SKYTRON®

SURGICAL TABLE

MAINTENANCE MANUAL

MODEL 6700 Series HERCULES

TEC-D-0018 REV0
8/09

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Although current at the time of publication, SKYTRON'S policy of continuous development makes this manual subject to change without notice.

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⚠ **WARNING** ⚠

Indicates a possibility of personal injury.

NOTE

Indicates important facts or helpful hints.

⚠ **CAUTION** ⚠

Indicates a possibility of damage to equipment.

BASIC RECOMMENDED TOOLS:

1/8". 1/4" STRAIGHT BLADE SCREWDRIVERS
#2 PHILLIPS SCREWDRIVER
HYDRAULIC PRESSURE GAUGE SKYTRON P.N. 6-050-02
METRIC ALLEN® WRENCHES 1.5mm-8mm
ADJUSTABLE CRESCENT WRENCH
DIGITAL VOLTMETER, TRUE RMS
METRIC OPEN END WRENCHES 7mm-18mm
LEVEL (CARPENTERS)

BASIC RECOMMENDED MAINTENANCE PROCEDURES

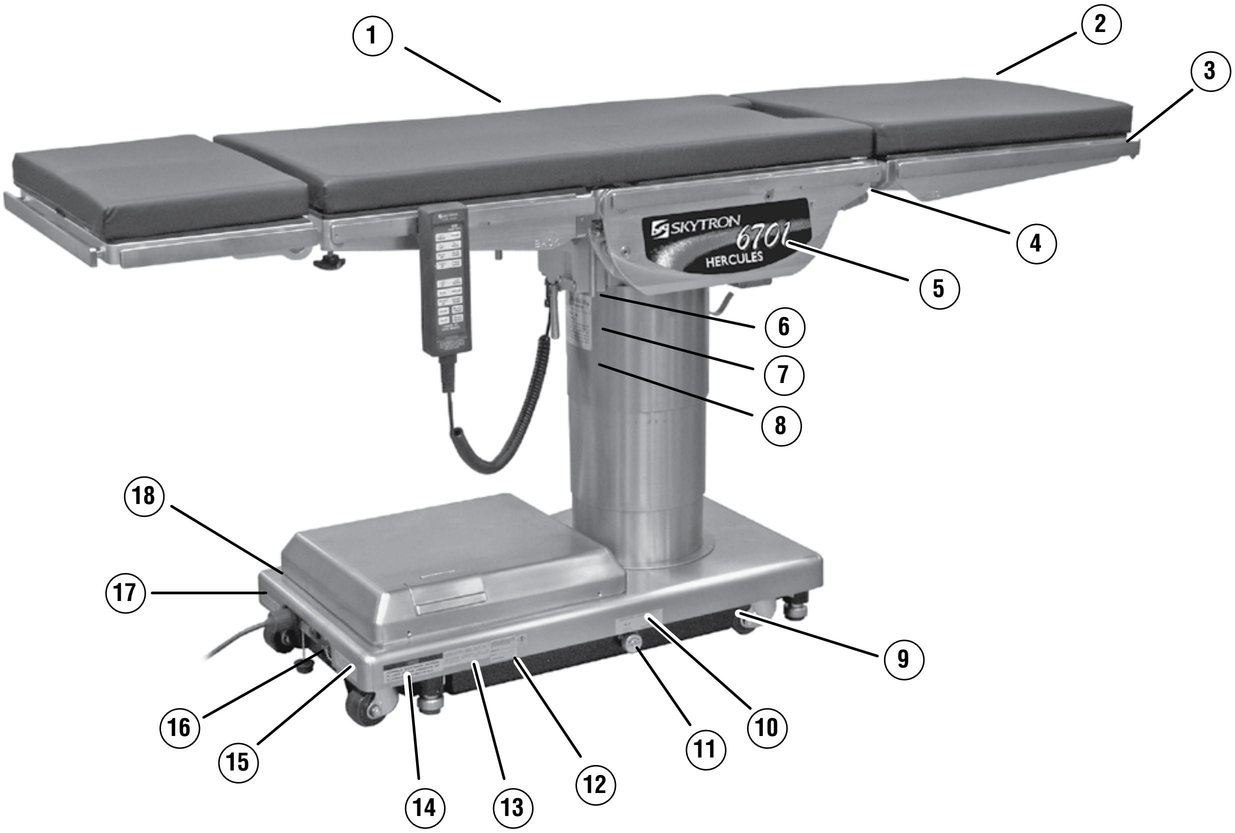
The specific items listed in the MODEL 6701 SERIES MAINTENANCE MATRIX (Appendix) and the basic items below shall be inspected and repaired or replaced as necessary. The suggested time intervals are intended as a guideline only and actual maintenance will vary by use and conditions. For optimal usage, safety and longevity of the product, have it serviced only by an authorized Skytron representative with authentic Skytron replacement parts.

• Check All Table Functions
• Lubricate Elevation Slider Assembly with Mobilux EP (Extreme Pressure) Grease P/N D6-010-89-1
• Tighten X-Ray Top Stand-Offs, Use Blue Loc-Tite

⚠ Only facility-authorized SKYTRON trained, maintenance personnel should troubleshoot the SKYTRON 6700 Series Surgical Table. Trouble shooting by unauthorized personnel could result in personal injury or equipment damage.

How to contact us:
Skytron
5085 Corporate Exchange Blvd. SE, Grand Rapids, MI 49512
PH: 1-800-759-8766 (SKY-TRON)
FAX: 616-656-2906

6700 Series Equipment Labels



1 — D6-032-43

<NOTE>

DUE TO INTERLOCK SYSTEM, BACK SECTION CANNOT BE RAISED ABOVE HORIZONTAL WHEN KIDNEY LIFT IS RAISED

2 — D6-032-47

WARNING

USE HEAD SECTION AS FOOT EXTENSION ONLY - WHEN REVERSING PATIENT ON TABLE REFER TO OPERATOR MANUAL.

3 — D6-032-46

WARNING

DO NOT SIT ON END OF LEG SECTION(S) AS LOADS IN EXCESS OF 140 LBS, MAY CAUSE INSTABILITY THAT COULD CAUSE THE TABLE TO BE TIPPED OVER.

4

SKYTRON
GRAND RAPIDS, MI
1-800-SKYTRON
(616) 957-0500

IPX4

REFER TO ACCOMPANYING DOCUMENTS

MODEL NO. ____ 120V ~ | 60 Hz | 5 AMP

SERIAL NO. ____

FUSE ____ AMP FAST ACTING

MANUFACTURED BY MIZUHO IKA CO., LTD. - TOKYO, JAPAN

5 — D3-067-11 (6700B)
D3-067-31 (6701)

SKYTRON 6701
HERCULES

6 — D6-034-18

TOP ROTATION
HANDLE

7 — D6-011-29

TABLE TOP

---------- WARNING ----------

ALWAYS LOCK THE TABLE TOP IN POSITION AFTER A FULL ROTATION OF 180° DO NOT ROTATE THE TOP WITH AN UNDISTRIBUTED PATIENT LOAD AS INSTABILITY MAY RESULT, EXERCISE CAUTION WITH THE TABLE TOP ROTATED 90° TO THE BASE SINCE AN IMPROPERLY DISTRIBUTED PATIENT LOAD MAY CAUSE THE TABLE TO BE TIPPED OVER.

8 — D6-067-26

Table Capacity:
Lift 1200 lbs.
Articulate 1000 lbs.

See Operators Manual for Limitations.

9 — D6-017-05

TYPE B EQUIPMENT

10 — D6-017-28

EMERGENCY BRAKE RELEASE

UNLOCK CLOCKWISE

LOCK COUNTER-CLOCKWISE

11 — D6-017-29

UNLOCK LOCK

12 — D6-011-34

THIS PRODUCT COMPLIES WITH RADIATION PERFORMANCE STANDARD 21 CFR AT THE TIME OF MANUFACTURE

Manufactured: ____

Model No. ____

SKYTRON

13 — D6-065-24

DANGER - EXPLOSION HAZARD. DO NOT USE IN THE PRESENCE OF FLAMMABLE ANAESTHETICS

DANGER - RISQUE D'EXPLOSION. NE PAS EMPLOYER EN PRESENCE D'ANESTHESIQUES INFLAMMABLES

14 — D6-065-23

DANGER

POSSIBLE EXPLOSION HAZARD IF USED IN THE PRESENCE OF FLAMMABLE ANESTHETICS.

15 — D6-065-22

CAUTION

To reduce the risk of electric shock, do not move cover or back. Refer servicing to qualified service personnel. Refer to accomanying documents.

16 — D6-034-21

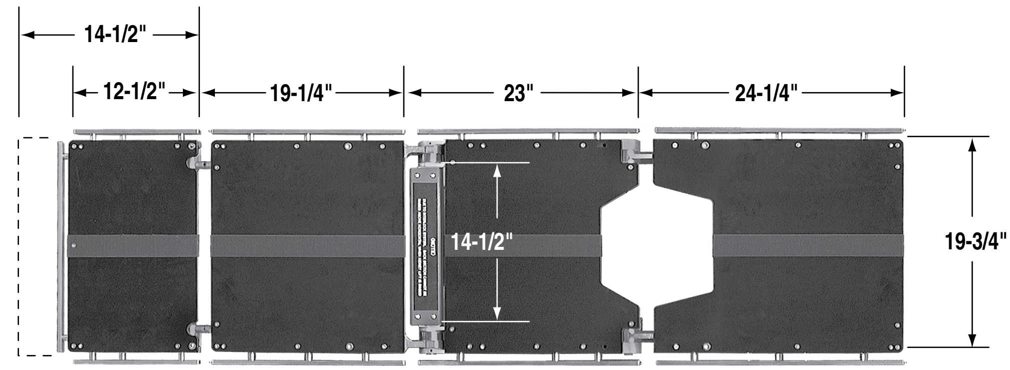
17 — D6-065-21

Grounding reliability can only be achieved when the equipment is connected to an equivalent receptacle marked "Hospital Only" or "Hospital Grade"

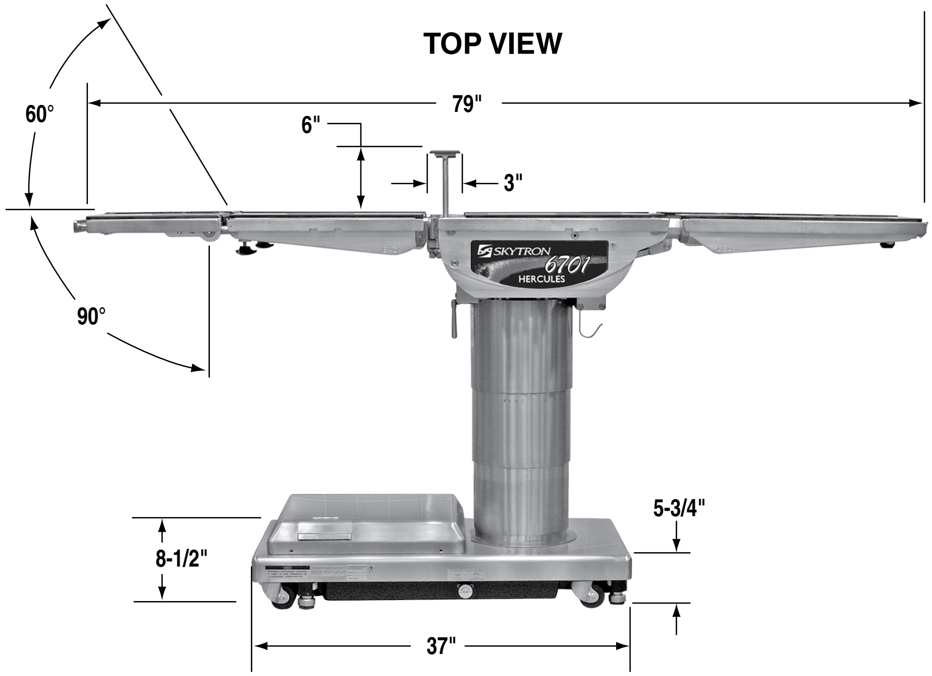
18 — D6-067-27

TWIST TO LOCK OR RELEASE PLUG

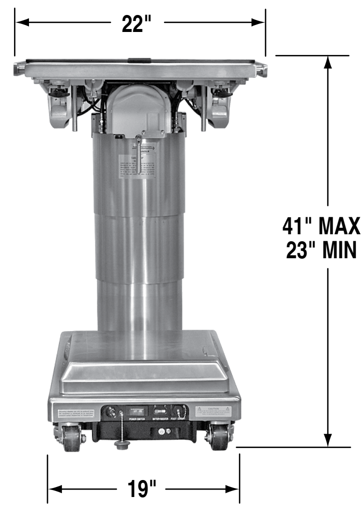
6700 Series Specifications



TOP VIEW



SIDE VIEW



END VIEW

ETL LISTED
CONFORMS TO
UL STD 60601-1
CERTIFIED TO
CAN/CSA STD C22.2 NO.601.1

Electrical Specifications

Power requirements	120 VAC, 60Hz, 450 Watts
Current Leakage	Less than 100 micro amps
Power Cord	15 feet w/hospital grade connector (removable)

CLASS I DEFIBRILLATION PROOF, TYPE B EQUIPMENT- IPX4 RATED.
INTERNALLY POWERED EQUIPMENT

UNIT TO BE USED ONLY IN SPECIFIED ENVIRONMENTAL CONDITIONS

SECTION I HYDRAULIC SYSTEM

1-1. General

Electro-Hydraulic System

The hydraulic system (with the exception of the hydraulic cylinders and hoses) is contained within the base of the table. The hydraulic valves and pump are electrically controlled by the use of a hand-held push button pendant control. The power requirements for the table are 120 VAC, 5 amp, 60 Hz.

The table contains the following components. Refer to the block diagram (figure 1-1) for relationship.

a. Oil Reservoir - Main oil supply. Approximately two quarts.

b. Motor/Pump Assembly - A positive displacement gear type pump provides the necessary oil pressure and volume.

c. Pressure Relief Valve - Provides an alternate oil path when the hydraulic cylinders reach the end of their stroke.

d. Electro/Hydraulic Mini-Valve Assemblies - These direct the fluid to the appropriate hydraulic cylinders.

e. Hydraulic Lines, Fittings, Connections - They provide a path for the hydraulic oil.

f. Hydraulic Cylinders - They convert the hydraulic fluid pressure and volume into mechanical motion.

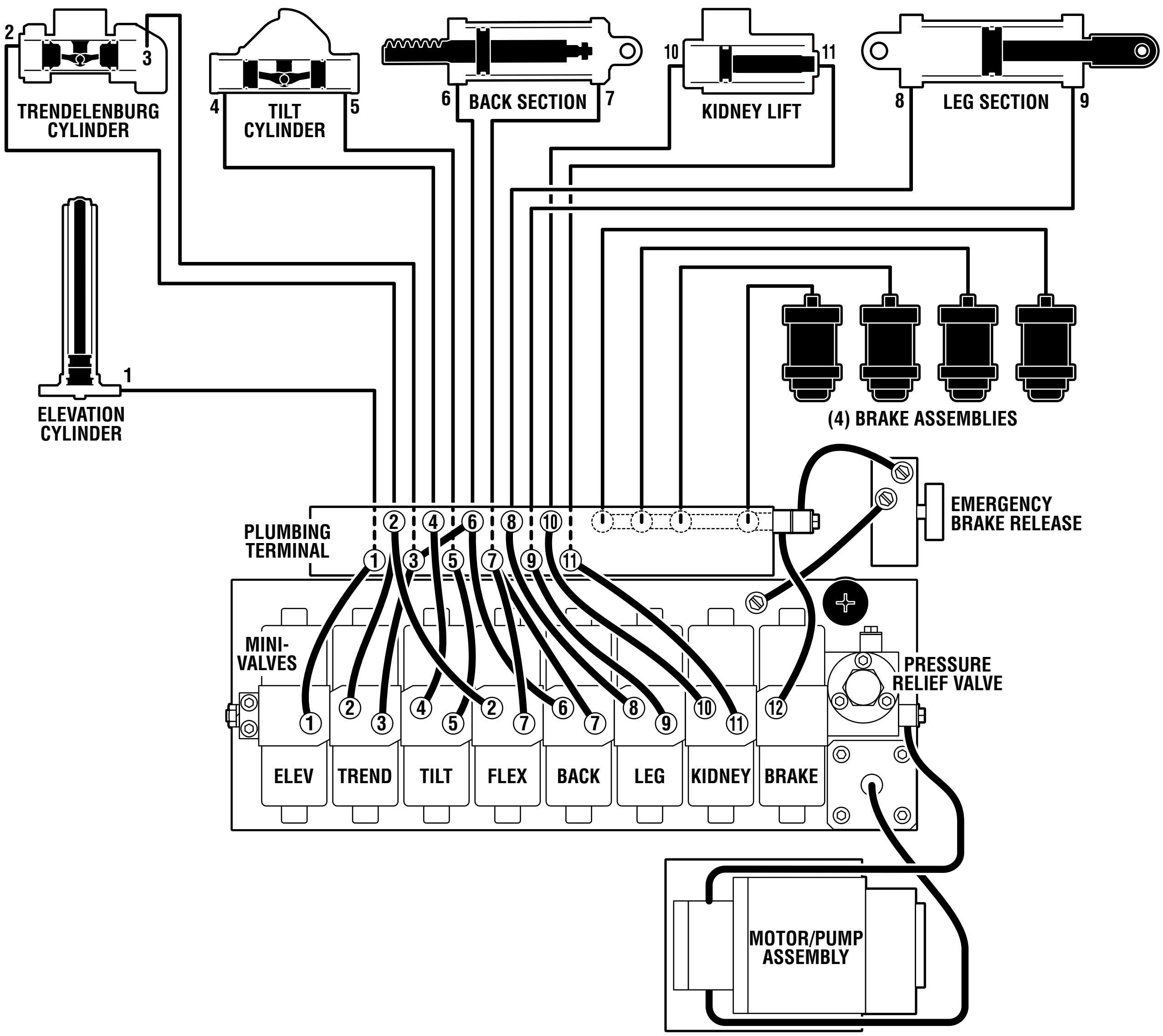


Figure 1-1. Hydraulic Block Diagram

1-2. Component Operation

a. Motor/Pump Operation

The motor/pump assembly is a gear type pump that provides the oil pressure and volume for the entire hydraulic system. The pump has an inlet side and an outlet side. The inlet side is connected to the reservoir which provides the oil supply. The reservoir has a very fine mesh screen strainer which prevents foreign material from entering the oil system.

The output line of the pump is connected to the main oil galley which is internal and common to all the hydraulic mini-valves and pressure relief valve. Also, common to the hydraulic mini-valves and pressure relief valve is an oil galley that internally connects to the oil reservoir to provide a return path for the hydraulic oil. See figure 1-2.

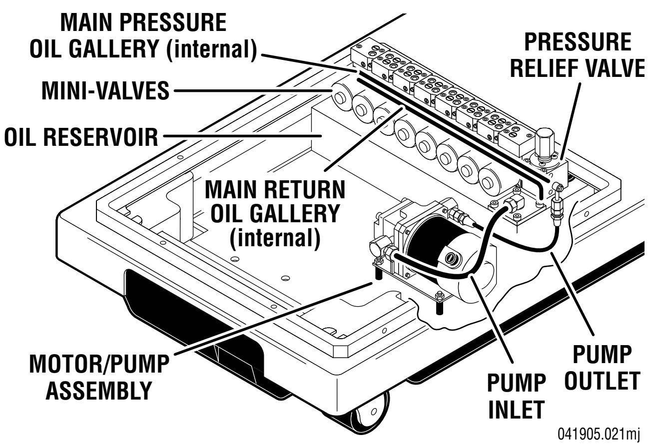


Figure 1-2.

b. Pressure Relief Valve

This device provides an alternate oil path back to the reservoir when the hydraulic cylinders reach the end of their stroke and the pump continues to run. If this path were not provided, the pump motor would stall because the oil cannot be compressed. The pressure relief valve is directly connected to the mini-valve bodies and shares both the common internal main pressure oil galley, and the return oil galley that internally connects to the reservoir. See figure 1-3.

The main component of the valve is an adjustable spring loaded plunger that when it is pushed off from its seat by the oil pressure, the oil flows back into the reservoir. See figure 1-4. Turning the adjustment nut clockwise increases the amount of oil pressure required to open the valve, and turning it counter-clockwise decreases the amount of oil pressure. (See adjustment section for specification.)

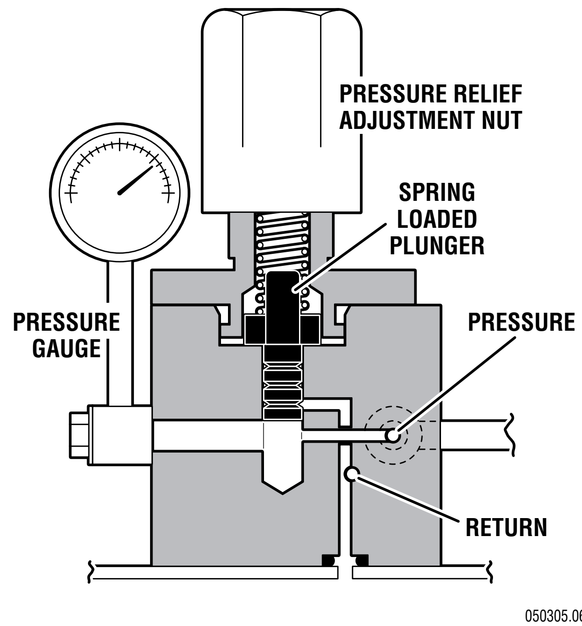


Figure 1-3. Pressure Relief Valve Not Functioning

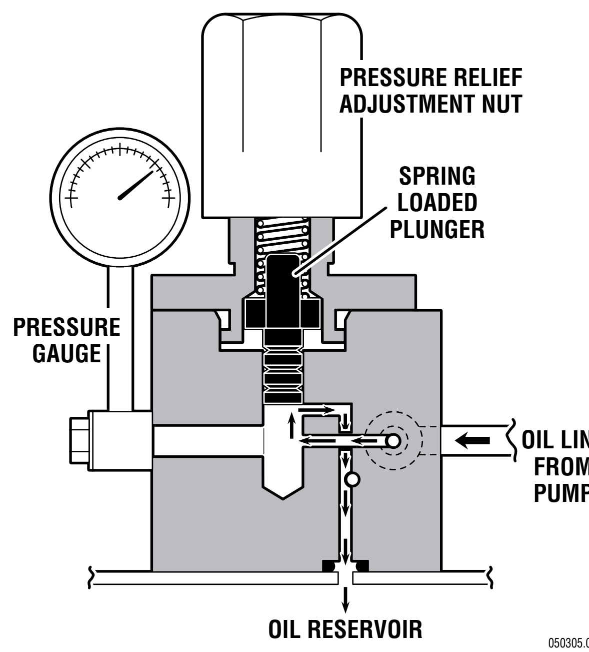


Figure 1-4. Pressure Relief Valve Functioning

c. Mini-Valves

The operation of the mini-valves is identical for all table functions except the elevation and brake circuits. These two hydraulic circuits use a 3-way (single check valve) type mini-valve. All other functions use a 4-way (dual check valve) type mini-valve.

Either type mini-valve is controlled by two pushing type, electrically operated solenoids. The solenoids push the spool valve (located in the lower portion of the valve) one way or the other. This motion opens the main supply galley (which has pump pressure) allowing the oil to flow through the various parts of the mini-valve to the function. The spool valve also opens an oil return circuit which allows the oil to return to the oil reservoir.

The main components of the mini-valve and their functions are listed below:

1. Spool Valve - Opens the main oil galley (pump pressure) to either mini-valve outlet depending on which direction the spool valve is pushed. Also it provides a return path for the oil returning back into the reservoir.

2. Pilot Plunger - There are two plungers in a four-way mini-valve (one in a 3-way mini-valve), one under each check valve. The purpose of the pilot plungers is to mechanically open the return check valve allowing the oil to return back into the reservoir.

3. Check Valve - Two are provided in each four-way mini-valve to seal the oil in the cylinders and oil lines and prevent any movement of the table. One check valve is provided in a 3-way mini-valve.

4. Speed Controls - There are two speed controls in each 4-way mini-valve. They are needle valve type controls which restrict the volume of oil returning back into the reservoir, thereby controlling the speed of the table surface movement. A 3-way mini-valve has only one speed adjustment.

The speed controls are always located in the return oil circuit to allow the movement of the cylinder to be controlled. Also, by using this control method, it does not matter what size cylinder and piston is used because the speed is controlled by restricting the return oil. If the pump puts out more volume to a slave cylinder than is allowed by the speed control, the pressure relief valve opens and provides an alternate path for the pump oil to return to the reservoir.

The following material depicts the three operating positions of the mini-valve. The movement of the slave cylinder piston (extend or retract) is determined by which port of the Mini-Valve is activated.

Mini-Valve in Neutral Position
(No fluid flow) See figure 1-5.

• Spool Valve Centered - This closes off both oil pressure and oil return galleys.

• Pilot Plungers Both Closed -The pilot plungers control the opening of the check valves. If they are closed, the check valves must be closed.

• Check Valves - Both check valves are closed trapping the oil in the cylinder and oil lines.

• Speed Control - When the mini-valve is in the neutral position, the speed control does not affect anything.

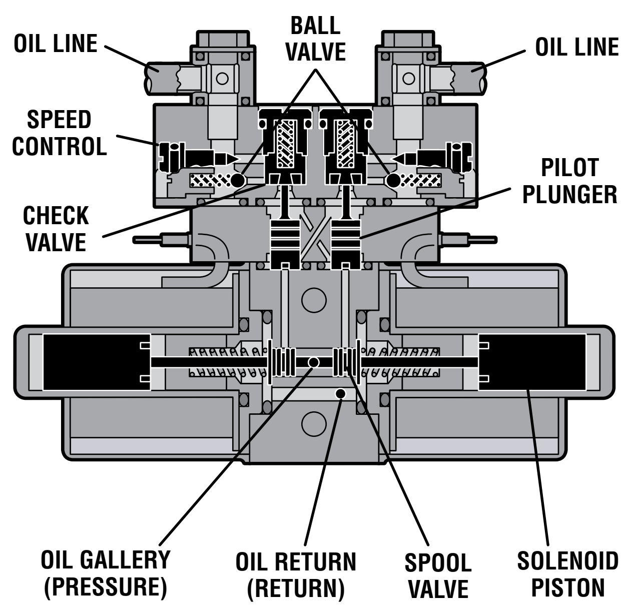


Figure 1-5. Mini-Valve in Neutral Position

Mini-Valve Right Port Activated
(See figure 1-6)

Right Mini-Valve Port is Supply Line
Left Mini-Valve Port is Return Line

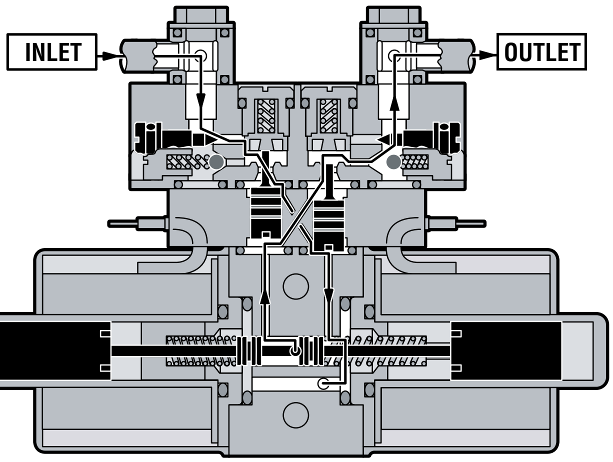


Figure 1-6. Mini-Valve Right Port Activated

• Spool Valve-Pushed to the left by electric solenoid. This opens the internal oil pressure galley allowing the fluid to go through the check valve and on to the cylinder. Also, the spool valve opens the oil return line providing an oil path through the internal oil galley back to the reservoir.

• Pilot Plunger Valve - Left pilot plunger valve is pushed up by the incoming oil pressure mechanically opening the check valve located above it in the return circuit. This action allows the oil from the return side of the slave cylinder to go back into the reservoir. The right pilot plunger valve is not affected in this operation mode.

• Check Valves - Both check valves are opened in this operation mode. The right check valve is pushed open by the oil pressure created by the pump. The oil then continues through the lines and supplies the inlet pressure to move the slave cylinder piston. The left check valve is held open mechanically by the pilot plunger and allows the oil from the return side of the slave cylinder to go through the mini-valve back to the reservoir.

• Speed Control - The right speed control (output side) does not have any effect in this operation mode because the oil is routed around the speed control through a by-pass valve to the output port. The left speed control controls the speed of the table function by restricting the flow of oil going back into the reservoir.

Mini-Valve Left Port Activated
(See figure 1-7.)

Left Mini-Valve Port is Supply Line
Right Mini-Valve Port is Return Line

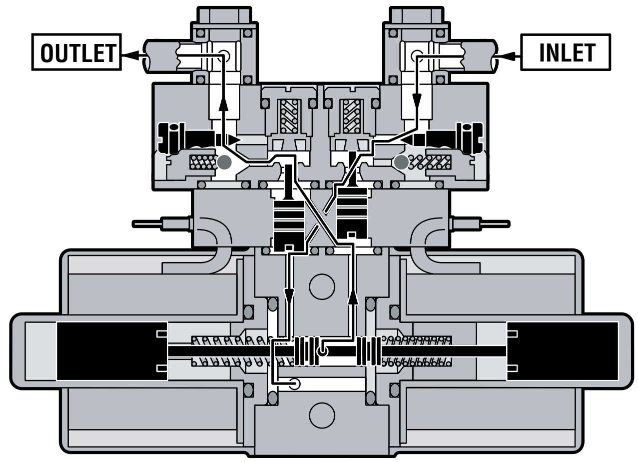


Figure 1-7. Mini-Valve Left Port Activated

• Spool Valve-Pushed to the right by electric solenoid. This opens the internal oil pressure galley allowing the fluid to go through the check valve and on to the cylinder. Also, the spool valve opens the oil return line providing an oil path through the internal oil galley back to the reservoir.

• Pilot Plunger Valve - Right pilot plunger valve is pushed up by the incoming oil pressure mechanically opening the check valve located above it in the return circuit. This action allows the oil from the return side of the slave cylinder to go back into the reservoir. The left pilot plunger valve is not affected in this operation mode.

• Check Valves - Both check valves are opened in this operation mode. The left check valve is pushed open by the oil pressure created by the pump. The oil then continues to go through the lines and supplies the inlet pressure to move the slave cylinder piston. The right check valve is held open mechanically by the pilot plunger and allows the oil from the return side of the slave cylinder to go through the mini-valve back to the reservoir.

• Speed Control - The left speed control (output side) does not have any effect in this operation mode because the oil is routed around the speed control through a by-pass valve to the output port. The right speed control controls the speed of the table function by restricting the flow of oil going back into the reservoir.

d. Hydraulic Cylinders (Slave Cylinders)

There are several different types of hydraulic cylinders used in the table that activate the control functions. With the exception of the elevation and brake cylinders, all operate basically the same way. The control functions are listed below.

Back Section ------ 2 double action cylinders
Leg Section-------- 2 double action cylinders
Trendelenburg----- 1 double action cylinder
Lateral Tilt---------- 1 double action cylinder
Elevation ----------- 1 single action cylinder
Kidney Lift---------- 2 double action cylinders
Brakes -------------- 4 single action cylinders

1. Back Section and Leg Section Cylinders - The double action cylinders are closed at one end and have a movable piston with hydraulic fluid on both sides. Connected to this piston is a ram or shaft that exits out of the other end of the cylinder. Through the use of either a gear, or clevis and pin arrangement, this ram is connected to a movable table surface. The movable surface can be moved one way or the other by pumping hydraulic fluid into the cylinder on either side of the piston. Obviously, if oil is pumped into one side of the cylinder, a return path must be provided for the oil on the other side. See figure 1-8.

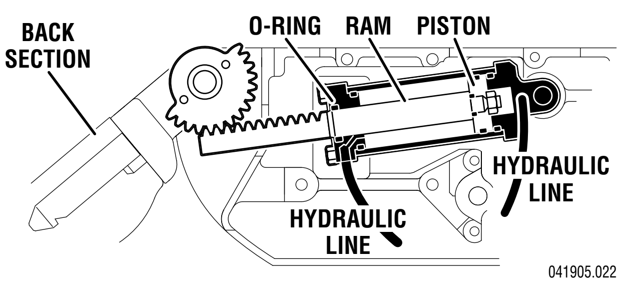


Figure 1-8. Back Section Cylinder

2. Trendelenburg Cylinder Assembly - The Trendelenburg tilt assembly consists of two cylinders, pistons and connecting rods. The connecting rods connect to the Trendelenburg lever which connects to the table side frames via the Trendelenburg axis. When hydraulic fluid is pumped into one cylinder, the piston and connecting rod pushes the Trendelenburg lever which tilts the table top. To tilt the table top in the opposite direction, fluid is pumped into the opposite cylinder. See figure 1-9.

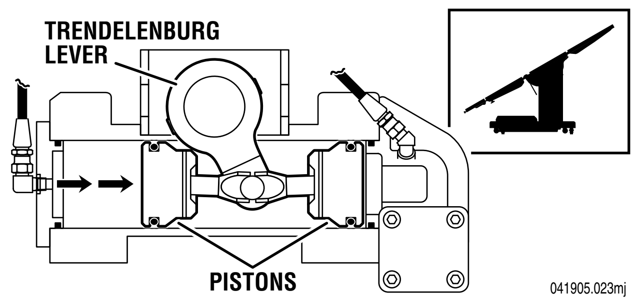


Figure 1-9. Trendelenburg Cylinder Assy.

3. Lateral Tilt Assembly - The lateral tilt assembly consists of two cylinders, pistons and connecting rods. The connecting rods attach to the lateral tilt lever which connects to the table side frames. When hydraulic fluid is pumped into one cylinder, the piston and connecting rod pushes the lateral tilt lever which tilts the table top to one side. To tilt the table top in the opposite direction, fluid is pumped into the opposite cylinder. See figure 1-10.

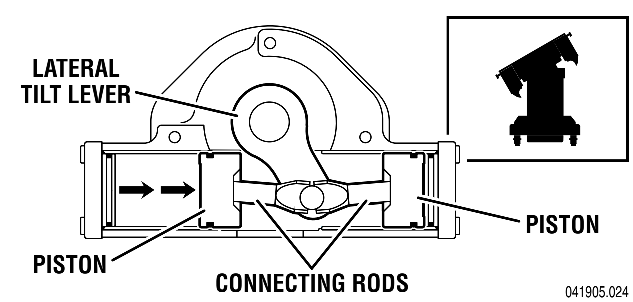


Figure 1-10. Lateral Tilt Cylinder Assembly

4. Elevation Cylinder - This single action cylinder does not have hydraulic fluid on both sides of the piston. It depends on the weight of the table top assembly to lower it. The cylinder is set in the center of the elevation main column. The two stage cylinder is elevated by the driven force of the oil pressure. When lowering, the oil that is accumulated in the cylinder is returned to the oil reservoir through the mini-valve due to the table top weight. A slider support assembly is used to support the weight of the upper table section. A stainless steel shroud covers the flexible hydraulic hoses and slider. See figure 1-11.

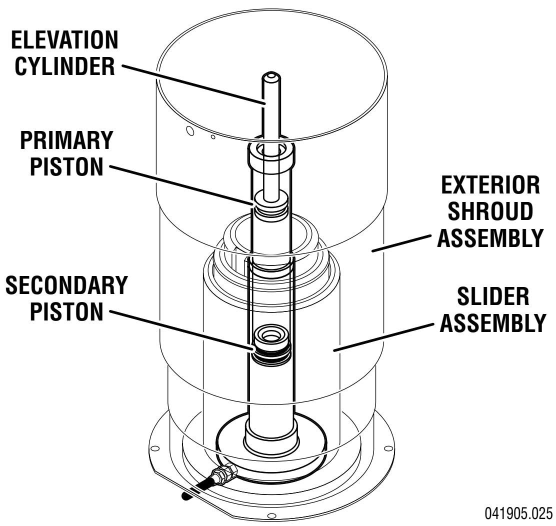


Figure 1-11. Elevation Cylinder Assembly

5. Kidney Lift - The two kidney lift cylinder assemblies are a unique type of double action cylinder where the piston remains stationary and the outer housing or cylinder has the relative motion. The cylinder housing has rack teeth cut into the top which meshes with a pinion gear. This gear meshes with other gears to supply the up or down drive for the kidney lift bars, depending on which direction the oil is pumped into the cylinder. See figure 1-12.

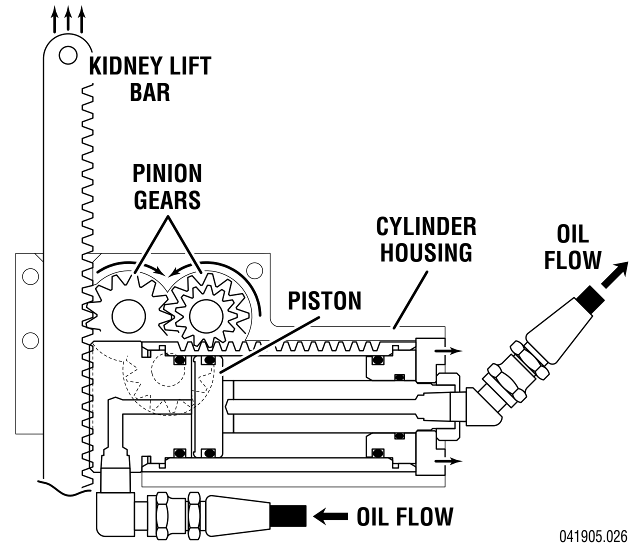


Figure 1-12. Kidney Lift Cylinder Assembly

6. Brake Cylinders - The brake cylinders are single action type similar to the elevation cylinder. The movable piston's ram is connected to a brake pad. See figure 1-13. Oil pumped into the top of the cylinder pushes the piston down raising the table base off its casters. An internal return spring on the bottom of the piston, pushes the piston up to return the oil through the mini-valve to the reservoir.

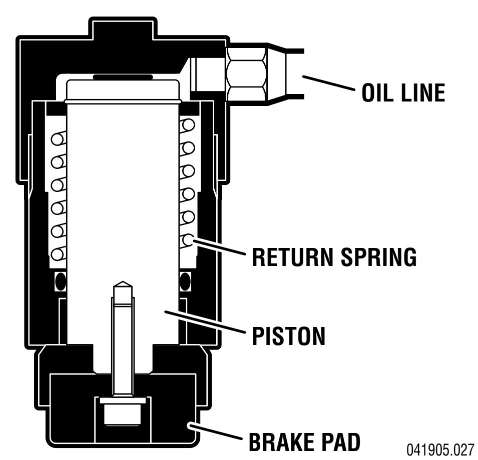


Figure 1-13. Single Action Brake Cylinder

e. Elevation Cylinder Return Circuit

A three-way (single check valve type) mini-valve controls both the elevation and return circuits. The elevation circuit operation within the mini-valve is identical to the operation of the four-way valves previously described (inlet pressure opens the check valve allowing the oil to enter the cylinder). In the return position, inlet pressure pushes the pilot plunger up and opens the return check valve. See figure 1-14. The open check valve allows a path for the oil in the elevation cylinder to return to the reservoir. When the pilot plunger valve is opened, the continuing pump pressure opens the pressure relief valve which provides a return oil path to the reservoir.

The mini-valve used in the elevation circuit contains only one check valve (all four-way mini-valves use two check valves). The check valve is used to trap the oil in the elevation cylinder thereby supporting the table top. When the top is being lowered the check valve is mechanically held open by the pilot plunger through pump pressure.

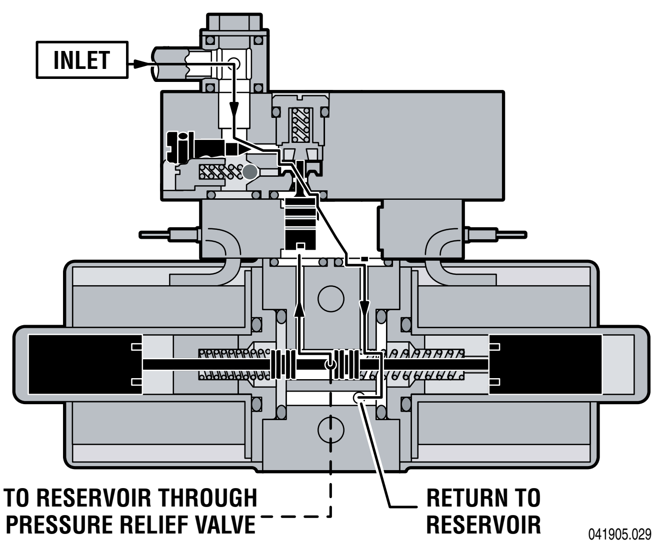


Figure 1-14. Elevation Return Circuit

f. Brake System

The brake system consists of the following components: (figure 1-15)

1. Single action slave cylinders (4 each).
2. 3-way (single check valve type) mini-valve.
3. Manually controlled emergency brake release.
4. Plumbing terminal, flexible hoses, copper lines and "O" rings.
5. Portions of the electrical system.

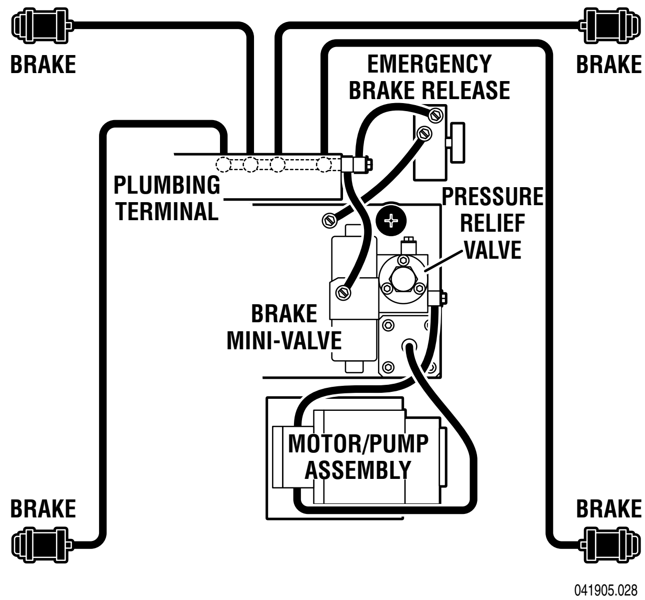


Figure 1-15. Brake System Block Diagram

Each corner of the cast-iron table base has a hydraulic brake cylinder. These single action cylinders are hydraulically connected in parallel to the mini-valve and all four are activated together. It is normal for one corner of the table to raise before the others due to the weight distribution of the table.

An electronic timer in the relay box is activated when any function on the pendant control is pushed momentarily. The pump/motor and brake system mini-valve are activated and the brake cylinders are completely set. The electronic timer runs for approx. 8-10 seconds.

The brakes are released by pushing the BRAKE UNLOCK button momentarily. An electronic timer in the relay box activates the brake function hydraulic mini-valve and pump/motor.

When activated, the return hydraulic circuit operates similar to the elevation cylinder return circuit. Return springs inside the single action brake cylinders retract the brake pads and provide the pressure to return the hydraulic oil back to the reservoir. The electronic timer operates the return circuit for approximately 8-10 seconds.

g. Emergency Brake Release

The emergency brake release is simply a manually operated bypass valve connected in parallel to the brake cylinders and the oil reservoir. See figure 1-16. When the valve is opened (turned counter-clockwise) a return circuit for the brake hydraulic fluid is opened. The return springs force the pistons up pushing the hydraulic oil back into the reservoir and retracting the brake pads.

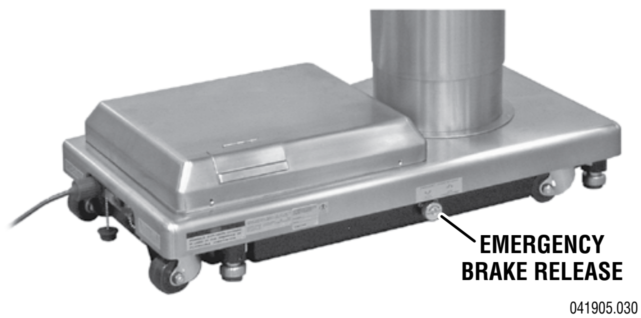


Figure 1-16.

NOTE

- The emergency brake release valve must be tightened securely when not in use.

- If the emergency brake release valve has been operated, the UNLOCK button on the pendant control may have to be pressed before brakes will lock again.

If the emergency brake release valve is open, the brakes will release slowly- depending on how loose the valve is, this could take anywhere from a few minutes to several hours.

h. Flex/Reflex System

The Flex/Reflex system incorporates an additional mini-valve which connects the trendelenburg and back section hydraulic systems in a series. When FLEX is activated by the pendant control, the Flex/Reflex mini-valve opens the oil pressure path to the Reverse Trendelenburg piston. The return oil path from the Trendelenburg piston is routed through the back section cylinder to the mini-valve return port. See figure 1-17

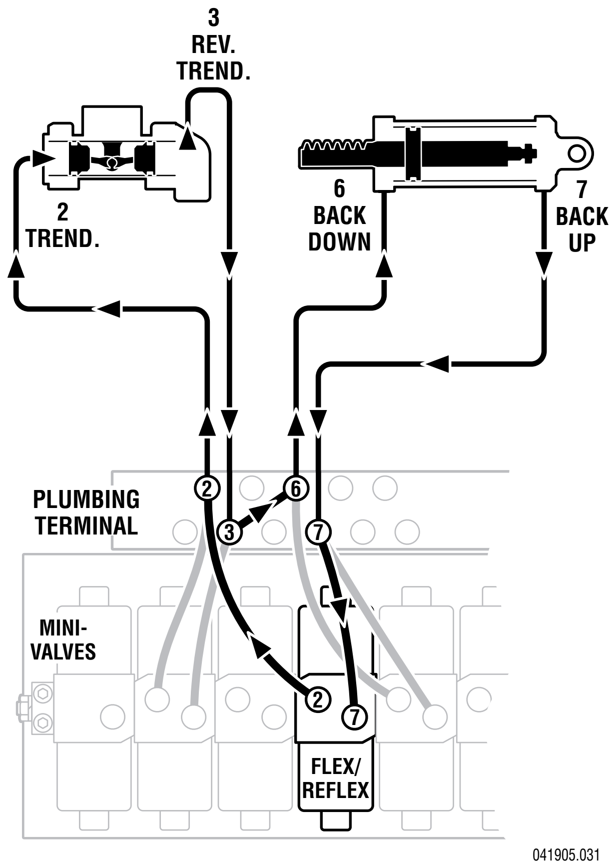


Figure 1-17. Flex/Reflex System

1-3. Hydraulic Adjustments

a. Fluid Level.

The fluid level should be approximately 1/2" below the filler hole or gasket surface. If additional fluid is needed, remove the filler vent cap with a phillips screwdriver and add fluid through this opening using a funnel. See figure 1-18.

NOTE

The elevation cylinder should be completely down, the brakes released and all the other control functions in their neutral position when checking oil level.

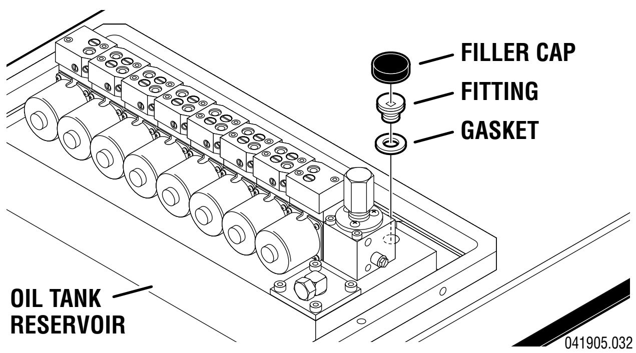


Figure 1-18.

The type of oil that should be used is SKYTRON P.N. D6-010-90 or equivalent. This is a very high quality hydraulic oil. The table requires approximately two quarts of oil to operate properly. Excercise caution when determining equivalance to avoid damage to the hydraulic system.

b. Bleeding The Hydraulic System

To purge the air from the hydraulic system, operate each function back and forth at least two or three times.

NOTE

Whenever a hydraulic line or component is replaced, bleed the air out of the line using the pump pressure by activating the function before making the final connection. Then operate the function until it stalls in both directions.

c. Pressure Relief Valve

The pressure relief valve is adjusted by turning the adjustment nut until the desired pressure is reached.

To adjust:

1. Remove the blind cap and attach a hydraulic pressure gauge to the main oil galley using a 6mm plumbing bolt. See figure 1-19.

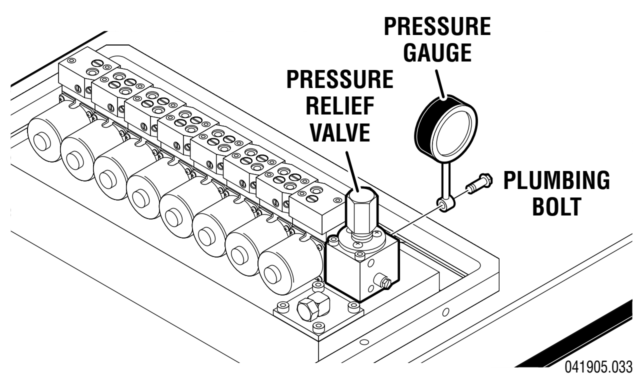


Figure 1-19.

2. Raise the table top until the piston reaches the end of its stroke and stalls. Observe reading on pressure gauge and turn the adjustment nut (clockwise to increase oil pressure, counterclockwise to decrease) until desired reading is obtained. Pressure should be 8MPA (80KG/CM^2 -1138 PSI). An erratic reading and/or inability to adjust to the recommended setting may indicate the need for replacement of the pressure relief valve.

d. Speed Controls

The speed controls restrict the volume of oil returning back to the reservoir thereby controlling the speed of each control function.

All four-way mini-valves, have two speed controls located in the ends of each valve body. All three-way mini-valves have only one speed control.

One speed control adjusts one direction of a particular function and the opposite speed control adjusts the other direction. They are adjustable by using a small straight blade screwdriver and turning the adjustment screw clockwise to decrease the speed and counterclockwise to increase the speed. See figure 1-20.

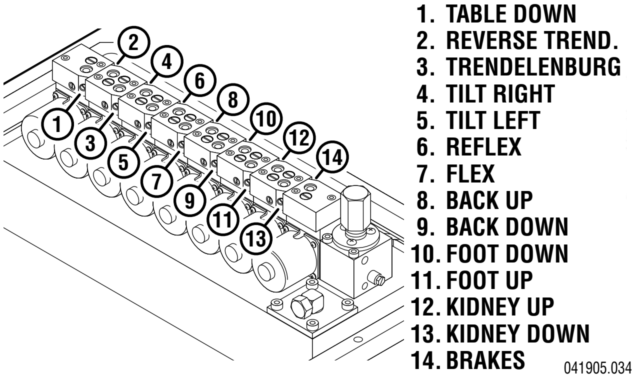


Figure 1-20.

Any control function should move in either direc-tion at the same rate. If the rate of a certain function is too slow, open the speed control slightly and re-check. Use the second hand on a watch and time a particular function. Match that time in the opposite direction by opening or closing the speed control. Approximate operating times are as follows:

Lateral Tilt	7 seconds
Back Up	25 seconds
Back Down	15 seconds
Kidney Lift	7 seconds

A pressure gauge should be used to set the speed of the back section, Trendelenburg and flex control functions.

To adjust:

1. Attach the pressure gauge onto the main oil galley as shown in figure 1-19.

2. The gauge should read the following values when operating the various control functions in either direction. Turn the speed controls until desired values are obtained.

Back Section	Up	65KG/CM^2 -925PSI
	Dn	65KG/CM^2 -925PSI
Trendelenburg	Up	65KG/CM^2 -925PSI
	Dn	65KG/CM^2 -925PSI
Flex		70KG/CM^2 -925PSI
Reflex		70KG/CM^2 -925PSI

NOTE

When adjusting Flex/Reflex speed controls, set Reflex last.

Elevation - There is not a speed adjustment for raising the table. The speed control will only affect the rate of descent and it should equal the rate of elevation.

SECTION II MECHANICAL TABLE ADJUSTMENTS

2-1. Back Section Gear Mesh Adjustment

The gear mesh is adjusted by the use of an eccentric cam. This cam moves the gear teeth closer together to eliminate gear lash. This adjustment arrangement compensates for any wear between the gears that might occur.

To adjust:

Loosen the cam locking allen set screw. Use an allen wrench to rotate the eccentric cam. See figure 2-1. Tighten the locking set screw when adjustment is complete.

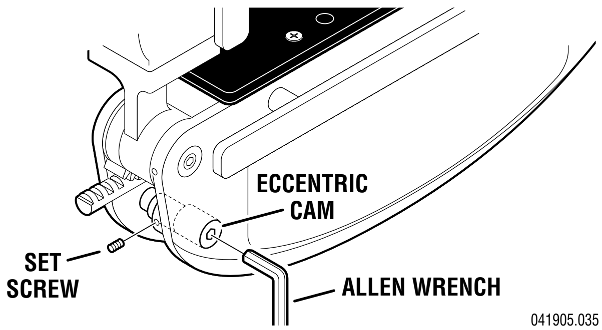


Figure 2-1. Eccentric Cam Adjustment

2-2. Hydraulic Cylinder Adjustment

The hydraulic cylinder rams that control both the back and foot / leg sections must move together so that these sections are not twisted when operated. This is accomplished by the use of eccentric cams that move the cylinder bodies fore and aft to adjust their effective stroke.

NOTE

Adjust gear mesh before adjusting eccentric cams for the back section.

a. Back Section

Position the back section all the way up until it stalls. Both sides of the back section should stop moving at the same time and should not show any signs of twisting.

Any twisting or flexing of the back section as it approaches the stalled position indicates that one of the cylinders is not reaching its fully extended position at the same time as the other. This condition would require an adjustment.

To adjust:

Remove the seat section top for access to the cam locking set screws and loosen the set screws. Use an allen wrench to turn the cylinder eccentric cams as required to shift either cylinder fore or aft as needed so no twisting or flexing of the back section is observed when it is stalled in the full up position. See figure 2-2. Tighten the set screws and replace the seat section top when the adjustment is completed.

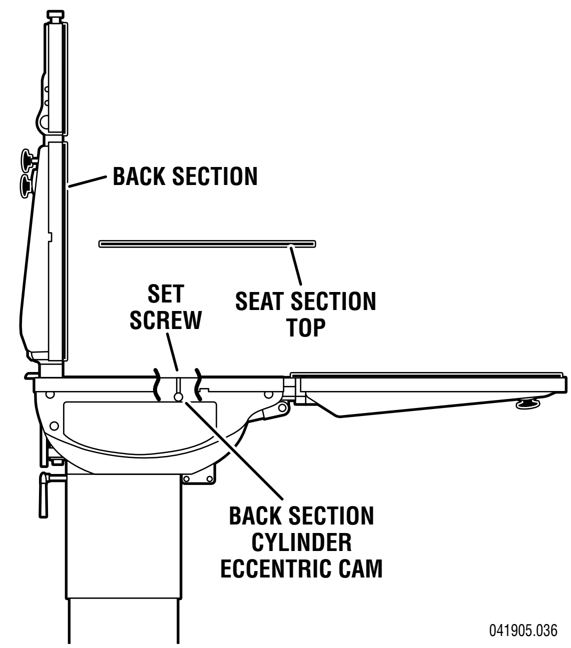


Figure 2-2. Back Section Adjustment

b. Leg Section

Position the leg section all the way up. Both sides of the leg section should stop moving at the same time and should not show any signs of twisting.

Any twisting or flexing of the leg section as it approaches the stalled position indicates that one of the cylinders is not reaching its fully extended position at the same time as the other and an adjustment is required.

NOTE

The leg section cylinder eccentric cam is located under the nameplate on the side casting. To make an adjustment, the nameplate will have to be removed and a new nameplate will have to be installed when the adjustment is completed.

To adjust:

Loosen the cam locking set screws located inside the table side frames. See figure 2-3. Use an allen wrench to turn the cylinder eccentric cams as required to shift either cylinder fore or aft as needed so no twisting or flexing of the leg section is observed when it is stalled in the above horizontal position. Tighten set screws when proper adjustment is achieved.

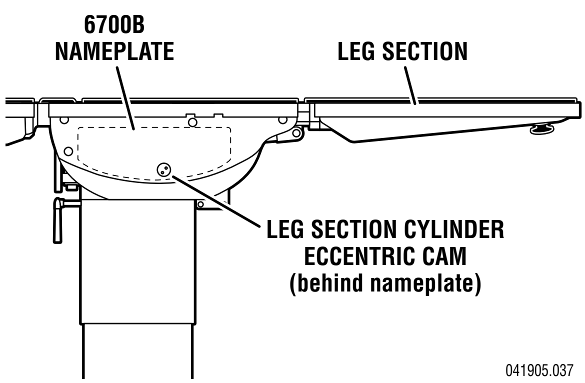


Figure 2-3. Leg Section Adjustment

2-3. Head Section Adjustment

The head section can be adjusted to eliminate any flexing throughout it's range of travel.

To adjust:

Place the head section in level position and remove the top. See figure 2-4. Loosen but do not remove the allen bolts securing the bearing block to the frame. Loosen the allen bolt in the top of the frame and turn the set screw as required to achieve proper adjustment. One or both of the blocks may require adjustment to achieve proper alignment. Tighten all allen bolts when adjustment is complete. Test the head section throughout its range of travel. Re-adjust as needed. Replace top section when proper adjustment is achieved.

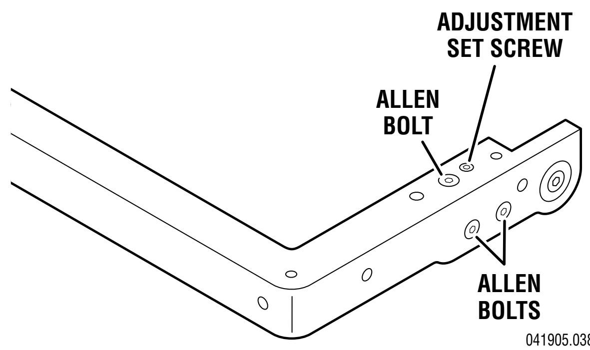


Figure 2-4. Head Section Adjustment

2-4. Trendelenburg Cap Bolt Torque Procedure

Over time the Trendelenburg tail cap bolts will loosen, resulting in the Trendelenburg tail cap sliding out of the cylinder housing.

To adjust:

Using a 6mm allen wrench, remove the cover from the head and foot end of the Trendelenburg cylinder housing. Using a 14mm wrench, slightly loosen the hydraulic line connection on the head end to relieve pressure in the Trendelenburg cylinder.

NOTE

Ensure to place a shop rag around the connection to collect hydraulic oil that will escape!

Using a 5mm allen wrench, torque each bolt to 18 N/meter (13.27 ft/lbs) on the head and foot end of the Trendelenburg cylinder following the star pattern shown in Fig. 2.5. Tighten the hydraulic line connection and replace both end covers when finished.

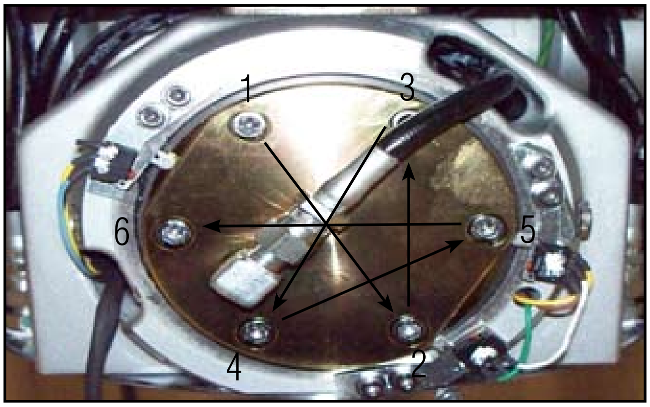


Fig 2-5. Cap Bolt Torque Sequence

2-5. Side Rails

Inspect each of the side rail sections. Make sure that all retaining hardware is tight. Inspect the gravity stops. Make sure that each gravity stop moves freely. Clean, lubricate or replace as necessary. See figure 2-6.

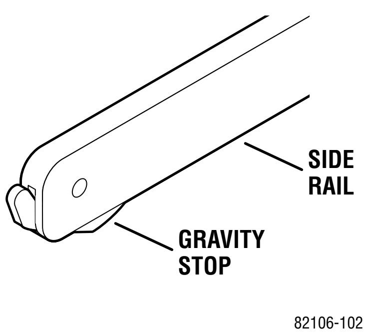


Figure 2-6

2-6 Casters

Clean and lubricate each of the casters. Remove any debris caught in the casters and old grease. Lubricate using a grease gun and conventional wheel bearing grease. The casters should rotate freely providing a smooth movement of the table during positioning. Replace worn or defective casters as required.

SECTION III HYDRAULIC TROUBLESHOOTING

3-1. Precautions

Before attempting to troubleshoot any hydraulic problem on the table, please read through the precautions and notes below.

CAUTION

When disconnecting any of the hydraulic lines, fittings, joints, hoses, etc., for the following control functions, be sure these table surfaces are in their down position or completely supported.

Elevation
Back Section
Leg Section
Kidney Lift

When working on the trendelenburg or lateral tilt hydraulic circuits, be sure to support the table top. When working on the brake system make sure the brakes are completely retracted.

WARNING

Failure to follow these precautions may result in an uncontrolled oil spray and damage to the table or personal injury.

3-2. Troubleshooting Notes

When troubleshooting a table malfunction, first determine the following:

1. Does the problem affect all control functions?

2. Does the problem affect only one control function?

3. If the problem affects one control function is it in both directions?

4. Is the problem intermittent?

5. Is the problem no movement of a table surface or does the table surface lose position?

Once the problem has been determined, concentrate on that particular hydraulic circuit or control function.

Listed below are the hydraulic components that are common with all hydraulic circuits. If there is a problem with any of them, it could affect all control functions.

1. Motor/Pump Assembly
2. Reservoir
3. Pressure Relief Valve
4. Certain Oil Lines and Galleys

If there was a problem in the following components, only one control function would normally be affected.

1. Mini-Valve
2. Slave Cylinder
3. Oil Lines

NOTE

Whenever a hydraulic line or component is replaced, bleed the air out of the lines using the pump pressure before making the final connection. After all connections are tight, cycle the control function back and forth two or three times to purge the remaining air from the system.

CAUTION

When installing new "O" rings use hydraulic oil or white lithium grease to thoroughly lubricate the "O" rings and cylinder. Keep everything clean.

Each complete oil circuit is shown on the following pages. When troubleshooting a particular function, refer to the appropriate oil circuit diagram and the list of possible problems.

3-3. ELEVATION DIAGNOSIS CHART

Problem	Reason
Table will not elevate properly	Pressure Relief Valve Not Set Properly Low on Oil Spool Valve Not Centered Defective Pump Defective Mini-Valve Defective Solenoid or Wiring Defective Relay Box or Pendant Control Leaking Cylinder Hose Uneven Weight Distribution
Table will not descend properly	Incorrect Speed Adjustment Bad Check Valve Spool Valve Not Centered Galled Slider Assembly Defective Solenoid or Wiring Defective Relay Box or Pendant Control Uneven Weight Distribution
Table loses elevation	Bad Check Valve Leaking Mini-Valve Loose Fittings, Joints, Hoses Leaking "O" Ring Inside Cylinder

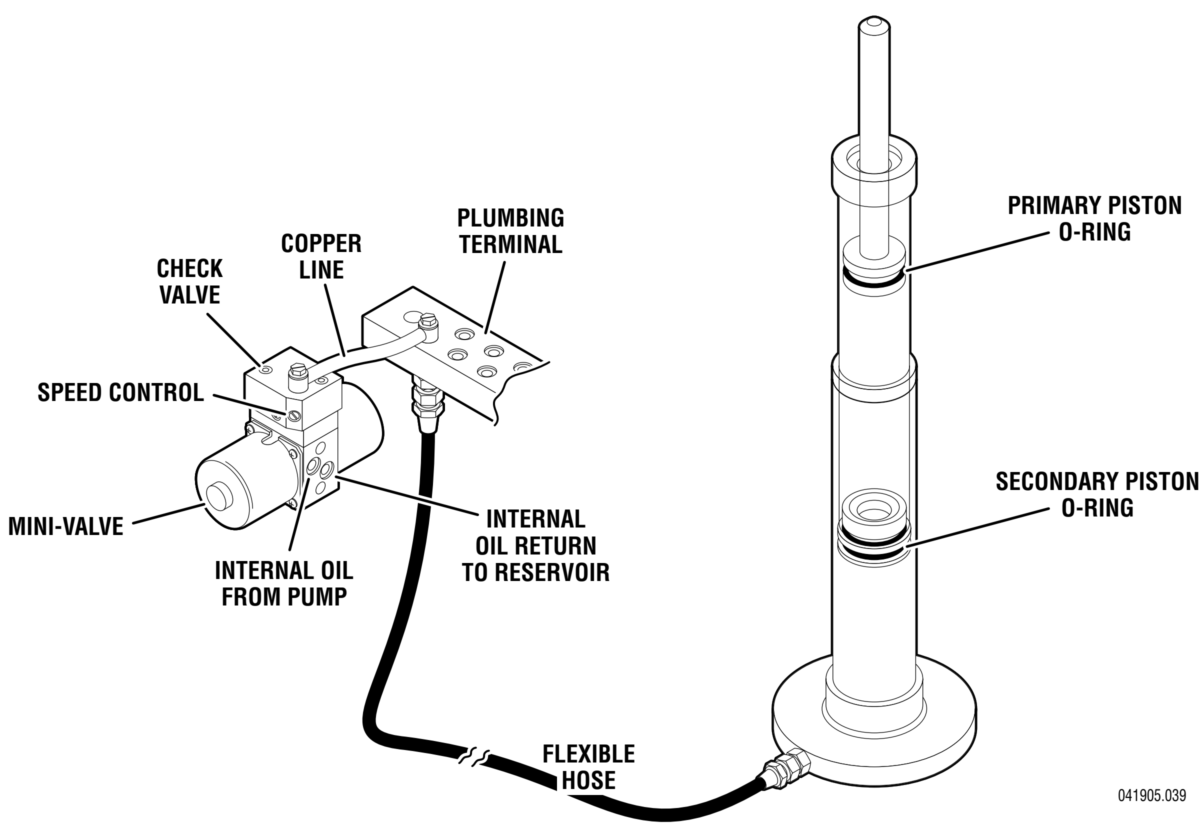


Figure 3-1. Elevation Circuit

3-4. TRENDELENBURG DIAGNOSIS CHART

Problem	Reason
Trendelenburg function moves improperly	Incorrect Speed Adjustment
	Spool Valve Not Centered
	Bad Check Valves
	Low on Oil
	Pinched Hose
	Defective Mini-Valve
	Pressure Relief Valve Not Set Properly
	Bad Solenoid or Wiring
	Defective Relay Box or Pendant Control
Trendelenburg function chatters or loses position	Defective or Dirty Check Valve
	Oil Leakage in Circuit
	Air Inside Cylinder
	Pinched Hose
	Low on Oil

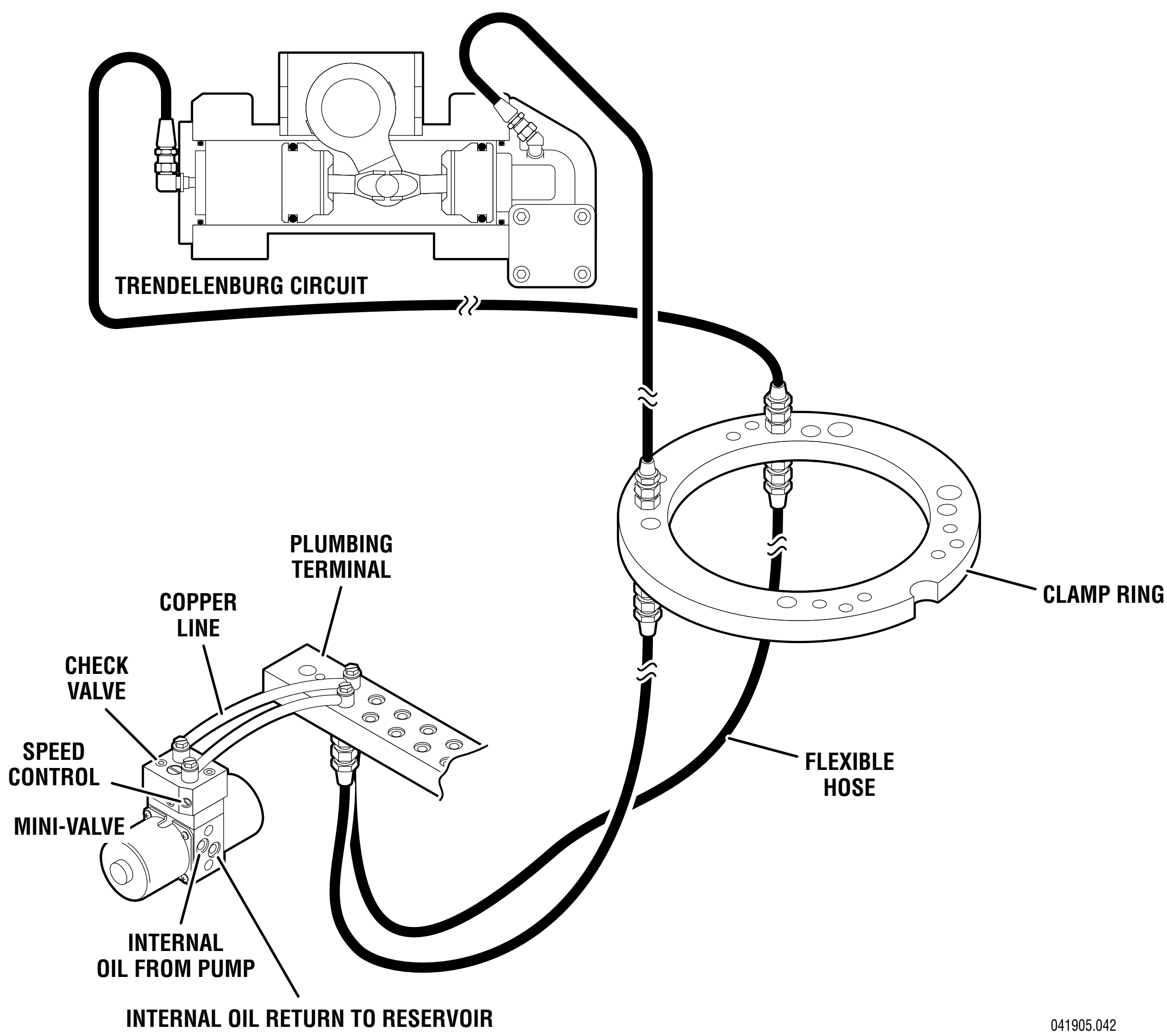


Figure 3-2. Trendelenburg Circuit

3-5. LATERAL TILT DIAGNOSIS CHART

Problem	Reason
Lateral tilt function moves improperly	Incorrect Speed Adjustment Spool Valve Not Centered Bad Check Valves Low on Oil Pinched Hose Defective Mini-Valve Pressure Relief Valve Not Set Properly Bad Solenoid Defective Relay Box or Pendant Control
Lateral tilt function chatters or loses position	Defective or Dirty Check Valves Oil Leakage in Circuit Air Inside Cylinder Pinched Hose Low on Oil

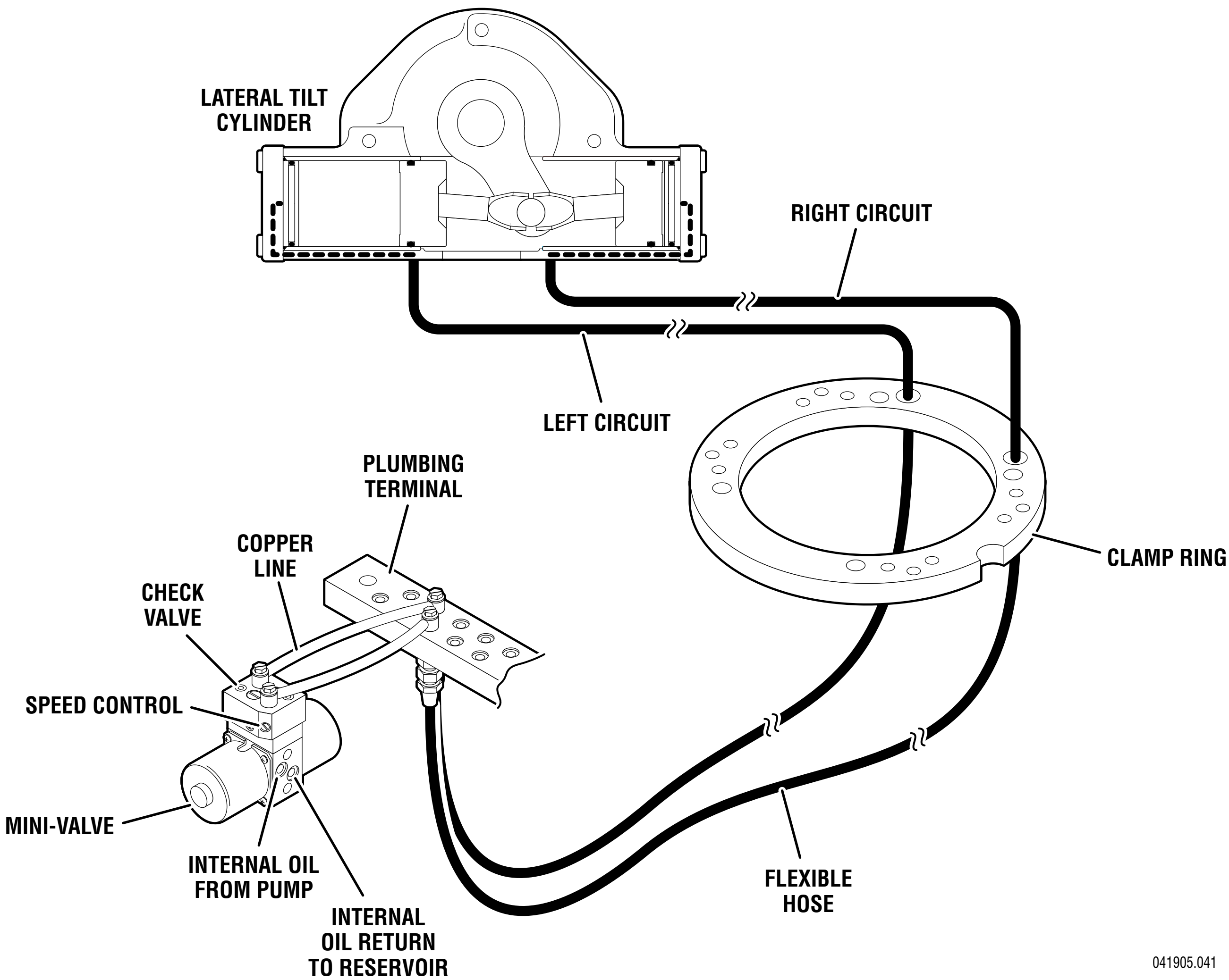


Figure 3-3. Lateral Tilt Circuit

3-6. FLEX SYSTEM DIAGNOSIS CHART

Problem	Reason
Back Section or Trendelenburg function moves improperly **NOTE** If Flex System does not function properly, check the back section and Trendelenburg functions before adjusting the flex system.	Incorrect Speed Adjustment (Trendelenburg, Back section or Flex - check with gauge) Spool Valve Not Centered Bad Check Valves Low on Oil Pinched Hose Defective Mini-Valve Pressure Relief Valve Not Set Properly Bad Solenoid Defective Relay Box or Pendant Control Kidney Bridge Raised
Back Section or Trendelenburg function chatters or loses position	Defective or Dirty Check Valves Oil Leakage in Circuit Air Inside Cylinder Pinched Hose Low on Oil

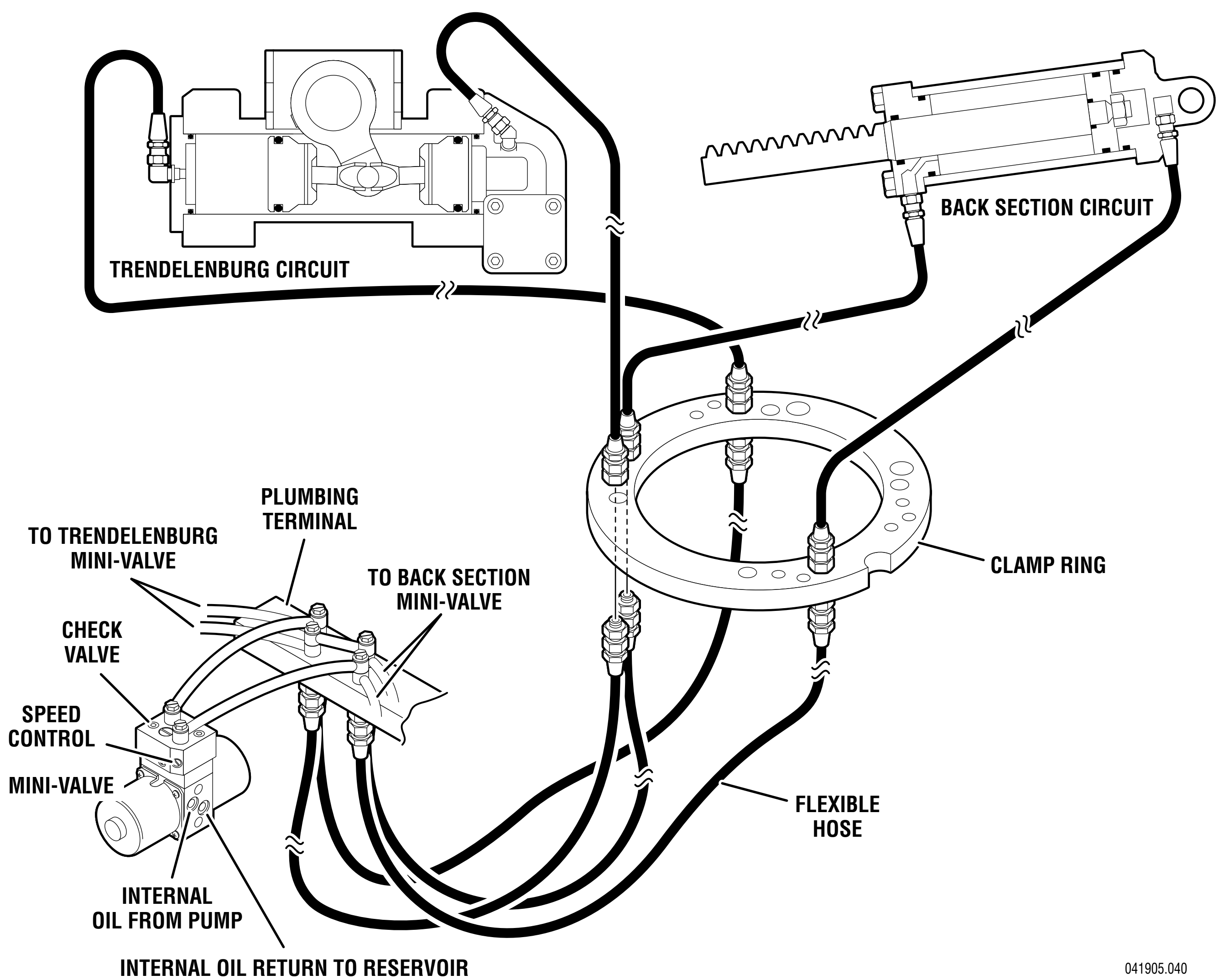


Figure 3-4. Flex System Circuit

3-7. BACK SECTION DIAGNOSIS CHART

Problem	Reason
Back Section function moves improperly	Incorrect Speed Adjustment Spool Valve Not Centered Bad Check Valves Low on Oil Pinched Hose Defective Mini-Valve Pressure Relief Valve Not Set Properly Bad Solenoid Defective Relay Box or Pendant Control Kidney Bridge Raised
Back Section function chatters or loses position	Defective or Dirty Check Valves Oil Leakage in Circuit Air Inside Cylinder Pinched Hose Low on Oil

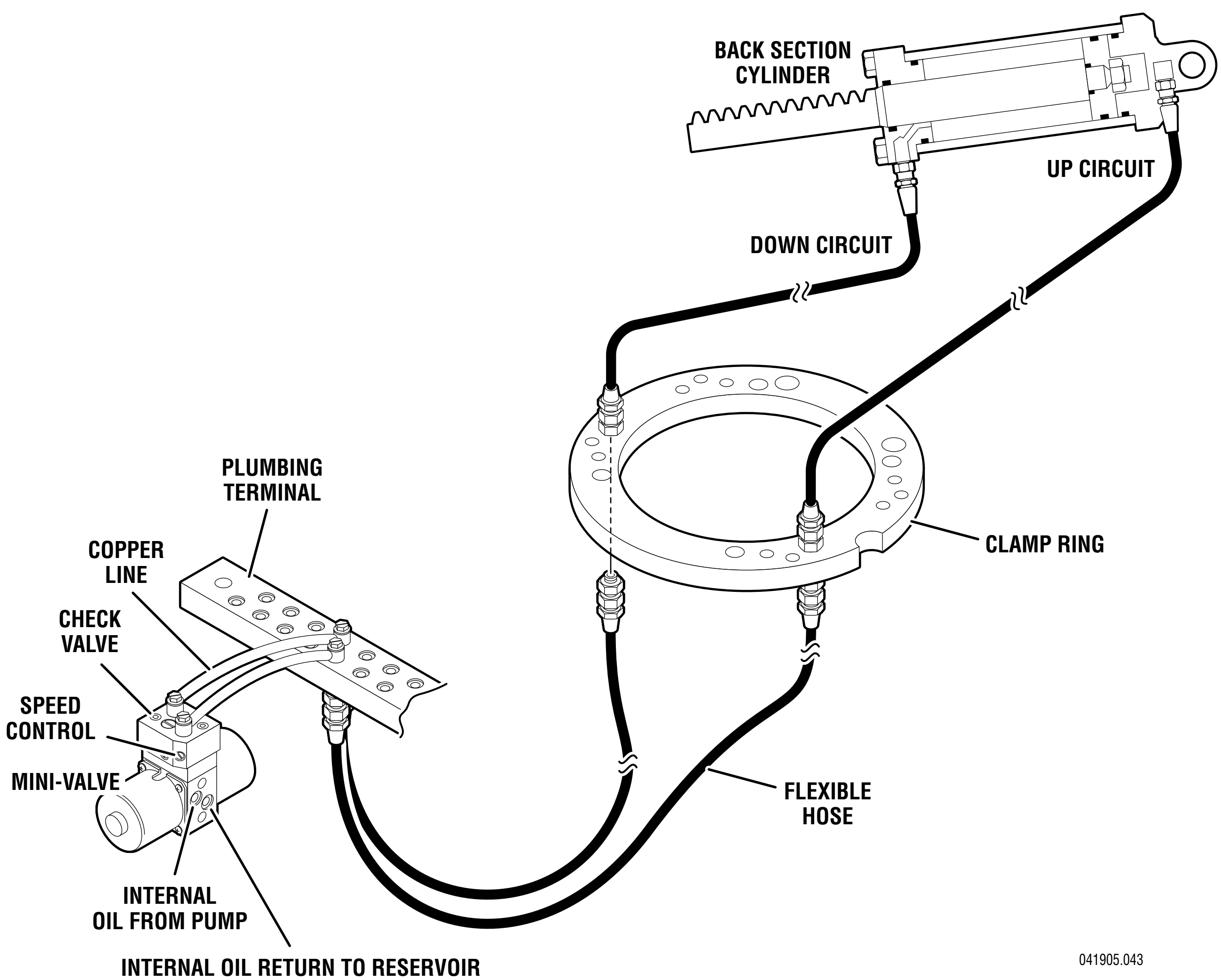


Figure 3-5. Back Section Circuit

3-8. LEG SECTION DIAGNOSIS CHART

Problem	**Reason**
Leg function moves improperly	Incorrect Speed Adjustment Spool Valve Not Centered Bad Check Valves Low on Oil Pinched Hose Defective Mini-Valve Pressure Relief Valve Not Set Properly Bad Solenoid Defective Relay Box or Pendant Control
Leg function chatters or loses position	Defective or Dirty Check Valves Oil Leakage in Circuit Air Inside Cylinder Pinched Hose Low on Oil

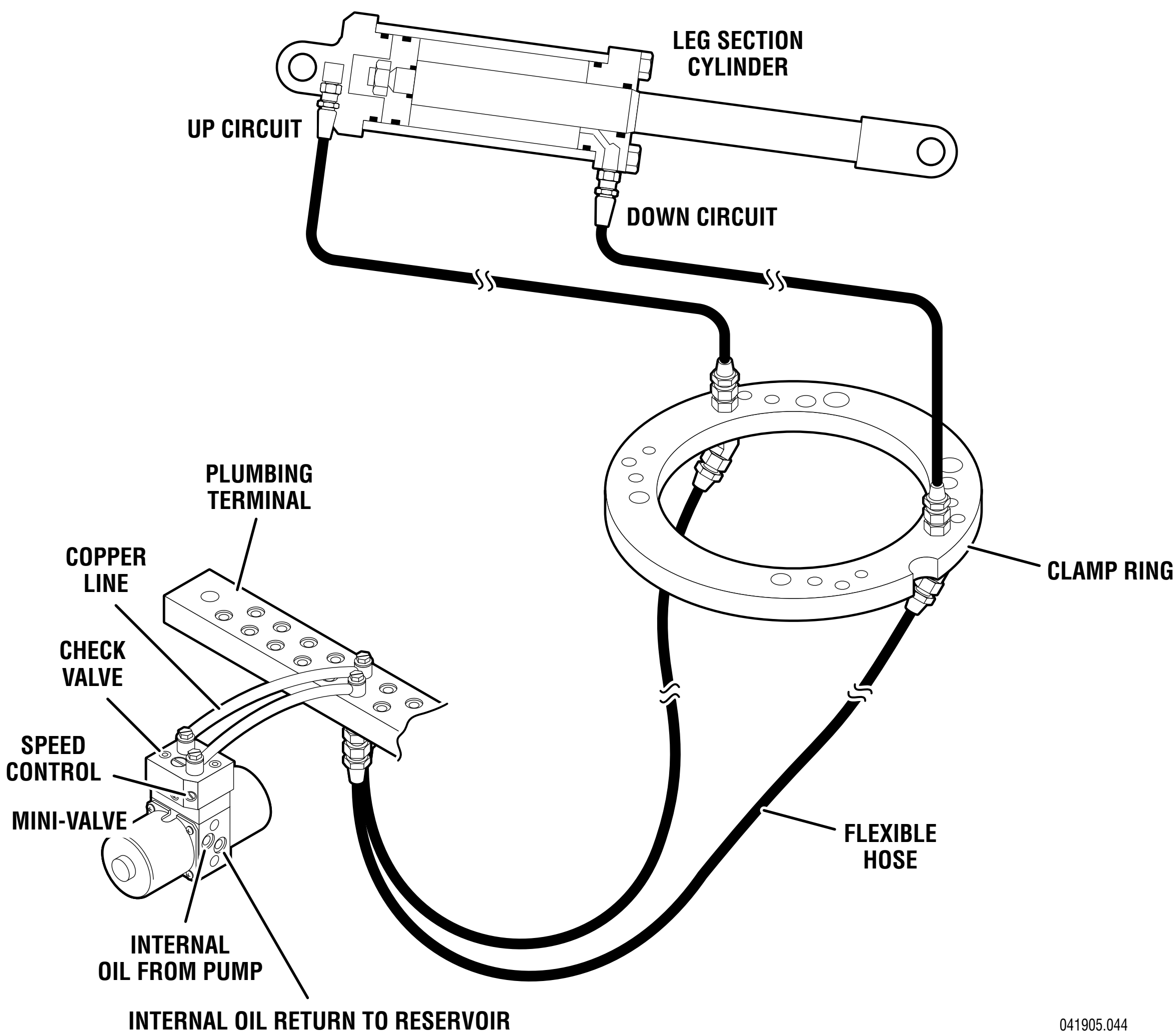


Figure 3-6. Leg Section Circuit

3-9. KIDNEY LIFT DIAGNOSIS CHART

Problem	Reason
Kidney Lift moves improperly	Incorrect Speed Adjustment Spool Valve Not Centered Bad Check Valve Low on Oil Pinched Hose Defective Mini-Valve Pressure Relief Valve Not Set Properly Bad Solenoid Defective Relay Box or Pendant Control
Kidney Lift chatters or loses position	Defective or Dirty Check Valve Oil Leakage in Circuit Air Inside Cylinder Pinched Hose Low on Oil Lift Rods Binding

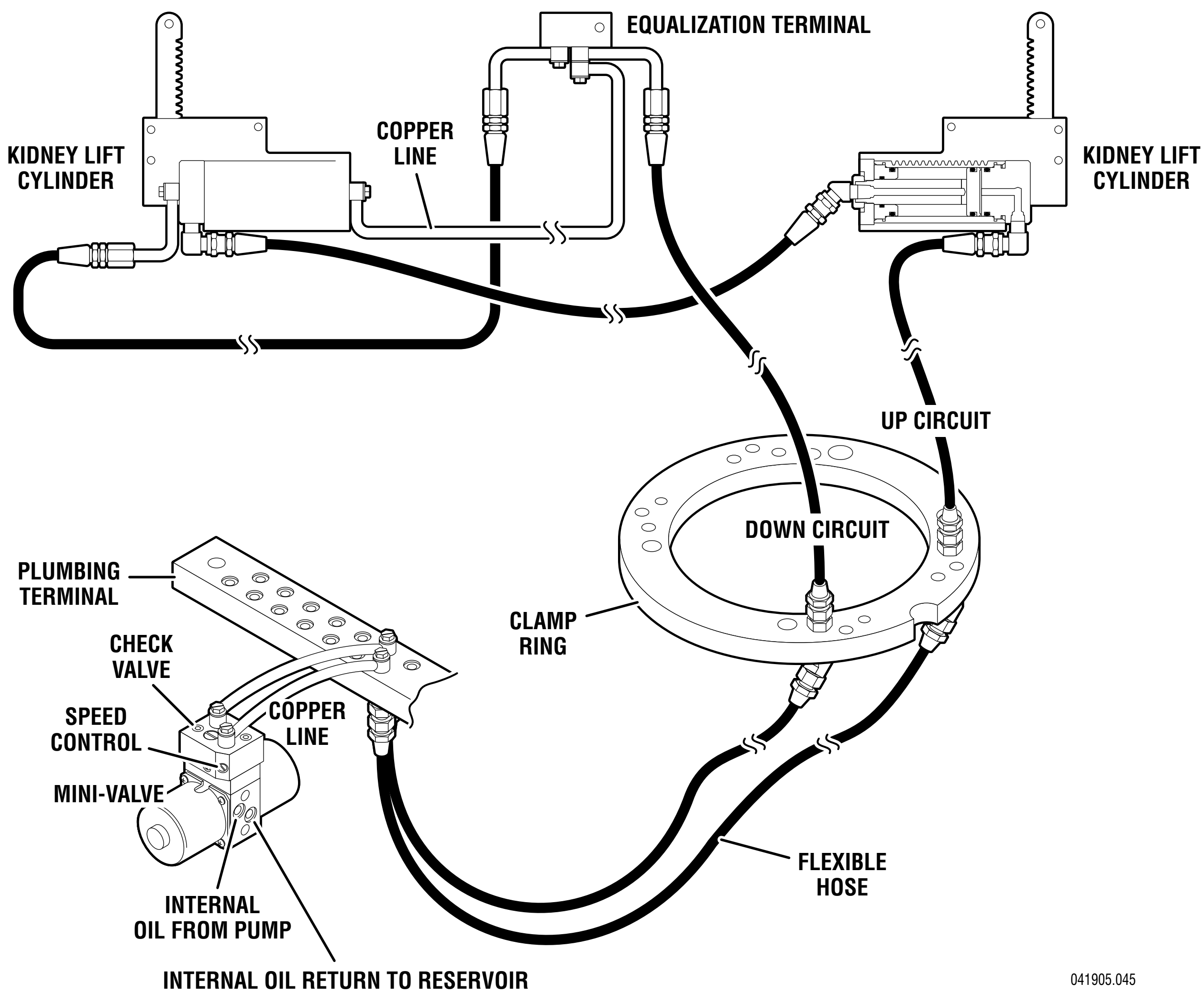


Figure 3-7. Kidney Lift Circuit

3-10. BRAKE CIRCUIT DIAGNOSIS CHART

Problem	Reason
Brakes will not set properly **NOTE** If brakes have been released with the Emergency Brake Release Valve, brakes will not reset until BRAKE UNLOCK Circuit has been activated.	Emergency Brake Release Valve Open or Defective Spool Valve Not Centered Bad Check Valve Low on Oil Pressure Relief Valve Not Set Properly Pinched Hose Defective Mini-Valve Defective Relay Box or Pendant Control
Brakes Will Not Stay Locked	Emergency Brake Release Valve Open or Defective Defective or Dirty Check Valve Oil Leakage in Circuit Leaking "O" Ring Inside Cylinder
Brakes will not retract properly	Incorrect Speed Adjustment Bad Check Valve Spool Valve Not Centered Defective Mini-Valve Pinched Hose Defective Solenoid or Wiring Defective Relay Box or Pendant Control Defective Brake Cylinder

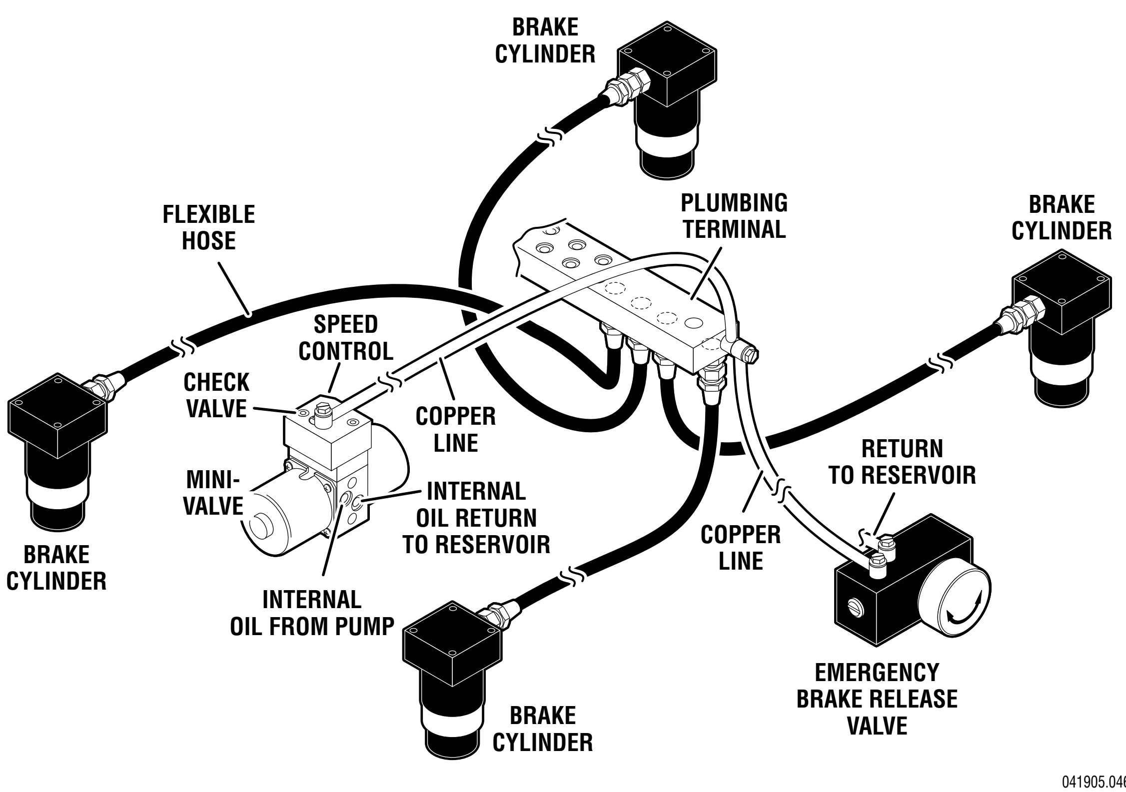


Figure 3-8. Brake System Circuit

3-11. Flexible Hose Identification and Placement

The flexible hydraulic hoses used in the table are number coded to aid in the correct placement of the hoses from the plumbing terminal to their respective hydraulic cylinders. Figure 3-9 shows the correct placement of the flexible hydraulic hoses and their respective number codes.

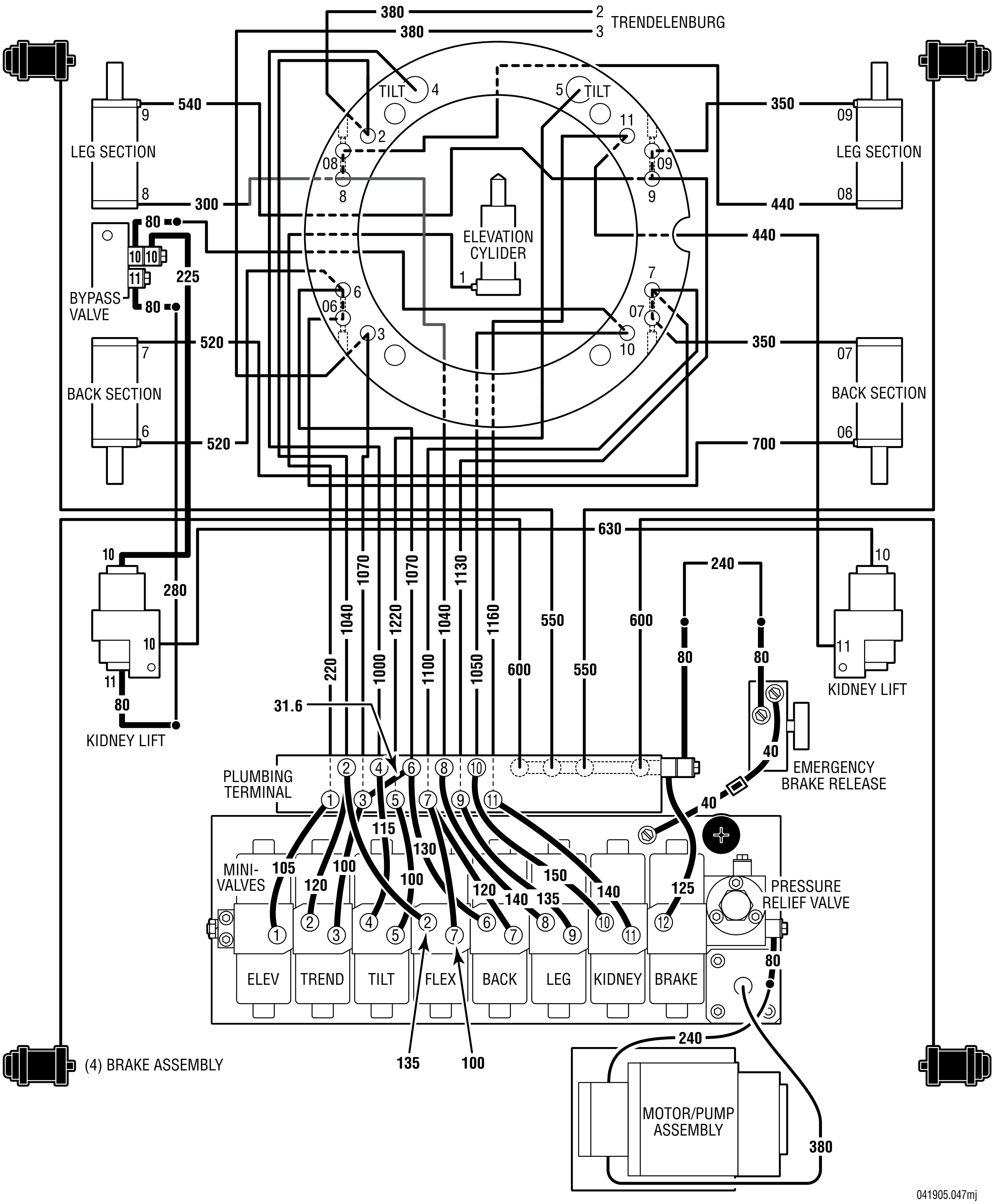


Figure 3-9. Flexible Hoses

3-12. Kidney Lift System

The Kidney Lift cylinders are connected in series so that both cylinders operate simultaneously.

Hydraulic pressure on one side of the lead piston causes the piston to move. The piston movement forces the hydraulic fluid on the other side of the piston through the system to the other cylinder. This simultaneously activates the other piston. A bypass valve is connected to the right cylinder assembly for initial set-up and adjustment of the kidney lift system. Refer to figure 3-9 for valve location. Use the following procedures to bleed or adjust the system if needed.

a. Bleeding the System

If the hydraulic lines or cylinders have been disconnected from the kidney lift system for any reason, use the following procedure to bleed the air from the system.

1. Remove the kidney lift top section and begin the procedure with both pistons in the down position (chambers A & C) as shown in figure 3-10.

NOTE

For this procedure you must use the KIDNEY DOWN switch on the base cover or remove the micro-switch from the bottom of the right side kidney cylinder. The KIDNEY DOWN inhibit switch prevents continued operation necessary to bleed the system.

2. Make sure the bypass valve is closed (valve screw tight) and activate "KIDNEY DOWN". The hydraulic fluid will fill cavity "D" as shown in figure 3-10.

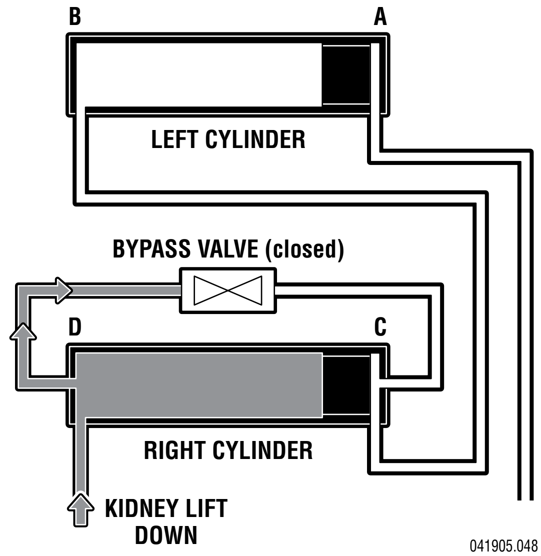


Figure 3-10.

3. Open the bypass valve by loosening the screw in the bottom of the valve and activate "KIDNEY UP". Hydraulic fluid fills cavity "A" and pushes the piston into cavity "B". The open valve allows a path for air to escape from cavity "B" without affecting the piston in "C". See figure 3-11.

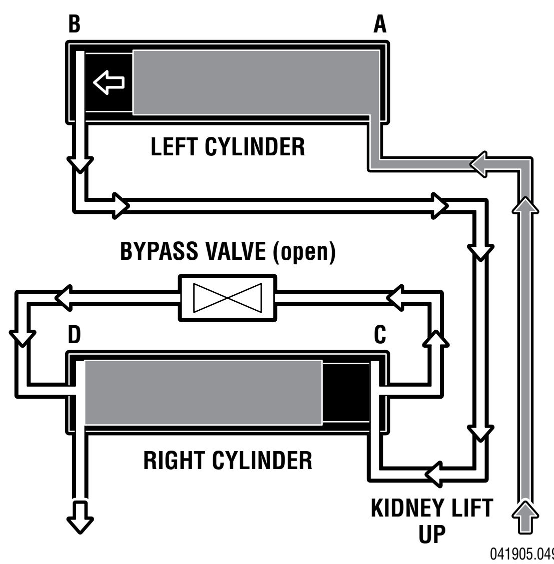


Figure 3-11.

4. Leave the bypass valve open and activate "KIDNEY DOWN". Hydraulic pressure keeps the piston in chamber "C", the hydraulic fluid passes through the bypass valve and fills cavity "B" pushing the piston into cavity "A". See figure 3-12.

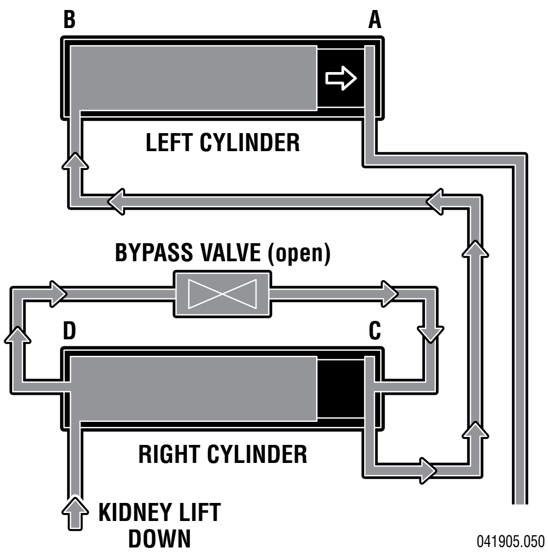


Figure 3-12.

5. Repeat steps 3 and 4 as needed to remove any remaining air in the system.

6. With both pistons in the full down position, activate "KIDNEY DOWN" to apply full system pressure and close the bypass valve (tighten the screw).

b. Cylinder Adjustment

If either of the kidney lift cylinders reaches the end of the down stroke before the other one, an adjustment is needed. Use the following procedure to adjust the system.

1. If the right side bottoms out before the left side, open the bypass valve and activate "KIDNEY DOWN" to align the cylinders.

2. If the left side bottoms out before the right side, activate "KIDNEY UP" to raise the cylinders. When the cylinders are at the full up position, open the valve and activate "KIDNEY UP" to align the cylinders. Close the valve before lowering the cylinders.

3. When the adjustment is complete, make sure the cylinders are completely down, activate "KIDNEY DOWN" and tighten the valve.

4. Make sure to re-install the micro-switch and re-adjust it as necessary.

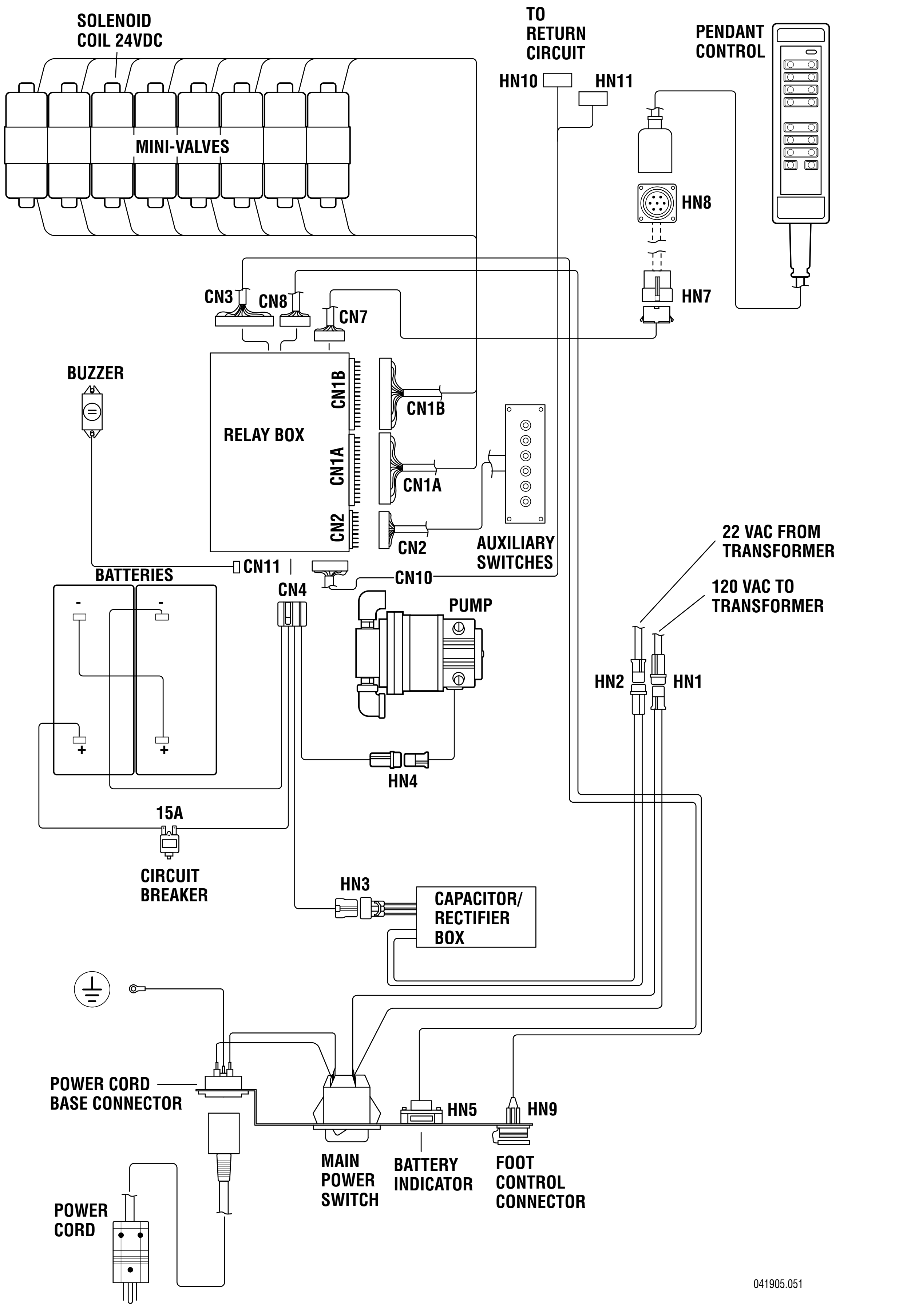


Figure 4-1. Electrical Circuit Block Diagram

4-1. General

The complete electrical system (with the excep-tion of the hand-held pendant control and the return circuit micro-switches) is contained within the base of the table. The pump motor and the hydraulic valves are controlled electrically with the pendant control.

The electrically operated functions are as follows:

- ELEVATION - Up and Down
- TRENDELENBURG - Head up and down
- LATERAL TILT - Right and left
- BACK SECTION - Up and Down
- LEG SECTION - Up and Down
- FLEX / REFLEX
- KIDNEY LIFT - Up and down
- LEVEL - Return to level
- BEACH CHAIR
- BRAKE UNLOCK - Brake release

The power requirements are 120 VAC, 60 Hz. The main power on-off switch is an enclosed DPST circuit breaker type and the power cord is a three-wire, fifteen foot long, removable, UL listed cord with a three-prong hospital grade plug.

4-2. Components

Refer to figure 4-1 for the relationship of the electrical components.

a. Wires, Connectors, Switches, Fuse - These provide the path for the various electrical circuits.

b. Relay Box - Contains the step down transformer, full wave rectifier, micro-processor and relay switches. The relay switches are activated by the pendant control signal to the micro-processor and in turn energize the solenoids.

c. Hand-Held Pendant Control - Contains circuit board mounted switches and a micro-processor which activate the relay box. Operates on 5 VDC.

d. Solenoids - These electrically open and close the hydraulic ports of the mini-valve to direct the fluid to the correct cylinders. They operate on 24 V DC.

e. Motor/Pump Assembly - 24 V DC motor with internal thermal protector.

5-1. General

The battery table components operate on 24VDC. The internal charging system also incorporates the components to transform the 120VAC input to 24VDC output to the components.

5-2. Troubleshooting Notes

The basic operation of each component will be defined along with a figure and an explanation on how to check it out.

Certain defective components could cause the entire table to stop functioning or only one control function to stop. It would depend on what part of the component failed. Other defective components would only cause one control function to stop.

The following defective components could cause all control functions to be affected:

a. Motor/Pump Assembly
b. Main Switch Circuit and Wiring
c. Pendant control

The following defective components could cause all control functions to be affected or only one control function:

a. Relay Box
b. Pendant Contro l
c. Auxiliary Switches

The component listed below would only affect one control function:

Solenoid

When troubleshooting an electrical circuit, start at the problem and work back to the power source.

NOTE

•Battery table troubleshooting should begin by switching the operating mode. For example; if a function fails in the AC120V mode, switch to the BATTERY mode. If the function now operates, the problem is probably located between the power cord and the relay box. If the function also fails in battery operation, use the auxiliary switches. If the function now operates, the problem is probably in the pendant control, connectors or wiring from the pendant control to the relay box.

•All connector pins are numbered usually with very small numbers.

5-3. Main Switch

The main power supply, 120 VAC, 60 HZ, comes in through the power cord and through the Power Switch. The Power Switch opens both lines when in the "OFF" position. The Power Switch is also a 10 Amp circuit breaker that is used to protect the complete electrical system.

a. Main Switch Test

The following test will determine if line voltage is applied to connector HN1, which in turn would supply 120VAC power to the table.

1. Plug the power cord into the 120VAC supply (wall receptacle) and turn the main switch ON.

2. Disconnect connector HN1. See figure 4-1. Leave all other connectors connected.

CAUTION

Line voltage (120VAC) will be measured in this test. Do not touch uninsulated connector pins or meter test leads.

3. Use an AC voltmeter capable of measuring 120 VAC and measure the voltage between pins 1 and 2 (black and white wires) located in connector HN1. See figure 5-1. You should receive line voltage 120 VAC.

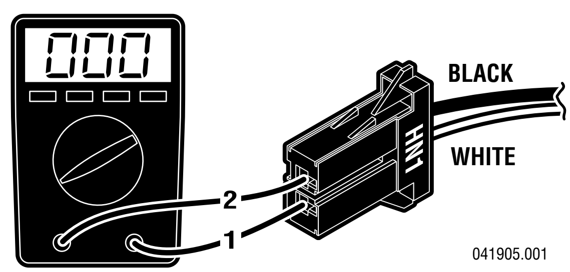


Figure 5-1. Connector HN1 Test

b. Test Results

If the correct voltage is obtained, everything is good up to this point and the problem would have to be in another area. If you do not receive the correct measurements, the problem would have to be in the wires, Power Switch, Power Cord, or main electrical Power Cord connector (3 pin twist lock connector).

Check the continuity from the power cord base connector, through the switch and wiring to connector HN1. Remove the power cord, disconnect HN1 (black and white wires), and test as shown in figure 5-2.

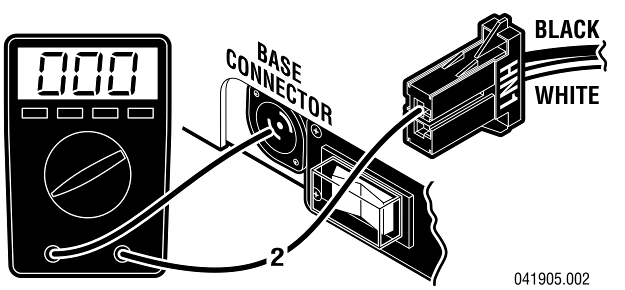


Fig. 5-2. Base Connector to HN1 Continuity Test

5-4. Batteries

The BATTERY operating mode is powered by two 12 volt batteries connected in series to provide the 24 volt operating power.

The battery system voltage should be 24VDC at a range of 22VDC to 26VDC. If the battery charge level falls below 23.5 volts the BATTERY operation indicator on the pendant control will blink indicating that the batteries require recharging. The built-in charging system automatically keeps the batteries at the proper charge level when the AC120V operating mode is ON. The charging system will operate while the table is being operated in the AC120V mode.

a. Battery System Test

1. Disconnect the main power cord and using a DC voltmeter, test each individual battery at its terminals. Meter should read 12VDC ± 1V.

2. To accurately test the batteries, they must be tested under a full load. Disconnect the main power cord and make sure all other connectors are connected.

3. Turn BATTERY power ON and elevate the table to its full up position.

4. Continue to press the TABLE UP button on the pendant control so that the pump motor continues to run and using a DC voltmeter, check the voltage drop of each battery individually. See figure 5-3.

5. Meter should read 12VDC ± 1VDC.

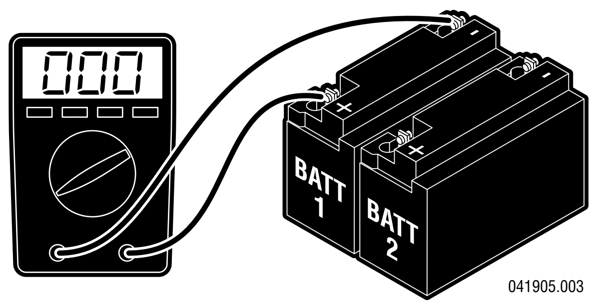


Figure 5-3.

b. Test Results

A reading of 11 volts or below indicates the battery needs charging.

After batteries have been fully charged, repeat the full load test. If either battery's voltage drops below 11VDC it should be replaced.

5-5. Capacitor / Rectifier / AC120V Transformer

The Capacitor / Rectifier Unit contains the battery charging system as well as the components for AC120V operation (except the transformer).

a. Transformer Test

1. Confirm 120VAC input at HN1 using Main Switch test in 5-3a.

2. Connect HN1, disconnect HN2 (brown and red wires) and using an AC voltmeter, test the transformer output at HN2. See figure 5-4.

3. Meter should read 22VAC.

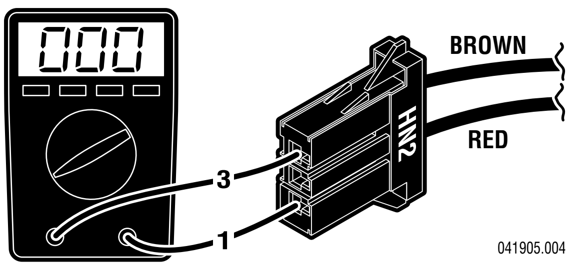


Figure 5-4. Connector HN2 Test

b. Test Results

If the correct voltage is obtained, everything is good up to this point and the problem would have to be in another area. If you do not receive the correct measurements, the problem may be in the wires, connectors, or transformer. The transformer is located in the rear of the base under the stainless steel base cover. The stainless steel cover will have to be disconnected and lifted from the base for access to the transformer for further testing.

c. Capacitor / Rectifier Unit Test

1. Make sure all connectors are connected, connect the power cord and turn AC120V operation ON. Test connectors HN2 and HN3 using a voltmeter. See figure 5-5.

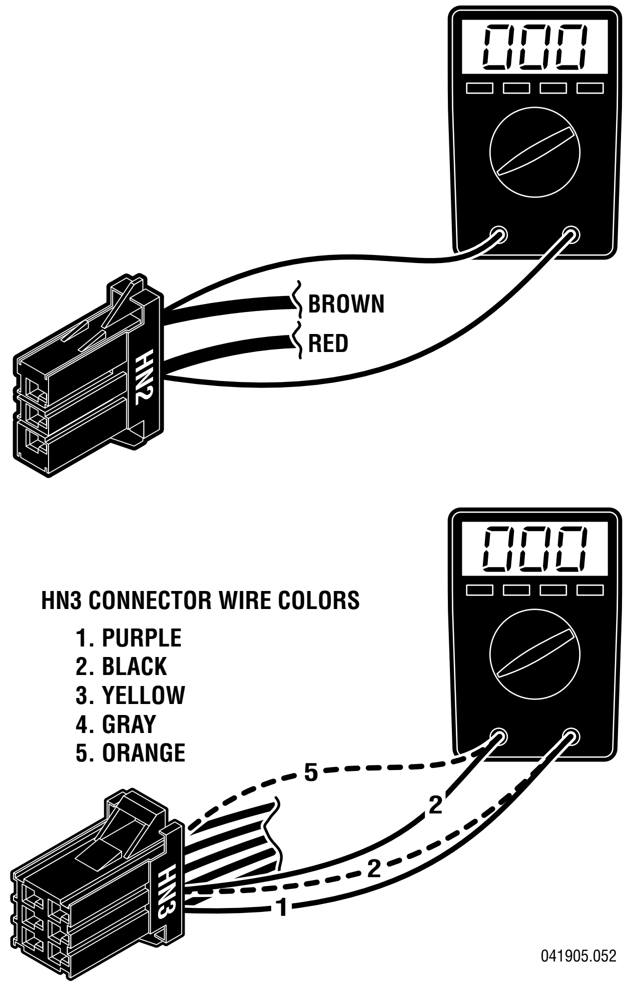


Figure 5-5. Connector HN3

2. Test connector HN2 at pins 1 (red) and 3 (brown). Meter should read AC23V.

3. Test connector HN3 at pins 1(purple) and 2 (black, ground). Meter should read DC30V.

4. Test connector HN3 at pins 5 (orange) and 2 (black, ground). Meter should read DC27V.

d. Test Results

If you do not receive the correct readings, the connectors, wires, or the Capacitor/Rectifier Unit may be defective.

NOTE

Normal charging time for a fully discharged battery is approximately 8 hours.

e. Charging Indicator Test

Charging Indicator contains 10 LEDs, 3 red, 4 yellow and 3 green.

All Indicators illuminated indicates full charge.
Indicators flash when charging is in process.
The following list shows the battery charge level as indicated by the lighted LED's:

3 green	100% -Fully charged
2 green	89%
1 green	78%
4 yellow	67%
3 yellow	56%
2 yellow	45% -Needs Charging (BATT indicator on pendant will flash)
1 yellow	34% -Needs Charging
3 red	23% -Needs Charging (poor performance)
2 red	12% -Needs Charging (intermittent performance)
1 red	1% -Needs Charging (inoperable)

Main Power Switch must be ON and power cord attached and plugged into outlet for charging system to operate.

Test output from relay box at CN3 pin 11 common and pin 1 (lowest charge) meter should read approx. 1.8 VDC. See figure 5-6.

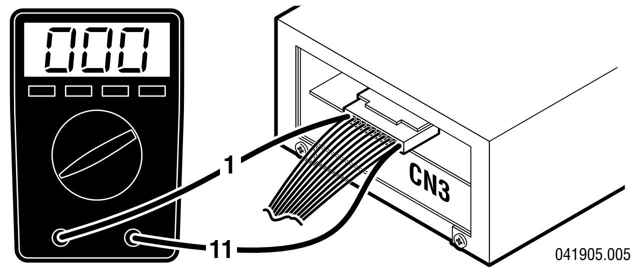


Figure 5-6

5-6. Pendant Control

The Pendant Control is part of the solid state, multiplex, logic control system. The pendant control contains illuminated, circuit board mounted switches and a micro processor. The encoded output from the pendant control is serial bit stream logic.

The output signal is transmitted to the micro processors in the relay box where the logic is decoded and the appropriate relays for the selected function are activated.

Pendant Control troubleshooting should begin by switching the operating mode of the table. For example; if a function fails when operating the table in the AC120V mode, switch to the BATTERY mode. If the function now operates, the problem is not the pendant control and probably is a problem located between the power cord and the relay box. If the function also fails when in battery operation, use the auxiliary switches to operate the function. If the function now operates, the problem is probably in the pendant control, connectors or wiring from the pendant control to the relay box.

a. Pendant Control Test

There are some serviceable components within the Pendant Control. The cord is detachable and can be tested for continuity between the pins on the connectors. Use the following procedure to test the pendant control cord. See figure 5-7.

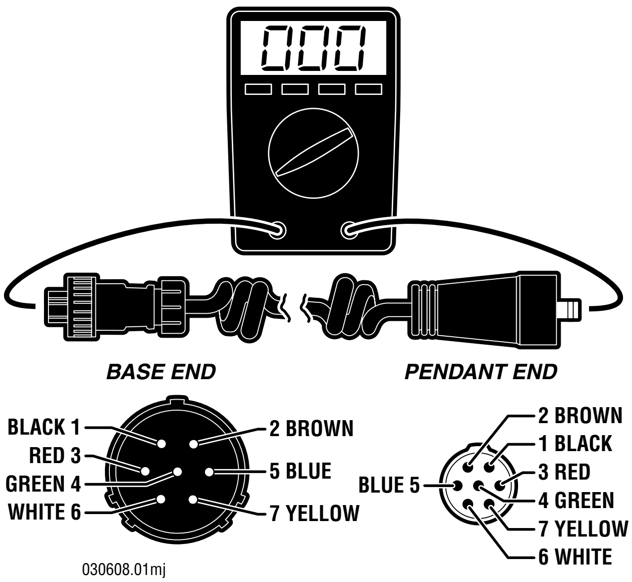


Figure 5-7. Pendant Control Test

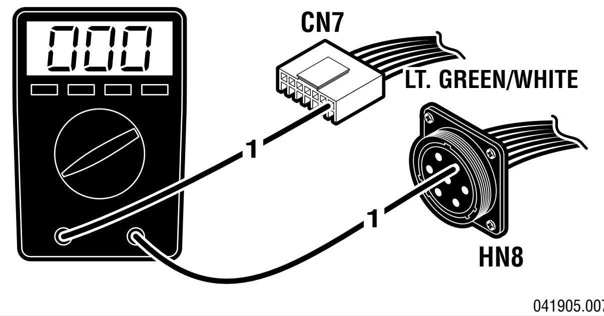
Disconnect the cord from the table connector and from the pendant control connector and using an ohmmeter, test the continuity between the corresponding pins in the connectors.

b. Test Results

If you do not receive the correct readings, the wiring or connector pins may be faulty.

c. Table Connector HN8 Test

If correct readings are received, test the wiring from the table connector to connector CN7 at the Relay Box. Disconnect connector CN7 from the Relay Box and using an ohmmeter, test the continuity between the corresponding pins in connectors CN7 and the table connector HN8. See figure 5-8.



CN7 CONNECTOR	HN8 CONNECTOR
1 LT. GREEN / WHITE	1
2 LT. GREEN	2
3 GREEN / BLACK	3
4 GREEN / RED	4
5 GRAY	5
6 GRAY / WHITE	6
7 - - -	7

Figure 5-8. Table Connector Continuity Test

d. Test Results

If the correct readings are not obtained, test the wiring from the table connector HN8 to connector HN7 (located under the Trendelenburg cylinder cover) and from connector CN7 to HN7. Disconnect connector HN7 and using an ohmmeter, test the continuity between the corresponding pins in connectors HN7 to CN7 and HN7 to HN8. Refer to figure 5-8.

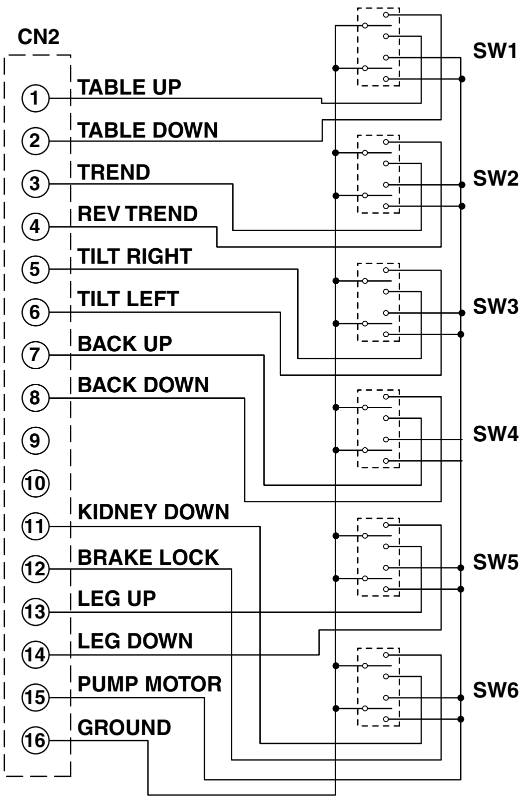
If the correct readings are obtained, this part of the circuit is okay and the problem may be the Pendant Control or the Relay Box. Contact SKYTRON if all tests performed indicate that the problem is located in the Pendant Control.

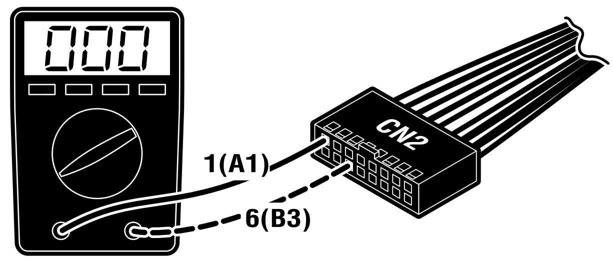
5-7. Auxiliary Switches

The following tests will determine if the auxiliary switches are functioning properly.

a. Switch Test

Disconnect connector CN2 at the Relay Box and using an ohmmeter check for continuity at the connector pins (pin 1A common) while activating the appropriate switch. See figure 5-9. Meter should read 0 ohms.





PIN NO	COLOR	PIN NO	COLOR
1 (A1)	Red	9 (A5)	--
2 (B1)	Green / White	10 (B5)	--
3 (A2)	Brown	11 (A6)	Black
4 (B2)	Yellow	12 (B6)	Blue / White
5 (A3)	Orange	13 (A7)	Gray
6 (B3)	Green	14 (B7)	Yellow / White
7 (A4)	Brown / White	15 (A8)	Red / White
8 (B4)	Blue	16 (B8)	Orange / White

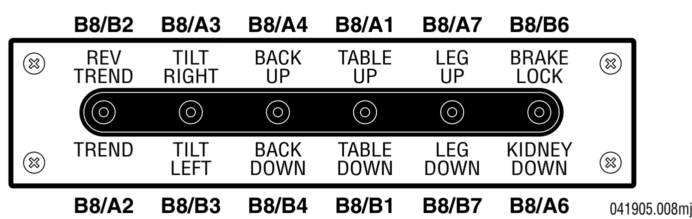


Figure 5-9. Auxiliary Switch Connector CN2

b. Test Results

If proper meter readings are not received, test the individual switches as necessary. Using an ohmmeter, test the operation of an individual switch with the (+) test lead at the center terminal of the switch and the (-) test lead at the terminal opposite the direction of the switch actuation. Refer to figure 5-10. Meter should read 0 ohms. If the switches check out, the problem would have to be in the wires, the switch circuit board or connector CN2.

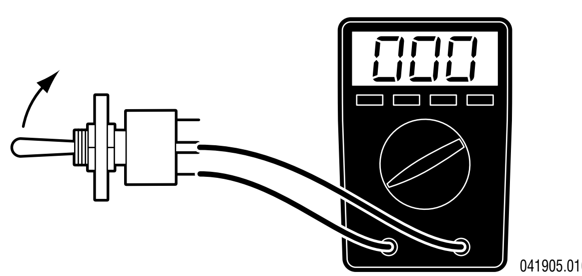


Figure 5-10. Auxiliary Switch Test

5-8. Relay Box

The power supply is directly connected to the relay contacts. When these contacts are closed, 24 volts is supplied to the solenoids which are mounted on the hydraulic mini-valves. One relay is used to supply power to the pump/motor and is always activated no matter what control function is selected. The brake locking circuit relay is also activated when any control function other than BRAKE UNLOCK is *initially* selected.

Also, inside the relay box is a step-down transformer and full-wave rectifier which decreases the voltage to 5-6 volts. This low voltage potential controls the relays by the use of the hand-held pendant control buttons. Basically the relays enable a 5-6 volt potential to control the 24 volt circuit.

The following tests will determine if the relay box is functioning correctly.

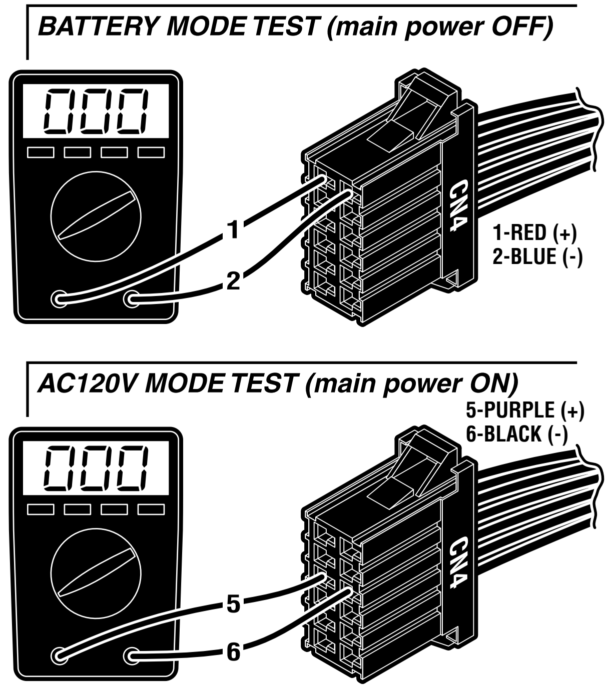
a. Checking Relay Box Input Power

1. Connect power cord to table. Plug the power cord into the 120VAC supply (wall receptacle). Disconnect connector CN4, leave all other connectors connected.

2. Using a DC voltmeter, test input power for both the BATTERY and AC120V operating modes. See figure 5-11. Meter should read approximately 24 -28 volts.

b. Test Results:

If you do not receive the correct meter readings, the problem is in the input wiring, connectors or components. If the correct readings are obtained, proceed to the next step.



CONNECTOR CN4 COLOR CODE	
1 RED	7 WHITE
2 BLUE	8 WHITE
3 RED	9 YELLOW
4 BLACK	10 GRAY
5 PURPLE	11 ORANGE
6 BLACK	12 - - -

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Figure 5-11. Relay Box Input

c. Checking Output to Pump

1. Make sure all connectors are connected and activate the AC120V operating mode. See figure 5-12.

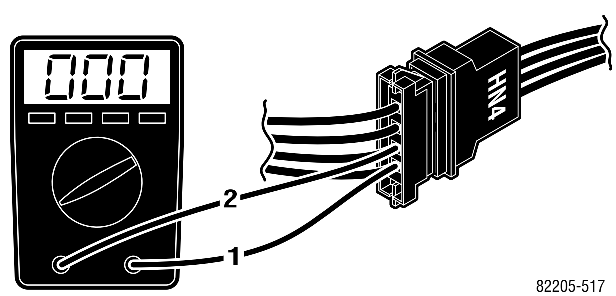


Figure 5-12. Output to Pump

2. Test HN4 at pin 1(+) and pin 2(-) with a DC voltmeter. Meter should read approximately 24-28 volts when any function button is activated. If no voltage is present, use an ohmmeter to test the continuity from HN4 to CN4 (red and black wires).

d. Checking Output to Solenoids

This test checks the voltage that is used to energize the solenoids.

1. Activate either BATTERY or AC120V operating mode.

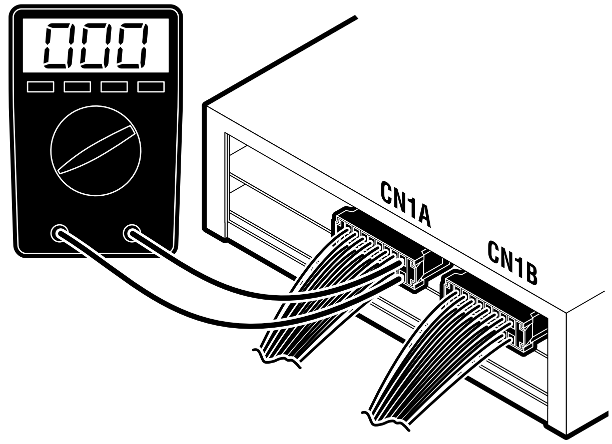
NOTE

•The Brake Lock function is activated by pressing any function button (except BRAKE UNLOCK). A timer in the Relay Box allows continuous output for about 7 seconds. If the brakes are already locked, no output is provided.

•The BRAKE UNLOCK button activates another timer in the relay box which allows continuous output for the brake release function for approximately 7 seconds. If the brakes are already released (using the BRAKE UNLOCK button) no output is provided.

2. Test connectors CN1A and CN1B from the back while attached to the relay box. All connectors should be connected.

3. Activate each of the pendant control buttons and measure the output voltage for the corresponding connector pins with a DC voltmeter. See figure 5-13. Meter should read 24 volts.



CN1A CONNECTOR		CN1B CONNECTOR	
FUNCTION	PINS	FUNCTION	PINS
Table Up	1 - 2	Back Up	1 - 2
Table Down	3 - 4	Back Down	3 - 4
Trendelenburg	5 - 6	Kidney Down	9 - 10
Reverse Trend.	7 - 8	Kidney Up	11 - 12
Tilt Right	9 - 10	Leg Up	13 - 14
Tilt Left	11 - 12	Leg Down	15 - 16
Reflex	13 - 14	Brake Set	17 - 18
Flex	15 - 16	Brake Unlock	19 - 20

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Figure 5-13. Solenoid Output Connectors

e. Test Results:

If you do not receive the correct meter readings, the relay box is defective and should be replaced.

NOTE

•Before deciding the relay box is defective, check the wires and pins in the connector blocks to make sure they are not loose or making a bad connection with their mate.
•If the battery power is ON and no table functions have been activated for 3 hours, the power off circuit will interrupt the battery power.

f. Checking Output to Pendant Control

The output to the Pendant Control can not be tested without specialized equipment. If all tests have been conducted and it appears that the Relay Box is faulty, contact SKYTRON.

5-9. Main Wire Harness Continuity Tests

If correct meter readings are not received in tests between components, before replacing the components, test the Main Wire Harness to be sure all connectors and wires are making a good connection.

a. CN4 to Batteries Test

1. Disconnect connectors CN4 and the (+) and (-) connectors from the batteries. Leave all other connectors connected.

2. Using an ohmmeter, test for continuity between pin 1 of CN4 and battery (+) connector. Also test between pin 2 of CN4 and battery (-) connector. See figure 5-14.

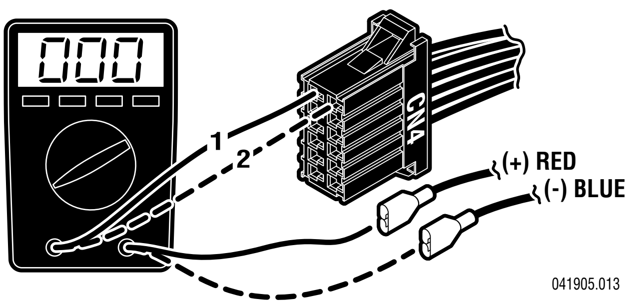


Figure 5-14.

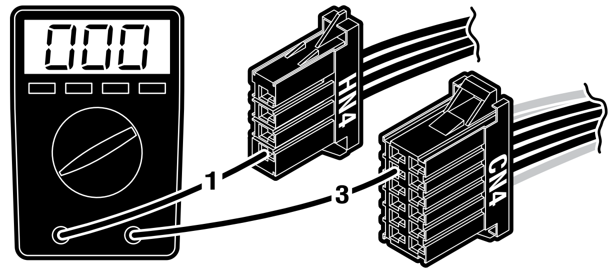
NOTE

The 15 amp battery protection circuit breaker is in the line between CN4 pin 1 and the battery connector. Test the continuity of the circuit breaker if correct meter reading is not received.

b. CN4 to Pump Test

1. Disconnect connectors CN4 and HN4. Leave all other connectors connected.

2. Using an ohmmeter, test for continuity between the pins of CN4 and pins on HN4. See figure 5-15.



WIRE COLOR / PIN NUMBER CODES		
HN4		*CN4*
1	RED	3
2	BLACK	4
3	WHITE	7
4	WHITE	8

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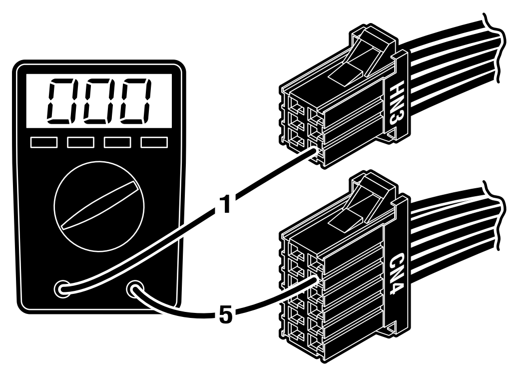
Figure 5-15.

c. CN4 to Capacitor / Rectifier Unit Test

1. Disconnect connectors CN4, and HN3. Leave all other connectors connected.

2. Using an ohmmeter, test for continuity between pins of CN4, and HN3. See figure 5-16.



PIN TEST COMBINATIONS		
HN3		*CN4*
1	-	5
2	-	6
3	-	9
4	-	10
5	-	11

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Figure 5-16. CN4 and HN3

5-10. Solenoids

The solenoids are energized by 24 volt potential that is controlled by the relay box. The solenoid windings are protected from excessive heat by an internal thermal fuse that will open after approx. 7 minutes of continuous operation. The solenoid must be replaced if the internal thermal fuse has been blown. The solenoids are mounted directly on either side of the hydraulic mini-valves and push the spool valve in one direction or the other depending upon which solenoid is activated.

a. Solenoid Test

The resistance of the solenoid coil can be checked out using an ohmmeter R x 1 scale.

1. Disconnect connectors CN1A and CN1B. Measure the resistance between the two pins at the connector for the solenoid in question as shown in figure 5-17. Polarity of meter leads is not important.

2. The meter should read approximately 16 ohms at room temperature.

3. Measure the resistance between either pin and ground.

4. Meter should read infinity.

b. Test Results:

If the solenoid does not check out with the meter, it is more than likely defective and must be replaced.

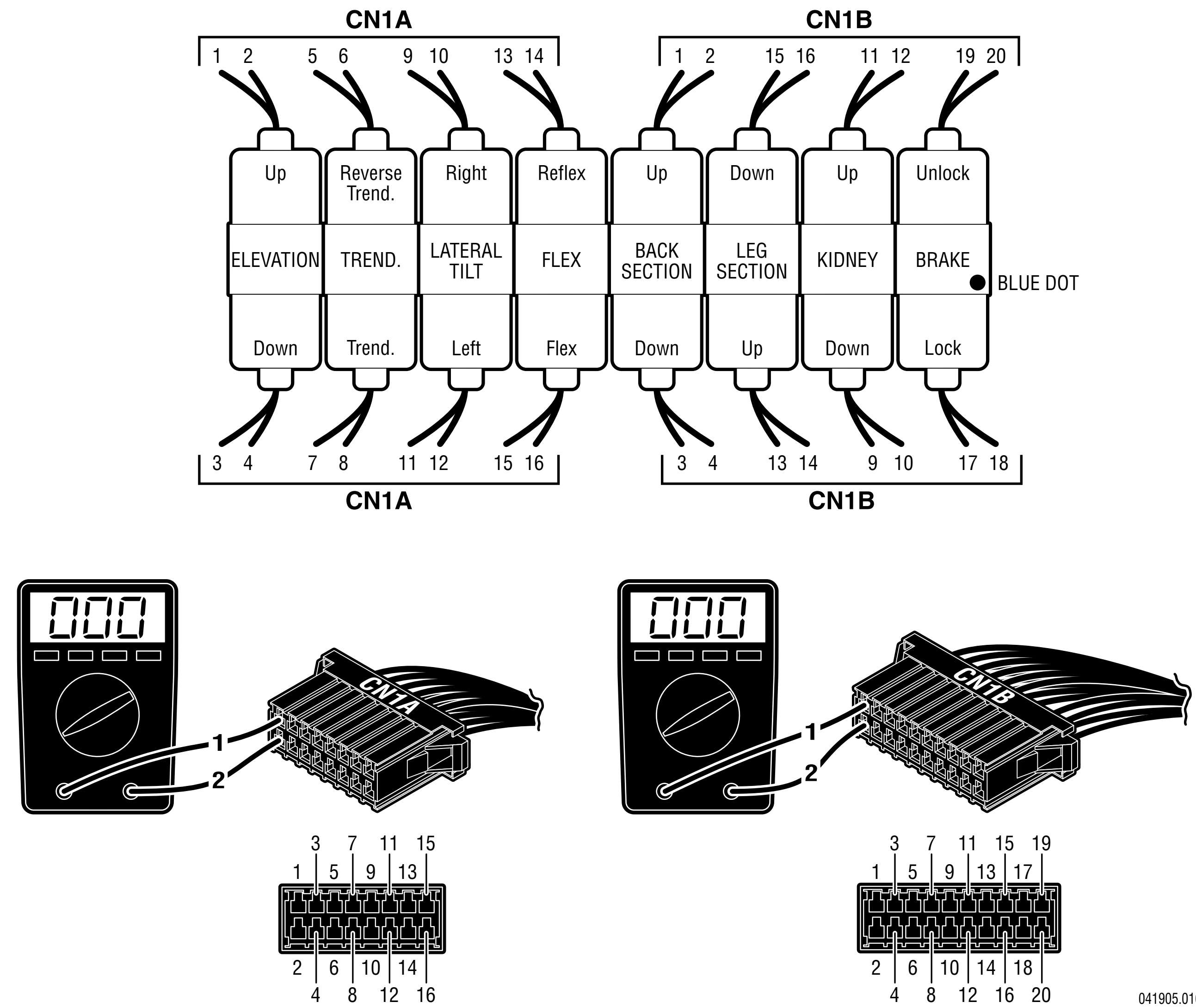


Figure 5-17. Solenoid Test

NOTE

Whenever there are several components of the same type, a defective unit can also be detected by substituting a known good unit or wire connector. In some cases this may be faster than using a multi-meter.

5-11. Motor/Pump Assembly

The hydraulic pump motor is a thermally protected 24 volt DC electric motor. The oil pump unit is attached to the bottom of the motor and is a gear type displacement pump with a pumping capacity of .4 liter per min. The Motor/Pump Assembly is mounted on insulators in the base of the table.

a. Motor/Pump Test

1. Make sure all connectors are connected and activate the AC120V operating mode. See figure 5-18.

2. Test HN4 at pin 1(+) and pin 2(-) with a DC voltmeter. Meter should read approximately 24-28 volts when any function button is activated. If no voltage is present, use an ohmmeter to test the continuity from HN4 to CN4 (red and black wires).

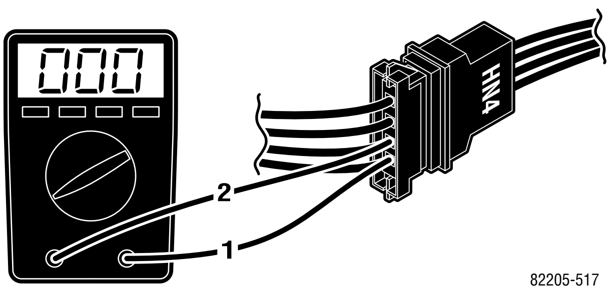


Figure 5-18. Motor Input Voltage

NOTE

If the pump has been activated continuously for 1-1/2 to 2 minutes, the thermal relay will interrupt the power to the pump.

b. Thermal Protector Test

The Thermal Protector is built in to the pump motor and is used to interrupt the current flow to the pump motor to protect it from possible damage due to overheating.

1. Turn OFF both BATTERY and AC120V operating modes.

2. Use an ohmmeter to test for continuity between terminals 3 and 4 on the connector HN4. See figure 5-19.

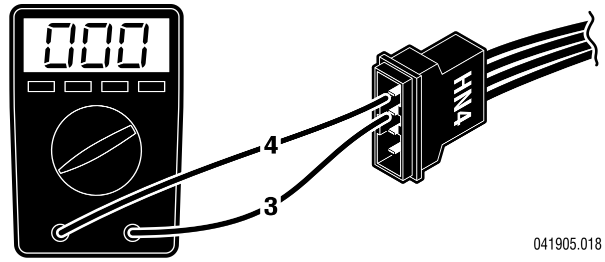


Figure 5-19. Thermal Protector

3. The Thermal Relay should reset itself after approximately one minute.

4. The Thermal Relay should activate after 1-1/2 to 2 minutes of continuous pump operation.

c. Motor Resistance Test

The motor can be statically checked for resistance using an ohmmeter. This test is not 100% accurate because you are checking the motor with very low voltage from the meter and without any load.

1. Using an ohmmeter R x 1 scale, measure the resistance between the pins 1 and 2 of HN4. See figure 5-20.
2. The meter should read 1 to 2 ohms at room temperature.
3. Measure the resistance between either pin and ground.
4. Meter should read infinity.

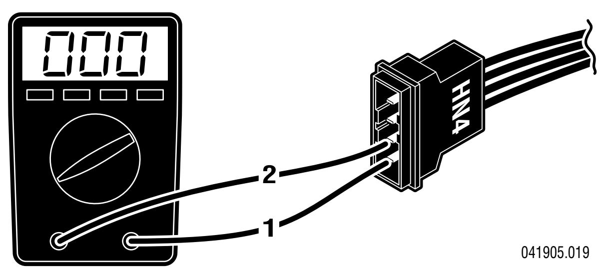


Figure 5-20. Motor Connector HN4

d. Test Results:

If you do not receive the correct meter readings, the motor or wiring is defective.

5-12. Return-to-Level / Positioning Inhibit Micro-Switches.

The return-to-level feature is activated by a single button on the pendant control and automatically levels the major table functions, lateral tilt, Trendelenburg, back section, and leg section.

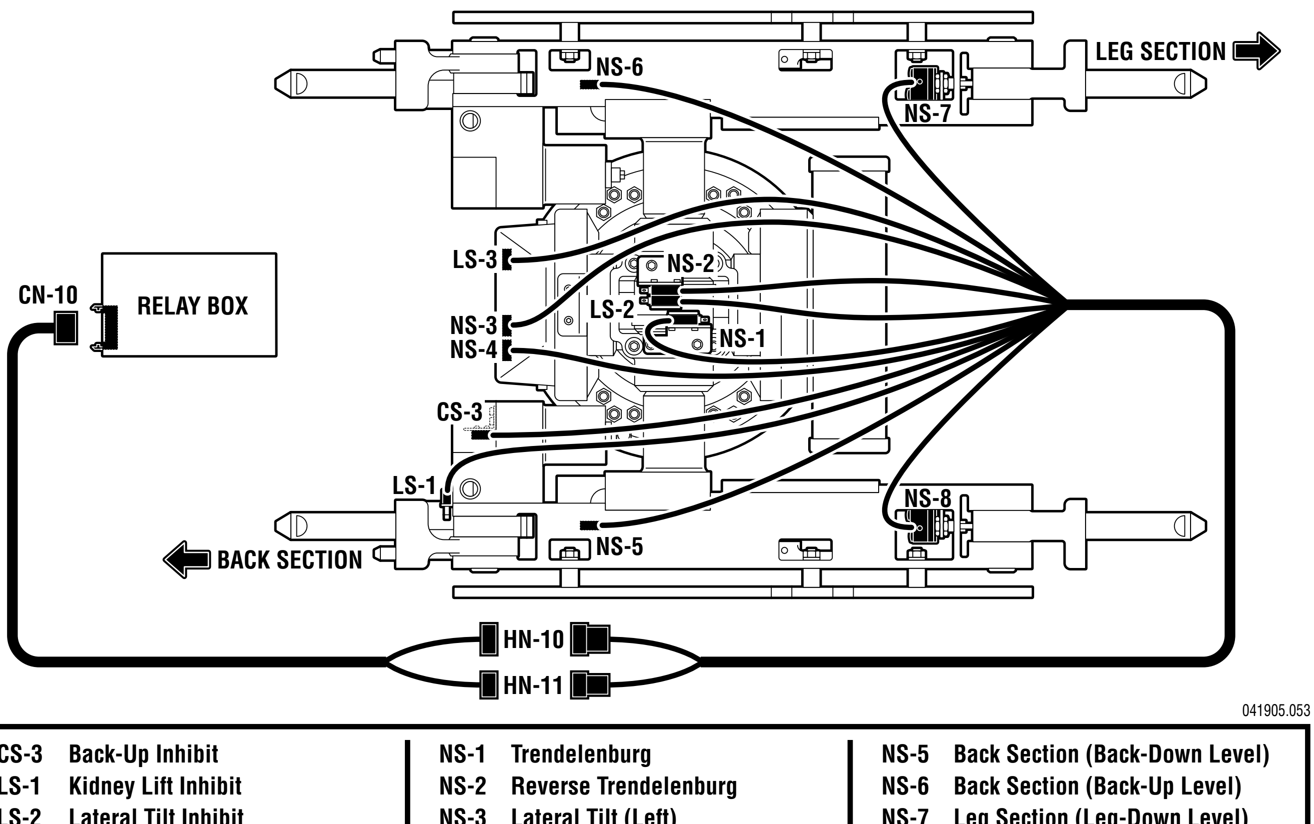
The kidney lift has a back section-up inhibit switch to prevent the table back section from damaging the kidney lift when the lift is raised. The back section still has the capability to be lowered, but will not raise above horizontal until the kidney lift is completely down. If the back section is raised above horizontal, the system will not allow the kidney lift to be raised. An audible alarm will sound if the kidney lift inhibit switch is activated and either function is activated - raising back section when Kidney lift is up or raising kidney bridge when back section is above horizontal.

The lateral tilt and Trendelenburg positioning functions incorporate a safety interlock system which limits the positioning capabilities. Lateral tilt positioning is limited to 20° if Trendelenburg positioning exceeds 20°. Likewise, Trendelenburg positioning is limited to 20° if lateral tilt positioning exceeds 20°. An audible alarm will sound if the positioning maximums are achieved.

The return-to-level / positioning inhibit system consists of 12 micro-switches, 3 electrical connectors, and the related wiring. The micro-switches are mounted on or adjacent to the function they control and are wired for normally open or normally closed operation. The micro-switches are either cam or lever actuated and can be adjusted at the individual switch mounting brackets.

The micro-switches operate on low voltage, and control the function circuits (pump/motor and appropriate solenoid valves) when activated by the pendant control LEVEL button.

The micro-switches are wired to the relay box through a riser cord and to the 26 pin connector CN10. See figure 5-21 for switch location and identification.



CS-3	Back-Up Inhibit	NS-1	Trendelenburg	NS-5	Back Section (Back-Down Level)
LS-1	Kidney Lift Inhibit	NS-2	Reverse Trendelenburg	NS-6	Back Section (Back-Up Level)
LS-2	Lateral Tilt Inhibit	NS-3	Lateral Tilt (Left)	NS-7	Leg Section (Leg-Down Level)
LS-3	Trendelenburg Inhibit	NS-4	Lateral Tilt (Right)	NS-8	Leg Section (Leg-Up Level)

Figure 5-21.

5-13. Troubleshooting

If a problem is suspected in the return / positioning circuits, disconnect the connector CN10 from the Relay Box to eliminate the circuits. Ensure that all table functions operate properly using the Pendant Control. If the functions do not work properly using the Pendant Control, refer to the appropriate test section and make all needed repairs before working on the return circuits.

NOTE

It is normal for the back section to move up if the LEVEL button is pushed when connector CN10 is disconnected from the relay box.

All of the micro-switches are connected to the relay box via a wiring harness and the micro-switch riser cord using connectors CN10, HN10 and HN11. Connectors HN10 and HN11 are located under the slider shroud in the same area as the hydraulic hoses. Connector CN10 plugs into the relay box and is the most convenient location to make circuit continuity checks. See figure 5-22 for connector pin locations.

NOTE

Wire colors may vary, however, connection from indicated pins on HN11 to pins on CN10 remain the same.

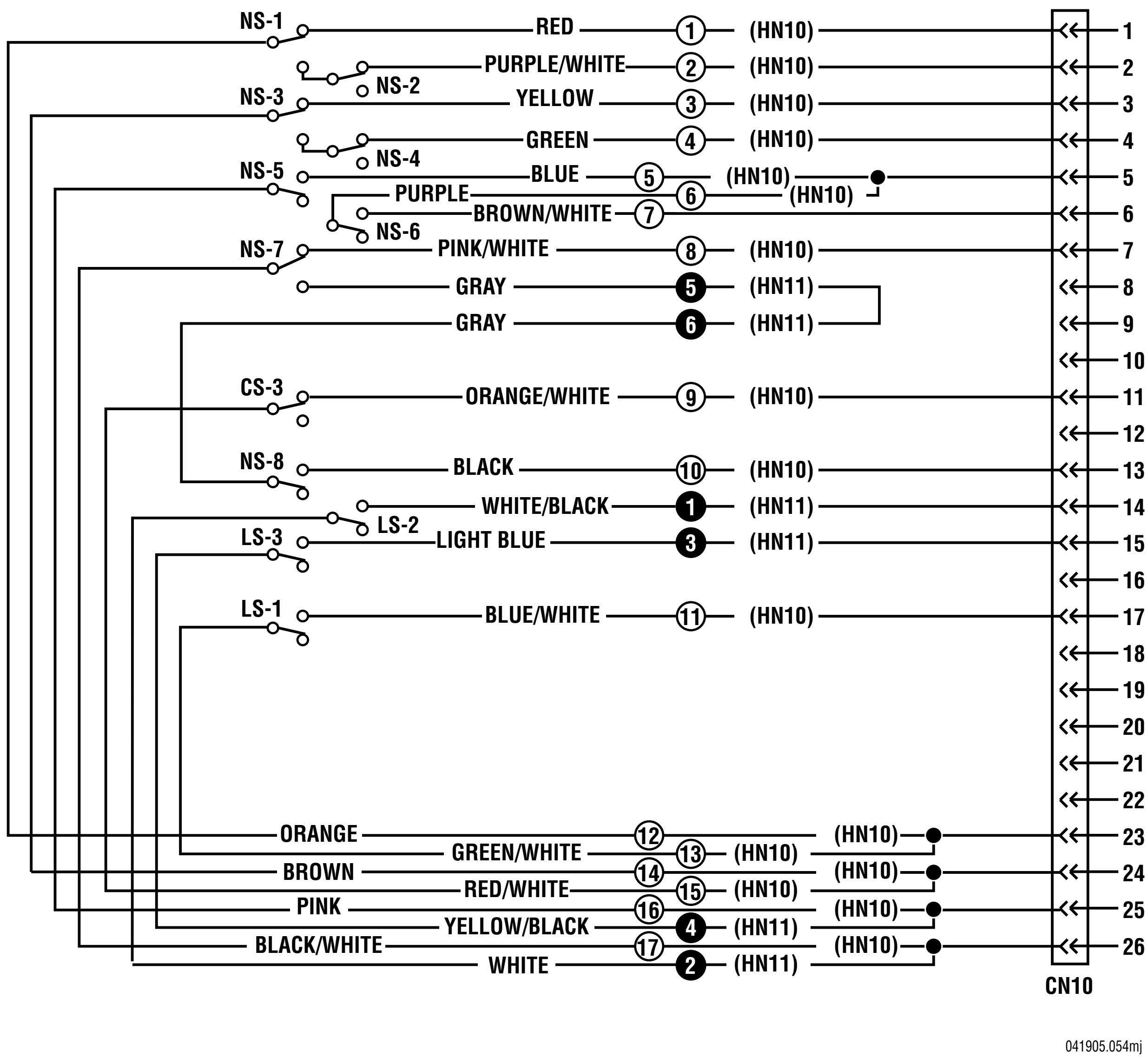


Figure 5-22. Return Micro-Switch Test

a. Switch Test

Turn Main Power ON, lock the table brakes, and place the table top sections in a level position with the Kidney Lift down. Disconnect connector CN10 from the relay box and using an ohmmeter, test the wiring and switch operation at the appropriate pin numbers for the micro-switch in question as shown in figures 5-23 through 5-27.

NOTE

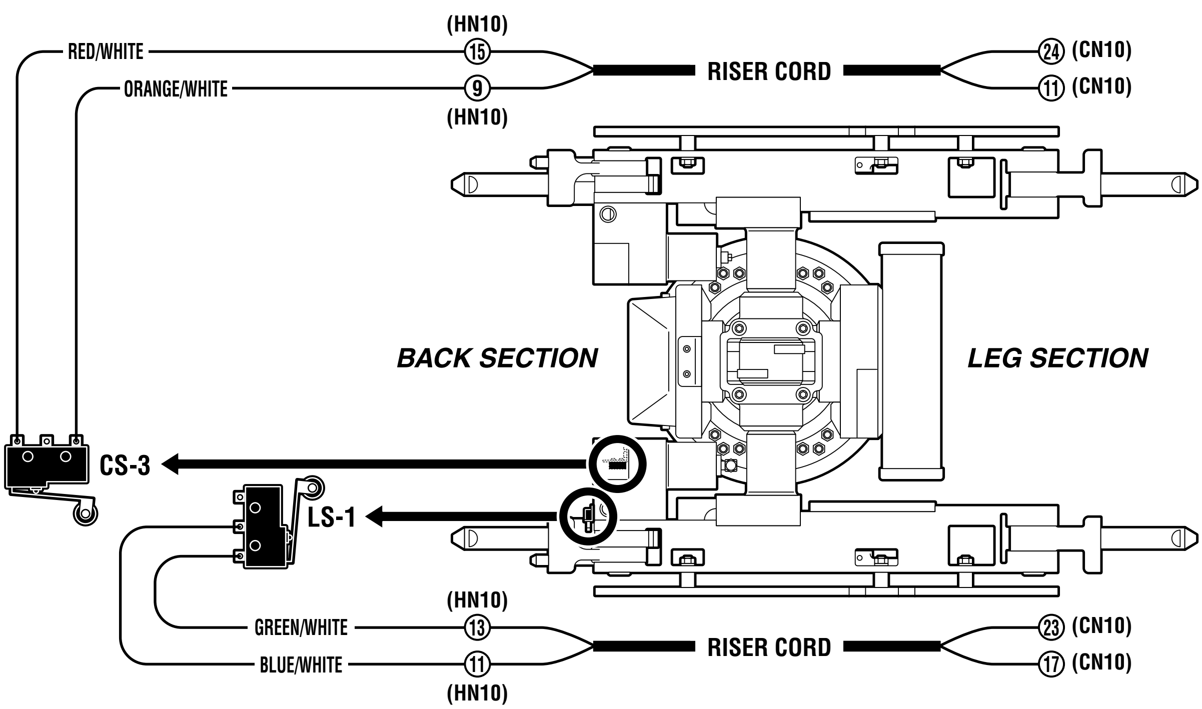
Be sure to isolate the circuit when making continuity checks.

NOTE

If you do not receive the proper continuity results at connector CN10 it does not necessarily mean the micro-switch is defective. There could be a problem with the riser cord between connectors CN10, HN10 and HN11, or in the wiring from the switch to connector. Further tests will have to be made to determine the exact problem.

CAUTION

Incorrect "Inhibit" micro-switch adjustment may allow component collision causing table damage and compromise patient safety.



When Kidney Lift is UP, Back Section Can Not go above horizontal.

CS-3 BACK UP INHIBIT - TEST AT PINS 11 & 24		
Table Position	**Switch Position**	**Meter Reading**
Kidney Lift Down	Open	Infinity
Kidney Lift Up	Closed	0

When Back Section is UP, Kidney Lift Can Not go up.

LS-1 BACK UP LIMIT - TEST AT PINS 17 & 23		
Table Position	**Switch Position**	**Meter Reading**
Back at level	Open	Infinity
Back > level	Closed	0

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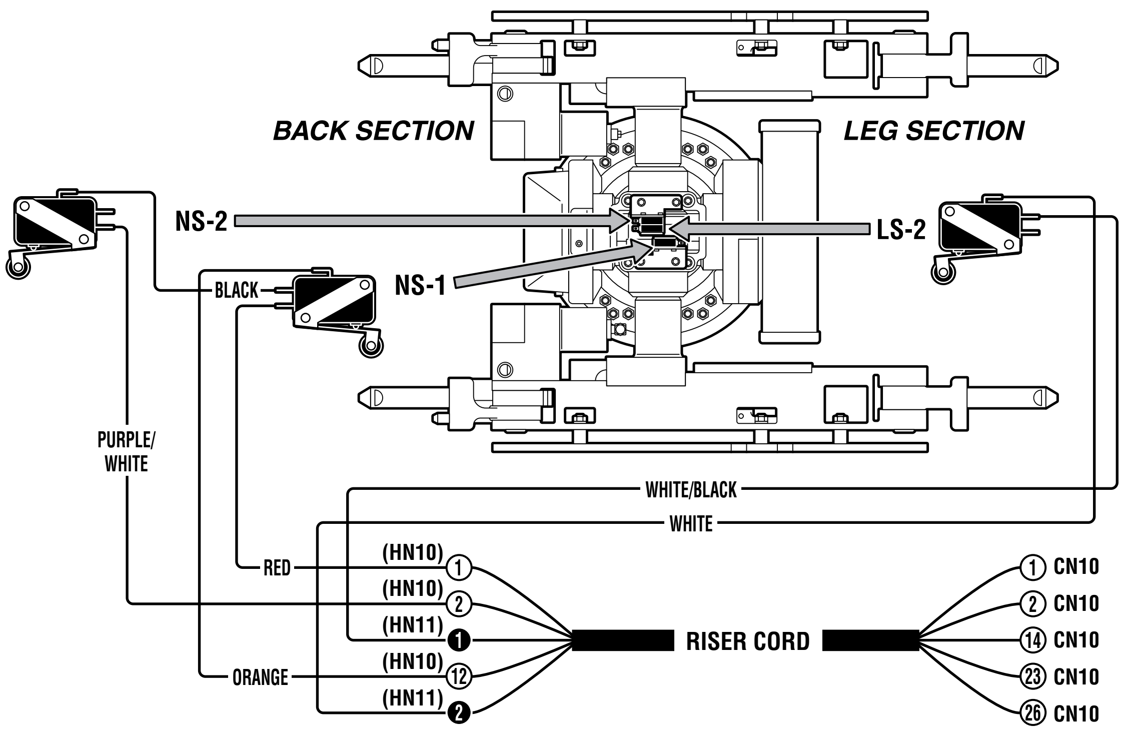
Figure 5-23. Back Up Inhibit Switch

Adjust CS-3 to close when kidney lift is raised.

Adjust LS-1 to close when back section is raised above level.

CAUTION

Incorrect "Inhibit" micro-switch adjustment may allow component collision causing table damage and compromise patient safety.



When table is in Trendelenburg Position, NS-1 brings the top back to level.

NS-1 TRENDELENBURG - TEST PINS 1 & 23		
Table Position	**Switch Position**	**Meter Reading**
Level	Open	Infinity
Reverse Trendelenburg	Open	Infinity
Trendelenburg	Closed	0

When table is in Reverse Trendelenburg Position, NS-2 brings the top back to level.

NS-2 REVERSE TRENDELENBURG - TEST PINS 2 & 23		
Table Position	**Switch Position**	**Meter Reading**
Level	Open	Infinity
Reverse Trendelenburg	Closed	0
Trendelenburg	Open	Infinity

When table is in Trendelenburg Position, more than 20º, Tilt is limited to 20º.

LS-2 TILT INHIBIT - TEST PINS 14 & 26		
Table Position	**Switch Position**	**Meter Reading**
Trendelenburg < 20º	Open	Infinity
Trendelenburg > 20º	Closed	0

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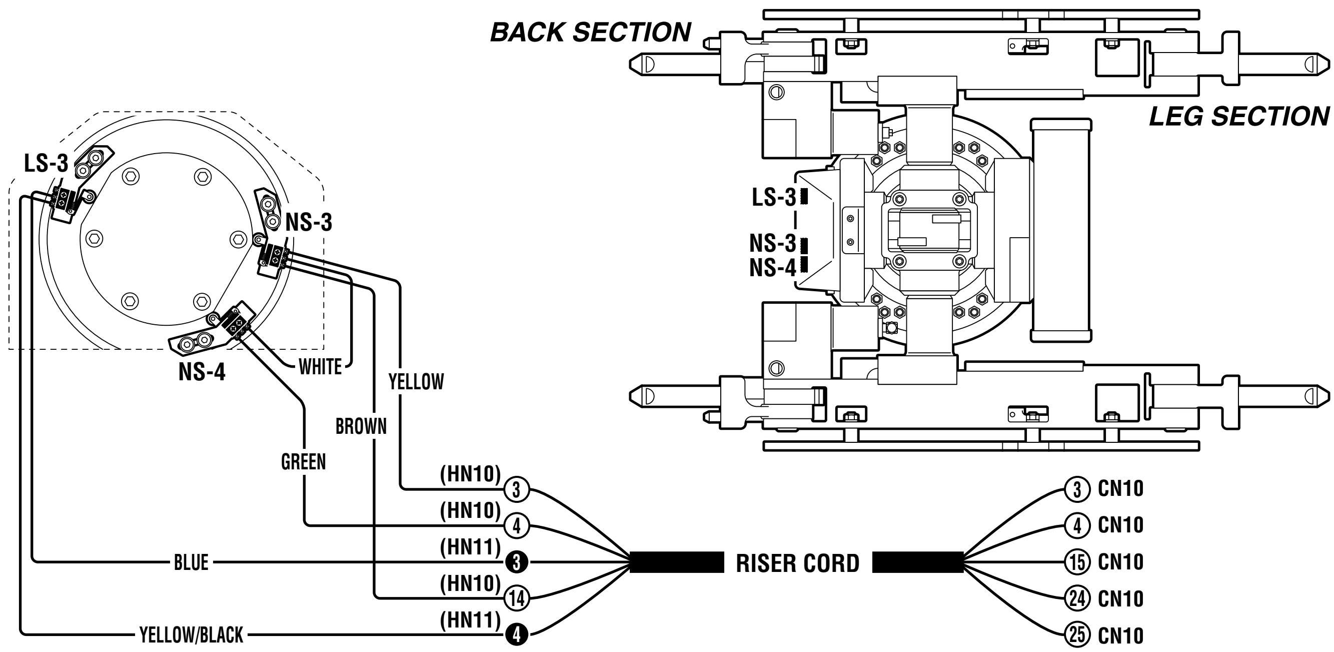
Figure 5-24. Trendelenburg Return Switches

Adjust LS-2 to close when Trendelenburg position reaches 20°

CAUTION

Incorrect "Inhibit" micro-switch adjustment may allow component collision causing table damage and compromise patient safety.



When table is in Tilt Position more than 20º, Trendelenburg is limited to 20º.

LS-3 LATERAL TILT LIMIT - TEST PINS 15 & 25		
Table Position	**Switch Position**	**Meter Reading**
Level	Open	Infinity
Tilt-Right > 20°	Closed	0
Tilt-Left > 20°	Closed	0

When table is in Tilt-Left Position, NS-3 brings the top back to level.

NS-3 LATERAL TILT-LEFT - TEST PINS 3 & 24		
Table Position	**Switch Position**	**Meter Reading**
Level	Open	Infinity
Tilt-Right	Open	Infinity
Tilt-Left	Closed	0

When table is in Tilt-Right Position, NS-4 brings the top back to level.

NS-4 LATERAL TILT-RIGHT - TEST PINS 4 & 24		
Table Position	**Switch Position**	**Meter Reading**
Level	Open	Infinity
Tilt-Right	Closed	0
Tilt-Left	Open	Infinity

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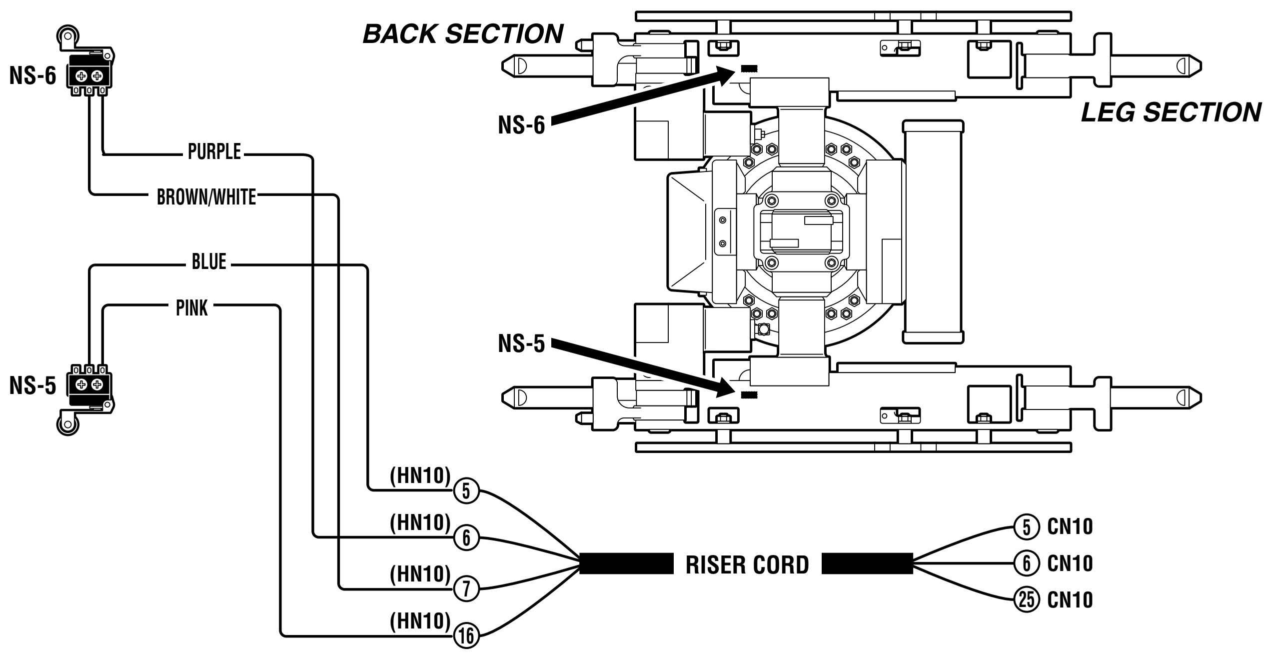
Figure 5-25. Lateral Tilt Return Switches

Adjust LS-3 to close when Lateral Tilt position reaches 20°



When the Back Section is Down,
NS-5 brings the Back Section Up to level.

NS-5 BACK SECTION DOWN - TEST PINS 5 & 25		
Table Position	**Switch Position**	**Meter Reading**
Level	Closed	0
Back-Down	Open	Infinity
Back-Up	Closed	0

When the Back Section is Up,
NS-6 brings the Back Section Down to level.

NS-6 BACK SECTION UP - TEST PINS 5 & 6		
Table Position	**Switch Position**	**Meter Reading**
Level	Open	Infinity
Back-Down	Open	Infinity
Back-Up	Closed	0

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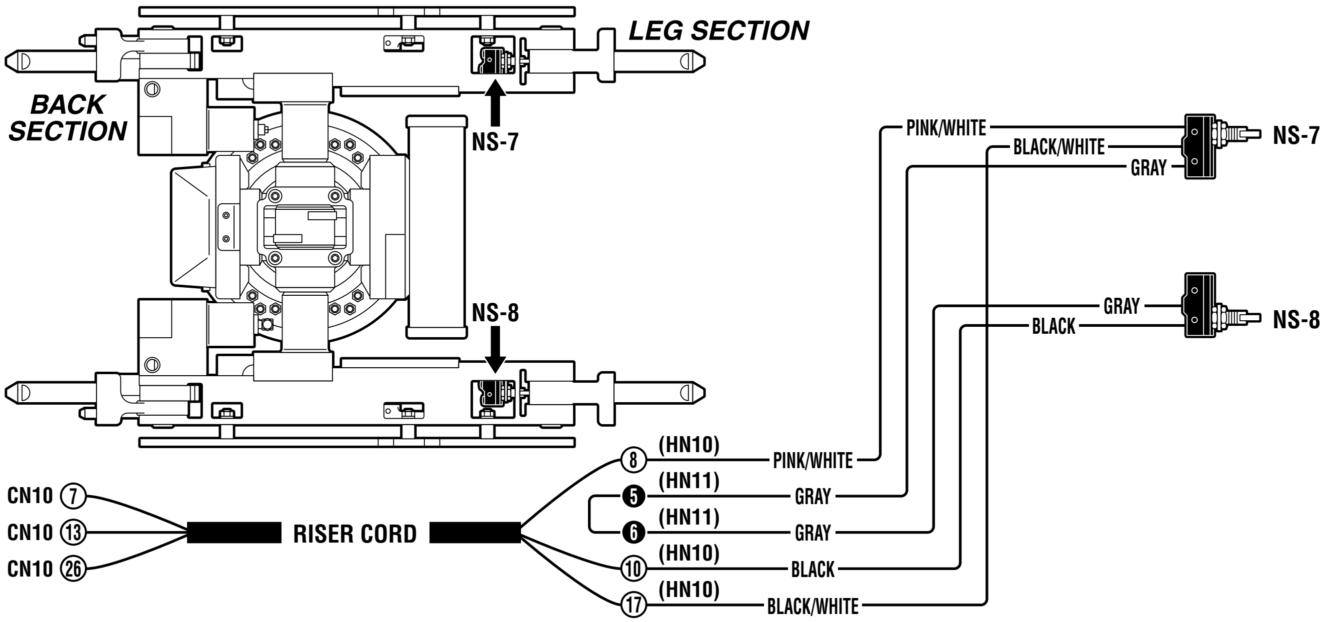
Figure 5-26. Back Section Return Switches



When the Leg Section is Down,
NS-7 brings the Leg Section Up to level.

NS-7 LEG SECTION DOWN - TEST PINS 7 & 26		
Table Position	**Switch Position**	**Meter Reading**
Level Leg-Down	Open Closed	Infinity 0

When the Leg Section is Up,
NS-8 brings the Leg Section Down to level.

NS-8 LEG SECTION UP - TEST PINS 7 & 13		
Table Position	**Switch Position**	**Meter Reading**
Level Leg-Down	Open Open	Infinity Infinity

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Figure 5-27. Leg Section Return Switches

b. Switch Adjustment.

If proper readings are not obtained during test or if table does not properly return to level, use the following procedure to adjust the switches.

1. Apply table brakes and (using a level) level the table top using the TRENDELENBURG and LATERAL-TILT function buttons on the pendant control.

2. For all switches except the Leg Section switches, carefully loosen the allen bolts securing the switch bracket and adjust the switches as needed. See figure 5-28.

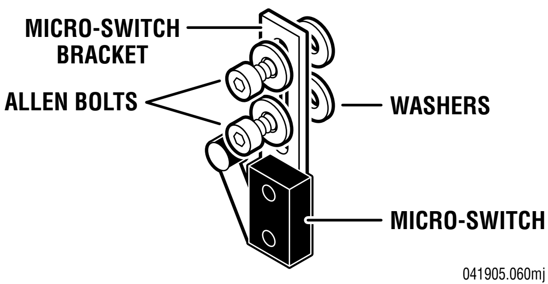

Figure 5-28. Micro-Switch Adjustment

3. To adjust the Leg Section switches remove seat section top, loosen the 2 phillips head screws securing bracket, adjust the switch, tighten the screws and replace the seat section top. See figure 5-29.

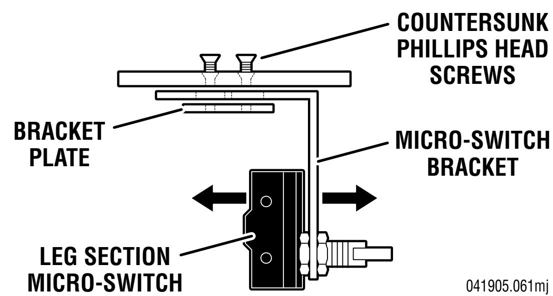

Figure 5-29. Leg Section Micro-Switch Adjustment.

APPENDIX: MODEL 6700 SERIES MAINTENANCE MATRIX						i = Inspect r = Replace
COMPONENT	1 YEAR	2 YEARS	5 YEARS	7 YEARS	10 YEARS	REFERENCE
Check for Hydraulic leaks	i					Pg. 3; 19 (3-1 thru 3-10)
Check Lateral Tilt Housing bolts	i					Pg. 22
Check Side Rails & Gravity Stops	i					Pg. 3; 18 (2-5)
Check Velcro	i					Pg. 3
Inspect Hydraulic Oil level	i					Pg. 7 (1-1a); 15 (1-3a)
Inspect Power Cord	i					Pg. 3; 33 (4-1); 35 (5-3b)
Inspect Self-Leveling Brake Pad	i					Pg. 12 (1.2d, 6); 13 (1.2f); 14 (1-2g)
Lubricate Casters	i					Pg. 19 (2-6)
Lubricate Elevation Column	i					Pg. 3
Tighten X-ray Top Stand-offs & apply Blue Loc-Tite	i/r					Pg. 3
Battery, 12 Volt		i				Pg. 35 (5-4a)
Back Section Cylinder O-Ring			i			Pg. 11 (1-2d,1); 24
Trendelenburg Cylinder O-Rings			i			Pg. 11 (1-2d,1); 22
Lateral Tilt Cylinder O-Rings			i			Pg. 11 (1-2d,3); 22
Elevation Cylinder O-Rings			i			Pg. 12 (1-2d,4); 20
Kidney Cylinder O-Rings			i			Pg. 12 (1-2d,5); 27
Foot-Leg Section Cylinder O-Rings			i			Pg. 11 (1-2d,1); 26
Plumbing & Terminal O-Rings			i			Pg. 13 (1-2f); 29 (3-11)
Brake Pad, Self-Leveling Hard			i			Pg. 12 (1-2d,6)
Brake Pad, Rubber Soft			i			Pg. 12 (1-2d,6)
Casters			i			Pg. 19 (2-6)
Check Valves			i			Pg. 9 (1-2c); 13 (1-2e); 22 (3-4)
Pendant Control Assembly			i			Pg. 33 (4-2c); 37 (5-6); 52 (5-13b)
Main ON/OFF Switch				i		Pg. 34 (5-3a)
Power Cord Assembly				i		Pg. 35 (5-3b)
Power Cord Receptacle				i		Pg. 35 (5-3b)
Pendant Control Connectors				i		Pg. 37 (5-6c)
Grounding Lead				i		
Back Section Micro Switches				i		Pg. 46 (5-13); 50 (Fig. 5-13a)
Trendelenburg Micro Switches				i		Pg. 46 (5-13); 48 (Fig. 5-13a)
Leg Section Micro Switches				i		Pg. 51
Lateral Tilt Micro Switches				i		Pg. 46 (5-13); 49 (Fig. 5-13a)

APPENDIX: MODEL 6700 SERIES MAINTENANCE MATRIX

i = Inspect
r = Replace

COMPONENT	1 YEAR	2 YEARS	5 YEARS	7 YEARS	10 YEARS	REFERENCE
Brake Cylinders					i	Pg. 12 (1-2d,6)
Emergency Brake Release Valve					i	Pg. 14 (1-2g)
Pump/Motor Assembly					i	Pg. 7 (1-1b); 8 (1-2a); 42 (5-9b); 44 (5-11a)
Pressure Relief Valve Assembly					i	Pg. 7 (1-1c); 8 (1-2b); 15 (1-3c); 20 (3-1)
Hydraulic Oil System					i	Pg. 14 (1-2f-g); 20 (3-2,5)
Mini-Valve Spool Valve Return Springs					i	Pg. 14 (1-2f-g)
Riser Cord Assembly					i	Pg. 45 (5-12); 46 (5-13); 47 (5-13a)
Slider Column					i	Pg 12 (1-2d,4); 13 (1-2e)
Elevation Shroud Gasket					i	
Access Cover Gasket					i	
Labels/Operational Decals					i	Pg. 4

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