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Although current at 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.

CAUTION

Indicates a possibility of damage to equipment.

NOTE

Indicates important facts or helpful hints.
**BASIC RECOMMENDED TOOLS:**

- STRAIGHT BLADE SCREWDRIVERS
- ASSORTED PHILLIPS SCREWDRIVERS
- HYDRAULIC PRESSURE GAUGE SKYTRON P.N. 6-050-02
- METRIC ALLEN WRENCHES 1.5mm-10mm
- ADJUSTABLE CRESCENT WRENCH
- DIGITAL VOLTMETER, TRUE RMS
- METRIC OPEN END WRENCHES 7mm-18mm
- LEVEL (CARPENTERS)
- WHITE LITHIUM GREASE
- HYDRAULIC OIL D6-010-25
- ALVANIA EP GREASE Z (SHELL)

**BASIC RECOMMENDED MAINTENANCE PROCEDURES**

The specific items listed in the MODEL 3003 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 Alvania EP Grease Z (SHELL)
- Check Carbon Fiber Top for Damage

Only facility-authorized SKYTRON trained, maintenance personnel should troubleshoot the SKYTRON 3003 Imaging 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
3003 EQUIPMENT LABELS

D - ___ - ___ (printed here)

DO NOT EXCEED 180 LBS. END LOAD OR MAY CAUSE INSTABILITY

1

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

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

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

Table Capacity:
Lift 500 lbs.
Articulate 500 lbs.
See Operators Manual for Limitations.

D6-065-29

Table Capacity:
Lift 500 lbs.
Articulate 500 lbs.
See Operators Manual for Limitations.

D6-017-29

EMERGENCY BRAKE RELEASE

UNLOCK CLOCKWISE ▼ COUNTER-CLOCKWISE

D6-017-28

DANGER - EXPLOSION HAZARD
IF USED IN THE PRESENCE OF FLAMMABLE ANESTHETICS.

D6-065-23

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

D6-065-21

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

D6-065-22

D6-034-21

CAUTION CENTER

NORMAL

LOW

D6-066-11

D6-065-24

D6-066-28

SKYTRON IMPULSE

D6-017-28

D6-066-29

D6-011-34

D6-017-05

D6-065-29

D6-066-28

D6-066-28

D6-067-27

D6-034-21

D6-066-28

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3003 Impulse Imaging Table Specifications

TOP VIEW

30"  33"

82.5"

17.625"

SIDE VIEW

8.125"

40.5"

5.625"

21.875"

42" MAX

28" MIN

END VIEW

21.875"

19"

Electrical Specifications

Power requirements
120 VAC, 60Hz, 450 Watts

Current Leakage
Less than 100 micro amps

Power Cord
15 feet w/hospital grade connector

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

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

UNIT TO BE USED ONLY IN SPECIFIED ENVIRONMENTAL CONDITIONS
TEMPERATURE: 15° - 30° C (60° -85° F)
HUMIDITY: 30% - 60% RELATIVE HUMIDITY, NON CONDENSING

INTERMITTANT DUTY CYCLE:
HIGH SPEED TABLE TOP OPERATION:
1 MIN. ON, 13 MIN. 17 SECONDS OFF
1-1. General

The hydraulic system (with the exception of the hydraulic cylinders and hoses) is contained within the base of the table. The hydraulic valves and pumps are electrically controlled by the use of a hand-held push button pendant control or joystick. 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. Approx. 2 quarts.

b. Motor/Pump Assemblies - Positive displacement gear type pumps provide 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 - Direct the fluid to the appropriate hydraulic cylinders.

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

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

---

---

Figure 1-1. Hydraulic Block Diagram - Model 3003
1-2. Component Operation

a. Motor/Pump Operation

The motor/pump assemblies are gear type pumps that provide the oil pressure and volume for the entire hydraulic system. Each 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 lines of the pumps are connected to the main oil galley which is internal and common to all the hydraulic mini-valves and pressure relief valve. An auxiliary high speed pump is provided for the top slide function when operated by the joystick control. To achieve high speed operation this pump provides a greater oil volume. A check valve is positioned between the high speed pump and the 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.

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.

Figure 1-2. Component Operation

Figure 1-3. Pressure Relief Valve Not Functioning

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 then flows back into the reservoir. See figure 1-4.

Figure 1-4. Pressure Relief Valve Functioning

Turning the adjustment nut clockwise increases the amount of oil pressure required to open the valve, and turning it counterclockwise decreases the amount of oil pressure. (See adjustment section for specification.)
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.
Mini-Valve Right Port Activated
(See figure 1-6)

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

- Spool Valve - Pushed to the left by electric solenoid. This opens the internal oil pressure gal-ley 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 mechani-cally 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

- Spool Valve - Pushed to the right by electric solenoid. This opens the internal oil pressure gal-ley 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 mechani-cally 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:
- Reverse Trendelenburg/Trendelenburg
- Lateral Tilt
- Longitudinal Slide Function
- Lateral Slide Function
- Elevation
- Brake Cylinders

1. Trendelenburg Cylinder - 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 a ball and socket 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.

2. Lateral Tilt Assembly - The lateral tilt cylinder assembly consists of a dual cylinder housing with two pistons complete with connecting rods. The connecting rods are attached to a stationary pin in the housing on top of the main support column. The cylinder housing attaches to the table frame and is attached to the support column with a pivot pin. See figure 1-9.

The pistons and connection rods are attached to a non-movable surface. Therefore, when hydraulic fluid is pumped into one side, the cylinder housing itself moves around its pivot pin causing the table top to tilt to one side. To tilt the table top in the opposite direction, hydraulic fluid is pumped into the other side of the cylinder assembly.

3. Longitudinal Slide Cylinder Assembly - The longitudinal slide system utilizes two double action cylinders plumbed in parallel, working in tandem. The two cylinder housings are connected together facing opposite directions. The ram of one cylinder is connected to the table top frame and the other one is attached to the elevation column. Hydraulic fluid is pumped into the same end of both cylinders at the same time. The two cylinder system allows the 20” of top slide to be performed by a short cylinder system. See figure 1-10.
4. Lateral Slide Function Cylinder - This cylinder is also a double action cylinder. It differs from the Trendelenburg cylinder in that the piston is connected to rams which exit from each end of the cylinder tube. The ends of the rams connect to each side of the table top. The cylinder tube is connected to the elevation column. When hydraulic fluid is pumped into one side of the cylinder, the entire table top assembly will slide laterally. See figure 1-11.

5. 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 piston and piston rod are elevated by the 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 1-12.

NOTE

Elevation slider bearing surfaces should be lubricated every 6 months using a quality lithium soap base grease containing extreme pressure additives - Alvania EP Grease 2 (Shell) or equivalent.
6. Brake Cylinders - The brake cylinders are single action type similar to the elevation cylinder. The movable piston 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 pushes the piston up to return the oil through the mini-valve 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 1-13. Single Action Brake Cylinder](image)

**Figure 1-13. Single Action Brake Cylinder**

**Figure 1-14. Elevation Return Circuit**

**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.

**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.
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 counterclockwise) 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.](image)

NOTE

- The emergency brake release valve must be tightened securely when not in use.
- If the emergency brake release valve has been operated, the BRAKE 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 far open the valve is, this could take anywhere from a few minutes to several hours.
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 1-17.

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.

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 lines using the pump pressure 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 1-18.
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/CM² -1138 PSI), low speed pump only, high speed pump 5MPA maximum. 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 1-19.

Any control function should move in either direction at the same rate. If the rate of a certain function is too slow, open the speed control slightly and recheck. 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.

A pressure gauge should be used to set the speed of the Trendelenburg 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 and times are obtained.

<table>
<thead>
<tr>
<th>Control Function</th>
<th>Pressure Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lateral Tilt</td>
<td>75KG/CM²-1065PSI</td>
</tr>
<tr>
<td>Trendelenburg</td>
<td>HdDn 30KG/CM² -425PSI</td>
</tr>
<tr>
<td></td>
<td>Hd Up 60KG/CM² -850PSI</td>
</tr>
<tr>
<td>Slide</td>
<td>55KG/CM²-780PSI</td>
</tr>
<tr>
<td>Brakes (Set)</td>
<td>10-30KG/CM²-142-425PSI</td>
</tr>
<tr>
<td>Pressure Relief Valve</td>
<td>80KG/CM²-1138PSI</td>
</tr>
</tbody>
</table>

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.

NOTE

These pressure values should be used as a guideline. If the speed of a control function moves faster in one direction than the other direction, adjust the speed control until they are equal. You may find that the pressure gauge may record a higher reading in one direction. This is normal.
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.
### Problem
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<td>Uneven Weight Distribution</td>
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<tr>
<td>Pressure Relief Valve Not Set Properly</td>
</tr>
<tr>
<td>Low on Oil</td>
</tr>
<tr>
<td>Spool Valve Not Centered</td>
</tr>
<tr>
<td>Defective Pump</td>
</tr>
<tr>
<td>Defective Mini-Valve</td>
</tr>
<tr>
<td>Defective Solenoid or Wiring</td>
</tr>
<tr>
<td>Defective Relay Box or Pendant Control</td>
</tr>
<tr>
<td>Leaking Cylinder Hose</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Table will not descend properly</th>
</tr>
</thead>
<tbody>
<tr>
<td>Uneven Weight Distribution</td>
</tr>
<tr>
<td>Incorrect Speed Adjustment</td>
</tr>
<tr>
<td>Bad Check Valve</td>
</tr>
<tr>
<td>Spool Valve Not Centered</td>
</tr>
<tr>
<td>Galled Slider Assembly</td>
</tr>
<tr>
<td>Defective Solenoid or Wiring</td>
</tr>
<tr>
<td>Defective Relay Box or Pendant Control</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Table loses elevation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bad Check Valve</td>
</tr>
<tr>
<td>Leaking Mini-Valve</td>
</tr>
<tr>
<td>Loose Fittings, Joints, Hoses</td>
</tr>
<tr>
<td>Leaking “O” Ring Inside Cylinder</td>
</tr>
</tbody>
</table>

### Figure 2-1. Elevation Circuit
2-4. TRENDELENBURG DIAGNOSIS CHART

<table>
<thead>
<tr>
<th>Problem</th>
<th>Reason</th>
</tr>
</thead>
<tbody>
<tr>
<td>Trendelenburg function moves improperly</td>
<td>Uneven Weight Distribution</td>
</tr>
<tr>
<td></td>
<td>Incorrect Speed Adjustment</td>
</tr>
<tr>
<td></td>
<td>Spool Valve Not Centered</td>
</tr>
<tr>
<td></td>
<td>Bad Check Valves</td>
</tr>
<tr>
<td></td>
<td>Low on Oil</td>
</tr>
<tr>
<td></td>
<td>Pinched Hose</td>
</tr>
<tr>
<td></td>
<td>Defective Mini-Valve</td>
</tr>
<tr>
<td></td>
<td>Pressure Relief Valve Not Set Properly</td>
</tr>
<tr>
<td></td>
<td>Bad Solenoid or Wiring</td>
</tr>
<tr>
<td></td>
<td>Defective Relay Box or Pendant Control</td>
</tr>
<tr>
<td>Trendelenburg function chatters or loses position</td>
<td>Defective or Dirty Check Valve</td>
</tr>
<tr>
<td></td>
<td>Oil Leakage in Circuit</td>
</tr>
<tr>
<td></td>
<td>Air Inside Cylinder</td>
</tr>
<tr>
<td></td>
<td>Pinched Hose</td>
</tr>
<tr>
<td></td>
<td>Low on Oil</td>
</tr>
</tbody>
</table>
2-5. LATERAL TILT DIAGNOSIS CHART

**Problem**
Lateral tilt function moves improperly
Lateral tilt function chatters or loses position

**Reason**
Excessive Patient Weight
Incorrect Speed Adjustment
Spool Valve Not Centered or Adjusted Properly
Bad Check Valves
Low on Oil
Pinched Hose
Defective Mini-Valve
Pressure Relief Valve Not Set Properly
Defective Solenoid or Wiring
Defective Relay Box or Pendant Control
Defective or Dirty Check Valve
Oil Leakage in Circuit
Air Inside Cylinder
Pinched Hose
Low on Oil

---

Figure 2-3. Lateral Tilt Circuit
2-6. LATERAL SLIDE DIAGNOSIS CHART

Problem
Slide function moves improperly

Reason
Excessive Patient Weight
Incorrect Speed Adjustment
Spool Valve Not Centered or Adjusted Properly
Bad Check Valves
Low on Oil
Pinched Hose
Defective Mini-Valve
Pressure Relief Valve Not Set Properly
Defective Solenoid or Wiring
Defective Relay Box or Pendant Control

Slide function chatters or loses position

Reason
Defective or Dirty Check Valve
Oil Leakage in Circuit
Air Inside Cylinder
Pinched Hose
Low on Oil

Figure 2-4. Lateral Slide Circuit
2-7. LONGITUDINAL SLIDE DIAGNOSIS CHART

Problem
Slide function moves improperly

Reason
Excessive Patient Weight
Incorrect Speed Adjustment
Spool Valve Not Centered or Adjusted Properly
Bad Check Valves
Low on Oil
Pinched Hose
Defective Mini-Valve
Pressure Relief Valve Not Set Properly
Defective Solenoid or Wiring
Defective Relay Box or Pendant Control

Problem
Slide function chatters or loses position

Reason
Defective or Dirty Check Valve
Oil Leakage in Circuit
Air Inside Cylinder
Pinched Hose
Low on Oil

Figure 2-5. Longitudinal Slide Circuit
2-8. BRAKE CIRCUIT DIAGNOSIS CHART

Problem
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.

Reason
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

Reason
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

Reason
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 2-6. Brake System Circuit
2-9. Flexible Hose Identification and Placement

The following figure will show the correct placement of the flexible hydraulic hoses used in the table and their respective number codes.

Figure 2-7, Hydraulic Hose Identification
SECTION III ELECTRICAL SYSTEM

3-1. General

The complete electrical system (with the exception 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
- LATERAL SLIDE
- LONGITUDINAL SLIDE
- RETURN TO LEVEL
- 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, UL listed cord with a three-prong hospital grade plug.

3-2. Components

Refer to figure 3-1 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. Also contains the circuitry that allows the joystick to activate the table top slide functions via the relay box. It also contains the switching circuitry to activate the auxiliary high speed pump, return-to-center and the orientation mode.

c. Joystick Control - Multi-directional controller which contains switches for slide positioning as well as push button switches to activate high speed, return-to-center and orientation modes.

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

e. Solenoids - These electrically open and close the hydraulic ports of the mini-valve to direct the fluid to the correct cylinders. They operate on 120 VAC.

f. Motor/Pump Assemblies - 120 VAC, 60 Hz, 200 Watt capacitor induction motor.
Figure 3-1. Electrical Circuit Block Diagram
4-1. Troubleshooting Notes

The basic operation of each component will be defined along with a drawing and 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 (starting capacitor)
b. Main Switch Circuit and Wiring

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

a. Relay Box
b. Pendant Control
c. Joystick Control
d. Joystick Interface Box

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.

4-2. 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 CN4, which in turn would power the table.

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

2. Disconnect connector CN4 from the relay box. See figure 4-1. Leave all other connectors connected.

   ![Figure 4-1. Main Power Test](image)

   **WARNING**

   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 2 and 1 (black and white wires) located in connector CN4. See figure 4-2. You should receive line voltage 120 VAC.

   ![Figure 4-2. Connector CN4](image)

b. Test Results

If you do not receive the correct voltage measurement, the problem would have to be in the wires, main switch or power cord. If the correct voltage is obtained, everything is good up to this point and the problem would have to be in another area.
4-3. 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.

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.

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. See figure 4-3.

b. Test Results

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

c. Table Base Connector Test

If correct readings are received, test the wiring from the table base 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 base connector HN7. See figure 4-4.

d. Test Results

If the correct readings are obtained, this part of the circuit is okay and the problem may be the Pendant Control circuit board or the Relay Box. Contact SKYTRON if all tests performed indicate that the problem is located in the Pendant Control.
4-4. Joystick Control

The Joystick Control and Relay Box contain the switching mechanism for the table top slide functions. The joystick control also contains switches for high speed, return to center and slide orientation.

Use the following procedure to test the joystick control:

a. Remove the 3 phillips head screws securing the joystick control base cover and remove the cover.

b. Disconnect the cord connector and using an ohmmeter, test the continuity between the connector and the table base connector. See figure 4-5.

d. Test the wiring between the joystick control base connector and the Relay Box connector CN5. Disconnect the connector CN5 from the Relay Box and using an ohmmeter, test the continuity between the corresponding pins in the connectors. See figure 4-6.

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

e. Test the Interface box functions using a jumper between the pins of IF CN3. All connectors should be connected and the main power ON. See figure 4-7. Table top should move as shown.
4-5. Relay Box

The power supply is directly connected to the relay contacts. When these contacts are closed, 120 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 120 volt circuit.

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

a. Checking Relay Box Connector CN4

1. Connect the power cord to the table. Plug the power cord into the 120 VAC power supply (wall receptacle) and turn the main switch ON. Leave all connectors connected.

   
   ![WARNING]

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

2. Use an AC voltmeter capable of measuring 120 volts and measure the voltage between pins 1 (white) and 2 (black) of connector CN4 for input voltage. See figure 4-8. Meter should read line voltage 120 VAC.

b. Test Results:

If you do not receive the correct meter readings, the relay box or wiring is defective. If the correct readings are obtained, this part of the relay box is okay. Proceed to the next step.
c. Checking Output to Solenoids

This test checks the high voltage (120V) that is used to energize the solenoids.

**WARNING**

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

**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 released (using the BRAKE UNLOCK button) no output is provided.

1. The power cord should be plugged into the wall receptacle and Power Switch turned ON.

2. Test connectors CN1 and CN2 from the back while attached to the relay box. All connectors should be connected.

3. Activate each of the Pendant Control buttons measure the voltage for the corresponding connector pins with an AC voltmeter. See figure 4-9. Meter should read 120VAC.

<table>
<thead>
<tr>
<th>FUNCTION</th>
<th>CN1 Pins</th>
<th>FUNCTION</th>
<th>CN2 Pins</th>
</tr>
</thead>
<tbody>
<tr>
<td>Table Up</td>
<td>1-2</td>
<td>Not Used</td>
<td>1-2</td>
</tr>
<tr>
<td>Table Down</td>
<td>3-4</td>
<td>Not Used</td>
<td>3-4</td>
</tr>
<tr>
<td>Trend</td>
<td>5-6</td>
<td>Slide - Foot</td>
<td>5-6</td>
</tr>
<tr>
<td>Rev Trend</td>
<td>7-8</td>
<td>Slide - Head</td>
<td>7-8</td>
</tr>
<tr>
<td>Tilt Right</td>
<td>9-10</td>
<td>Not Used</td>
<td>9-10</td>
</tr>
<tr>
<td>Tilt Left</td>
<td>11-12</td>
<td>Not Used</td>
<td>11-12</td>
</tr>
<tr>
<td>Not Used</td>
<td>13-14</td>
<td>Slide - Left</td>
<td>13-14</td>
</tr>
<tr>
<td>Not Used</td>
<td>15-16</td>
<td>Slide - Right</td>
<td>15-16</td>
</tr>
<tr>
<td>Table Down</td>
<td>1-2</td>
<td>Brake Lock</td>
<td>17-18</td>
</tr>
<tr>
<td>Table Down</td>
<td>3-4</td>
<td>Brake Unlock</td>
<td>19-20</td>
</tr>
</tbody>
</table>

**Figure 4-9. Solenoid Output Connectors**

d. Test Results:

If you do not receive the correct meter readings, the relay box or wiring 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.

e. 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.
4-6. Solenoids

The solenoids are energized by 120 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.

NOTE

If a solenoid does not function when the pendant control button is pushed, the problem could be the pendant control, the relay box or the solenoid.

a. Solenoid Test

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

1. Disconnect connectors CN1 and CN2. Measure the resistance between the two pins at the connector for the solenoid in question as shown in figure 4-10. Connector must be disconnected. Polarity of meter leads is not important.

2. The meter should read approximately 60 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 4-10. Solenoid Test
4-7. Motor/Pump Assemblies

The electric motors are capacitor start type with a rating of 120 VAC, 200 watts. The field windings are protected with a thermal protector that will open the winding circuit if the motor is run continuously for approximately 10 minutes. This protector will take about 10 minutes to automatically reset. An oil pump unit is attached to the bottom of each motor and is a gear type displacement pump with a pumping capacity of .4 liter per min. The Motor/Pump Assemblies are mounted on an insulated motor plate in the base of the table. The starting capacitors are mounted along side the motor/pump assemblies.

a. Motor/Pump Test

The following tests will check the voltage applied to the motor and the resistance of the motor field windings.

⚠️ WARNING ⚠️

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

b. Step #1

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

2. Disconnect the 3 pin connector at the motor to be tested. Leave all other connectors connected. See figure 4-11.

3. Activate a table function. Use a voltmeter capable of measuring 120 VAC and measure the following connector pins in connector. See figure 4-12.

<table>
<thead>
<tr>
<th>Pin No.</th>
<th>Meter</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-2</td>
<td>120 VAC</td>
</tr>
<tr>
<td>1-3</td>
<td>120 VAC</td>
</tr>
<tr>
<td>2-3</td>
<td>0</td>
</tr>
</tbody>
</table>

Figure 4-12. Pump Connectors

c. Test Results:

If you do not receive the correct meter readings, the problem could be in the wires, connectors, relay box, or main switch (refer to appropriate section for troubleshooting).

If the correct voltage is obtained, everything is good up to that point and the problem could be either the motor or the starting capacitor.
d. Step #2

If the starting capacitor is shorted or grounded, the motor will not run. Capacitors very seldom fail, and it requires a dielectric tester to accurately test one. However, an ohmmeter can be used to determine if the capacitor will store a low voltage charge and most of the time this is adequate.

1. Turn the main switch OFF.
2. Pump connector should be disconnected.
3. Use the R x 100 scale of the ohmmeter and touch pins 2 and 3 of the connector. See figure 4-12.

e. Test Results:

The meter should move up scale and then back down to infinity. This would indicate that the capacitor is storing an electrical charge.

NOTE

The capacitor may have to be discharged first (by shorting pins 2 and 3 together) before you will be able to see the ohmmeter needle swing up the scale.

g. Test Results:

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

<table>
<thead>
<tr>
<th>Pin No.</th>
<th>Meter</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-2</td>
<td>Approx. 5 ohms</td>
</tr>
<tr>
<td>1-3</td>
<td>Approx. 4 ohms</td>
</tr>
<tr>
<td>2-3</td>
<td>Approx. 8 ohms</td>
</tr>
</tbody>
</table>

Figure 4-13. Pump Connector CN15

f. Step #3

The motor windings can be statically checked for resistance using an ohmmeter.

1. Turn main power switch OFF.
2. Pump connector should be disconnected.
3. Use the R x 1 scale of the ohmmeter and measure the resistance between the pins located in the pump connector. See figure 4-13.
4-8. Return-to-Level Micro-Switches.

The return-to-level feature is activated by a single button on the pendant control and automatically levels the table top from lateral tilt and Trendelenburg positions.

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

The micro-switches are wired to the relay box through a riser cord and to the 26 pin connector CN10. See figure 4-14 for switch location and identification.

4-9. Troubleshooting

If a problem is suspected in the return 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.

a. Switch Test

Turn Main Power ON, lock the table brakes, and place the table top in a level position. 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 figure 4-15.

<table>
<thead>
<tr>
<th>TABLE POSITION</th>
<th>CONNECTOR CN10 PIN</th>
<th>VALUE OF RESISTANCE</th>
</tr>
</thead>
<tbody>
<tr>
<td>LEVEL</td>
<td>24 4</td>
<td>INFINITY</td>
</tr>
<tr>
<td></td>
<td>24 3</td>
<td>INFINITY</td>
</tr>
<tr>
<td></td>
<td>23 2</td>
<td>INFINITY</td>
</tr>
<tr>
<td></td>
<td>23 1</td>
<td>INFINITY</td>
</tr>
<tr>
<td>TILT RIGHT</td>
<td>24 3</td>
<td>INFINITY</td>
</tr>
<tr>
<td>TILT LEFT</td>
<td>24 3</td>
<td>INFINITY</td>
</tr>
</tbody>
</table>

Figure 4-14. Return-to-Level Micro-Switches

Figure 4-15. Return-to-Level Micro-Switch Test
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. Remove micro-switch covers (refer to figure 4-16), carefully loosen the switch retaining screws and adjust the switches as needed. See figure 4-17.

![Figure 4-16. Micro-Switch Covers](image1)

![Figure 4-17. Micro-Switch Adjustment](image2)
4-10. Return-to-Center Micro-Switches

The return-to-center feature is activated by a single button on the joystick control and automatically centers the table top from lateral and longitudinal slide positions.

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

The micro-switches are wired to the relay box through a riser cord and to the 26 pin connector CN14. See figure 4-18 for switch location and identification.

Figure 4-18. Return-to-Center Micro-Switches
4-11. Troubleshooting

If a problem is suspected in the return circuits, disconnect the connector CN14 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.

a. Switch Test

Turn Main Power ON, lock the table brakes and place the table top in a centered position. Disconnect connector CN14 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 figure 4-19.

<table>
<thead>
<tr>
<th>TABLE POSITION</th>
<th>CONNECTOR CN’14 PIN</th>
<th>VALUE OF RESISTANCE</th>
</tr>
</thead>
<tbody>
<tr>
<td>SLIDE FOOT</td>
<td>5 1 2</td>
<td>INFINITY 0 OHM</td>
</tr>
<tr>
<td>LEVEL (JOYSTICK)</td>
<td>5 1 2 6 3 4</td>
<td>INFINITY INFINITY INFINITY INFINITY</td>
</tr>
<tr>
<td>SLIDE HEAD</td>
<td>5 1 2</td>
<td>0 OHM INFINITY</td>
</tr>
<tr>
<td>SLIDE RIGHT</td>
<td>6 3 4</td>
<td>0 OHM INFINITY</td>
</tr>
<tr>
<td>SLIDE LEFT</td>
<td>6 3 4</td>
<td>INFINITY 0 OHM</td>
</tr>
</tbody>
</table>

**Figure 4-19. Return-to-Center Micro-Switch Test**
<table>
<thead>
<tr>
<th>COMPONENT</th>
<th>1 YEAR</th>
<th>2 YEARS</th>
<th>5 YEARS</th>
<th>7 YEARS</th>
<th>10 YEARS</th>
<th>REFERENCE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Check for Hydraulic leaks</td>
<td>i</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Pg. 11 (2-3 thru 2-8)</td>
</tr>
<tr>
<td>Check Lateral Tilt Housing bolts</td>
<td>i</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Check Side Rails &amp; Gravity Stops</td>
<td>i</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Pg. 3</td>
</tr>
<tr>
<td>Check Velcro</td>
<td>i</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Pg. 3</td>
</tr>
<tr>
<td>Inspect Lateral Tilt Axis Pins</td>
<td>i</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Pg. 3</td>
</tr>
<tr>
<td>Inspect Hydraulic Oil level</td>
<td>i</td>
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<td>Tighten X-ray Top Stand-offs &amp; apply Blue Loc-Tite</td>
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**NOTE**

Items denoted as having a requirement to be inspected at year one, should be inspected annually at every maintenance interval. This matrix is intended as a guideline only depicting minimal requirements. Actual service needs will vary by product use and must be addressed individually by the application of a preventative maintenance program administered by an authorized SKYTRON service provider.