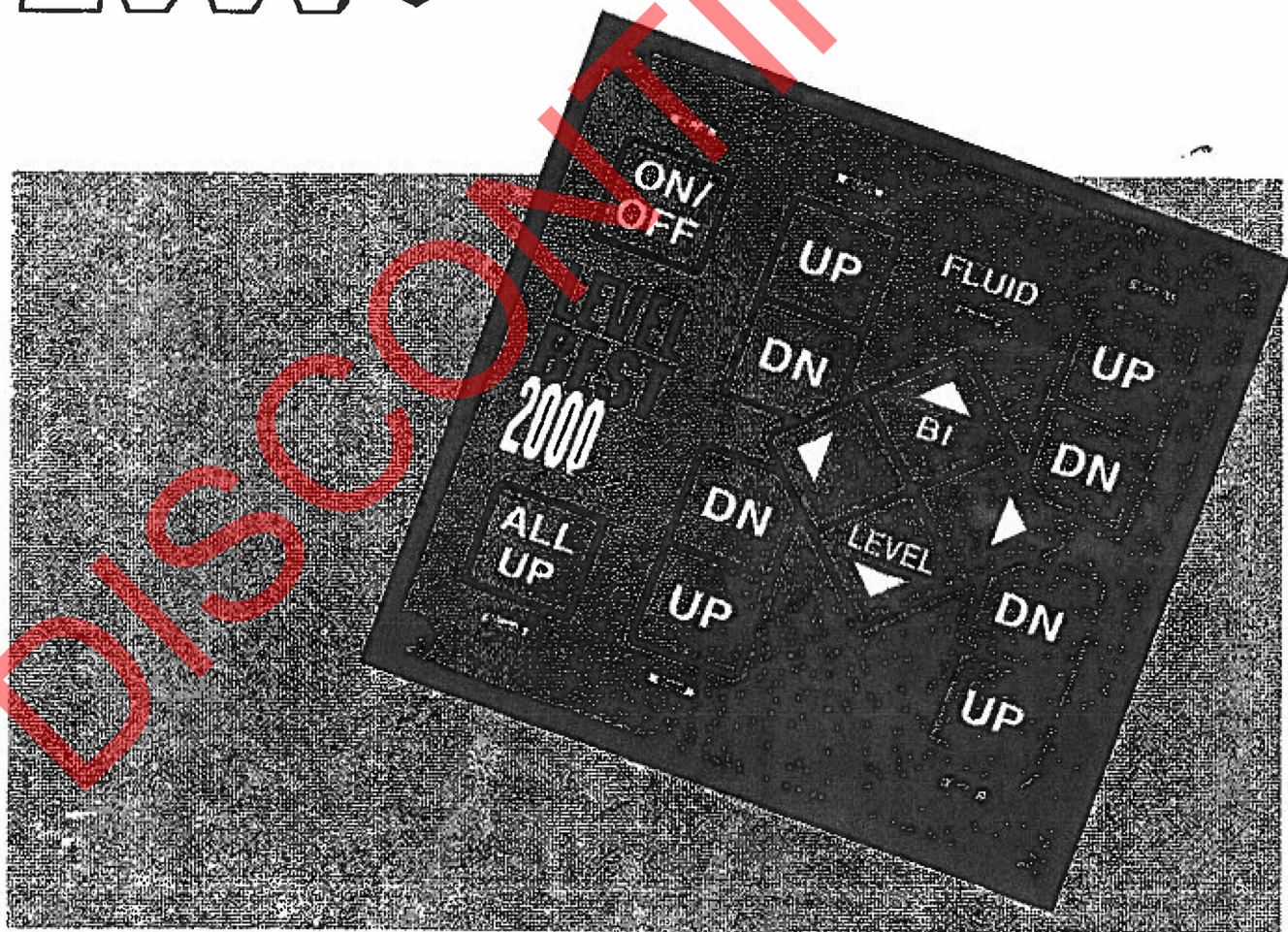


LEVEL BEST 2000

Kwikkee

Service Guide

April 1998



Kwikkee

The LB2000 Service Guide has been organized to facilitate quick and easy diagnostics and trouble shooting for the most common installation problems and serviceable part failures.

Each segment of the Service Guide, labeled 1-6, begins with a diagnostics flow chart illustrating the steps involved in the trouble shooting process. The flow charts are divided into alphabetical sections that correspond to the instructions that immediately follow the chart.

How to use the LB2000 Service Guide:

- 1. Use the Table of Contents to locate a topic area that best matches the symptoms**
- 2. Examine the flow chart at the beginning of the segment you select**
- 3. Review the system checks and maintenance procedures that correspond to the problem**
- 4. Follow the recommended steps to repair the system**
- 5. If system failure continues after completing the diagnostics and recommended repairs, call 1-800-738-9961**

This document has been modified from the original Kwikkee 04/98 release. All former references to the Kwikkee warranty and contact information were removed.

**For all concerns or questions, please contact
Lippert Components, Inc.**

Ph: (574) 537-8900 | Web: lci1.com | Email: customerservice@lci1.com

NOTE: Any parts returned for warranty service/repair with wires cut will result in voiding of the warranty.

NOTE: It is important to read and understand this manual thoroughly before initiating any installation of the jacks. Kwikkee Products Company, Inc., assumes no liability for damages or injury resulting from the improper installation or operation of the Level Best 2000® Hydraulic Leveling/Stabilizing System.

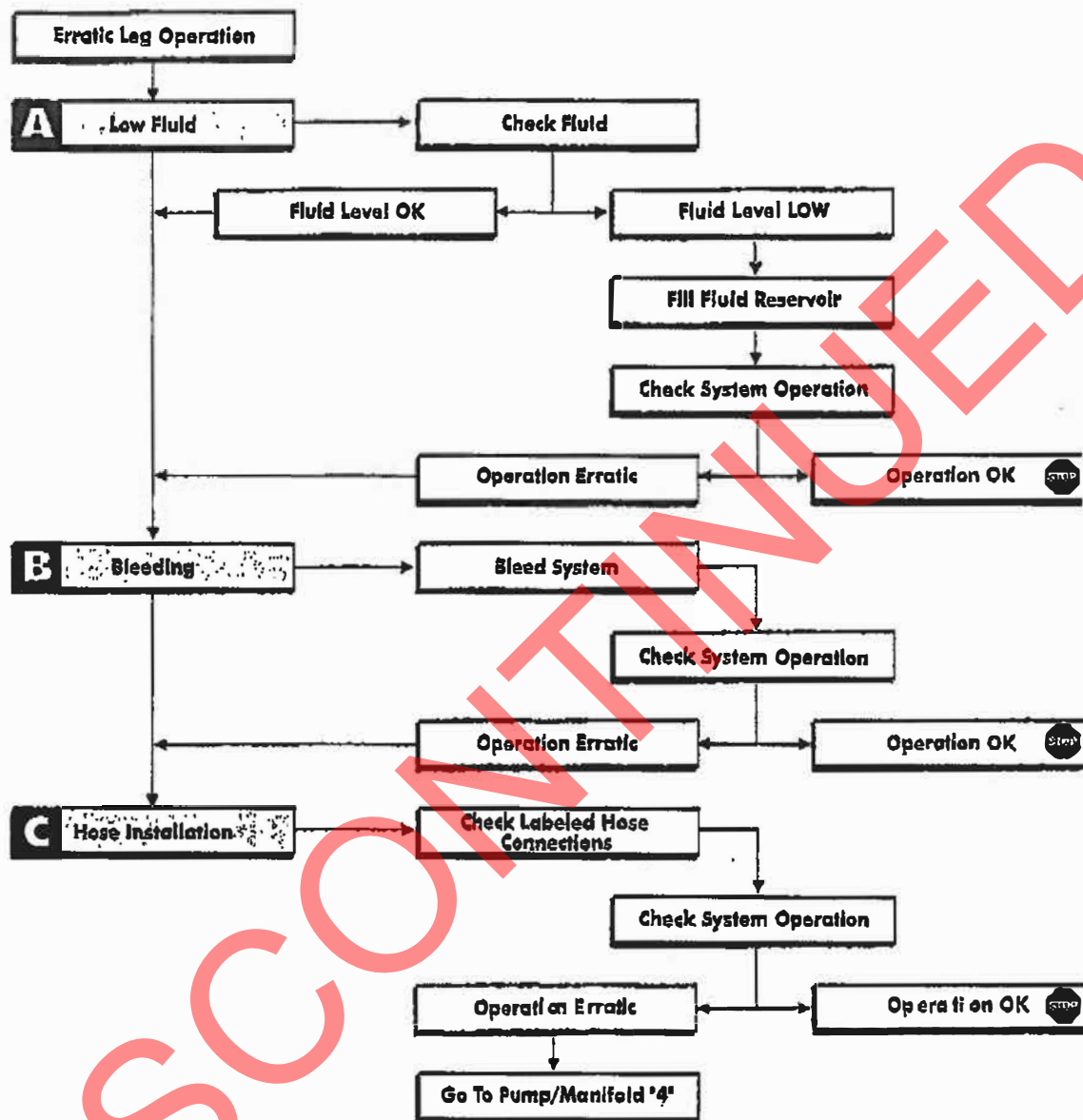
LEVEL BEST 2000 *Livest* Service Guide

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1

Erratic Leg Operation Diagnostics Chart



Erratic Leg Operation

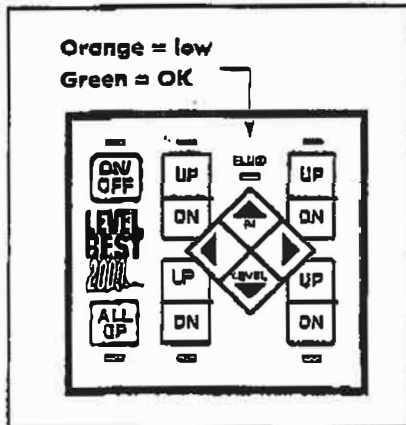


Figure 1a

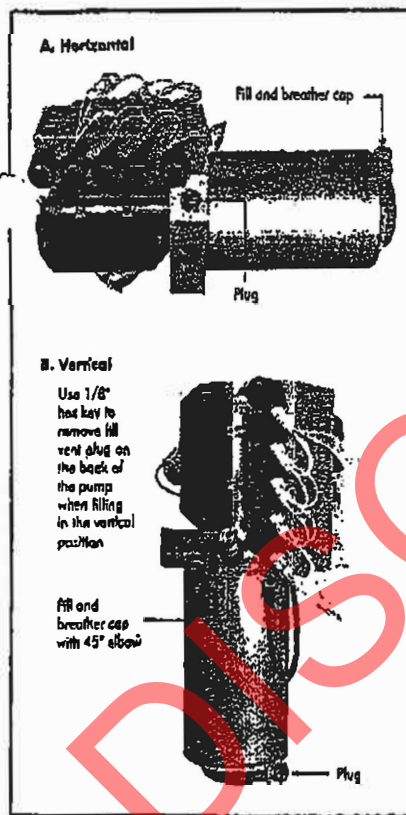


Figure 1b

A Low Fluid

1. Check system for low fluid level, this check should only be made when jacks are in the fully retracted position.
 - a. An orange LED located at the fluid check window on the control panel indicates a low fluid condition. A green LED indicates a correct fluid level. This LED illuminates only during system start up when all of the jacks are retracted. (Fig. 1a)
 - b. Fluid level may also be checked visually by removing the breather cap at the tank fill of the reservoir. (Fig.1b)
2. Fill reservoir to within " of the fill opening. Use transmission fluid only, we recommend the use of Dexron III; do not mix fluids.

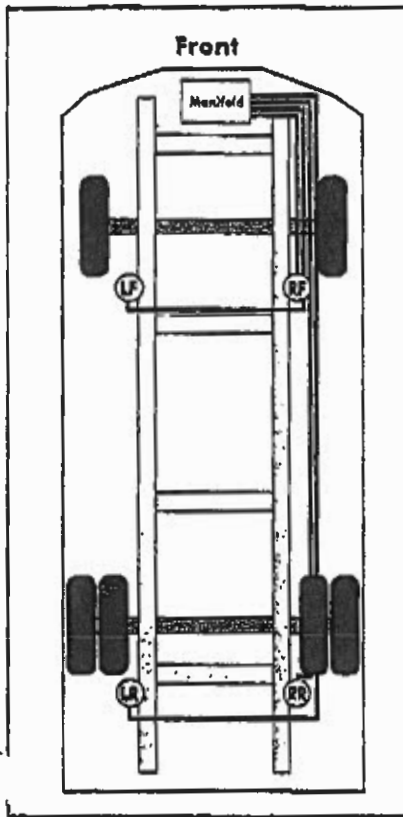
B. Bleeding

1. Air in cylinders and hydraulic lines will cause erratic system operation. Prior to initiating the bleeding process, check to be sure that all the fittings on the cylinders and the manifold have been tightened to 50-150 in/lbs. Also check that all swaged hose couplers are tightened to the fittings at 50-150 in/lbs. The entire system (cylinders and lines) must be filled with hydraulic fluid during the bleeding process.

NOTE: When filling and bleeding the system, use transmission fluid only. We recommend Dexron III; do not mix fluids. When checking the fluid level in the reservoir, or when filling the reservoir all levelers must be in the retracted position. (ALL UP)

2. With the reservoir filled and the fittings checked, turn the system on at the power switch on the control panel and begin to extend one of the rear cylinders. Initially, the system contains mostly air which prevents the manifold valves from sealing and allows all cylinders to extend erratically. As the hydraulic fluid begins to fill the lines and cylinders, the manifold valves will seal and each cylinder will begin to act in a more proper manner.

When the reservoir begins to run low on fluid, the resistance of the fluid within the pump lessens and the sound of the pump increases in pitch. Retract the cylinders and replenish the fluid in the reservoir at this time.

**Figure 1c**

CAUTION: Do not run the pump without fluid as damage to the pump may occur. Do not engage the pump motor for periods greater than thirty (30) seconds as motor damage may occur.



WARNING: During the retracting of the jacks, the cam on the upper portion of the leg will make contact with lift plate and cause the leg assembly to swing upward; failure to stay clear of the levelers when the system is being operated can result in severe injury.

3. Continue to extend the cylinder until it reaches the end of its stroke, then follow by retracting all cylinders. With air in the lines, the cylinders will emit squeaking and humming noises and move in a jumpy manner; as air is purged from the system, the cylinders will move in a smoother, quieter manner. It may be necessary to extend and retract each cylinder several times to completely purge the lines of air.
4. When the system has been bled, retract all of the levelers and check the fluid level in the reservoir. With all cylinders fully retracted, the fluid level within the reservoir should be just visible in the filler fitting.

a. Manually bleeding the cylinders

Most cylinders will bleed themselves. However, if you have difficulty with a particular cylinder during the bleeding process, it is possible to manually bleed a cylinder. Extend the cylinder as far as possible and loosen the top hose fitting on the cylinder; you will hear air escaping. Do not remove the fitting from the cylinder to vent this air. Tighten the fitting to 50-150 in/lbs. when air ceases to vent. Operate the cylinder in and out several times to check for smooth operation; repeat the manual bleeding process as necessary.

c.

Incorrect Hose Installation

1. Check hose routings and attachments at cylinders and manifold. (Fig. 1c)

Erratic Leg Operation (continued)

2. Manifold connections are labeled 1T through 4T & 1B through 4B. "T" indicates top hose at cylinder, "B" indicates bottom hose, match the hose labeled TOP to the "T" port on the manifold. (Fig. 1d)

Left Front Extend	1T
Right Front Extend	2T
Left Rear Extend	3T
Right Rear Extend	4T

Left Front Retract	1B
Right Front Retract	2B
Left Rear Retract	3B
Right Rear Retract	4B

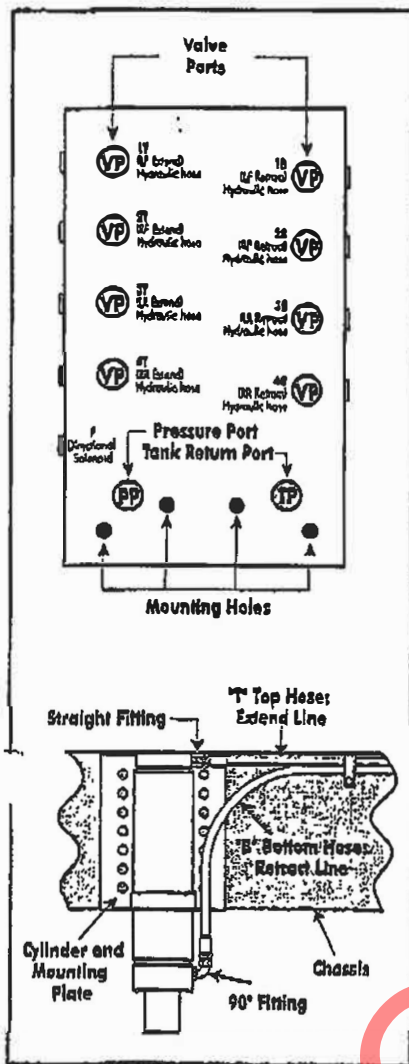
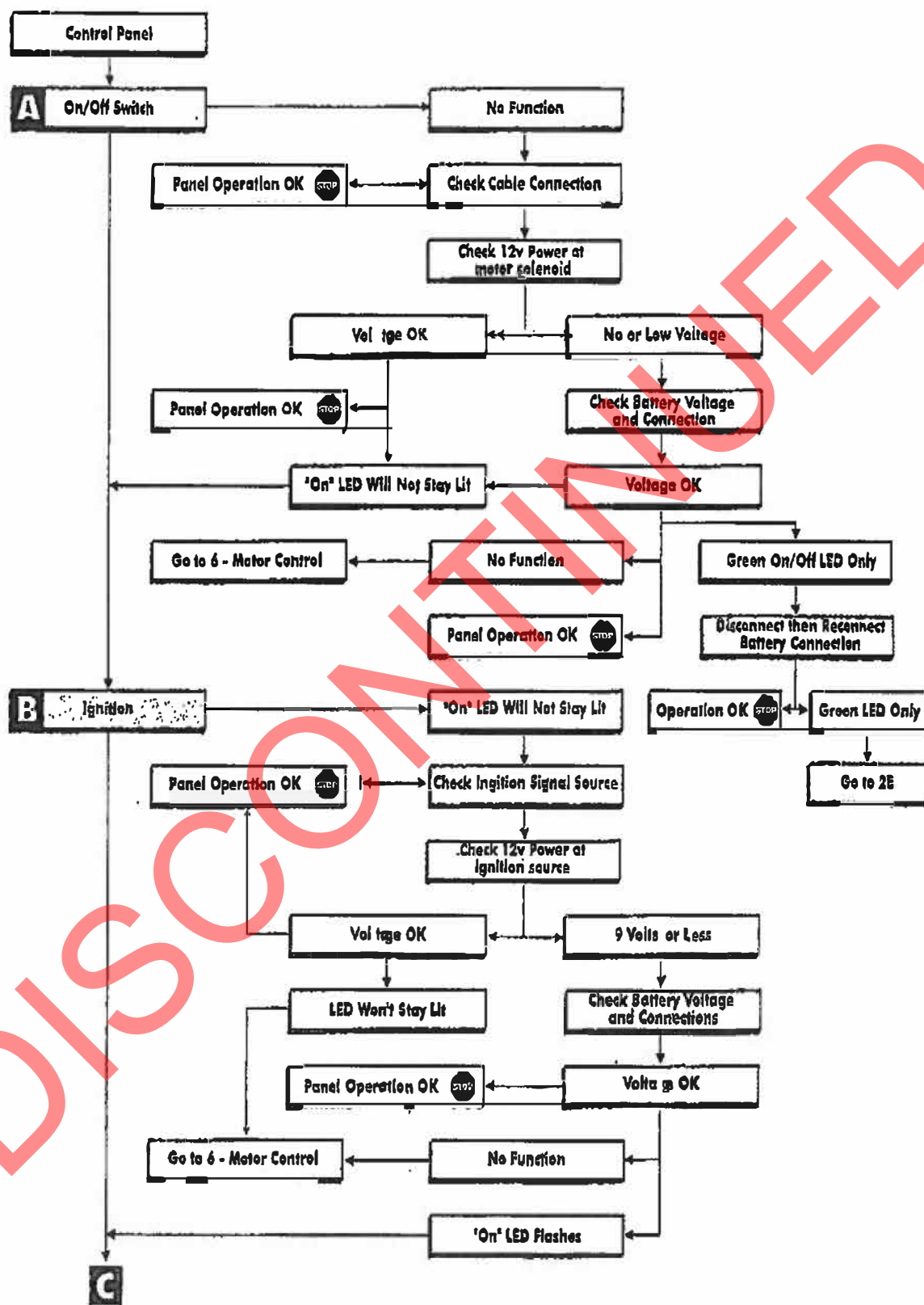
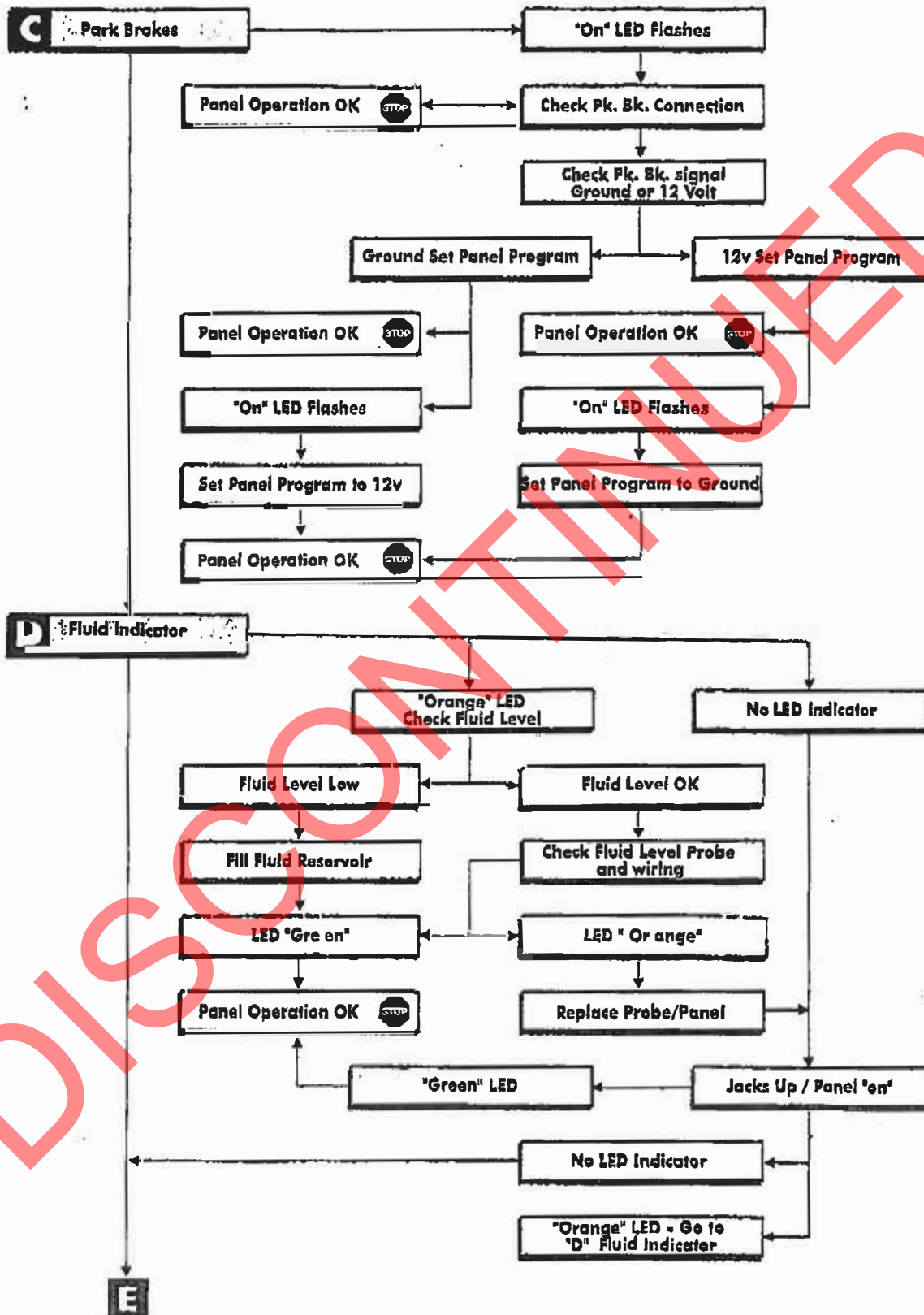


Figure 1d

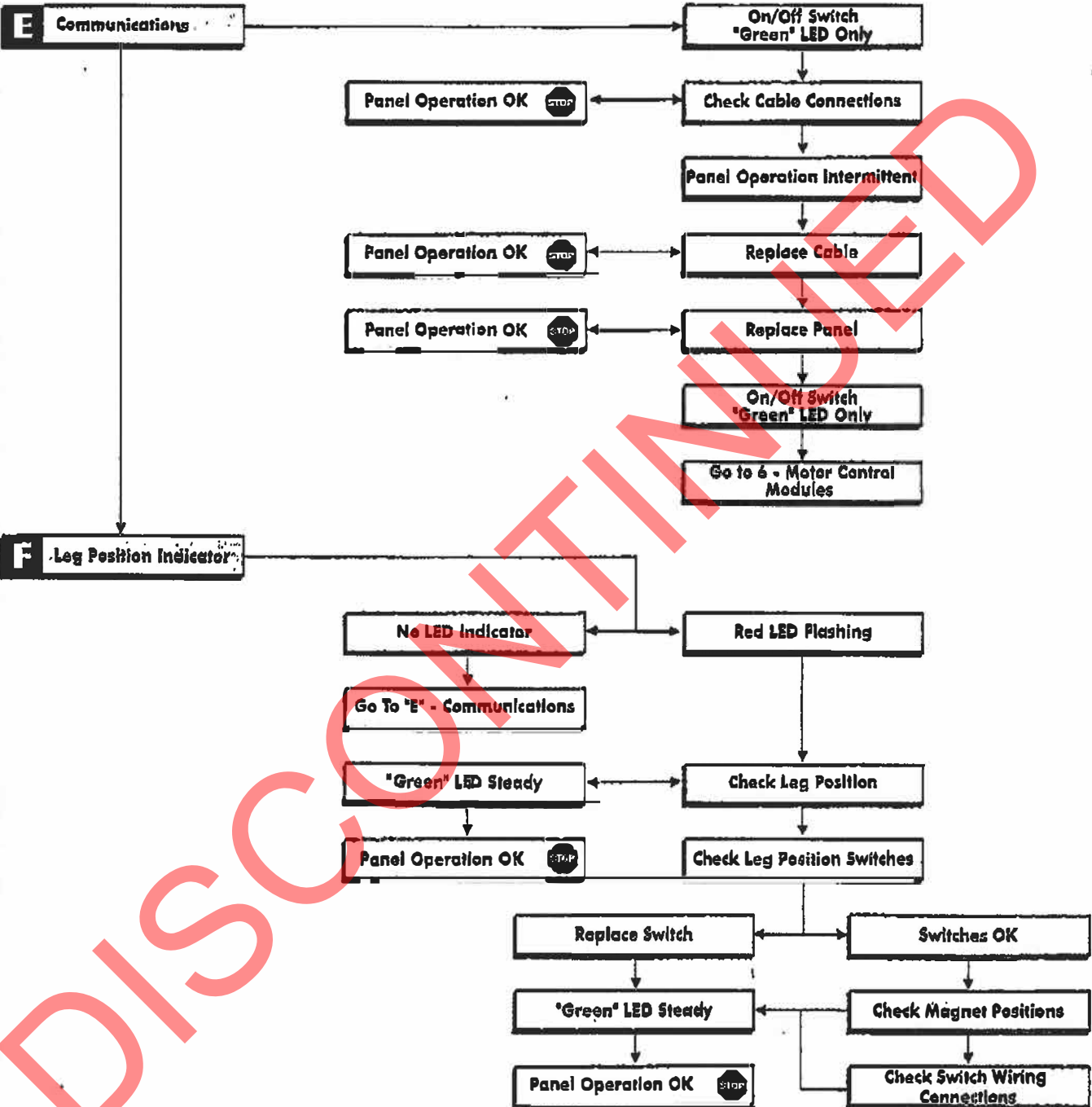
Keypad Panel Diagnostics Chart 1 of 3





2

Keypad Panel Diagnostics Chart 3 of 3



2

Keypad Panel

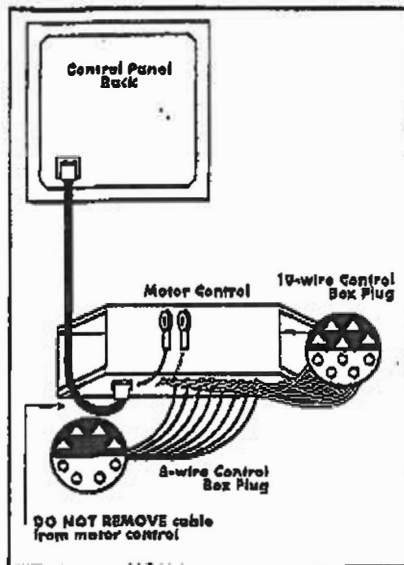


Figure 2a

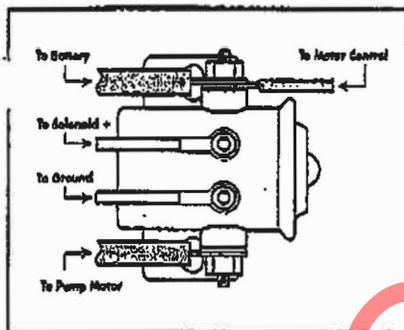


Figure 2b

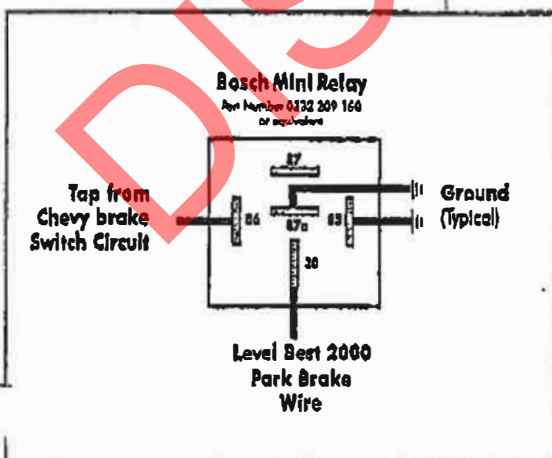


Figure 2c

A. On / Off Switch (no function)

1. No function indicates that the panel is not receiving power. Power is transmitted to the control panel by the telephone style cable. Check the cable connections at the panel and at the motor control, which is located at the "Level Best", pump motor. Verify that the cable is not damaged and is fully inserted into connectors. Do not remove the cable from the motor control. (fig. 2a)
2. Check the motor control hot lead connection that is attached to the pump motor solenoid. This connection is located on the same terminal as the battery cable from the vehicle battery. All power for the control system is derived from this connection. The "Level Best 2000" control system requires a minimum of 12 volts for proper operation. (fig. 2b)
3. If the "On/Off" LED is the only lit LED and no panel functions work the control panel may be locked. To unlock it, disconnect then reconnect the motor control power lead then retest functions.
4. After you have checked the control connections, and that the battery is or has been sufficiently charged and the control panel still will not function refer to Section "6" Motor Control.

B. On / Off Switch (ignition)

1. Green LED will not stay illuminated when control panel is energized or while attempting to use the leveling system. This condition indicates a lack of, or an inadequate ignition signal or a low battery. Check the source for the ignition signal. The ignition source must be a constant signal with a minimum of 12 volts.

The "Level Best" control panel is designed to not operate when the vehicles ignition system is in the off position.

C. On / Off Switch (park brake)

1. Green LED flashes when energized. This condition indicates an improper, or an inadequate signal for the park brake interlock. Check that the park brake is set on. Check the connection at the signal source, this is normally located at or near the parking brake assembly. In some General Motors vehicles the park brake may be energized by a large yellow handled switch located on or near the dash panel. This type of switch requires an additional "mini relay" to transform the signal for the control panel. (Fig. 2c)

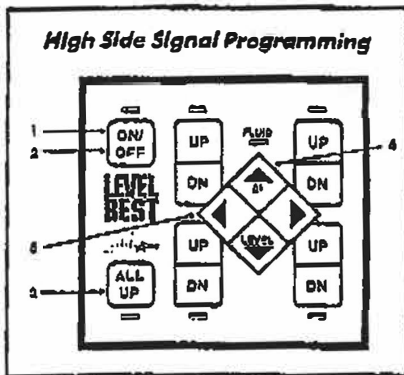


Figure 2d

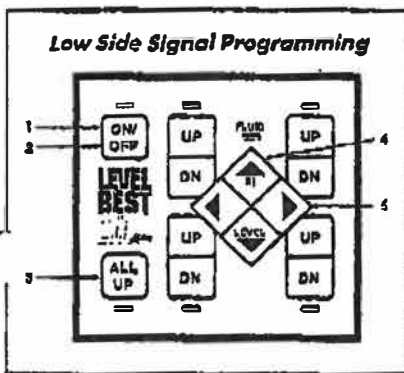


Figure 2e

The LB2000 is designed to operate only when the parking brake is engaged.

2. Check for the type of signal, 12 volt or ground. The control panel can be programmed for signal type. Programming the park brake signal requires pressing the control panel switches in the following sequences¹.

- a. For programming a high side signal ("12" volts when brake is applied).

- PRESS (Fig 2d)
- 1. "ON" (On LED must light)
- 2. "OFF"
- 3. "ALL UP"
- 4. "BI-LEVEL FRONT"
- 5. "BI-LEVEL LEFT"

- b. For programming a low side signal ("ground" when brake is applied).²

- PRESS (Fig 2e)
- 1. "ON" (On LED must light)
- 2. "OFF"
- 3. "ALL UP"
- 4. "BI-LEVEL FRONT"
- 5. "BI-LEVEL RIGHT"

NOTE: These commands must be entered with less than two seconds between keystrokes for the programming to be accepted.

NOTE: The system comes preprogrammed for a low side signal.

D. Fluid Level Indicator

1. The fluid level in the "Level Best" reservoir is checked only when the "ON" switch has just been turned ON, and the jacks are in the "UP" (Retracted position). If no LED is lighted in the fluid window with the above conditions proceed to Section "2 E" Communications.

A fluid sensing probe is mounted into the fluid reservoir. This device sends a signal to the control panel based on the end of the probe being below the surface of the fluid.

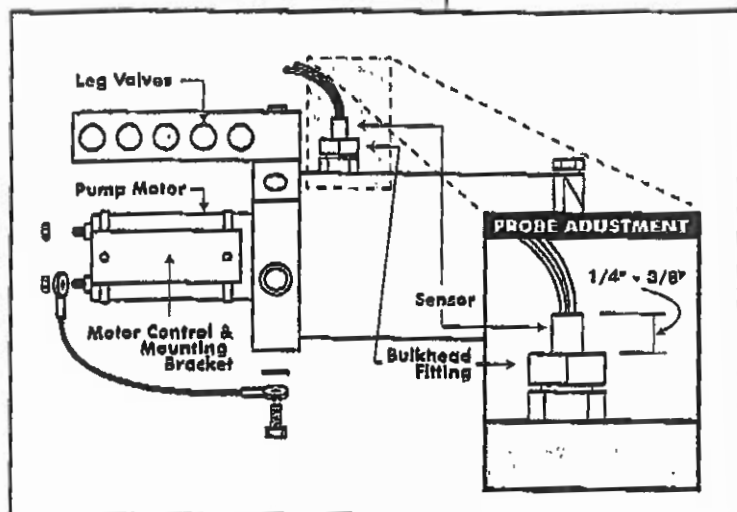


Figure 2g

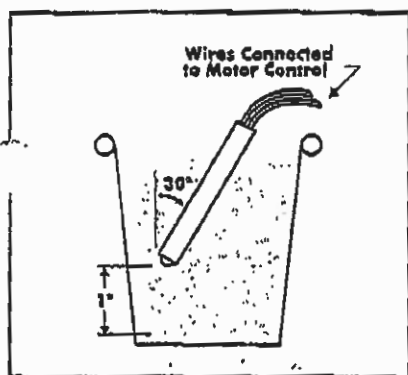


Figure 2h

1. A green LED indicates proper fluid level while an orange LED indicates a low fluid level.
 - a. If the fluid level in the reservoir checks out OK manually and an orange LED is shown on the control panel, you will need to adjust the fluid level probe.
 - b. Adjust the probe by loosening the upper nut on the brass bulkhead fitting located near the top of the reservoir. Adjust the height of the probe so that it protrudes a minimum of 1/4" and a maximum 3/8" above the upper nut of the bulkhead fitting when tightened. (Fig. 2g)

2. Retest panel, if the panel still only indicates an orange fluid level LED the fluid level probe will require testing.
3. Remove probe from the reservoir and place in a paper cup filled with ordinary tap water. Suspend the end of the probe an inch above the bottom of the cup at an angle of approximately 30 degrees and retest panel. (Fig. 2h)
4. Retest panel, if the panel still only indicates an orange fluid level LED the probe will require replacement.
5. If after replacing the probe the LED has not changed to green, replacement of the Control Panel will be necessary.

E. Communications

1. Communication between the Control Panel and the Motor Control is carried through the telephone style cabling connected to both devices. Two of these wires are used for communication, one for low voltage power, and one for electrical ground.
2. When the control panel is turned "ON" and the only LED that lights up and stays on is the green On / Off LED there is a problem with the communications link between the panel and motor control.
 - a. Check Cable connections, verify that the cable is not damaged and is fully inserted into the panel and motor control connectors. Do not remove cable from control.

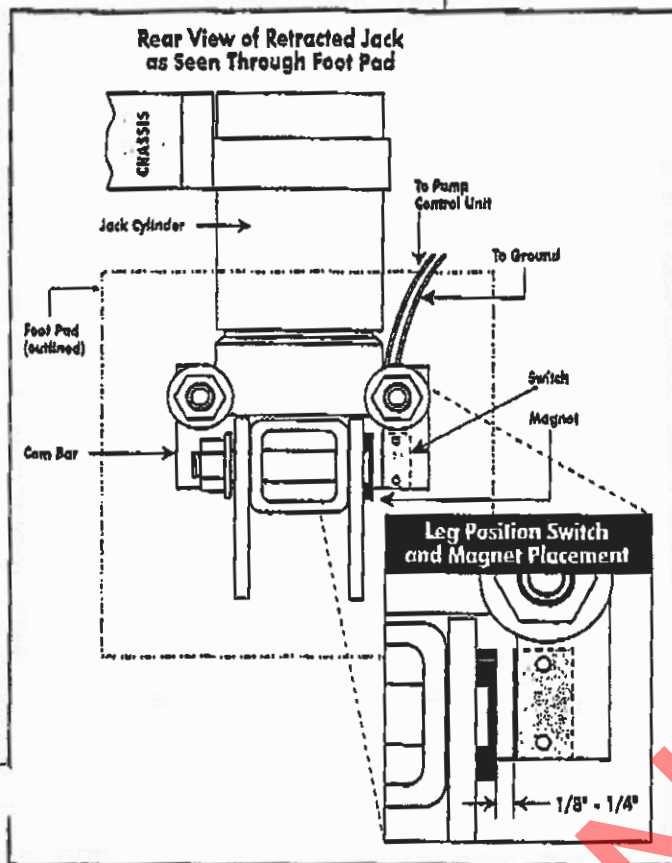


Figure 2i

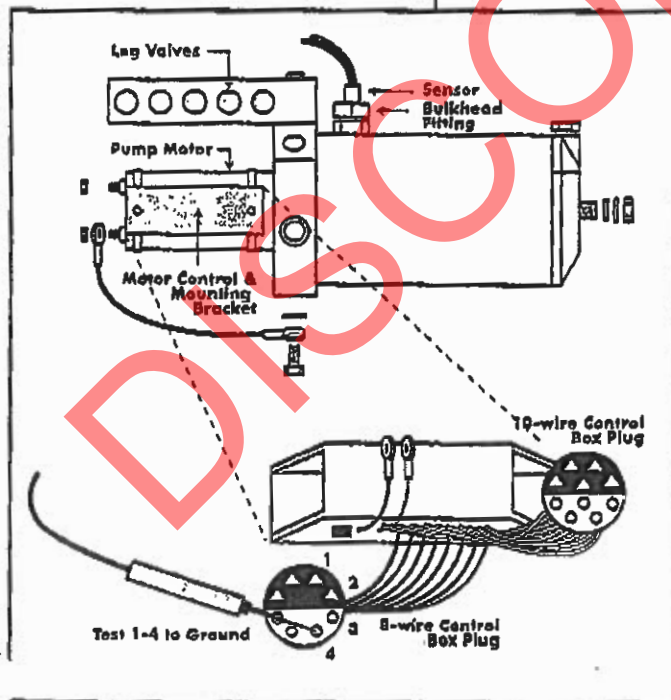


Figure 2j

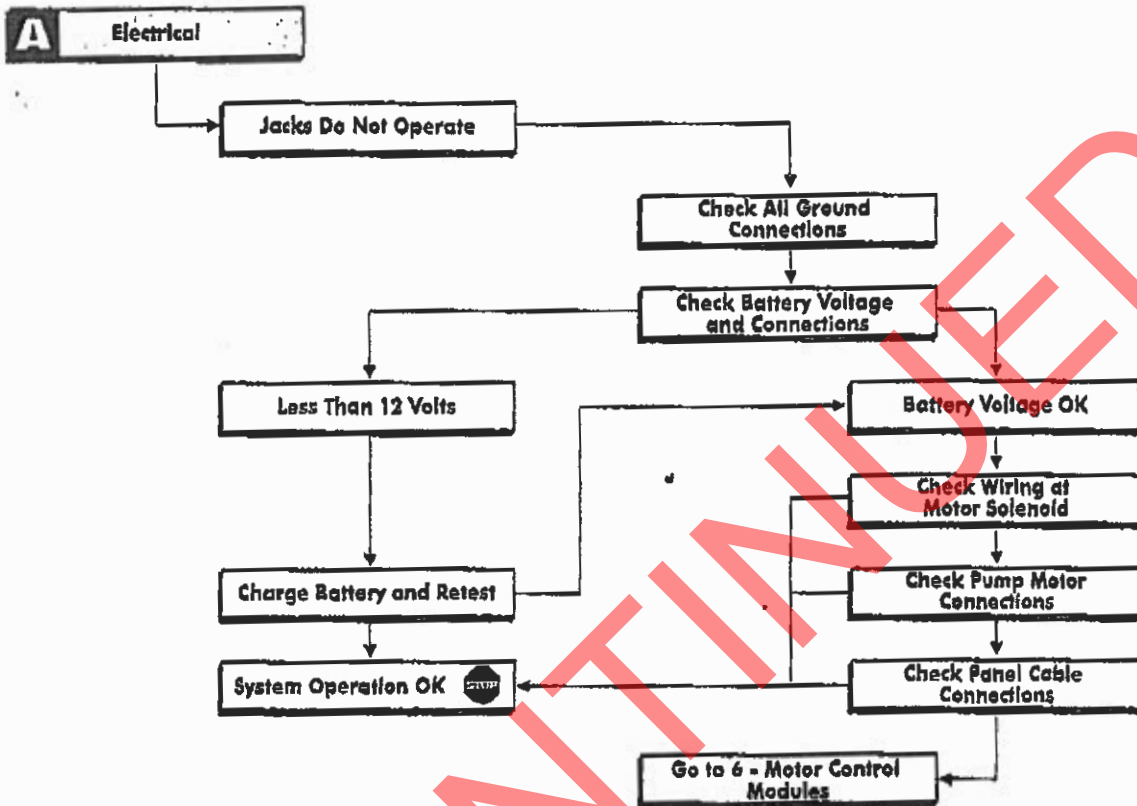
- b. Retest system after checking connections, if the panel functions have not been corrected or the panel displays erratic behavior, replace the control cable.
- c. Retest system, if panel functions have not been corrected or the panel displays erratic behavior, replace the Control Panel.
- d. Retest system, if panel functions have not been corrected or the Control Panel continues to display erratic behavior, refer to Section "6" Motor Control.

F Leg Extended Indicator

1. The control panel will display a flashing red LED at the All / Up button to indicate if any leveling leg is not in the fully retracted position. When legs are fully retracted this LED will turn to green. The absence of a lighted LED indicates a panel communication problem, go to Section "2 E" Communication.
2. Flashing red LED. Visually check to verify leveling leg positions, if legs are fully retracted check leg position switches and magnets that are located on the leg and cylinder assemblies.
 - a. Check switch and magnet locations. In the leg retracted condition these should be adjacent to each other with 1/8" to 1/4" gap. If required, adjust the position of the magnet to obtain proper operation. (Fig. 2i)
 - b. Retest panel, if the LED continues to flash red, check leg reed switch function. Separate the large wiring connector plug at motor control containing the leg position wires, (labeled, LEGA, LEGB, LEGC, LEGD). Using an ohm meter check the wire leading to each of the leg switches to ground. Each of these wires should show continuity to ground when the legs are fully retracted. If a wire does not show continuity trace wire to defective leg switch and replace. (Fig. 2j)

3

Electrical Wiring/Connections Diagnostics Chart



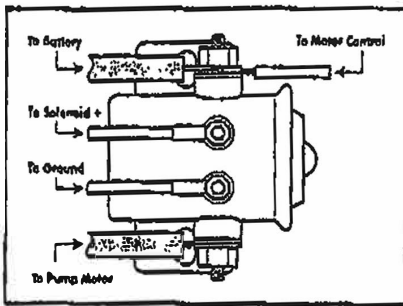


Figure 3a

A. Function

All power for the "Level Best" electronic operating system is derived from the battery cable connection at the pump motor solenoid. The red power lead for the motor control module also originates from this connection. (Fig. 3a)

1. Check all ground connections. These connections are critical for the proper operation of the control system. Check the battery to chassis ground, the pump motor negative post to chassis ground and the motor control ground wire (black) to the pump motor negative post. Incorrect or inadequate grounds can lead to permanent damage of the motor control unit. (Fig. 3b)

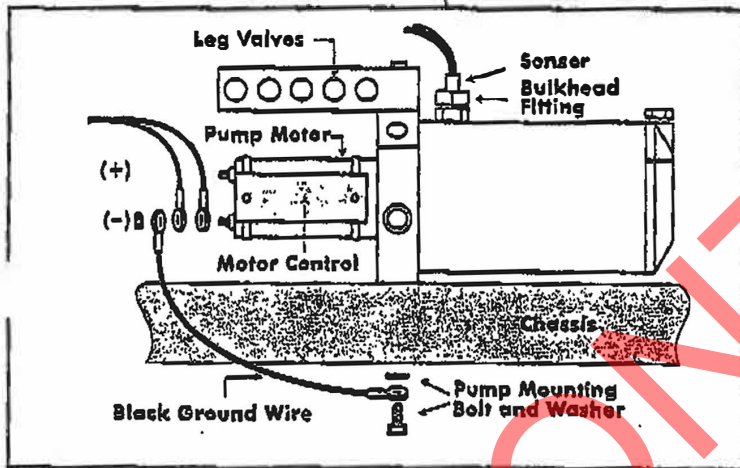
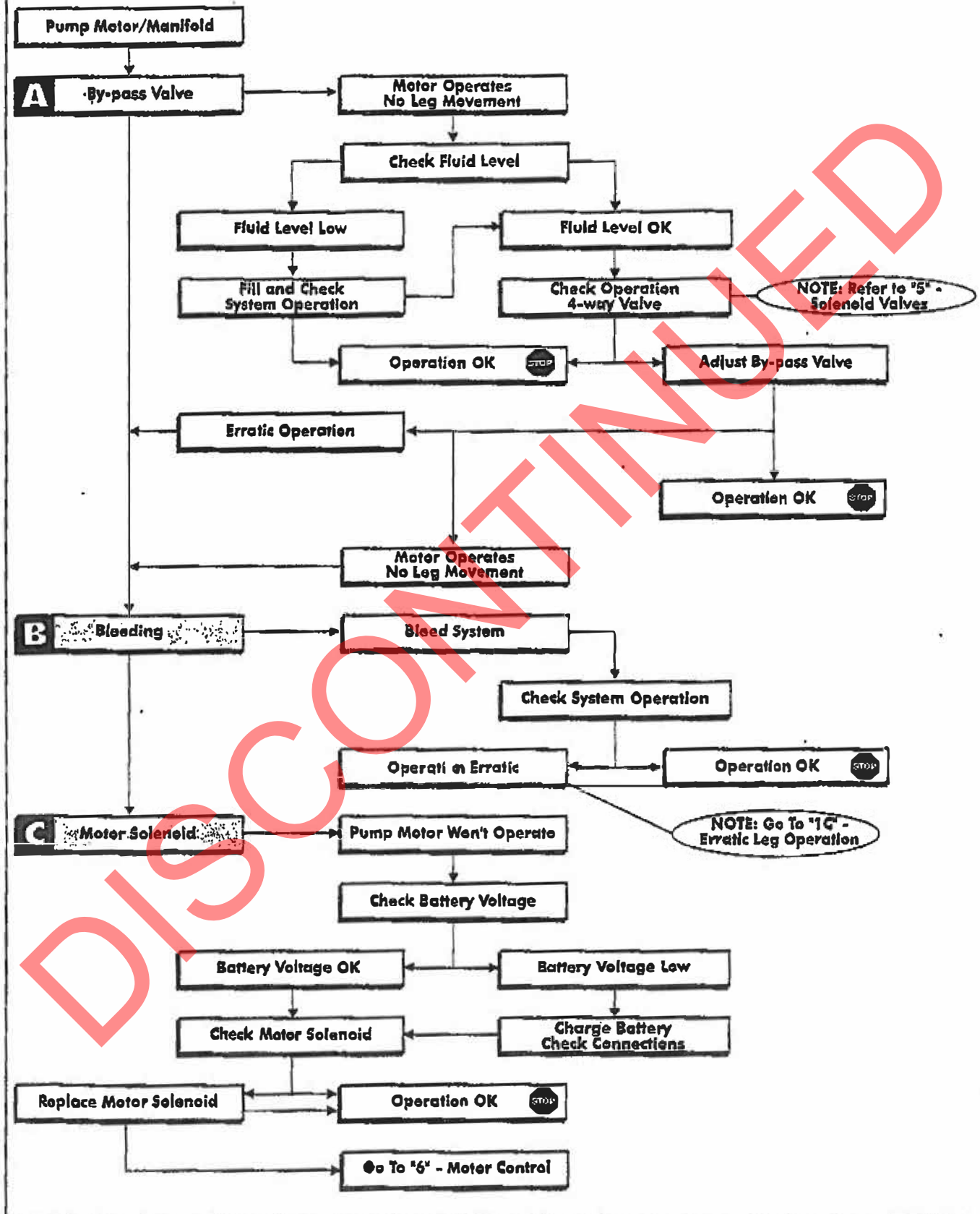


Figure 3b

2. Check battery voltage and connections. A battery in good condition and properly charged will have a no load voltage of approx. 12.6 volts. Check the voltage at the battery and at the cable connection to the motor solenoid. Insure that all battery and motor connections are tightened properly. Recharge or replace the battery as necessary and retest system for proper operation.
3. Check the wire connection at the motor solenoid to motor control. Check that all wiring terminals are properly installed and that the fusible link on the motor control power lead is in good condition. This red wire provides all of the electrical power required for the "Level Best" control system. (Fig. 3a)
4. Check the cable connections between the control panel and the motor control refer to Section "2" keypad / Control panel.
5. Check that all wiring has been properly routed and protected and that all connections are secure and complete.
6. Retest system, if system is not operating or operating incorrectly please refer to section "6" Motor Control.

4

Pump Motor/Manifold Assembly Diagnostics Chart



4

Pump Motor/Manifold Assembly

A. By-Pass Valve

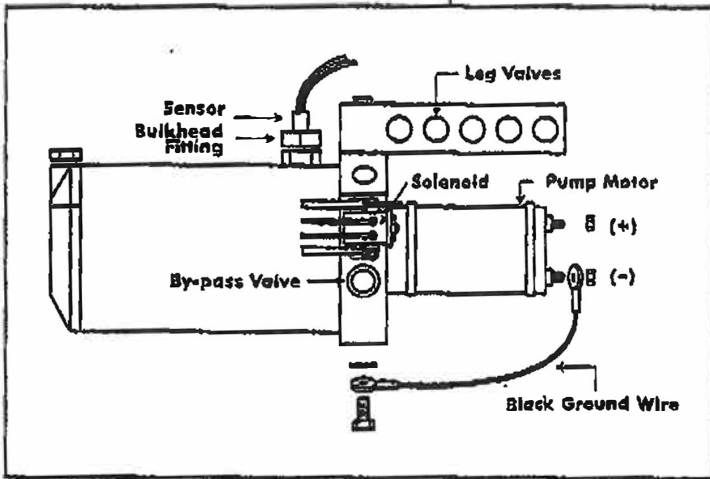


Figure 4a

1. The By-Pass valve controls the pressure at which the leveling system operates. The standard duty Level Best system operates at a pressure of 1500 pounds per square inch while the heavy duty system operates at 1800 pounds per square inch. The By-Pass valve is located on the side of the pump motor mounting block below the motor solenoid. (Fig. 4a)
2. If the pump motor runs but leveling legs do not operate, check the reservoir fluid level, refer to Section "1 A" Fluid Level.
3. If the legs will retract but not extend, check 4-Way valve operation refer to Section "5" solenoid valves.
4. Check the system pressure by installing a gauge in one of the top hydraulic lines between the manifold and cylinder / leg assembly. The gauge will read the by-pass pressure when the jack is at full extension. Adjust the socket head screw clockwise for more pressure and counter clockwise for less pressure. You will have to momentarily reverse the leg direction and reextend each time the valve is adjusted to get a correct reading. (Fig. 4b)

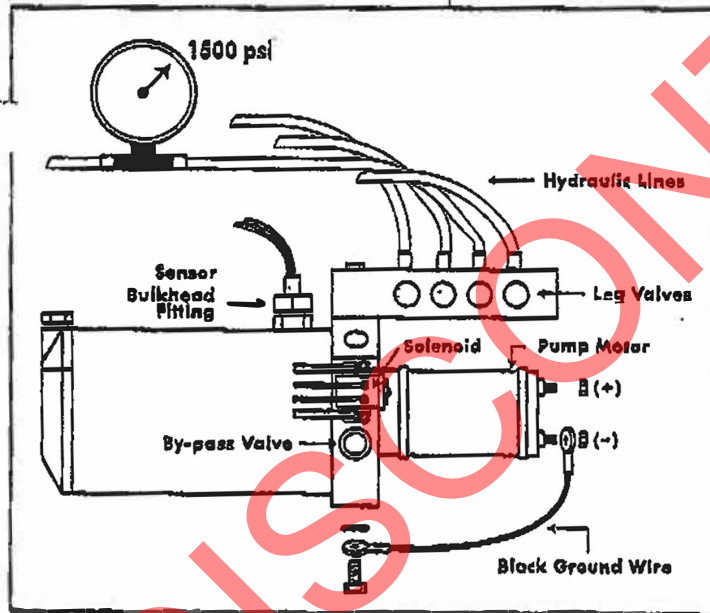


Figure 4b

B. Bleeding

Please refer to Section "1 B" for bleeding procedures.

C. Motor Solenoid

1. The pump motor solenoid is located on the side of the motor mounting block of the pump manifold assembly. This solenoid controls the electrical power to the pump motor. The solenoid has four terminals, two large and two small. The two large terminals

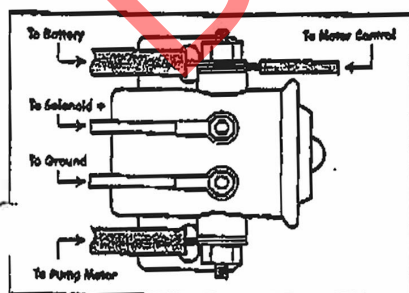
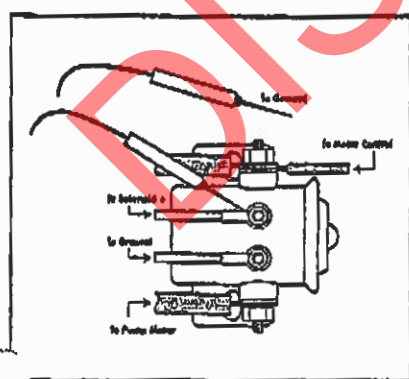
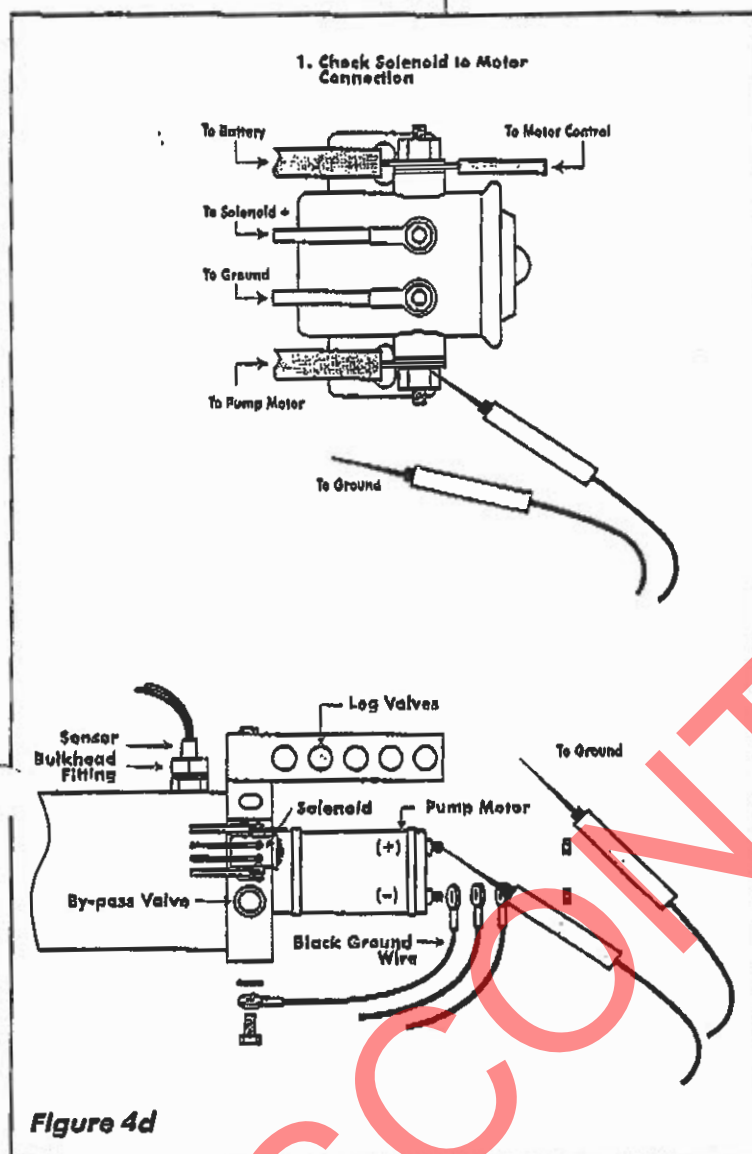


Figure 4c



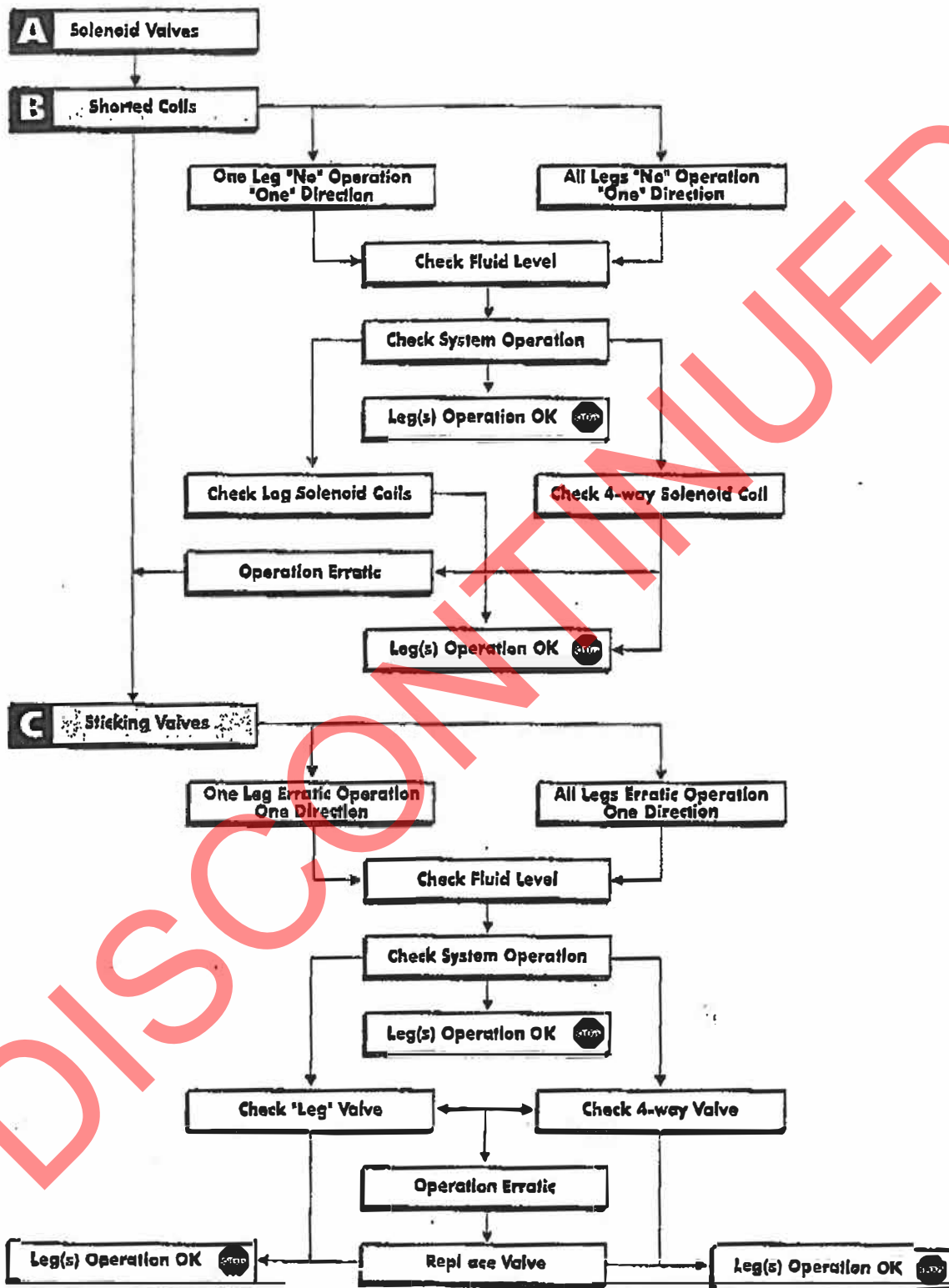
are for the connection of the battery power cables, one to the pump motor and one from the vehicle battery. The two small terminals are for the connection of the control circuits, one for ground and one for power from the motor control module. (Fig. 4c)

2. Pump motor will not operate. Check battery voltage and connections, voltage at the battery to solenoid cable connection should be approximately 12.6 volts. Reference section "3" Electrical for battery and connection information.
3. Check motor solenoid operation. Solenoid should engage each time that a leg button on the control panel is pushed. Using a volt meter check for voltage at the solenoid to motor cable connection. If voltage is detected this indicates that the motor solenoid is operating correctly. Check the voltage at the pump motor cable connection to the pump motor, if voltage is present at this connection when a panel leg button is pressed and the pump motor does not operate, replacement of the motor will be necessary. (Fig. 4d)
4. If no voltage is detected at the solenoid to motor cable connection check the solenoid power wire from the motor control module.

CAUTION should be exercised when testing any of the motor control wires, use only a quality volt meter **DO NOT GROUND OR SPARK WIRES** this will permanently damage the motor control module. When the control panel leg buttons are activated power should be detected at the motor control wire that is connected to one of the small terminals on the motor solenoid. If power is detected and the solenoid does not operate replace the solenoid. (Fig. 4e)

5. When no voltage is detected at the solenoid control terminal, the control module will require replacement. Refer to Section "6" Motor Control.

Solenoid Valves Diagnostics Chart



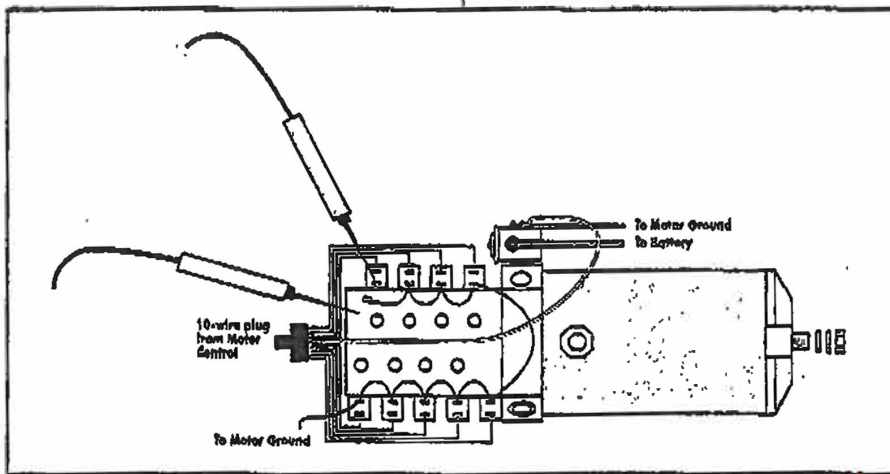
A Functions

Figure 5a

The solenoid valves control the operation of the leveling systems cylinders and legs. There are eight cylinder / leg valves and one direction valve (4-way). The leg valves allow for the operation of the individual legs while the 4-way controls the direction of all the legs. The four leg valves located at manifold ports "1B" through "4B" open as required to allow the return of fluid during the extend sequence, and ports "1T" through "4T" open during the retract sequence. The 4-way valve is energized during the extend cycle.

B. Shorted Coil

1. A leg will not operate or will only operate in one direction. Check the reservoir fluid level, if low refer to Section "1 A".
2. Check leg valves for shorted coils.

Using an ohmmeter place one probe on the manifold and the other probe on one of the coils terminals, if the meter shows continuity the coil must be replaced. If after replacing the coil the problem still persists refer to Section "6" Motor Control.

3. All legs move only in one direction. Check 4-way valve for shorted coil.

Using an ohmmeter place one probe on the manifold and the other probe on one of the two coil terminals, if the meter shows continuity the coil must be replaced (Fig. 5a). If after replacing the coil the problem still persists refer to Section "6" Motor Control.

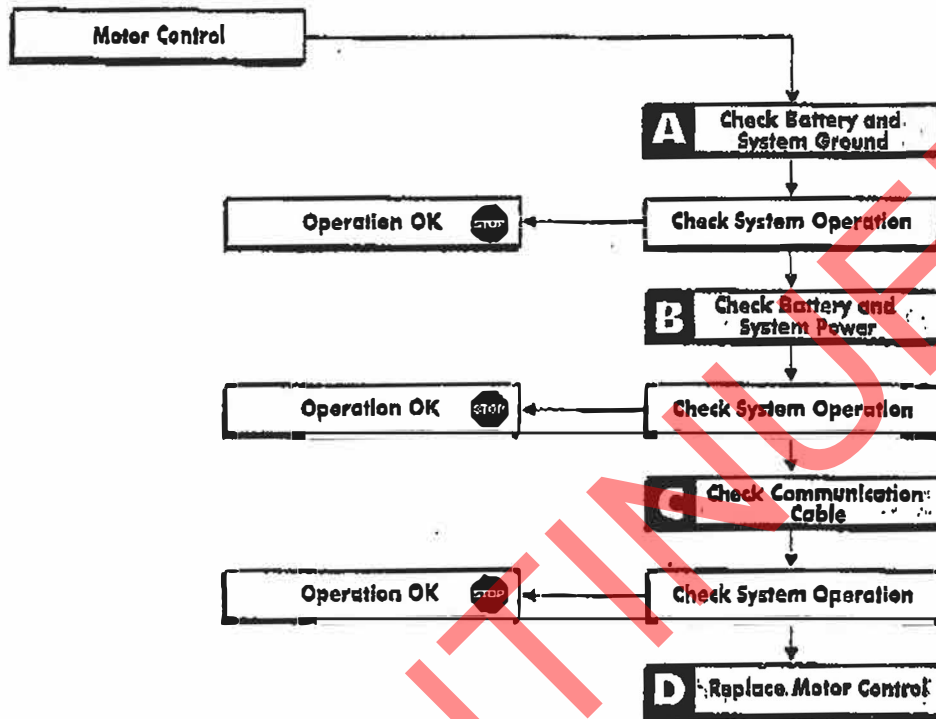
CAUTION should be exercised when testing any of the Motor Control wires, use only a quality volt / ohmmeter **DO NOT GROUND OR SPARK WIRES**, this will permanently damage the motor control module.

C. Sticking Valve

1. A leg will not operate or will only go in one direction. Check the reservoir fluid level, refer to Section "1 A".
2. Check leg valve operation.
 - a. Check that valve coil is receiving power from the motor control module (If no power is present at the valve coil refer to Section "6" Motor Control).
 - b. Remove valve from manifold; use caution as fluid in the manifold may be under pressure. Test valve actuation on the workbench using a 12-volt battery or a regulated 12-volt power supply.
 - i. Check for bent valve assembly.
 - ii. Check valve orifices for any obstructions or contaminants.
 - c. Replace Valve
3. All legs move only in one direction.
 - a. Check that 4-way valve coil is receiving power from the motor control module (If no power is present at valve coil refer to Section "6" Motor Control).
 - b. Remove 4-way valve from manifold; use caution as fluid in the manifold may be under pressure. Test valve actuation on the workbench using a battery or a regulated 12-volt power supply.
 - i. Check for bent valve assembly.
 - ii. Check valve orifices for any obstructions or contaminants.
 - c. Replace Valve

6

Motor Control Modules Diagnostics Chart



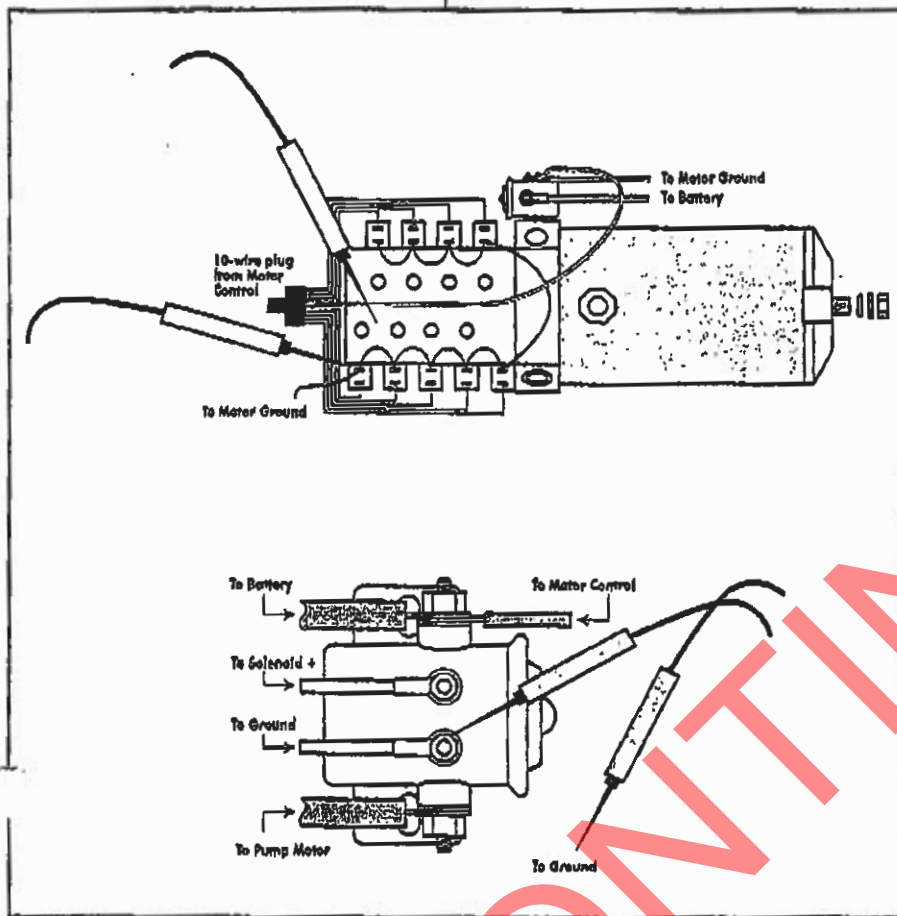


Figure 6a

The Motor Control is the heart of the Level Best 2000 electronic control system.

NOTE: Extreme care should be exercised when working with this device. **Disconnect batteries**, as any short circuit or inadvertent grounding will permanently damage the control. The Motor Control microprocessor handles all of the "Level Best 2000" switching functions, including the motor solenoid, 4-way valve, and cylinder / leg valves.

Electrical requirements, 12-volt power and ground, as well as all of the necessary leveling system information is processed through the Motor Control microprocessor. This information includes fluid level sensor, leg position switches, ignition and park brake signals, leveling sensor and fluid pressure sensor.

A Electrical—Grounds

(Reference Section "3" Electrical)

1. Check vehicle battery ground connections.
2. Check pump motor to chassis / battery ground. (Figure 4a)
3. Check motor control to pump motor ground connection. (Figure 3b)
4. Check master ground for the pump motor solenoid and solenoid valves. (Fig. 6a)

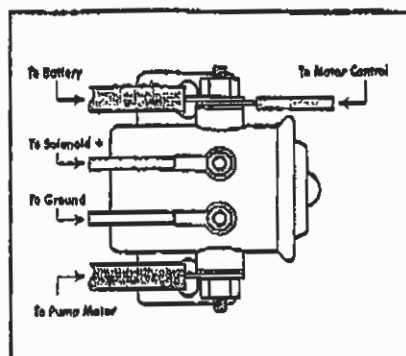


Figure 6b

B. Electrical—12-Volt

(Reference Section "3" Electrical)

1. Check vehicle battery connections, insure that all connections have been made and are secure.
2. Check battery to pump motor solenoid cable connection and motor control power supply connection. (Fig. 6b)
3. Check motor solenoid to pump motor cable connections.
4. Check for 12-volt from the motor control to the pump motor solenoid. (Refer to Section "5" Solenoid Valves)
5. Check for 12-volt from the motor control to the 4-way and leg solenoid valves. (Refer to Section "5" Solenoid Valves)

C. Motor Control to Keypad / Control Panel Cable

(Reference Section "2 E" Communications)

D. Replace Motor Control

1. Disconnect Battery Power connections.
2. Remove control panel communications cable.
3. Disconnect Motor Control power supply wire from the motor solenoid.
4. Disconnect motor solenoid control wire.
5. Disconnect the two large round black 10 wire connectors.
6. Disconnect Motor Control ground wire to pump motor ground terminal.
7. Release clamps and remove Motor Control and bracket.

Install new Motor Control

1. Install Motor Control and bracket. Reuse existing clamps.
2. Connect Motor Control ground wire to pump motor ground terminal.
3. Connect motor solenoid control wire.
4. Connect the two large round black wire connectors.
5. Connect the motor solenoid control wire.
6. Connect the Motor Control power supply wire to the pump motor solenoid to battery terminal.
7. Reinstall control panel communications cable.
8. Check that all ground wires are properly installed and secure.
9. Reconnect Battery Power connections.