Tab 47 replaces page 18 if machine equipped with Optional Stainless Steel Additive System
Tab 48 & 49 replace pages 19 & 20 if machine is equipped with Optional Self-Loading Valve
Tab 50 is Table of Contents for Appendix.
Tab 51 is Optional Emulsion Spray Bar

On Page 25 - use this text for variable displacement emulsion pump:
The emulsion is calibrated to determine the weight of emulsion pumped per revolution of the Aggregate Conveyor Head Shaft. The emulsion pump is a variable displacement pump. It must be set at the intended displacement prior to calibration. To calibrate the emulsion proceed as follows:

Table of Contents

Safety Information

Be alert when seeing this symbol in this manual.

There is the potential for personal injury

Follow recommended precautions and safe operating practices.

Personnel must be fully qualified to perform procedures in this manual.

Follow Safety Instructions

Learn how to operate the machine properly. Do not let anyone operate without instruction.

Keep your machine in proper working condition. Unauthorized modifications to the machine may impair the machine's function and/or safety features and may also affect machine life.

Prevent Bypass Starting

Avoid possible injury or death from engine runaway. Do not start machinery by bypassing normal engine circuitry. Not only is it extremely dangerous, it can also VOID your warranty.

Start engine ONLY from operator's platform.

Prepare for Emergencies

Be prepared if a fire starts.

Keep a first aid kit and fire extinguisher and emergency numbers handy.

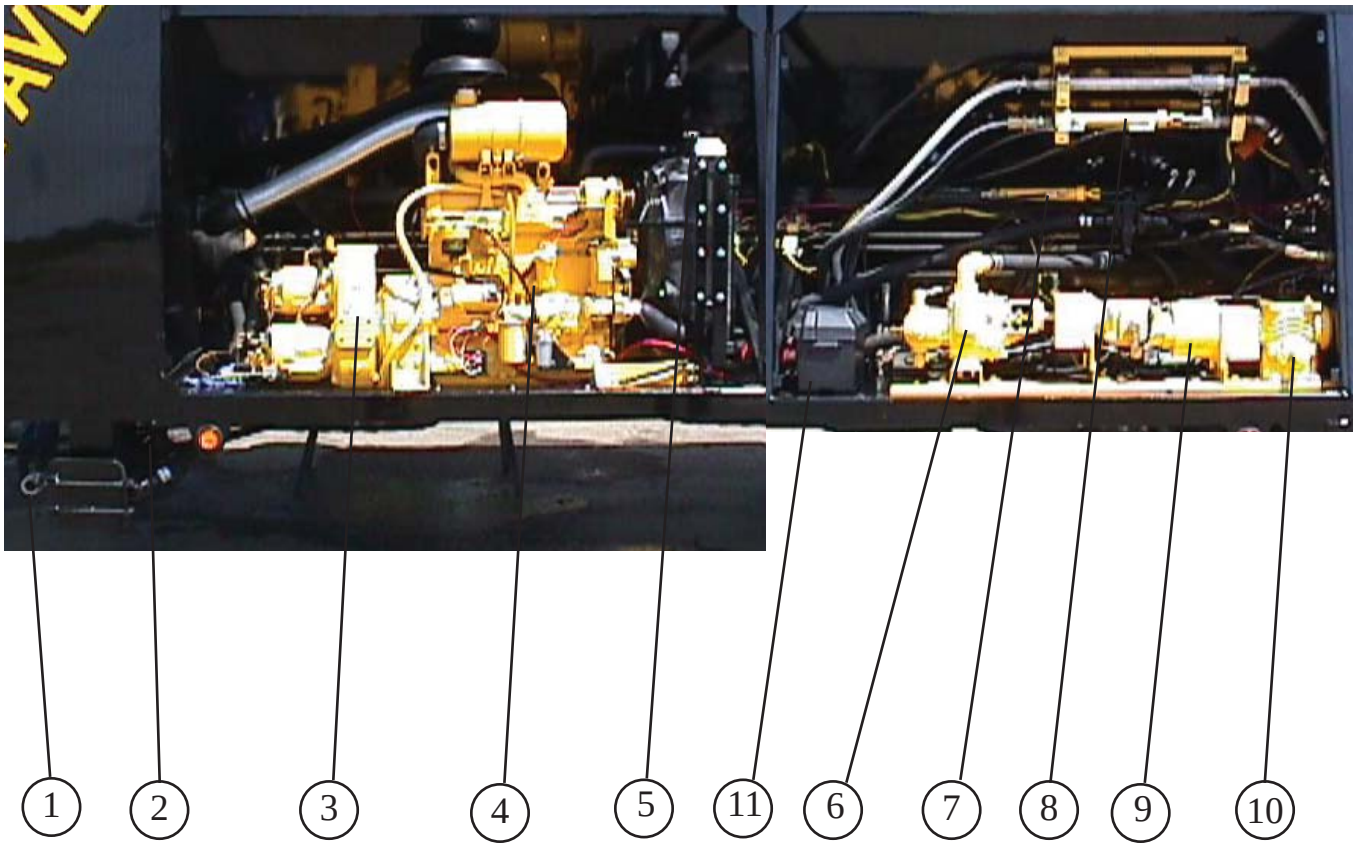
Stay Clear of Rotating Drivelines

Entanglement in rotating driveline can cause serious injury or death.

Keep guards and covers in place at all times when operating machine.

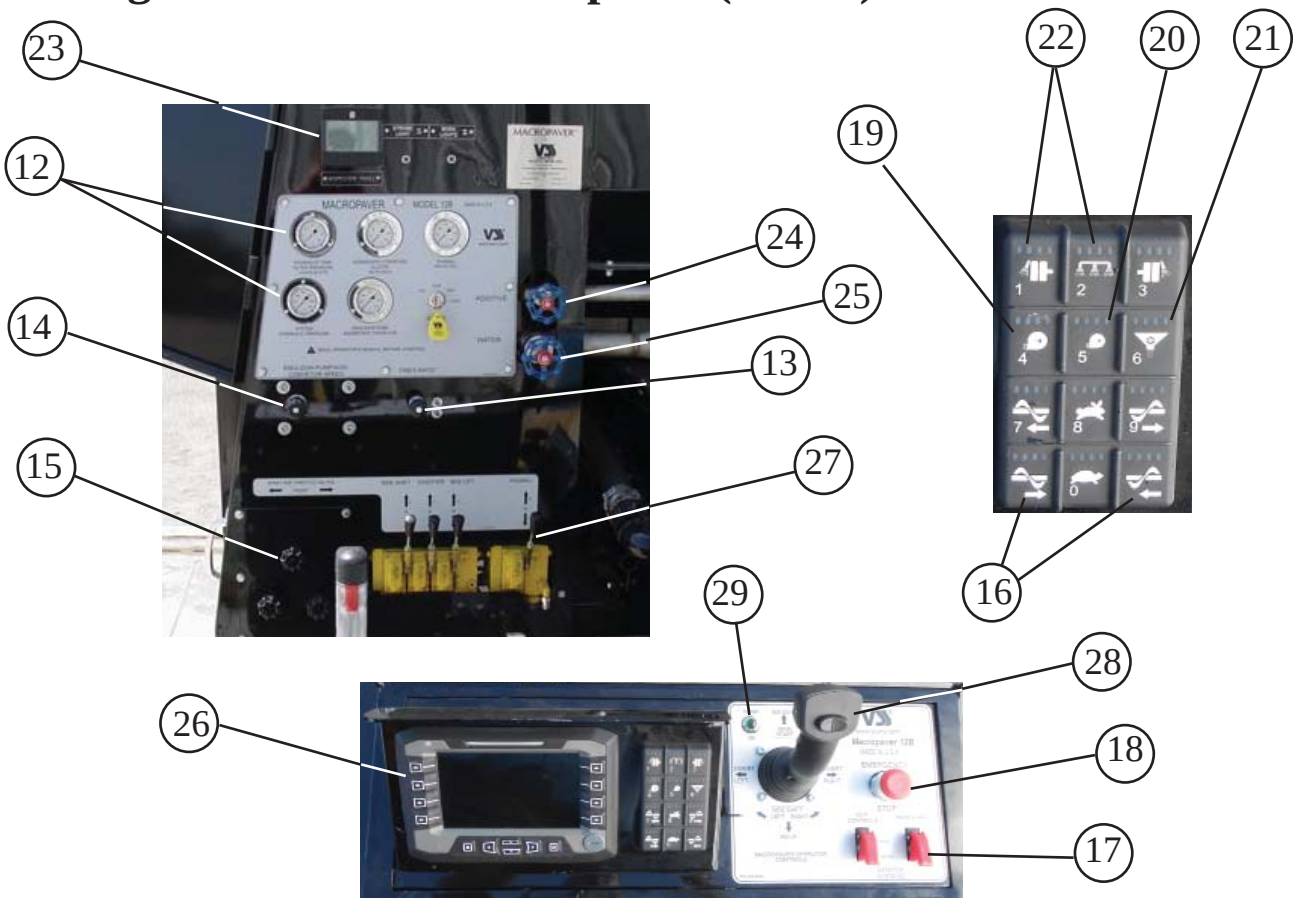
Do not wear loose clothing. Stop engine and be sure drivelines are stopped before making adjustments or performing any type of service on equipment.

Getting To Know The Macropaver



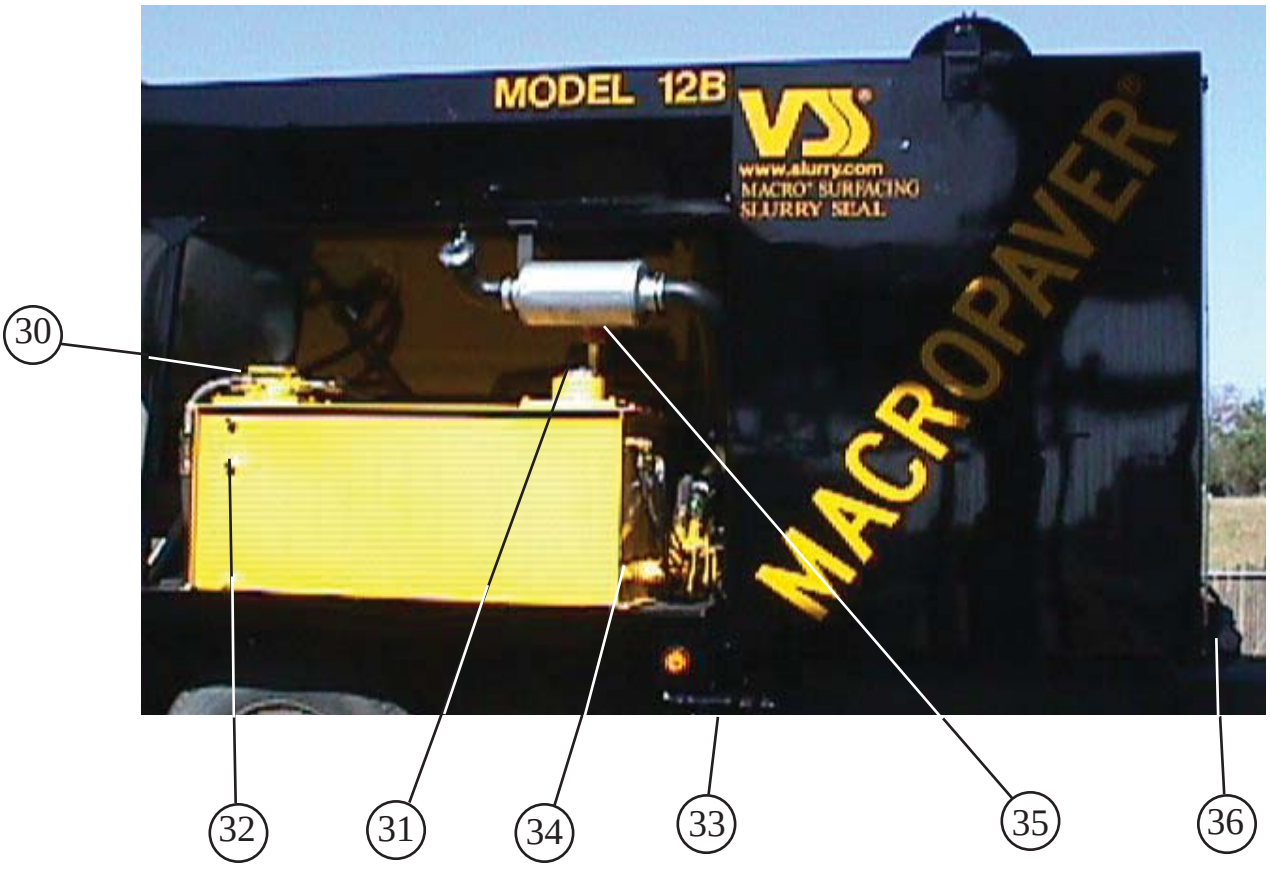
1. Emulsion Tank Fill Port and Valve
2. Emulsion Strainer Valve
3. Gearbox Oil Level
4. Engine Oil Level
5. Radiator Fill Cap
6. Emulsion Pump
7. Emulsion Sequence Cylinder
8. Water/Additive Sequence Cylinder
9. Conveyor Clutch
10. Conveyor Drive Gearbox
11. 12 Volt Engine Battery

Getting To Know The Macropaver (cont'd)



12. Hydraulic System Gauges
13. Fines Feeder Speed Control
14. Emul. Pump/Conveyor Speed Control
15. Spray Bar Control Valves
16. Auger Control Switch Buttons
17. Manual Override Switches
18. Emergency Stop Switch
19. Water Pump Switch Button
20. Additive Pump Switch Button
21. Fines Enable Switch Button
22. Spray Bar Control Switch Buttons
23. Inspector Panel (Optional)
24. Additive Flow Control Valve
25. Water Flow Control Valve
26. EZ-OP Control Panel
27. Pugmill Control Valve
28. Joystick Control Handle
    Trigger - Main Start On/Off
    Side to Side - Material Diverter Left or Right
    Forward and Back - Box Lift Up and Down
    Thumb Switch - Side Shift Left or Right
29. 'Power On' Indicator Light - Indicates 12V

Getting To Know The Macropaver (cont'd)



30. Hydraulic Filter Assembly

31. Hydraulic Reservoir Fill Cap

31. Hydraulic Reservoir Level Indicators

33. Water Pump

34. Hydraulic Oil Temperature Gauge

35. Hydraulic Reservoir Breather

36. Water Fill Port

Getting To Know The Macropaver (cont'd)

Definitions

1. Slurry Seal - Slurry seal is a mixture of crushed aggregate, asphalt emulsion, water and other special purpose additives such as mineral fillers and/or liquid quick set control additives. Slurry seals are for repair of worn pavements caused by time, weather and traffic. Slurry seals extend the life of the pavement by sealing the surface and providing a new wearing surface.

2. Microsurfacing - Microsurfacing is a specialized form of slurry surfacing. It is also a mixture of crushed aggregate, asphalt emulsion, water and additives. But, the asphalt emulsion is polymer modified and the additives are specialized for fast setting and break control. The spreader box is also specialized in that it always uses augers for material distribution and it provides more control over depth, flatness and texture of the material.

3. Aggregate - Aggregate is hard, crushed stone; such as granite, slag, limestone or other high quality rock. It must be free of expansive clays and be uniformly graded. The size of the aggregate ranges in particle sizes from the thickness of the finished overlay (usually 1/4" or 6 mm) down to approximately #200 seive size.

4. Asphalt Emulsion - An asphalt emulsion is tiny globules of asphalt suspended in water by the use of a soap solution. Asphalt emulsions are liquid at normal ambient temperatures. They can be pumped by normal means. Once the emulsion is mixed with the aggregate and laid onto the pavement as slurry seal, the mixture will break in around 5 - 10 minutes and cure in about 3 - 4 hours, depending on conditions.

5. Fines - Fines are a dry additive or mineral filler used to adjust the workability of the slurry and/or modify the setting and curing characteristics. The most common mineral filler is Portland cement and the most common dry additive is aluminum sulfate crystals.

6. Liquid Additives - Liquid additives are also used to adjust the workability of the slurry and/or modify the setting and curing characteristics. The most common liquid additve is liquid aluminum sulfate.

7. Main Start - For proper mixing of the slurry seal, all of the above components must come to together at the same time, even though the slurry seal machine stores them separately and uses different means to move them from storage to mixing. This is where main start comes in - it is a means of starting and controlling the timing of the movement of all of the materials so they properly come together.

Getting To Know The Macropaver (cont'd)

Definitions (cont'd)

8. Pugmill - The pugmill is where the materials come together. It is a mixing chamber, using paddles mounted on two hydraulically driven shafts. As the pugmill is mixing, it is also moving the material from the inlet end to the outlet end and then depositing it into the spreader box.

9. Spreader Box - The spreader box controls the actual laying of the slurry seal or microsurfacing onto the pavement. The spreader box defines the width of the pass by striking off the outside edges and the thickness of the pass by striking off the depth of the slurry. It controls texture of the surface of the slurry by use of a drag flap or texture flap. For wide passes or for thicker or faster setting mixes, the spreader box uses hydraulically powered augers to help spread the slurry mixture from the middle to the outer ends of the spreader box.

Getting To Know The Macropaver (cont'd)

Materials Systems Descriptions

Aggregate

The aggregate for laying slurry is stored in the main hopper. It is brought out of the hopper by the aggregate conveyor, into the inlet hopper and then into the pugmill. There is a vibrator in the main hopper, mounted on a hanging beam, that prevents bridging of the aggrgate in the hopper. The conveyor and vibrator are hydraulically driven and are started when Main Start is engaged, the conveyor by the conveyor clutch and the vibrator by the vibrator on/off valve. The amount of output per revoluton of the conveyor is controlled by the adjustable aggregate gate at the back of the main hopper and the speed of the revolutions of the conveyor is controlled by the emulsion pump/aggregate conveyor speed control valve.

Emulsion

Emulsion for laying slurry is stored in the emulsion tank, which is located on the left front of the machine. It is brought out of the tank by the emulsion pump, into the inlet hopper and then into the pugmill. The emulsion pump on/off and speed is controlled by the emulsion pump/aggregate conveyor speed control valve. When the emulsion pump is operating it is normally recirculating the emulsion back to the emulsion tank through the three-way emulsion sequence valve. When Main Start is engaged, the sequence valve is shifted so that the emulsion stops flowing back to the tank and then flows to the inlet hopper.

Emulsion Pump, Clutch, Conveyor Gearbox

This assembly ties the emulsion pump and the conveyor mechanically together so that the speed of each is in a constant ratio to each other. This is necessary for proper slurry seal operation as the ratio of emulsion to aggregate is the most important factor in obtaining a good slurry seal application. A single hydraulic motor drives both systems. As described above, the emulsion pump is always rotating and when main start is engaged the conveyor clutch engages and the conveyor starts rotating. Adjusting the emulsion pump/aggregate conveyor speed control valve varies the speed of both systems simultaneously as required.

Water

Water for laying slurry, for the spray bars and spray hose(s) and for the pressure washer is stored in the water tank, which is located on the right front of the machine. It is brought out of the tank by the hydraulically driven water pump. Water for laying slurry flows to the water/additive sequence valve, into the inlet hopper and then into the pugmill. The sequence valve is shifted to the open position when Main Start is engaged. The flow of water for the slurry mixture is controlled by the water flow control valve and the amount is monitored by the water flow meter. Water for the spray bars, spray hoses and pressure washer is available whenever the water pump is operating.

Getting To Know The Macropaver (cont'd)

Fines

Fines storage is in the fines feeder hopper. It is brought out of the fines hopper by a hydraulically driven auger built into the feeder, then into the inlet hopper and into the pugmill. The auger is started when Main Start is engaged, providing the fines feeder on/off switch is turned on. The rate at which the fines feeder delivers fines to the inlet hopper is controlled by the fines feeder speed control valve.

Liquid Additive

Liquid additive is stored in the additive tank and is brought out of the tank by the additive pump. It flows to the water/additive sequence valve, into the additive wye where it mixes with the water and then it flows into the inlet hopper and pugmill. The sequence valve is shifted to the open position when Main Start is engaged. The additive pump is a hydraulically driven pump and is controlled by the additive pump on/off switch. The amount of flow of additive is controlled by the additive flow control valve, and is monitored by the additive flow meter.

NOTE: The Macropaver aggregate, emulsion, water, fines and liquid additive hoppers and tanks are for storage use only within jobsite work areas. These hoppers and tanks are not intended for transport purposes due to chassis weight limitations and possible local truck transportion regulations.

EZ-OP Monitoring System

The monitoring system provides information regarding the amounts of material used, the rate at which it is being applied and provides shut-downs when the material in the machine is used up. Monitoring systems can vary from machine to machine depending on customer requirements, but most have water and additive flow meters, aggregate and fines counters, a fines-to-aggregate ratio meter, an emulsion pump speed meter and a shutdown system. The aggregate and fines totalizers use an electronic sensor to count the total revolutions of the aggrgate conveyor head pulley or the fines feeder auger. Once the machine has been calibrated (see "Calibrating the Macropaver" section of this manual), the EZ-OP system can then calculate the total volume of material that has been used by the machine. The fines to aggregate ratio meter is utilized to be able to set the speed of the fines feeder to achieve the correct percentage of fines for the slurry seal mixture. The emulsion pump speed meter provides information as to the rate at which material is being applied. The usual shutdown system provided is for low aggregate, but a low emulsion shutdown system can also be supplied. Refer to the separate "Monitoring System" instruction manual for full details for the system supplied with this machine.

Getting To Know The Macropaver (cont'd)

Machine Systems Descriptions

Engine and Hydraulics

All power for operating the Macropaver is provided by the John Deere diesel engine. This engine powers hydraulic pumps which in turn provide flow and pressure for the various hydraulic systems. Fuel for the diesel engine is provided from the same fuel tank that supplies the truck engine.

The hydraulic system utilizes three hydraulic pumps. These pumps are variable displacement piston pumps. They are pressure compensated pumps, which means that the maximum pressure the pumps can achieve is determined by a control valve built into the pumps. When the maximum pressure is reached, the pump will reduce its flow output to zero. The pumps are also load sense pumps, which means that the pumps sense the hydraulic pressure required to operate the system. This also means that the pumps can be put into a low pressure, or stand-by, mode by making this load sense circuit read '0' pressure. All three pumps are driven by the pump drive gearbox attached to the back of the engine.

The lower in-board pump, or main start pump, supplies oil flow to all of the hydraulic circuits, except for the pugmill, emulsion pump and water pump. It has a maximum oil flow capacity of 40 GPM (151 LPM) @ 2200 RPM. The system pressure is set at 1750 psi (121 Bar) and the stand-by pressure is set at 150 - 250 psi (10 - 17 bar). This system is monitored by the pressure gauge labeled "SYSTEM HYDRAULIC PRESSURE" on the dash panel of the machine. To aid in engine starting, a starting/unloading valve is used to put the pump in a low pressure condition. This valve is electrically operated and is supplied with power from the EZ-OP computer either by the automatic engine speed ramp up or by the "PUMP LOAD" button. This valve allows the pump to come up to full system pressure only when the pump load function is in the on position. When the valve is off it blocks the flow of oil to the load sense compensator. Blocking this oil then doesn't allow the pump to build any pressure, putting it in stand-by mode. (NOTE: This valve is a normally on valve, so when the pump load is in the 'on' mode, power is actually off to the valve and the valve is then in the 'on' mode. This makes the system more reliable as an electrical failure will not cause a hydraulic system shutdown.)

The lower out-board pump supplies oil flow to the emulsion pump / water pump circuit. It has a maximum oil flow capacity of 40 GPM (151 LPM) @ 2200 RPM. The system pressure is set at 1950 psi (134 bar) and the stand-by pressure is set at 250 - 300 psi (17 - 21 bar). This system is monitored by the pressure gauge labeled "EMULSION PUMP / AGGREGATE CONVEYOR" pressure gauge on the dash panel of the machine. The load sense circuit on this pump senses the pressure required to run the emulsion pump/ aggregate conveyor and water pump through a line from the emulsion/water pump block. There is a shuttle valve in this valve block which allows the pump to sense whichever pressure is higher. When the "EMULSION PUMP/AGG. CONVEYOR SPEED" control is turned off and the "WATER PUMP" switch is turned off, the flow of oil to the load sense compensator is blocked, putting the pump in stand-by mode. This circuit has a starting/unloading valve similar to the above circuit, except it is controlled automatically by

Getting To Know The Macropaver (cont'd)

Engine and Hydraulics (cont'd)

the ignition switch. This valve is also a normally on valve, so when the ignition switch is in the 'start' mode, the valve is powered to the 'off' position, thereby unloading the pump while the engine is cranking. Also, the load sense circuit contains a bleed valve that is used to "fine tune" the sensing circuit. It bleeds a small amount of oil out of the circuit back to tank to stabilize the sensing function of the pump.

The upper pump supplies oil flow to the pugmill circuit. It has a maximum oil flow capacity of 25 GPM (95 LPM) @ 2200 RPM. The system pressure is set at 2500 psi (172 bar) and the stand-by pressure is set at 150 - 250 psi (10 - 17 bar). This system is monitored by the pressure gauge labeled "PUGMILL" pressure on the dash panel of the machine. The load sense circuit on this pump senses the pressure required to run the pugmill through a line from the pugmill control valve. When the pugmill valve is in the off position, the flow of oil to the load sense compensator is blocked, putting the pump in stand-by mode.

When starting and stopping the engine on the Macropaver, it is preferred that all of the pumps be in stand-by mode. Do this by turning off the "EMULSION PUMP/AGG. CONVEYOR SPEED" control knob, the "WATER PUMP" switch button and the pugmill. The pump load function is automatically turned off by the EZ-OP computer whenever the engine is turned off.

The oil for the hydraulic system is stored in the 130 gal. (490 liter) hydraulic reservoir located on the opposite side of the Macropaver from the engine. Each pump draws its oil from the reservoir through separate suction hoses, each equipped with a suction strainer located inside the reservoir. Oil returned to the reservoir is filtered by a tank mounted 7 micron filter assembly. Filter condition is monitored by the pressure gauge labeled "HYDRAULIC TANK FILTER PRESSURE". The oil flow from the emulsion pump/aggregate conveyor motor is routed through an air-to-oil cooler mounted in front of the engine radiator.

Main Hydraulic Circuit

Oil from the main pump flows from the pump outlet to a tee at the main start block, located behind the dash panel. Approximately 10 - 12 GPM (38 - 45 LPM) of oil can go into this valve assembly and the rest of the oil will flow out the side of the tee to the box control valve (located behind the dash), the auger valves (located at the operator's console) and, if equipped, the optional high pressure washer and/or pugmill gate. As the pump is variable displacement, only the oil flow required by the various circuits in use is put out by the pump.

Main Start Valve Assembly:

- Additive Pump Valves - These valves include a fixed flow control, set at 2 GPM (8 LPM), and an electrically operated on/off valve. The on/off valve is turned on by the "ADDITIVE PUMP" switch button on the keypad.

Getting To Know The Macropaver (cont'd)

Main Hydraulic Circuit (cont'd)

- Fines Valves - These valves include an electrically operated on/off valve mounted in the Main Start Valve Assembly. This electrically controlled valve comes on when Main Start is engaged, if the "FINES" switch button on the keypad is on. From the on/off valve the oil flows to a separate "FINES RATIO" valve, located on the dash panel. This is an adjustable flow control valve, that directs the required flow of oil to the fines feeder motor. The "FINES RATIO" control is turned clockwise to decrease the speed (reduce the ratio) of the fines feeder motor and counter-clockwise to increase the speed (increase the ratio).

- Vibrator Valves - These valves include a fixed flow control, set at 2 GPM (8 LPM); a pressure reducing valve, set at 350 psi (24 bar); and an electrically operated on/off valve. The on/off valve is turned on when Main Start is engaged (see below).

- Main Start Cylinder Sequence and Conveyor Clutch Valves - These are on/off valves electrically operated valves. Two supply oil to the two hydraulic cylinders that actuate the emulsion and water/additive valves and one supplies oil to the hydraulic clutch to engage the aggregate conveyor. When these valves are turned on by engaging the Main Start trigger, oil is directed to the cylinders to open these valves. At the same time, oil is directed to the conveyor clutch which engages and starts the conveyor. This oil flows through a pressure reducing valve where the pres sure is reduced to 265 psi (18 bar). This pressure is monitored by the pressure gauge labeled "AGGREGATE CONVEYOR CLUTCH PRESSURE" on the dash panel of the machine. The Main Start output is also connected to the vibrator on/off valve and the fines feeder function. The Main Start output will simultaneously start or stop all of these functions when it is turned on or off. All of these main start functions are controlled by the EZ-OP control computer.

- NOTE: Main Start operation is interlocked to Pugmill. Pugmill must be 'ON' for main start to function during normal operation. During calibration of emulsion and fines, this interlock is disabled.

- NOTE: The Additive, Fines, Vibrator and all three Main Start On/Off valves have an override feature that will allow the valves to work in case of electrical failure. See "Manual Override" section for more details.

Sequence Adjustment and Sequence Override:

The sequence at which the emulsion valve actuating cylinder, the water/additive valve actuating cylinder and the conveyor clutch operate is controlled by the EZ-OP computer - see "Adjustment of Automatic Sequencing" section for adjustment instructions. The EZ-OP panel can also be used to override or manually operate either the emulsion, water/additve or conveyor clutch functions for calibration procedures or when off loading individual materials. See "Manual Override" section.

Getting To Know The Macropaver (cont'd)

Main Hydraulic Circuit (cont'd)

Box Control Valves:

The box control valves are located at the base of the dash panel and are controlled by the joystick control handle on the operator's console. The box control valves are electrically operated proportional directional control valves and they control the pugmill diverter and the spreader box side shift and lift. In case of an electrical problem, they can also be operated manually by using the control levers furnished with the valves. But, first the electrical power must be turned off to the valves by turning the "BOX CONTROLS" switch to the "MANUAL" mode. In either mode of operation, the valves are proportional acting. The amount that the joystick (or lever) is moved will determine the flow output of the valve which determines the speed at which these functions operate.

Auger Control Valves:

The auger control valves are located on the left side of the operator's console and they control the spreader box augers. They include auger on/off/directional valves and auger speed control valves. The on/off/directional control valves control the auger on/off and direction of rotation and they are electrically controlled by the "RIGHT & LEFT AUGER DIRECTION" switch buttons located on the keypad on the operator's console. The directional valves are hydraulically pilot operated and they in turn are operated by electrically controlled on/off valves. The knob operated "AUGER SPEED CONTROL" knobs operate flow control valves that control the auger speed.

High Pressure Washer (Optional):

The high pressure washer is powered by the main hydraulic circuit. Its oil is supplied through a tee at the end of the pressure tubing near the inlet of the main start valve. The high pressure washer circuit is turned on or off by turning the switch located next to the high pressure washer pump. The high pressure washer circuit can only be operated when all of the other main circuit hydraulic functions are turned off (or turning very slowly). The main water pump must be operating for the high pressure washer to function. The high pressure washer switch will turn on the main water pump when it is turned on.

Pugmill Gate (Optional):

The pugmill gate is powered by the main hydraulic circuit. Its oil is supplied through a tee at the inlet of the auger control valve block. The pugmill gate valve is located underneath the operator's console. It is an electrically controlled directional valve, controlled by either a separate "PUGMILL GATE" switch or by a second joystick control handle.

Getting To Know The Macropaver (cont'd)

Emulsion Pump / Water Pump Circuit

Oil from the emulsion pump / water pump hydraulic pump flows to the emulsion/water pump block located behind the dash panel. As the pump is variable displacement, only the oil flow required by the circuits in use is put out by the pump.

- Emulsion Pump/Agg. Conveyor Speed Control - This valve controls on/off and speed control for both the emulsion pump and the aggregate conveyor. The valve is adjustable from 0 - 25 GPM (0 - 95 LPM). The oil flows to a single motor which has an output shaft on each end. The emulsion pump is always operating when the valve is turned on and the conveyor only operates when Main Start is engaged

- Water Pump Valves - One valve controls the on/off of the water pump. It is an electrically controlled valve operated by the "WATER PUMP" switch. It is equipped with a manual override to operate the valve in case of electrical failure. See "Manual Override and Sequencing Valves" section. The other valve is a fixed flow control valve which allows 10 GPM (38 LPM) to flow to the water pump motor.

Pugmill Circuit

Oil from the pugmill pump flows from the pump outlet to the pugmill on/off/speed control valve. This valve, located in the dash panel, controls not only the pugmill on and off but also its speed. It is a proportional valve, so the amount that the valve lever is moved will determine the flow output of the valve and the speed of rotation of the pugmill. The oil then flows to the pugmill motor.

Getting To Know The Macropaver (cont'd)

Electrical System

The electrical system is 12 volt DC, negative ground. It is supplied from a battery and charging system driven from the truck or Macropaver engine. The Macropaver's electrical system is protected with two 30 amp fuses, located between the power input on the engine starter battery terminal and the ignition switch and main power relay. The ignition switch is a 4-position Accessory-Stop-Run-Start switch. The run terminal (IGN) powers the engine electronics. The electronic control will stop the engine if a loss of oil pressure or a high engine coolant temperature condition exists. The run terminal (IGN) also is used to switch the main power relay which powerrs the balance of the electrical circuits and fuel supply pump. The main power relay receives its power directly from one of the main fuses. The accessory (ACC) terminal is connected to the engine electrical harness. The following is a brief description of each of the accessory electrical circuits:

- E-Stop (Emergency Stop) Circuit - This circuit is controlled by the E-Stop button. Pressing the button interrupts power, stopping all of the hydraulic circuits, including the box auger valves. The E-Stop button is a maintained style switch. The button must be pulled up to operate the Macropaver.

- Main Start Circuit - This circuit is controlled by the Main Start Trigger on the Joystick Control Handle via EZ-OP controller. When the trigger is pulled the first time, the controller will bring the engine up to full operating RPM and turn on the pump load function for the main hydraulic circuit. With the second trigger pull, the controller will actuate the main start function, which will power the main start valves and the vibrator valve. It also supplies power to the fines feeder switch which, if it is turned on, will power the fines feeder valve. When the trigger is then pulled the third time, the controller will switch off the main start relay, turning off power flow to all of the main start functions. The engine speed will stay at high idle a pre-set period of time after which pump load will turn off and the engine will return to idle. If Main Start Trigger is pulled while engine is running at full speed, the controller will actuate main start on the first pull and turn off main start with the second pull.

- 3 Second Shutdown Circuit - The main start circuit can be interrupted by the 3 second delay function of the controller which is triggered by the low aggregate switch (and low emulsion and conveyor slip functions on optional control system). If the aggregate flowing out of the main hopper on the aggregate conveyor drops below a pre-set level, the aggregate gate switch will close. This switch closure will start the timer on the 3 second delay function and after 3 seconds it will turn off the main start circuit. When the aggregate gate switch closes, it will immediately trigger the aggregate alarm light, alerting the operator that the system will shut down in 3 seconds. This circuit can be over-ridden by depressing the button next to the light.

- EZ-OP Control System - The control system receives its power directly from the main power relay. The control system is described in detail in the separate "Monitoring System" instruction manual.

- Water Pump & Additive Pump Circuits - These circuits are powered by their respective switches. The switches receive power directly from the main power relay.

Daily Start Up

Before Starting

1. Check engine oil level.

2. Check engine radiator level.

3. Check pump gearbox oil level.

4. Check hydraulic oil reservoir level.

NOTE: Hydraulic reservoir level should always be above lower site gauge. If engine is started with reservoir level too low, pumps will cavitate. Serious pump damage may result.

After checking all components, the Macropaver is ready to start.

Start Up

NOTE: Refer to John Deere operator's manual for complete operating guidelines.

1. Make sure the pugmill control handle is centered, the "EMULSION PUMP/AGG. CONVEYOR SPEED" control is off and the water pump and additive pump switches are turned off.

2. Turn the key switch clockwise to crank engine.

NOTE: Do not operate starter for more than 30 seconds at a time. To do so may overheat the starter. If the engine does not start the first time, wait at least 2 minutes before trying again. If it does not start after four attempts, see troubleshooting section in John Deere Operator's Manual.

3. After the engine starts, release the key.

Daily Start Up (cont'd)

NOTE: If key switch is released before the engine starts, wait until the starter and the engine stop turning before trying again. This will prevent possible damage to the starter and/or flywheel.

4. Go to "ENGINE" screen of EZ-OP control and check all gauges for normal engine operation. If operation is not normal, stop engine and determine the cause.

NOTE: Should the engine die when operating under load, shut off all controls and restart the engine to prevent overheating of turbocharger parts caused when the flow of oil for cooling and lubrication is stopped.

5. Engine Speed Control Operation:
   a. Manual Engine Speed can be controlled by buttons on the "ENGINE" screen:
      1. Rabbit / Turtle: Full speed / idle speed.
      2. Up / Down: Use to adjust speed between full speed and idle speed.
      3. Keypad Switch Buttons: The Rabbit / Turtle buttons can also be used to enable full or idle speed.
   b. Automatic Engine Speed is controlled by the first trigger pull of the Main Start Trigger. This will put the engine at full operating speed. The engine will automatically idle down after a preset period as long as Main Start is not on. Access for adjusting this time period is by pressing the "ENGINE IDLE" button in the "ENGINE" screen.

Warming Engine

1. Check oil pressure gauge as soon as engine starts. If gauge needle does not rise above minimum pressure within 5 seconds, stop the engine and determine the cause. Normal engine oil pressure is 55 PSI at rated full load speed (2200 RPM).

2. Watch coolant temperature gauge. Do not place engine under full load until engine reaches normal temperature. The normal engine coolant temperature range is 82° - 94° C (180° - 202°F). Maximum continuous coolant temperature is 110° C (230° F). If temperature exceeds this level, the electronic engine control will derate the engine to reduce load on the engine. The high coolant temperature shut down in the engine controller is set at 115° C (239° F).

NOTE: To assure proper lubrication, during start-up, operate engine at or below 1200 RPM with no load for 1-2 minutes. Extend this period when operating at temperatures below freezing.

Loading Procedures

Filling Water Tank

1. Remove plug from the cam lock fitting located at the right front of the Macropaver (see page 5 for location).

2. Insert male hose fitting and lock down the fitting cam locks.

3. Fill tank to desired level.

4. After closing valve from water source, unlock cam lock fitting. The check valve will retain the water in the tank, but it is best to also install and lock the camlock cover.

Filling Additive Tank

1. Open tank lid by rotating lid counter-clockwise.

2. Fill tank with additive to be used.

3. After filling tank, reinstall tank lid and securely tighten.

CAUTION: CHECK MATERIAL SAFETY DATA SHEETS (MSDS) BEFORE HANDLING AND LOADING CHEMICALS. ALWAYS WEAR PROPER SAFETY GEAR!

Loading Procedures (cont'd)

Loading Emulsion From Stockpile Tanker

NOTE: This procedure uses a pump located on the tanker.

1. Make sure emulsion fill valve located next to emulsion strainer is closed (see page 3 for location).

2. Remove fill plug cam lock fitting.

3. Hook up the female cam lock coupler to valve fitting.

4. Open emulsion fill valve to allow emulsion to flow directly into the emulsion tank through the strainer housing. (NOTE: The emulsion is not strained as it enters the tank.)

5. Fill tank to desired level.

6. Close emulsion fill valve.

7. Close emulsion valve on supply tanker.

8. Release cam lock fitting from Macropaver.

Loading Procedures (cont'd)

Self Loading The Macropaver With Emulsion

1. Start the truck engine and run at 1000 - 1500 RPM to warm up the emulsion pump. The emulsion pump center section must be hot (approximately 80° C - 180° F) before starting the pump. Start the Macropaver engine.

2. Make sure emulsion fill valve located next to emulsion strainer is closed (see page 3 for location).

3. Remove fill plug cam lock fitting.

4. Hook up the female cam lock coupler to valve fitting

5. Open emulsion fill valve to allow emulsion to be pumped into the emulsion tank through the emulsion strainer and pump. (NOTE: The emulsion is strained as it passed through the strainer before reaching the pump.)

6. Close emulsion strainer valve (see page 3 for location)

7. With the Macropaver now warmed up, adjust the "EMULSION PUMP SPEED" control to about 600 RPM. Pump speed can be adjusted to fit the desired filling speed. Faster speed will not damage pump. If emulsion has lumps, the pump can become noisy and stall, so run the pump at more than 450 RPM if this occurs.

NOTE: If, while loading material, emulsion pump starts making excessive noise and still runs, but does not seem to be pumping, reduce pump RPM immediately. DO NOT run emulsion pump over 350 RPM under these conditions, as pump is probably cavitating.

8. Fill tank to desired level and stop pump.

9. Close emulsion fill valve.

10. Open emulsion strainer valve.

11. Close emulsion valve on supply tanker.

12. Release cam lock fitting from Macropaver.

Unloading Procedures

Follow these procedures to unload individual materials from the Macropaver when other materials are loaded. These instructions assume the Macropaver engine is running, has been warmed up and is at operating speed of 2200 RPM with the "PUMP/LOAD" switch on.

Unloading Aggregate Only

1. From the main screen on the EZ-OP controller, press the "DIAGNOSTICS" button and then the "OUTPUTS" buttton.

2. Open the "EMULSION PUMP SPEED" control and set the emulsion pump speed at approximately 600 RPM.

3. Turn on the pugmill to full speed forward direction by pushing the lever inward toward the dash panel.

4. Lower the box lift and center the diverter chute using the Joystick Control Handle.

5. Press the "CONVEYOR CLUTCH" button.

6. Aggregate will start unloading and coming out of the pugmill. It may be necessary to move the truck forward depending on the amount of aggregate to be unloaded. If the aggregate piles up to the pugmill discharge opening it can block the opening and plug up the pugmill.

Unloading Emulsion Only

1. From the main screen on the EZ-OP controller, press the "DIAGNOSTICS" button and then the "OUTPUTS" buttton.

2. Disconnect the emulsion hose from the inlet hopper camlock fitting,

3. Connect this hose to a hose going to the tank where the emulsion will be pumped.

4. Open the "EMULSION PUMP SPEED" control and set the pump speed at approximately 600 RPM.

5. Press the "EMULSION VALVE" button.

6. Emulsion will now be pumped from the emulsion tank on the Macropaver to the storage tank.

Unloading Procedures (cont'd)

Unloading Water Only

1. From the main screen on the EZ-OP controller, press the "DIAGNOSTICS" button and then the "OUTPUTS" buttton.

2. Turn "WATER PUMP" switch on. Make sure "ADDITIVE PUMP" switch is off.

3. Press the "WATER/ADDITIVE VALVE" button.

4. Water will flow through the pugmill and out the diverter chute.

Unloading Fines Only

1. From the main screen on the EZ-OP controller, press the "DIAGNOSTICS" button and then the "OUTPUTS" buttton.

2. Turn "FINES" switch on.

3. Open the "FINES RATIO" control one to two turns.

4. Turn on the pugmill to full speed forward direction by pushing the lever inward toward the dash panel.

5. Lower the box lift and center the diverter chute using the Joystick Control Handle.

6. Press the "FINES MOTOR" button.

7. Fines will start unloading and coming out of the pugmill. The unloading speed can be adjusted by changing the "FINES RATIO" valve.

Calibrating The Macropaver

To produce a Slurry Seal mixture to laboratory specifications the Macropaver must be calibrated to work with the specific materials being used on a job. The Macropaver mixing system is built around the aggregate conveyor head pulley. The emulsion pump is a positive displacement pump and is driven from the conveyor head shaft with a fixed ratio. This allows the emulsion to aggregate ratio to be adjusted by changing the aggregate gate opening. The fines filler to aggregate ratio is controlled by changing the speed ratio between the fines feeder and aggregate conveyor. The ratio of fines feeder speed to aggregate conveyor speed is displayed on the Fines / Agg. Ratio Meter. Both water and liquid additive flow rates are controlled by adjusting the corresponding gate valves. A truck scale will be will be required to weigh the truck for aggregate and emulsion calibration and a portable scale will be necessary for weighing the fines. The EZ-OP "CALIBRATE" system will provide step by step instructions as well as allow for input of the calibration data. Its instructions are basically the same as shown on the following pages.

Aggregate Calibration

Aggregate is generally the first material to be calibrated. **(Macropaver MUST have emulsion in emulsion tank as emulsion pump will be operating during this calibration procedure.)** This calibration will develop a graph for the Aggregate Gate Setting versus Emulsion to Agg Ratio. (The aggregate used for calibration must be representative of the aggregate to be used on the job. Aggregate density can vary greatly.) A sheet is provided to record the calibration data. Fill it out as shown below or enter data into EZ-OP controller. 100 head shaft revolutions for each gate setting is the recommended amount.

Proceed as in the example that follows:

1. Load the Macropaver with aggregate - load aggregate from the WATER TANK side of the machine ONLY.

2. Weigh the Macropaver and record this weight as the Heavy Weight for Trial #1. Set the desired number of head shaft revolutions in the EZ-OP "AGGREGATE" calibration screen.

3. Set the aggregate gate opening height and record as the aggregate gate setting. (Start with a small opening and proceed to larger openings.)

4. Drive the Macropaver to a location where the aggregate can be unloaded onto the ground.

5. Start the emulsion pump by turning the "EMULSION PUMP SPEED" control. Set it to about 500 RPM to start - faster speeds are okay.

6. The aggregate counter will reset automatically to read 0.0 counts for each trial during the EZ-OP calibration process.

Calibrating The Macropaver (cont'd)

7. Turn the pugmill on to full speed in the forward direction.

8. Press the Main Start Trigger on the Joystick Control Handle. Watch the aggregate coming out of the pugmill. It will be necessary to move the Macropaver forward to keep aggregate from building up at the back of the machine and plugging the pugmill.

9. The aggregate flow will shut-off when the desired number of Aggregate Conveyor Head Shaft revolutions has been reached. Record this number in the space marked "Head Shaft Revolutions". Stop the pugmill AFTER it has emptied of aggregate.

10. Weigh the Macropaver and record this number as Light Weight under Trial #1.

11. Repeat this procedure at the same gate setting for trials 2 and 3.

Figure #1: Example of Aggregate Calibration with Trial Data and Calculations

Aggregate Gate Setting	in(cm)	4.5					
	UNITS		Trial #1	Trial #2	Trial #3		
Heavy Weight	lbs (Kg)		62160	58300	54360		
Light Weight	lbs (Kg)		58300	54360	50440		
Aggregate Unloaded	lbs (Kg)		3860	3940	3920		
Head Shaft Revolutions	Rev counts		50.1	50.1	50.1	SUM	Average
Agg. Weight / Rev	lbs/Rev (Kg/Rev)		77.05	78.64	78.24	233.93	77.98

Aggregate Gate Setting	in(cm)	5.5					
	UNITS		Trial #1	Trial #2	Trial #3		
Heavy Weight	lbs (Kg)		66640	61820	56980		
Light Weight	lbs (Kg)		61820	56980	52180		
Aggregate Unloaded	lbs (Kg)		4820	4840	4800		
Head Shaft Revolutions	Rev counts		50.1	50.1	50.1	SUM	Average
Agg. Weight / Rev	lbs/Rev (Kg/Rev)		96.21	96.61	95.81	288.62	96.21

Aggregate Gate Setting	in(cm)	6.5					
	UNITS		Trial #1	Trial #2	Trial #3		
Heavy Weight	lbs (Kg)		62180	56100	49920		
Light Weight	lbs (Kg)		56100	49920	44020		
Aggregate Unloaded	lbs (Kg)		6080	6180	5900		
Head Shaft Revolutions	Rev counts		50	50	50	SUM	Average
Agg. Weight / Rev	lbs/Rev (Kg/Rev)		121.60	123.60	118.00	363.20	121.07

Equations used in above tables:

Aggregate unloaded = Heavy Weight - Light Weight

Calibrating The Macropaver (cont'd)

Sum = (Agg. Weight / Rev Trial #1) + (Agg. Weight / Rev Trial #2) + (Agg. Weight / Rev Trail #3)

Average = Sum / 3

Emulsion Calibration

The emulsion is calibrated to determine the weight of emulsion pumped per revolution of the Aggregate Conveyor Head Shaft. To calibrate the emulsion proceed as follows:

1. Unload any aggregate left in aggregate hopper from the aggregate calibration.

2. Make sure the Macropaver emulsion tank is full with emulsion.

3. Weigh the Macropaver and record this weight as the Heavy Weight for Trial #1. Set the desired number of head shaft revolutions in the EZ-OP "EMULSION" calibration screen.

4. Disconnect the emulsion line from the pugmill inlet hopper and connect it to a line returning to an emulsion storage tank.

5. Start the emulsion pump by turning the "EMULSION PUMP SPEED" control. Set it to about 500 RPM.

6. The emulsion counter will reset automatically to read 0.0 counts for each trial during the EZ-OP calibration process.

7. Press the Main Start Trigger on the Joystick Control Handle. This will start the emulsion pumping from the Macropaver into the emulsion storage tank. (NOTE: Pugmill does not have to be ON for main start to operate during emulsion calibration.)

8. The emulsion flow will shut off when the desired number of Aggregate Conveyor Head Shaft rev0lutions has been reached. Record this number as Head Shaft Revolutions under Trial #1.

9. Weigh the Macropaver and record this number as Light Weight under Trial #1.

10. Repeat this procedure for trials 2 and 3.

Calibrating The Macropaver (cont'd)

Figure #2. Example of Emulsion Calibration with Trial Data and Calculations

	UNITS		Trial #1	Trial #2	Trial #3		
Heavy Weight	lbs (Kg)		45640	44137	46206		
Light Weight	lbs (Kg)		44137	42606	44685		
Emulsion Pumped	lbs (Kg)		1503	1531	1521		
Head Shaft Revolutions	Rev counts		100.2	100.7	100.7	SUM	Average
Emulsion / Rev	lbs/Rev (Kg/Rev)		15.00	15.20	15.10	45.31	15.10

Equations used in above table:

Emulsion Pumped = Heavy Load - Light Load

Emulsion / Rev = Emulsion Pumped / Head Shaft Revolutions

Sum = (Emulsion / Rev trial #1) + (Emulsion / Rev trial #2) + (Emulsion / Rev trial #3)

Average = Sum / 3

Emulsion to Aggregate Graph

Figure #3: Example of Percent Emulsion to Aggregate Ratio

	UNITS	Gate Setting		
Agg. Gate Setting	in. (cm)	4.5	5.5	6.5
Ave. Emulsion / Rev	lbs/Rev (Kg/Rev)	15.10	15.10	15.10
Ave Agg. / Rev	lbs/Rev (Kg/Rev)	77.98	96.21	121.07
Emulsion to Agg.		0.1937	0.157	0.1247
% Emulsion to Agg Ratio	%	19.37	15.70	12.47

Equations used in above table:

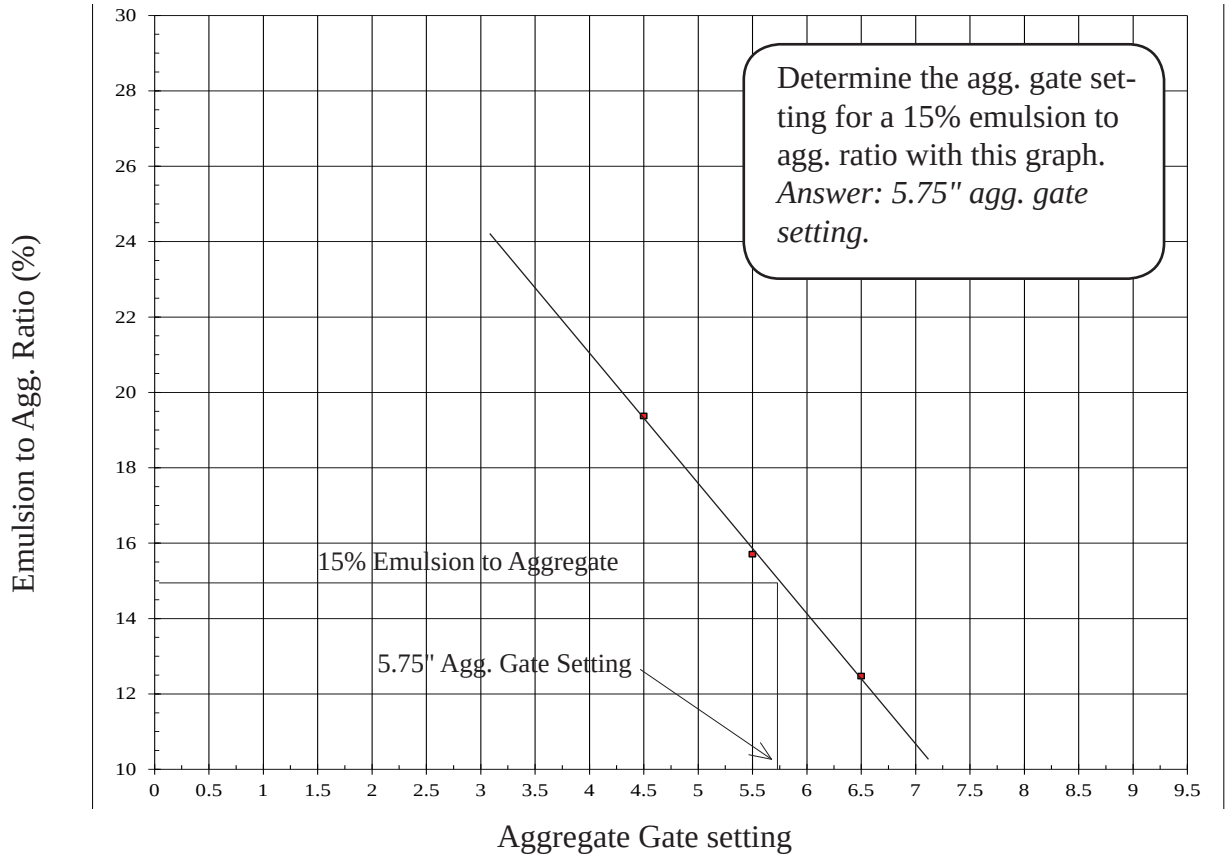
Emulsion to Agg = (Ave. Emulsion Weight / Rev) / (Ave. Aggregate Weight / Rev)

% Emulsion to Aggregate Ratio = Emulsion to Agg x 100

Plot the values of percent emulsion to aggregate versus aggregate gate setting on a graph as shown on the following page. This is used to determine the aggregate gate setting to achieve a given percent emulsion to agg ratio. Enter the graph at the desired percent emulsion to agg ratio. Draw a horizontal line to the right until it intersects the calibration line. Then draw a vertical line down from that point to determine the agg gate setting.

Calibrating The Macropaver (cont'd)

Example Emulsion to Aggregate Calibration Graph



Fines Filler Calibration

The fines to aggregate ratio displays the ratio of fines being fed to aggregate being fed.

The Macropaver must be calibrated before this becomes useful information to the operator. In other words, we must determine the weight of the product per shaft revolution for both the fines and the aggregate. The aggregate calibration shown previously should have been completed at this point. The fines feeder must now be calibrated to determine the weight of fines discharged per auger revolution. This procedure is similar to the emulsion and aggregate calibration measurements, and is shown in the following example.

1. Unload any aggregate left from calibration.

2. With the Macropaver engine off, remove the pugmill inlet hopper and find a suitable container to place under the fines feeder discharge. **CAUTION:** Place pugmill cover back over pugmill.

Calibrating The Macropaver (cont'd)

3. Load the fines feeder hopper with cement representative of that to be used on the job.

4. Weigh the empty container on a suitable scale that will weigh up to approximately 200 lbs. (100 Kg). Record this weight as the Empty Weight for Trail #1. Set the desired number of shaft revolutions in the EZ-OP "FINES" calibration screen.

5. Set the "FINES RATIO" control to a middle range and turn the "FINES" switch button on.

6. The fines counter will reset automatically to read 0.0 counts for each trial during the EZ-OP calibration process.

7. Press the Main Start Trigger on the Joystick Control Handle to start feeding fines out of the hopper. (NOTE: Pugmill does not have to be ON for main start to operate during fines calibration.)

8. The fines flow will shut off when the desired number of Fines Auger Shaft revolutions has been reached. Record this as Fines Auger Revolutions under Trial #1.

9. Weigh the full container and record this number as Full Weight under Trail #1.

10. Repeat this procedure for trials 2 and 3.

Figure 4. Example of Fines Calibration Data and Calculations

	UNITS	Trial #1	Trial #2	Trial #3		
Full Weight	lbs (Kg)	105.7	108.4	106.7		
Empty Weight	lbs (Kg)	4	4	4		
Fines Unloaded	lbs (Kg)	101.7	104.4	102.7		
Auger Shaft Revolutions	Rev counts	50.1	50.3	50.1	SUM	Average
Fines / Rev	lbs/Rev (Kg/Rev)	2.03	2.08	2.05	6.16	2.05

Equations used in above table:

Fines Unloaded = Full Weight - Empty Weight

Fines / Rev = Fines Unloaded / Auger Shaft Revolutions

Sum = (Fines / Rev Trial #1) + (Fines / Rev Trial #2) + (Fines / Rev Trial #3)

Average = Sum / 3

Calibrating The Macropaver (cont'd)

Fines to Aggregate Ratio Calibration

Plot the values of aggregate weight per conveyor head shaft revolution versus aggregate gate setting found in figure 1 on a graph as shown below. Enter the graph at the aggregate gate setting determined from the emulsion and aggregate calibration, draw a vertical line up until it intersects the calibration line. Then draw a line to the left from that point to determine the weight of aggregate per revolution. This will be used to calculate the fines to aggregate ratio to match the laboratory design mix.

Example Aggregate Gate Setting versus Weight of Aggregate per Revolution Calibration Graph

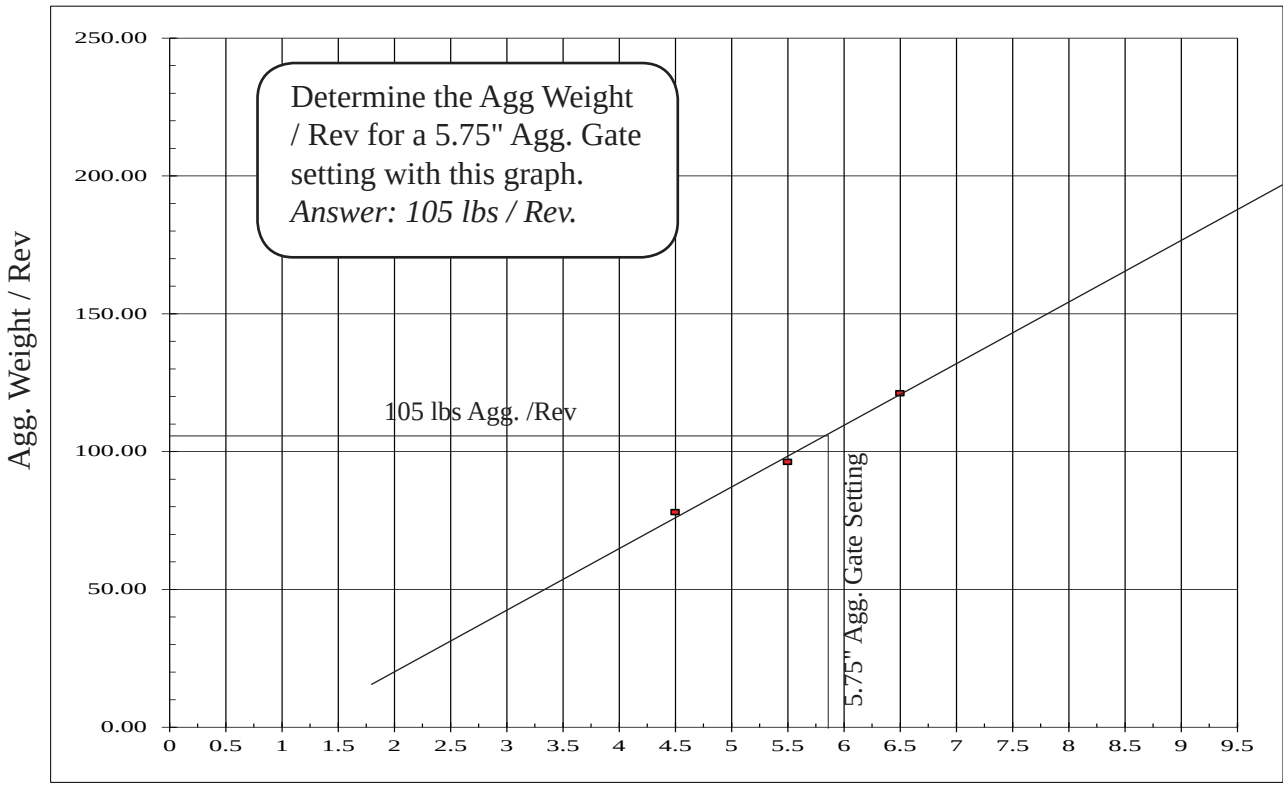


Figure 5. Example of Fines to Aggregate Ratio

	UNITS	
Desired Fines to Agg. Ratio	%	0.75
Aggregate / Rev	lbs/Rev (Kg/Rev)	105
Ave. Fines / Rev	lbs/Rev (Kg/Rev)	2.05
Fines / Agg.	lbs/Rev (Kg/Rev)	0.7875

Equations used in above table:

$$\text{Fines / Agg.} = \frac{(\text{Desired Fines to Agg Ratio}) \times (\text{Aggregate / Rev})}{100}$$

Calibrating The Macropaver (cont'd)

Liquid Additive Flow Calculation

If liquid additive is required, the mix design will specify the amount by a percentage of the dry aggregate. Once calibration is complete and the mix design data is entered, the EZ-OP controller will calculate the requred liquid additive flow rate as well as water flow rate. But, if it is desired to also calculate this manually this percentage can be converted into a flow rate based upon the emulsion pump RPM. The emulsion pump speed is indicated on the EZ-OP "OPERATE" screen and from this the aggregate conveyor speed can be calculated. So, for a known aggregate conveyor speed and aggregate gate setting, we can determine the pounds (or kg.) of aggregate / minute the machine is producing. From this aggregate output rate, we can calculate the additive flow reguired:

The gearbox that drives the conveyor has a 15:1 ratio, so at emulsion pump speed of about 450 RPM, the conveyor will be turning about 30 RPM.

At a gate setting of 5.75", the aggregate output is 105 lbs./ rev. x 30 RPM = 3150 lbs./min.

With an additive requirement of 1%, the flow rate required is .01 x 3150 = 31.50 lbs./min. Assuming the additive specific gravity is 1.335 (or approx. 11.15 lbs./gal.), then the flow rate is 31.50 ÷ 11.15 = 2.8 GPM.

If the mix design recommends an approximate water flow rate, this can be calculated using the same method (using 8.34 lbs./gal.).

Aggregate Calibration Charts

Job:________________________ Date:________________________

Machine No:________________________ Measured By:________________________

Aggregate Type:____

Aggregate Moisture%:______________

Aggregate Calibration

Aggregate Gate Setting	in(cm)						
	UNITS		Trial #1	Trial #2	Trial #3		
Heavy Weight	lbs (Kg)						
Light Weight	lbs (Kg)						
Aggregate Unloaded	lbs (Kg)						
Head Shaft Revolutions	Rev counts					SUM	Average
Agg. Weight / Rev	lbs/Rev (Kg/Rev)						

Aggregate Gate Setting	in(cm)						
	UNITS		Trial #1	Trial #2	Trial #3		
Heavy Weight	lbs (Kg)						
Light Weight	lbs (Kg)						
Aggregate Unloaded	lbs (Kg)						
Head Shaft Revolutions	Rev counts					SUM	Average
Agg. Weight / Rev	lbs/Rev (Kg/Rev)						

Aggregate Gate Setting	in(cm)						
	UNITS		Trial #1	Trial #2	Trial #3		
Heavy Weight	lbs (Kg)						
Light Weight	lbs (Kg)						
Aggregate Unloaded	lbs (Kg)						
Head Shaft Revolutions	Rev counts					SUM	Average
Agg. Weight / Rev	lbs/Rev (Kg/Rev)						

Emulsion Calibration Charts

Job: _____ Date: _____

Machine No: _____ Measured By: _____

Emulsion Type: _____

Emulsion Temperature: _____

Emulsion Calibration

	UNITS		Trial #1	Trial #2	Trial #3		
Heavy Weight	lbs (Kg)						
Light Weight	lbs (Kg)						
Emulsion Pumped	lbs (Kg)						
Head Shaft Revolutions	Rev counts					SUM	Average
Emulsion / Rev	lbs/Rev (Kg/Rev)						

% Emulsion to Aggregate Ratio

	UNITS	Gate Setting		
Agg. Gate Setting	in. (cm)			
Ave. Emulsion / Rev	lbs/Rev (Kg/Rev)			
Ave Agg. / Rev	lbs/Rev (Kg/Rev)			
Emulsion to Agg.				
% Emulsion to Agg Ratio	%			

Fines Calibration Charts

Job: _____ Date: _____

Machine No: _____ Measured By: _____

Fines Type: _____

Fines Calibration

	UNITS	Trial #1	Trial #2	Trial #3		
Full Weight	lbs (Kg)					
Empty Weight	lbs (Kg)					
Fines Unloaded	lbs (Kg)					
Auger Shaft Revolutions	Rev counts				SUM	Average
Fines / Rev	lbs/Rev (Kg/Rev)					

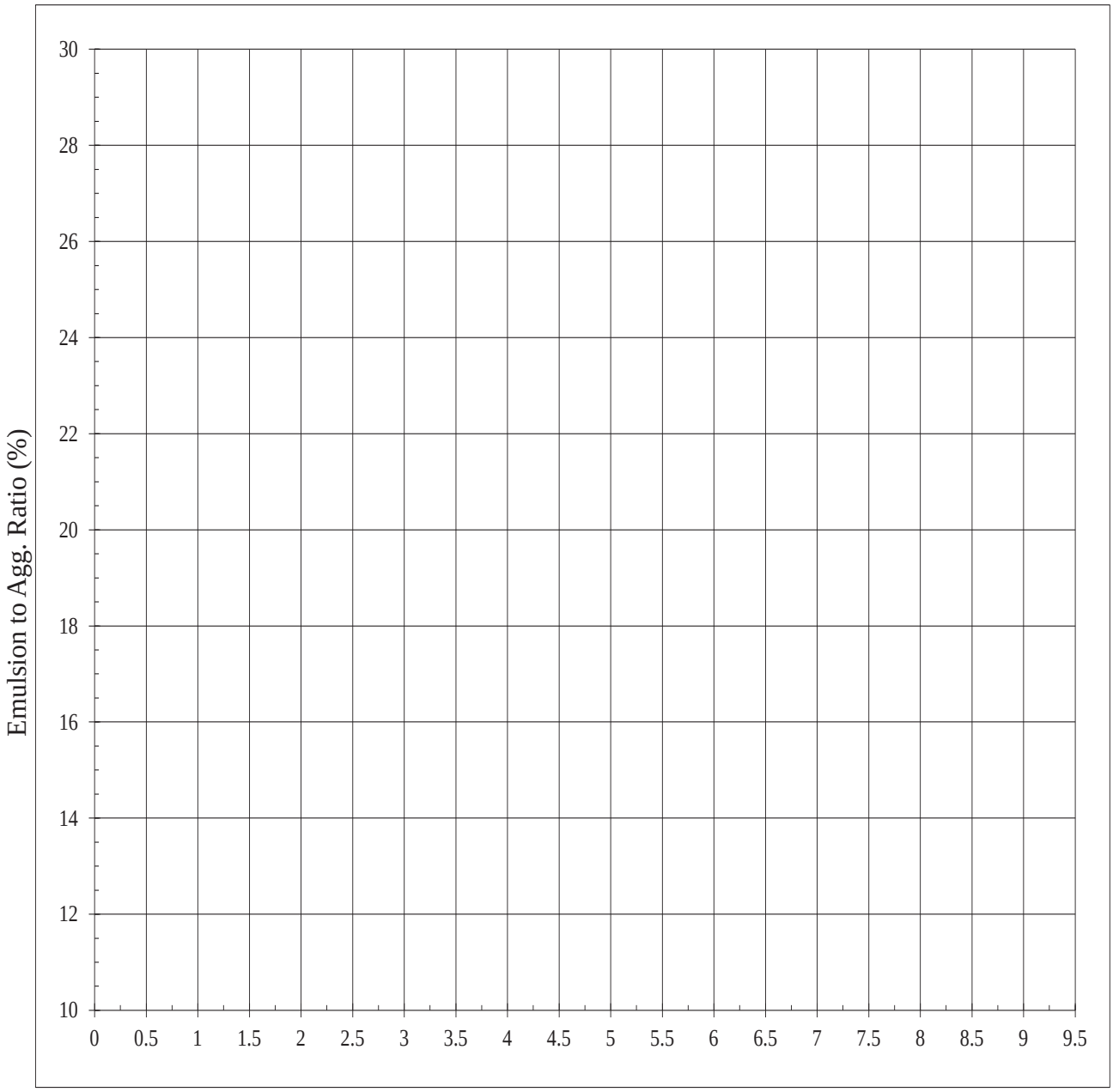
% Fines to Aggregate Ratio

	UNITS	
Desired Fines to Agg. Ratio	%	
Aggregate / Rev	lbs/Rev (Kg/Rev)	
Ave. Fines / Rev	lbs/Rev (Kg/Rev)	
Fines / Agg.	lbs/Rev (Kg/Rev)	

Emulsion To Aggregate Calibration Graph

Job: _____ Date: _____

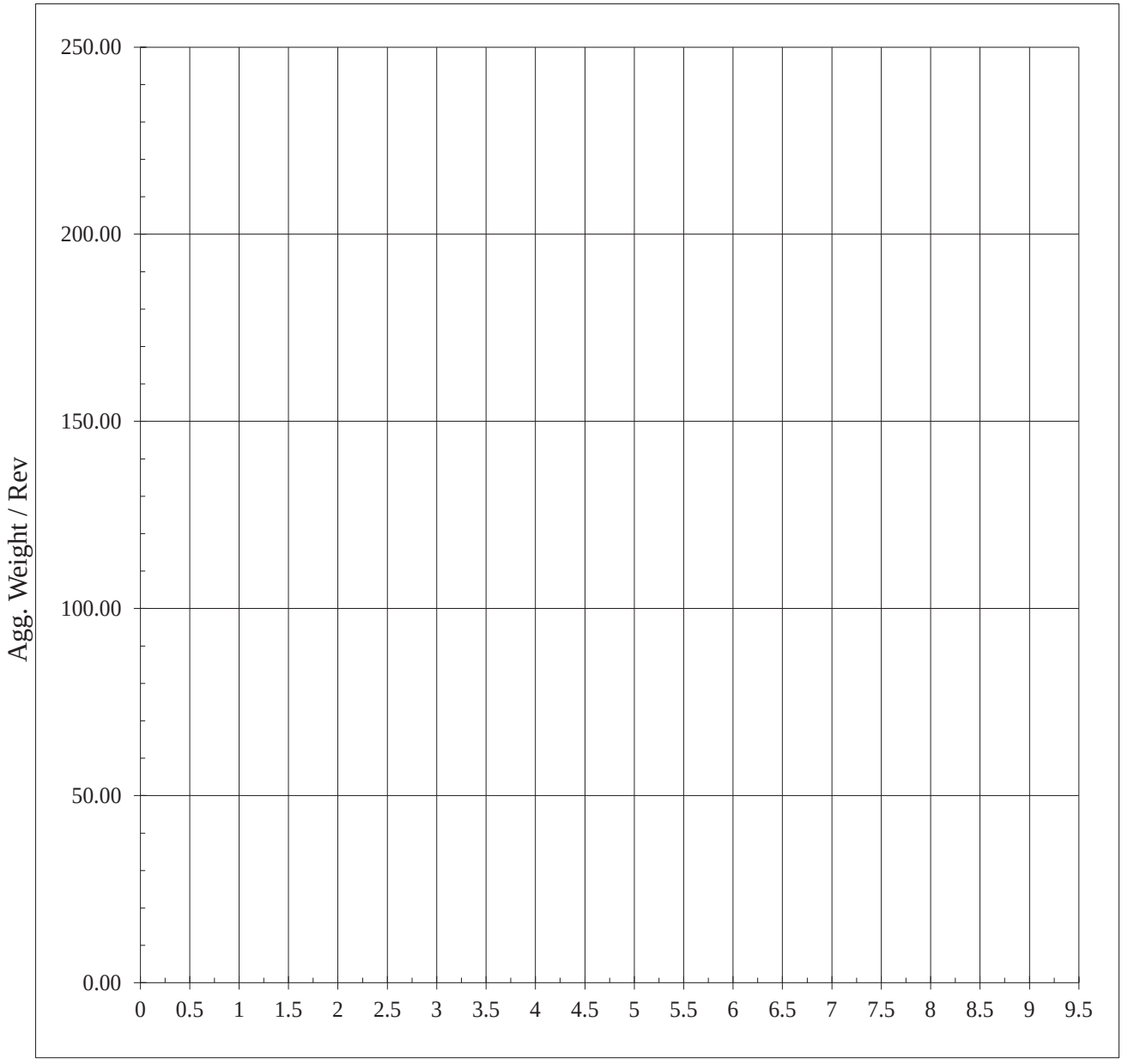
Machine No: _____ Measured By: _____



Aggregate Weight Per Revolution Calibration Graph

Job: _____ Date: _____

Machine No: _____ Measured By: _____



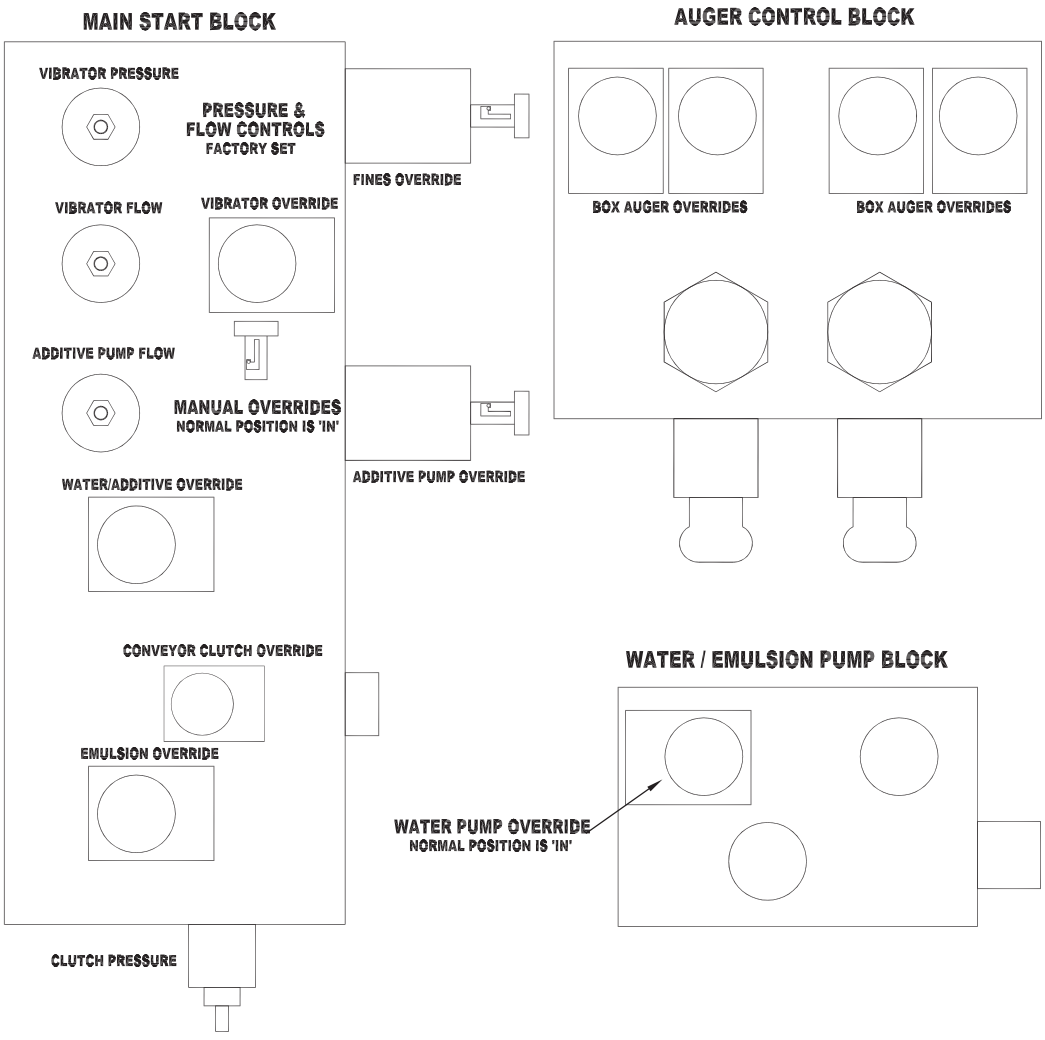
Manual Override

The Macropaver's hydraulic and electrical system provides for manual over-rides of most functions. The valve over-rides shown below are mounted in their respective hydraulic blocks located behind the dash. Main start and box control over-ride switches are located on the operator's console.

NOTE: The box control valve manual override switch controls the power to the side shift, material diverter, and box lift hydraulic valves. If there is a need to control any of these cylinders manually, power to the valves must be switched off. Otherwise severe damage could result.

The main start over-ride switch can be used to activate the main start function instead of the joystick trigger in the case of joystick or controller failure.

The valve over-ride controls shown below can be used to activate their respective function in the case of electrical failure. It is not necessary to over-ride these valves when using the main start over-ride switch.

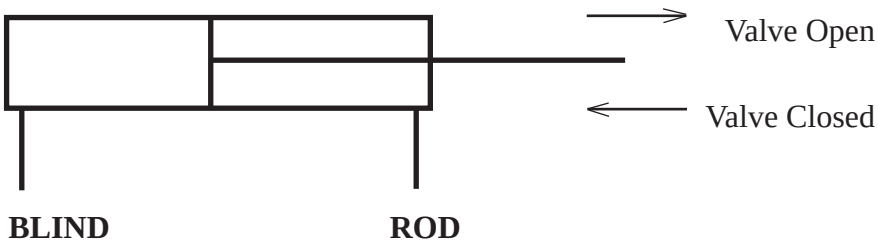


Adjustment Of Automatic Sequencing

The Macropaver is equipped with an adjustable automatic sequencing system controlled by the EZ-OP controller. This system controls the timing of material delivery to the pugmill assuring consistent quality through the entire paving operation. This is accomplished with valves operated by hydraulic cylinders. The emulsion valve is a three way valve that recirculates emulsion back to the tank during standby or sends emulsion to the pugmill during mixing and the water/additive valves are two ways valves that turn on or off the water and additive flows.

The delay of opening or closing of each cylinder is adjusted in the "SEQUENCE" screen in the "SETUP" section of the EZ-OP. The delay in opening of the cylinders is controlled by oil flow into the blind end of the cylinder and the delay in the closing of the cylinders is controlled by oil flow into the rod end of the cylinder. The emulsion and water/additive cylinders are adjusted independently of each other. If the mix is too dry when Main Start Trigger is pulled to start the mixing, then the amount of delay in the opening of the cylinders should be reduced. If the mix is too wet, then the delay should be increased. If the mix is too dry when the Main Start Trigger is pulled to stop the mixing, then the amount of delay in the closing of the cylinders should be increased. If the mix is too wet, then the delay should be reduced.

SEQUENCE CYLINDER



Note: Decreasing delay to the blind end increases wetness of mix at start of mixing.

Decreasing delay to the rod end decreases wetness of mix at end of mixing.

Adjustment Of Automatic Sequencing (cont'd)

Setting Sequencing

Observe the arrival of the emulsion with respect to the aggregate when Main Start Trigger is pulled. If the emulsion arrives too late, reduce the "EMULSION VALVE OPEN" delay a few tenths of a second or so. This will speed up the arrival of the emulsion. If the emulsion arrives too early, increase the "EMULSION VALVE OPEN" delay a few tenths of a second or so. This will delay the arrival of the emulsion to the pugmill. Adjust until the desired coordination of aggregate and emulsion occurs.

Now observe the end of emulsion flow with respect to the aggregate when the Main Start Trigger is pulled. If the emulsion stops too late, reduce the "EMULSION VALVE CLOSE" delay a few tenths of a second or so. This will reduce the amount of extra emulsion at the end of a batch. If the emulsion stops too soon, increase the "EMULSION VALVE CLOSE" delay a few tenths of a second or so. This will keep the end of the batch from being too lean. Adjust until the desired coordination of aggregate and emulsion occurs.

Repeat these steps for the water/additive cylinder. All settings will be saved when the screen is exited.

Spreader Box

Hooking Up The Spreader Box

1. Using the Joystick Control Handle, center the material diverter by tilting the control handle left or right.

2. Slowly backup the Macropaver, centering the material diverter rubber with the center of the spreader box.

3. Stop the Macropaver when the material diverter rubber is centered over the front section of the spreader box.

4. Connect the two box lift chains to the chain hooks that are mounted on the end of the Macropaver's box lift.

5. When using standard slurry box, connect the spreader box pull chains to the hook assemblies that are pinned in the bottom hole of the vertical square tubes located behind the rear tires of the Macropaver. When using microsurfacing box or rut box, use just the pin portion of the hook assembly. The drag link bars for these types of boxes are then hooked onto the pins.

NOTE: Mark chains with wire, cloth or paint at desired hook-up location for easy re-connection.

6. Hook the side shift bar from the spreader box onto the pin on side shift cylinder arm bracket on the Macropaver. Use Thumb Switch on Joystick Control Handle to shift cylinder arm left or right to align with side shift bar.

NOTE: Be sure material diverter bar is in the horizontal position before lifting box lift mechanism.

CAUTION: BE SURE ALL GROUND PERSONNEL ARE CLEARED FROM THE AREA WHEN BACKING THE MACROPAVER TOWARDS THE SPREADER BOX.

Laying Slurry Seal

Once the Macropaver has been calibrated, all settings made, and sequencing set you are ready to lay slurry seal. Move the Macropaver to the work location and pull Main Start Trigger one time to bring engine up to operating speed and to turn on pump load.

Proceed as follows:

1. Lower the spreader box where the slurry seal is to be placed.

2. Turn on water and additive pumps. Turn on fines feeder switch.

3. Set the emulsion pump to 500 - 600 RPM.

4. Shift the Pugmill Control Handle to the full forward position.

NOTE: The pugmill must be 'ON' for Main Start to operate. The pugmill is interlocked to main start and if it is not operating or has stalled due to plugging, main start will not function.

NOTE: The center position of the pugmill control handle has a small stop. The further the handle is moved away from the center detent, the faster the pugmill drive will go. Up is forward and down is backward.

5. If you are using an augered box, shift the "LEFT & RIGHT AUGER DIRECTION" control switches to the desired direction you require the augers to move the slurry seal mix. Speed of the augers is controlled by the "LEFT & RIGHT AUGER SPEED CONTROL" valves.

6. To start mixing material, press Main Start Trigger on the Joystick Control Handle. If you are using water spray bars, turn appropriate switches on now.

   A. The slurry seal mixture will flow down the material diverter rubber into the spreader box.

   B. Observe the fines ratio meter, water and additive flow meters and the mix as it leaves the pugmill.

   C. Adjust mix as required. Observe the rate at which material is produced. Adjust "EMULSION PUMP/AGG. CONVEYOR SPEED" control to increase or decrease material flow rate as desired. Settings for water and additive may have to be adjusted for the new mixing rate. Fines ratio control will have to be adjusted to maintain the required fines ratio meter setting.

Laying Slurry Seal (cont'd)

D. As mixed material flows out of the pugmill, the material diverter can be used to direct the mixture to either side of the box as required. This is done by tilting the Joystick Control Handle to the left or right.

E. To side shift the spreader box, place your thumb on the black Thumb Switch on the top end of the Joystick Control Handle. Move the switch with your thumb in the direction you want the spreader box to move side to side.

F. When you are within approximately 10 yards (10 meters) of the end of the where the slurry seal is to stop and the spreader box is full, press and quickly release the Main Start Trigger in order to stop the material mixing. Continue to drag out the remainder of the material in the box to where that pass should end. Stop the Macropaver. Turn off water spray bars. If you have excess slurry in the box, lift up the box and hand squeegee it back onto the pass that was just laid, spreading it evenly and uniformly.

Hints:

A. Work out hand signals between the operator of the Macropaver and the truck driver for starting, speed up, slow down and stop.

B. Pull outside or curb passes first, then run center passes.

C. Be sure to use left and right seam sprayers to eliminate joints when laying inside passes. The spray bar water will also help the squeegee man smooth out the joint overlap from previous passes.

D. When the slurry seal dries, the surface texture should be uniform.

CAUTION: THE DRIVER MUST BE AWARE OF TREE BRANCHES AND OTHER OBSTRUCTIONS AS THEY CAN CAUSE SERIOUS INJURY TO THE OPERATOR. THE DRIVER MUST EITHER AVOID SUCH OBSTACLES OR ADVISE THE OPERATOR THEY ARE PRESENT.

High Pressure Washer - Optional Equipment

WARNING: NEVER POINT OR AIM THE HIGH PRESSURE WAND AT ANYONE AT ANYTIME. IT CAN CAUSE SERIOUS INJURY OR EVEN DEATH. ALWAYS WEAR EYE PROTECTION WHEN USING THE HIGH PRESSURE WASHER.

The high pressure washer system is powered by the Macropaver's main hydraulic system. Use the following procedure for operating the washing system.

1. Start up the Macropaver and bring the engine to up to at least 1400 RPM.

2. Turn on the "PUMP LOAD" switch.

3. Go to the washer on the right rear and turn the water ball valve to the on position.

4. Turn on the "HIGH PRESSURE WASHER SWITCH".
   (Note: This switch will also turn on the main water pump.)

5. Remove the wand and pull out the amount of hose needed. Pull the trigger. The washer will start and stop when the trigger is pulled or released.

6. The pressure wand has high and low settings. To change, PUSH IN on the nozzle to go to HIGH pressure or PULL OUT on the nozzle to go to LOW pressure.

NOTE: Be careful to avoid spraying water on exposed electrical components when cleaning unit. Be especially careful behind the dashboard.

Hydraulic System Troubleshooting

Before getting into specifics of trouble shooting, it is important to have a basic understanding of hydraulics and the Macropaver's hydraulic system. Hydraulic oil flow is developed by three direct drive axial piston pressure compensated pumps driven by the John Deere Turbodiesel. Each pump powers certain parts of the hydraulic system and are basically separate systems with a common reservoir. Two starting/unloading valves are included to allow the engine to be started without a hydraulic load. Refer to the "Getting To Know The Macropaver" section and the enclosed hydraulic schematics for more information on the system.

TROUBLE	POSSIBLE CAUSE
No system function (0 PSI), or	1. Starting/unloading valve unloaded
System hydraulic pressure low	2. Pump load switch faulty
	3. Pump pressure compensator stuck
	4. More oil being used than pump can supply
High hydraulic oil temperature	1. Hydraulic pressure set higher than required.
	2. Hydraulic pump or motor failing.
	3. Restriction in hydraulic hose or fitting.
	4. Excessive time spent idling with pump/load switch on.
Pump noisy, operation of systems erratic	1. Oil level in reservoir low.
	2. Suction strainer clogged.

Material Systems Troubleshooting

TROUBLE	POSSIBLE CAUSE
Emulsion pump does not pump	1. Emulsion pump water jackets not hot enough
or shaft not turning	2. Emulsion pump flow control not 'on'
Emulsion pump shaft turning but not	1. Three way emulsion fill valve not at 0° position
delivering emulsion to pugmill	2. Emulsion strainer plugged
	3. Emulsion pump input shaft key sheared
	4. Emulsion sequence valve not being actuated
Emulsion pump and hoses vibrating	1. Pump is sucking air causing cavitation
or surging, pump making rattling noise	2. Hyd. system chatter - open load sense bleed valve approx. 1/8 to 1/4 turn - tighten jam nut after adjustment
	3. Emulsion has lumps or chunks - check emulsion
	4. Worn or damaged pump gears, bearings or shafts - disassemble and check
Aggregate conveyor does not	1. Emulsion pump flow control not 'on'
deliver aggregate to pugmill	2. No or low hydraulic pressure to clutch

Sensor And Monitoring Panel Troubleshooting

TROUBLE	POSSIBLE CAUSE
All Sensors	1. Check all connections from the sensor to the meter 2. Check the air gap between sensor and target wheel
Emulsion Pump Speed Meter does not display a speed	1. Check the emulsion pump to be sure it is turning 2. Be sure #3 light on the Sensor Junction Box is blinking
Emulsion Totalizer display number does not increase during operation	1. Check the emulsion pump to be sure it is turning 2. Be sure #3 light on the Sensor Junction Box is blinking
Aggregate Totalizer display number does not increase during operation	1. Be sure conveyor turns and clutch engages 2. Be sure #3 light on the Sensor Junction Box is blinking
Fines Totals or Meter display does not increase during operation	1. Be sure Fines auger is turning 2. Be sure #1 light on the Sensor Junction Box is on (The blink rate is too fast to see)

The Sensor Junction Box supplies power to the fines, emulsion pump shaft and aggregate tail shaft sensors and sends all the signals in one cable to the monitoring panel. There are five lights on it which give status information. The bottom center light indicates that power is present at the junction box. Each of the other two or three sensor lights by their respective connectors indicate whether a signal is present. During operation of the Macropaver, the power light should be on continuously and the sensor lights will blink as the shafts they monitor turn. The fines sensor blinks at a very high rate and will look as if the light stays on, this is normal.

Each sensor has an air gap between the head of the sensor and the target wheel it is monitoring that must be maintained. If the air gap is too large, the sensor will either give intermittent response or none at all. If the air gap is too small, the sensor head could come into contact with the target wheel and damage or destroy the sensor or wheel. Listed below are the air gap specifications and junction box connector number for each sensor.

The pugmill also has a speed sensor, located on the pugmill drive motor. It does not have a light to check operation. Operation can be checked by operating the pugmill and observing to see if pugmill speed is shown on display.

Sensor Air Gap

Sensor	Location	Air Gap	Junction #	
Emulsion Pump	Emulsion Pump	.157" (4 mm)	3	
Tail Shaft	Behind Pumps	.157" (4 mm)	4	(Opt. Caltrans Only)
Fines Motor	Right Rear of Paver	Pre-set	1	

EZ-OP Troubleshooting

The "DIAGNOSTIC" screens of the EZ-OP control system can be used to troubleshoot various electrical or hydraulic problems on the Macropaver. There are two diagnostic screens: "INPUTS" and "OUTPUTS"

INPUTS:

This screen will show the various inputs to the Macropaver EZ-OP system.

NOTE: Be sure to set the Emulsion Pump Speed and Water Pump & Additive Pump Switches to the 'OFF' position so that these functions will not activate if Main Start Trigger is actuated during testing procedures.

Press in and release the Main Start Trigger. The circle on the screen next to "TRIGGER" will light up green to show that the Main Start Trigger is pulled while the trigger is being pulled. After the trigger is released the circle will go blank until the Main Start Trigger is pressed again.

Raise and lower the aggregate gate sensor arm. The circle on the screen next to "AGG. LOW" will light up green when the aggregate gate drops below approximately 30° from horizontal.

The functioning of many of the sensors can be determined by operating the sensor manually (for instance placing a screwdriver in front of the emulsion pump sensor) and seeing if the circle lights up green.

OUTPUTS:

The various output functions of the Macropaver can be manually checked in this screen. Each function can be turned on or off by pressing the button next to the function and watching to see if the circle turns green indicating that the EZ-OP is sending power to that circuit to operate that function. If the function still does not operate, then try activating the manual override on the hydraulic valve. If the function now works, then there is either a bad electrical connection or a bad coil on the valve. Remove the connector from the coil and check to see if it has voltage. If it does, the coil is bad. If it doesn't, check the wiring to locate the bad wire or bad connection. Another way to check if the coil is functioning, is to hold a screwdriver to the stem of the valve. If the coil is functioning it will be magnetized and will pull on the screwdriver.

See **"Monitoring System Manual"** for more details on EZ-OP diagnostics.

Loading Procedures

Filling Water Tank

NOTE: This inlet fills at the top of the tank and does not allow siphoning of water back to source.

1. Remove plug from the cam lock fitting located at the right front of the Macropaver (see page 5 for location).

2. Insert male hose fitting and lock down the fitting cam locks.

3. Fill tank to desired level.

4. After closing valve from water source, unlock cam lock fitting. The water remaining in the pipe on the Macropaver will come out at this point, so move out of the way.

Filling Additive Tank

1. Unlock tank lid by pulling handle towards outside of truck. After unlocking lid, pull handle down and rest on tank side.

2. Open tank lid.

3. Fill tank with additive to be used.

4. After filling tank, close tank lid and lock in place.

CAUTION: CHECK MATERIAL SAFETY DATA SHEETS (MSDS) BEFORE HANDLING AND LOADING CHEMICALS. ALWAYS WEAR PROPER SAFETY GEAR!

Loading Procedures - Self-Loading Valve (cont'd)

Loading Emulsion From Stockpile Tanker

NOTE: This procedure uses a pump located on the tanker.

1. Remove fill plug cam lock fitting located next to 3-way emulsion valve (see page 3 for location).

2. Hook up the female cam lock coupler to valve fitting.

NOTE: Emulsion valve has teflon insert. DO NOT use torch or flame to heat the valve or this insert will be damaged!

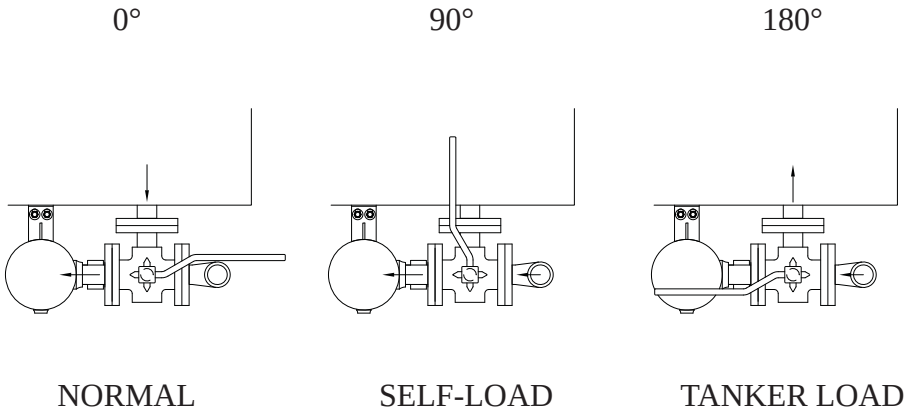
3. Turn 3 way emulsion valve handle (next to fitting) to 180° position to allow emulsion to flow directly into emulsion tank.

4. Fill tank to desired level.

5. Turn emulsion valve back to the 0° position.

6. Close emulsion valve on supply tanker.

7. Release cam lock fitting from Macropaver.



Loading Procedures - Self-Loading Valve (cont'd)

Self Loading The Macropaver With Emulsion

1. Start the truck engine and run at 1000 - 1500 RPM to warm up the emulsion pump. The emulsion pump center section must be hot (approximately 80° C - 180° F) before starting the pump. Start the Macropaver engine.

2. Remove fill plug cam lock fitting located next to 3 way emulsion valve (see page 3 for location).

3. Hook up the female cam lock coupler to valve fitting.

NOTE: Emulsion valve has teflon insert. DO NOT use torch or flame to heat the valve or this insert will be damaged!

4. Turn emulsion valve handle (next to fitting) to 90° position to allow emulsion to be pumped into emulsion tank through emulsion strainer and pump.

5. With the Macropaver now warmed up, adjust the "EMULSION PUMP SPEED" control to about 600 RPM. Pump speed can be adjusted to fit the desired filling speed. Faster speed will not damage pump. If emulsion has lumps, the pump can become noisy and stall, so run the pump at more than 450 RPM if this occurs.

NOTE: If, while loading material, emulsion pump starts making excessive noise and still runs, but does not seem to be pumping, reduce pump RPM immediately. DO NOT run emulsion pump over 350 RPM under these conditions, as pump is probably cavitating.

6. Fill tank to desired level.

7. Turn emulsion valve back to 0° position.

8. Close emulsion valve on supply tanker.

9. Release cam lock fitting from Macropaver.

Appendix

1. John Deere Diesel Engine Operation and Maintenance Manual

2. Emulsion Pump Installation, Operation and Maintenance Manual

3. Water Pump Installation, Operation, Maintenance and Parts Bulletin

4. Additive Pump Operating, Maintenance and Parts Bulletin (Optional Equipment)

5. High Pressure Washer Operating, Maintenance and Parts Bulletin (Optional Equipment)

6. Hose Reel Operating, Maintenance and Parts Bulletin (Optional Equipment)

7. Pintle Hitch Operating, Maintenance and Parts Bulletin (Optional Equipment)

8. Tarp System Operating and Parts Bulletin (Optional Equipment)

9. Rear Camera System Operation Guide (Optional Equipment)

Emulsion Spray Bar - Optional Equipment

Setting Up & Operating Emulsion Spray Bar

1. Load appropriate emulsion into emulsion tank.

2. Mount spray bar into the end of the box lift. Remove diverter cylinder from box lift and mount it to emulsion spray bar. Install stroke limiter tube onto cylinder rod.

3. Disconnect emulsion line from the inlet hopper and connect it to the inlet (female camlock connected to bottom of spray bar) of the emulsion spray bar using extension hose provided..

4. Connect the outlet (male camlock connected to top of spray bar) of the emulsion spray bar to the fitting by the gate valve at the rear of the Macropaver using extension hose provided.

5. Make sure additive and water pump switches are OFF. Disconnect the rod end of the water/additive sequence cylinder from the sequence valves. This will keep the water/additive sequence valves from opening during spraying operation. MAKE SURE the cylinder hangs down slightly and that the rod will not hit anything as it extends.

6. Remove coupling chain from chain coupler between the conveyor clutch and conveyor gearbox. This will keep the conveyor from turning during spraying operation.

7. Turn "EMULSION PUMP/AGG. CONVEYOR SPEED" control so emulsion pump is operating about 400 - 500 RPM.

8. Start spraying emulsion by pressing the Main Start Trigger on the Joystick Control Handle and moving the Joystick Handle right (cylinder retracting) to open the spray bar valves.

9. Test the spray bar flow and adjust by turning the gate valve at the back of the Macropaver. Opening the gate valve will decrease flow and closing will increase flow. This valve restricts the flow of emulsion exiting the spray bar thereby imparting a back pressure into the spray bar. Do NOT close the gate valve too far or excess pressure will be developed in the emulsion system.

10. To stop spray bar flow, press the move the Joystick Handle left (cylinder extending) to close the spray bar valves. And, when done spraying, stop flow of emulsion to the spray bar by pressing the Main Start Trigger on the Joystick Control Handle.

IMPORTANT: Flush spray bar system with water and/or asphalt release agent immediately after use. If system is not flushed immediately, the system could clog and damage the pump or plumbing or the valves could stick and become damaged upon next use..