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Introduction

The Service Manual is intended for technical personnel who maintain and repair electric wheelchairs. It is important that anyone who performs maintenance and repairs described in this manual reads and understands the content of this manual so that the work is performed professionally. Always state the chassis number when contacting Permobil to ensure that the correct information is provided.

Technical Support
In the event of technical problems, you should contact your dealer, or Permobil Inc. USA at 800-736-0925.

Spare parts
Spare parts must be ordered through your dealer.

Warranties
Contact your dealer or Permobil Inc. USA for information about the warranties for this chair.

Maintenance
See the information in the Owner’s Manual.
Identification plates

Chassis

Fig. 1. Chassis identification number

Pilot+ output stage

Fig. 2. Pilot+ output stage identification number.

Control panel

Fig. 3. Control panel identification number.
Operating the seat elevator manually

**WARNING !**

*Warning! Using a drilling machine during the manual operation of the seat lift is not allowed. There is a risk of material damage.*

**Electric seat elevator**

If the seat elevator will not move normally because the battery is flat or the adjusting mechanism is broken.

1. Remove the cushion and plastic plug from the seat.
2. Raise/lower the seat using the seat elevator crank supplied, see fig. 4.

**Fixed seat post**

1. Remove the cover and plastic plug from the seat.
2. Loosen the seat tube clamp screw (5:2).
3. Crank up the seat using the seat elevator crank supplied, see fig. 4.
4. Lower the seat and turn it so that the locating screw (5:1) seats in its groove.
5. Tighten the seat tube clamp screw. Torque: 11 ft.lb.

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*Fig. 4. Use the seat elevator crank to raise the seat.*

*Fig. 5. Fixed seat post.*
Covers

Removal
1. Raise the seat to its highest position.
2. First remove the rear battery cover, which is fitted with two handles on each side. Disassembly is facilitated if the brake release lever is moved to the forward position.
3. Remove the rear cover, it is attached by five screws. Unscrew the rubber pads on the seat support. Disconnect the rear light cable at the connector in the cable.
4. Remove the seat lift cover, which is fitted with two plastic plugs on the upper side of the chassis.
5. Remove the front battery cover, which is secured by two screws on the upper side of the chassis.
6. Remove the front cover, it is attached by two screws on the front edge.

Fitting
Fitting is the reverse procedure.

Fig. 6. Chassis cover attachment points.

A. Front cover  B. Seat elevator cover  C. Front battery cover  D. Rear battery cover  E. Rear cover

Fig. 7. The front cover is attached by two screws at the front edge.
Batteries

NB! Use protective goggles when working on batteries.

Removal
1. Put the wheelchair on a level surface.
2. Raise the seat. To raise the seat manually, see page 7.
3. Put the circuit breaker in the “OFF” position, see fig. 8.
4. Remove the battery covers and rear cover, see page 8.
NB! Take care when removing the rear cover; the rear light cable is attached to the electronic unit.
5. Disconnect the battery leads, positive terminals first.
6. To make access to the battery easier, you can also disconnect the electrical connections for the drive motor, magnetic brake, lights and brake release sensor. Make a careful note of the location of the cables for reconnection.
7. Lift out the batteries.

Fitting
1. Lift the batteries into position, with the poles at the back, see fig. 9.
2. Attach the electrical connections for the drive motor, magnetic brake, lights and brake release sender, if you disconnected them earlier.
3. Reconnect the battery leads, negative first.
4. Refit the covers.
5. Put the circuit breaker in the “ON” position, see fig. 8.
6. Lower the seat. For manual lowering, see page 7.
Drive wheels

Removal
1. Switch off the main switch.
2. Lift up the chair and support it on blocks, so that the wheels are off the ground.
3. Undo and remove the hubcap (5), bolt (4) and washers (2 and 3), see fig. 11.
4. Pull the wheel off the shaft. Use puller 304103-99-0 if the wheel is tight, see fig. 10.

Fitting
1. Check the axle and rim for any damage. If necessary, you should clean these parts of dirt and rust. If any parts are damaged, they should be replaced.
2. Check that the key fits solidly in the keyway of the axle. If necessary, install the new key and check for fit.
3. Lubricate the shaft with a thin layer of copper paste (Würth 0893800x, Art. no.: 1820540).

**WARNING !**

**Warning!** Do not use any type of lubrication in the threaded hole in the axle or on the bolt. If necessary, you should clean these parts.

4. Fit the wheel onto the axle. The use of hand force only is preferred, but, if need be, carefully use a rubber mallet, whose head diameter is no less than 1.5 inches (38 mm), to ensure that the rim is fully seated upon the motor.

**NB!** Hitting too hard with a rubber mallet could cause damage to the gear.
5. Put the washers (2 and 3) onto the bolt (4) and tighten the wheel, see fig. 11.

**Use a torque wrench to tighten the bolt to 18 ft-lbs.** Install the hub cap (6), see Fig. 11.

**NB!** The bolt must be used once only. Removed bolt is not allowed to be refitted.

**WARNING!**

**Warning!** Other types of bolts or washers are not to be used.

**WARNING !**

**Warning!** Do not use any other type of thread lock.
Brake release cables
The upper cable controls the left brake unit and the lower cable controls the right brake unit.

Removal
1. Make sure the brakes are engaged.
2. Raise the seat elevator to its highest position.
3. Remove the battery and seat elevator covers, see page 8.
4. Slacken the locknut, see fig. 12:2.
5. Screw the adjusting screw fully in, see fig. 12:1.
6. Detach the cable at the magnetic brake and brake release mechanism.

Fitting
1. Attach the cable to the magnetic brake, then to the release lever.
2. Adjust the length of the cable sleeve using the adjusting screw (12:1), so that the cable is tensioned but does not pull the brake release arm.
3. Check the operation. Operate the release lever to release the brake and check that the wheel can turn.
4. Tighten the locknut (12:2).
5. Refit the covers.

Fig. 12. Brake release mechanism.
Magnetic brakes

Removal

1. Raise the seat elevator to its highest position.
2. Switch off the main switch on the control panel.
3. Put the circuit breaker in the “OFF” position, see page 23.
4. Remove the battery cover and rear cover, see page 8.
5. Remove the battery from the side you are working on, see page 9, to facilitate removal of the magnetic brake.
6. Disconnect the electrical connector from the magnetic brake, see fig. 13.

7. Pull the cable sleeve forwards and take the cable out through the slot in the cable mounting. Unhook the brake release cable from the magnetic brake, see fig. 14.

8. Unscrew the three screws that hold the brake, see fig. 15. Note the position of the brake release arm for refitting. Remove the brake, complete with the disc and cover.
Fitting

1. Fitting new brakes, use the adjusting screws to adjust the magnetic brake, as described in the instructions on the back of the magnetic brake, see fig. 16.

2. Fit the brake disc into the magnetic brake.

3. Fit the cover.
4. Insert a bolt to align the parts. Note the position of the brake release arm; fit the brake so that it is aligned with motor’s cable mounting. Secure the magnetic brake using the three bolts.

5. Connect the magnetic brake electrical connector, see fig. 20.

6. Fit the brake release cable, see fig. 21.
7. Fit the batteries, see page 9.
8. Fit the covers, see page 8.
9. Put the circuit breaker in the “ON” position, see page 23.
Drive motor

Removal

1. Raise the seat to its highest position.
2. Switch the main power breaker off.
3. Put the circuit breaker in the “OFF” position, see fig. 22.
4. Remove the battery cover and front cover, see page 8.
5. Remove the battery on the side concerned, see page 9, to facilitate removal of the motor.
6. Raise the relevant side of the chair on blocks.
7. Remove the wheel, see page 10.
8. Disconnect the electrical connectors to the motor and magnetic brake, see fig. 23.
9. Pull the cable sleeve forwards and take the cable out through the slot in the cable mounting. Unhook the brake release cable from the magnetic brake, see fig. 24.
10. Remove the three bolts holding the motor.
11. Turn the motor sideways to free the wheel shaft. Pull the motor straight forwards.

Fitting
Fitting is the reverse procedure.

Seat lift
Removal
1. Raise the seat using the accompanying seat lift crank, see page 7. Raise the seat until it will not go any higher while you crank, i.e. the seat lift is “not engaging”.
2. Switch off the main power switch on the control panel.
3. Set the main fuse to the “OFF” position, see page 23.
4. Detach the seat lift and chassis covers, see page 8.
5. Clip off the wiring bundle tie mounted on the cabling between the seat and the chassis.
6. Loosen the seat lift motor’s cable connection, pay attention to the placement of the cables for purposes of later remounting, see page 21.
7. Lift out the seat, place it on its side next to the chassis, see Fig. 27.
   NB! The seat is heavy, hence there should be two people to do this. Be careful with the cabling
8. Unscrew and remove the two screws on the seat lift’s upper fastener, see fig. 27:1.
9. Remove the two screws on the seat lift’s lower fastener, see fig. 27:2.
10. Detach the seat lift by drawing it straight up.

11. Clip off the wiring bundle tie holding together the seat lift cabling, follow the cabling to its end, and loosen the contact at the SLS Drive, as well as the conductor joint located beside the SLS Drive, prior to detaching the SLS Drive, see page 24.

The upper part of the seat lift is mounted on the seat and can be detached as described in the following.

12. Unscrew and remove the two screws holding the seat plate, see fig. 28.

13. If the seat is equipped with seat tilt, unfasten the actuator’s front bracket, see fig. 29. Draw the seat tilt mechanism apart, see fig. 30.

14. Unscrew and remove the four screws holding the seat lift, see fig. 30 and 31.

Fitting

Fitting is the reverse procedure.
Seat lift cable

Removing
1. Remove the seat lift; follow the instructions on page 18.
2. Remove the seat lift sensors. Note the position of the sensors for refitting, see fig. 32-33.

Fitting
Fitting is the reverse procedure.

NB! After fitting, check that the arm of the Lever switch can move freely.

1. Screw
2. Lever switch plate
3. Lever switch
4. Insulating plate
5. Seat lift
6. Plate
7. Nut
Seat lift motor

Removing
1. Remove the seat lift, see page 17.
2. Disconnect the seat lift cable at the motor; note the position of the connectors, see fig. 34.
3. Remove the seat lift motor by taking out the three bolts that hold it, see fig. 34.

Fitting
Fitting is performed in reverse order.
Seat lift drive belt

Removing
1. Remove the seat lift, see page 18.
2. Loosen the two bolts holding the shaft to the seat lift motor. Push the shaft sideways to slacken the drive belt.
3. Remove the belt from the motor shaft, then from the toothed wheel on the seat lift screw.
4. Fit the new belt using the reverse procedure.
5. Adjust the belt tension as described below.
6. Fit the seat lift, see page 18.

Adjusting the belt tension
1. Loosen the two bolts near the belt, see fig. 36.
2. Adjust the belt tension by moving the motor shaft sideways.
3. Tighten the two screws.
4. Check the belt tension. The belt is correctly tensioned when it can be pressed in 4 - 5 mm, see fig. 37.
Pilot+ output stage

Removal
1. Raise the seat to its highest position, see page 7.
2. Put the circuit breaker in the “OFF” position, see page 23.
3. Remove the battery cover and rear cover, see page 8.
4. Loosen the knob that holds the cover plate over the electronics, see fig. 38.
5. Lift up the output stage.
6. Disconnect the electrical connectors from the output stage, note their locations, see fig. 39.

Fitting
Fitting is the reverse procedure.

Fig. 38. The Pilot+ output stage and SLS drive stage are under a cover plate.

SLS Drive stage

Removal
1. Raise the seat to its highest position, see page 7.
2. Put the circuit breaker in the “OFF” position, see page 23.
3. Remove the battery cover and rear cover, see page 8.
4. Loosen the knob that holds the cover plate over the electronics, see fig. 38.
5. Lift up the drive stage.
6. Pull the cover off the drive stage.
7. Cut off the ties holding the cables and disconnect the electrical connectors, note their locations for refitting.
8. Take the circuit board out of the box by removing the plastic clip fixings. There could be two fixing screws in the center of the board.

Fitting
Fitting is the reverse procedure.

Fig. 39. Electrical connectors for the Pilot+ output stage.

Fig. 40. Electrical connectors for the SLS drive stage.
Control panel

Removal
1. Put the circuit breaker in the “OFF” position, see page 23.
2. Disconnect the control panel cable by pulling the connector at the rear of the control panel straight outwards.
3. To remove the control panel, remove the screws holding the common bracket for the control panel and Seat control panel, see fig. 38. Remove the control panel bracket by removing the two screws on the rear of the control panel, see fig. 42.

Fitting
Fitting is the reverse procedure.

Seat control panel

Removal
1. Remove the cover of the Seat control panel by pulling it straight upwards. If the lid is stuck, you can carefully use a screwdriver to pry between the lid and the lower part of the end of the box, see fig. 43
2. You can now lift the circuit board and cable out of the box.
3. Disconnect the cable from the circuit board by pulling the connector straight upwards, see fig. 44.
4. To remove the control panel, remove the screws holding the common bracket for the control panel and Seat control panel, see fig. 41. Remove the Seat control panel bracket by removing the two screws on the underside of the box, see fig. 42. Note the position of the bracket for refitting.

Fitting
Fitting is the reverse procedure.
Circuit breaker and fuses

Resetting the circuit breaker

The circuit breaker also acts as a battery isolator, but is usually referred to as the circuit breaker.

You will not normally need to change the circuit breaker, as you can reset it when it has tripped. It is located on the underside of the chassis, over the right rear wheel, see fig. 45. The circuit breaker is protected from dirt and water by a rubber lip, which can easily be folded back.

NB! A tripped circuit breaker often means that there is a serious electrical fault. Check the cause thoroughly before you reset the circuit breaker.

Changing the circuit breaker

1. Remove the battery cover and rear cover, see page 8.
2. Put the circuit breaker in the “OFF” position, see fig. 45.
3. Disconnect the battery positive lead, which is between the battery and the circuit breaker.
4. Remove the circuit breaker by removing the two screws, see fig. 46.

NB! Note the orientation of the circuit breaker. The ON/OFF positions must agree with the label.
5. Disconnect the cables from the circuit breaker by loosening the screws, see fig. 47.
6. Connect the cables to the new circuit breaker. Put the circuit breaker in the “OFF” position.

NB! Check that the cables are fully secure.
7. Attach the new circuit breaker with the two screws, see fig. 46.

NB! Check the orientation of the circuit breaker. The ON/OFF positions must agree with the label.
8. Reconnect the battery positive lead.
9. Fit the battery cover and the rear cover, see page 8.
10. Put the circuit breaker in the “ON” position, see fig. 45.

Fig. 45. Circuit breaker/Battery isolator.

Fig. 46. Circuit breaker fixings.

Fig. 47. Circuit breaker electrical connections.
Changing the charge fuse
The charge fuse is on the underside of the chassis, over the right rear wheel, next to the circuit breaker, see fig. 48. Switch off the main power breaker and the charger, if in use, before you change the charge fuse.

NB! The circuit breaker must be in the “ON” position during charging.

Changing the seat/lights fuse
There are two fuses in the SLS drive stage, F1 (24V unswitched) and F2 (24V switched). These protect two outlets, located to the left of the SLS drive stage, next to the charge socket. One of the outlets (24V unswitched) supplies power irrespective of whether the chair is switched on or off. The other outlet (24V switched) supplies power only when the chair is switched on. The seat and lights are normally connected to this outlet.

1. Switch off the main switch on the control panel.
2. Put the circuit breaker in the “OFF” position, see page 23.
3. Remove the battery cover and rear cover, see page 8.
4. Loosen the knob that holds the cover plate over the electronics, lift up the SLS drive stage, see page 21.
5. Pull the lid off the SLS drive stage.
6. Change the blown fuse.
7. Put the lid back on the box.
8. Put the SLS drive stage back in place in the chassis.
9. Refit the cover plate.
10. Refit the covers, see page 8.
11. Put the circuit breaker in the “ON” position, see page 23.

Brake release sensor
Removal
1. Put the circuit breaker in the “OFF” position, see page 23.
2. Remove the battery cover and seat elevator cover, see page 8.
3. Remove the brake release sensor by removing the two screws, see fig. 50.
4. Separate the connector in the connection cable.

Fitting
Fitting is the reverse procedure.
# Troubleshooting

## Battery voltage indicator
The battery voltage indicator shows the status of the wheelchair.

### Permanently on
Everything is working correctly.

### Flashing slowly
The batteries need to be charged.

### Flashing quickly
Fault signal. A fault has occurred and the wheelchair can not be driven.

## Fault signals
The number of flashing lights indicates the fault.
- Note the number of flashing lights.
- Switch off the chair.
- Switch the chair back on.
- If the fault is still there, count the number of flashing lights, then look up the possible cause and action in the table below.

<table>
<thead>
<tr>
<th>CAUSE</th>
<th>LEDs</th>
<th>ACTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>High battery voltage</td>
<td>10</td>
<td>Check the battery and the connections between the battery and control unit.</td>
</tr>
<tr>
<td>Break in the brake circuit</td>
<td>9</td>
<td>Check the connections to the magnetic brake.</td>
</tr>
<tr>
<td>Fault in the electronics</td>
<td>8</td>
<td>Check the connections to the output stage. If the fault persists, change the output stage.</td>
</tr>
<tr>
<td>Fault in the control panel</td>
<td>7</td>
<td>Make sure the joystick isn’t actuated at switch-on, change the control panel.</td>
</tr>
<tr>
<td>Short circuit, right drive motor</td>
<td>5</td>
<td>Check the motor connections and cable.</td>
</tr>
<tr>
<td>Open circuit, right drive motor</td>
<td>4</td>
<td>Check the connection to the right drive motor. Check whether the drive motor brushes are worn.</td>
</tr>
<tr>
<td>Short circuit, left drive motor</td>
<td>3</td>
<td>Check the motor connections and cable.</td>
</tr>
<tr>
<td>Open circuit, left drive motor</td>
<td>2</td>
<td>Check the connection to the left drive motor.</td>
</tr>
<tr>
<td>Low battery voltage</td>
<td>1</td>
<td>Check the condition of the battery. Check the connection between the battery and the control unit.</td>
</tr>
</tbody>
</table>