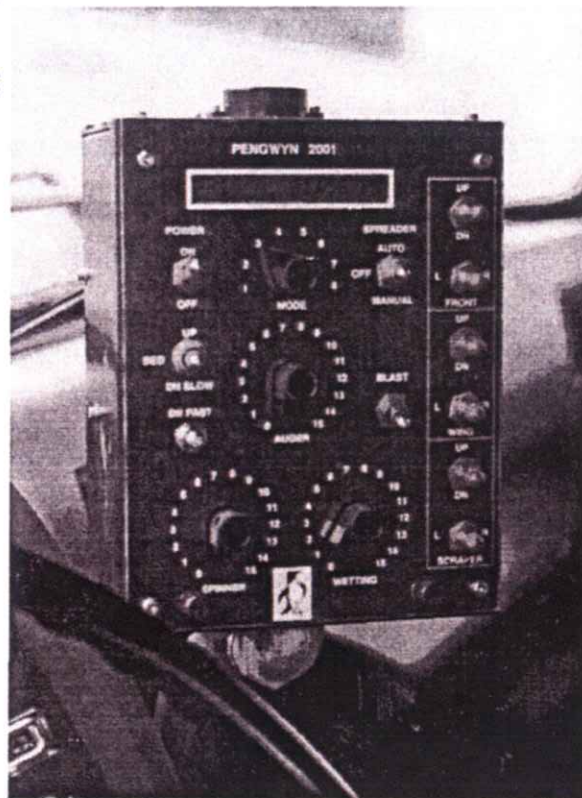


PENGWYN 1995 TECHNICAL MANUAL 2003 SYSTEM



Models:
2001
2002
2003

PENGWYN
2550 West Fifth Avenue
Columbus, Ohio 43204-3815
(614) 488-2861
(800) 233-7568
Fax: (614) 488-0019

WELCOME to the "State Of The Art" Pengwyn ground oriented central hydraulic system for snow and ice trucks. The Pengwyn system has been designed to be the safest, most reliable, and most feature beneficial ground oriented system available on the market.

This manual has been printed for the use of the end user's management, maintenance personnel and equipment operators. Its purpose is to provide instructions for operation and required customer calibration and diagnostics. Pengwyn offers free and in depth training. With the assistance of this manual, the end user will be responsible for performing all the procedures. Pengwyn also offers free over the phone technical assistance. If you have questions, please call us at 1-800-233-7568. We will be happy to assist you.

LIMITED WARRANTY

Pengwyn warrants products of its manufacture to be free of defects in material and workmanship, under normal use and service for a period of two (2) years from date of shipment. Pengwyn's obligation under this warranty is limited to repairing or replacing at its factory, or other location designated by Pengwyn, any part or parts thereof which are returned within thirty (30) days of the date when failure occurs or defect is noted, with transportation charges prepaid, and which upon examination appears to Pengwyn's satisfaction to have been defective. **Such free repair or replacement does not include transportation charges, or the cost of installing the new part or any other expense incident thereto. Pengwyn will not be liable for other loss, damage, or expense directly or indirectly arising from the use of its products, nor will Pengwyn be liable for special, incidental or consequential damages.**

Ordinary wear and tear, and damage from abuse, misuse, neglect or alteration are not covered by this warranty. Pengwyn assumes no liability for expenses incurred or repairs made outside Pengwyn's factory except by written consent. Pengwyn's warranty also does not cover the requirement of control box programming. All control box programming is to be performed by the end user after receiving training and with the use of the technical manual. This warranty is null and void if instructions and operating procedures are not followed.

Equipment or parts not manufactured by this company, but which are furnished in connection with Pengwyn products, are covered directly by the warranty of the manufacturer supplying them. However, Pengwyn will assist in obtaining adjustment on such equipment or parts when necessary.

It is recommended that spare parts be purchased for critical items to allow continued operation of equipment during the inspection, evaluation, or repair/replacement process.

THIS WARRANTY IS IN LIEU OF ALL OTHER WARRANTIES EXPRESSED OR IMPLIED INCLUDING ANY IMPLIED WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE AND OF ANY OTHER OBLIGATION OR LIABILITY OF PENGWYN.

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Pengwyn reserves the right to make any changes in or improvements on its products without incurring any liability or obligation whatever and without being required to make any corresponding changes or improvements in products previously manufactured or sold.

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CAUTION

DISCONNECT AMPHENOL PLUG FROM MANIFOLD AND REMOVE CONTROL CONSOLE FROM THE CAB BEFORE WELDING ON THE TRUCK.

DO NOT OVER TIGHTEN SOLENOID COIL NUT - THE COIL SPINDLE IS HOLLOW AND EASILY DAMAGED. ALSO, BE CAREFUL NOT TO PINCH WIRES UNDER COIL WHEN INSTALLING.

TURN THE CONTROL CONSOLE POWER SWITCH OFF BEFORE CONNECTING AND DISCONNECTING BATTERY CABLES, BATTERY CHARGERS, OR JUMPING THE BATTERY.

DO NOT DRILL HOLES IN NOR MOUNT AUXILLARY SWITCHES TO THE CONTROL CONSOLE. THIS WILL VOID WARRANTY. USE THE CONTROL CONSOLE MOUNTING BRACKET FOR THIS PURPOSE.

**PENGWYN
DO IT BETTER!**

INTRODUCTION

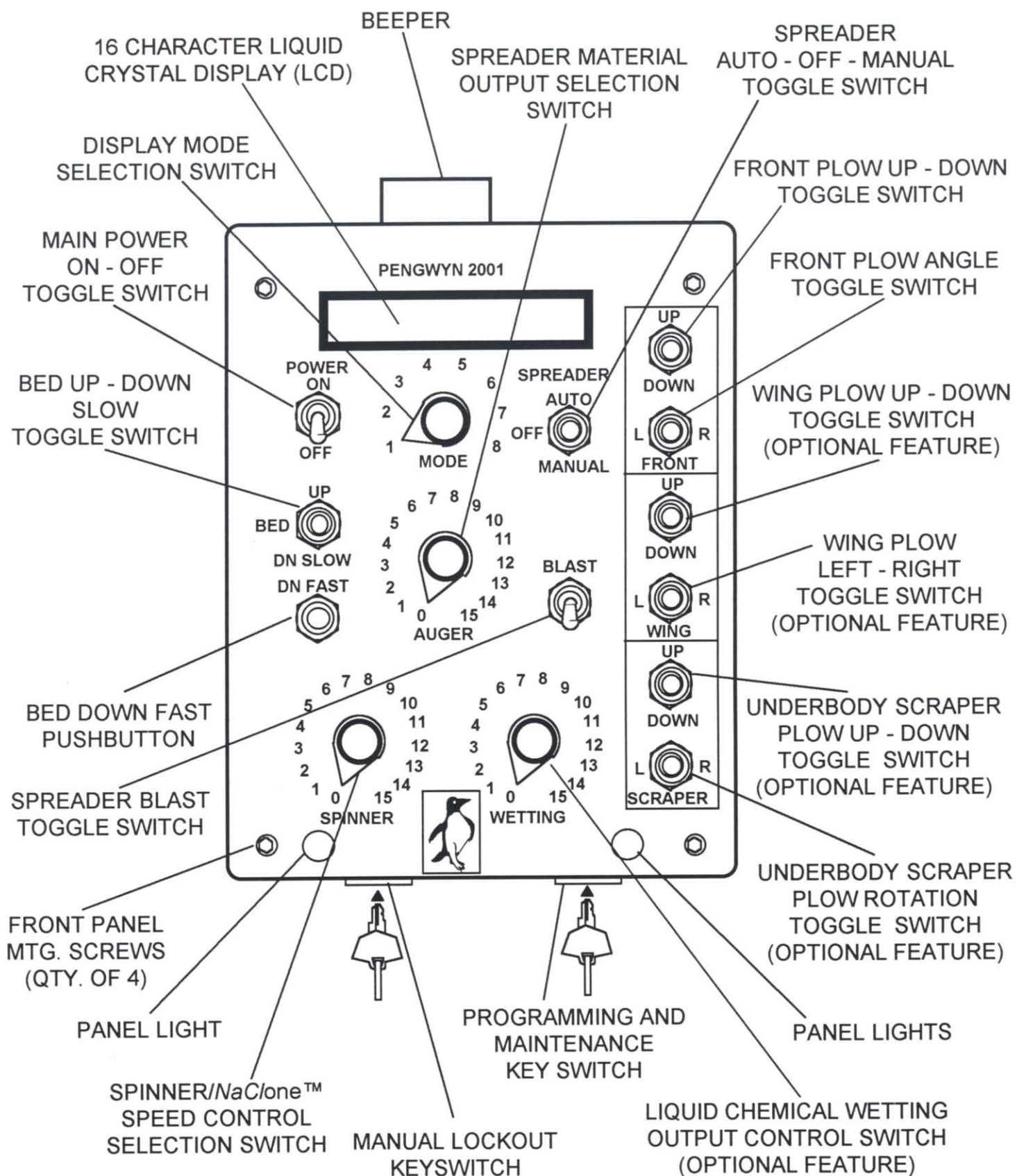
The Pengwyn is a central hydraulic system incorporating an electronically operated, ground oriented granular material spreader system for trucks utilized in snow and ice control. Through the use of an onboard computer, the ground oriented material spreader allows the operator, through management programming, to set a desired material spread rate and then will automatically adjust and maintain this setting throughout the vehicle speed range, therefore, maintaining a consistent pounds per mile application rate. The major advantages are; improved operating efficiencies, a reduction in material usage, faster coverage of ice and snow covered roadways and safer operation of the snow truck. An electronic ground oriented material spreader system is estimated to reduce your annual salt usage by as much as 20 to 40%.

The general design of the Pengwyn system offers major advantages in the areas of safe operation, cost effective operation, reliability, maintenance, diagnostics and simple operation. The Pengwyn system uses the rugged Autosucker™ dry valve design fixed displacement "on demand" gear pump to generate hydraulic flow to a series of digital poppet-style solenoid cartridge valves which direct the oil flow to the appropriate function. The poppet-style solenoid cartridge valve is inherently reliable, always repeatable, extremely dirt tolerant, insensitive to long periods of sitting idle, inexpensive to repair and contains only static seals. A poppet valve is a bang-bang solenoid device which means that it is either on or it is off. With a poppet-style solenoid cartridge, digital hydraulics and digital electronics, no feathering or external speed pick-up devices are required to vary function output flow. If the poppet valve of a particular function should malfunction, it is a simple task to diagnose the faulty valve, remove the individual valve and either clean or replace it without disconnecting any plumbing connections or disturbing any other valve or function in the assembly and can be done from inside the cab which is a much more favorable environment. This process would typically take very little time. A poppet-style solenoid cartridge valve used in a series circuit arrangement also does not require large pump displacements and high flows to achieve the required performance and will allow simultaneous operation of functions.

The Pengwyn system also incorporates several automatic system monitoring alarm functions which allow the operator to stay abreast of the system operation without having to constantly monitor material output or operate with the bed of the truck constantly in the up position. These alarms were originally designed into the system specifically at the request of the Ohio Department of Transportation due to their concerns over safety and to reduce their liability position.

Remember, Pengwyn technology does not use standard mobile type hydraulic components that have been adapted to snow truck applications. The Pengwyn system was designed specifically for snow truck applications with the input of management, drivers and mechanics from various D.O.T's. and addresses their concerns with safety, reliability, simplicity of operation, maintainability, operational efficiency and reduced material usage. The Pengwyn system has grown to become "the most feature beneficial system currently available".

CONTROL CONSOLE FRONT PANEL



OPERATION OF CONTROL CONSOLE

MAIN POWER SWITCH

Turn the main power switch to the "ON" position. The panel lights will come on and the display will flash the current software update. For example, the display will temporarily show:

2003 VERSION 2.2

After that, the display will show the information dictated by the position of the mode selection switch.

NOTE: The programming key should be in the "RUN" position before powering off the console.

MODE SELECTION SWITCH

The position of the mode switch determines what information is shown on the liquid crystal display (LCD). The mode switch will display the following information:

POSITION 1 - DISPLAYS THE VEHICLE SPEED IN MILES PER HOUR (MPH).

MILES/HOUR XX

POSITION 2 - DISPLAYS THE POUNDS PER MILE OF MATERIAL OUTPUT AT THE SPREADER.

POUNDS/MI XXXX

POSITION 3 - DISPLAYS THE DAY AND TIME.

MON 11:38 AM

POSITION 4 - POSITION 4 ALLOWS THE TRUCK TO BE USED FOR DISTANCE MEASURING AND WILL DISPLAY THE DISTANCE TRAVELED IN FEET. TO USE THIS FUNCTION, THE SPREADER MUST BE IN THE OFF POSITION. WHEN THE TRUCK COMES TO THE STARTING POINT OF THE DISTANCE TO BE MEASURED, HIT AND HOLD THE BLAST SWITCH UNTIL THE DISPLAY READS:

START FEET XX

AND THEN RELEASE. THE DISTANCE, IN FEET, TRAVELED WILL BEGIN TO INCREASE ON THE DISPLAY. CONTINUE DRIVING THE TRUCK UNTIL THE END OF THE DESIRED MEASUREMENT IS REACHED. AGAIN, HIT THE BLAST SWITCH. THE DISPLAY WILL SHOW:

STOP FEET XXXX

IF YOU WOULD LIKE TO SEE THIS DISTANCE DISPLAYED IN MILES, TURN THE MODE SELECTION SWITCH TO POSITION 5. TO CLEAR THE STORED MEASUREMENT, TURN THE MODE SELECTION SWITCH TO POSITION 6.

POSITION 5 - SAME AS POSITION 4, EXCEPT, THE DISTANCE IS SHOWN IN MILES INSTEAD OF FEET. THE OPERATION IS THE SAME AS POSITION 4.

POSITION 6 - POSITION 6 IS USED FOR DATA LOGGING. THE CONTROL CONSOLE WILL STORE THE TOTAL POUNDS OF MATERIAL SPREAD AND THE TOTAL MILES TRAVELED WHEN THE SPREADER SWITCH IS ON.

XX M XX P

IF THE SPREADER SWITCH IS TURNED "OFF", THE DATA ACCUMULATION STOPS, BUT, THE INFORMATION IS HELD IN MEMORY. WHEN THE SPREADER SWITCH IS TURNED BACK ON, THE DATA ACCUMULATION CONTINUES. THE NEW DATA IS ADDED TO THE DATA HELD IN MEMORY. THE STORED DATA IS DISPLAYED BY TURNING THE MODE SELECTION SWITCH TO POSITION 6. TO CLEAR THE STORED DATA, TURN THE MODE SWITCH TO POSITION 6, TURN THE SPREADER OFF AND HIT THE BLAST BUTTON. THE DISPLAY RETURNS TO "0".

POSITION 7 - DISPLAYS THE HYDRAULIC SYSTEM PRESSURE IN POUNDS PER SQUARE INCH (PSI).

PRESSURE = XXXX

POSITION 8 - DISPLAYS THE HYDRAULIC RESERVOIR TEMPERATURE IN °F.

FLUID TEMP XXXX

BED SWITCHES

Push the bed switch to the "UP" position to raise the bed. To lower the bed slowly, push the bed switch to the "DN SLOW" position. To lower the bed fast, push the bed switch to the "DN SLOW" position and simultaneously push the "DN FAST" button.

FRONT PLOW SWITCHES

To raise the front plow, push the front plow up - down switch to the "UP" position. To lower the front plow, push the switch to the "DOWN" position. To rotate the front plow, push the front plow angle switch to the "L" position to rotate left and to the "R" position to rotate right.

WING PLOW SWITCHES (OPTIONAL FEATURE)

This is an option that may not be used on all trucks. To raise the wing plow, push the wing plow up - down switch to the "UP" position. To lower the wing plow, push the switch to the "DOWN" position. To pull the wing plow in, push the wing plow left - right switch to the "L" position. To extend the wing plow, push the wing plow left - right switch to the "R" position.

UNDERBODY SCRAPER PLOW SWITCHES (OPTIONAL FEATURE)

This is an option that may not be used on all trucks. To raise the underbody plow, push the underbody plow up - down switch to the "UP" position. To lower the underbody plow, push the switch to the "DOWN" position. To rotate the underbody plow, push the underbody plow - left right switch to the "L" position to rotate left and to the "R" position to rotate right. **NOTE:** The Pengwyn system incorporates a timing circuit on the underbody scraper plow that is activated when the plow down switch is engaged and is deactivated when the plow up switch is engaged. The timing circuit in combination with an accumulator, allows an automatic, constant and continuous down pressure to be applied to the scraper and requires no operator input to maintain a down force on the scraper plow.

DIGITAL OPEN LOOP AUTOMATIC SPREADER CONTROL

With the spreader switch in the "OFF" position, the spreader system is in the de-activated mode and will not function. To operate in the automatic, ground oriented mode, push the spreader switch to the "AUTO" position. Use the spreader material output selection switch to select the desired material output rate in pounds per mile. This switch has 16 possible selections from "0" to "15". In "0", no material output will be obtained. In positions "1" through "15", the rate of material output, in pounds per mile, is determined by the rate that has been programmed into that particular number's position. For example, position "1" could be programmed at 50 pounds per mile, position "2" could be programmed at 100 pound per

mile, and so on. These settings are determined and programmed into the console by the customer (see programming section). With the mode switch in position "2", the rate of application will be displayed on the LCD. To control a standard broadcast type spinner, use the spinner speed control selection switch. In position "0", the spinner will not turn. By turning the spinner selection switch to position "1", the digital spinner will turn at a very slow rate of speed. Increasing the setting to higher numbers will progressively increase the spinner speed. **DO NOT USE POSITION "15" ON A CONVENTIONAL BROADCAST STYLE SPINNER. POSITION "15" MAKES THE SPINNER GROUND ORIENTED AND IS ONLY USED WITH THE NaClone™ ZERO VELOCITY STYLE SPINNER OPTION.** If using a NaClone™ zero velocity ejector, the spinner speed control switch should be set at position "15" whenever operating in the automatic spreader mode.

DIGITAL OPEN LOOP MANUAL SPREADER CONTROL

NOTE: The manual system is locked out and will not function if the manual lockout key switch is in the "OFF" position. To operate the spreader in manual, the key must be turned to the "ON" position. The purpose of the manual spreader override is to by-pass the processor and allow continued operation of the system should some computer problem occur. To operate in manual, turn the spreader switch to "MANUAL". Use the spreader material output selection switch to activate the auger/conveyor. In manual, the position numbers on this switch are equal to the amount of hydraulic flow, in gallons per minute (GPM), being sent to the auger/conveyor drive motor. For example, position "1" would be 1 GPM, position "2" would be 2 GPM, and so on up to 15 GPM. In manual, the material output is no longer ground oriented. The auger/conveyor turns at a fixed speed based on the setting of the spreader material output switch. In manual, the position numbers of the spinner speed control switch also are equal to the amount of hydraulic flow, in gallons per minute, being sent to the spinner drive motor. This would be the same for both a conventional broadcast style spinner and for the NaClone™ zero velocity ejector.

LIQUID CHEMICAL WETTING (OPTIONAL FEATURE)

Liquid chemical wetting is an optional feature. For those trucks equipped with this option, liquid chemical wetting pumps a liquid from an on board storage tank onto the granular material at the spinner. In the automatic spreader mode, the output is ground oriented and is controlled in a gallons per ton ratio of liquid to granular material. The maximum gallons per ton ratio is a number selected and programmed into the console by the customer (see programming section). The liquid chemical wetting output control switch is used to vary the output ratio. The numbers on this switch represent the percent of the maximum gallons per ton ratio number programmed into the console. For example, assume that the maximum ratio number is 10 gallons per ton. Position "0" would be 0% of maximum and no liquid flow would occur. Position "2" would be 20% of maximum and a ratio of 2 gallons per ton would be sprayed onto the granular material. The increase in ratio would progressively continue up to position "10" which is 100% of maximum. At this point, a 10 gallon per ton ratio would occur. Turning the liquid chemical switch beyond position "10" in the automatic spreader mode will not give any further increase in wetting to granular ratio. In automatic, the wetting system also incorporates chemical pump slip compensation. When operating the spreader in manual, the position numbers of the liquid chemical wetting switch are equal to the amount of hydraulic flow, in gallons per minute (GPM), being sent to the wetting system. For example, position "1" would be 1 GPM, position "2" would be 2 GPM, and so on up to 15 GPM. In manual, the wetting output is no longer ground oriented.

HYDRAULIC TOOL MODE

The Pengwyn system is capable of operating hydraulic tools. To hook-up hydraulic tools, connect the pressure hose of the tool to the pressure side of the auger circuit and the return hose of the tool to the return side of the spinner circuit. Turn the manual lockout key switch to the "ON" position. Turn the mode switch to position "4". The LCD will read:

TOOL MODE

With the tool connected, push the spreader switch to manual. Bring the truck engine speed up to about 1000 RPM. Use the spreader material output switch to select the proper flow of hydraulic fluid required by the hydraulic tool. The numbers on this switch are equal to the amount of hydraulic flow, in gallons per minute, being sent to the hydraulic tool. Refer to the tool manufacturers literature to determine the proper flow requirements.

WARNING ALARMS

LOW FLUID -

When the spreader auto-off-manual switch is in the "MANUAL" or "AUTO" position, the control box will produce an audible beep. The LCD will also flash:

LOW FLUID

regardless of the spreader switch position. This is indicating that the reservoir tank is low on hydraulic fluid. While all functions will continue to work as long as there is some oil in the reservoir, the spreader switch should be turned to the "OFF" the beep will stop but the "LOW FLUID" display will continue. The truck should be immediately returned to the shop for inspection/repairs .

HIGH TEMPERATURE -

The control box will produce an audible beep and the LCD will flash:

FLUID TEMP XXX

This is indicating that the hydraulic system has exceeded the maximum recommended operating temperature indicating some type of problem. The truck should be returned to the shop.

SPREADER ALERT -

The control box will produce an audible beep and the LCD will flash:

SPREADER ALERT

This is indicating that the auger/conveyor drive motor has unloaded. The main cause of this alarm is an empty spreader box or out of material condition. Other causes could be tunneling/bridging, a broken mechanical connection between the drive motor and the auger/conveyor, a blown hose on the auger/conveyor drive motor or a drive motor that has changed in mechanical efficiency from it's new condition to a used condition. Spreader alert is indicating that no material output is occurring.

SPREADER JAM -

The control box will produce a rapidly repeating audible beep and the LCD will flash:

SPREADER JAM

This is indicating that the auger/conveyor has jammed and that no material output is occurring. Spreader jam would also occur if a quick disconnect on the auger/conveyor drive motor is not connected.

CONTROL CONSOLE DIAGNOSTIC FEATURES

CAUTION: Always return the programming key to the "RUN" position before turning the console power switch off or the truck key switch off. Turning the power off before resetting the programming key may cause the loss of some of the newly programmed numbers.

TEMPERATURE SENSING

The Pengwyn control console will read and display the hydraulic reservoir temperature. Turn to mode "7" to read the temperature. The LCD will show:

FLUID TEMP XXX

Push the spreader switch to "AUTO" and wait approximately 10 seconds. This allows the pump to circulate reservoir fluid through the manifold to the temperature sensor. The temperature now displayed is the reservoir temperature.

PRESSURE SENSING

The Pengwyn control console will read and display the hydraulic system pressure. To read system pressure, push the spreader auto-off-manual switch to "OFF", start the engine and run at the desired engine speed. Turn the mode switch to "8." Push the spreader switch to "MANUAL". The LCD will show:

PRESSURE = XXXX

The pressure displayed is the pressure required to push pump flow through the manifold, compensator valves, the pump by-pass valve and return line hosing. Operate any hydraulic function and the pressure required to move the function will be displayed. By running the cylinders to the end of their stroke or disconnecting the spreader system quick disconnects, the pressure setting of the relief valve protecting the specific function will be displayed.

PRE-TRIP TEST

The Pengwyn control box's initial procedure is a pre-trip testing of its control functions.

Upon initialization, the display prompts the operator to set the RPM to 1,500 and to lift the plow cylinder and hold. This procedure will test the temperature sensor and both pressure transmitters. Continuing to hold will also test all of the programmed constants to see if they are all rational. The control will then beep indicating that the display constants check out.

If the initial Pengwyn prompt is ignored three times the unit will revert to its normal mode of operation.

CONTROL CONSOLE PROGRAMMING

CAUTION: Always return the programming key to the "RUN" position before turning the console power switch off or the truck key switch off. Turning the power off before resetting the programming key may cause the loss of the newly programmed numbers.

NOTE: The speed constant and the distance measuring constant are the same. Either method can be used to program the control console to the truck speedometer. Using the measured mile method with distance measuring is the most accurate. See the Pre Winter Check List on page 8-2 for recalibration.

SETTING THE SPEED CONSTANT BY THE SPEEDOMETER METHOD

Turn the programming key to the "CALIBRATE" position. Turn the mode selection switch to position "1". The display will read :

CAL MPH

Drive the truck at a constant speed of 30 MPH or more. Use the truck speedometer, not the control console, to determine the truck speed. Compare the truck speedometer to the speed shown on the console LCD. **NOTE:** If the LCD continues to display "0", a jumper change may need to be made to the control console (see page 7-1). To adjust the speed of the console to match the speed of the truck speedometer, push the bed switch to the "UP" position to increase the displayed console speed or to the "DN SLOW" position to decrease the displayed console speed. The speedometer setting is now complete. Turn the mode selection switch to position "4". Record the number shown for your records. Repeat process in 2nd ratio if using a 2-speed rear end.

SETTING THE SPEED CONSTANT BY THE DISTANCE MEASURING METHOD

***Using A Surveyed Mile:** Turn the programming key to the "CALIBRATE" position. Turn the mode selection switch to position "4". The display will read:

PULSES/.1MI XXXX

(the XXXX indicates some number which could be anything from 0 to 5000). Drive the truck towards the starting point of the measured mile. When hitting the starting point, push up on the blast switch. The LCD will instantaneously show:

CAL MILE

and then will begin increasing as the truck continues toward the mile marker. When reaching the end of the measured mile, again push up on the blast switch. The LCD will now show the number of pulses the console counted over the measured mile. The console speedometer setting is now complete. Record the number shown for your records.

***Using A Known Constant:** Turn the programming key to the "CALIBRATE" position. Turn the mode selection switch to position "4". The display will read:

PULSES/.1MI XXXX

(the XXXX indicates some number which could be anything from 0 to 5000). If the correct pulse count is known, this number can be directly inserted without having to drive the truck. Pushing the bed switch to the "UP" position will increase the number displayed. Pushing the bed switch to the "DN SLOW" position will decrease the number displayed. If a large number change must be made, pushing the front plow up-down switch to the "DN" position while simultaneously pushing the bed switch "UP" or "DOWN" will change the displayed number in increments of 100. When the correct number is achieved, the speedometer setting is complete.

SETTING THE MINIMUM VALUE

When operating in the automatic mode, the Pengwyn system is set up to send a minimum flow value to the auger/conveyor drive motor, regardless of the amount of material output requested. This is to compensate for volumetric inefficiencies of the drive motor and assure that the system puts material out of the spreader when starting the truck from a dead stop. To set the minimum value number, turn the programming key to the "CALIBRATE" position. Turn the mode selection switch to position "2". Push the front plow up-down switch to the "UP" position. The display will read:

MINIMUM VALUE X

While holding the plow switch, push the bed switch "UP" to increase the displayed number or "DN SLOW" to decrease the displayed number. The minimum value number is adjustable from 1 to 5. For most applications, the minimum value should be set at 1. Record the minimum value number for your records.

SETTING THE NaClone™ ZERO VELOCITY EJECTOR CONSTANT

This is an option that may not be used on all trucks. If your truck uses a conventional broadcast type spinner, ignore this programming procedure. The "CAL SPIN" setting is the truck speed at which the zero velocity ejector achieves maximum hydraulic flow. This speed must be programmed into the console. To check for the correct setting the first time the truck is programmed, decide what the desired maximum spreading speed will be. Plug this number into the console and then do a trial run to see if maximum effectiveness is achieved. Once the correct number is decided, record the number for your records. To set the ground oriented NaClone™, turn the programming key to the "CALIBRATE" position. Turn the mode selection switch to position "2". Push the front plow up-down switch to the "DOWN" position. The LCD will read:

CAL SPIN XX

While holding the front plow switch, push the bed switch to "UP" to increase the number or "DN SLOW" to decrease the number. Once the desired number is set, this setting is complete.

SETTING THE GROUND ORIENTED LIQUID CHEMICAL WETTING

This is an option that may not be used on all trucks. If your truck does not use ground oriented wetting, ignore this programming procedure. To set this constant, first determine the maximum gallons of liquid per ton of granular material ratio that is desired. For example, the ratio might be 10 gallons per ton. To set this number in the console, turn the programming key switch to "CALIBRATE". Turn the display mode switch to position "7". The LCD will read: Push "UP" on the bed switch to increase the number or "DN SLOW" to decrease the number until the desired value is

WETTING MAX XX.X

obtained. Record the wetting max number for your records. Next, push the front plow up-down switch to "UP". The LCD will read:

This number is adjustable from 0 to 3. On the Pengwyn supplied wetting components, this number will typically be 1. To

PUMP SLIP GPM X

adjust this number, while holding the plow switch, push the bed switch "UP" to increase or "DN SLOW" to decrease. Record the pump slip number for your records. Finally, push and hold the blast button. The LCD will read:

For the Pengwyn supplied wetting components, this number will typically be .39. To adjust this number, while holding the

WET CONST .XX

blast button, push the bed switch "UP" to increase or "DN SLOW" to decrease. Record the pump slip number for your records. The wetting program is complete.

SETTING THE DAY AND TIME

Turn the programming key to the "CALIBRATE" position. Turn the mode selection switch to position "3". The LCD will read:

CAL DAY XXX

(XXX represents the day, ie, SUN, MON, etc.). Push the bed switch to "UP" until the correct day is shown. Now, push the front plow angle switch to "L". The LCD will read:

CAL HRS XX:XX A

While holding the front plow switch, push the bed switch to "UP" to change the displayed hours and the displayed AM or PM. This works on a 24 hour clock and is set the same as a digital watch. When this is set correctly, push the front plow angle switch to "R". The LCD will read:

CAL MIN XX:XX A

While holding the front plow switch, push the bed switch to "UP" to change the displayed minutes. This works on a 60 minute clock and is set the same as a digital watch. When this is set correctly, the day and time setting are complete.

CAUTION: Always return the programming key to the "RUN" position before turning the console power switch off or the truck key switch off. Turning the power off before resetting the programming key may cause the loss of some of the newly programmed numbers.

SETTING SPREADER ALERT

NOTE: This procedure must be done every time a control console is changed. The procedure should be repeated from time to time as a standard maintenance check to adjust for auger/conveyor motor wear. The procedure should also be done anytime the auger/conveyor motor is changed or the design of the spreader is changed. This is to prevent nuisance auger fault alarms.

With the engine running and the **spreader box or conveyor belt empty of material**, turn the programming/maintenance key to "MAINT.". Push the spreader switch to "MANUAL" and wait approximately 10 seconds. Push the spreader switch to "OFF". Read the temperature on the LCD. If the temperature is below 80°, the hydraulic oil must be warmed-up to 80°. If the temperature is at or above 80°, continue with the programming procedure. To warm up the hydraulic oil, bring the truck engine speed to 1,500 RPM. Push the spreader switch to "MANUAL". Turn both the spreader material output switch and the spinner speed control switch to position "15". Push the front plow up-down switch to the "UP" position and hold. Periodically, push the spreader switch to the "OFF" position and read the temperature on the LCD. If it is below 80°, switch the spreader switch back to "MANUAL" and continue holding the plow switch "UP". Repeat this until the temperature is at or above 80°. Once the proper temperature is achieved, release the plow switch, maintain the 1,500 RPM engine speed, turn the spreader switch to "OFF", turn the spreader material output switch and the spinner speed control switch to "0", and then push the spreader switch to "AUTO". The LCD will read:

SETTING 1 = XXX

Then the LCD will read:

SETTING 2 = XXX

The displayed pressure readings should slightly increase for each progressive setting. This will continue, automatically, up to:

SETTING 15 = XXX

The LCD will then read:

FINISHED

and then:

TURN SPREAD OFF

Turn the spreader switch to "OFF" and lower the engine speed. The spreader alert is now set.

NOTE: As the automatic spreader alert settings advance, write down a few of the settings so they can be checked in the next programming step.

CHECKING THE SPREADER ALERT

To assure the auger fault programming numbers were maintained in memory, the program numbers can be reviewed. To review these numbers, turn the programming key switch to "CALIBRATE", turn the spreader material selection switch to position "1", and momentarily push the front plow angle switch to the "R" position. All of the spreader alert programming numbers will flash across the LCD. Check these to the numbers that were written down. If they match, the numbers held. If the numbers did not hold, repeat the spreader alert procedure. If they still do not hold, replace the control console.

SETTING SPREADER JAM

Spreader jam is the pressure setting at which the control box will alarm the operator that the auger/conveyor has jammed or locked up. Spreader jam is typically set at about 2300, but, should be set at about 200 psi below the main relief valve setting. To set this number, turn the programming key to the "CALIBRATE" position. Turn the mode selection switch to position "2" and push the front plow angle switch to the "R" position. The LCD will read:

CAL JAM XXX

While holding the plow switch, push the bed switch to the "UP" position to increase the setting and to the "DN SLOW" position to decrease the setting. The numbers will change in increments of 10. Record the spreader jam number for your records.

SETTING MATERIAL LOAD

The auger drag setting determines the amount of material remaining on the auger or conveyor when the spreader alert alarm goes off. To set the material load, turn the programming key to the "CALIBRATE" position. Turn the mode selection switch to position "2" and push the front plow angle switch to the "L" position. The LCD will read:

MATR LOAD XX

This number will typically be set at between 50 and 120. It varies with the type and make of spreader used on the truck. While holding the front plow switch, push the bed switch to the "UP" position to increase the setting and to the "DN SLOW" position to decrease the setting. Record the material load number for your records.

CHECKING THE MATERIAL LOAD

With material on the spreader box or the conveyor, start the engine and bring the engine speed up to about 1,500 RPM. Turn the manual lockout key to "ON" and the programming key to "RUN". Turn the spreader material selection switch to position "15". Push the spreader switch to manual. Allow the system to run until the spreader alert alarm goes off and immediately push the spreader switch to "OFF". Go back and check the amount of material left on the auger/conveyor. If too much material remains, lower the auger drag number. If too little material remains, raise the auger drag number.

SETTING THE AUTOMATIC SPREADER CONTROL

When operating the spreader in automatic, positions "1" through "15" on the spreader material output selection switch determines the spreader output rate in pounds per mile. Each individual position must have the desired output rate programmed into it. The number programmed into each setting determines the available spreader rates the operator has to choose from and it is up to the end user to determine the programmed rates they wish to make available to the operator. To program, turn the programming key switch to the "CALIBRATE" position and the mode switch to position "2". Turn the spreader material selection switch to the position to be programmed ("1" through "15"). Each position must be individually set. The LCD will read:

AUGER XX- XX

To increase the setting, push the bed switch to "UP" and to decrease the setting, push the bed switch to "DN SLOW". The numbers will change in increments of 10. Record the spreader settings for each position for your records. **NOTE: If '0' is programmed into any setting, the auger/conveyor will not turn when that setting is selected.**

FINDING THE SPREADER CONSTANT

NOTE: To find the spreader constant, material must be in the bed of the truck and the spreader system attached and operable.

To find the spreader constant programming number, first get an empty bucket capable of holding from 30 to 90 lbs. of your granular de-icing material. Weigh the empty bucket. Position the bucket under the output of the spreader so that as the auger/conveyor turns, the material will all fall into the bucket. Make sure that material is distributed over the entire spreader box or conveyor belt. With a V-box hopper, the gate opening must be adjusted to the position the truck will be operated. If the gate opening is changed, the new auger constant number must be found or the spreader system accuracy will no longer be maintained. To find the auger constant, turn the manual lockout key switch to the "ON" position and the programming key switch to the "RUN" position. Start the engine and bring the engine speed to 1000 RPM. Turn the spreader material output switch to position "1" and the spinner speed control switch to position "0". With a stop watch in hand, push the spreader switch to "MANUAL" and start timing. Allow the system to run for **one minute** and turn the spreader switch to "OFF". Turn the engine off. Weigh the bucket of material. Run the test again in manual spreader rate "2." Weight that amount and subtract the weight of "1" from "2." The resulting number is the spreader constant. Record this number for your records.

SETTING THE SPREADER CONSTANT

To insert the spreader constant into the control console, turn the programming key to "CALIBRATE". Turn the mode selection switch to position "2". Turn the spreader material output switch to position "0". The LCD will read:

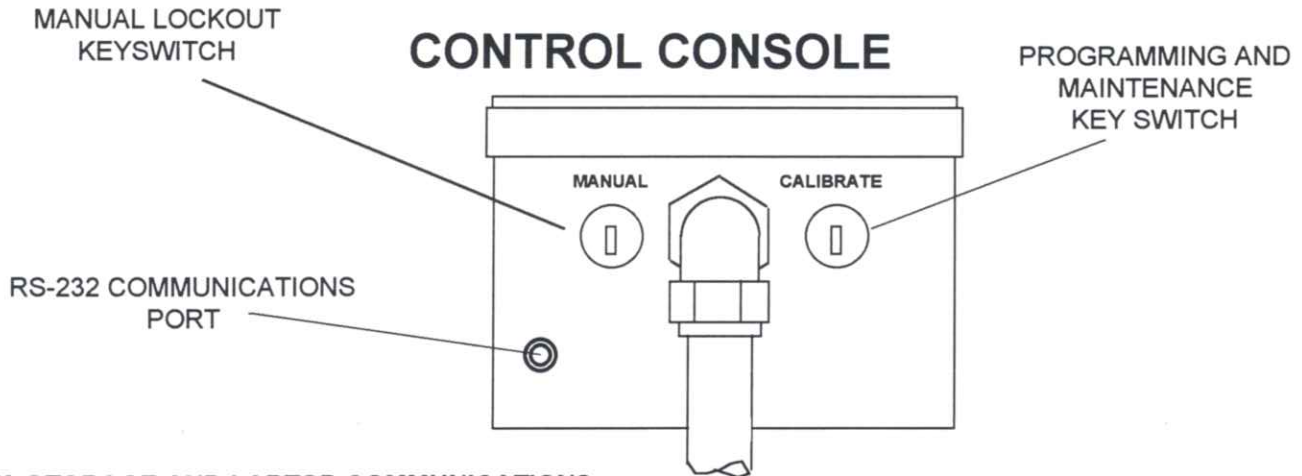
CAL AUGER XX

Push the bed switch to "UP" to increase the number or "DN SLOW" to decrease the number until the number on the display matches the spreader constant number that was found from the above procedure.

CHANGING CONTROL CONSOLES

If it becomes necessary to change a control console, the only programming test procedure that is required to be repeated is the spreader alert setting (assuming no changes to the spreader system). All other programming numbers can be directly plugged into the console based on the numbers that were recorded during the initial set-up.

LAPTOP PROGRAMMING AND DATA LOGGING



DATA STORAGE AND LAPTOP COMMUNICATIONS

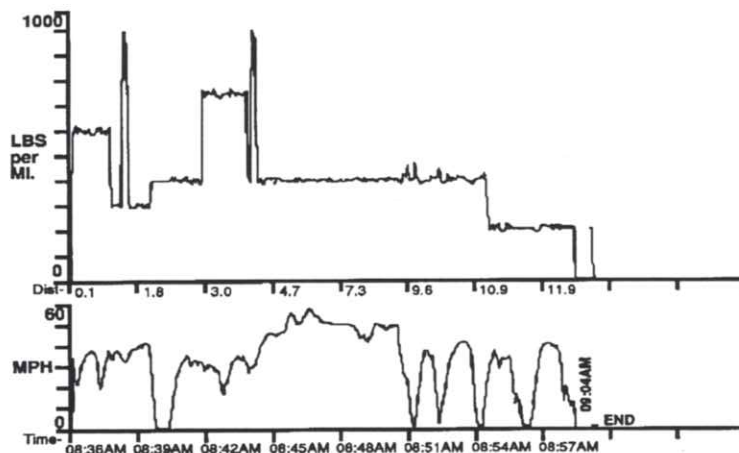
The Pengwyn 2000 control console comes equipped with an RS-232 data communications port as a standard feature. The control console also includes a 32K battery backed ram chip for patrol data storage. The storage capacity affords retrieval of 12 hours of operating information. The data stored includes:

- Time control console is turned on.
- Truck speed.
- Miles driven with:
 - Spreader on.
 - Spreader off.
- Time truck idles.
- Material spread rates.

Software is provided so that the accumulated data can be downloaded into a DOS based laptop PC (and/or a desktop PC) through the RS-232 communications port. The data can be presented in a log summary itemizing all spreader on and off times and all truck idle times to give a totalized account of:

- Total miles driven with the spreader on.
- Total miles driven with the spreader off.
- Average spread rate.
- Peak speed spreader on.
- Total miles traveled.
- Peak spread rate.
- Total material spread.
- Peak speed spreader off.

The provided software will also enable plotting a graph similar to the following example:



The software will also allow programming and calibration of the Pengwyn control console directly from the laptop computer. Programming values can be individually changed by tabbing through a displayed table on the laptop screen and typing in the desired value(s). If several trucks are to be programmed with the same values, a calibration log can be created in the laptop and then the complete log transferred to the control console simply by plugging into the RS-232 port, calling up the input screen on the laptop and pressing "enter". The entire file is transferred to the control console.

Unit ID #	DT632	SPEED	SPREAD	Estimated			
Filename	07150904	Max.	Avg.	Max.	Avg.	Miles	Lbs.
Scale Hrs = 0.5		59	33	1087	421	12.5	5320

PRESSURE ADJUSTMENTS

Depending on the options supplied, the manifold system could incorporate up to 7 relief valves. Pengwyn tests each manifold for function and sets each relief valve prior to shipping. **After manifold installation, the relief valve pressures should be checked and, if necessary, reset to the pressures recommended by the equipment manufacturers.** Use the following procedures to adjust the relief pressures based on the system you have. Refer to page 4-1 and 4-2 for location of relief valves.

A. MAIN RELIEF

- 1) Turn the maintenance key to "MAINT."
- 2) Turn manual key switch to "ON".
- 3) Disconnect the spreader pressure hose quick disconnects.
- 4) Start engine and bring engine speed to 1500 rpm.
- 5) Turn Pengwyn "ON".
- 6) Turn spreader switch to "MANUAL".
- 7) Turn spreader material output switch to position "1".
- 8) Quickly read the pressure on the LCD. (Allow approximately 5 seconds to stabilize)
- 9) Turn engine off.
- 10) Remove cap from main relief (some reliefs have external adjustment screw with locking nut).
- 11) With allen wrench, adjust internal/external screw CW to increase pressure setting or CCW to decrease pressure setting.
- 12) Replace cap or tighten lock nut.
- 13) Repeat above procedure until proper setting is achieved.
- 14) Return the maintenance key to "RUN" and manual key switch to "OFF" when finished.

B. BED UP/PLOW UP RELIEF

- 1) Turn the maintenance key to "MAINT."
- 2) Turn manual key switch to "ON".
- 3) Start engine and bring engine speed to 1500 rpm.
- 4) Turn Pengwyn "ON".
- 5) Turn spreader switch to "MANUAL".
- 6) Push front plow up-down switch to "UP", extending cylinder until it bottoms out.
- 7) Quickly read the pressure on the LCD. (Allow approximately 5 seconds to stabilize)
- 8) Turn engine off.
- 9) Remove cap from bed up/plow up relief (some reliefs have external adjustment screw with locking nut).
- 10) With allen wrench, adjust internal/external screw CW to increase pressure setting or CCW to decrease pressure setting.
- 11) Replace cap or tighten lock nut.
- 12) Repeat the above procedure until proper setting is achieved.
- 13) Return the maintenance key to "RUN" and manual key switch to "OFF" when finished.

C. BED DOWN RELIEF

- 1) Turn the maintenance key to "MAINT."
- 2) Turn manual key switch to "ON".
- 3) Start engine and bring engine speed to 1500 rpm.
- 4) Turn Pengwyn "ON".
- 5) Turn spreader switch to "MANUAL".
- 6) Push bed up-down slow switch to "DN SLOW".
- 7) With the bed all the way down, quickly read the pressure on the LCD. (Allow approximately 5 seconds to stabilize)
- 8) Turn engine off.

- 9) Remove cap from bed down relief (some reliefs have external adjustment screw with locking nut).
- 10) With allen wrench, adjust internal/external screw CW to increase pressure setting or CCW to decrease pressure setting.
- 11) Replace cap or tighten lock nut.
- 12) Repeat the above procedure until proper setting is achieved.
- 13) Return the maintenance key to "RUN" and manual key switch to "OFF" when finished.

D. FRONT & WING PLOW DOWN RELIEF (Double Acting Cylinder)

NOTE: Both plow down reliefs are set in the same manner.

- 1) Turn the maintenance key to "MAINT."
- 2) Turn manual key switch to "ON".
- 3) Start engine and bring engine speed to idle.
- 4) Turn Pengwyn "ON".
- 5) Turn spreader switch to "MANUAL".
- 6) Push appropriate plow up-down switch to "DOWN", retracting cylinder until it bottoms out.
- 7) Quickly read the pressure on the LCD. (Allow approximately 5 seconds to stabilize)
- 8) Turn engine off.
- 9) Remove cap from appropriate plow down relief (some reliefs have external adjustment screw with locking nut).
- 10) With allen wrench, adjust internal/external screw CW to increase pressure setting or CCW to decrease pressure setting.
- 11) Replace cap or tighten lock nut.
- 12) Repeat the above procedure until proper setting is achieved.
- 13) Return the maintenance key to "RUN" and manual key switch to "OFF" when finished.

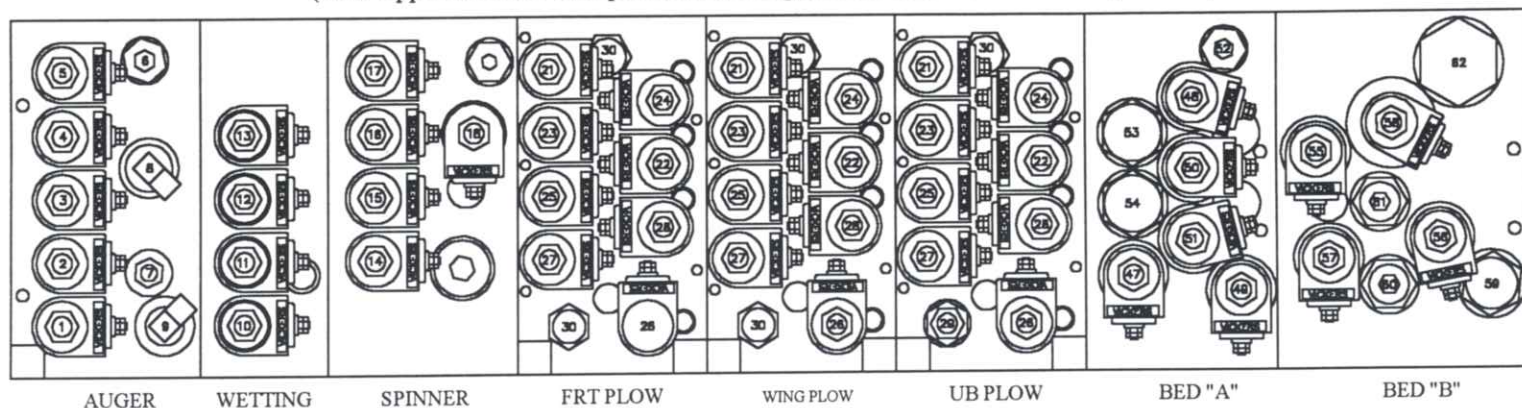
E. UNDERBODY SCRAPER PLOW DOWN RELIEFS

There are two relief valves on the underbody plow circuit, one in the manifold in the UB plow block and one in the UB latch block mounted to the frame. The reliefs must be set simultaneously by the following procedure:

- 1) Determine the desired underbody plow down pressure setting.
- 2) Turn the maintenance key to "MAINT."
- 3) Turn manual key switch to "ON".
- 4) Start engine and bring engine speed to idle.
- 5) Turn Pengwyn "ON".
- 6) Turn spreader switch to "MANUAL".
- 7) Push scraper plow up-down switch to "DOWN", extending cylinder until it bottoms out.
- 8) Quickly read the pressure on the LCD. (Allow approximately 5 seconds to stabilize)
- 9) Turn engine off.
- 10) Remove cap from both relief valves (some reliefs have external adjustment screw with locking nut).
- 11) With allen wrench, adjust internal/external screw CW approximately 1 turn on the relief in the frame mounted UB latch block.
- 12) Repeat steps 2 through 9.
- 13) The pressure should read approximately 400 to 500 psi. If it does not, with allen wrench, adjust the plow down relief in the UB plow block in the manifold CW to increase the pressure setting or CCW to decrease the pressure setting. Repeat steps 2 through 9 and make adjustments as necessary until correct pressure is obtained.
- 14) Now, adjust internal/external screw CCW on the relief in the frame mounted UB latch block and repeat steps 2 through 7. Release the scraper plow switch and read the pressure on the cab mounted pressure gauge.
- 15) If the pressure gauge does not hold the desired UB down pressure setting, adjust internal/external screw on the relief in the frame mounted UB latch block CW to increase pressure setting or CCW to decrease pressure setting. Repeat until desired down pressure is achieved.
- 16) Replace caps or tighten lock nuts.
- 17) Return the maintenance key to "RUN" and manual key switch to "OFF" when finished.

Complete 2000 Valve Diagram

(See: Appendix A for examples of valve diagrams for other manifold configurations)



Example Model Number

2002 - [] - [] / A - W - S - P1C - P2 - P3 - R - A - B / TAS - 237 - 388 - L

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16

Model Code Breakdown

- | | |
|--------------------------------|------------------------------------|
| 1) SERIES NUMBER | 10) * Not Required |
| 2) * Single Manifold | R Underbody Refreshing Accumulator |
| OU Over / Under Manifold | 11) * No Bed Hoist |
| 3) * Control Console w/ Alarms | A Standard Bed Hoist Block |
| NA No Console Alarms | (Required with B Option) |
| 4) AUGER / CONVEYOR | 12) * Not Required |
| 5) * No Wetting | B High Flow Bed Hoist Block |
| W With Electronic Wetting | 13) SAS Single Pump |
| 6) SPINNER | TAS Tandem Pump |
| 7) * No Plow 1 | (Required with B Option) |
| P1C Front Plow, Closed Center | 14) FIRST PUMP DISPLACEMENT |
| P1O Front Plow, Open Center | 237 2.37 cu. in/rev |
| 8) * No Plow 2 | 15) SECOND PUMP DISPLACEMENT |
| P2 Wing Plow | * Single Pump |
| 9) * No Plow 3 | 388 3.88 cu. in/rev |
| P3 Plow 3 Option | 16) PUMP ROTATION |
| UB Underbody Plow Option | R Clockwise |
| | L Counter Clockwise |

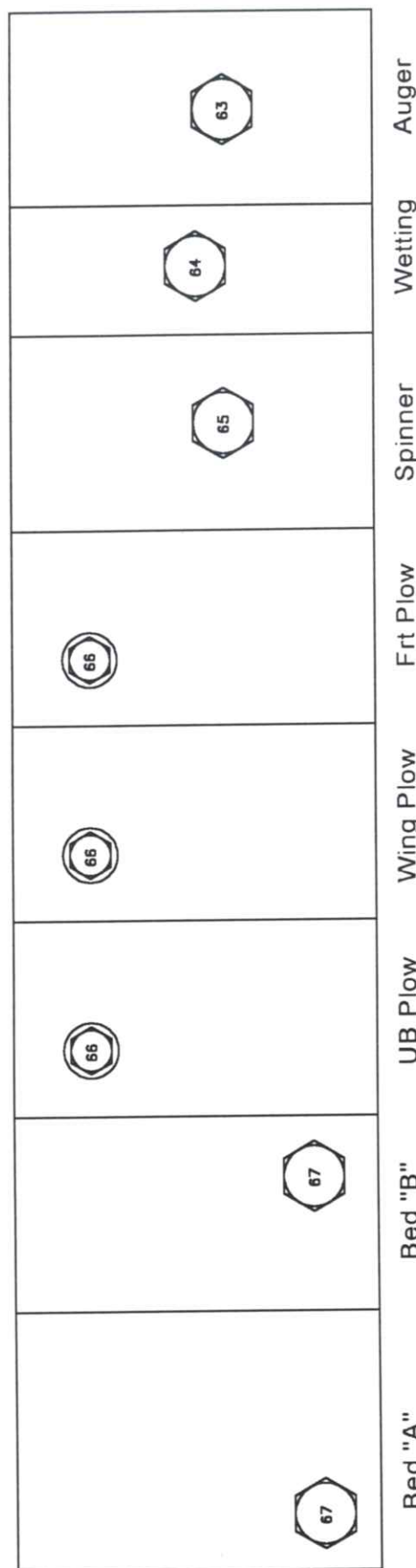
* There will be no code in the model number for this feature ** See the list on page 4-2 for the function and wire colors.

WIRE AND FUNCTION CHART FOR VALVE DIAGRAMS

FLAG NUMBER	FUNCTION	WIRE COLOR
1	Auger 0.5	PINK
2	Auger 1	WHITE
3	Auger 2	WHITE/YELLOW
4	Auger 4	WHITE/GREEN
5	Auger 8	WHITE/BLUE
6	Main Relief set at 2750 PSI	
7	Thermistor	
8	High Pressure Transducer	
9	Low Pressure Transducer	
10	Wetting 1	PINK
11	Wetting 2	WHITE
12	Wetting 4	WHITE/YELLOW
13	Wetting 8	WHITE/GREEN
14	Spinner 0.5	WHITE/ORANGE
15	Spinner 1	WHITE/BROWN
16	Spinner 2	WHITE/PURPLE
17	Spinner 4	WHITE/BLUE
18	Pump Bypass	WHITE/BLACK
19	Bed Up/ Plow Up relief set @ 2000 PSI	
20	Plug	
21	Front Plow Left (pressure)	GREY
22	Front Plow Left (return to tank)	GREY (FRONT PLOW CLOSED CENTER) PURPLE (FRONT PLOW OPEN CENTER)
23	Front Plow Right (pressure)	PURPLE
24	Front Plow Right (return to tank)	PURPLE (FRONT PLOW CLOSED CENTER) GREY (FRONT PLOW OPEN CENTER)
25	Front Plow Up (blind to pressure)	WHITE/GREY
26	Front Plow Up (rod to tank)	WHITE/GREY
27	Front Plow Down (rod to pressure)	BROWN
28	Front Plow Down (blind to tank)	BROWN
29	Plow Down Relief set @ 900 PSI	
30	Check Valve	
31	Wing Plow Left (blind to pressure)	GREY
32	Wing Plow Left (rod to tank)	GREY
33	Wing Plow Right (rod to pressure)	PURPLE
34	Wing Plow Right (blind to tank)	PURPLE
35	Wing Plow Up (blind to pressure)	WHITE/GREY
36	Wing Plow Up (rod to tank)	WHITE/GREY
37	Wing Plow Down (rod to pressure)	BROWN
38	Wing Plow Down (blind to tank)	BROWN
39	UB Plow Left (blind to pressure)	GREY
40	UB Plow Left (rod to tank)	GREY
41	UB Plow Right (rod to pressure)	PURPLE
42	UB Plow Right (blind to tank)	PURPLE
43	UB Plow Up (rod to pressure)	WHITE/GREY
44	UB Plow (blind to tank)	WHITE/GREY
45	UB Plow Down (blind to pressure)	BROWN
46	UB Plow Down (rod to tank)	BROWN
47	Bed Up (blind to pressure)	ORANGE
48	Bed Up (rod to tank)	ORANGE
49	Bed Down Slow (rod to pressure)	WHITE/RED
50	Bed Down Slow (blind to tank)	WHITE/RED
51	Bed Down Fast (blind to tank)	2000 W/O BED 'B' YELLOW 2000 W/ BED 'B' WHITE/ RED
52	Bed Down Relief set @ 800 PSI	
53	Bed Down Slow Compensator	
54	Bed Down Fast Compensator	
55	Bed Up (rod to tank)	ORANGE
56	Bed Up (blind to pressure)	ORANGE
57	Bed Down Fast (rod to pressure)	YELLOW
58	Bed Down Fast (blind to tank)	YELLOW
59	Check valve	
60	Bed Up Relief set @ 2000 PSI	
61	Bed Down Fast Relief set @ 800 PSI	
62	Bed Down Fast Compensator	

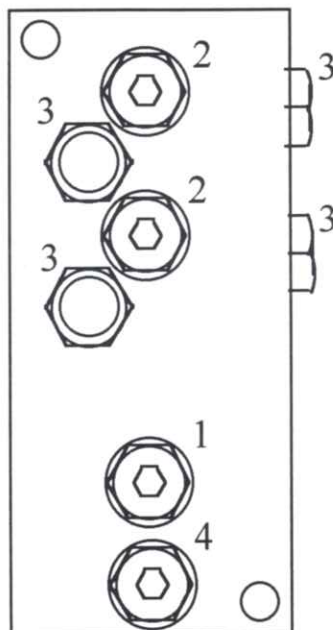
**** This chart is universal, some applications may or may not apply.**

Manifold Viewed From Rear Cab Wall



Flag Number	Function
63	Auger Compensator
64	Wetting Compensator
65	Spinner Compensator
66	Check Valve (Qty. of 3)
67	Check Valve

UNDERBODY LATCH BLOCK VALVE DIAGRAM



FLAG NUMBER	FUNCTION
1	Underbody Down Relief
2	Lock Sequence Valve
3	Check Valve
4	Underbody Up Relief

UNDERBODY LATCH BLOCK PARTS LIST

FLAG NUMBER	DESCRIPTION	PART NUMBER
1,4	Underbody Relief Valve	RD800
2	Lock Sequence Valve	RV601
3	Check Valve	CV101P

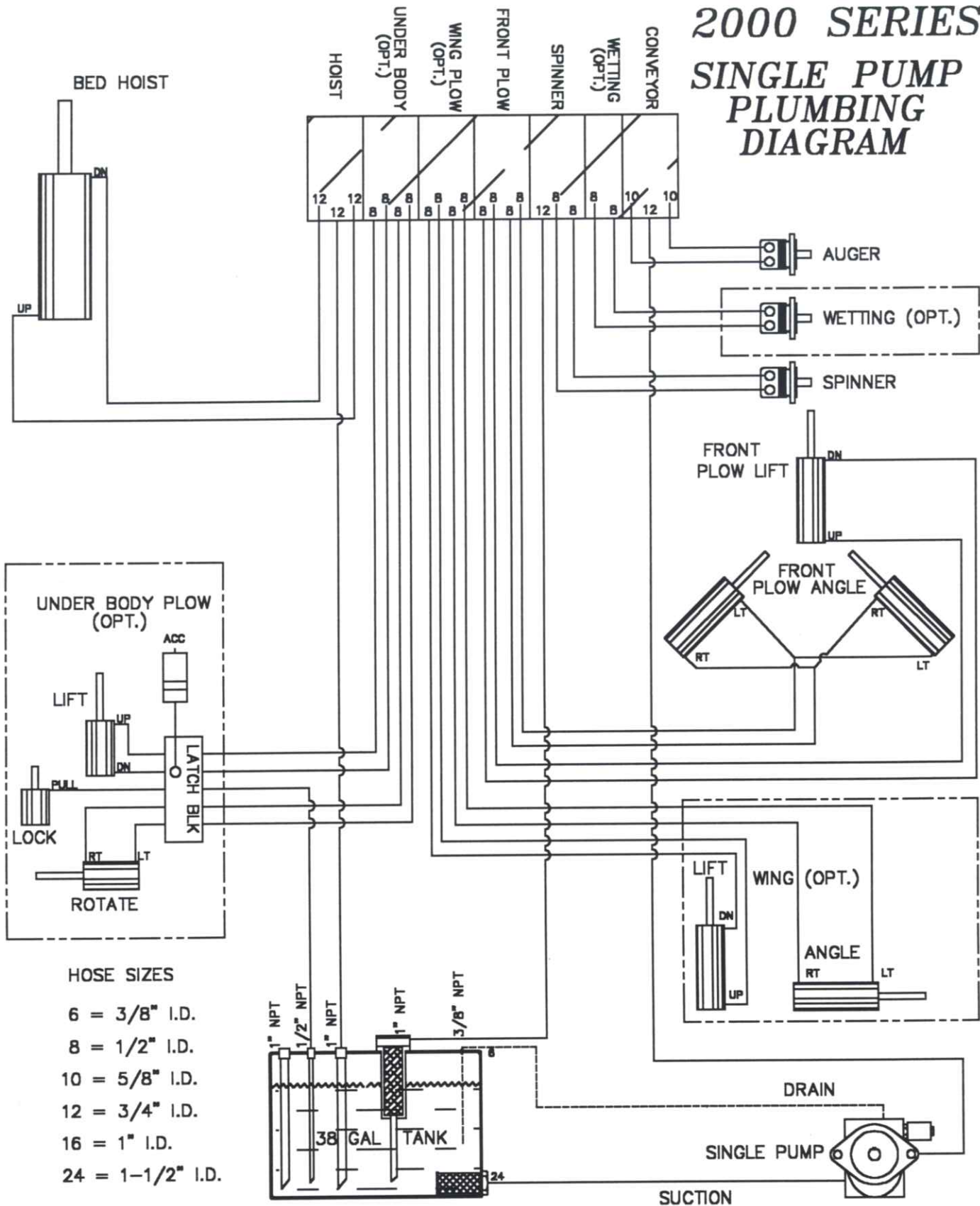
MANIFOLD ASSEMBLY PARTS LIST

FLAG NUMBER	DESCRIPTION	PART NUMBER
1-5,10-17,21, 22*, 23, 24*, 25-28,31-46	Normally closed solenoid valve size 10	DS101C or SV101
22**, 24**	Normally open solenoid valve size 10	DS101N or SV201
6	Main relief valve	RV501
7	Thermistor composite	TC101
8,9	Pressure transducer with plug	X5000-P
18	Normally open solenoid valve size 16	DS161N or SV301
19,29,52	Bed/plow relief valve	RV601
20,67	Check Valve	CV301
30,66	Check Valve	CV101P
47-51	Normally closed solenoid valve size 16	DS161C or SV401
53	Bed down slow compensator valve	PC501
54	Bed down fast compensator valve	PC601
63-65	Auger/wetting/spinner compensator valve	CP701
No Flag	Molded coil, rectangular Molded coil, rounded	RC101P RC102

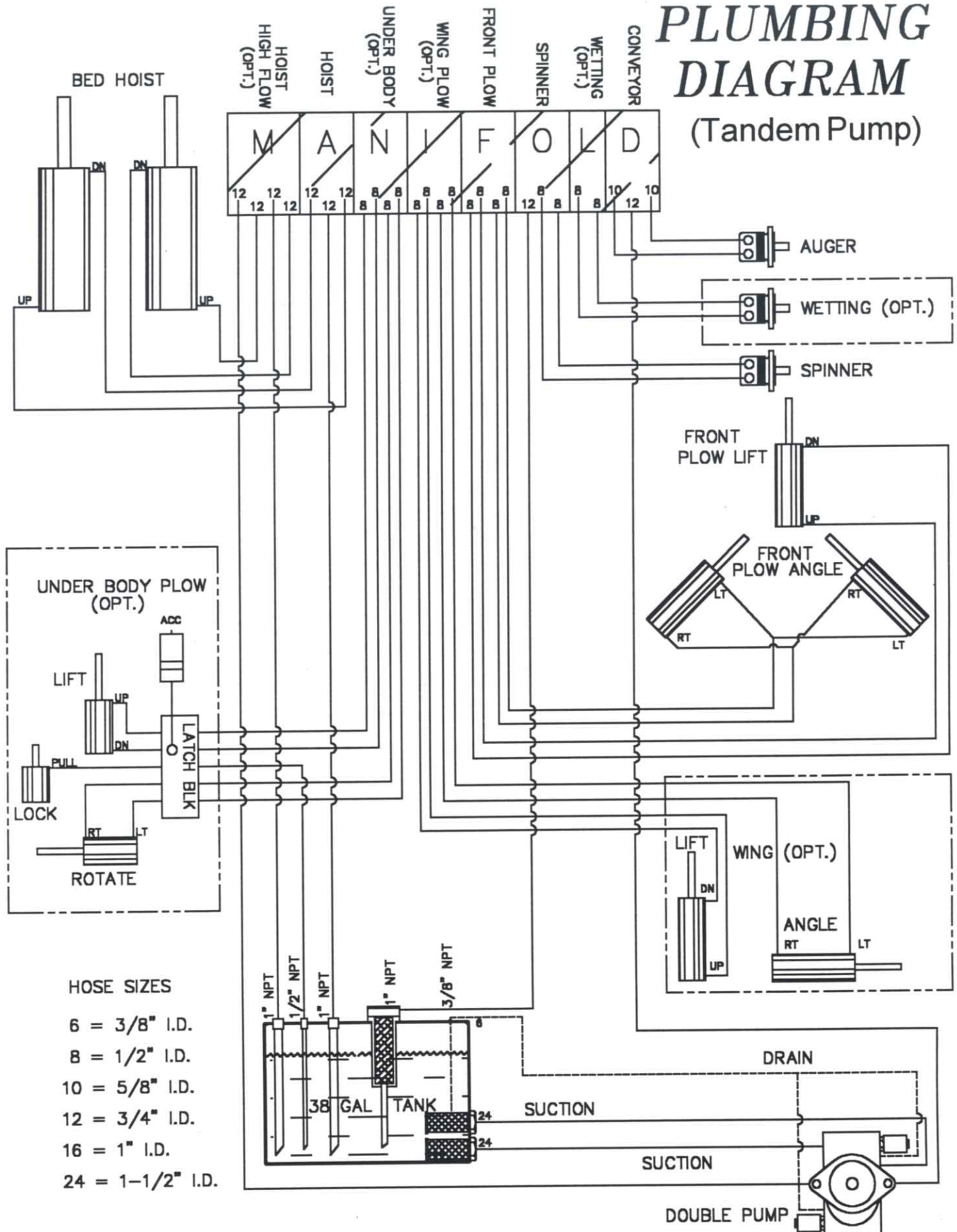
* P1C - Front Plow Closed Center System

** P1O - Front Plow Open Center System

2000 SERIES SINGLE PUMP PLUMBING DIAGRAM

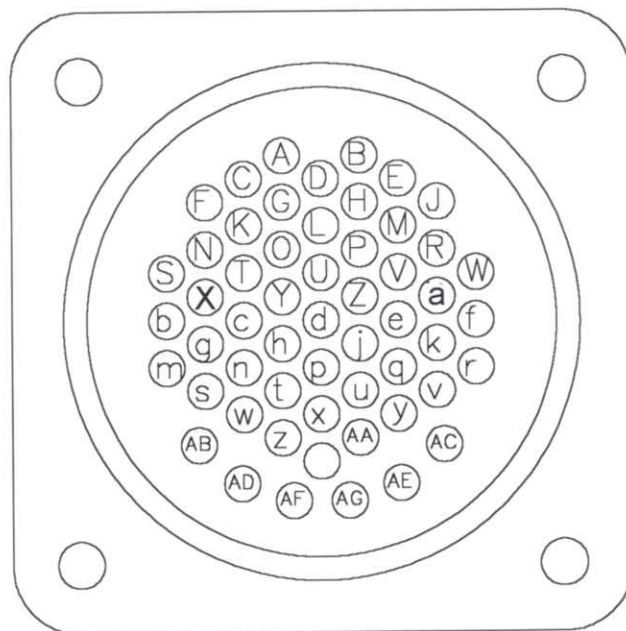


PLUMBING DIAGRAM (Tandem Pump)

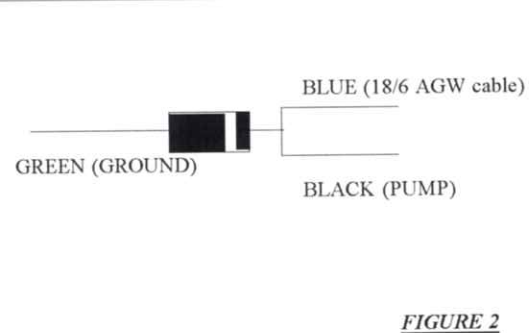
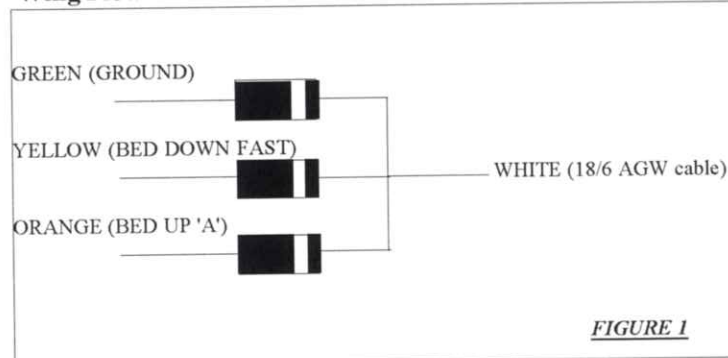


2000 SERIES VEAM WIRES AND DIODES

FUNCTION	Color	pin #
Auger 0 (0.5)	Pink	A
Auger 1 (1)	White	B
Auger 2 (2)	White/Yellow	C
Auger 3 (4)	White/Green	D
Auger 4 (8)	White/Blue	E
Bed Up 'A'	Orange	F
Bed Down Slow	White/Red	G
Bed Down Fast	Yellow	H
Pump	Black	J
Spinner 0 (1)	White/Orange	K
Spinner 1 (2)	White/Brown	L
Spinner 2 (4)	White/Purple	M
Spinner 3 (8)	White/Blue	N
Plow Up	White/Grey	O
Plow Down	Brown	P
Plow Left	Grey	R
Plow Right	Purple	S
Wetting 0 (1)	Pink	T
Wetting 1 (2)	White	U
Wetting 2 (4)	White/Yellow	V
Wetting 3 (8)	White/Green	W
Bypass Pump	White/Black	X
Bed Up 'B'	Orange	Z
Wing Plow 'A' left	Grey	a
Wing Plow 'A' right	Purple	b
Wing Plow 'A' up	White/Grey	c
Wing Plow 'A' down	Brown	d



Wing Plow 'B' left	Grey	e
Wing Plow 'B' right	Purple	f
Wing Plow 'B' up	White/Grey	g
Wing Plow 'B' down	Brown	h
Low oil	Orange (18/6)	r
Thermistor 'pos'	#3-2cond. White	s
Thermistor 'neg'	#3-2cond. Black	t
Low pressure	#2-2cond. White	u
High pressure	#1-2cond. Black	v
Low pressure	#2-2cond. Black	w
High pressure	#1-2cond. White	x
2 Speed Trans	Red (18/6)	y
Tachometer	Black (18/6)	z
12 volt dc	White 12/2	p
Ground	Black 12/2	q



*System without BED 'B' will use only FIGURE 2.
System with BED 'B' will use both FIGURE 1 & 2.*

TROUBLESHOOTING

To check if a function is operating properly, touch the 1/2"-20 nut at the top of the coil with a steel tool, such as a screwdriver, while actuating the function on the control console. You should be able to feel the magnetism generated by the coil when it is energized. This is usually done with the ignition switch on and the engine not running.

The following solenoid charts show which solenoids are energized with each different function. "E" denotes energized.

The pump bypass solenoid is not required to operate the auger and the spinner. When the auger and the spinner are disconnected from the truck, the spreader material output selection switch and the spinner/*NaCl*one™ speed control switch must be set at position "0". Except when using the control console for pressure measuring, the spreader switch should also be in the "OFF" position.

For safety, operate the power switch only when all of the toggle switches are in the off position. Do not hold the bed and plow switches for long periods after their respective cylinders are completely extended.

CAUTION

DISCONNECT AMPHENOL PLUG FROM MANIFOLD AND REMOVE THE CONTROL CONSOLE FROM THE CAB BEFORE WELDING ON THE TRUCK.

DO NOT OVER TIGHTEN SOLENOID COIL NUT - THE COIL SPINDLE IS HOLLOW AND EASILY DAMAGED. ALSO, BE CAREFUL NOT TO PINCH WIRES UNDER COIL WHEN INSTALLING.

TURN THE CONTROL CONSOLE POWER SWITCH OFF BEFORE CONNECTING AND DISCONNECTING BATTERY CABLES, BATTERY CHARGERS OR JUMPING THE BATTERY.

DO NOT DRILL HOLES IN NOR MOUNT AUXILLARY SWITCHES TO THE CONTROL CONSOLE. THIS WILL VOID WARRANTY. USE THE CONTROL CONSOLE MOUNTING BRACKET FOR THIS PURPOSE.

SOLENOID ENERGIZATION CHART

AUGER MANUAL

SOLENOID NUMBER						
RATE	2	3	4	5	PUMP	GPM
0					E	0
1	E				E	1
2		E			E	2
3	E	E			E	3
4			E		E	4
5	E		E		E	5
6		E	E		E	6
7	E	E	E		E	7
8				E	E	8
9	E			E	E	9
10		E		E	E	10
11	E	E		E	E	11
12			E	E	E	12
13	E		E	E	E	13
14		E	E	E	E	14
15	E	E	E	E	E	15

SPINNER MANUAL

SOLENOID NUMBER						
RATE	14	15	16	17	PUMP	GPM
0					E	0
1	E				E	1
2		E			E	2
3	E	E			E	3
4			E		E	4
5	E		E		E	5
6		E	E		E	6
7	E	E	E		E	7
8				E	E	8
9	E			E	E	9
10		E		E	E	10
11	E	E		E	E	11
12			E	E	E	12
13	E		E	E	E	13
14		E	E	E	E	14
15	E	E	E	E	E	15

WETTING MANUAL (Optional Feature)

SOLENOID NUMBER						
RATE	10	11	12	13	PUMP	GPM
0					E	0
1	E				E	1
2		E			E	2
3	E	E			E	3
4			E		E	4
5	E		E		E	5
6		E	E		E	6
7	E	E	E		E	7
8				E	E	8
9	E			E	E	9
10		E		E	E	10
11	E	E		E	E	11
12			E	E	E	12
13	E		E	E	E	13
14		E	E	E	E	14
15	E	E	E	E	E	15

NOTE: "E" denotes the coil should be energized.

FRONT PLOW

	SOLENOID NUMBER									
	18	21	22	23	24	25	26	27	28	PUMP
UP	E					E	E			E
DOWN	E							E	E	E
LEFT	E	E	E							E
RIGHT	E			E	E					E

WING PLOW

	SOLENOID NUMBER									
	18	31	32	33	34	35	36	37	38	PUMP
UP	E					E	E			E
DOWN	E							E	E	E
LEFT	E	E	E							E
RIGHT	E			E	E					E

UNDERBODY PLOW

	SOLENOID NUMBER									
	18	39	40	41	42	43	44	45	46	PUMP
UP	E					E	E			E
DOWN	E							E	E	E
LEFT	E	E	E							E
RIGHT	E			E	E					E

BED, DOUBLE ACTING

	SOLENOID NUMBER						
	18	47	48	49	50	51	PUM
UP	E	E	E				E
DOWN SLOW	E			E	E		E
DOWN FAST	E			E	E	E	E

NOTE: "E" denotes the coil should be energized.

TROUBLESHOOTING CHART

BEFORE TROUBLESHOOTING THE PENGWYN SYSTEM, CHECK ALL QUICK DISCONNECTS TO BE SURE THAT THEY ARE IN GOOD WORKING ORDER AND ARE CONNECTED PROPERLY. THIS IS A COMMON PROBLEM.

PROBLEM	CAUSE	SOLUTION
Solenoid valve stays open or closed all the time.	Coil nut too tight and cartridge spindle has been stretched.	Replace cartridge.
Noisy pump.	Low on fluid.	Add hydraulic oil.
Pump noisy all the time especially under a load.	Pump solenoid valve stuck.	Clean valve and check operation electrically while removed from pump then reinstall.
	Main poppet stuck.	Carefully clean poppet bore with fine emery cloth - check for free movement with fingers.
	Suction line or strainer plugged.	Clean suction line and sump strainer.
Pump noisy oil aerated.	Pump solenoid cartridge loose allowing air in.	Tighten pump solenoid cartridge.
	Pump check valve cartridge loose.	Tighten pump check valve cartridge.
	Shaft seal leaking.	Replace shaft seal.

Pump noisy, oil aerated. (cont'd)	Suction line loose.	Tighten suction line.
	Dump hoist vent leaking.	Clean, repair, or replace vent.
Nothing works, Pump runs.	Out of fluid.	Add hydraulic oil Check for leaks.
	Solenoid bad on pump bypass valve.	Replace coil.
	Suction poppet stuck.	Clean suction poppet.
	Bypass coil nut over tightened.	Replace bypass cartridge.
No pump effect.	Bad pump coil or wiring.	Repair or replace.
Solenoid does not magnetize when turned on.	Bad electrical ground.	Remove cartridge carefully, punch threads to make ground, and replace cartridge.
Auger does not change speeds smoothly.	One of the auger solenoids not working.	Turn manual key on then set augerswitch to (1), (2), (4), and (8) to find the bad valve. Clean valve or change coil as needed.
Auger runs all the time.	Dirt holding one of the auger solenoid valves open.	Clean solenoid valve.
Auger turns on and off but runs too fast when empty and stalls when loaded.	Dirt in auger compensator spool.	Remove auger compensator spool on outside of truck. Clean and reinstall.
	Compensator spool too tight.	Loosen spool slightly.

Spinner turns on and off but runs too fast when empty and stalls when loaded.	Dirt in spinner compensator spool.	Remove spinner compensator spool on outside of truck clean and reinstall.
	Compensator spool too tight.	Loosen spool slightly.
Spinner does not change speeds smoothly.	One of the spinner solenoids not working.	Set spinner switch to (1), (2), and (4) to find bad valve. Clean valve or change coil as needed.
Spinner runs all the time.	Dirt holding one of the spinner solenoid valves open.	Clean solenoid valve.
Bed won't go up.	Bed down valve stuck open.	Clean bed down valves.
	Bed up solenoid failed.	Replace bed up coil.
	Bed up coil nut over tightened.	Replace bed up cartridge.
	Pump bypass valve not operating.	Clean or replace.
Bed will not go up.	Auger or spinner valve leaking when spreader disconnected.	Clean or replace.
Bed goes up when plow up is operating.	Dirt in bed up solenoid valve.	Clean valve.
Bed drifts down.	Dirt in any one of the lift port valves 14, 15 or 16.	Clean all valves Check poppets for spring action.

Bed will only creep down. (no high speed)	Bed compensator cartridge bad.	Replace bed compensator cartridge.
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Bed chatters down.	Compensator cartridge bad.	Replace bed compensator cartridge.
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Plow will not go up.	Plow down valve stuck open.	Clean valve.
	Plow up valve failed.	Clean or replace valve.
	Plow relief set too low.	Adjust bed / plow relief.
	Plow up coil nut over tightened.	Replace plow up cartridge.

Plow drifts down.	Dirt in plow up valve.	Clean valve.
	Dirt in plow down valve.	Clean valve.
	Plow down coil over tightened.	Replace plow down cartridge.

Plow will go up, but will not go down.	Faulty plow quick disconnect.	Clean or replace as necessary.
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Hydraulic fluid too hot.	Low fluid level.	Add hydraulic fluid.
	Bypass coil nut over tightened.	Replace bypass cartridge.

Speed display slow or erratic.	Transmitter pick up out of adjustment or failed.	Adjust or replace transmitter.
Display not showing speed.	Jumper in wrong position.	Move jumper. (see: Page 7-2)
Auger will not turn when fully loaded but oil is heard in manifold.	Main relief is set too low.	Check pressures and reset pressure relief.
Bed / plow will not raise but oil is heard in manifold.	Bed / plow relief is set too low.	Check pressures and reset pressure relief.
Bed will not lower when all the way up but oil is heard in manifold.	Bed down relief is set too low.	Check pressures and reset pressure relief.
Auger is in blast in automatic.	Auger constant calibration is on "0".	Change calibration to correct number (see: page 3-7).
Control will turn off and turn on automatically.	Circuit Breaker is in the main power feed.	Take circuit breaker out and replace it with a 30 Amp fuse.
Bed does not power down .	Jumper in single acting.	Change jumper to double acting.
Pump operates about 2 minutes and quits then starts again in a few minutes.	Short in pump wiring.	Fix wiring.
	Bad pump coil.	Replace pump coil.
	Circuit Breaker is in the main power feed.	Take circuit breaker out and replace it with a 30 Amp fuse.

Plow will angle in one direction but not in the other.

Faulty disconnect.

Replace quick disconnect.

Gunning engine makes the bed come down slower.

Bed jumper in single acting/ double acting.

Change jumper to proper configuration.

Beeper comes on too often in spreader alert.

Auger drag set too high.

Lower auger drag constant see page 3-6.

Material is bridging across the auger.

Break salt bridge.

Spreader alert programming was done with material in the bed/hopper.

Empty material and recalibrate spreader alert.

Hydraulic drive motor mechanical friction has reduced.

Recalibrate Spreader alert.

Broken connection in mechanical link between hydraulic drive motor and auger shaft/conveyor belt.

Repair mechanical connection.

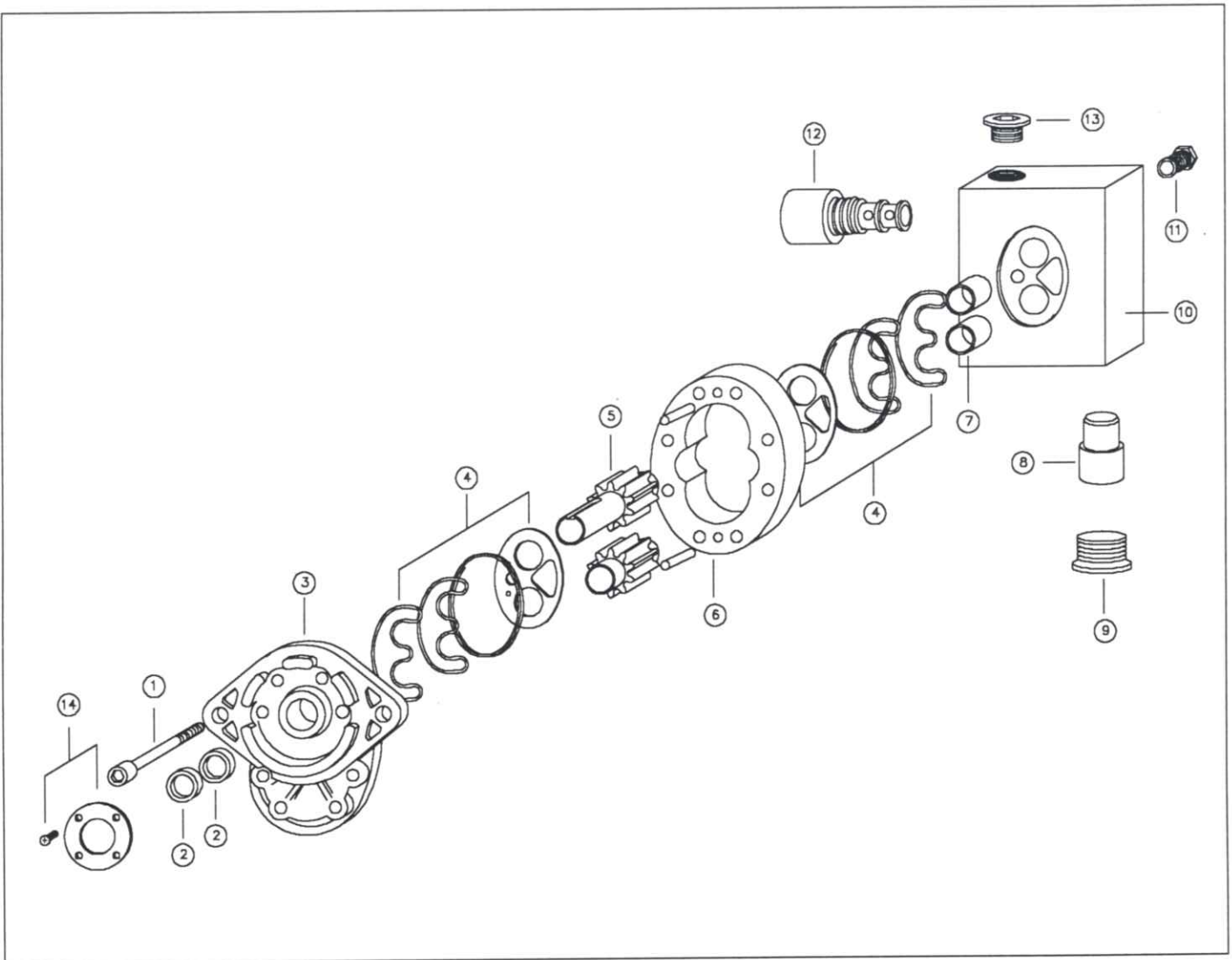
Blown hydraulic hose on drive motor.

Repair hose.

PARTS DRAWING

SINGLE AUTOSUCKER™ PUMP

AS-237-LH



PARTS LIST

SINGLE AUTOSUCKER™ PUMP

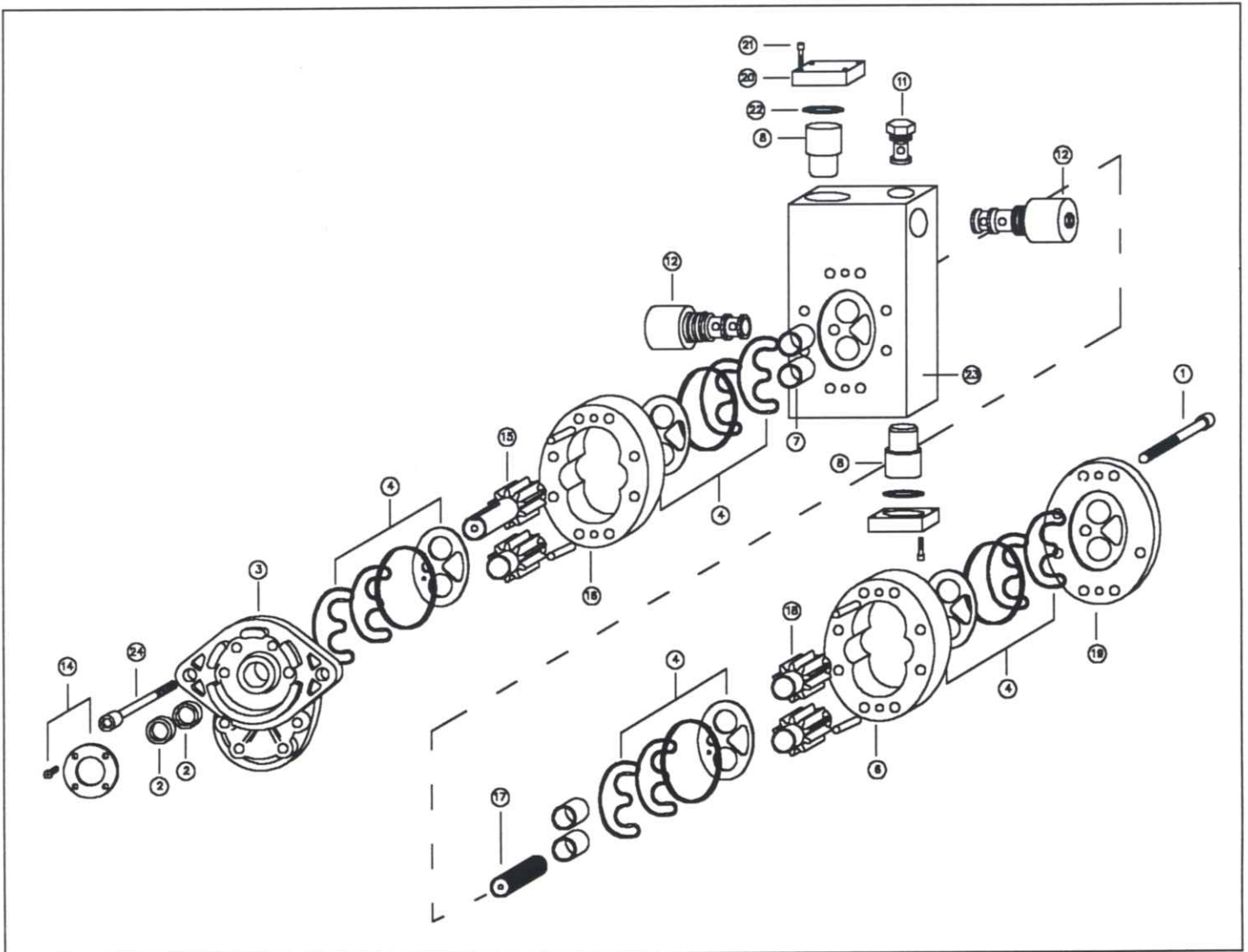
AS-237-LH

PART	PART NUMBER
1. Bolt Kit (8 peices)	A-237-10
2. Shaft Seal	A-20
3. Front Cover	A-LH-30
4. Wear Plate Kit	A-40
Pre-load seal	A-45
Load seal	A-46
Seal ring	A-47
Wear plate	A-48
5. Gear Set	A-237-50
6. Gear Housing	A-237-60
7. Shaft Bearing Kit (2 peices)	A-70
8. Suction Poppet	A-80
9. Suction Poppet Cap	A-90
10. Back Cover	AS-100
11. Check Valve	A-110
12. Solenoid Valve Assembly	A-120
Coil only	A-125
Nut only	A-126
Valve only	A127
13. Plug	A-150
14. Seal Retainer and Screws (4 pieces)	SRSTB-4
Seal retainer	SR-11394
Screws (4 pieces)	STB-4-1420
Double Shaft Seal and Retainer Kit	ASRK-237
Seal Kit	A-140

PARTS DRAWING

DUAL AUTOSUCKER™ PUMP

AS-237 / 388-LH



PARTS LIST

DUAL AUTOSUCKER™ PUMP

AS-237 / 388-LH

PART	PART NUMBER
1. Bolt Kit (8 peices)	A-237-10
2. Shaft SealA-20	
3. Front Cover	A-LH-30
4. Wear Plate Kit	A-40
Pre-load seal	A-45
Load seal	A-46
Seal ring	A-47
Wear plate	A-48
6. Gear Housing	A-237-60
7. Shaft Bearing Kit (2 peices)	A-70
8. Suction Poppet	A-80
11. Check Valve	A-110
12. Solenoid Valve Assembly	A-120
Coil only	A-125
Nut only	A-126
Valve only	A127
14. Seal Retainer and Screws (4 pieces)	SRSTB-4
Seal retainer	SR-11394
Screws (4 pieces)	STB-4-1420
15. Drive Gear Set - Front Section	A-388-50
16. Gear Housing - Front Section	A-388-60
17. Spline Coupler	A-160
18. Idler Gear Set - Rear Section	A-237-55
19. Rear Cover Assembly	A-170
20. Poppet Cover	A-180
21. Cap Screws - 4	A-190
22. O'Ring Seal	A-185
23. Center Section	AS-200
24. Bolt Kit - Front Section	A-388-10

MISCELLANEOUS PARTS LIST

2000 SYSTEM

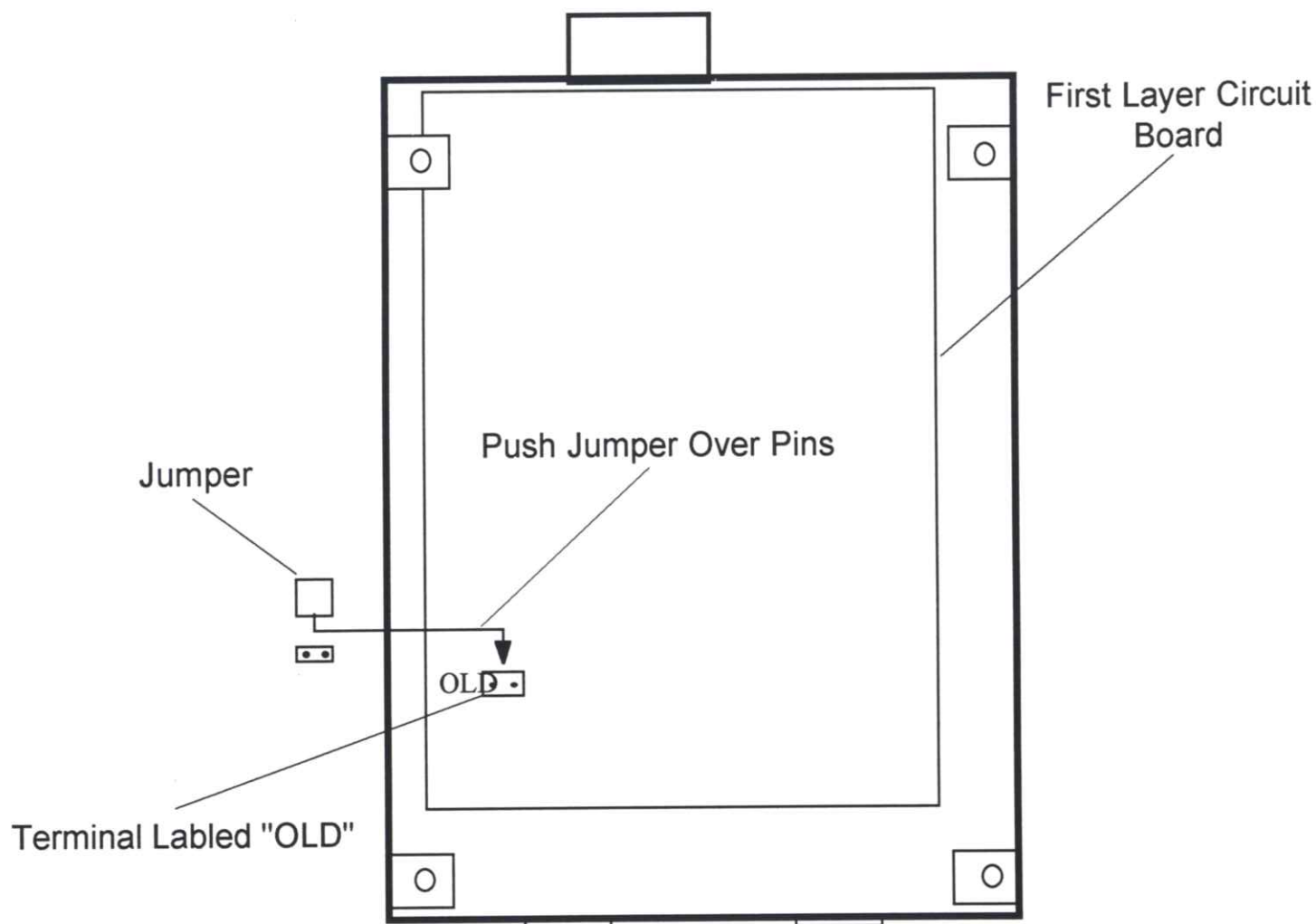
DESCRIPTION	PART NUMBER
Silencer - Pressure line	SA-101
Console mounting nut kit	CN-101
Control console	CB-2002
Manifold adaptor kit	MA-2002
Single pump adaptor kit	PA-101
Tandam pump adaptor kit	PA-102
Tank filter	TF-101
Test guage kit - Autosucker™ pump	TG-101
Illumination light for control console	LB-101
Single Autosucker™ pump assembly	AS-237-LH
Filter assembly, return line	FA-101
Replacement filter element	FE-101
UB latchblock manifold assembly	UBL-2002
UB accumulator	AC-2002
<i>NaClone</i> ™ ejector assembly	NC-101
Wetting pump	PW-101
<i>NaClone</i> ™ drive motor	NA-110A
Wetting drive motor	MC-040
Shaft seal for wetting pump	PW-101SS
Seal kit for wetting motor	MC-040SK
Seal kit for <i>NaClone</i> ™ motor	NA-110SK
O-Ring boss seal kit	SK-ORB
Seal kit 2002	SK-2002

SPEEDOMETER JUMPER

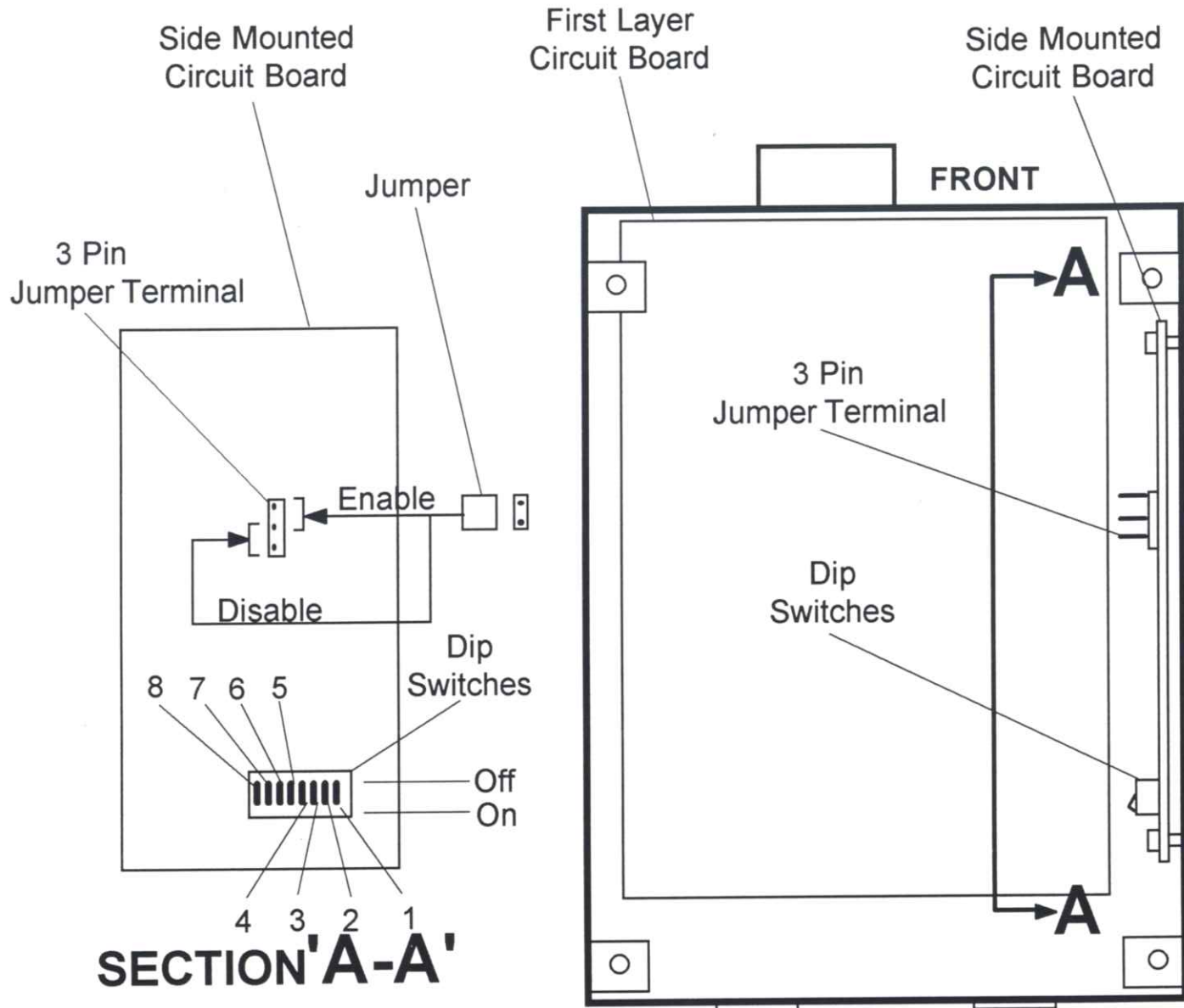
On trucks using the Allison World Transmission or on Freightliner trucks, it is necessary to have a jumper in the box as shown below to allow the Pengwyn control console to pick up the truck speedometer. If specified in advance, Pengwyn will supply the control console with this jumper installed. In cases where the jumper was not installed at the factory, proceed as follows:

1. Remove the four front panel mounting screws.
2. Lift the front cover up and swing it out of the way.
3. Find the two small pins labeled "OLD" in the bottom left hand corner of the first layer board.
4. Push the jumper over both pins.
5. Re-assemble the front cover.

NOTE: Sometimes the control console is supplied with the jumper installed on one of the two pins. To activate, pull the jumper off and follow steps 3 - 5.



UNDERBODY AUTOMATIC REFRESHING CIRCUIT ENABLE - DISABLE



The 2000 control box has the built in capability to automatically send a flow of oil to the underbody scraper at regular timed intervals on a continuous basis. This is called a refreshing circuit and it works in conjunction with a refreshing accumulator connected into the down side of the underbody scraper's cylinder.

When the underbody scraper down switch is activated by the operator, the hydraulic manifold sends oil to the down side of the hydraulic cylinder which pushes the underbody plow down and also charges the accumulator. The accumulator serves to maintain a constant down pressure on the underbody plow, even while going over bumps, manholes, pot holes, etc. This prevents the plow from creating unplowed skips in the road. However, the accumulator would eventually discharge itself. The electronic circuit, via a time delay function, will automatically energize the down side valves in the manifold at regular intervals. This will allow the accumulator to maintain it's charge and will allow the underbody plow to maintain a constant and continuous down force, automatically, with no operator input. When the operator hits plow up, the automatic circuit is deactivated.

To turn the refreshing circuit on or off and to set the time delay sequence, proceed as follows:

- 1) Remove the four front panel mounting screws.
- 2) Lift the front cover up and swing it out of the way.

CAUTION: Sometimes a plug in wire connector may slip off the front cover section while performing these settings. Be sure to reattach these prior to re-assembly.

- 3) Locate the circuit board mounted to the right side of the control console. On this board, you will find a dip switch block consisting of 8 small switches located on the key lock side of the board. Also mounted approximately in the middle of the board is a 3 pin terminal with a jumper.
- 4) To enable (turn on) the underbody refreshing circuit, the jumper should be installed on the front two pins. To disable (turn off) the underbody refreshing circuit, the jumper should be installed on the rear two pins. Carefully use small needle nose pliers to remove and install the jumper.
- 5) Determine the desired length of pulse and the delay time between pulses. Switches 1 - 4 are used to set the length of the pulse, in seconds, while switches 5-8 are used to set the delay time between pulses, in seconds. Generally, a 1 second pulse every 15 seconds has been determined to work best.

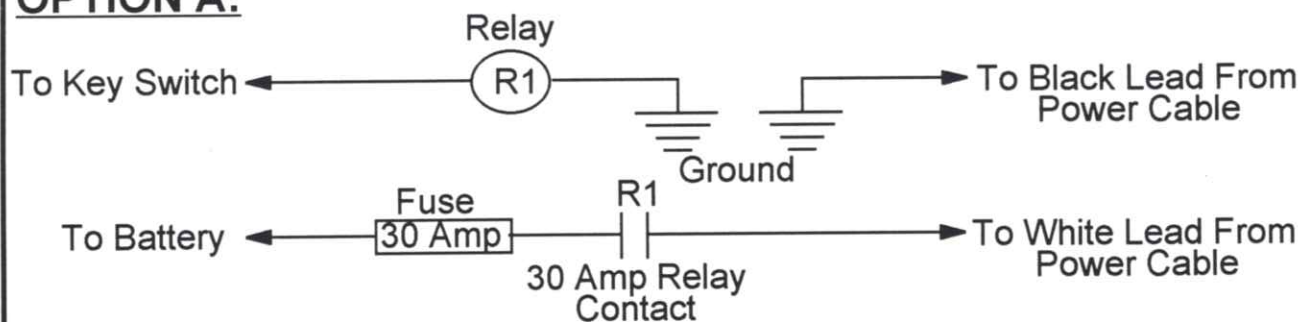
PULSE: Switch 1 = 1 Sec
 Switch 2 = 2 Sec
 Switch 3 = 3 Sec
 Switch 4 = 4 Sec

DELAY: Switch 5 = 15 Sec
 Switch 6 = 30 Sec
 Switch 7 = 45 Sec
 Switch 8 = 60 Sec

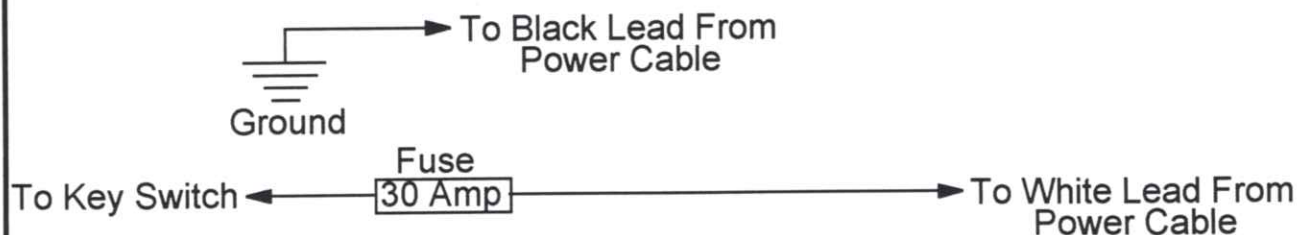
- 6) To activate the pulse time, push the appropriate switch (1-4) to the "ON" position. To activate the delay between pulses, push the appropriate switch (5-8) to the "ON" position. All other switches should be in the "OFF" position.
- 7) Re-assemble the front cover.

POWER HOOK-UP OPTIONS

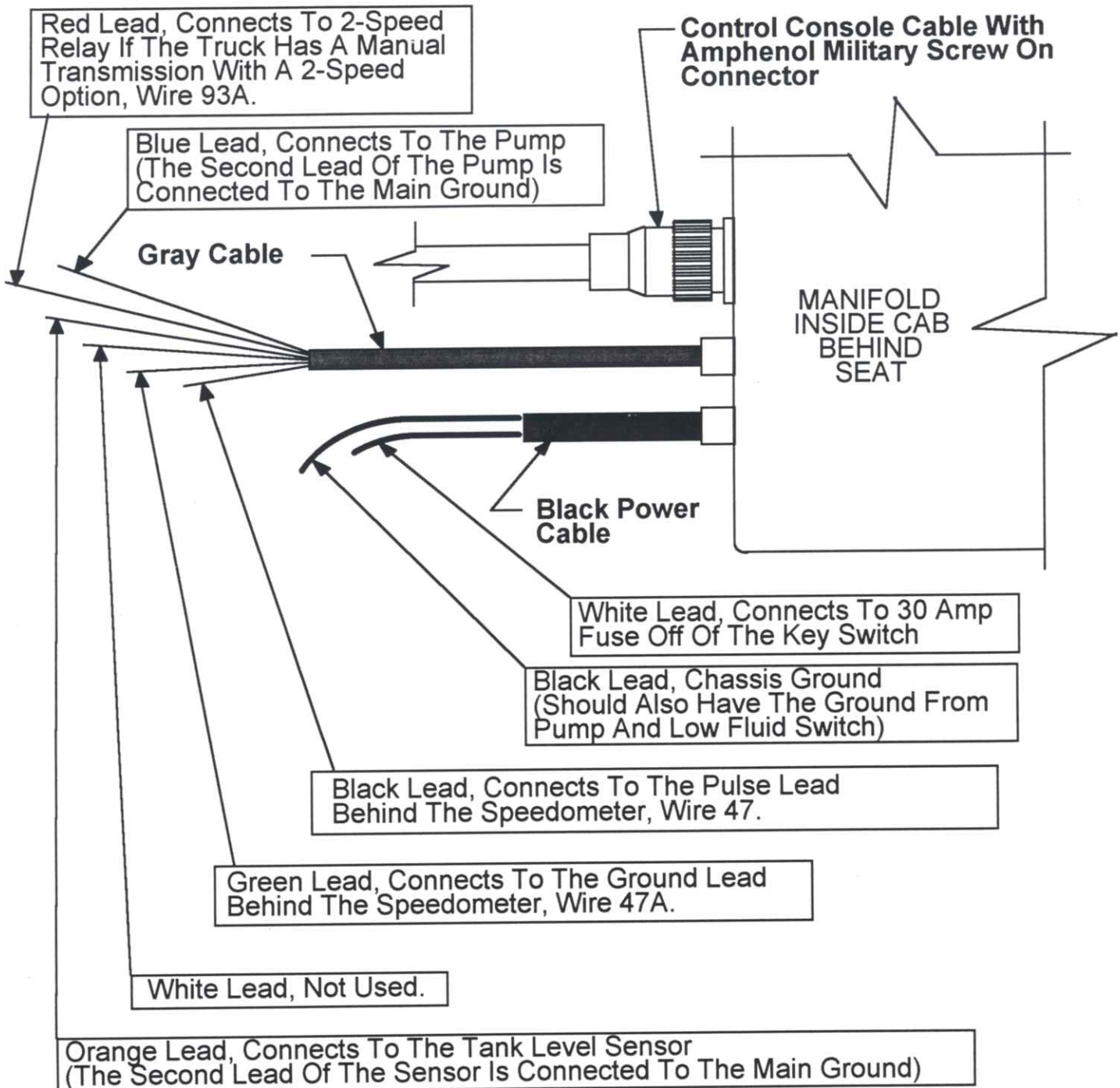
OPTION A:



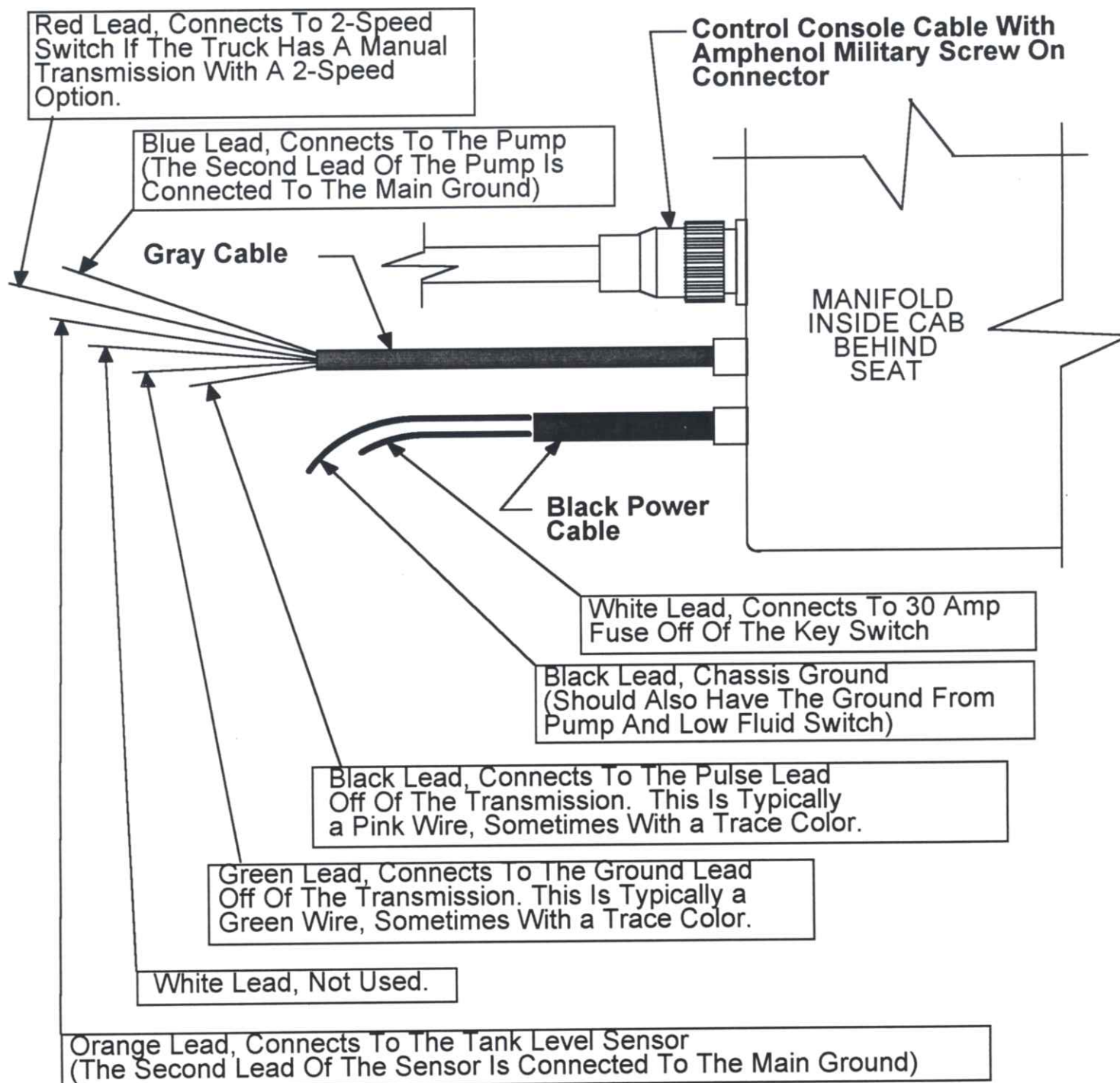
OPTION B:



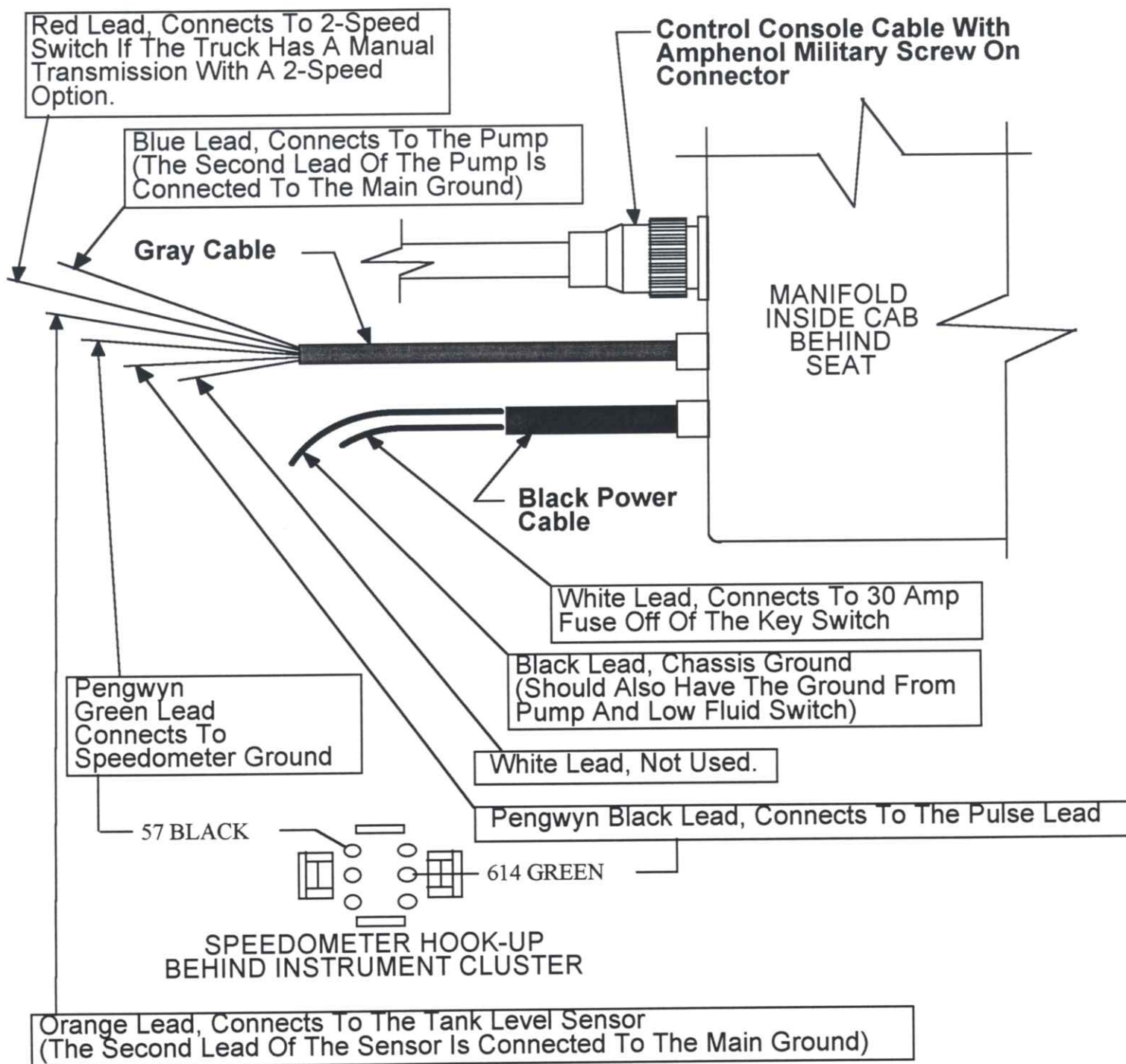
NAVISTAR TRUCK WIRING



CHEVY/GMC TOPKICK TRUCK WIRING

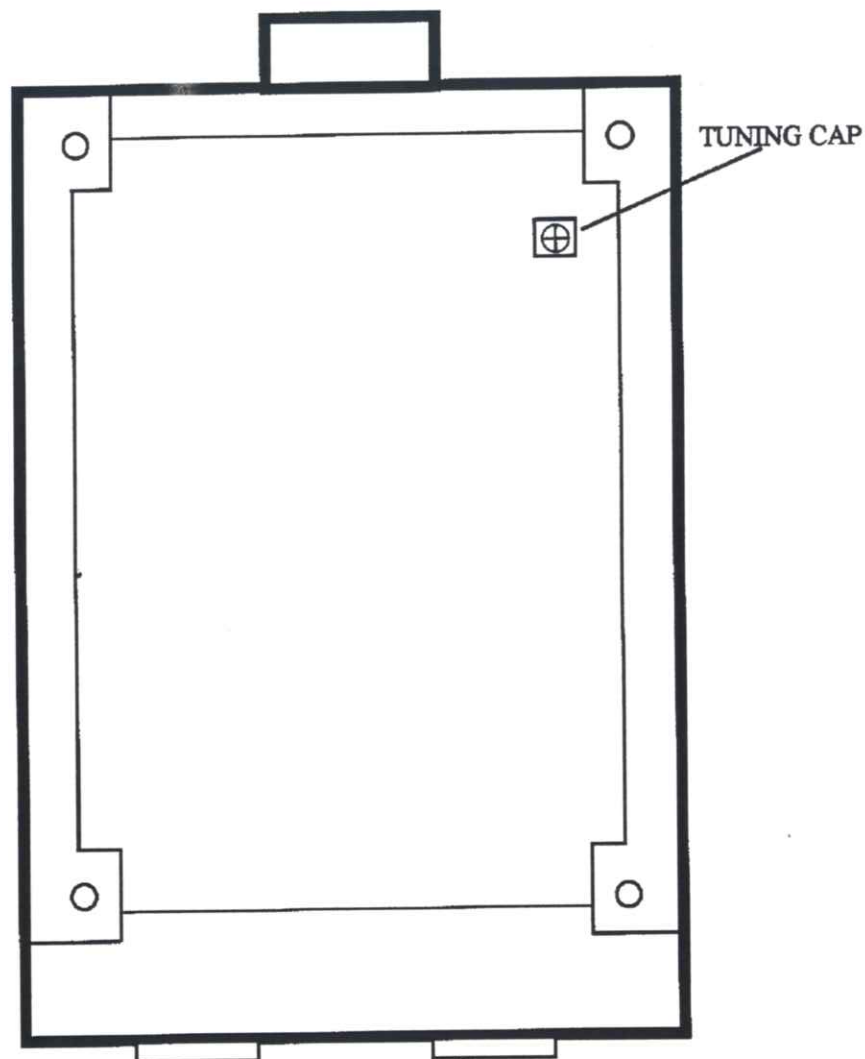


FORD TRUCK WIRING



RFI ADJUSTMENT

The Pengwyn processor circuit board design incorporates aero-space technology, including exterior grounding planes to isolate radio frequency interference. In the rare event that the Pengwyn processor interferes with the truck 2-way radio, the processor frequency can be adjusted, moving the frequency off the 2-way radio channel. The adjustment capacitor is conveniently located under the bottom cover and can be adjusted with power on. Contact Pengwyn for details.



PROGRAMMING CONSTANTS

RECORD YOUR PROGRAMMING CONSTANTS BELOW FOR FUTURE REFERENCE.

CAL SPREAD

CAL SPIN

MINIMUM VALUE

CAL DRAG

CAL JAM

PULSES/.1MI

WETTING MAX

PUMP SLIP GPM

WET CONST

SPREADER 1-

SPREADER 2-

SPREADER 3-

SPREADER 4-

SPREADER 5-

SPREADER 6-

SPREADER 7-

SPREADER 8-

SPREADER 9-

SPREADER 10-

SPREADER 11-

SPREADER 12-

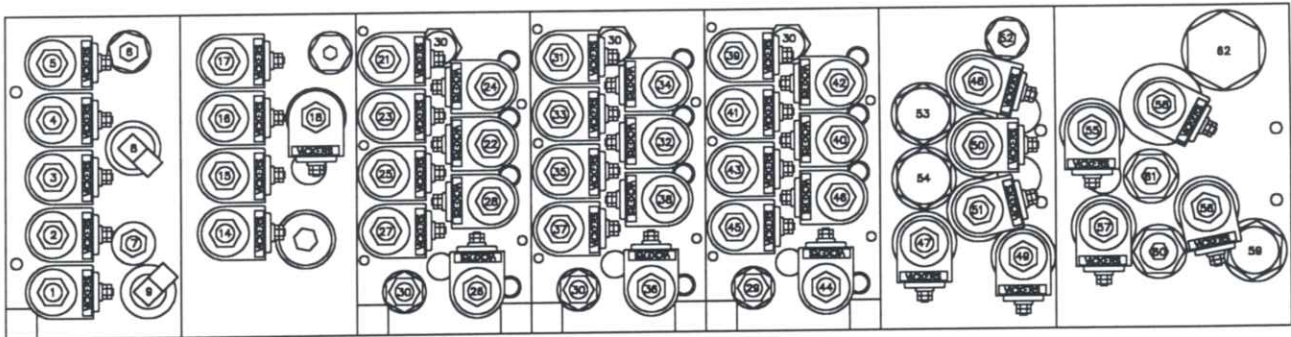
SPREADER 13-

SPREADER 14-

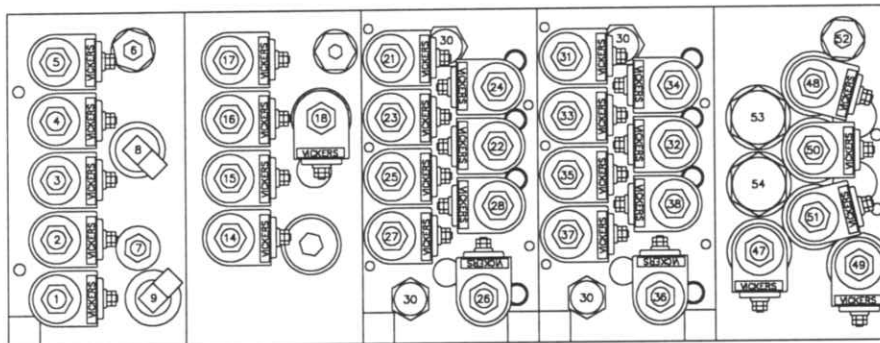
SPREADER 15-

COMBINATION OF 2000 SERIES BLOCKS

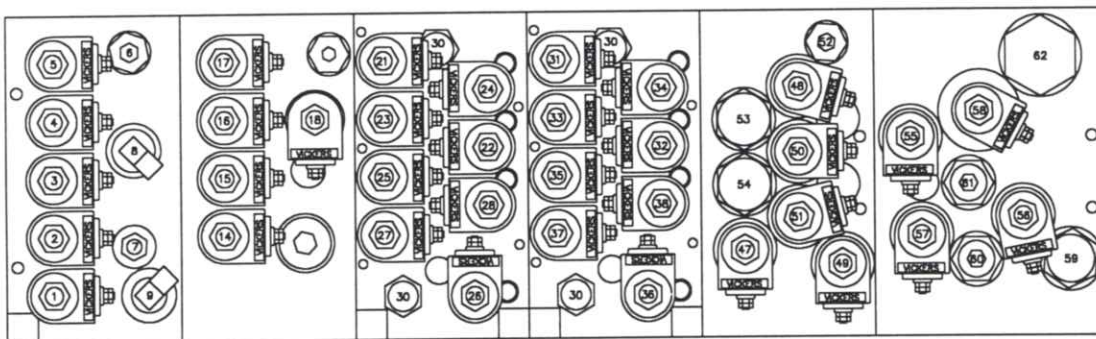
AUGER/SPINNER/FRONT PLOW/WING PLOW/UNDERBODY PLOW/BED 'A'/BED 'B'



AUGER/SPINNER/FRONT PLOW/WING PLOW/BED 'A'



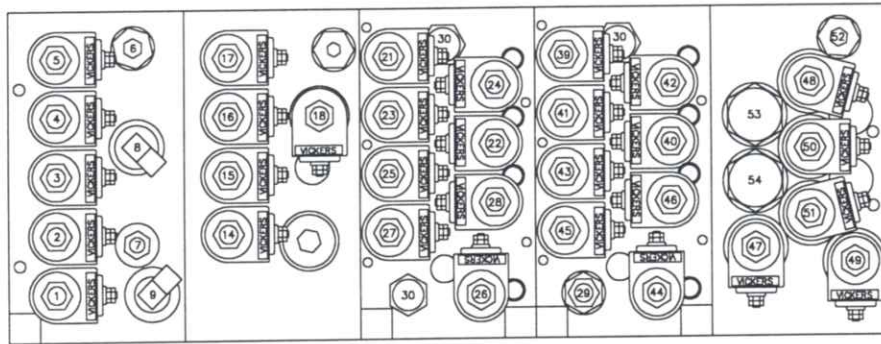
AUGER/ SPINNER/ FRONT PLOW/ WING PLOW/ BED 'A'/ BED 'B'



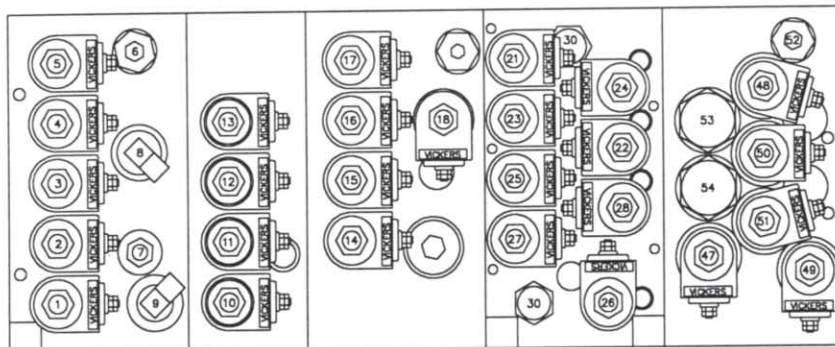
** See the list on page 4-2 for the function and wire colors.

COMBINATION OF 2000 SERIES BLOCKS

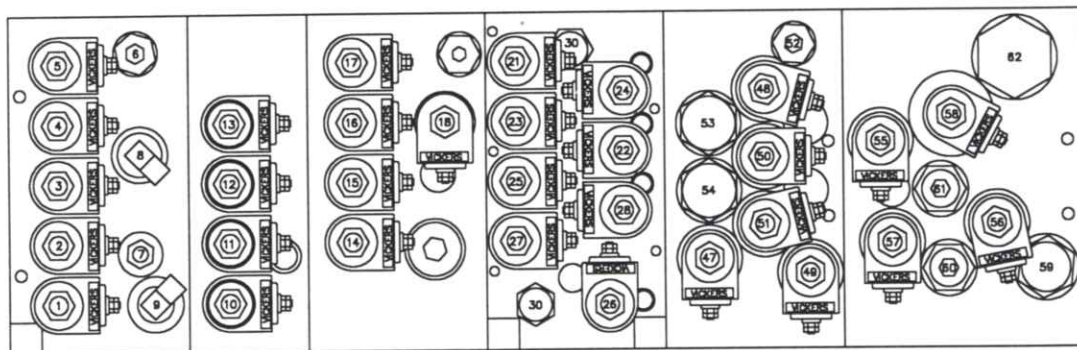
AUGER/SPINNER/FRONT PLOW/UNDERBODY PLOW/BED 'A'



AUGER/WETTING/SPINNER/FRONT PLOW/BED 'A'



AUGER/WETTING/SPINNER/FRONT PLOW/BED 'A'/BED 'B'



** See the list on page 4-2 for the function and wire colors.

2000 Series Pengwyn System Pre-Winter Check List

Tag Number
Software Version
Equipment Number

Manifold S.N.
Control Box S.N.
Pump S.N.

Date Tested
Test By

Constant Setting	Manual Lock Out Key Position	Programming Key Position	Mode Switch Position	Spreader Switch	Auger Switch	Bed Switch	Plow Lift Switch	Plow Angle Switch	Blast Switch	Display Reads	Existing Value	New Value	Notes
Existing Pulses	ON	CALIBRATE	4	OFF	0	UP to increase DN to decrease	Down for 100's	OFF	OFF	PULSES / .1 MI XXXX			Measure the set distance. Blast to "Start Feet." Run distance then blast to "Stop Feet."
Calculating Speed Constant	ON	RUN	4	OFF	0	OFF	OFF	OFF	UP Start Feet	START FEET X			$((D / A) \times EP = NP)$ D = Display FT A = Actual FT EP = Existing Pulses NP = New Pulses
Minimum Value	ON	CALIBRATE	2	OFF	0	UP to increase DN to decrease	UP	OFF	OFF	MINIMUM VALUE X			Min. value of "1" is recommended for single axle trucks.
Zero Velocity	ON	CALIBRATE	2	OFF	0	UP to increase DN to decrease	DN	OFF	OFF	CAL SPIN XX.X or 0 VEL MPH XX.X			Required for Zero Velocity Equipped trucks only.
Day of Week	ON	CALIBRATE	3	OFF	0	UP to advance	OFF	OFF	OFF	CAL DAY XXX			When used with laptop, laptop will set.
Time of Day (HRS)								LT		CAL HRS XX:XX XX			
Time of Day (MIN)								RT		CAL MIN XX:XX XX			
Main Relief Pressure	ON	MAINTENANCE	6	MANUAL	0	OFF	OFF	OFF	ON	HI = XXXX DF = XXXX			Run engine approx. 1,500 RPM. Auger hoses should be disconnected.
Bed / Plow Relief Pressure	ON	MAINTENANCE	6	MANUAL	0	OFF	OFF	RT	OFF	HI = XXXX DF = XXXX			Run engine approx. 1,500 RPM. Bottom out plow cylinder.

Constant Setting	Manual Lock Out Key Position	Programming Key Position	Mode Switch Position	Spreader Switch	Auger Switch	Bed Switch	Plow Lift Switch	Plow Angle Switch	Blast Switch	Display Reads	Existing Value	New Value	Notes
Bed Down Relief Pressure	ON	MAINTENANCE	6	MANUAL	0	DOWN	OFF	OFF	OFF	HI = XXXX DF = XXXX			Run engine approx. 1,500 RPM. Hold bed down switch.
Auger Fault or Spreader Alert	ON	MAINTENANCE	1	AUTO	0	OFF	OFF	OFF	OFF	SETTING 1 = XXXX SETTING 2 = XXXX SETTING 3 = XXXX SETTING 4 = XXXX SETTING 5 = XXXX SETTING 6 = XXXX SETTING 7 = XXXX SETTING 8 = XXXX SETTING 9 = XXXX SETTING 10 = XXXX SETTING 11 = XXXX SETTING 12 = XXXX SETTING 13 = XXXX SETTING 14 = XXXX SETTING 15 = XXXX	----- ----- ----- ----- ----- ----- ----- ----- ----- ----- ----- ----- ----- ----- ----- -----	----- ----- ----- ----- ----- ----- ----- ----- ----- ----- ----- ----- ----- ----- ----- -----	Spreader should be installed but empty. Warm fluid to 80 degrees. Rev engine to 1,500 RPM. Dead head plow up switch. Set engine throttle to 1,500 RPM and record values. When finished, turn spreader switch off.
Calibrated Drag or Material Load	ON	CALIBRATE	2	OFF	0	UP to increase DN to decrease	OFF	LF	OFF	CAL DRAG XXXX OR MATR LOAD XXXX			This should usually be set this around 50 - 100 PSI. (higher settings cause alarms sooner)
Constants Check	ON	CALIBRATE	1	OFF	0	OFF	OFF	RT	OFF	DISPLAYS CONSTANTS			

Constant Setting	Manual Lock Out Key Position	Programming Key Position	Mode Switch Position	Spreader Switch	Auger Switch	Bed Switch	Plow Lift Switch	Plow Angle Switch	Blast Switch	Display Reads	Existing Value	New Value	Notes
Spreader Jam	N / A	CALIBRATE	2	OFF	0	UP to increase DN to decrease	OFF	RT	OFF	CAL JAM XXX OR JAM PSI XXXX			Set at 200 PSI below main relief setting.
Obtaining LBS / GPM Spreader Constant	ON	RUN	2	ON	1 & 2	OFF	OFF	OFF	OFF	POUNDS / MILE	N / A	N / A	Run engine at 1,500 RPM. Weigh spreader output for 1 minute at setting 1 then again for setting 2. Subtract value 1 from value 2 and enter.
LBS / GPM or Spreader Constant	ON	CALIBRATE	2	OFF	0	UP to increase DN to decrease	OFF	OFF	OFF	AUGER CNST XXXX LBS PER GPM XXXX			Install spreader value from above.
Spread Rate 1	ON	CALIBRATE	2	OFF	1	UP to increase DN to decrease	OFF	OFF	OFF	SPREADER-1 XXXX	-----	-----	
2					2					SPREADER-2 XXXX	-----	-----	
3					3					SPREADER-3 XXXX	-----	-----	
4					4					SPREADER-4 XXXX	-----	-----	
5					5					SPREADER-5 XXXX	-----	-----	
6					6					SPREADER-6 XXXX	-----	-----	
7					7					SPREADER-7 XXXX	-----	-----	
8					8					SPREADER-8 XXXX	-----	-----	
9					9					SPREADER-9 XXXX	-----	-----	
10					10					SPREADER-10 XXXX	-----	-----	
11					11					SPREADER-11 XXXX	-----	-----	
12					12					SPREADER-12 XXXX	-----	-----	
13					13					SPREADER-13 XXXX	-----	-----	
14					14					SPREADER-14 XXXX	-----	-----	
15					15					SPREADER-15 XXXX	-----	-----	
Orifice Check	ON	RUN	N / A	MANUAL	1 2 4 8	OFF	OFF	OFF	N / A		----- ----- ----- -----	----- ----- ----- -----	

Constant Setting	Manual Lock Out Key Position	Programming Key Position	Mode Switch Position	Spreader Switch	Auger Switch	Bed Switch	Plow Lift Switch	Plow Angle Switch	Blast Switch	Display Reads	Existing Value	New Value	Notes
Fluid Temperature	ON	RUN	7	N/A	0	OFF	OFF	OFF	OFF	FLUID TEMP XXX	N/A	N/A	Engine speed should be idle.
Underbody Plow Pressure Check	N/A	RUN	1	OFF	0	OFF	Scraper DOWN	OFF	OFF	N/A			Plow down pressure pulses routinely per manual.
Fluid Pressure	ON	RUN	8	N/S	0	OFF	OFF	OFF	OFF	PRESSURE XXX	N/A	N/A	Engine speed should be idle.