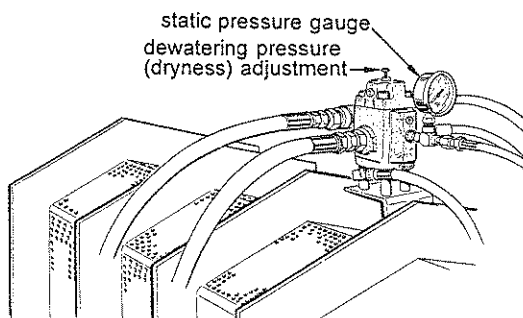


Fig. 43 Restriction system unloader valve and static pressure gauge

Initial (factory) settings

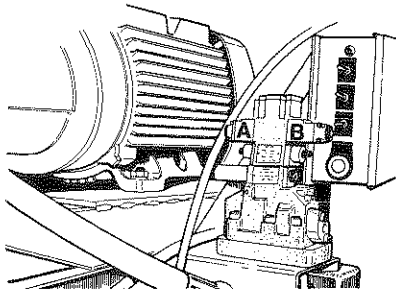


Fig. 44 Plunger direction control valve

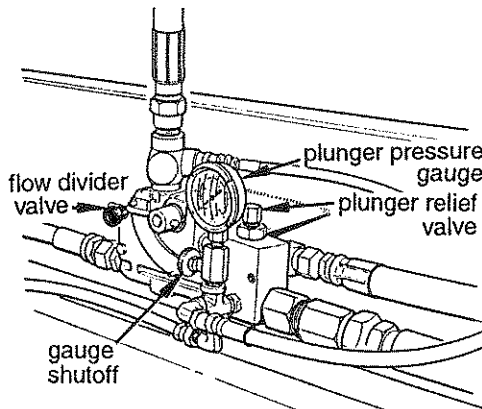


Fig. 45 Plunger system relief valve and pressure gauge

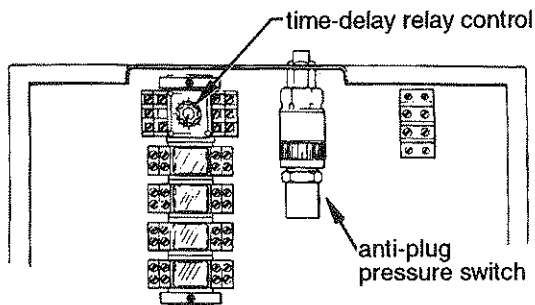


Fig. 46 Anti-plug pressure switch (PS-1) and time-delay relay (RL-2)

11. ADJUST ANTI-PLUG PRESSURE SWITCH TO 2,500 PSI
When pressure in the plunger hydraulic system reaches 2,500 psi (factory setting) the anti-plug pressure switch (PS-1) closes, supplying power to the restriction system anti-plug control valve (SOL-3). This extends the two restriction system hydraulic cylinders, fully opening the restriction rail and reducing the abnormally high restriction on the discharging product.

Note The anti-plug pressure switch (PS-1) is set to be 500 psi above the restriction system unloader valve setting. If the anti-plug pressure switch is set too low, the switch will operate before the unloader valve, causing poor restriction system regulation. The 2,500 psi anti-plug pressure switch setting is set to be 500 psi above the 2,000 psi factory setting of the unloader valve.

Open the control box and connect a voltmeter (120 V ac) to the two power connections (terminal 2 white wire and terminal 4 orange wire) that are connected to the restriction system anti-plug solenoid valve. See wiring diagram 24934E.

Find the anti-plug pressure switch inside the control box (fig. 46). Use a 1 1/4 inch wrench to hold the anti-plug pressure switch from turning when making adjustments to the knurled part of the switch. The knurled part of the switch is turned clockwise (looking from below the switch) to increase the switch pressure setting.

Press solenoid B button (right-hand solenoid) on the plunger direction control valve (fig. 44). The plunger will fully extend and then stall, and the plunger system pressure gauge will show the 2,500 psi system pressure.

While pressing the solenoid B button, observe the voltmeter. If the voltmeter indicates line voltage (120 V ac), turn the knurled part of the anti-plug switch clockwise until the voltmeter reads zero. Then slowly decrease (counterclockwise adjustment) the pressure setting until the voltmeter again reads line voltage. Release the solenoid B button.

The anti-plug pressure switch is now set to operate at 2,500 psi. The operation of the anti-plug pressure switch sends power to the restriction system anti-plug control valve, causing the restriction rail to open.

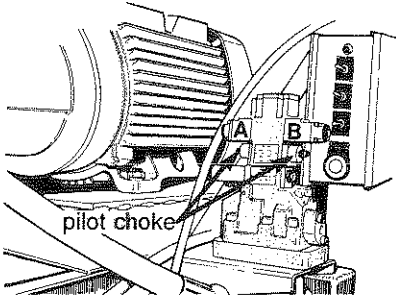


Fig. 47 Pilot choke locations

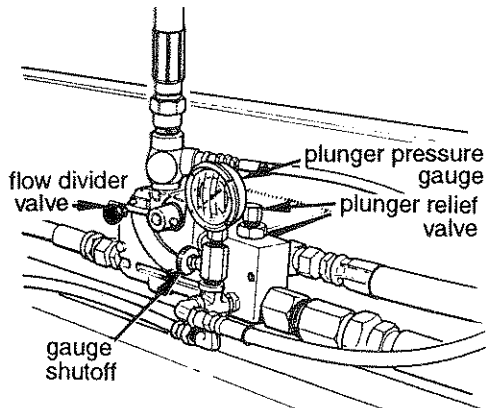


Fig. 48 Plunger system relief valve and pressure gauge

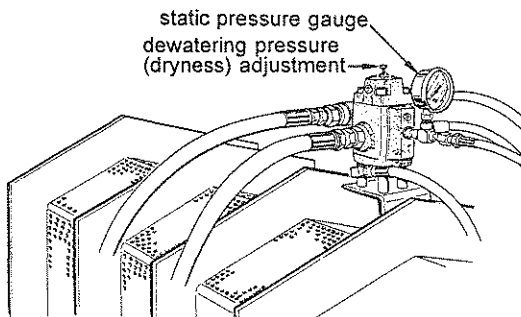


Fig. 49 Restriction system unloader valve and static pressure gauge

12. ESTABLISH 2,000 PSI REFERENCE PRESSURE

The plunger relief valve is temporarily set to 2,000 psi to act as a reference for setting the restriction system unloader valve.

Ensure the control box CONTROL CIRCUIT switch is set to OFF. Press solenoid B button (fig. 47, right-hand solenoid) on the plunger direction control valve. The plunger will fully extend and then stall, and the plunger system pressure gauge (fig. 48) will show system pressure.

While pressing the solenoid B button, turn the hex wrench in the plunger system relief valve (fig. 48) counterclockwise (decreases pressure) until the plunger system pressure gauge shows 2,000 psi. Release the solenoid B button.

13. ADJUST RESTRICTION UNLOADER VALVE TO 2,000 PSI

This procedure adjusts the restriction rail control system unloader valve to 2,000 psi. The 2,000 psi start-up setting is appropriate for water extraction from paper waste (adjustment range is 700 to 2,800 psi). The restriction system unloader valve (controlling the restriction rail) is the primary adjustment for an applied pressure that fits the product's characteristics. This pressure setting is also known as the "dewatering" pressure.

Loosen the locknut on the restriction system unloader valve adjustment capscrew (fig. 49). Turn the adjustment capscrew fully clockwise until it stops (maximum pressure position).

Two people are required for the restriction system unloader valve adjustment. One person adjusts the unloader valve and the other person presses the solenoid B button (right) on the plunger direction control valve (fig. 47). Check the control box switch settings:

- CONTROL CIRCUIT to OFF
- RESTRICTION CONTROL to MAN (manual)
- ANTI-PLUG to OFF

Press the solenoid B button (right). The restriction system static pressure gauge (fig. 49) should now indicate 600 psi (set in step 9). While pressing the solenoid B button, turn the restriction unloader adjustment capscrew counterclockwise until the restriction system static pressure gauge pressure reading just begins to drop (dewatering pressure). Release the solenoid B button and tighten the adjustment screw locknut.

Note Depressing the solenoid button for more than 10 seconds can activate the motor overload device.

14. ADJUST PLUNGER SYSTEM RELIEF VALVE TO 3,500 PSI

Depress the control valve solenoid B button (right). Turn the hex wrench at the plunger system relief valve clockwise (increases pressure) until the plunger system pressure gauge (fig. 48) shows 3,500 psi. Release the solenoid B button.

Initial (factory) settings

Warning Pressure greater than 3,500 psi creates a hazard to personnel.

Caution An adjustment of the plunger system relief valve to over 3,500 psi will cause pump damage.

Remove the hex wrench from the plunger system relief valve pressure adjustment and replace the protective cap.

15. ADJUST PLUNGER LIMIT SWITCHES, PILOT CHOKES
Adjust the pilot chokes for smooth plunger stops and reversals, then adjust the limit switches to automatically (in "AUTO") stop and reverse the plunger 1 inch before the full (manually operated) plunger travel limits.

Remove the left side panel covering the limit switches. Loosen limit switch (LS-1 and LS-2) fasteners. Slide the limit switches toward each other (fig. 50) to prevent the plunger from making forceful contact during pilot choke adjustments.

Move the control box CONTROL CIRCUIT switch to ON and the RESTRICTION CONTROL switch to AUTO. Place an object in contact with the level detector face to cause the plunger to operate continuously. Adjust the two pilot chokes (6 millimeter hex wrench) for smooth plunger stops and reversals.

The pilot chokes are located under the plunger direction control valve (fig. 47). The "A"-side pilot choke adjustment affects the extended plunger reversal or stopping smoothness. The "B"-side pilot choke adjustment affects the retracted plunger reversal smoothness. After making the adjustments, move the CONTROL CIRCUIT switch to OFF.

Manually extend the plunger by pressing the control valve solenoid B button (fig. 47, right). Mark the trailing edge of the manually extended plunger. (Limit switch LS-1 is adjusted to cause the AUTO-controlled plunger to stop or reverse 1 inch away from the manually operated position.)

Manually retract the plunger by pressing the control valve solenoid A button. Mark the trailing edge of the manually retracted plunger. (Limit switch LS-2 is adjusted to cause the AUTO-controlled plunger to reverse direction 1 inch away from the manually operated position.)

Adjust the two limit switches to reverse or stop the AUTO-operated plunger trailing edge 1 inch within the previously marked manually operated plunger face travel limits (fig. 51). Make adjustments with the CONTROL CIRCUIT switch in the OFF position, checking the adjustment with the CONTROL CIRCUIT switch in the AUTO position.

When the adjustments are complete, move the CONTROL CIRCUIT switch to the OFF position, tighten the limit switch fasteners, and replace the left side panel.

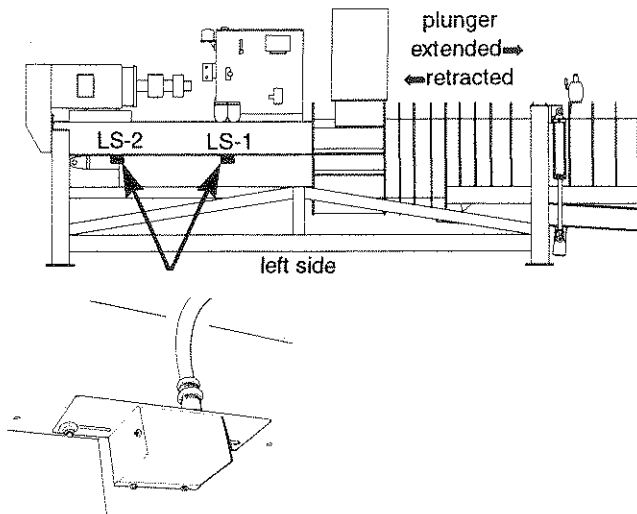


Fig. 50 Limit switch (LS-1 and LS-2) locations

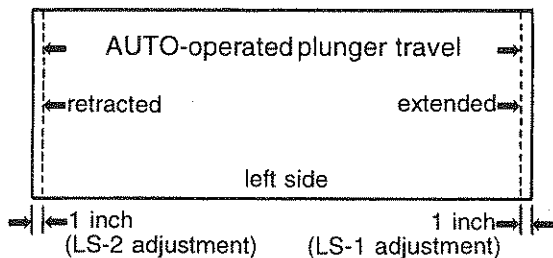


Fig. 51 Adjust for AUTO-operated plunger travel 1 inch within manually operated travel limits

Initial (factory) settings

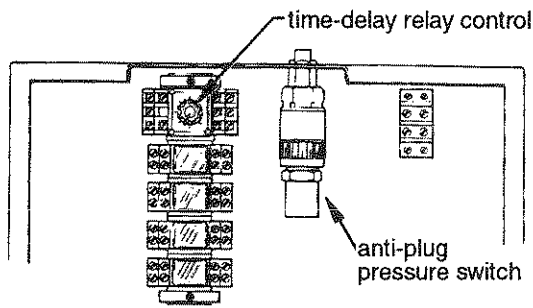


Fig. 52 Preset time-delay control to "2"

16. **PRESET TIME-DELAY RELAY TO "2"** Preset the control box time-delay relay control (fig. 52) to "2" (approximately 3.5 seconds delay). (The "2" setting has a good chance of being the final installation setting.)

17. **LEVEL DETECTOR VERTICAL POSITION** Check that the level detector mount bracket is installed with the mounting flanges down, to the second from the bottom row of mounting holes (fig. 53).

18. **ADJUST LEVEL DETECTOR** The cover screw at the back of the level detector covers the sensitivity adjustment (fig. 54). Remove the cover screw and O-ring. The O-ring provides a seal against dirt and moisture.

Note The level detector sensitivity adjustment screw has no stop. The resistance change of this potentiometer occurs over approximately 16 turns.

Rotating the sensitivity adjustment clockwise increases the detecting distance. Turn the exposed sensitivity adjustment clockwise (+ direction on the detector marking) until the detector switch is turned on (detector light on). Note the position of the screwdriver slot.

Rotating the sensitivity adjustment counterclockwise decreases the detecting distance. Turn the exposed sensitivity adjustment counterclockwise (- direction arrow on the detector marking), noting the number of turns, until the detector switch is turned off (detector light off). Note the position of the screwdriver slot. Record the number of turns difference between the on and off positions.

Note Stable detection will be achieved if the product being sensed provides at least 1.5 turns difference between the detector on and off positions.

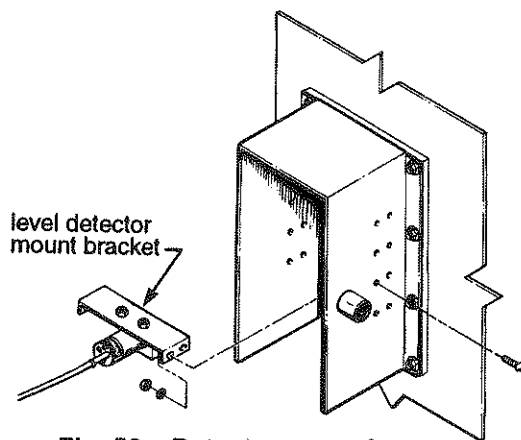


Fig. 53 Detector mountings

19. **REPLACE COVER SCREW** Replace the cover screw and O-ring at the back of the level detector. The O-ring provides a seal against dirt and moisture.

20. **REMOVE HIGH-LOW VALVE GAUGE** Turn off power to the water extractor and remove the pressure gauge installed in the high-low unloader valve port. Replace the 1/4 inch O-ring port plug.

21. **EXAMINE FOR LEAKS, CLEAN UP** Close the control box. Check for leaks and tighten or replace as required.

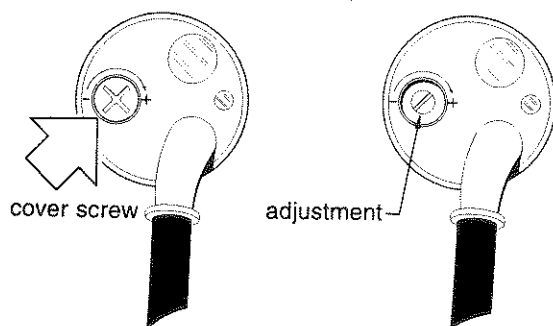


Fig. 54 Sensitivity adjustment

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