

Elevance[®] Dental Chair



Service Manual

Model Numbers:

153810



Language of origin: English

FOR USE BY MIDMARK TRAINED TECHNICIANS ONLY

004-0752-00 (Revised: 7/23/2013)

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THEORY OF OPERATION & TROUBLESHOOTING

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Elevance Chair Troubleshooting Chart

Condition	Check		Solution
Nothing happens when any button on any control is pressed. No relays can be heard energizing.	1.	Green "power ON" indicator light, located on the chair base, is illuminated.	Chair does not have power if green "power ON" indicator light is not on.
	2.	Verify power cord is plugged in.	Plug in power cord.
	3.	Verify facility circuit breaker is not tripped.	Determine why breaker tripped. Correct issue and reset breaker.
	4.	Fuse(s) <u>F1</u> , <u>F2</u> , or <u>F3</u> on Chair PC Board are blown or open	Replace bad fuse(s). Refer to PC Board wiring diagram.
	5.	Check for loose wire connections. Verify line voltage at <u>J3</u> connection on the chair control PC Board.	Tighten loose connections and refer to PC Board wiring diagram to determine loss of power at J3.
If using a wireless remote	1.	Check batteries.	Replace depleted batteries with new ones.
	2.	Check battery leaf-spring contacts.	Remove batteries and straighten leaf-springs to ensure that they make good contact with battery. Reference battery contacts illustration.
Chair has power, but control buttons still do not operate chair.	1.	Verify chair is in calibration mode (SW2 Program Switch #4 ON) TIP: <i>The wireless remote has an override feature - press and hold the P button and any arrow. This feature allows chair movements that override the software controlled movements. This moves the chair whenever it is powered.</i>	Move SW2 program switch #4 to OFF. Cycle power (plug then unplug power source from chair).
	2.	Chair may not be calibrated.	Refer to Chair Calibration procedure.
	3.	Check all connections and harnesses.	Repair or replace malfunctioning connector(s) or wire harnesses. Refer to PC Board wiring diagram for part numbers of harnesses.
	4.	If LIN Coupler is used to connect Assistant's Unit keypad - verify LIN connections.	Use LIN Coupler to verify LIN harness /LIN coupler functionality.
	5.	Chair PC Board is malfunctioning. NOTE: Incoming line voltage <i>is present</i> at J3 connector on Chair PC Board. LED is not ON next to the related relay when the function is operated.	Replace Chair PC Board.
Some functions work with control buttons, but at least one function does not.	1.	Safety bail limit switch contacts open on one or both limit switches or on the cuspidor limit switch (<u>J6</u>). These limit switches prevent the chair from going down. LED (<u>D17</u>) on Chair PCB is <u>ON</u> when limit switch contacts are <u>CLOSED</u> . Limit switches are wired in series with each other.	Remove obstacle causing switch(es) to open or replace malfunctioning switch.
	2.	Verify continuity on all harnesses. Look for broken wires or loose connections.	Repair or replace loose connectors or broken harnesses.
	3.	Perform a continuity check on each switch on membrane touchpads and foot control. Depressing a key on a touchpad closes the switch. Refer to touchpad wiring diagrams.	If a switch does not show continuity when depressed to the closed position, then replace the membrane touchpad or foot control.
	4.	If hydraulic UP functions do not work, then verify the capacitor for the hydraulic motor pump by replacing it with a known good capacitor of the same rating.	Replace malfunctioning capacitor.
	5.	Chair PCB is malfunctioning. NOTE: Incoming line voltage is present at <u>J3</u> connector on the Chair PCB. LED is not ON next to the related relay on the Chair PCB when the function is being operated. Check visually for damaged components or broken traces on PCB.	Replace malfunctioning Chair PC Board.
	6.	Back or base position sensor shows an open or shorted condition. Check connectors. Check continuity on all harnesses for broken wires or loose connections.	Replace suspected back or base positioning sensor. Repair faulty connector(s). Replace harness(es).

Elevance Chair Troubleshooting Chart (continued)

Condition		Check	Solution
BACK UP function does not work. Nothing happens when any BACK UP button is depressed (all other functions work properly).	1.	Check for broken wires and loose connections for back up solenoid at <u>J1</u> connector on Chair PCB.	Repair or replace harnesses or connections.
	2.	"Open" coil on the back up solenoid valve.	Replace hydraulic solenoid valve assembly.
	3.	Back Up solenoid valve is stuck in the closed position or clogged preventing hydraulic fluid flow.	
	4.	Throttle valve (<u>TV3</u>) turned in too far or closed on hydraulic solenoid valve assembly.	Adjust <u>TV3</u> throttle valve. Travel time from end point to end point should be 15 seconds (+/- 1 second) with 180 lbs. (82 kg) on chair.
	5.	Hydraulic back cylinder leaks while using chair.	Replace cylinder.
	6.	Potted back tilt sensor connection is loose or harness is broken.	Tighten connection or replace potted back tilt sensor.
	7.	Potted back tilt sensor is damaged (open or shorted).	Replace potted back tilt sensor.
	8.	On Chair PCB, LED <u>D12</u> by <u>K4</u> relay should be ON. Line voltage should be present at <u>J1</u> terminals 1 and 2 to back up solenoid.	Replace Chair PC Board.
BACK DOWN function does not work. Nothing happens when any BACK DOWN button is depressed (all other functions work properly).	1.	Look for obstructions that are: 1) contacting the covers or cuspidor (if applicable), 2) actuating limit switches and 3) removing power from hydraulic functions.	Remove obstructions.
	2.	Verify connections on safety bail limit switches are secure and on correct terminals. If a cuspidor is not installed a jumper must be in place on <u>J6</u> on Chair PCB. NOTE: The normally closed safety bail limit switches open when the chair back or shrouds are deflected and the actuator bracket moves away from the switch.	Connect harnesses correctly and verify that a jumper is on <u>J6</u> if there is no cuspidor.
	3.	Verify connections on cuspidor safety limit switch are secure and on correct terminals. NOTE: The normally open cuspidor safety limit switch is tripped closed with cuspidor in normal operating position. The switch opens when cuspidor is deflected.	Connect harnesses correctly.
	4.	Throttle valve (<u>TV4</u>) turned in too far or closed on hydraulic solenoid valve assembly.	Adjust <u>TV4</u> throttle valve. Travel time from end point to end point should be 15 seconds (+/- 1 sec) with 180 lbs. (82 kg) on chair.
	5.	Back down solenoid coil has an open winding, is disconnected or has a broken lead.	Repair wires and connections.
	6.	Back down solenoid valve is stuck in CLOSED position or is clogged, preventing hydraulic fluid to flow back into reservoir.	Replace hydraulic solenoid valve assembly.
	7.	Potted back tilt sensor connection is loose or harness is broken.	Tighten connection or replace potted back tilt sensor.
	8.	Potted back tilt sensor is damaged (open or shorted).	Replace potted back tilt sensor .
	9.	On Chair PCB, LED <u>D11</u> by <u>K3</u> Relay should be ON. Line voltage should be present at <u>J1</u> terminals 3 and 4 to Back Up solenoid.	Replace Chair PC Board.
BASE UP function does not work. Nothing happens when any BASE UP button is depressed (all other functions work properly).	1.	Broken wires or loose connections at BASE UP solenoid and at <u>J1</u> on Chair PCB.	Repair or replace harnesses or connections.
	2.	"Open" coil on the Base UP solenoid valve.	Replace hydraulic solenoid valve assembly.
	3.	Base UP solenoid valve is stuck in the CLOSED position or clogged, preventing hydraulic fluid flow.	
	4.	Throttle valve (<u>TV1</u>) turned in too far or closed on hydraulic solenoid valve assembly.	Adjust <u>TV1</u> Throttle Valve. Travel time from end point to end point should be 20 seconds (+/- 1 second) with 180 lbs. (82 kg) on chair.
	5.	Hydraulic back cylinder leaks while using chair.	Replace cylinder.
	6.	On Chair PC Board, LED <u>D10</u> by <u>K2</u> Relay should be ON. Line voltage should be present at <u>J1</u> terminals 3 and 4 to Back up solenoid.	Replace Chair PC Board.

Elevance Chair Troubleshooting Chart (continued)

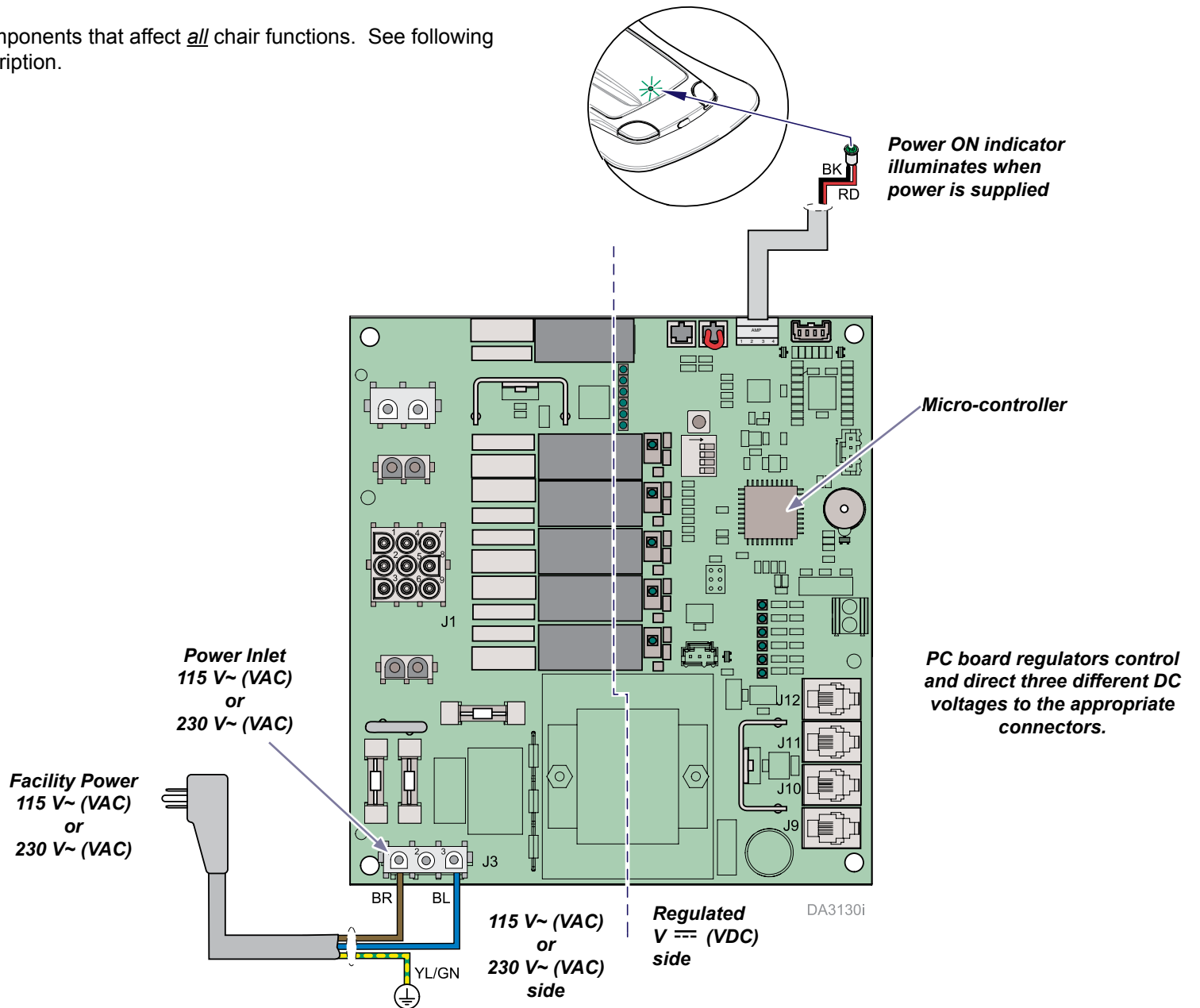
Condition		Check	Solution
BASE DOWN function does not work. Nothing happens when any BASE DOWN button is depressed (all other functions work properly).	1.	Look for obstructions that are: 1) contacting the covers or cuspidor (if applicable), 2) actuating limit switches, and 3) removing power from hydraulic functions.	Remove obstructions.
	2.	Verify connections on safety bail limit switches are secure and on correct terminals. If a cuspidor is not installed a jumper must be in place on J6 on Chair PC Board. NOTE: The normally closed safety bail limit switches open when the chair back or shrouds are deflected and the actuator bracket moves away from the switch.	Connect harnesses correctly and verify that a jumper is on J6 if there is no cuspidor.
	3.	Verify connections on cuspidor safety limit switch are secure and on correct terminals. NOTE: The normally open cuspidor safety limit switch is tripped closed with cuspidor in normal operating position. The switch opens when cuspidor is deflected.	Connect harnesses correctly.
	4.	Throttle Valve (TV2) turned in too far or closed on hydraulic solenoid valve assembly.	Adjust TV2 throttle valve. Travel time from end point to end point should be 20 seconds (+/- 1 sec) with 180 lbs. (82 kg) on chair.
	5.	Base Down solenoid coil has open winding or a loose or broken lead.	Repair wires and connections.
	6.	Base Down solenoid valve is stuck in CLOSED position or clogged, preventing hydraulic fluid flow back to reservoir.	Replace hydraulic solenoid valve assembly.
	7.	On Chair PCB, LED D9 by K1 Relay should be ON. Line voltage should be present at J1 terminals 1 and 2 to Base down solenoid.	Replace Chair PC Board.
BASE and BACK DOWN functions do not work. Nothing happens when any BASE or BACK DOWN buttons are depressed (all other functions work properly).	1.	Look for obstructions that are: 1) contacting the covers or cuspidor (if applicable), 2) actuating limit switches and 3) removing power from hydraulic functions.	Remove obstructions.
	2.	Verify connections on safety bail limit switches are secure and on correct terminals. If a cuspidor is not installed a jumper must be on J6 on Chair PCB. NOTE: The normally closed safety bail limit switches open when the chair back or shrouds are deflected and the actuator bracket moves away from the switch.	Connect harnesses correctly and verify that a jumper is on J6 if there is no cuspidor.
	3.	Verify connections on cuspidor safety limit switch are secure and on correct terminals. NOTE: The normally open cuspidor safety limit switch is tripped closed with cuspidor in normal operating position. The switch opens when cuspidor is deflected.	Connect harnesses correctly.
BASE and BACK UP functions do not work. Nothing happens when any BASE or BACK UP buttons are depressed (all other functions work properly).	1.	Check hydraulic motor pump <u>internal thermal overload</u> . Check continuity between white and red motor leads and then between yellow and red motor leads.	If no continuity - let motor cool 10 minutes or more and recheck. If overload remains open or no continuity registers, then replace hydraulic motor pump. Hydraulic pump operates intermittently. Running the motor continuously for a 30 second period will cause the overload to open.
	2.	Hydraulic fluid in oil reservoir is low.	Fill oil reservoir to correct level.
	3.	Hydraulic motor pump leads are disconnected or loose.	Connect electrical leads properly. Refer to PC Board wiring diagram.
	4.	Capacitor on hydraulic motor pump weak or inoperative.	Replace capacitor with a known good capacitor of same voltage and manufactured rating.
	5.	Line voltage to chair is low. Line voltage should be between 110.0 to 126.0 VAC on a 115 VAC unit or 220 to 252 VAC on a 230 VAC unit.	Correct low line voltage at source.
	6.	Pressure relief valve is open or leaking.	Replace pressure relief valve.
BASE drifts down from elevated position.	1.	If excessive hydraulic fluid is returning to reservoir through the <u>vent tube of base cylinder</u> , then cylinder is leaking past its piston seals.	Replace Base hydraulic cylinder.
BACK drifts down from elevated position.	1.	If excessive hydraulic fluid is returning to reservoir through the <u>vent tube of back cylinder</u> , then cylinder is leaking past its piston seals.	Replace Back hydraulic cylinder.
Hydraulic Motor Pump continues to run after the chair reaches its Up or Down limit.	1.	Potted back tilt sensor connection is loose on chair PC Board (J13).	Tighten connection at J13 .
	2.	Potted back tilt sensor is malfunctioning.	Replace potted back tilt sensor.

Elevance Chair Troubleshooting Chart (continued)

Condition		Check	Solution
Chair does not operate correctly with heavier loads. Chair moves slowly or not at all under heavier loads.	1.	Line voltage supplied to chair is too low.	Check supply line voltage at source. Voltage should be between 110.0 to 126.0 VAC on 115 VAC units or 220 to 252 VAC for 230 VAC units.
	2.	Weak capacitor on hydraulic motor pump.	Replace capacitor with a known good capacitor of same voltage and manufactured rating.
	3.	Patient weight exceeds maximum limitation of 450 lbs. (204 kg).	Follow maximum weight limitations.
	4.	Hydraulic fluid is leaking past hydraulic pressure relief valve. Excessive fluid is flowing back to reservoir during operation.	Replace hydraulic solenoid valve assembly.
	5.	Hydraulic cylinder(s) leaking past piston seals, visible by excessive fluid returning to oil reservoir thru vent tubing.	Replace hydraulic cylinder(s).
BASE DOWN travel is too slow or too fast.	1.	<u>Base down (TV2)</u> Throttle valve is either turned in too far, restricting flow back to reservoir or not turned in enough allowing too much flow, causing a faster descent.	Adjust <u>TV2</u> Throttle Valve. Travel time from end point to end point should be 15 seconds (+/- 1 sec) with 180 lbs. (82 kg) on chair.
BACK DOWN travel is too slow or too fast.	1.	<u>Back down (TV4)</u> Throttle valve is either turned in too far restricting flow back to reservoir, or not turned in enough, allowing too much flow, causing a faster descent.	Adjust <u>TV4</u> Throttle Valve. Travel time from end point to end point should be 20 seconds (+/- 1 sec) with 180 lbs. (82 kg) on chair.
	2.	Back lift spring is detached or broken. Back is designed to lower from top to bottom in 15 seconds with 80 lbs. (82 kg) load.	Repair or replace back lift spring.
Hydraulic Pump is too noisy during BACK or BASE UP functions.	1.	Restriction in suction line from oil reservoir resulting in some cavitation. Check for kinks in tubing and restrictions in suction line.	Repair or replace tubing.
	2.	Internal parts failure in hydraulic motor pump.	Replace hydraulic motor pump.
Rotational brake not working. Reading Brake LEDs on Chair PC Board: D2 on - indicates switch (pedal) activated D17 on - indicates solenoid activated	1.	Press brake pedals individually and check LED D2 turns on. If LED D2 does not turn on, then check for switch or wiring issues.	Repair connections or replace harness.
	2.	Press brake pedals individually and check LED D15 turns on. If LED D15 turns on, then verify you can hear the solenoid energize. If LED D15 does not turn on, then test brake solenoid (J16) by moving plug to AUX (J2) on the PC Board - a good solenoid will energize immediately. Do not leave it plugged in for more than a few seconds to test it.	Check for a physical obstruction at the brake pin or a missing/broken spring.
Rotational brake will not release.	1.	Loose connections or short in brake solenoid harness to <u>J2</u> on Chair PCB.	Repair connections or replace harness.
	2.	Verify continuity on brake solenoid coil.	If coil shows open continuity, then replace solenoid.
Rotational brake will not lock.	1.	Spring attached to brake lever arm is missing or broken.	Replace spring.
Headrest difficult to adjust or does not stay in position.	1.	Verify the friction cam adjustment.	Reset the friction cam mechanism.
SerenEscape Remote Control Heat light blinks.	1.	Verify connection plugs on SerenEscape control box.	Secure connection(s).
	2.	Verify red cable connection in upholstered back.	Straighten bent pins. Wrap connections with electrical tape in a "figure 8" pattern.
	3.	Look for upholstered back, remote control or control box issues.	Replace upholstered back, remote control or control box, in this order.
Power light blinks.	1.	Verify connections at both ends of the SerenEscape power supply	Secure connections.
	2.	SerenEscape power supply voltage is incorrect. Should be between 10 - 14 VDC.	If voltage is incorrect, replace SerenEscape power supply.
One or both massage motors do not operate.	1.	Verify both black cable connections.	Secure black cable connections with electrical tape wrapped in a "figure 8" pattern.

Power to the Chair

This illustration shows the components that affect all chair functions. See following page for a more detailed description.



Models:	153810
Serial Numbers:	all

Power to the Chair

Facility Power

When the power cord is properly connected, facility power supplies 115 V~ (VAC) or 230 V~ (VAC) to the power inlet on the PC board.

Power Inlet

Supply voltage 115 V~ (VAC) or 230 V~ (VAC) comes thru the power inlet and passes thru three fuses on its way to the transformer.

Transformer

Supply line voltage 115 V~ (115 VAC) or 230 V~ (VAC) enters the transformer where it passes thru or is regulated to multiple, lower, V $\overline{=}$ (VDC) voltages by three regulators.

Regulators (hardware)

Electronic devices that regulate incoming 115 V~ (VAC) or 230 V~ (VAC) into more stable, V $\overline{=}$ (VDC) voltages used by the PC board.

PC Board

Circuitry on the PC board provides pathways for voltages to connected components as well as pathways for input signals to and from the micro-controller.

Micro-controller (software)

The micro-controller processes input signals received from users and sensors, then sends the appropriate output signals to activate electronically controlled components.

115 V~ (VAC) or 230 V~ (VAC) Supply voltage is supplied to:

Brake Release Solenoid thru J16
Hydraulic Pump thru J15
Hydraulic Valve Solenoids thru J1
Auxiliary Output thru J2

Regulated voltages:

12 V $\overline{=}$ (VDC) is supplied to:

Safety Limit Switches thru J4
Optional Cuspidor Safety Switch thru J6
Brake Safety Switch and Power ON Light thru J8
Communication Ports for Control Devices and J-Box connections J9 thru J12
Optional Cuspidor Power Connection thru J5
Optional Light Communication thru TB1

Note

The same regulated voltage distributed to multiple devices is commonly called a BUS.

5 V $\overline{=}$ (VDC) is supplied to:

Test Port thru J14
Micro-controller

3 V $\overline{=}$ (VDC) is supplied to:

Back Tilt sensor thru J13

Power ON Light

When proper power is supplied to the PC Board, the power ON light illuminates.

Note

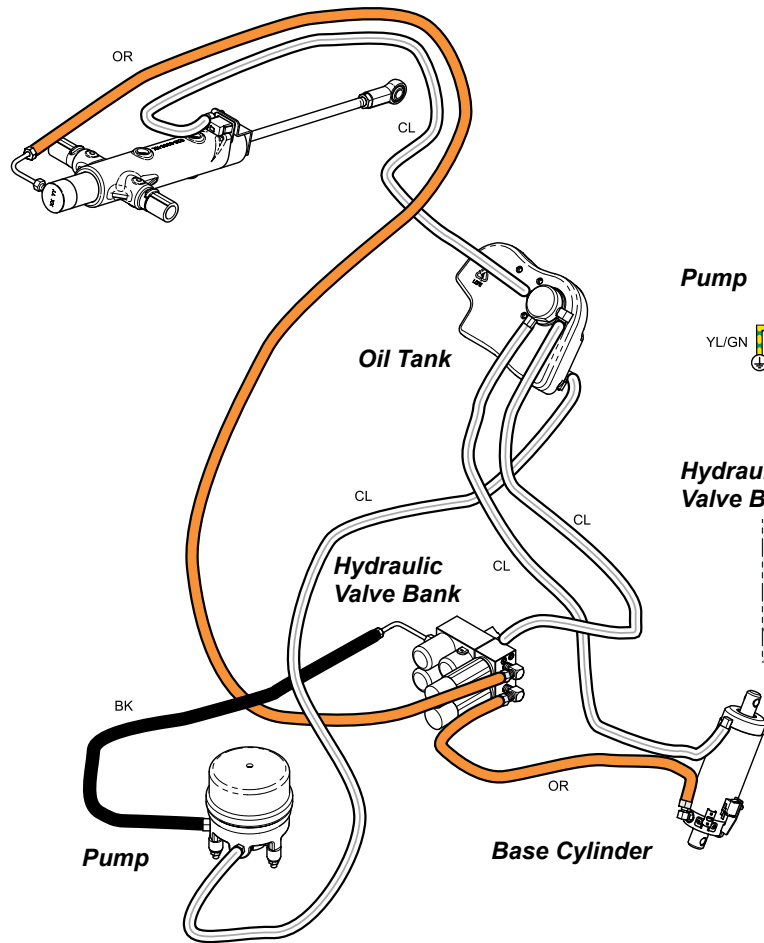
The Power ON light operates on regulated voltage coming directly from the 12 V $\overline{=}$ (VDC) BUS. The micro-controller has no connection to this light.

Models:	153810	
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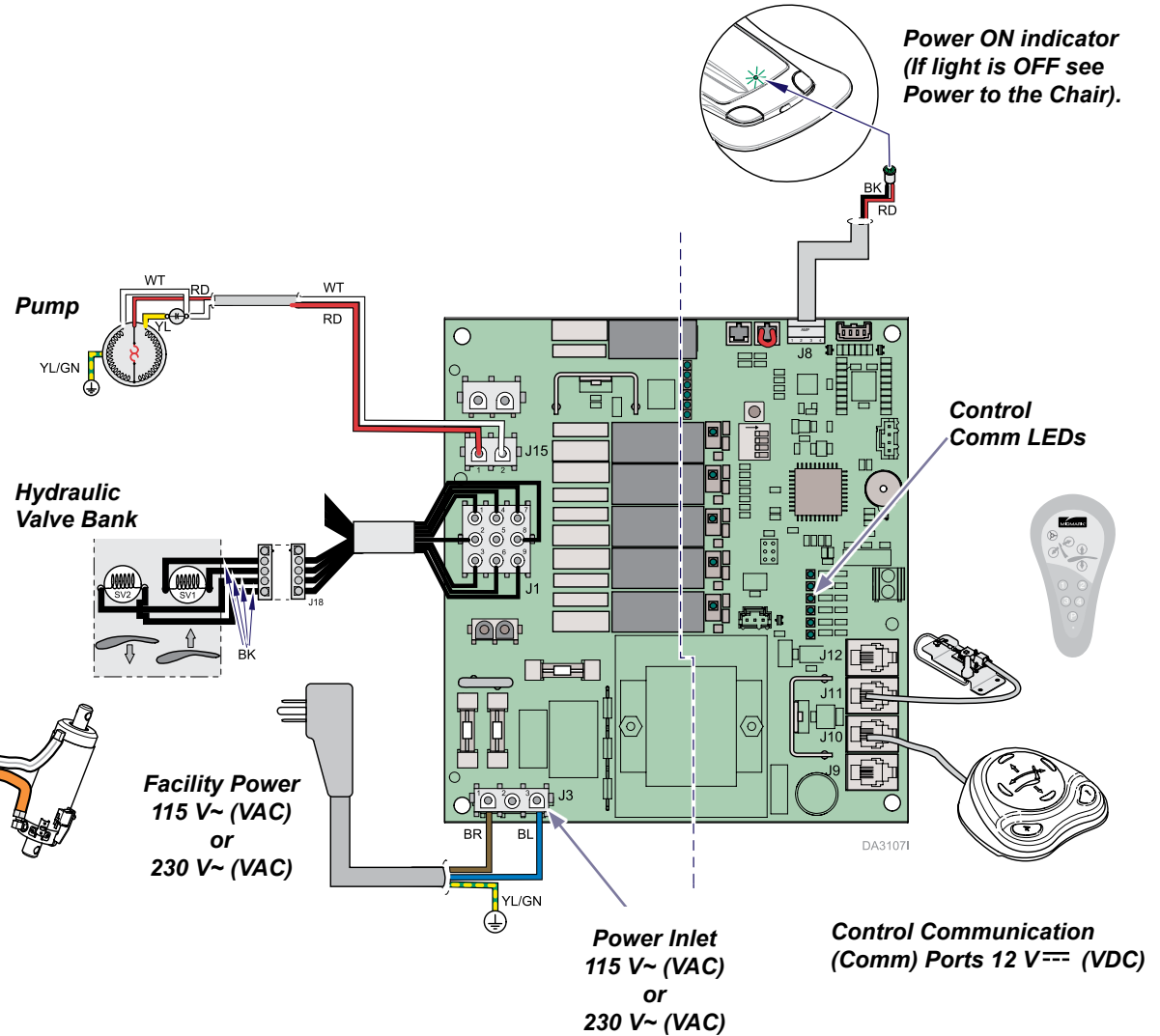
Base UP / DOWN Function

This illustration shows the components involved in the Base Up / Down function. See following page for more detailed description of the function.

Hydraulics



Electrical



Models:	153810
Serial Numbers:	<i>all</i>

Base UP / DOWN Function

Is there Power to the Chair?

When voltage is present at J3 on the PC Board the Power light is ON.

(Refer to **Power to the Chair** more information)

Electric Power to Controls

PC board components supply line and regulated voltages to components involved in the functions.

Hydraulic Power to Controls

The pressurized oil system provides fluid for all hydraulic operations.

[Link to Checking Oil Level](#) for more information

Relevant voltage readings:

115 V~ (VAC) at J3, Power inlet. (Read pins 1 & 3)

115 V~ (VAC) at J15, Pump Motor. (Read pins 1 & 2)

115 V~ (VAC) at J1 (Hydraulic Valve Bank)

Read pins 9 + 1, 2, or 3 for Base UP

Read pins 6 + 1, 2, or 3 for Base DOWN

Look at LEDs for the J9 - 12, Control (Comm)
Communication Ports to verify power and activity
LED ON = device connection is seen by software
LED BLINKING = comm port is receiving a command from a user

Base Up

When a Base Up button is pressed, the control device senses the command and converts it to an electronic signal. This signal is sent, thru the air, to the remote control base antenna (if wireless remote button was pressed) or by wire (if wired control button was pressed) to the chair PC board.

The PC board supplies 115 V~ (VAC) to turn the Pump on, then, 115 V~ (VAC) to the Base Up Solenoid to open the Base Up valve.

As the Pump Motor runs, fluid is pumped thru the open Base Up valve, filling the base cylinder, extending the shaft and raising the base.

The PC board monitors sensory devices throughout the chair and determines if all pre-conditions required for the function are met.

Base continues up until:

1. Base Up button is released.
2. Base reaches upper extent.
3. Thermal overload on the pump trips.
Thermal overload switch resets after approximately ten minutes cooling time.)

Base Down

When a Base Down button is pressed, the control device senses the command and converts it to an electronic signal. This signal is sent, thru the air, to the remote control base antenna (if wireless remote button was pressed) or by wire (if wired control button was pressed) to the chair PC board.

The PC board supplies 115 V~ (VAC) to the Base Down Solenoid which opens the Base Down valve. Gravity pulls the hydraulic fluid out of the base cylinder, into the oil tank, lowering the base cylinder shaft and the base.

Base continues down until:

1. Base down button is released.
2. Base reaches lower extent.
3. Collision Protection System activates.

Note

The PC Board constantly monitors safety limit switches and sensory devices on the chair.

The Collision Protection System activates when a chair cover (equipped with a safety limit switch) hits an object as it is moving down.

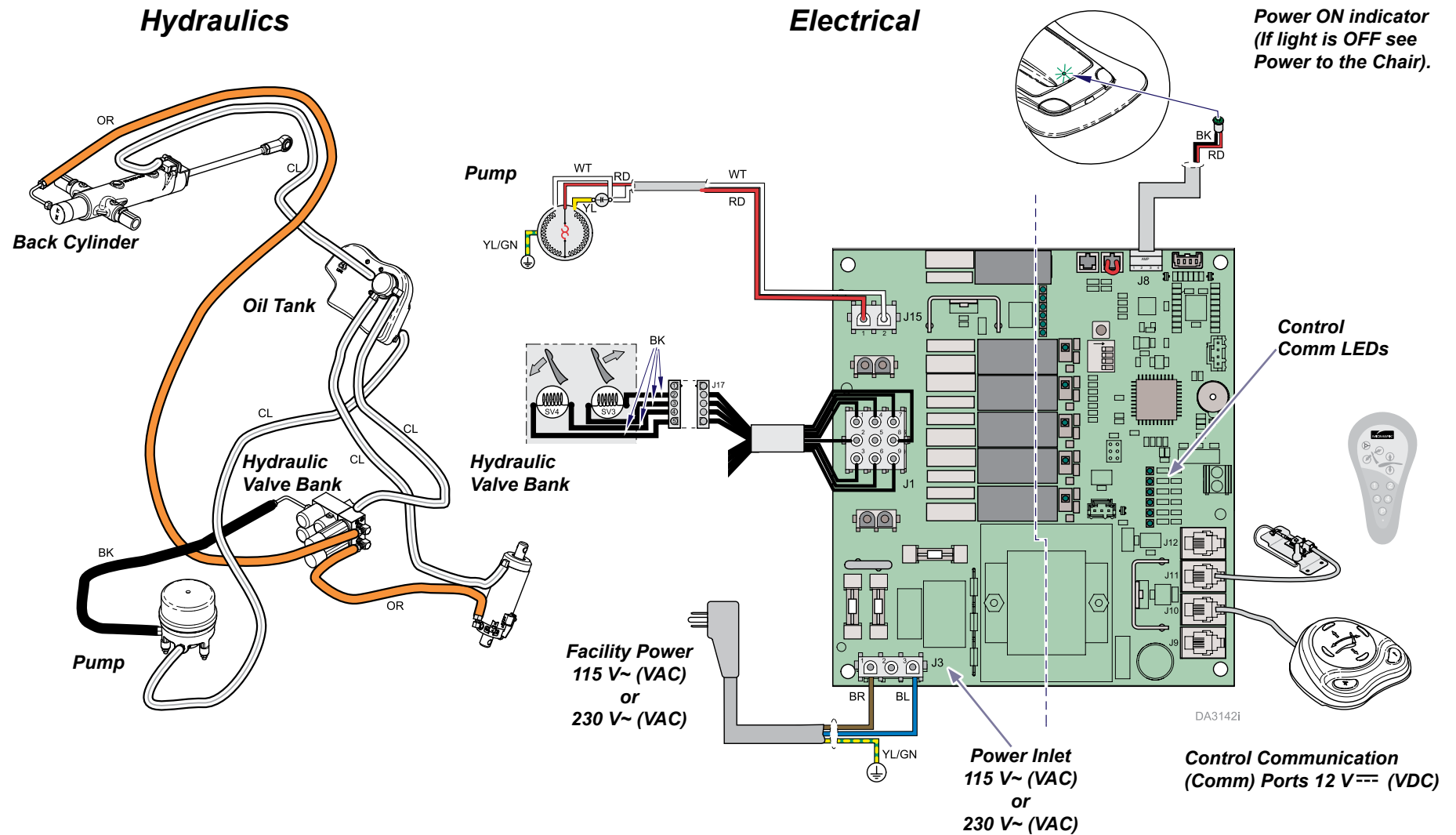
The chair stops and raises slightly to disengage contact; The chair also beeps until the control button is released.

Normal operation can resume once the object is removed and the safety limit switch becomes inactive.

Models:	153810
Serial Numbers:	<i>all</i>

Back UP / DOWN Function

This illustration shows the components involved in the Back Up / Down function. See following page for more detailed description of the function.



Models:	153810	
Serial Numbers:	<i>all</i>	

Back UP / DOWN Function

Is there Power to the Chair?

When voltage is present at J3 on the PC Board the Power light is ON.

(Refer to **Power to the Chair** more information)

Power to Controls

PC board supplies 12 V $\equiv$ (VDC) to J9 thru J12 control pad communication ports.

Relevant voltage readings:

115 V~ (VAC) at J3, Power inlet. (Read pins 1 & 3)

115 V~ (VAC) at J15, Pump Motor. (Read pins 1 & 2)

115 V~ (VAC) at J1 (Hydraulic Valve Bank)

Read pins 7 + 1, 2, or 3 for Back UP

Read pins 8 + 1, 2, or 3 for Back DOWN

Look at LEDs for the J9 - 12, Control (Comm) Communication Ports to verify power and activity
LED ON = device connection is seen by software
LED BLINKING = comm port is receiving a command from a user

Back Up

When a Back Up button is pressed, the control device senses the command and converts it to an electronic signal. This signal is sent, thru the air, to the remote control base antenna (if wireless remote button was pressed) or by wire (if wired control button was pressed) to the chair PC board.

Outputs are activated in this sequence:

1. Pump Relay (D13)
2. Pump Triac (D1)
3. Back Up Relay (D12)

The PC board supplies 115 V~ (VAC) to turn the Pump on, then, 115 V~ (VAC) to the Back Up Solenoid to open the Back Up valve.

As the Pump Motor runs, fluid is pumped thru the open Back Up valve, filling the back cylinder, extending the shaft and raising the back.

The PC board monitors sensory devices throughout the chair and determines if all pre-conditions required for the function are met.

Back continues up until:

1. Back Up button is released.
2. Back reaches upper extent.
3. Thermal overload on the pump trips.
(Thermal overload switch resets after approximately ten minutes cooling time.)

Motion stops in this sequence:

1. Back Up Relay (D12) turns off
2. Pump Triac (D1) turns off
3. If no further movement after a few seconds, the Pump Relay (D13) turns off.

Back Down

When a Back Down button is pressed, the control device senses the command and converts it to an electronic signal. This signal is sent, thru the air, to the remote control base antenna (if wireless remote button was pressed) or by wire (if wired control button was pressed) to the chair PC board.

If all safety bail limit switches are closed, the Back Down Relay (D11) is activated.

The PC board supplies 115 V~ (VAC) to the Back Down Solenoid which opens the Back Down valve. Gravity pulls the hydraulic fluid out of the back cylinder back into the oil tank, lowering the back cylinder shaft and the back.

Back continues down until:

1. Back down button is released.
2. Back reaches lower extent.
3. Collision Protection System activates.

Note

The PC Board constantly monitors safety limit switches and sensory devices on the chair.

The Collision Protection System activates when a chair cover (equipped with a safety limit switch) hits an object as it is moving down.

The chair stops and raises slightly to disengage contact; The chair also beeps until the control button is released.

Normal operation can resume once the object is removed and the safety limit switch becomes inactive.

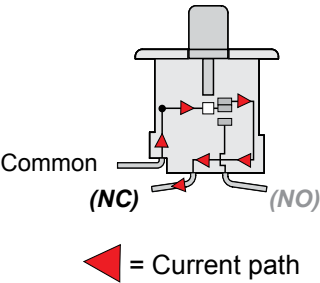
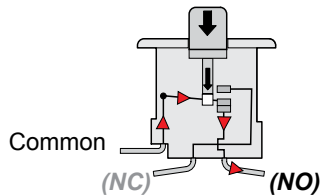
Models:	153810
Serial Numbers:	<i>all</i>

Collision Protection System and the Home Function

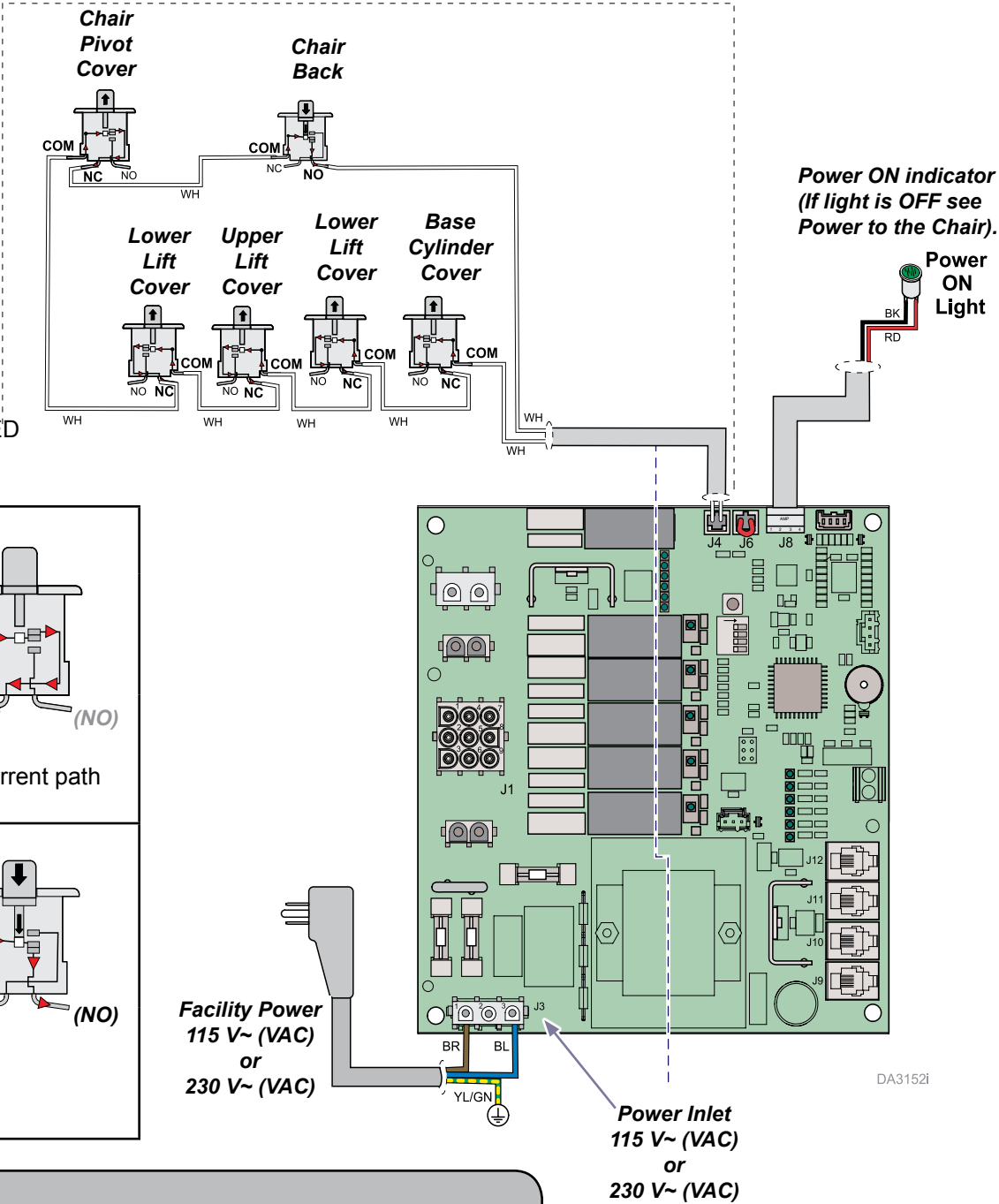
This illustration shows the safety bail limit switches involved in this system. See following page for a more detailed description of how this system works.

How Safety Bail Limit Switches Work

Switches can be used as Normally OPEN or Normally CLOSED devices. The switch name describes the rest (normal) state. The active state is opposite the normal state.

Normally CLOSED (NC) Switch		
Normal State	Plunger UP Current flows thru switch and exits NC path	
Active State (Not Shown)	Plunger DOWN Current flows into switch and exits NO path	
Normally OPEN (NO) Switch		
Normal State	Plunger DOWN Current flows into switch and exits NO path	
Active State (Not Shown)	Plunger UP Current flows thru switch and exits NC path	

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Serial Numbers:	all



Collision Protection System and the Home Function

The system:

The chair has six safety bail limit switches wired in series mounted in these areas:

- Lower Pivot Cover
- Upper Lift Arm Cover
- Lower Lift Arm Cover (right and left sides)
- Base Cylinder Cover
- Chair Back

All of these switches are normally closed switches except for the Chair Back switch, which is a normally open switch.

How functions are disabled:

1. When a cover equipped with a normally closed switch makes contact with an object as the base is moving downward, the switch opens.
2. When the back makes contact with an object as the back is moving downward, the switch actuator bracket moves away from the normally open switch, closing it.

When any safety bail switch moves out of its normal position, power is removed from the Base and Back Down Hydraulic Valve Bank solenoids.

After an obstruction is hit, the base (or back) stops lowering and raises a little so the object can be removed.

How are functions resumed:

1. Release the down control button.
2. Remove the object obstructing downward movement.
3. Press control buttons to resume operation.

The Home Function

The home position is a software directed base height, back up position convenient for installation procedures or patient access.

Tap any lift arm or a pivot cover three times to activate the home function.

Note

The chair beeps as it moves and stops beeping when it reaches the home position.

Relevant voltage readings:

115 V~ (VAC) at J3, Power inlet. (Read pins 1 & 3)

12 V== (VDC) at J4 Limit Switch Connector

LED indicators:

Look at LED D17 to read status of all safety bail switches .

LED ON = all switches are in normal state

LED OFF = one or more switches is active

Note

The PC Board constantly monitors safety limit switches and sensory devices on the chair.

The Collision Protection System activates when a chair cover (equipped with a safety limit switch) hits an object as it is moving down.

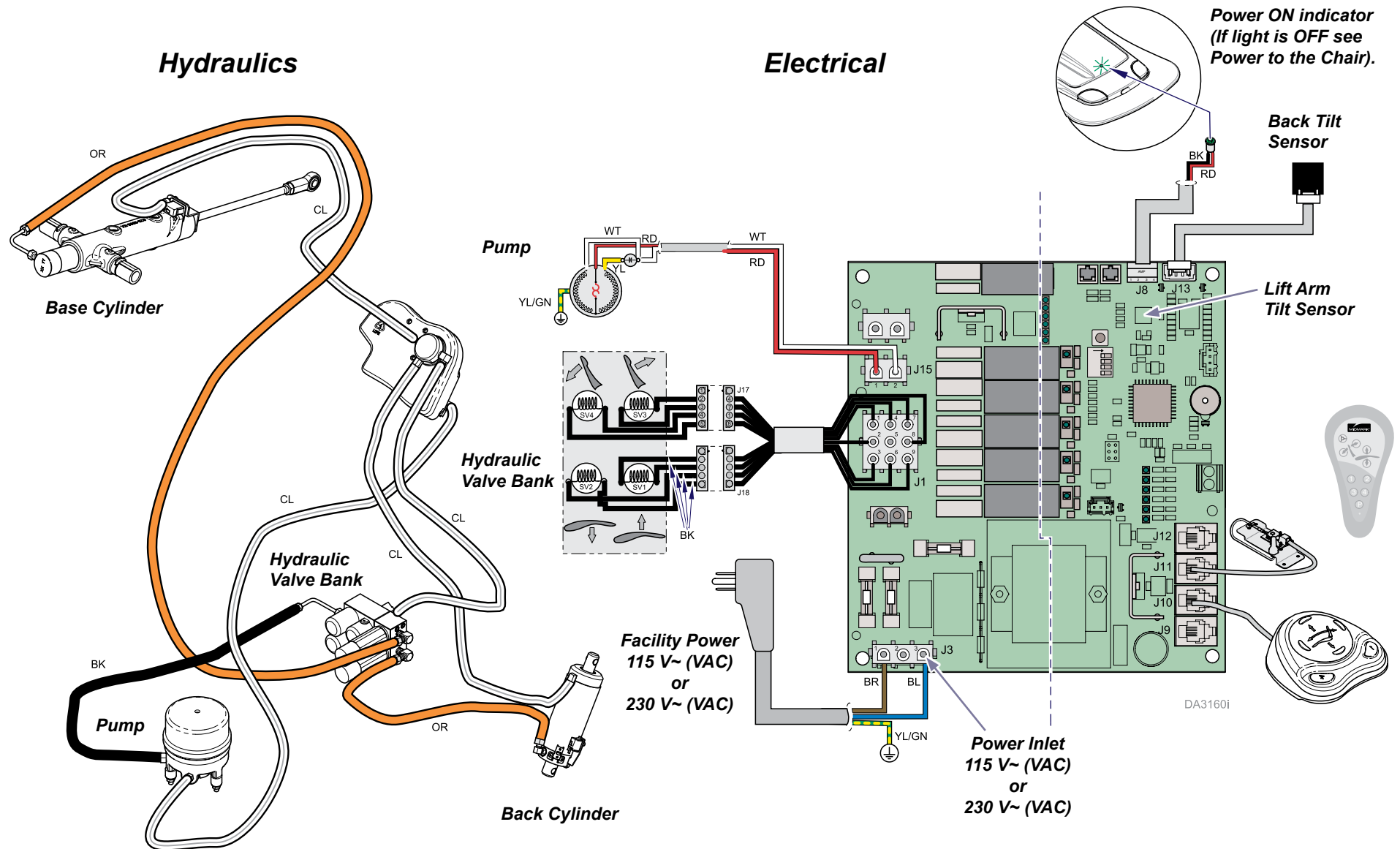
The chair stops and raises slightly to disengage contact; The chair also beeps until the control button is released.

Normal operation can resume once the object is removed and the safety limit switch becomes inactive.

Models:	153810	
Serial Numbers:	<i>all</i>	

Position Programming

This programming function allows a user to program and store up to four specified seat and back position configurations for a quick single button recall. See following page for a more detailed description of how this system works.



Models:	153810
Serial Numbers:	<i>all</i>

Position Programming

The system:

Two tilt sensors (accelerometers) constantly monitor positions, relative to the floor, of the lift arm (base) and the back. This data is transmitted to the PC board where the software stores it, enabling a user specified position to be recalled using a single programmed, position button.

Recalling a programmed position:

When a programmed position is recalled, the PC board software activates all the required functions (at the same time) to return the base and back to the same coordinates the software has stored for that programmed button.

Relevant voltage readings:

115 V~ (VAC) at J3, Power inlet. (Read pins 1 & 3)
115 V~ (VAC) at J15, Pump Motor. (Read pins 1 & 2)
115 V~ (VAC) at J1 (Hydraulic Valve Bank)
Read pins 7 + 1, 2, or 3 for Back UP
Read pins 8 + 1, 2, or 3 for Back DOWN
Read pins 9 + 1, 2, or 3 for Base UP
Read pins 6 + 1, 2, or 3 for Base DOWN

Look at LEDs for the J9 - 12, Control (Comm)
Communication Ports to verify power and activity
LED ON = device connection is seen by software
LED BLINKING = comm port is receiving a command from a user

To program a button to a specified position....

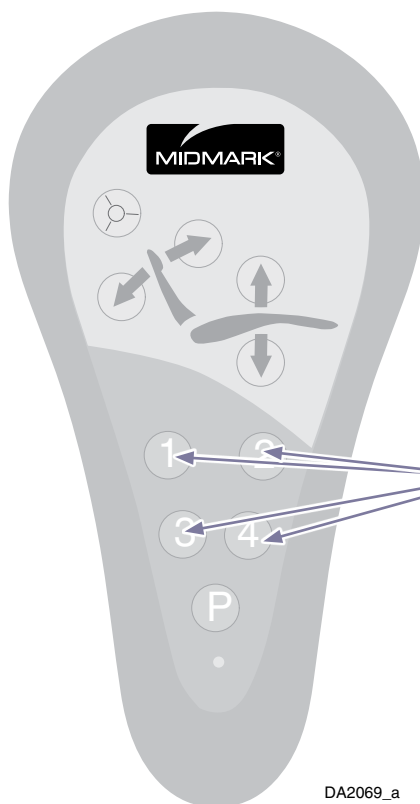
- A) Use the arrow buttons to move the chair to desired position.
- B) Press and hold any position button two seconds to set it for that position. The chair beeps three times to indicate the button is programmed.

To recall a programmed position....

- A) Press the desired position button (1, 2 3 or 4). The chair will move to the programmed coordinates stored for that button.

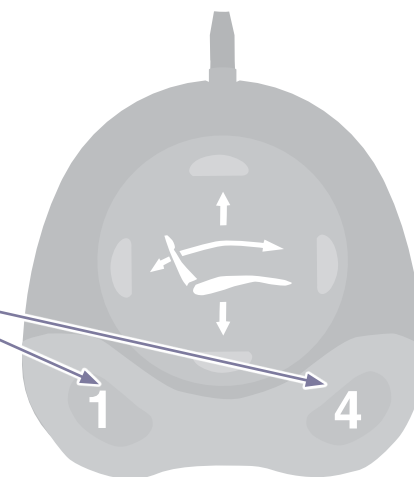
Note

The chair can be stopped any time during a programmed positioning sequence by pressing any other button on the control device.



DA2069_a

Position Buttons

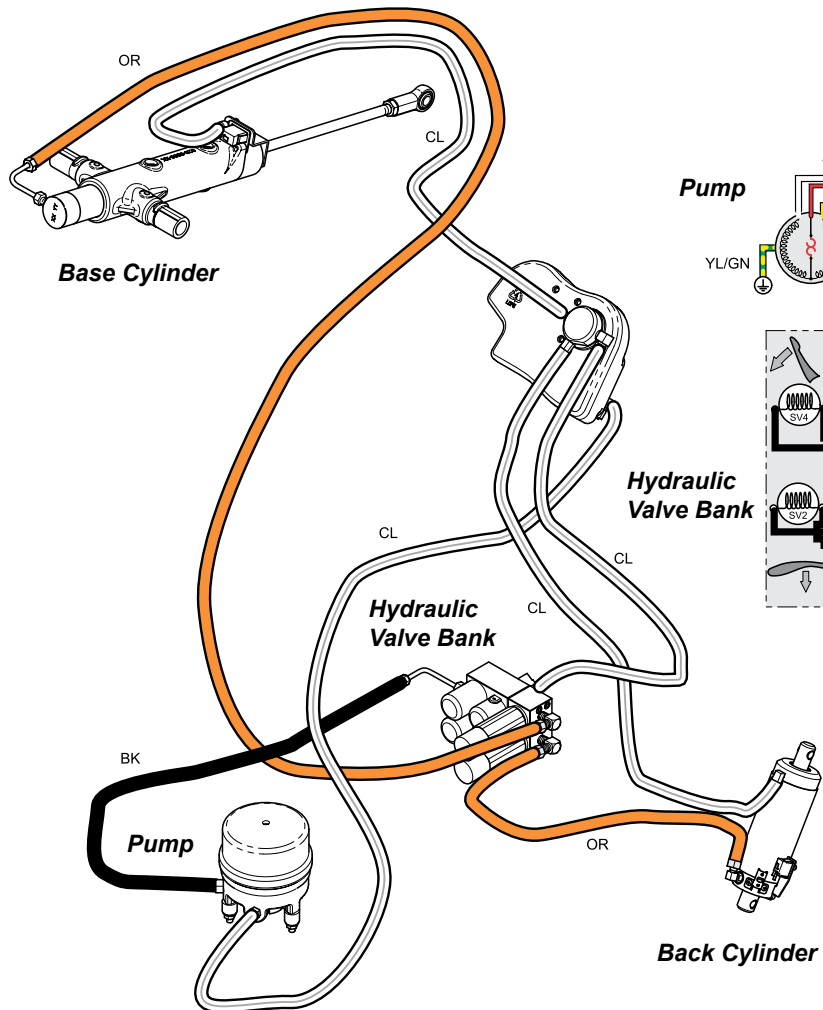


Models:	153810
Serial Numbers:	<i>all</i>

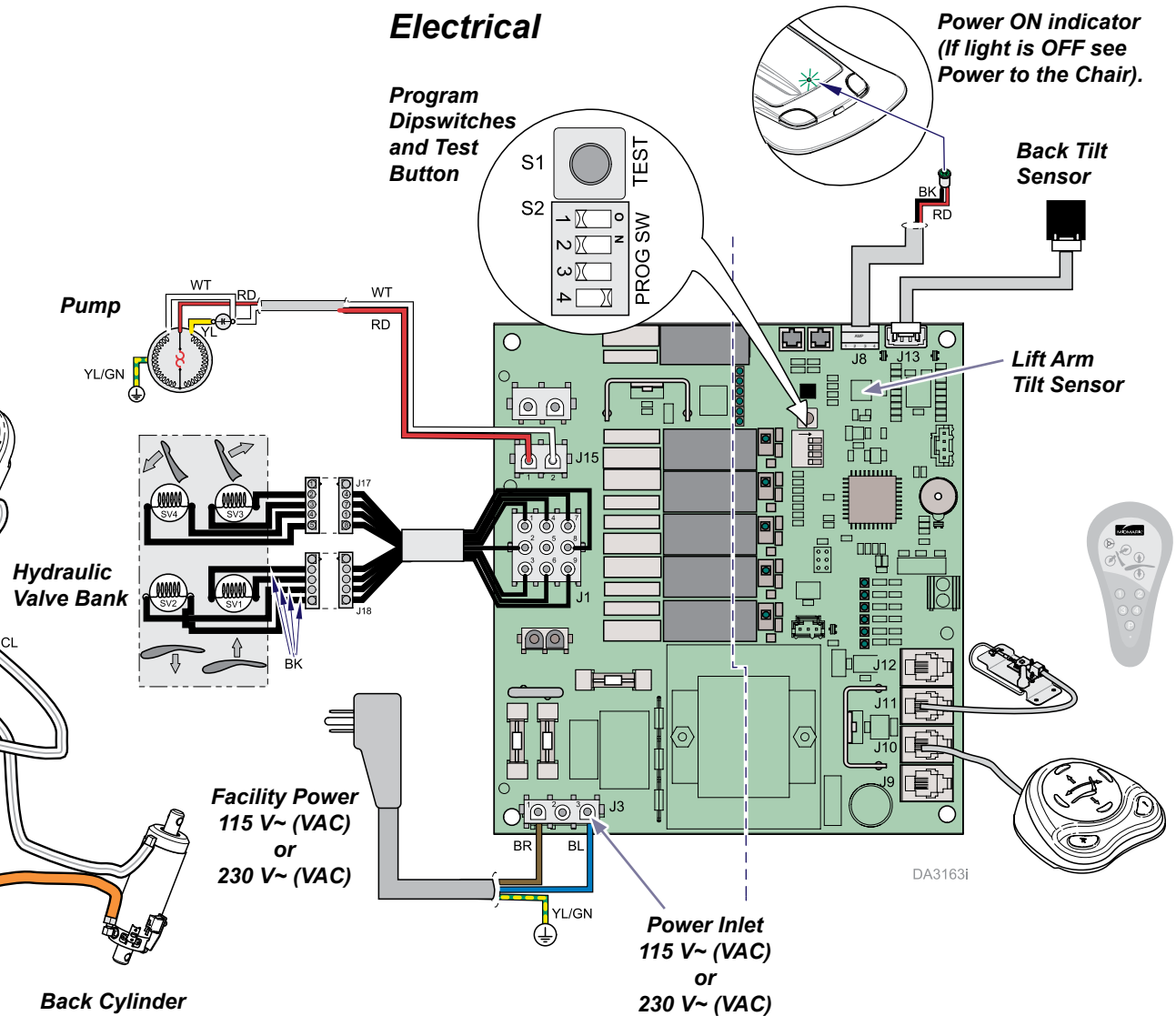
Chair Calibration and the Override Function

Chair Calibration is an automated routine of software controlled outputs working with continuous sensory inputs that keep the chair moving with precision, within an acceptable range of extents. The Override function allows a user to move the chair anytime it is powered, by bypassing software directed chair movements. See following page for a more detailed description of how this system works.

Hydraulics



Electrical



Models:	153810
Serial Numbers:	<i>all</i>

Chair Calibration and the Override Function

Chair Calibration is an automated, software directed routine of chair movements that identifies and stores data expressing the full range of acceptable chair movements. The Override function allows a user to move the chair anytime it is powered, by bypassing software directed chair movements.

The system:

Two tilt sensors (accelerometers) constantly monitor positions, relative to the floor, of the lift arm (base) and the back. This data is transmitted to the PC board where the software uses it locate the ends of travel points, calculate working values for these points and store these values in memory.

Chair Calibration

Calibration is an automated routine of the full range of back and seat movements performed to collect, calculate and store data that expresses this motion in the software's "language" and then test the results of the routine.

[Link to Chair Calibration Procedure](#)

Manual Calibration

Manual calibration is a modified version of the chair calibration routine, allowing a user to manually set the travel limits of the seat and back for a customized application.

[Link to Manual Chair Calibration Procedure](#)

Override Function

The wireless remote has an override function, activated by pressing and holding the P button and any arrow button simultaneously.

The override function allows a user to raise or lower the seat or back any time the chair is powered. The override function is directed by the user's button inputs, which override software directed inputs.

Relevant voltage readings:

115 V~ (VAC) at J3, Power inlet. (Read pins 1 & 3)
115 V~ (VAC) at J15, Pump Motor. (Read pins 1 & 2)
115 V~ (VAC) at J1 (Hydraulic Valve Bank)
Read pins 7 + 1, 2, or 3 for Back UP
Read pins 8 + 1, 2, or 3 for Back DOWN
Read pins 9 + 1, 2, or 3 for Base UP
Read pins 6 + 1, 2, or 3 for Base DOWN

Look at LEDs for the J9 - 12, Control (Comm) Communication Ports to verify power and activity
LED ON = device connection is seen by software
LED BLINKING = comm port is receiving a command from a user

Note

Dipswitch #4 must be moved to the ON position to perform calibration.

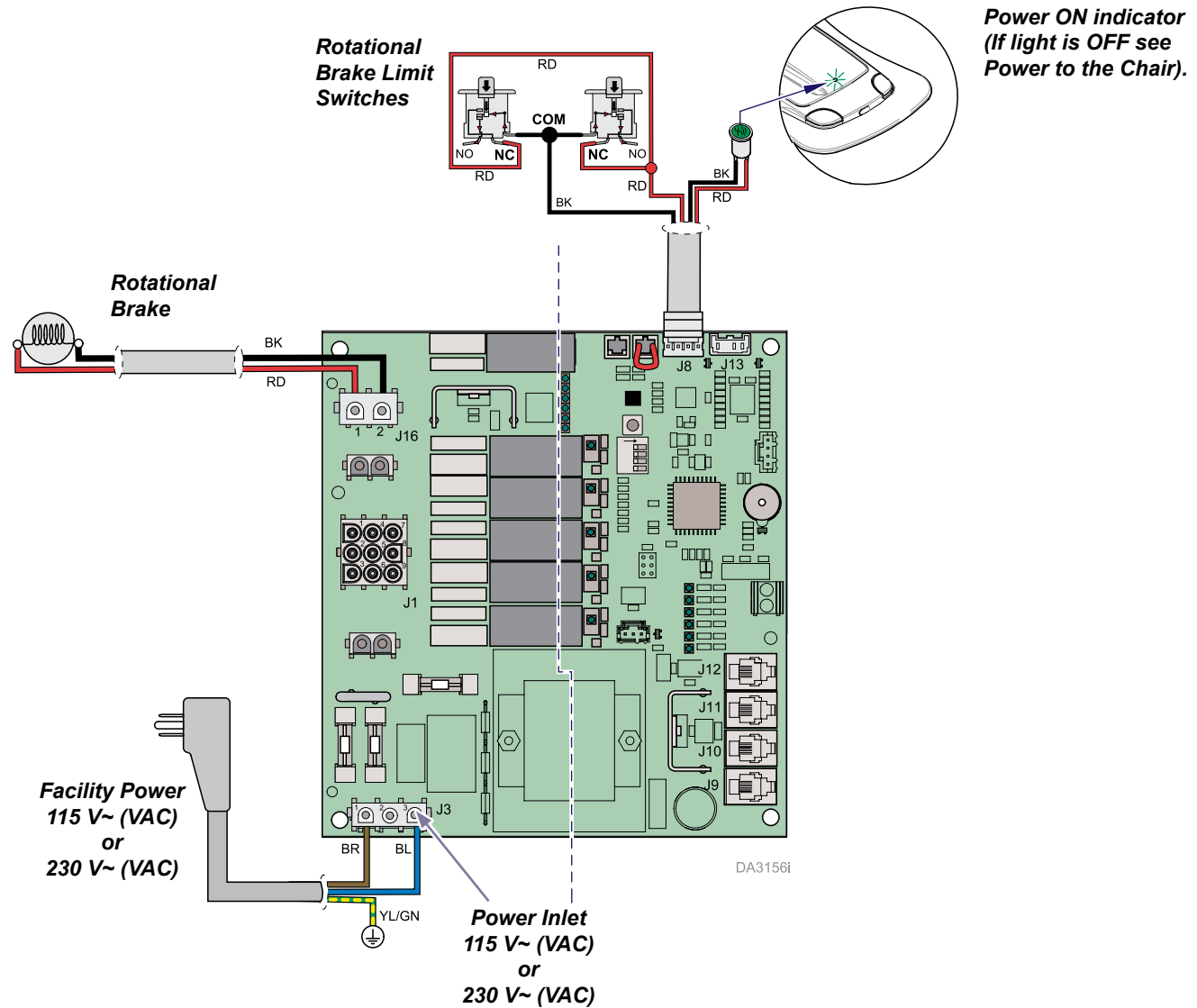
Dipswitch #4 must be moved to the OFF position for normal operation of the chair.

Always cycle the power off/on when changing the dipswitch position.

Models:	153810	
Serial Numbers:	<i>all</i>	

Rotational Brake and Lockout Feature

This illustration shows only the rotational brake components. For more details on how it works see the next page.



Models:	153810
Serial Numbers:	<i>all</i>

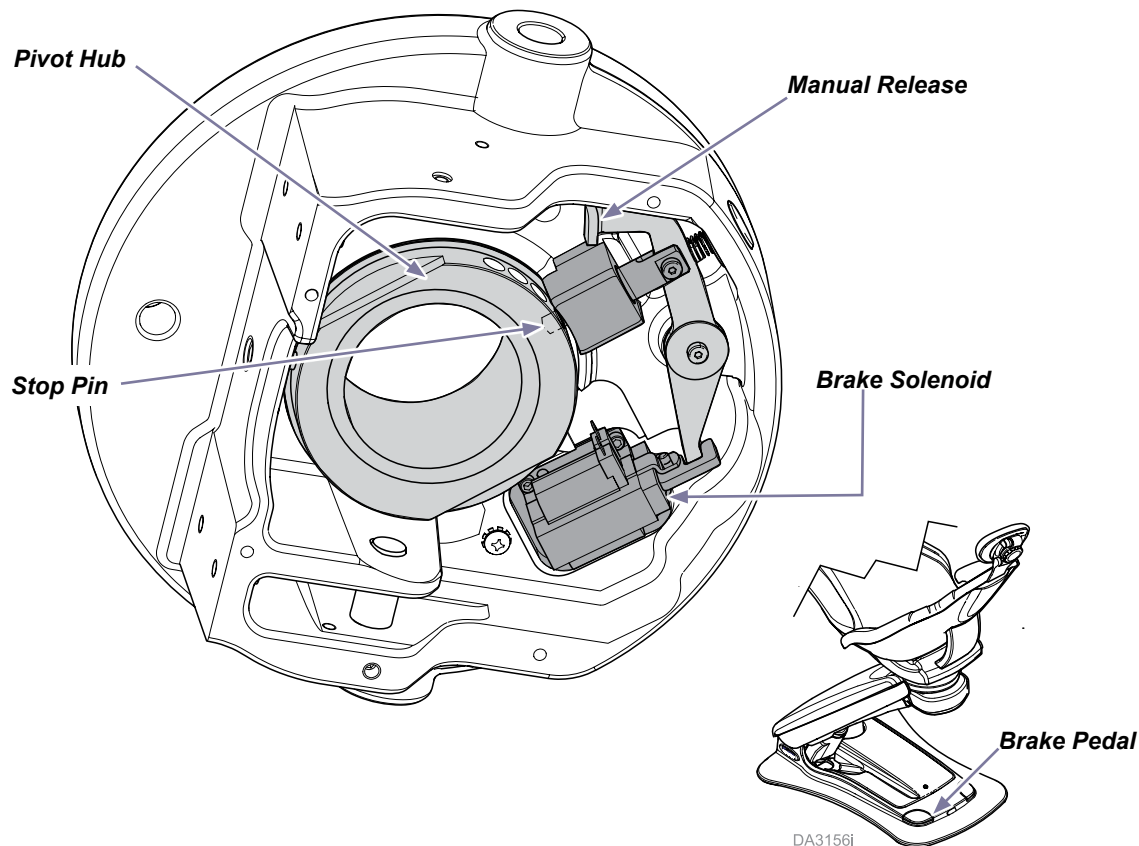
Rotational Brake and Lockout Feature

An electric rotational brake holds the chair in place by inserting a stop pin into one of a series of holes spaced around the pivot hub. A software controlled lockout feature completely locks out all chair movement when activated.

The system:

Stepping on either brake release pedal on the chair base frame, closes a limit switch enabling the brake solenoid to activate, drawing in the stop pin and allowing the chair to rotate freely.

When the brake pedal is released, the solenoid releases the spring-loaded stop pin, allowing it to pop into the next hole it comes to in the pivot hub.



Lockout Feature:

A lockout feature is provided to disable all electronic controls on the chair to prevent unintentional use.

To activate the lockout feature, press either of the brake release pedals five times in succession. The chair beeps five times to indicate it is locked out. (Buttons on control devices and the brake release pedals will no longer work.)

To release the lockout feature, press either of the brake release pedals five times in succession. The chair again beeps five times to indicate it is **unlocked**. (Buttons on control devices and the brake release pedals will function normally again.)

Relevant voltage readings:

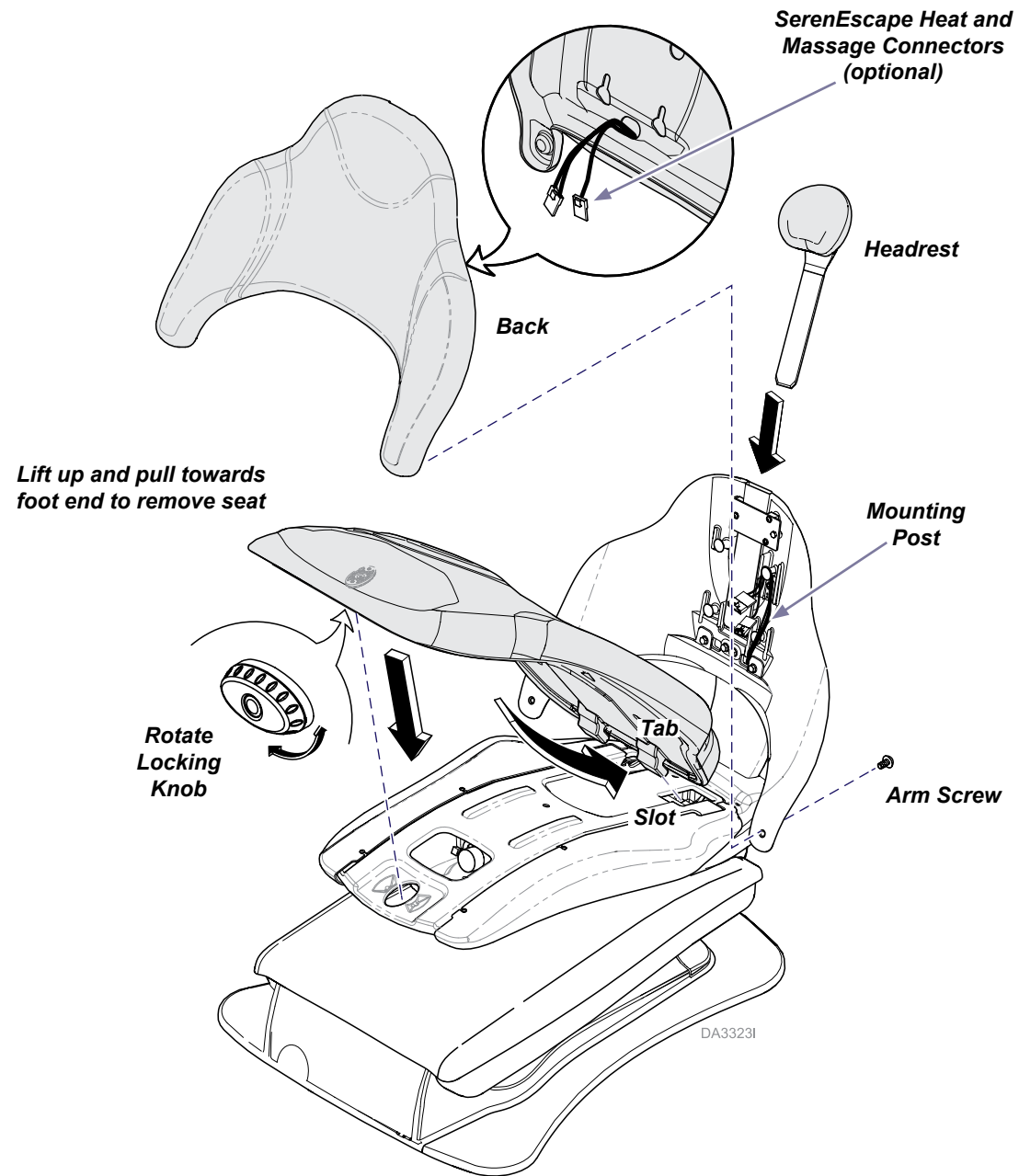
115 V~ (VAC) at J3, Power inlet. (Read pins 1 & 3)

115 V~ (VAC) at J16, Rotational Brake (Read pins 1 & 2)

12 V== (VDC) at J8, for Power Light and Brake Limit Switches

Models:	153810	
Serial Numbers:	<i>all</i>	

Upholstery



Models:	153810	
Serial Numbers:	<i>all</i>	

Lift Arm and Base Front Covers

Step 1: Raise chair and disconnect power supply.

- A) Raise chair approximately 26 to 28" from floor.
- B) Disconnect power supply from chair.



Equipment Alert

Tap a lift arm or lower pivot cover three times to raise the chair to the pre-programmed "home" position; a convenient height for installation or patient access.

The chair beeps until it reaches the home position.



WARNING

Always disconnect chair from the power source before removing any covers. Failure to do so may result in personal injury.

Step 2: Remove upper arm lift cover.

- A) Push clips in with a slotted screwdriver to release clips.
- B) Lift upper arm lift cover up to free front clips from shaft.



Lower Lift Arm Cover

Upper Lift Arm Cover

Base Front Cover

Step 4: Remove lower arm lift cover.

- A) Working one side at a time, move cover to the side and back to free it from mounting pins.

Step 3: Remove base front cover.

- A) Grasp bottom of base front cover
- B) Rotate up and out to remove.

Models:	153810	
Serial Numbers:	all	

Pivot and Base Covers

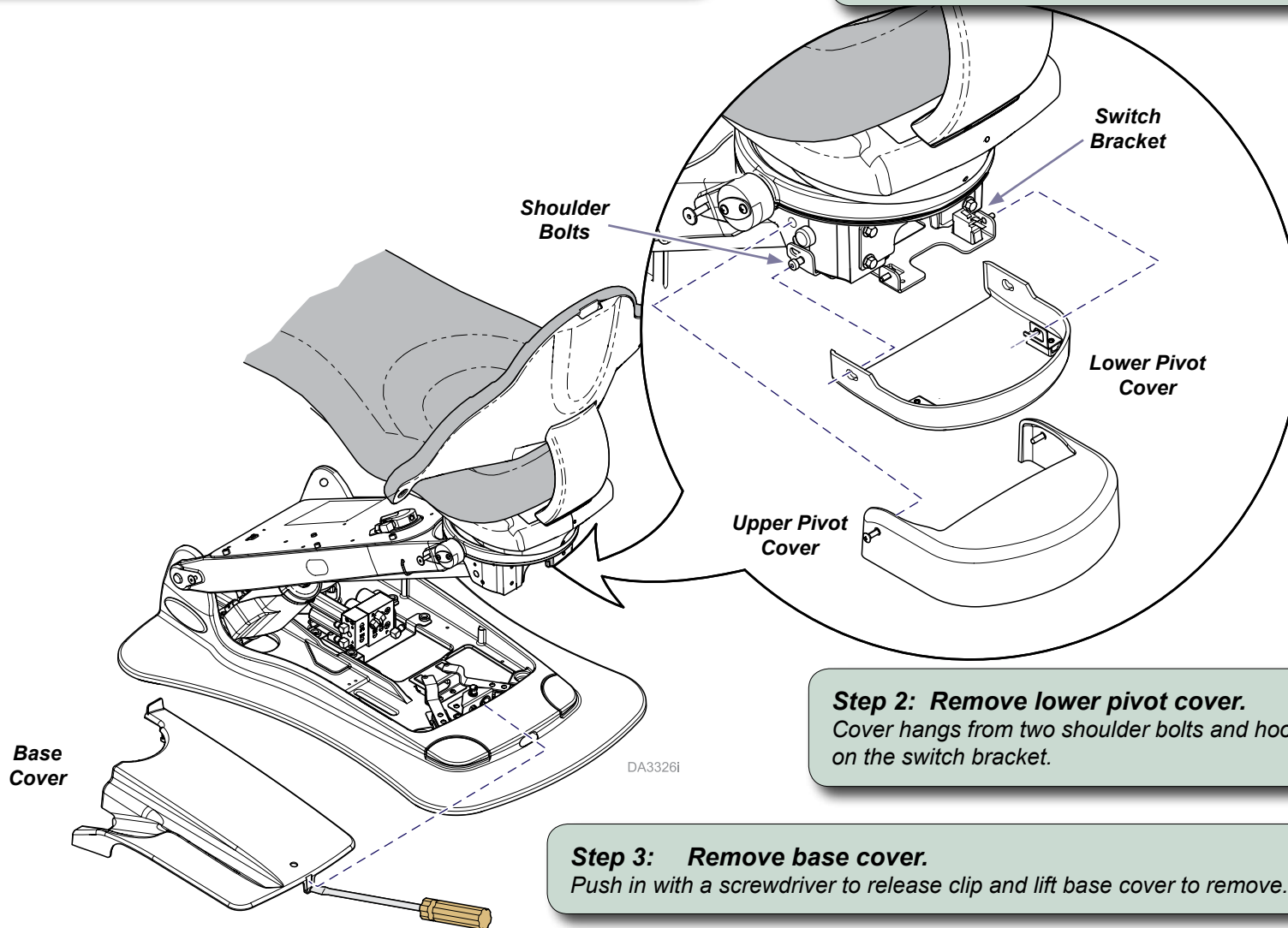


WARNING

Always disconnect chair from the power source before removing any covers. Failure to do so may result in personal injury.

Step 1: Remove upper pivot cover.

Two screws mount the upper pivot cover on the chair pivot.



Step 2: Remove lower pivot cover.

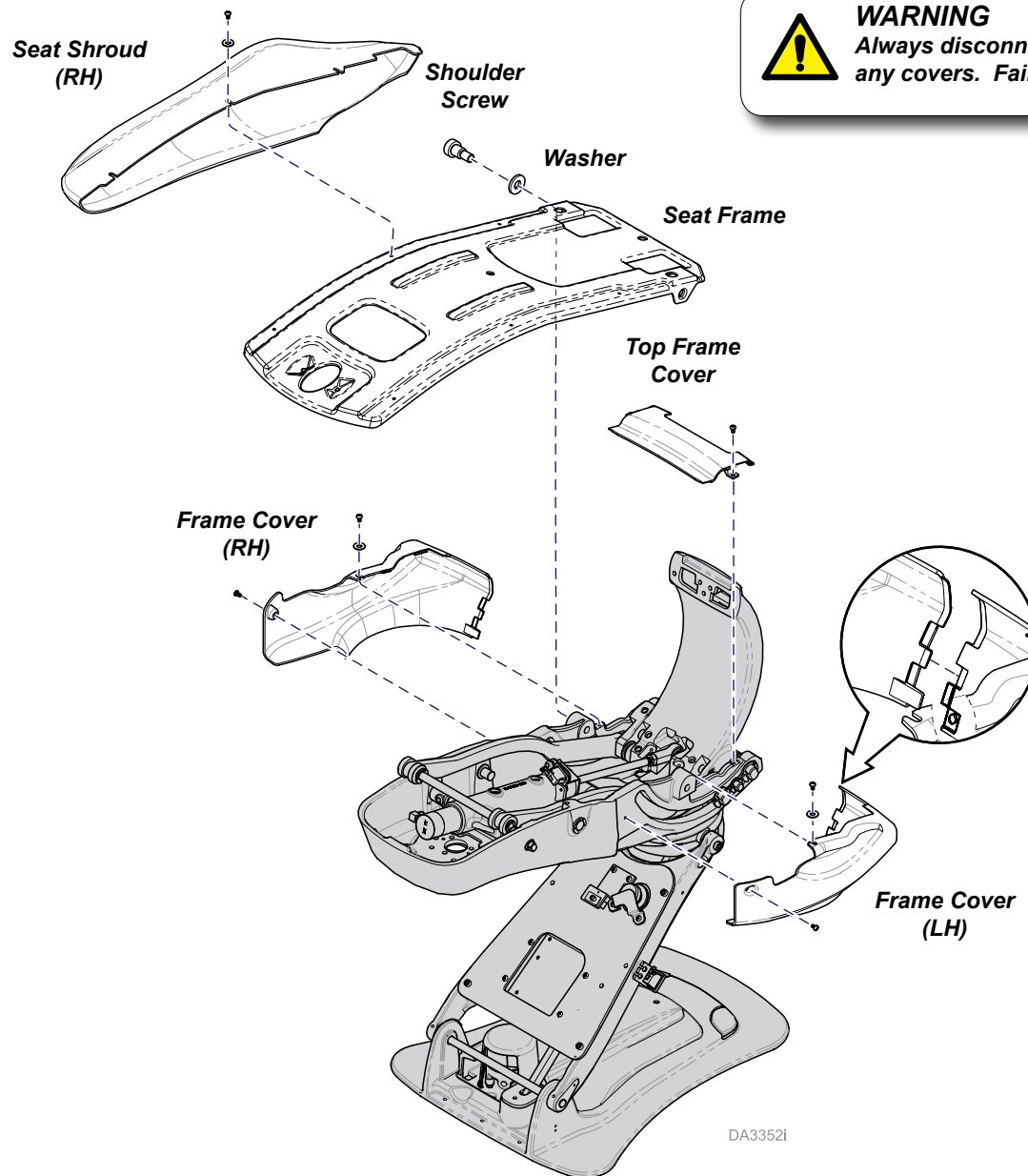
Cover hangs from two shoulder bolts and hooks over two pins on the switch bracket.

Step 3: Remove base cover.

Push in with a screwdriver to release clip and lift base cover to remove.

Models:	153810
Serial Numbers:	<i>all</i>

Seat Shrouds and Frame Covers

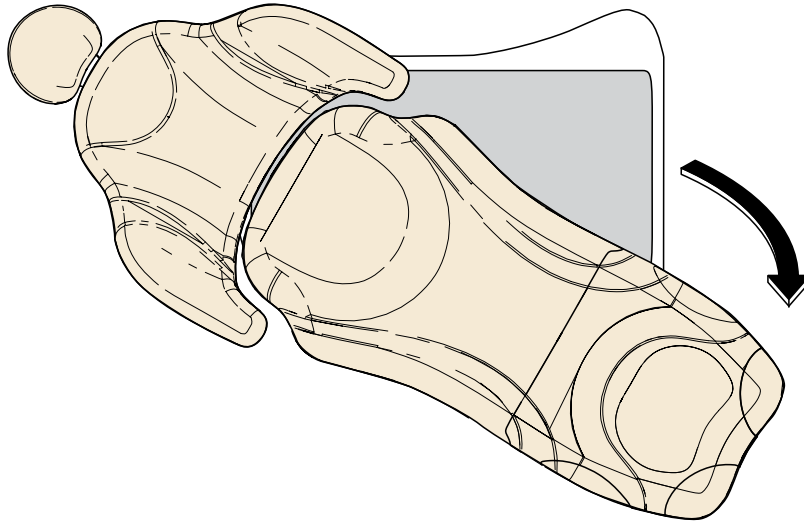


WARNING

Always disconnect chair from the power source before removing any covers. Failure to do so may result in personal injury.

Models:	153810
Serial Numbers:	<i>all</i>

Checking Oil Level



Step 1: Position chair.

- A) Rotate chair to the right for more room to work.
- B) Tap a lift arm cover three times to raise chair to the home position.
- C) Lower back until level with seat.
- D) Disconnect chair from power supply.

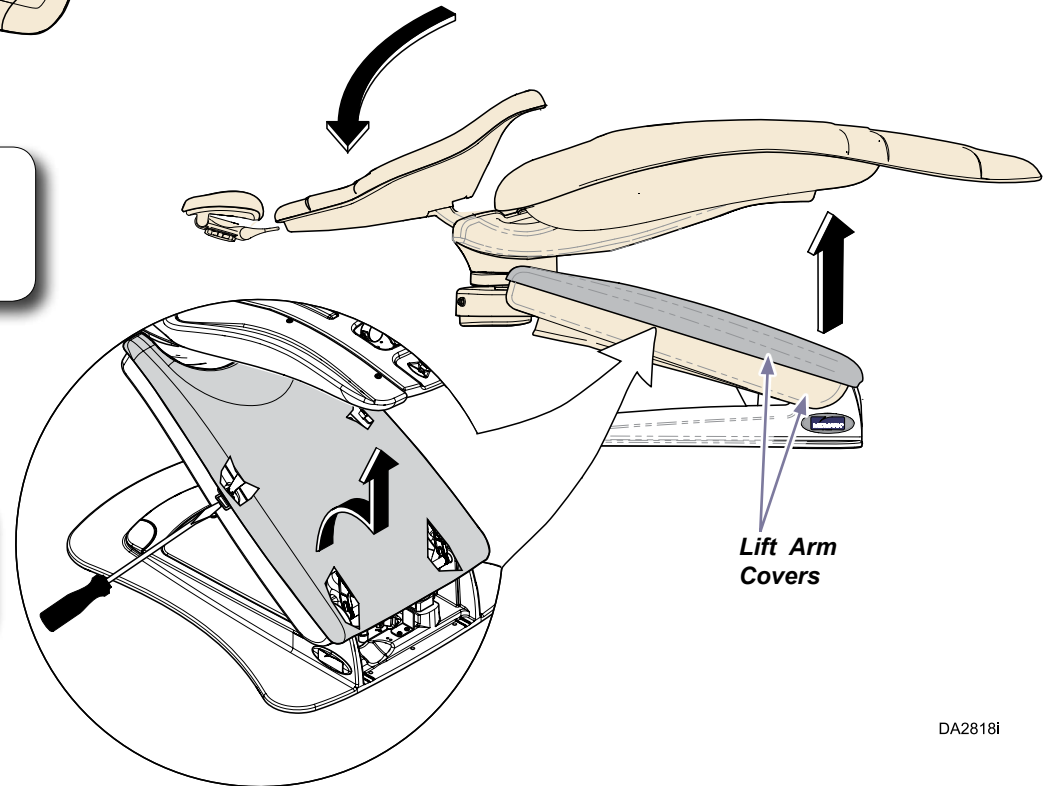


WARNING

Always disconnect chair from the power source before removing any covers. Failure to do so may result in personal injury.

Step 2: Remove upper lift arm cover.

- A) Push in with a slotted screwdriver to release upper lift arm cover clips. Lift cover off chair.



DA2818i

Checking Oil Level - continued

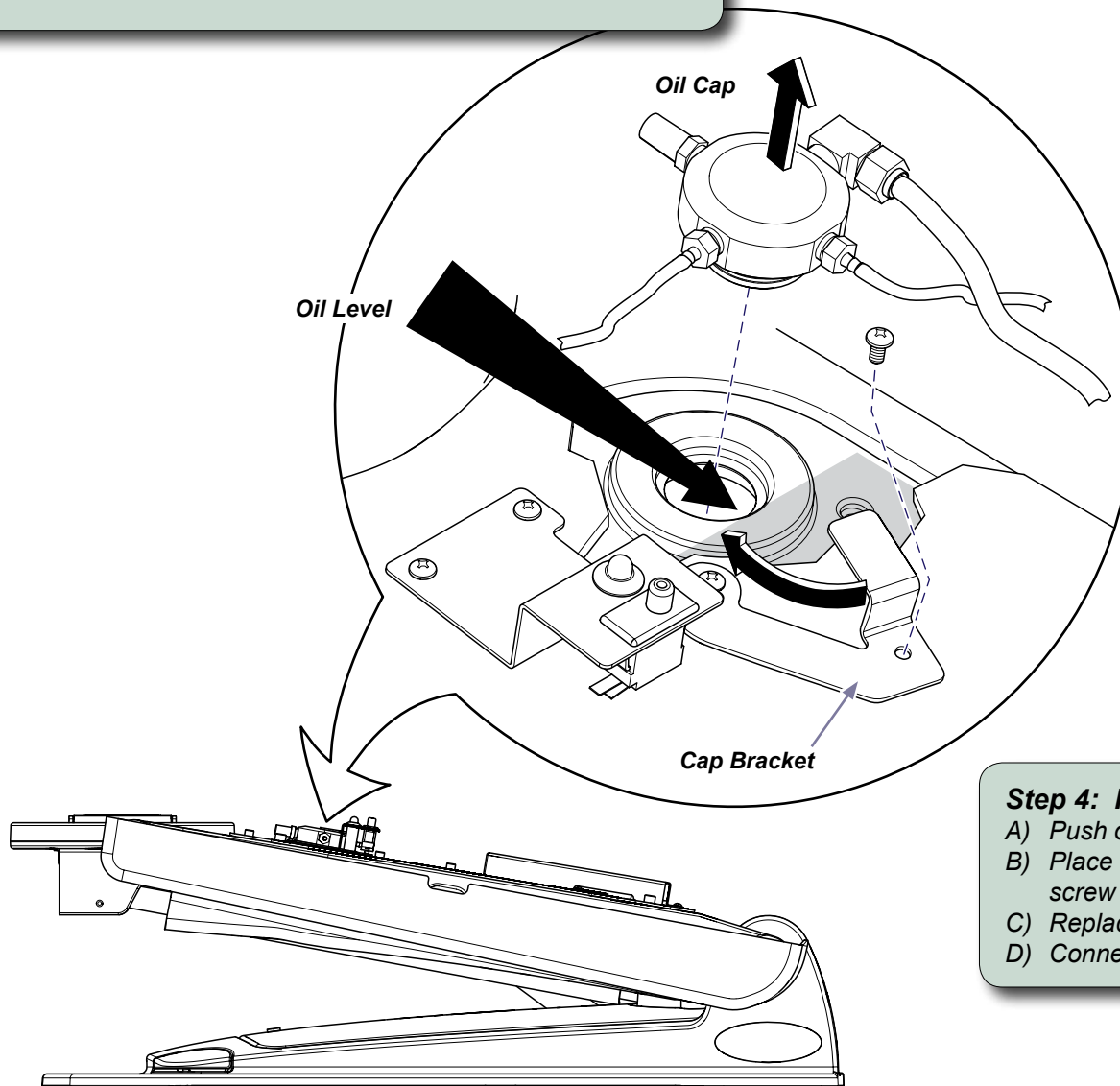
Step 3: Check oil level.

- A) Remove screw in cap bracket and rotate bracket to remove.
- B) Pull up on oil cap to remove from reservoir.
- C) Oil should be level with the base of the oil cap opening.
- D) Add only Hydraulic Oil with Viscosity ISOVG 32. if oil level is low.



Equipment Alert

Factory fill volume: 1.3 - 1.4 U.S. quarts
(1.2 - 1.3 liters).



Step 4: Install oil cap, cap bracket and lift arm cover.

- A) Push oil cap into tank opening.
- B) Place bracket over screw, rotate bracket to fit over oil cap and screw into tank.
- C) Replace upper arm lift cover - see Step 2.
- D) Connect chair to power supply.

DA2815i

Chair Calibration Procedure

Note

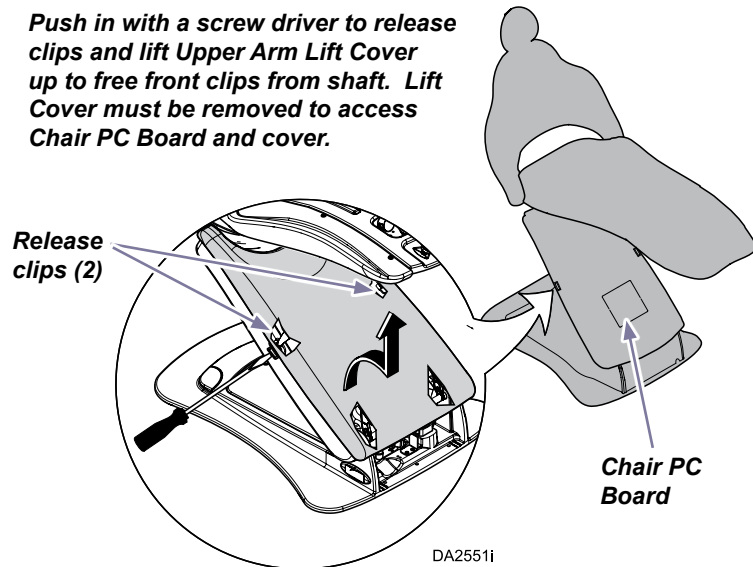
Calibration is only required if the chair is not operating at all, or if it is not raising/lowering to the proper extents. Power to the chair must also be cycled after moving the #4 dipswitch to complete the procedure. Calibration should always be performed after replacing a chair's PC Board, a tilt sensor or any lift mechanism.

Movement of the chair is monitored by sensory devices that keep the chair within the range of motion accommodated by the drive mechanisms controlling the chair. **The Calibration Mode** is a programmed routine of chair movements that locates the end of travel points, calculates working values for these points, stores these values in memory and then tests the results of the routine. Follow these steps to calibrate a chair.

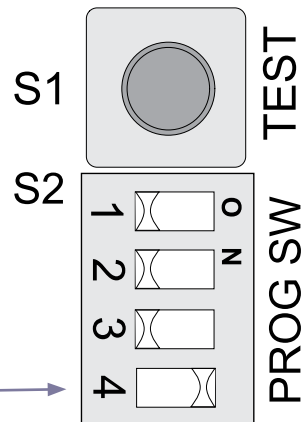
Step 1: Unplug the chair from the power supply.

Step 2: Remove the Upper Lift Arm Cover and PC Board cover (2 screws). Locate S1 and S2 switch components on the Chair PC board.

Push in with a screw driver to release clips and lift Upper Arm Lift Cover up to free front clips from shaft. Lift Cover must be removed to access Chair PC Board and cover.



Step 3: Move the #4 dipswitch on the S2 program switch to the Calibration Mode position (ON).



Step 6: Install PC Board Cover and Upper Lift Arm Cover. Plug chair back into power supply. Activate control buttons to test chair operation.

Step 5: Unplug the Chair and move dipswitch #4 on S2 program switch out of Calibration Mode (OFF position).



Equipment Alert

Control buttons do not work normally during a Calibration Mode. Pressing any button (including the S1 Test pushbutton) will stop the chair movement and end the Calibration Mode.

Step 4: Plug chair into power supply and press the TEST button on switch S1.

As soon as the TEST button is pressed, Calibration begins. Step back and allow the chair to complete all 3 up/down cycles of the calibration routine.

Note: The chair emits a short beep every 2 seconds while calibrating. When finished calibrating the chair emits 3 long, confirmation beeps.

The Calibration Mode has failed if the chair emits 1 long beep at the end of the calibration mode.

Manual Calibration - use to set your own high and low extents for base and back travel.

Note
Manual Calibration is only required to modify one or more of the limit of travel extents the base and back are set to originally.
Power to the chair must be cycled after dipswitch #4 is returned to OFF position to complete the procedure.

Base and back movements are monitored by sensory devices that keep them within a controlled range of extents. **Manual Calibration** is a modified calibration routine that allows you to set your own end of travel points, stores these values and then tests the results of the routine. Below is the Manual Chair Calibration procedure.

Manual Calibration...

- A) Unplug chair from power supply.
- B) Remove upper lift arm cover and PC Board cover (two screws). Locate S1 and S2 switches on the PC board.
- C) Move dipswitch #4 on the S2 Prog SW to ON position.
- D) Plug chair into power supply, press and hold the TEST button on S1 switch (for five seconds). Listen for a beep to indicate it is in Manual Calibration mode. Beeps continue, one every 5 seconds, as long as you are in manual calibration.
- E) Extents can be manually set or skipped for each of these base and back travel points using the same keypad selections.

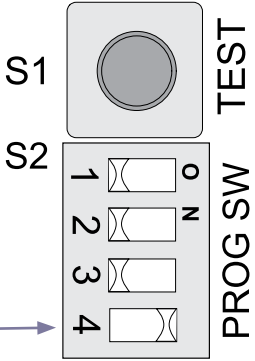
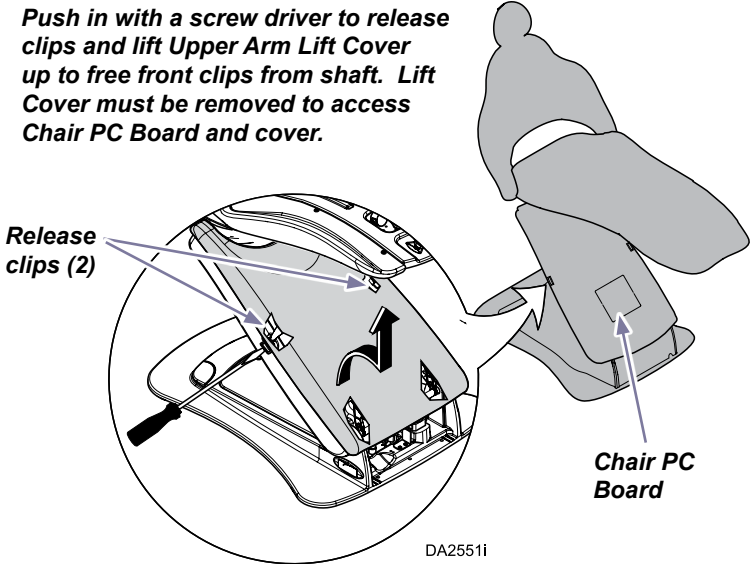
Extents must always be set in this order: Base Low Back High Base High Back Low	To set an extent:	
	Move base or back to desired extent, then press and hold button 1 for two seconds to set the extent.	Two beeps indicate extent is set.
	OR, to skip setting current extent:	
	Press and hold button 4 for two seconds.	Two beeps indicate extent remains at chair limit.

Note: You can abort the manual calibration procedure any time by pressing the TEST button on S1 switch.

- F) As soon as the final (Back High) extent is set the calibration routine begins. Step back and allow the chair to complete the necessary number of up/down cycles, which takes a few minutes.

Note: The chair emits a short beep every 2 seconds while calibrating. When calibration is successful, the chair emits three long, confirmation beeps.

If calibration failed, the chair emits one long beep at the end of the routine. Repeat entire Manual Calibration.



Manual Calibration continued...

- G) Unplug chair from power supply and move dipswitch #4 on S2 program switch out to OFF position.
- H) Install covers (see B).
- I) Plug chair back into to power supply.
- J) Activate keypad and remote buttons to test operation.

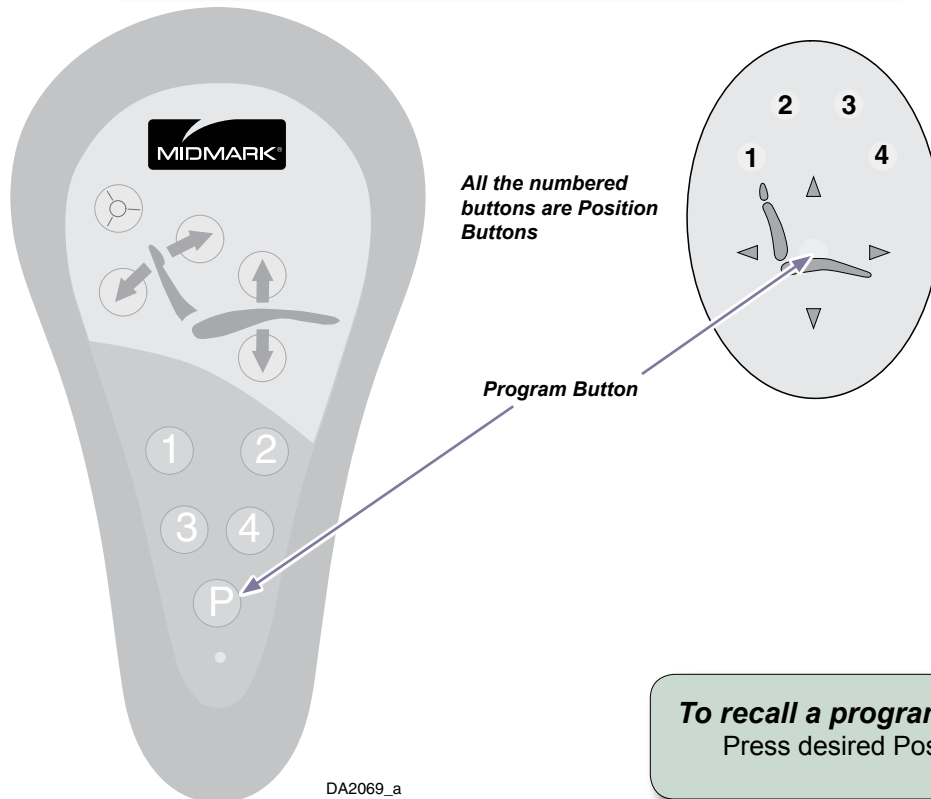
Programming Chair Positions

To program a button to a specified chair position....

- A) Use the arrow buttons to move the chair to desired position.
- B) Press the Program Button. You will hear a single beep to indicate you are in the program mode*.
- C) Press the desired Position Button (1, 2, 3, or 4) to set the programmed position to that button. You will hear three beeps to indicate the button is programmed.

Alternate/Foot Control Programming Method: With the chair in the desired position, you can just press and hold a position button 2 seconds. The chair will beep three times to indicate the button is programmed.

* The Control device gives you 3 seconds to press (program) a Position button after you are in the Program mode. After 3 seconds the control returns to the normal operating mode.



Note

The chair can be stopped any time during a programmed positioning sequence by pressing any other button on the control device.



Special Programming Features

The number 4 Position Button is capable of being programmed to invoke any one of these three different functions.

- A) The Cuspidor Return Function.
- B) The Return to the Last Position Function.
- C) Function the same as any other Position button.

Which of these functions the 4 button invokes is dependant on a dipswitch setting on the PC Board and should only be changed by a service technician.

To recall a programmed position....

Press desired Position Button (1, 2, 3, or 4).

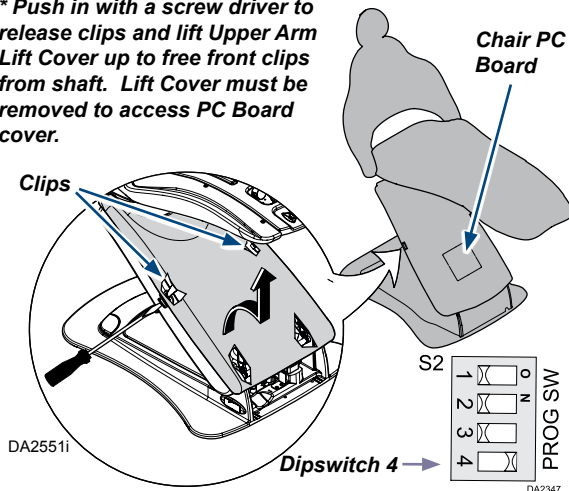
Synchronize the Wireless Remote

If nothing happens when any button on the Wireless Remote is pressed and no led lights on the PC board flash, the remote either needs new batteries or needs to be synchronized.

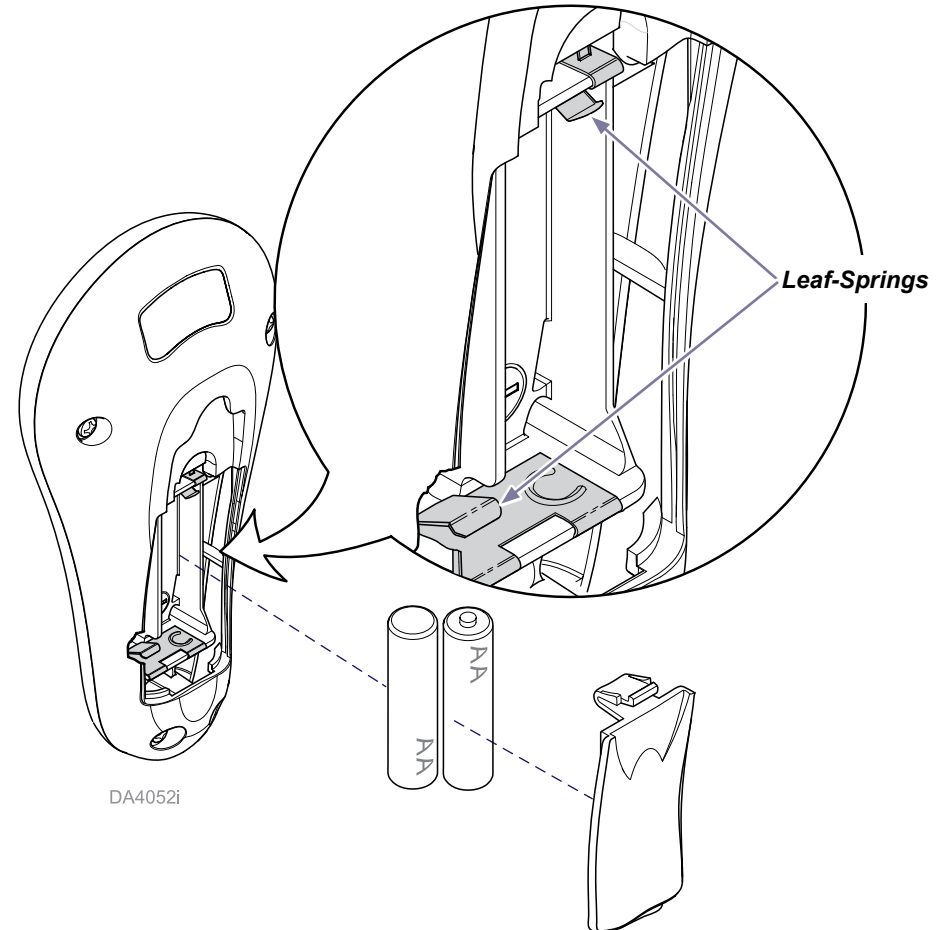
To synchronize the remote:

1. Chair must be Powered ON.
2. Verify that Chair has been calibrated.
(Refer to Chair Calibration procedure in Installation Guide 003-1923-99).
3. Remove Upper Arm Lift Cover* and the PC Board cover (two screws).
4. Locate the S2 PROG SW on the PC board and set the dipswitch 4 to the ON position. Listen for two beeps.
5. Press and hold buttons 2 and 3 on the remote within three seconds from moving dipswitch 4. Listen for three short beeps from the Chair then three beeps from the Remote.
6. Set dipswitch 4 to the OFF position to complete the synchronization process.
7. Replace PC Board & Upper Arm Lift covers.

** Push in with a screw driver to release clips and lift Upper Arm Lift Cover up to free front clips from shaft. Lift Cover must be removed to access PC Board cover.*



Battery Contacts

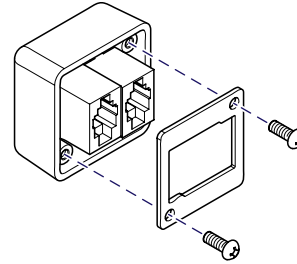


Verifying LIN Connections

Step 1: Use LIN Coupler to check connectors.

- Unplug LIN connections from the LIN coupler.
- Remove two screws and the metal cover from the LIN coupler.

LIN Coupler

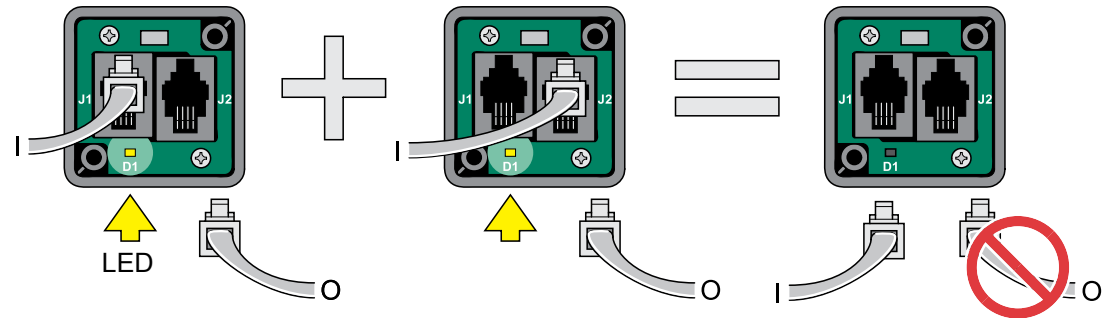


WARNING

Use caution when operating equipment with covers removed.

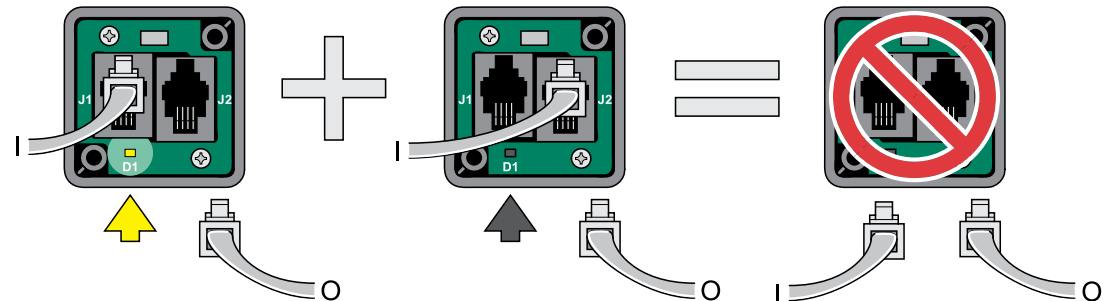
Step 2: Check for faulty O (outgoing) harness.

Replace O if the I (incoming) harness illuminates the LED when plugged into either side.



Step 3: Check for a faulty LIN Coupler.

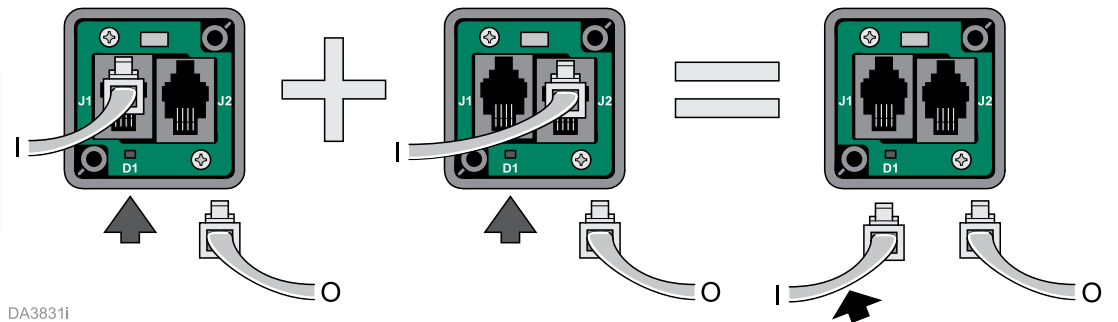
The LIN coupler is faulty if the I harness illuminates the LED ONLY when plugged into the LED side.



Step 4: Check for a faulty I harness.

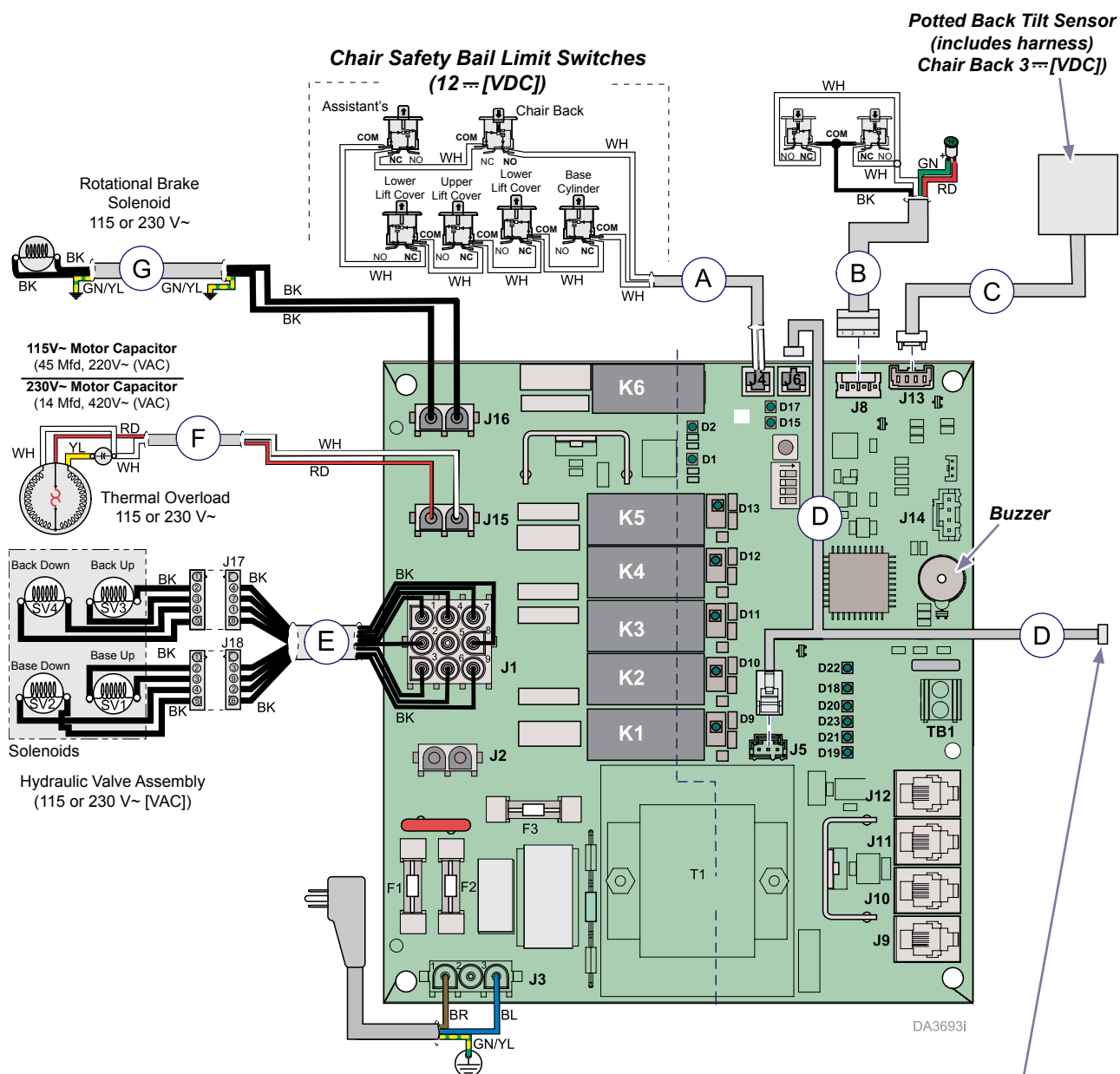
Replace the I harness if it does not illuminate the LED when plugged into either side.

Note: This check is only valid when power is present in the I harness.



DA38311

PC Board Wiring Diagram, Harnesses & Information



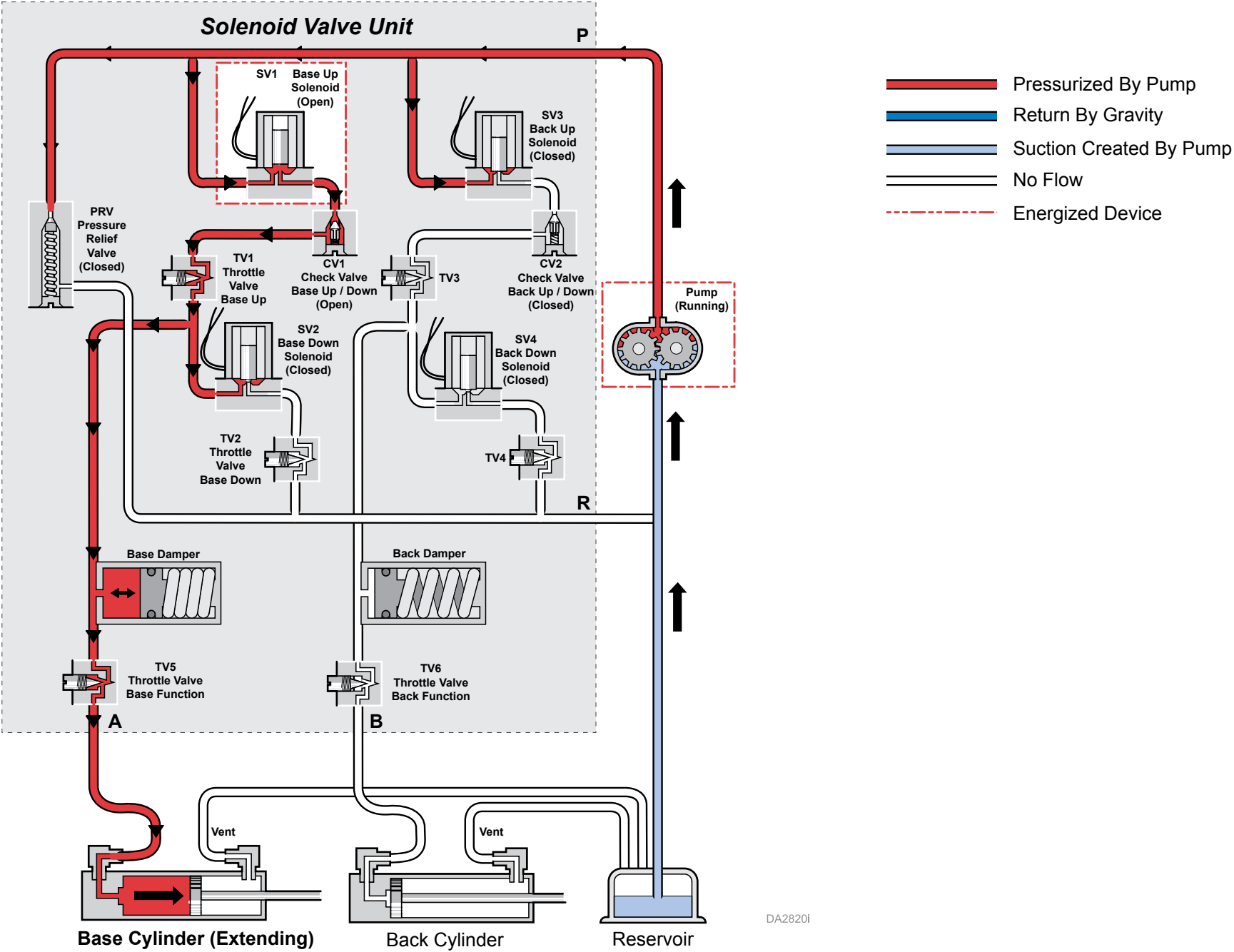
A Chair with no cuspidor has a jumper across this connector and across J6 (cuspidor limit switch).

PC Board Information		
Outputs	PC Board Description	LED
K1	Base Down	D9
K2	Base Up	D10
K3	Back Down	D11
K4	Back Up	D12
K5 Triac	Pump-R Pump-T } Work Together	D13 D1
K6	Rotational Brake	D2
Indicator LEDs		LED
Brake (comes on when break pedal is pressed)		D15
OK (comes on when both limit switches J5 and J6 are closed)		D17
* Foot Control (option)		D22
Dental Light (option)		D18
* Remote Control Base Station (option)		D20
Assistant's Unit Keypad (option)		D21
Delivery Unit Keypad (option)		D23
Extra (used for options)		D19
* One of these options is required		
Information	Connector	
Auxiliary Output (Line VAC)	J2	
Cuspidor Power and Rinse	J5	
Test Plugs for Factory Use Only	J7 & J14	
Keypad Communication Lines	J9 - 12	
Communication Terminal for non-chair mounted Lights	TB1	

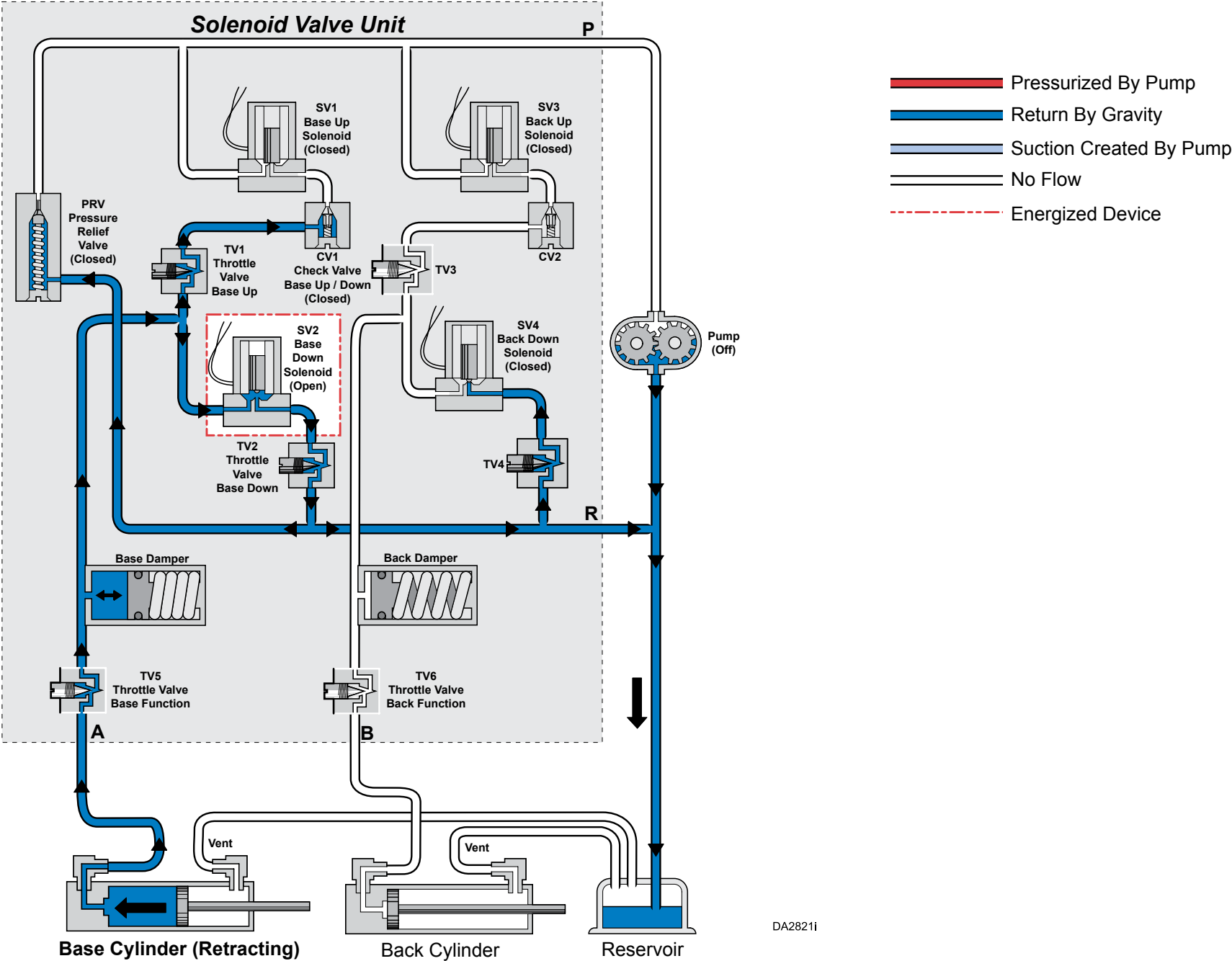
PC Board Wiring Diagram and Harnesses: Elevance Chair

Item	Description	Part Number
A	Safety Bail Harness	015-2239-00
B	Brake Release / Power Light Harness	015-2237-00
C	Potted Back Tilt Sensor	015-2682-02
D	Cuspidor Power / Limit Switch Harness	015-2323-00
E	Solenoid Adapter Harness	015-2321-00
F	Pump Adapter Harness	015-2320-00
G	Rotational Brake Solenoid Harness	015-2319-00

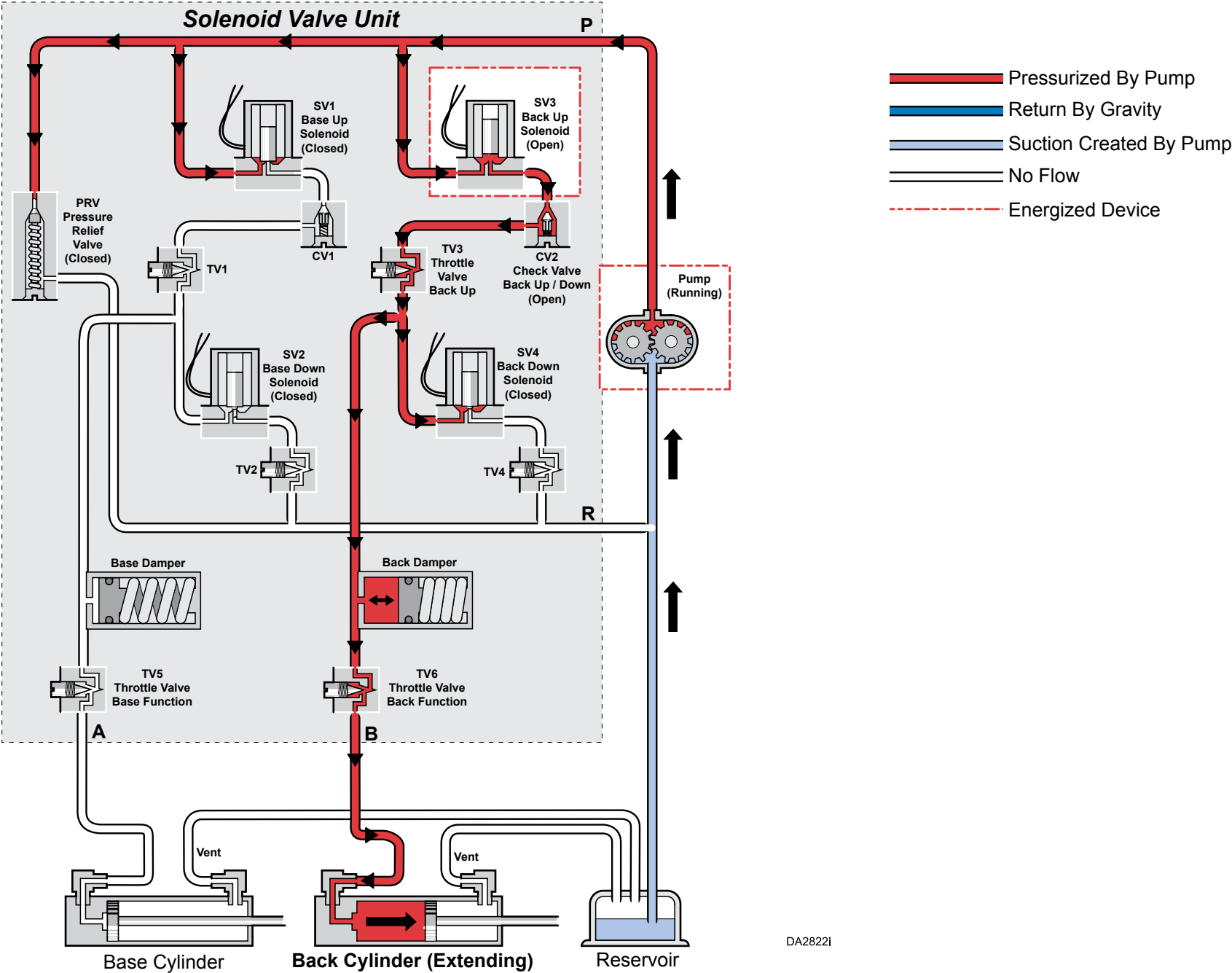
BASE UP Hydraulic Function



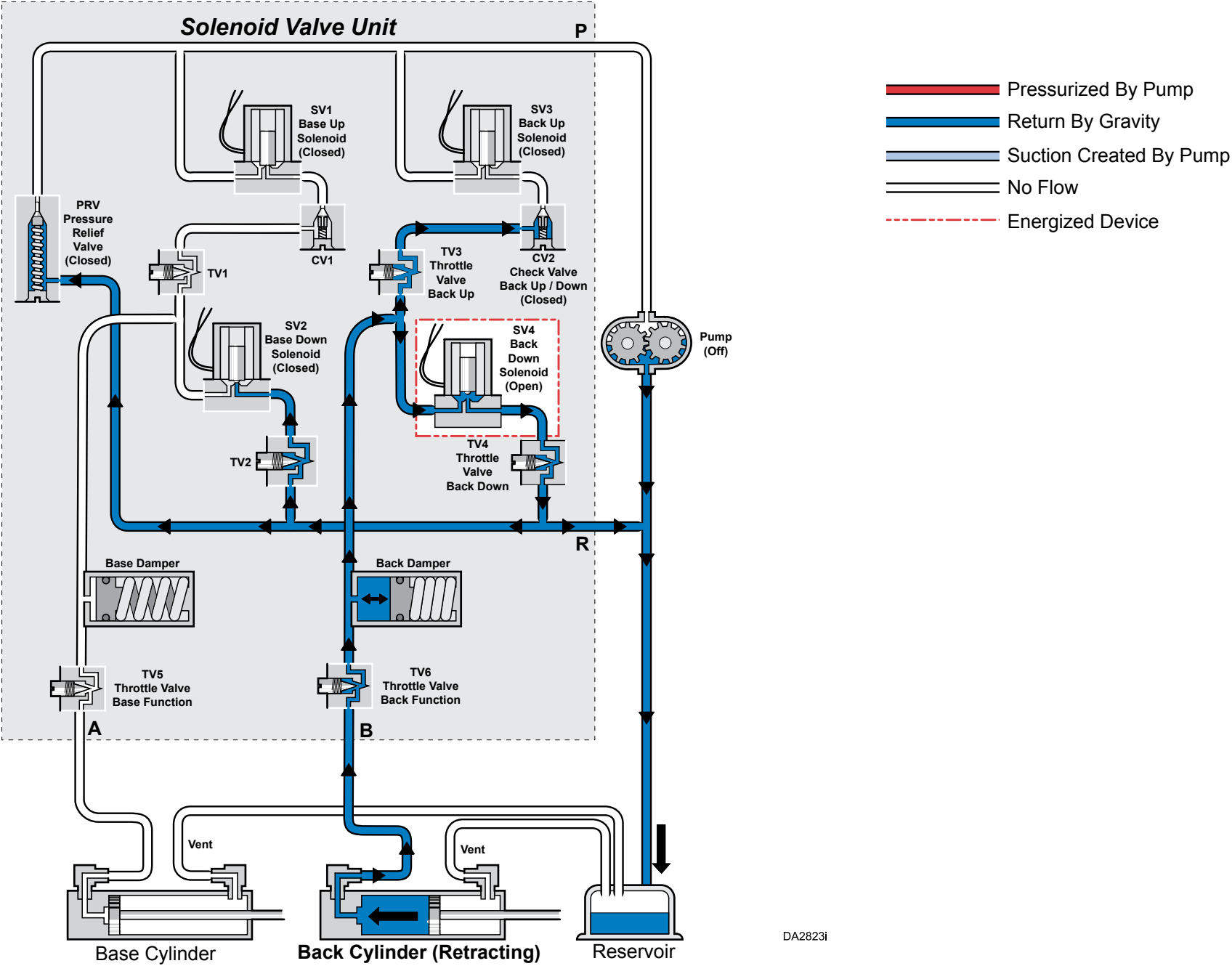
BASE DOWN Hydraulic Function



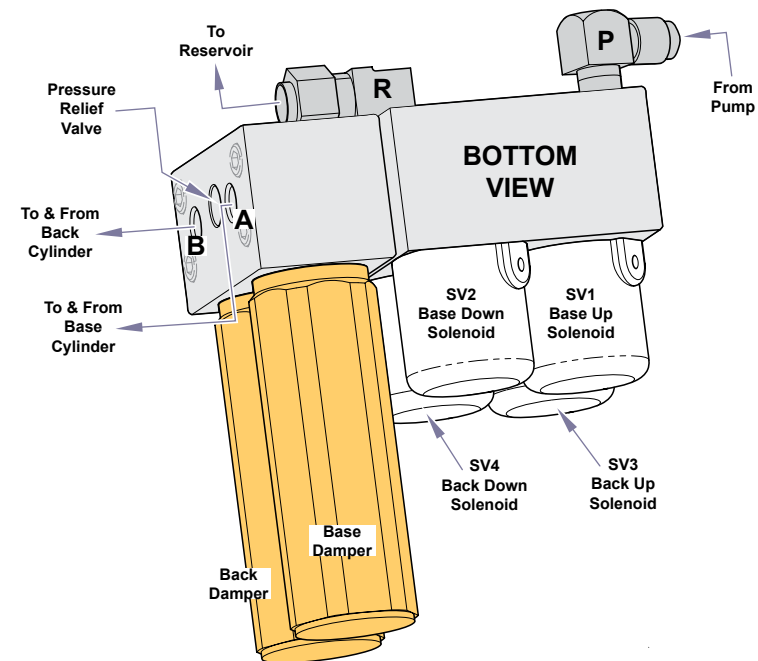
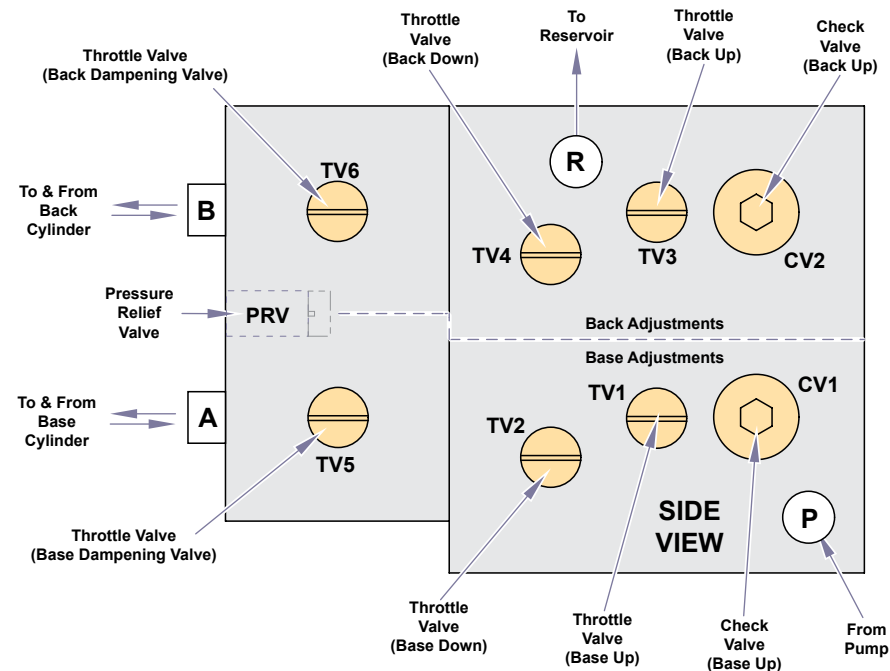
BACK UP Hydraulic Function



BACK DOWN Hydraulic Function



Hydraulic Valve Assembly Information



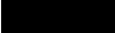
DA2826i

Note: The Throttle Valves have been set by the factory and normally will not require adjustments

Throttle Valve Settings (Number of Turns OPEN from the FULLY CLOSED position)			
Throttle Valve		Chair Only	Chair w/ L/R or Console
Base	TV1 Base Up	3 Full turns	5 1/2 Full turns
	TV2 Base Down	3 1/4 Full turns	2 3/4 Full turns
	TV5 Base Damper	3 Full turns	4 1/2 Full turns
Back	TV3 Back Up	1 1/2 Full turns	1 1/2 Full turns
	TV4 Back Down	5 1/2 Full turns	5 1/2 Full turns
	TV6 Back Damper	5 Full turns	5 Full turns

Description		Purpose Of Component
Pressure Relief Valve	PRV	Opens, returning hydraulic fluid directly to reservoir, if pressure in hydraulic system exceeds maximum allowable limit. Preset at factory, do not change.
Dampers	Base - TV5 Back - TV6	Act as hydraulic cushions when raising or lowering base or back for a smooth stop and start. (ADJUSTED AT THE FACTORY, should not require adjustments).
Check Valves	CV1 Base CV2 Back	Prevents hydraulic fluid from going back to discharge side of hydraulic pump during Base Down or Back Down functions.
Base Throttle Valves	TV1, TV2, TV5	For setting speed of Base Up (TV1), Base Down (TV2) or both (TV5) functions.
Back Throttle Valves	TV3, TV4, TV6	For setting speed of Back Up (TV3), Back Down (TV4) or both (TV6) functions.
Base Solenoid Valves	SV1, SV2	Electrically operated valves that are normally closed until power is applied to solenoid. SV1 opens to raise chair from Base. SV2 opens to lower chair to Base
Back Solenoid Valves	SV3, SV4	Electrically operated valves that are normally closed until power is applied to solenoid. SV3 opens to raise Back. SV4 opens to lower Back.

Color Abbreviation Chart

	Item	Color (English)	Farbe (Deutsch)	Couleur (Français - Europe)	Color (español europeo)	Colore (italiano)	Color (others)
	BK	Black	Schwarz	Noir	Negro	Nero	
	BL	Blue	Blau	Bleu	Azul	Blu	
	BR	Brown	Braun	Marron	Marrón	Marrone	
	CL	Clear	Durchsichtig	Incolore	Transparente	Trasparente	
	GN	Green	Grün	Vert	Verde	Verde	
	GY	Grey	Grau	Gris	Gris	Grigio	
	OR	Orange	Orange	Orange	Naranja	Arancione	
	PR	Purple	Purpur	Pourpre	Morado	Porpora	
	CL/PR	Clear Purple	Durchsichtig Purpur	Incolore Pourpre	Transparente Morado	Trasparente Porpora	
	RD	Red	Rot	Rouge	Rojo	Rosso	
	WH	White	Weiß	Blanc	Blanco	Bianco	
	YL	Yellow	Gelb	Jaune	Amarillo	Giallo	
	PK	Pink	Pink	Rose	Rosa	Rosa	
	TN	Tan	Hellbraun	Fauve	Marrón claro	Tanè (marrone scuro)	
	BK/WH	Black/White	Schwarz / Weiß	Noir / Blanc	Negro / Blanco	Bianco / Nero	
	BL/WH	Blue/White	Blau / Weiß	Bleu / Blanc	Azul / Blanco	Blu / Bianco	
	BR/WH	Brown/White	Braun / Weiß	Marron / Blanc	Marrón / Blanco	Marrone / Bianco	
	CL/BK	Clear / Black	Durchsichtig / Schwarz	Incolore / Noir	Transparente / Negro	Trasparente / Nero	
	GN/WH	Green / White	Grün / Weiß	Vert / Blanc	Verde / Blanco	Verde / Bianco	
	GN/YL	Green / Yellow	Grün / Gelb	Vert / Jaune	Verde / Amarillo	Verde / Giallo	
	OR/WH	Orange / White	Orange / Weiß	Orange / Blanc	Naranja / Blanco	Arancione / Bianco	
	PR/WH	Purple / White	Purpur / Weiß	Pourpre / Blanc	Morado / Blanco	Porpora / Bianco	
	RD/WH	Red / White	Rot / Weiß	Rouge / Blanc	Rojo / Blanco	Rosso / Bianco	
	VI/WH	Violet / White	Violett / Weiß	Violet / Blanc	Violeta / Blanco	Viola / Bianco	
	YL/WH	Yellow / White	Gelb / Weiß	Jaune / Blanc	Amarillo / Blanco	Giallo / Bianco	
	YL/GN	Yellow / Green	Gelb / Grün	Jaune / Vert	Amarillo / Verde	Giallo / Verde	
	YL/BK	Yellow / Black	Gelb / Schwarz	Jaune / Noir	Amarillo / Negro	Giallo / Nero	

Midmark Corporation

60 Vista Drive

Versailles, OH 45380 USA

1-800-526-3662

1-937-643-6275



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