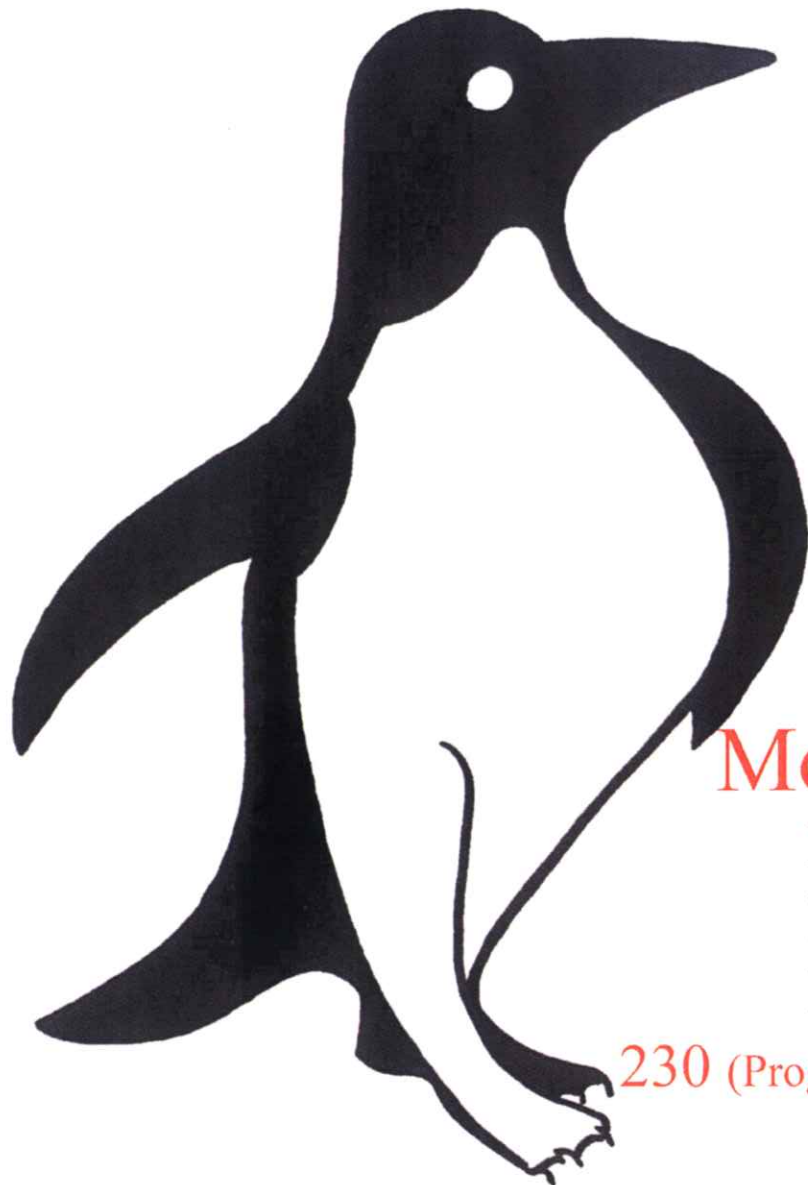


M Series

Technical Manual



Models:

M97

M98

M99

230 (Programming Only)

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Introduction

Thank you for choosing our ground-oriented central hydraulics system. Our goal has always been to provide great customer service and a safe, reliable product that emphasizes:

- **simplicity of operation,**
- **operator safety,**
- **management control,**
- **reduced operating costs, and**
- **year round usage.**

In order to reach our goal of reliability, your new Pengwyn system uses the rugged Autosucker™ on-demand pump. It has a dry valve design with fixed displacement that generates hydraulic flow to a series of poppet-style solenoid cartridge valves. Poppet valves are bang-bang solenoid devices which means they are either on or off. They are reliable, dirt tolerant, inexpensive to repair, contain only static seals, and are not damaged by long periods of sitting idle. These features, as well as the testing done on each system before it leaves the facility, contribute to the overall dependability.

Not only is your new system reliable, but it has been designed to be safe and easy for the operator, as well as the maintenance personnel. The operator has complete control of all the functions with the touch of a switch or dial on the control console. This allows the operator to concentrate on the road. Another feature to help the operator is the system of alarms. The alarms alert the operator to any problems with low material, jams, high oil temperature, low oil level, low/high pressure, and internal faults. This again keeps the operator from diverting attention from the roadway. Another safety consideration includes having all the hydraulics on the exterior of the cab and away from the operator.

Other features of your Pengwyn system, include running hydraulic tools off the system itself and allowing for management programming of spreader constants. By allowing for management control and year round utilization, your system is cost effective and lowers deicing material usage. Lowered material usage not only allows money to be used for something else, but helps to limit the damage done to the environment.

Please look to this manual for information on the major features, calibration of the system, and troubleshooting guidelines. This manual will help you calibrate, operate, and maintain your new spreader system. Pengwyn does offer extensive training and we are also available by calling 1-800-233-7568. Please call if you have a problem. We are here to help you.

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 HOL-
LOW AND EASILY DAMAGED. BE CARE-
FUL 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 OR MOUNT
AUXILIARY SWITCHES TO THE CON-
TROL CONSOLE. THIS WILL VOID THE
WARRANTY. USE THE CONTROL CON-
SOLE MOUNTING BRACKET FOR THIS
PURPOSE.**

LIMITED WARRANTY

Pengwyn warrants M Series components 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.

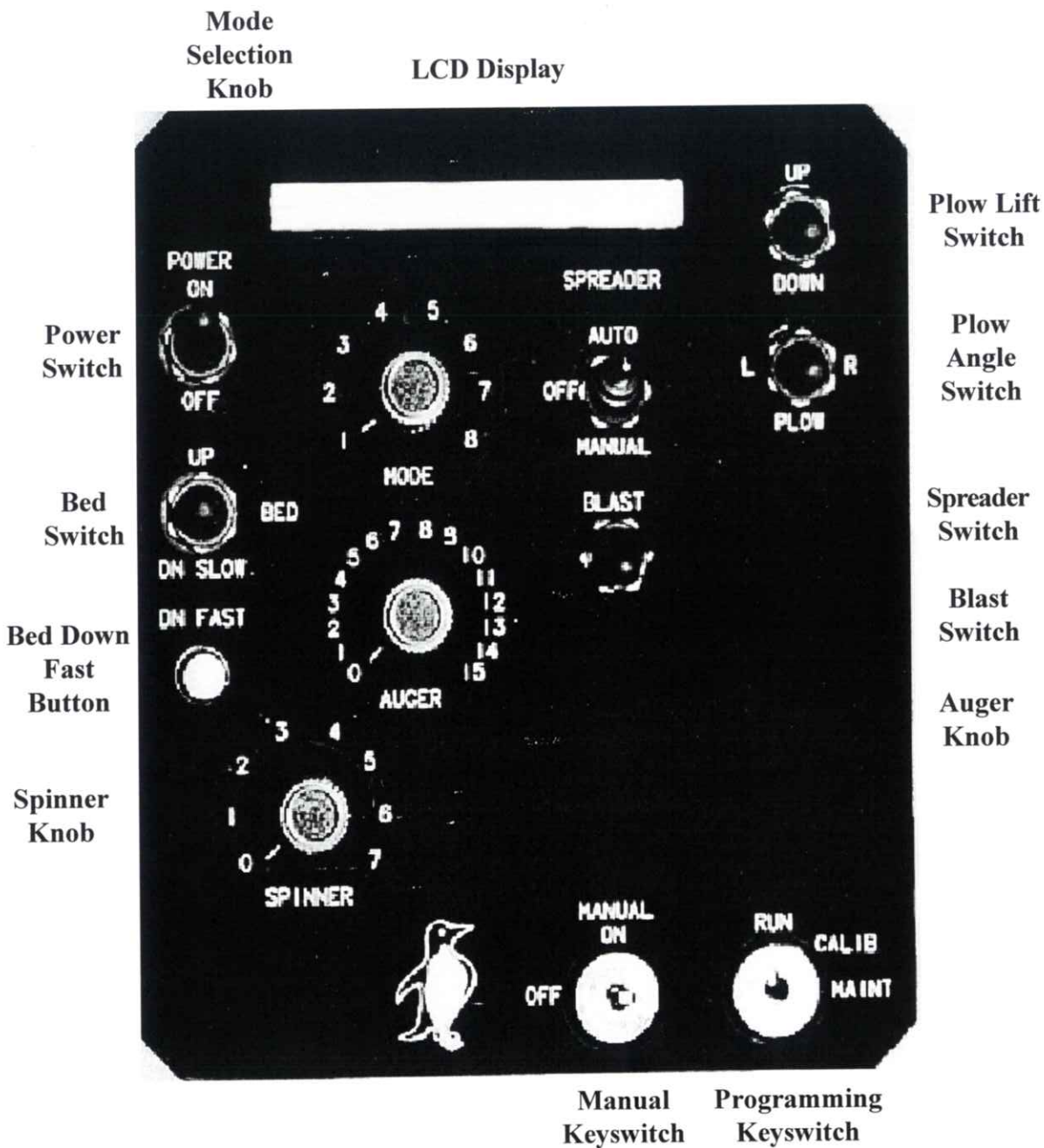
It is recommended that spare parts be purchased for critical items to allow continued operation of equipment during the inspection, evaluation, or repair/replacement process.

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.

PRODUCT IMPROVEMENT LIABILITY DISCLAIMER

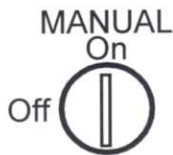
Pengwyn reserves the right to make any changes in or improvements on its products without incurring any liability or obligation whatever and without being required to make any corresponding changes or improvements in products previously manufactured or sold.

Control Console Front Panel



Operation of Control Console

Manual Lockout Keyswitch



The manual lockout keyswitch position determines whether the system's manual control of the auger and/or spinner is available. If locked off, no power will be sent to the auger/spinner coils when the spreader switch is in **MANUAL**.



Programming and Maintenance Keyswitch

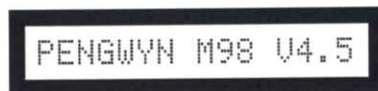


The programming and maintenance keyswitch has three settings. They are run, calibrate, and maintenance. **RUN** is at 12:00 o'clock position, **CALIB** is at 1:30 position, and **MAINT** is at the 3:00 o'clock position. Each setting will be discussed in more depth where they apply.

The programming and maintenance keyswitch must always be returned to the **RUN** position before the truck is returned to the operator for everyday use. If the key position is left in **CALIB** or **MAINT**, not all of the hydraulic functions will work correctly until the key is turned back to **RUN**.



Main Power



When the power switch is in the **ON** position, the panel will light up and the display will come on. The display will briefly show the system number, the software version and then the information dictated by the mode selected.



Bed Switches

There is a bed switch and a bed down fast button. The switch controls raising the bed and lowering it slowly. When the bed switch is in the down position and the bed down fast button is pushed at the same time the bed is lowered more quickly.



Plow Switches

There are two plow switches on the lower right of the control box. The upper plow switch controls the up and down motion of the plow. The lower plow switch controls the left and right movement of the plow.



Spreader Switch

The spreader switch has three positions: **AUTOMATIC**, **OFF**, and **MANUAL**. The manual position is only active if the manual lockout keyswitch is turned to **ON**.

Operation of Control Console (Cont'd)

Mode Selection Switch

The selection of the mode dial indicates the type of information shown on the display. The following table shows the information displayed at each selection of the dial.

Position	Type of Information
1	Vehicle speed in miles per hour (MPH) Should closely match truck speedometer.
2	Pounds per mile of material output at the spreader Number shown is material output if the truck is driven at the current speed for one full mile.
3	Day and Time
4	Distance measured in feet When the spreader is OFF this will measure distance in feet. Press blast and the distance will be displayed with the screen "RUN XXXXXX FT". Press blast again and the count will stop. The display will read "STOP XXXXXX FT". In manual with the spreader ON , this position will read "TOOL MODE" and the alarms will be off, allowing the tools to be run off the Pengwyn system without nuisance alarms.
5	Distance measured in miles This is the same as mode 4 but shows the distance measured in miles.
6	Total miles traveled and total pounds of material The control console stores the total pounds of material spread and the total miles traveled when the spreader switch is ON . Data accumulation stops when the spreader switch is turned OFF , but continues when it is turned back ON . The data is added to that in memory. When the spreader is off, the blast switch is depressed, and this display is selected; the display values and datalog will be reset to 0. The information can be downloaded into a computer for display of graph and table information.

Operation of Control Console (Cont'd)

Mode Selection Switch (cont'd)

FLUID TEMP XXX°F

7 Fluid temperature

Displays the hydraulic reservoir temperature in Fahrenheit degrees.

The Pengwyn control console will read and display the hydraulic reservoir temperature. To read the temperature:

1. Turn mode switch to position 7.
2. Start engine and run at idle.

The display will show "FLUID TEMP XXX°F".

3. Push the spreader switch to **AUTOMATIC**.
4. Wait 10 seconds.
5. Turn spreader switch **OFF**.

This allows the pump to circulate hydraulic fluid from the reservoir through the manifold to the temperature sensor. It will now display the actual temperature.



XXXX/XXXX PSI

8 Pressure

Displays the hydraulic system pressure in pounds per square inch (psi). Both the high and the differential pressure readings are shown. The first reading is the high pressure (taken from the pump pressure) and the second reading is the differential pressure (Represents the pressure differential across the auger motor).

The Pengwyn control console will read and display the hydraulic system pressure and differential pressure. To read system pressure:

1. Turn the mode switch to position 8.

The display will show "XXXX/XXXX PSI". The pressure displayed is the pressure required to push pump flow through the manifold, compensator valves, pump bypass valve, and return line hosing.

2. Start truck and increase engine speed to 1500 RPM.
3. Operate any hydraulic function (normally used for relief valve pressure settings - see: Pressure Adjustments section for more information).

The pressure required to operate that 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.

Operation of Control Console (Cont'd)

Auger Switch (Spreader Material Output Selection Switch)

The auger has 15 settings. If the spreader switch is on **MANUAL** and the manual lockout keyswitch is turned **ON** then each numerical position sets the flow to the auger circuit. Position **1** will indicate that one GPM of hydraulic oil is moving to the auger circuit and so on up to 15 GPM at position **15**. Flow to the auger circuit in **MANUAL** is constant and not ground oriented.

If the spreader switch is on **AUTOMATIC** then the positions will output preprogrammed values in pounds per mile (lbs/mi). This will be ground oriented and depends on truck speed. Position **1** will output the amount that is programmed into it, such as 100 lbs of material per mile. Position **2** may be set for 200 lbs of material and so on up to position **15**. The Penwyn increases/decreases hydraulic flow to the auger so the operator will have an even material application throughout the entire speed range of the truck and maintain the output of lbs/mi that the operator has selected. When the truck is stopped, the auger will also stop.



Spinner Switch (Spinner / NaClone™ Speed Control Selection Switch)

The spinner has eight settings. Position **0** is off. When the spreader switch is turned **ON** to either **AUTOMATIC** or **MANUAL**, settings **1** through **7** increase hydraulic flow to the spinner by one gallon per minute for each setting. The flow is not ground oriented and the spinner will continue to turn even when the truck stops. In position **7**, when the spreader is in **AUTOMATIC** only, the spinner is ground oriented and flow is determined by the speed of the truck. When the truck is stopped and the spinner is in position **7** the circuit has a minimum flow of 1 GPM. Position **7** is used for zero velocity. The spinner is not effected by the blast switch unless Z-Blast is turned **ON** (To check that Z-Blast is **OFF** refer to the pre-winter checklist at the back of this manual. Z-Blast is intended for use only with zero-velocity on the Z98 Series). When spreading in **MANUAL** there is no ground oriented setting for the spinner.



Blast Switch

The blast switch is designed to allow maximum material output when going through intersections, over bridges, or wherever a higher application rate may be needed.

The blast switch is a spring return to neutral toggle switch that is used to override the setting of the auger switch in either the automatic or manual mode of operation. When activated, the blast switch energizes all the auger/conveyor valves, sending maximum hydraulic flow to the auger/conveyor drive motor. The auger/conveyor will put out maximum material when the blast switch is activated. When released, the switch returns to its **OFF** position and the spreader returns to the material output as set by the auger switch.

Operation of Control Console (Cont'd)

Hydraulic Tool Mode



In order to run tools off the Pengwyn system, you must 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. The manual lockout key will be in the **ON** position and the dial labeled mode should be on position **4**. The display will read "TOOL MODE". Bring the truck engine speed up to approximately 1000 RPMs. The dial labeled auger will allow you to select the gallons per minute needed for the tool. Each position on the dial is equal to the gallons per minute. Therefore, position **1** gives one gallon per minute of flow and so on.

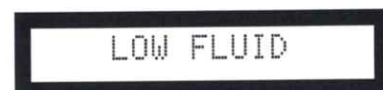


Warning Alarms

There are five warning alarms that include:

- Low fluid
- Spreader alert
- Spreader jam
- High temperature
- Internal fault

Low Fluid



If the spreader switch is in the **MANUAL** or **AUTO** position, the control box will produce an audible beep to warn about low fluid. The display will only flash "LOW FLUID" even if the spreader switch is in the **OFF** position.

This warning indicates that the hydraulic fluid in the reservoir tank is low. This will not interrupt the functions of the system, as long as there is some hydraulic fluid in the reservoir. The spreader switch should be turned to the **OFF** position to protect the pump, and the truck should be returned to the shop for maintenance immediately.



High Temperature



This warning indicates that the temperature has exceeded the maximum recommended operating temperature. The control box will produce an audible beep and the display will flash "FLUID HOT". By selecting mode **7** on the control box, the hydraulic fluid temperature will be displayed. All hydraulic functions should be turned off and the truck should be returned to the shop for maintenance immediately.

Operation of Control Console (Cont'd)

Spreader Alert (auger unload fault)

SPREADER ALERT

If there is an audible beep and the control box display flashes "SPREADER ALERT", there is no material being ejected by the spreader.

Spreader Alert indicates that there has been a reduction of the load on the drive motor. Generally, this is caused when the spreader is out of material. Other causes include:

- Tunneling/bridging of the material
- A broken mechanical connection between the drive motor and the auger/conveyor
- A blown hose on the auger/conveyor drive motor
- A drive motor with reduced efficiency



Spreader Jam (auger jam fault)

SPREADER JAM

Spreader Jam will cause an audible beep and the control box display will flash "SPREADER JAM". This indicates that no material is being ejected by the spreader system. It may be caused by a material jam at the auger/conveyor or spinner. Another possibility may be that a quick disconnect to the auger/conveyor or spinner drive motor may not be connected.



Internal Fault

INTERNAL FAULT

If there is a failure on any of the internal hardware, "INTERNAL FAULT" will flash on the screen. The control box may need repaired. The fault may be related to electronic noise from other devices in the cab. In this case, turn the control box off and back on.



Operation of Control Console (Cont'd)

Retracting the Plow Cylinder

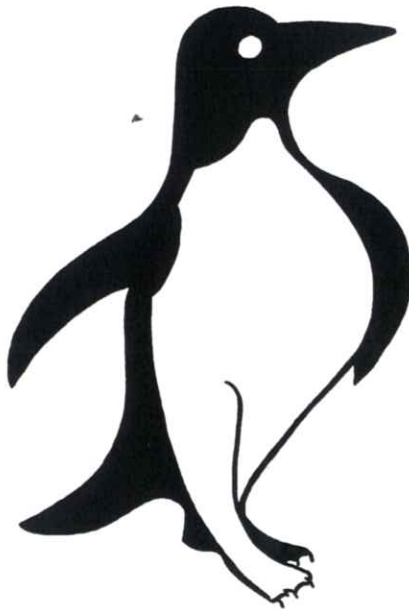
The M98 Series plow circuit is basically a single acting circuit which utilizes the plow's weight to retract the cylinder or lower the plow; however, for hook up purposes only, oil is used from the bed down circuit to retract the plow cylinder. This is accomplished by simultaneously operating the plow down and the bed down switches. This will hydraulically retract the plow cylinder.



Very Cold Temperature Operation

During extremely cold weather with the spreader off the hydraulic fluid viscosity may become so thick the cylinder functions become very sluggish. To remedy this, two procedures will help.

1. Turn the auger switch to **0**, the spinner switch to **2**, and the spreader switch to **AUTO**. This will allow continuous circulation of the pump with the spreader off.
2. If more rapid hydraulic fluid warming is desired, hold the plow switch **UP** for a minute or two; dead heading the plow cylinder and forcing the oil over the plow relief valve. This will warm the oil approximately five to 10 degrees per minute.



Control Console Programming

Caution: Always return the programming key to the RUN position before turning the console power switch or the truck key off. Turning the power off before resetting the programming key (turning it back to RUN) may cause the loss of some of the newly programmed numbers. By turning the key to the RUN position any programmed constants will be saved to the Pengwyn memory and the control box will be returned to normal hydraulic operating mode.

Setting the Speed Constant

CAL MPH 0

The speed constant and the distance measuring constant method can both be used to program the control console to the truck's speedometer. Using the surveyed mile method it is the most accurate.

1. Jack rear axle of truck up and block the front wheels.

OR

1. Be prepared to drive the truck.
2. Turn the programming key to the **CALIB** position.
3. Turn the **MODE** switch to position **1**.

The display will read CAL MPH 0.

4. Operate the truck at a constant speed (30 MPH or more).

Use the truck speedometer, not the control console, to determine truck speed.

5. Compare truck speedometer to speed shown on control console display.

To adjust the speed of the console to match the speed of the truck speedometer:

1. In mode **1**, push the **BED** switch to the **UP** position to increase the displayed console speed.
2. Push the **BED** switch to the **DOWN SLOW** position to decrease the displayed console speed.
3. Turn programming key to **RUN** position to save.

The speedometer setting is now complete.

4. Turn the **MODE** switch to position **4**.
5. Turn programming key to **CALIB** position.
6. Record the pulse count shown for your records.
7. Return programming keyswitch to **RUN**.



Setting the Distance Measuring Constant (using a surveyed mile)

START XX FT

To set the distance measuring constant using a surveyed mile:

1. Turn the programming key to the **RUN** position.
2. Turn the **MODE** switch to position **4**.

The display will read "START XX FT".

3. Drive the truck toward the starting point of the measured mile.
4. Push up on the blast switch when at the starting point.

Control Console Programming (Cont'd)

Setting the Distance Measuring Constant (Cont'd)

RUN XXXXXX FT

STOP XXXXXX FT

This calculation can be done for any measured distance over 400 ft.

PULSES/.1MI XXXX

The display will read "RUN XX FT" and then will begin increasing as the truck continues toward the mile marker.

5. Bring the truck to a stop at the end of the measured distance and push up on the blast switch when the end of the measured mile is reached.

The display will now show "STOP XX FT". XX will be the feet the console counted over the measured distance.

6. Record the number shown for your records (this number will be needed for a later calculation).

To find the pulse constant or if setting the constant with a known value:

1. Turn the programming key to the **CALIB** position.
2. Turn the **MODE** switch to position 4.

The display will read "PULSES/.1MI XXXX". The XXXX indicates some number that could be anything from 0 to 5000. If the correct pulse count is known, this number can be directly inserted without driving the truck. If the correct pulse is not known record the pulse for the calculation that must be computed, otherwise:

3. Push the **BED** switch to the **UP** position to increase the number displayed.
4. Push the **BED** switch to the **DOWN SLOW** position to decrease the number displayed.

If a large number change must be made, pushing the bed down fast button while simultaneously pushing the bed switch **UP** or **DOWN SLOW** will change the displayed number in increments of 100. When the correct number is achieved, the speedometer setting is complete.

5. Turn the programming key to the **RUN** position to save the settings.

Use steps above to put new pulse number into control box.

Calculation for Setting the Distance Measured Constant

$$\frac{\text{Measured Distance (from control box)}}{\text{Actual Distance Traveled (ft)}} \times (\text{Pulses from Control Box}) = \text{New Pulse Constant to be installed}$$

Once the MPH calibration is completed for a truck the pulse constant will always remain the same for the life of that truck.

Control Console Programming (Cont'd)

Conveyor Minimum Value



CONVEYOR MIN X

When operating in the automatic mode, the Pengwyn system is set up to send a minimum flow rate 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 out material when starting the truck from a dead stop. To set the minimum number:

1. Turn the programming key to the **CALIB** position and the **MODE** switch to position 2.
2. Push the **PLOW** switch to the **UP** position and hold.

The display will read "CONVEYOR MIN X".

3. Push the **BED** switch to the **UP** position while holding the plow switch to increase the displayed number.
4. Push the **BED** switch to the **DOWN** position while holding down the plow switch to decrease the displayed number.

The minimum value number is adjustable from 0 to 5 in 1 gallon increments. A setting of one is recommended for single axle trucks and a setting of two for V-Box equipped trucks.



Control Console Programming (Cont'd)

Setting the Day and Time

CAL DAY XXX

CAL HRS XX:XX AM

CAL MIN XX:XX AM

2. Turn the **MODE** selection switch to position **3**. The display will read "CAL DAY XXX". The XXX represents the day, i.e. SUN, MON, etc.

3. Push the **BED** switch to the **UP** or **DOWN** position until the correct day is shown.

4. Push the **PLOW** angle switch to the **LEFT** position and hold.

The display will read "CAL HRS XX:XXAM".

5. Hold the **PLOW** switch and push the **BED** switch to the **UP** position to change the displayed hours and the displayed AM or PM (using the bed down fast button with the bed down switch will speed up the display).

This works on a 24 hour clock and is set the same as a digital watch. When this is set correctly:

6. Push the plow angle switch to **RIGHT** and hold.

The display will read "CAL MIN XX:XXAM".

7. Hold the plow switch and push the **BED** switch to the **UP** position 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 settings are complete.



Setting Spreader Alert

Unless loading previous constants from a laptop, this procedure must be done if a control box is changed. The procedure should be repeated occasionally as a standard maintenance check to adjust for auger/conveyor or motor wear. The procedure should also be done any time the auger/conveyor motor is changed or the design of the spreader is changed. This is to prevent nuisance spreader alert alarms. To set the spreader alarm:

1. Have the engine running.
2. Have the spreader box or conveyor belt empty.
3. Turn the mode switch to position **7**.
4. Read the temperature on the display.
5. If temperature is below 80° then warm up the hydraulic oil to approximately 80°.

To warm up the hydraulic oil:

1. Bring truck engine speed to 1500 rpm.
2. Push the **PLOW UP** switch.
3. Bottom plow cylinder.
4. Turn to **MODE 7** to monitor temperature.

Control Console Programming (Cont'd)

Setting Spreader Alert (Cont'd)



SETTING 1 = XXXX

There will be a short delay before the control box starts through the settings.

Once the proper temperature is achieved continue to set the spreader alarm:

5. Release the plow switch.
6. Maintain 1500 rpm engine speed.
7. Turn the programming key to **MAINT**.
8. Turn the **AUGER** switch and the **SPINNER** switch to **0**.
9. Push the **SPREADER** switch to **AUTO**.

As the automatic spreader alert settings advance.

10. Write down the settings so they can be checked in "Checking the Spreader Alert" setting below.

The display will read "SPREADER CALIBRATE" and "PRESSURE CALIBRATE", as it tests the pump pressure. The display then will read "START UNLOAD CAL" and then "SETTING 1 = XXX", "SETTING 2 = XXX" and so on. The displayed pressure readings should slightly increase for each progressive setting. This will continue automatically up to "SETTING 15 = XXX". The display will then read "FINISHED" and then "TURN SPREADER OFF".

11. Turn the spreader **OFF**.
12. Lower the engine speed.
13. Turn the programming key to **RUN** to save constants.

The spreader alert is now set.



Checking the Spreader Alert

To assure the spreader alert programming numbers were maintained in memory, the program numbers should be reviewed. To review these numbers:

1. Turn the programming key switch to **CALIB**.
2. Turn the **MODE** switch to position **1**.
3. Push and hold the **PLOW** angle switch to the **RIGHT** position.

The display will show low temperature, high temperature, alarm setting, and then all the spreader alert programming numbers will flash across the display.

4. Check these to the numbers that were displayed in step 10 above.

If they match, the numbers were stored in the memory. If the numbers are not the same, repeat the spreader alert procedure.



Control Console Programming (Cont'd)

Setting the Spreader Jam

CAL JAM XXXX

Spreader jam is the pressure setting at which the control box will alarm the operator that the auger/conveyor or spinner has jammed or locked up. Spreader jam is factory set at 2500. It should be set at 200 psi below the main relief valve setting. To set this number:

1. Turn the programming key to the **CALIB** position.
2. Turn the **MODE** switch to position **2**.
3. Push the **FRONT PLOW** switch to the **RIGHT** position and hold.

The display will read "CAL JAM XXXX".

4. Hold the **PLOW** switch and push the **BED** switch to the **UP** position to increase the setting.
5. Hold the **PLOW** switch and push the **BED** switch to the **DOWN SLOW** position to decrease the setting.

The numbers will change in increments of 10. When the bed down fast button is used with the bed switch the numbers will change in increments of 100.

6. Record the spreader jam constant for your records.
7. Turn programming key to **RUN** to save constant.

Setting the Spreader Drag

CAL DRAG XXX

The spreader drag setting determines the amount of material remaining on the auger or conveyor when the spreader alert alarm goes off. The number shown is the pressure above the empty auger fault reading when the Pengwyn sounds the alarm. To set the spreader drag:

1. Turn the programming key to the **CALIB** position.
2. Turn the mode switch to position **2**.
3. Push the **FRONT PLOW** switch to the **LEFT** position and hold.

The display will read "CAL DRAG XXX". This number will usually be set between 50 and 120. This number varies with the type and make of the spreader used on the truck.

4. Hold the **PLOW** switch and push the **BED** switch to the **UP** position to increase the setting.
5. Hold the plow switch and push the **BED** switch to the **DN SLOW** position to decrease the setting (using the down fast button will change the number in increments of 10).
6. Record the spreader drag number for your records.
7. Return programming key to the **RUN** position to save the constant.

Control Console Programming (Cont'd)

Checking the Spreader

Drag (auger)

With material on the spreader box or the conveyor:

1. Start the engine.
2. Bring the engine speed up to about 1500 RPM.
3. Turn the programming key to the **RUN** position.
4. Turn the auger switch to position **8 (or any setting)**.
5. Push the spreader switch to **MANUAL**.

(Manual key turned to the **ON** position)

6. Allow the system to run until the spreader alert alarm goes off.
7. 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 spreader drag number. If too little material remains, raise the spreader drag number. Setting the drag too high can cause nuisance alarm signals.



Setting the Spread Rate (auger)

SPREADER 1 - XXXX

When operating the spreader in automatic, positions **1** through **15** on the auger switch determine the spreader output rate in pounds per mile. Each position must have the desired output rate programmed into it. The number programmed into each setting determines the available spreader rates in pounds per mile (lbs/mi) the operator has to choose from. It is up to the end user to determine the programmed rates they wish to make available to the operator. To program:

1. Turn the programming key to the **CALIB** position.
2. Turn the **MODE** switch to position **2**.
3. Turn the **AUGER** switch to the position to be programmed (**1** through **15**).

Each position will have to be set. The display will read "SPREADER 1 - XXXX".

4. Push the **BED** switch to the **UP** position to increase the setting.
5. Push the **BED** switch to the **DN SLOW** position to decrease the setting.

The numbers will change in increments of 10. When using the bed down fast button with the bed switch the numbers will change in increments of 100.

6. Record the spreader settings for each position for your records.

If 0 is programmed into any setting, the auger/conveyor will not turn when that setting is selected.



Control Console Programming (Cont'd)

Finding the Spreader Constant (auger)

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

To set up to find the spreader constant:

1. Weigh an empty bucket capable of holding 30 to 90 lbs of your granular deicing material.
2. Position bucket under output of the auger/conveyor to catch the material.
3. Ensure that material is distributed evenly over entire spreader box or conveyor belt.

With a V-box hopper, the gate opening must be adjusted to the position in which the truck will be operated. If the gate opening is changed, the new auger constant number must be found or the spreader system will no longer be accurate.

To find the spreader constant:

4. Turn the manual key to the **ON** position and the mode switch to position **2**.
5. Turn the programming key to the **RUN** position.
6. Start the engine and bring the engine speed to 1000 RPM.
7. Turn the **AUGER** switch to position **1**.
8. Turn the **SPINNER** switch to position **0**.

You will need a stop watch to time the procedure.

9. Push the spreader switch to **MANUAL** and start timing.
10. Allow the system to run for one minute.
11. Turn the spreader switch **OFF**.
12. Weigh the bucket of material.
13. Repeat the procedure with the auger switch in position **2**.
14. Subtract value measured at auger 1 from auger 2.
15. Record this number for your records.


Auger 2 =	<input type="text"/>
Auger 1 =	<input type="text"/>
Spreader Constant	<input type="text"/>

The resulting number is the spreader constant. You may want to run through this procedure twice, in order to double check.



Control Console Programming (Cont'd)

Setting the Spreader Constant (auger)



CAL SPREADER XX

To insert the spreader constant into the control console:

1. Turn the programming key to **CALIB**.
2. Turn the **MODE** switch to position **2**.
3. Turn the **AUGER** switch to position **0**.

The display will read "CAL SPREADER XX".

4. Push the **BED** switch to **UP** to increase the number.
5. Push the **BED** switch to **DOWN SLOW** to decrease the number (bed down fast increases/decreases the number in increments of 10).

When the number on the display matches the spreader constant number this procedure is finished.

6. Return the programming key to **RUN** to save.



Speedometer Type



SPEEDOMETER: XXX

The type of speedometer is now selected in the calibration procedure. The two choices include SINE which is for all manual transmissions and SQR for trucks with an Allison World Transmission. To select the appropriate setting:

1. Turn program key to **CALIB**.
2. Turn the mode switch to position **1**.
3. Push **FRONT PLOW UP** and hold.
4. Use the **BED** switch to toggle between the two settings.



Cylinder Selection for Plow and Bed



CYND.PLW:X BED:X

S = single acting
D = double acting

In this setting specify whether the plow, bed, or both are single/double acting. To change the setting:

1. Turn the program keyswitch to **CALIB**.
2. Turn mode switch to **8**.
3. Push **FRONT PLOW** switch to **LEFT** and hold.
4. Push the **BED** switch **UP** or **DOWN** to toggle through the settings.



Control Console Programming (Cont'd)

Beeper Option

BEEP OPTION: XXXX

It is now possible to specify how the alarm system should go off. If **ONCE** is selected then the alarm beeps the first time the alarm message is shown, but not again. If **CONT** is selected the alarm sounds every time the alarm message flashes on the screen. **OFF** disables the beeper completely, but the alarm message will flash on the screen. To set the beeper option:

1. Turn the programming key to **CALIB**.
2. Turn the **MODE** switch to **8**.
3. Push **PLOW** angle switch to **RIGHT** and hold.
4. Push the **BED** switch **UP** or **DOWN** to toggle through the settings.
5. Turn the programming key to **RUN** to save.



NaClone Minimum Value (Spinner Minimum)

NACLONE MIN: X

This determines the minimum hydraulic flow to the spinner in automatic. It should be set at 3 for zero velocity or at 0 for a conventional spreader. To change the setting:

1. Turn the programming key to **CALIB**.
2. Turn the **MODE** switch to **1**.
3. Push the **FRONT PLOW** to **DOWN** and hold.
4. Push the **BED** switch **UP** to increase the setting and **DOWN** to decrease the setting.
5. Return the programming key to **RUN** to save.

Fluid Type

FLUID TYPE XXXX

The fluid type allows the type of fluid being used to be selected. The two choices include **AW46** for hydraulic fluid and **ATF** for automatic transmission fluid. The default and suggested setting is **AW46**. When changing this setting be sure to change temperature settings to match the type of fluid being used. To change the setting:

1. Turn programming key to **CALIB**.
2. Turn the **MODE** switch to **8**.
3. Use the bed switch to toggle between settings.



Control Console Programming (Cont'd)

High Temperature

HIGH TEMP= XXX°F

This is factory set at 120° and should not be changed unless necessary. To change setting:

1. Turn programming key to **CALIB.**
2. Turn **MODE** switch to **6.**
3. Push the **PLOW** switch **UP** and hold.
4. Push the **BED** switch **UP** to increase the number or **DOWN** to decrease the number.



Low Temperature

LOW TEMP= XX°F

This is factory set at 60° and should not be changed unless necessary. To change setting:

1. Turn programming key to **CALIB.**
2. Turn **MODE** switch to **6.**
3. Push the **PLOW** switch **DN** and hold.
4. Push the **BED** switch **UP** to increase the number or **DOWN** to decrease the number.



Temperature Alarm

ALARM= XXX°F

This is factory set at 160° and should not be changed unless necessary. To change setting:

1. Turn programming key to **CALIB.**
2. Turn **MODE** switch to **6.**
3. Push the **PLOW** angle switch to **RIGHT** and hold.
4. Push the **BED** switch **UP** to increase the number or **DOWN** to decrease the number.



Beeper Option

BEEP OPTION:XXXX

It is now possible to select warning alarm options when calibrating the control box. The three options include:

ONCE - Beeps the first time the error occurs.

Alarm flashes on display once every few seconds.

CONT - Beeps every time the error is shown on the screen.

OFF - Never beeps, but error is flashed on display.

1. Turn programming key to **CALIB.**
2. Turn **MODE** switch to **8.**
3. Push the **PLOW** angle switch to **RIGHT** and hold.
4. Push the **BED** switch **UP** to select **ONCE**, **CONT** or **OFF.**

Control Console Programming (Cont'd)

Changing Control Consoles

If it is necessary to change the control console, the only programming test that is required to be repeated is the spreader alert. All other programming numbers can be directly plugged into the console based on the numbers that were recorded during the initial setup. If using a laptop, all constants including spreader alert can be loaded into the new control box.



When programming a M98 you may find some constants that have not been mentioned in this manual. If this occurs, disregard them. The M98 shares the same software with our larger central hydraulic system control box the Z98.



See the Pre-Winter Checklist at the back of this manual for a guide to programming the Pengwyn in the field.



Factory pre-set constants can be reloaded into a control box by turning to MODE 3, turning the programming key to calibrate and pushing the BLAST switch UP. This will reset all of the original constants into the memory.



Laptop Programming and Data Logging

Data Storage

The Pengwyn control console is equipped with an RS-232 data communications port. The storage capacity affords retrieval of 42 hours of operating information depending on spreader usage, including:

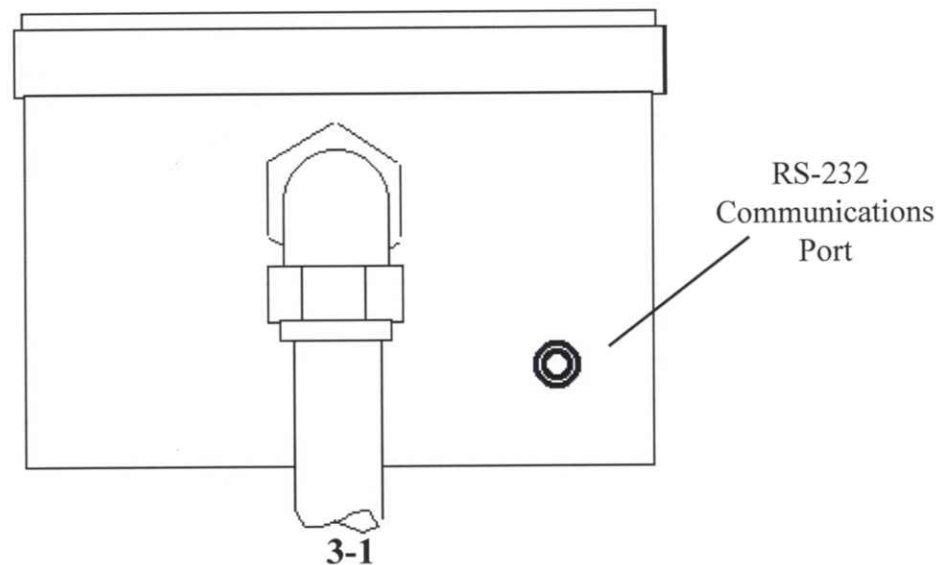
- Time control console is turned on
- Truck speed
- Miles driven with the spreader on
- Miles driven with the spreader off
- Time the truck idles
- Material spread rates

Laptop Communications / Software

Software is provided so that the accumulated data can be downloaded into a DOS-based laptop PC or a desktop PC. This is done 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 total 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

Control Console



Laptop Programming and Data Logging (Cont'd)

Laptop Communications / Software (Cont'd)

The provided software will also plot a graph similar to the example below.

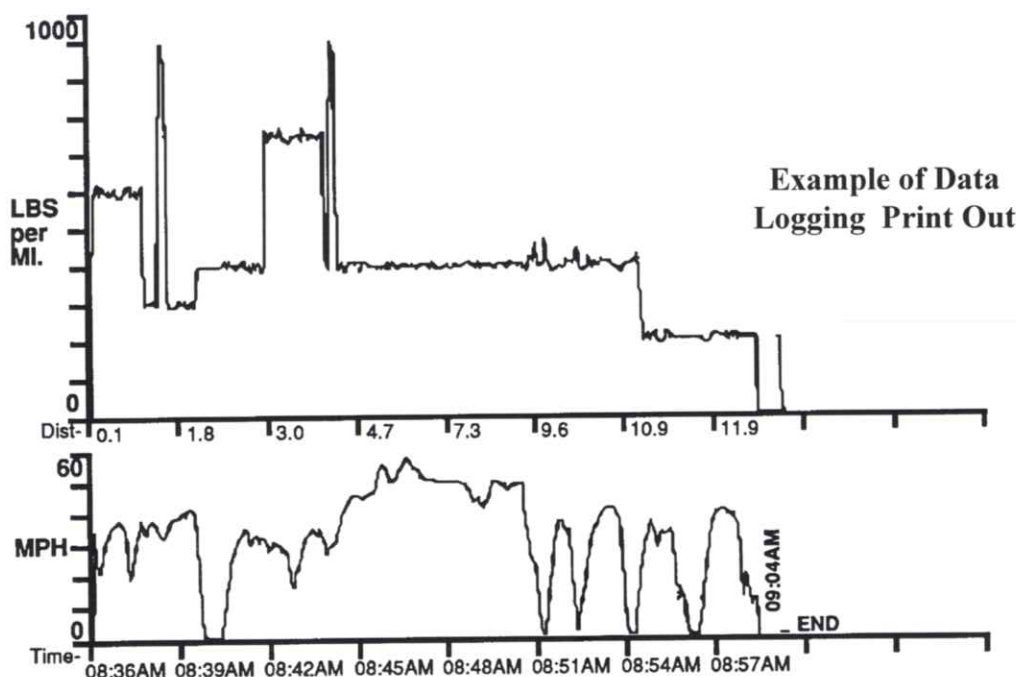
Programming and calibration of the Pengwyn control console can be done directly from the laptop computer through the software. Programming values can be individually changed by moving through (use the TAB key) a displayed table on the laptop screen and typing in the desired value(s). If several trucks 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 by doing the following:

- Plug into the RS-232 port
- Call up the input screen on the laptop
- Press ENTER

The entire file is transferred to the control console.

Additional Information

For more information on this feature consult the Pengwyn *Data Control System Laptop Version Installation & Operating Manual*. If you have any questions, please contact Pengwyn.



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

The M97 Series manifold system incorporates three 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, set to the pressures recommended by the equipment manufacturers. (See: Valve Function Diagram for location of valves)

Main Relief



XXXX/XXXX PSI

(HIGH PRESSURE/DIFFERENTIAL PRESSURE)

1. Start engine and bring engine speed to 1500 rpm.
2. Turn the programming key to **RUN** and the **MODE** switch to position **8**.
3. Turn manual keyswitch to **ON**.
4. **Disconnect the auger pressure hose quick disconnects.**
5. Turn **SPREADER** switch to **MANUAL**.
6. Turn **AUGER** to position **0** and hit blast.
7. Read the pressure on the display between spreader jam alert readings.
(Normal high pressure is 2500 to 2700 psi.)
8. Turn engine off.
9. Remove cap from main relief (some reliefs have an external adjustment screw with locking nut).
10. Use an allen wrench to adjust the internal/external screw clockwise to increase pressure setting or counter clockwise to decrease pressure setting.
11. Replace cap or tighten lock nut.
12. Repeat above procedure until proper setting is achieved.
13. **Reconnect the auger hoses when finished.**



Bed Up / Plow Up Relief



XXXX/XXXX PSI

(HIGH PRESSURE/DIFFERENTIAL PRESSURE)

1. Start engine and bring engine speed to 1500 rpm.
2. Turn maintenance key to **RUN** and the **MODE** switch to position **8**.
3. Turn manual keyswitch to **ON**.
4. Push **FRONT PLOW** switch to **UP** and extend cylinder until it bottoms out.
5. Read the pressure on the display.
(Normal high pressure is 1800 to 2000 psi.)
6. Turn engine off.
8. Remove cap from bed up/plow up relief (some reliefs have an external adjustment screw with locking nut).
9. Use an allen wrench to adjust the internal/external screw clockwise to increase pressure setting and counter clockwise to decrease pressure setting.

Pressure Adjustments (Cont'd)

Bed Up / Plow Up Relief (Cont'd)

10. Replace cap and tighten lock nut.
11. Repeat the above procedure until proper setting is achieved.
12. Return manual key switch to **OFF** when finished.



Bed Down Relief (for double acting only)



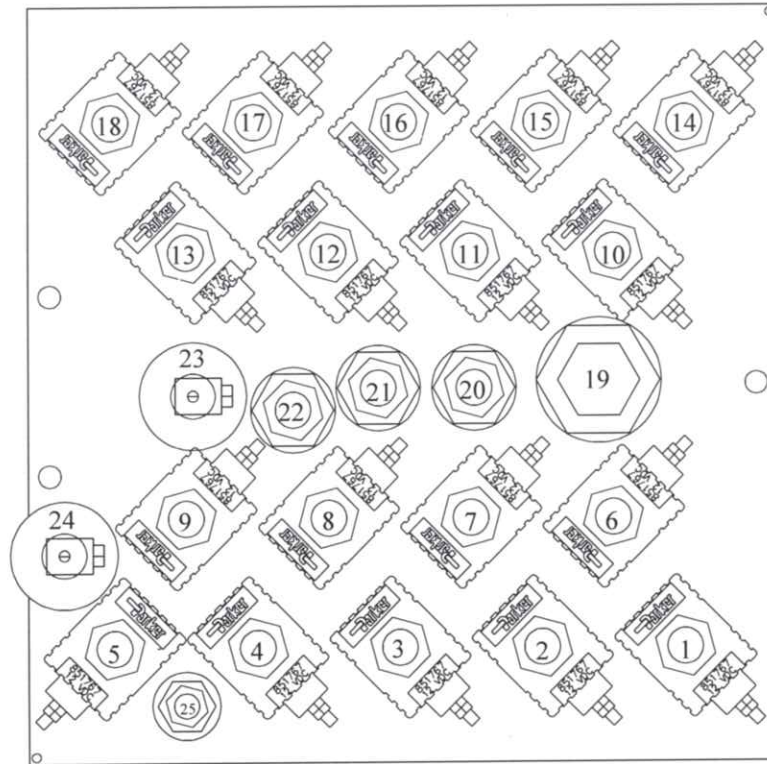
(HIGH PRESSURE/DIFFERENTIAL PRESSURE)

1. Start engine and bring engine speed to 1500 rpm.
2. Turn manual keyswitch to **ON**.
3. Turn the maintenance key to **RUN** and the **MODE** switch to position **8**.
4. Push bed switch to **DOWN SLOW**.
5. When the bed is all the way down read the pressure on the display.
(Normal high pressure is around 800 psi.)
6. Turn engine off.
7. Remove cap from bed down relief (some reliefs have an external adjustment screw with a locking nut).
8. Use an allen wrench to adjust the internal/external screw clockwise to increase pressure setting and counter clockwise to decrease pressure setting.
9. Replace cap or tighten lock nut.
10. Repeat above procedure until proper setting is achieved.
11. Return the manual key switch to **OFF** when finished.



Valve Function Diagram

As viewed inside cab facing rearward



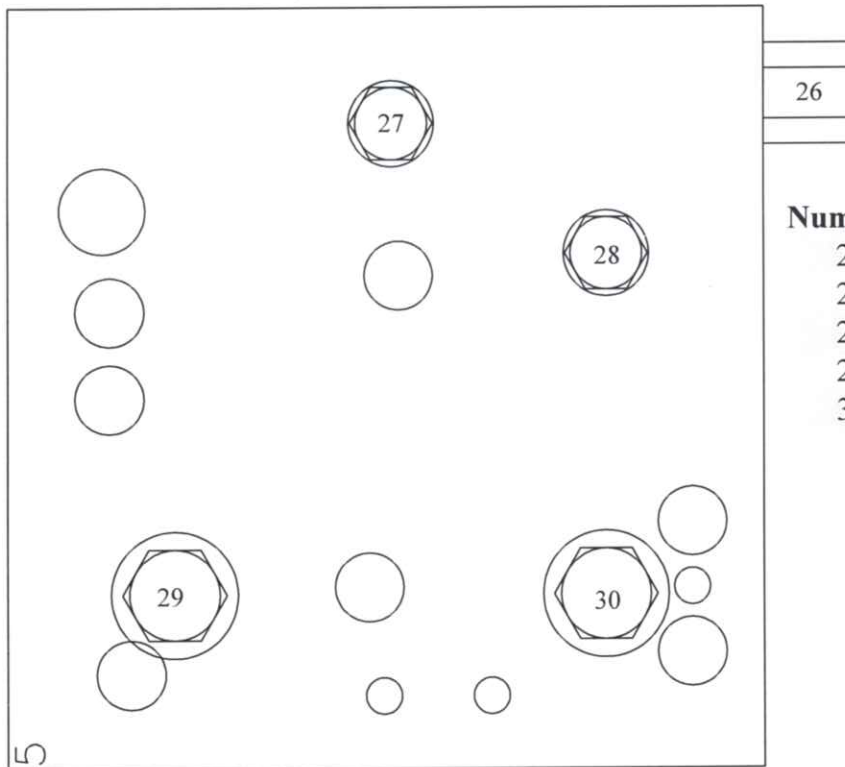
FUNCTION

WIRE COLOR

1.	Spinner 2	White / Brown
2.	Spinner 4	White / Purple
3.	Auger 0.5	Pink
4.	Auger 2	White / Yellow
5.	Auger 8	White / Blue
6.	Spinner 1	White / Orange
7.	Pump Bypass Valve	White / Black
8.	Auger 1	White
9.	Auger 4	White / Green
10.	Hoist, Rod to Tank	Orange
11.	Hoist, Rod to Pressure	White / Red
12.	Plow Down	Brown
13.	Plow Up	White / Gray
14.	Hoist Down Slow, Blind to Tank	White / Red
15.	Hoist Down Fast, Blind to Tank	Yellow
16.	Hoist Up, Blind to Pressure	Orange
17.	Plow Right	Purple
18.	Plow Left	Gray
19.	Bed Compensator	N/A
20.	Bed/Plow Up Relief	N/A
21.	Bed Down Relief	N/A
22.	Main Relief	N/A
23.	High Pressure Transducer	N/A
24.	Low Pressure Transducer	N/A
25.	Thermistor	N/A

Valve Function Diagram

As viewed facing rear cab wall

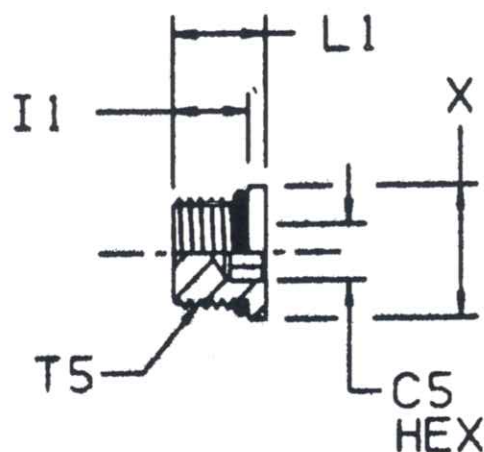


Number	Function
26	Plow Angle Shuttle
27	Bed Check Valve
28	Plow Check Valve
29	Spinner Compensator
30	Auger Compensator

Parts List for Manifold Assembly

FLAG NUMBER	FUNCTION	PART NUMBER
1,2,3,4,5,6,8, 9,12,13,14,17,18 10, 11, 15, 16	Normally Closed Solenoid Valve - 10 Size	DS101C
7	Normally Closed Solenoid Valve - 16 Size	DS161C
19	Normally Open Solenoid Valve - 16 Size	DS161N
20	Bed Compensator	FRC600
21	Bed / Plow Up Relief	RD2500
22	Bed Down Relief	RD0800
23,24	Main Relief	RD2500
25	Pressure Transducer With Plug	X5000-P
26	Thermistor Assembly	TC101
27	Shuttle Valve	CP721
28	Check Valve	CV103P
29,30	Check Valve	CV101P
No Flag	Auger / Spinner Compensator	CP701
	Molded Coil (Parker)	RC101P

Torque Specs & O-Ring Numbers

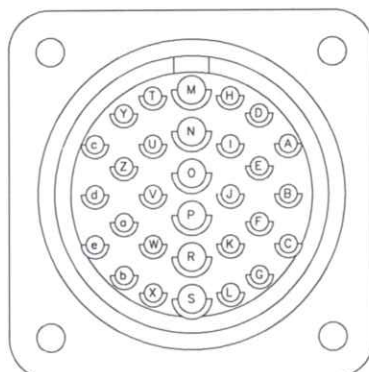


**C5—ACROSS INTERNAL
HEX FLATS**

Use a removable thread locker, such as Loctite 545.

TUBE FITTING PART #	T5 PORT THD UN / UNF-2A	C5 HEX	I1	L1	X DIA.	ASSEMBLY TORQUE FT. LBS	O-RING NUMBERS
#02 SAE O-Ring Boss	5/16-24	1/8	.30	.39	.44	3 ± .5	902
#03 SAE O-Ring Boss	3/8-24	1/8	.30	.39	.50	5 ± .5	903
#04 SAE O-Ring Boss	7/16-20	3/16	.37	.46	.56	11 ± 1	904
#05 SAE O-Ring Boss	1/2-20	3/16	.37	.46	.63	15 ± 1	905
#06 SAE O-Ring Boss	9/16-18	1/4	.40	.49	.69	18 ± 1	906
#08 SAE O-Ring Boss	3/4-16	5/16	.44	.57	.88	46 ± 2	908
#10 SAE O-Ring Boss	7/8-14	3/8	.50	.63	1.00	75 ± 5	910
#12 SAE O-Ring Boss	1 1/16-12	9/16	.59	.75	1.25	85 ± 5	912
#14 SAE O-Ring Boss	1 3/16-12	9/16	.59	.75	1.38	130 ± 6	914
#16 SAE O-Ring Boss	1 5/16-12	5/8	.59	.75	1.50	135 ± 6	916
#20 SAE O-Ring Boss	1 5/8-12	3/4	.59	.75	1.88	225 ± 12	920

Amphenol Wiring



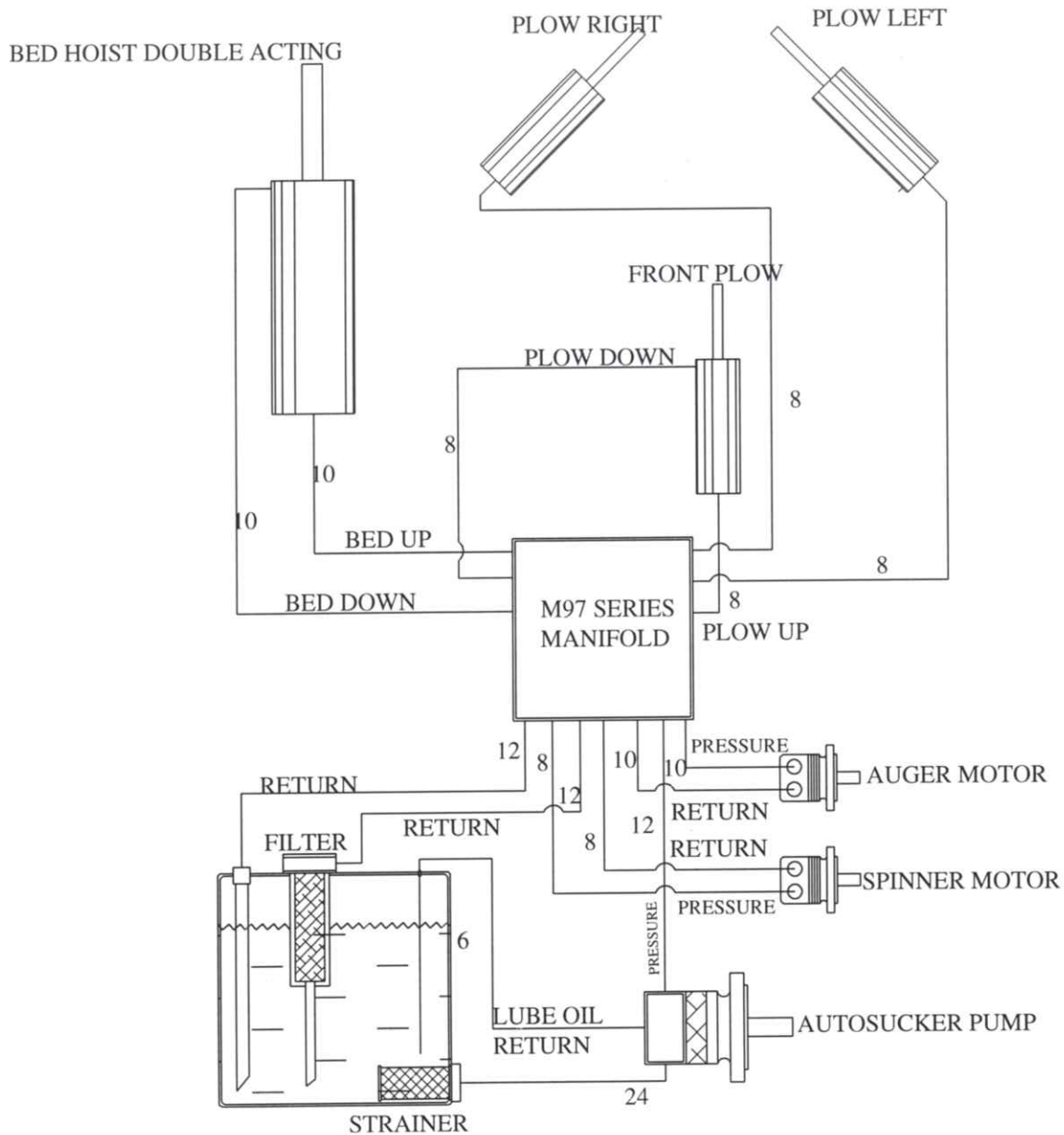
1.	White 22-2 (#2 or LOW)	e
2.	Black 22-2 (#3 or thermistor -to-manifold plug)	d
3.	White 22-2 (#3)	a
4.	Brown	Z
5.	White / Gray	Y
6.	White / Red (#1)	X
7.	White / Red (#2)	X
8.	Yellow	W
9.	Purple	V
10.	Gray	U
11.	White 22-2 (#1 or HIGH)	S
12.	Black 18 gauge	R
13.	Black 22-2 (#2 or LOW)	P
14.	Green	O
15.	Black 22-2 (#1 or HIGH)	N
16.	Orange (#1)	L
17.	Orange (#2)	L
18.	White / Purple	K
19.	White / Brown	J
20.	White / Orange	I
21.	White / Black	H
22.	White / Blue	G
23.	White / Green	F
24.	White / Yellow	E
25.	White	D
26.	Green	C
27.	Pink	B

(see: Valve Function Diagram for wire functions)

External		
28.	Red	A
29.	Black	b
30.	Orange	c

Plumbing Diagram

As viewed from rear of truck



Hose Size Requirements

- 6 - 3/8" ID- Lube Oil Return for Autosucker™
- 8 - 1/2" ID - Plows and Spinner Motor
- 10 - 5/8" ID - Bed Hoist and Auger Motor
- 12 - 3/4" ID - Pump Pressure and Returns
- 24 - 1 1/2" ID - Pump Suction

Troubleshooting

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.

Be careful not to pinch wires under the 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 or mount auxiliary switches to the control console. This will void warranty. Use the control console mounting bracket for this purpose.



Always be sure to carefully wipe off all auger and spinner disconnects before hooking up the spreader.

If the spreader is hooked up and the disconnects are dirty, the dirt could lodge in the valves down stream from the disconnects and causes the auger and spinner compensators to hang up. This results in the fluid being blocked from any downstream functions. This disables all the bed and plow functions.

Checking Energization

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 function.

Solenoid 7 (the pump bypass valve) 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/ NaClone™ speed control switch must be set at position 0. The exception to this is when using the control console for pressure measuring. At this time the spreader switch should also be in the OFF position.

For safety, operate the power switch only when all 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 unless warming up hydraulic fluid for calibration purposes..

Solenoid Energization Chart

Auger (Manual)		Solenoid Number					
	Rate	8	4	9	5	PUMP	GPM
E = the coil should be energized	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	6	1	2	PUMP	GPM
E = the coil should be energized	0				E	0
	1	E			E	0.8
	2		E		E	1.6
	3	E	E		E	2.4
	4			E	E	3.2
	5	E		E	E	4.0
	6		E	E	E	4.8
	7	E	E	E	E	5.6

Plow		Solenoid Number							
		7	13	12	17	18	14	11	PUMP
E = the coil should be energized	Up	E	E						E
	Down			E					
	Power Dn	E		E			E	E	E
	Left	E				E			E
	Right	E			E				E

Bed (Double Acting)		Solenoid Number						
		7	16	10	14	11	15	PUMP
E = the coil should be energized	Up	E	E	E				E
	Down Slow	E			E	E		E
	Down Fast	E			E	E	E	E

Troubleshooting Chart

Before troubleshooting the Pengwyn system, check all quick disconnects to be sure that they 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.
<hr/> 		
Noisy pump.	Low on fluid.	Add hydraulic oil.
<hr/> 		
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.
<hr/> 		
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.

Troubleshooting Chart (Cont'd)

Pump noisy, oil aerated. (Cont'd)

Shaft seal leaking.
Suction line loose.

Replace shaft seal.
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 auger switch to (1), (2), (4), and (8) to find the bad valve. Clean valve or change coil as needed.



Troubleshooting Chart (Cont'd)

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.

Troubleshooting Chart (Cont'd)

**Bed won't go up.
(Cont'd)**

Bed-up coil nut
over tightened.

Replace bed-up cartridge.

Pump bypass valve
not operating.

Clean or replace.

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.

Bed chatters down.

Compensator
cartridge bad.

Replace bed-compensator
cartridge.

Plow won't go up.

Plow-down valve
stuck open.

Clean valve.

Plow-up valve
failed.

Clean or replace valve.

Troubleshooting Chart (Cont'd)

**Plow won't go up.
(Cont'd)**

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.



Hydraulic fluid too hot.

Low fluid level.

Add hydraulic fluid.

Bypass valve stuck closed.

Clean valve.

Bypass coil nut over tightened.

Replace bypass cartridge.



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.



Troubleshooting Chart (Cont'd)

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.

Spreader constant calibration is on "0".

Change calibration to correct number (See: Finding the Spreader Constant in Control Console Programming)



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.



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.



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

Hot shuttle valve too tight.

Loosen valve slightly.

Faulty disconnect.

Replace quick disconnect.



Beeper comes on too often in spreader alert.

Auger drag set too high.

Lower auger drag constant (See: Setting the Spreader Drag in Control Console Programming / p.2-6).

Material is bridging across the auger.

Break salt bridge.

Constants out of calibration.

Check spreader alert constants (See: Setting Spreader Alert in Control Console Programming / p.2-5).



Troubleshooting Chart (Cont'd)

Spinner speed is not adequate.

Spinner at setting **8** and spreader in **AUTO**.

Change spinner to setting **7**.

Spinner coil may be burnt out.

Replace coil.

Valve may have dirt in it.

Clean valve.



Spreader switch will not stay on AUTO or MANUAL.

The rubber boot may have shrunk due to temperature.

Stretch or shave the rubber boot to allow for full motion of the switch.



Spinner is effected by pressing the blast switch.

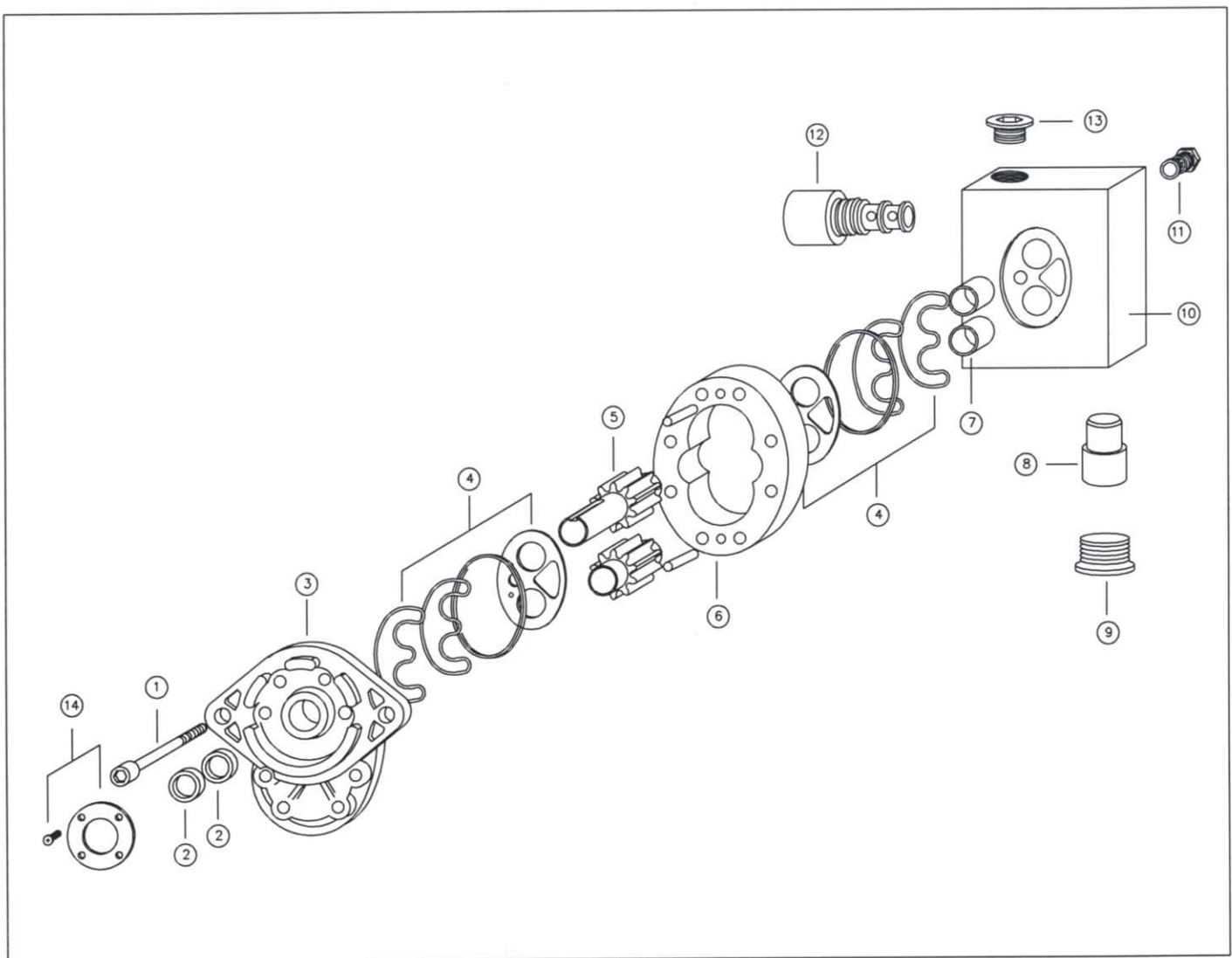
Z-Blast is turned on.

See: the Pre-Winter Checklist for steps to turn this function off. This is used only with zero-velocity for the Z97 Series.



Parts Drawing

Single Autosucker™ Pump



Parts List for Single Autosucker™ Pump

1.	Bolt kit (8 pieces)	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 pieces)	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	A-127
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

Miscellaneous Parts List

FE-202	Filter Replacement Element
IT-2010	Tank Immersed Filter
AS-237-LH	Single Autosucker™ Pump
CN-101	Control Console Mounting Nuts
DC-101	Data Logging Cable (6' long)
FB-101	Filler Breather
FC-800	Flow Control
LS-101	Level Sensor
SG-101	Sight Glass
SP-9100788	Switch Panel (Auxiliary for lights, etc.)
SW-101	Data Logging PC Software w/ Cable
SW-102	Data Logging Software Disk Only
TF-101	Tank Filter, Suction Strainer
AUGCK-101	Auger return check valve
SPNCK-101	Spinner return check valve

Truck Wiring

Caution: Power to the Pengwyn system must be off during engine cranking.

The manifold includes a power relay and 30 amp fuse.

Green lead connects to accessory pole on ignition switch.

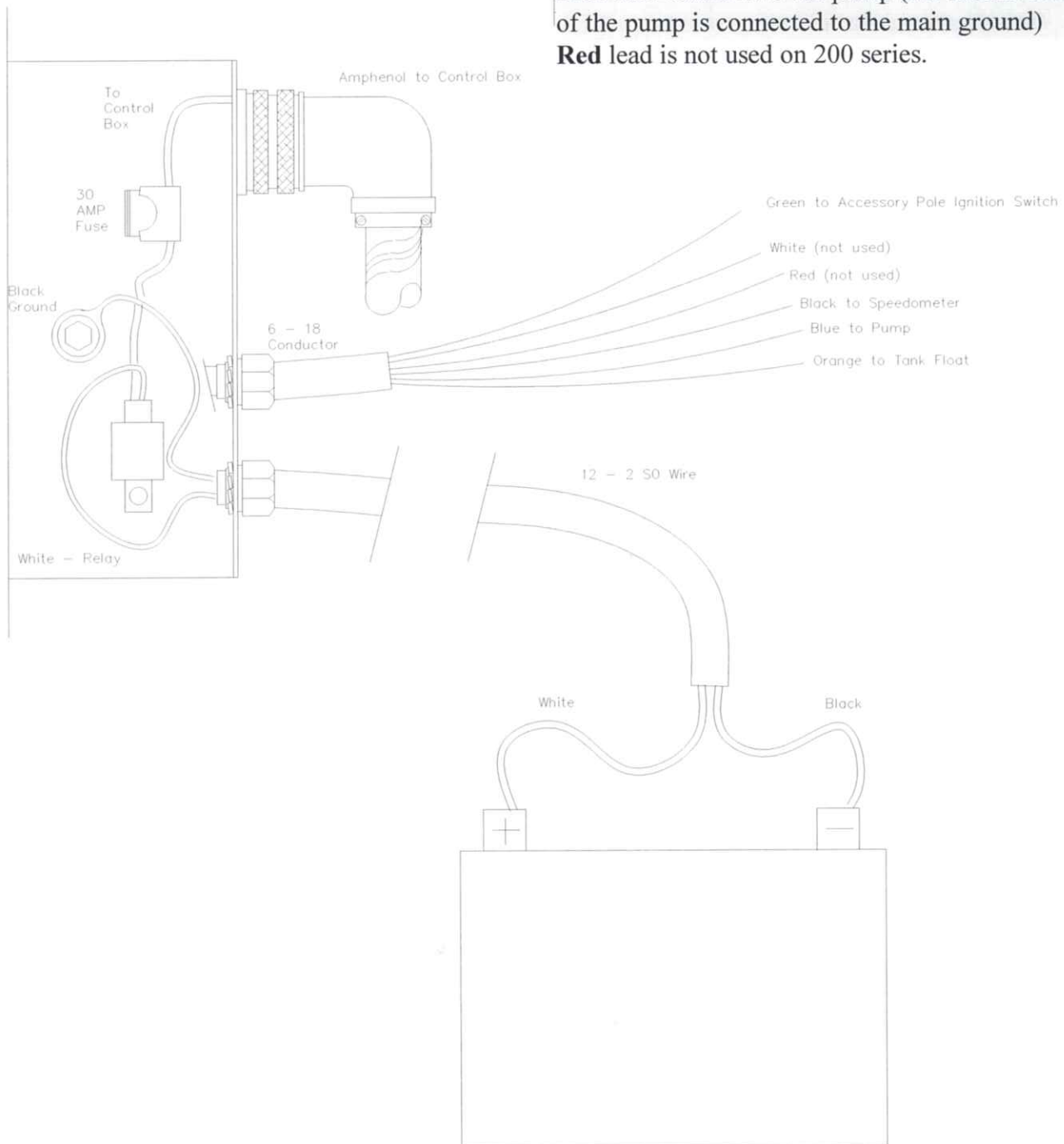
Black lead connects to the pulse lead behind the speedometer.

White lead is not used on 200 series.

Orange lead connects to the tank level sensor (the second lead of the sensor is connected to the main ground).

Blue lead connects to the pump (the second lead of the pump is connected to the main ground)

Red lead is not used on 200 series.



Programming Constants

Record your programming constants below for future reference. It is important to keep this record in the event of a control box change.

SPEEDOMETER	SINE / SQR
PULSES/.1MI	
CAL SPREADER	
CAL SPIN	
CAL DRAG	
CAL JAM	
CYLINDER.PLOW/BED	PLOW_____BED_____
BEEPER OPTION	
CONVEYOR MIN	
NACLONE MIN	
FLUID TYPE	
HIGH TEMP	FACTORY SET @ 120°
LOW TEMP	FACTORY SET @ 60°
ALARM	FACTORY SET @ 160°
SPREADER 1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
11	
12	
13	
14	
15	



M&Z Series Pengwyn Hydraulic System Pre-Winter Check List



Tag Number: _____

Manifold S.N.: _____

Date Tested: _____

Software Version: _____

Control Box S.N.: _____

Equipment Number: _____

Pump S.N.: _____

Tested By: _____

Miles Per Hour

1. Jack the rear axle of the truck up and block the front wheels.
OR

1. Be prepared to drive the truck.

2. Turn the programming key to the **CALIBRATE** position.

3. Turn the mode selection switch to position 1.

The display will read: **CAL MILE XX**

4. Operate the truck at a constant speed (30 MPH or more)

Use the truck speedometer, not the control console, to determine truck speed.

5. Compare truck speedometer to speed shown on control console display.

If the display remains at 0, see Speedometer section below.

6. Push the bed switch to the UP position to increase the displayed console speed.

7. Push the bed switch to the DN SLOW position to decrease the displayed console speed.
The speedometer setting is now complete.

8. Turn the mode selection switch to position 4.

9. Record the Pulse count shown for your records.

PULSE/.1mi = _____

10. Turn key back to RUN position.

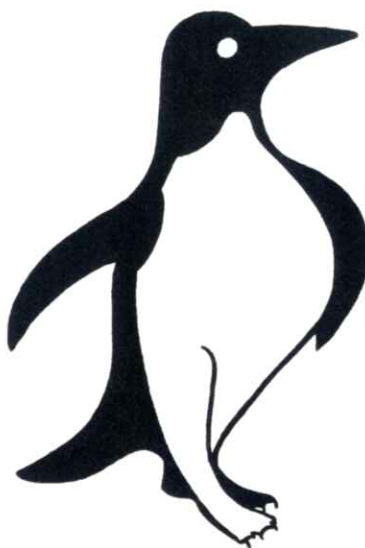
Constant Setting	Notes Section	MODE	PROGRAMMING KEY POSITION	PLOW UP/DN	PLOW ANGLE	OTHER SWITCH	DISPLAY READS	BED SWITCH	PROGRAMMED CONSTANT
Speedometer	SINE= Manual SQR= Alison World Engine speed should be idle.	1	CALIBRATE	UP & hold			SPEEDOMETER: XXX	UP/DN to change #	
Fluid Temperature		7	RUN				FLUID TEMP: XXX		
Cylinder/PLOW	S= Single / D= Double	8	CALIBRATE		LT & hold		CYND.PLW:X BED:X	UP/DN to change	
Beeper Option	Once: Beeps only the first time alarm message is shown CONT: Beeps every time the alarm message is shown. OFF: Does not beep.	8	CALIBRATE		RT & hold		BEEP OPTION:XXXX	UP/DN to change #	

Constant Setting	Notes Section	MODE	PROGRAMMING KEY POSITION	PLOW UP/DN	PLOW ANGLE	OTHER SWITCH	DISPLAY READS	BED SWITCH	PROGRAMMED CONSTANT
Auger Fault/ Spreader Alert CONSTANTS CHECK	Allows you to view the Auger Fault/Spreader Alert settings currently saved in memory to record for your records. These are Pressure readings in PSI. The settings are 1 Gallon Per Minute increments of hydraulic fluid being sent to the auger. <i>Numbers should start low at Setting 1 and increase at each setting until reaching 15. If the numbers do not increase at each setting you should recalibrate the box as described below.</i>	1	CALIBRATION		RT & hold		Setting1=____ Setting2=____ Setting3=____ Setting4=____ Setting5=____ Setting6=____ Setting7=____ Setting8=____ Setting9=____ Setting10=____ Setting11=____ Setting12=____ Setting13=____ Setting14=____ Setting15=____		
Auger Fault/ Spreader Alert CALIBRATION	<i>This allows you to calibrate the Auger Fault/ Spreader Alert settings. This should be done at least once a year. The calibration is automatic once the following conditions are met:</i> <i>1. Spreader should be installed but empty. 2. Warm fluid to 80 degrees. (Warm fluid up by dead heading the plow up switch) 3. Set engine throttle to 1500 RPM and record values.</i>	1	MAINTENANCE			REV TRUCK TO 1500RPM Put Spreader Switch into AUTOMATIC Record Values in column to the right. <i>When finished follow control box instructions to "Turn Spreader Off". Return Program- ming Key to the RUN position to save the new constants.</i>			Setting1=____ Setting2=____ Setting3=____ Setting4=____ Setting5=____ Setting6=____ Setting7=____ Setting8=____ Setting9=____ Setting10=____ Setting11=____ Setting12=____ Setting13=____ Setting14=____ Setting15=____ <i>Record new calibrated values from control box above.</i>



Constant Setting	Notes Section	MODE	PROGRAMMING KEY POSITION	PLOW UP/DN	PLOW ANGLE	OTHER SWITCH	DISPLAY READS	BED SWITCH	PROGRAMMED CONSTANT
Calibrated Drag (Material Load)	This should usually be set around 50-100 psi. <i>The higher settings cause the alarm sooner.</i>	2	CALIBRATE		LT & hold		CAL DRAG: XXXX	UP/DN to change #	
Main Relief Pressure	Run Engine approx. 1500 RPM. <i>Auger hoses should be disconnected.</i>	8	RUN			1. Spreader Switch to Manual 2. Blast switch Up & hold	XXXX/XXXX PSI		____ / ____ PSI
Bed/Plow Relief Pressure	Run Engine approx. 1500 RPM. <i>Reconnect auger hoses.</i>	8	RUN		RT & hold	1. Spreader Switch to Manual	XXXX/XXXX PSI		____ / ____ PSI
Bed/Plow Relief Pressure	Run Engine approx. 1500 RPM.	8	RUN		BED DOWN & hold	1. Spreader Switch to Manual	XXXX/XXXX PSI		____ / ____ PSI
Spreader Jam	Run Engine approx. 1500 RPM.	2	CALIBRATE		RT & hold		CAL JAM: XXXX	UP/DN to change DAY	____ PSI
Day of Week		3	CALIBRATE				CAL DAY: XX:XX	UP/DN to change #	
Time of Day (HRS)		3	CALIBRATE		LT & hold		CAL HRS: XX:XX	UP/DN to change #	
Time of Day (MIN)		3	CALIBRATE		RT & hold		CAL MIN: XX:XX	UP/DN to change #	
Auger Minimum Value	<i>The Minimum amount of hydraulic flow to the Auger when the truck is moving and the spreader is in Automatic. 1 is recommended for single axle trucks. 2 for tandems</i>	2	CALIBRATE	UP & hold			CONVEYOR MIN: X	UP/DN to change #	

Constant Setting	Notes Section	MODE	PROGRAMMING KEY POSITION	PLOW UP/DN	PLOW ANGLE	OTHER SWITCH	DISPLAY READS	BED SWITCH	PROGRAMMED CONSTANT
Finding Spreader Constant	1.) Run engine at 1500 RPM 2.) Turn spreader ON. 3.) Catch material in bucket or tarp. 4.) Weigh spreader output for one minute at AUGER 1 . 5.) Follow above steps again for AUGER 2 . Subtract value 1 from value 2 and enter value below.	2	RUN			Auger 1 Auger 2	_____ _____		LBS/MILE EQUATION Auger 2 (A2) -Auger 1 (A1) New Spreader Constant $\frac{A2}{A1} - \frac{\text{SP.}}{\text{Const.}}$
Spreader Constant		2	CALIBRATE			Auger 0	CAL SPREADER XX	UP/DN to change #	
Spread Rate	These are the values that management assigns for each auger setting (1-15) in pounds per mile when the spreader is running in automatic.	2	CALIBRATE			Auger 1	Spreader 1-	UP/DN to change #	
						Auger 2	Spreader 2-	UP/DN to change #	
						Auger 3	Spreader 3-	UP/DN to change #	
						Auger 4	Spreader 4-	UP/DN to change #	
						Auger 5	Spreader 5-	UP/DN to change #	
						Auger 6	Spreader 6-	UP/DN to change #	
						Auger 7	Spreader 7-	UP/DN to change #	
						Auger 8	Spreader 8-	UP/DN to change #	
						Auger 9	Spreader 9-	UP/DN to change #	
						Auger 10	Spreader 10-	UP/DN to change #	
						Auger 11	Spreader 11-	UP/DN to change #	
						Auger 12	Spreader 12-	UP/DN to change #	
						Auger 13	Spreader 13-	UP/DN to change #	
						Auger 14	Spreader 14-	UP/DN to change #	
						Auger 15	Spreader 15-	UP/DN to change #	



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