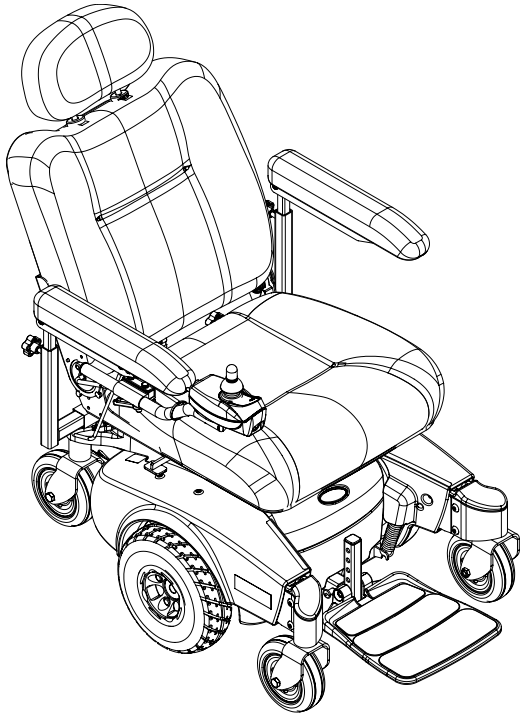
Service Manual

Pronto® Series

M50™

M51™

M61™



DEALER: Keep this manual. The procedures in this manual **MUST** be performed by a qualified technician.

For more information regarding Invacare products, parts, and services, please visit www.invacare.com

INVACARE

Yes, you can.

⚠ WARNING

A QUALIFIED TECHNICIAN MUST PERFORM ALL PROCEDURES IN THIS SERVICE MANUAL.

DEALERS AND QUALIFIED TECHNICIANS: DO NOT SERVICE OR OPERATE THIS EQUIPMENT WITHOUT FIRST READING AND UNDERSTANDING (1) THE OWNER'S OPERATOR AND MAINTENANCE MANUAL, (2) THE SERVICE MANUAL (IF APPLICABLE) AND (3) THE SEATING SYSTEM'S MANUAL (IF APPLICABLE). IF YOU ARE UNABLE TO UNDERSTAND THE WARNINGS, CAUTIONS AND INSTRUCTIONS, CONTACT INVACARE TECHNICAL SUPPORT BEFORE ATTEMPTING TO SERVICE OR OPERATE THIS EQUIPMENT. OTHERWISE, INJURY OR DAMAGE MAY RESULT.

RECOMMENDED TOOLS

The following tools are recommended for servicing this wheelchair:

- Invacare Power Mobility Field Service Kit - p/n 1125222
- 5mm ball head 10-inch t-handle allen wrench
- Flat tip screwdriver
- ½-inch deep socket and 3/8-inch ratchet
- Small and Medium Phillips® screwdriver
- Needle nose pliers
- Wire cutters
- Tie-wrap assortment
- Dead blow hammer
- ¼-inch to ½-inch wrenches

REFERENCE DOCUMENTS

DOCUMENT	PART NUMBER
M50/51/61 Owner's Manual	1125085
MK5™ NX™ Electronics Manual	1110532
Quad-Link Instruction Sheet (for assemblies after 4/6/06)	1134844
MK6i™ Field Reference Guide	1141471
MK6i Service Manual	1143203

NOTE: Updated versions of this manual are available on www.invacare.com.

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SPECIAL NOTES

Signal words are used in this manual and apply to hazards or unsafe practices which could result in personal injury or property damage. Refer to the table below for definitions of the signal words.

SIGNAL WORD	MEANING
DANGER	Danger indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury.
WARNING	Warning indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.
CAUTION	Caution indicates a potentially hazardous situation which, if not avoided, may result in property damage.

NOTICE

THE INFORMATION CONTAINED IN THIS DOCUMENT IS SUBJECT TO CHANGE WITHOUT NOTICE.

WHEELCHAIR USER

As a manufacturer of wheelchairs, Invacare endeavors to supply a wide variety of wheelchairs to meet many needs of the end user. However, final selection of the type of wheelchair to be used by an individual rests solely with the user and his/her healthcare professional capable of making such a selection.

WHEELCHAIR TIE-DOWN RESTRAINTS AND SEAT RESTRAINTS

Wheelchair users should not be transported in vehicles of any kind while in wheelchairs. As of this date, the Department of Transportation has not approved any tie-down systems for transportation of a user while in a wheelchair, in a moving vehicle of any type.

It is Invacare's position that users of wheelchairs should be transferred into appropriate seating in vehicles for transportation and use be made of the restraints made available by the auto industry. Invacare cannot and does not recommend any wheelchair transportation systems.

⚠ WARNING

ALWAYS wear your seat positioning strap. The seat positioning strap is a positioning belt only. It is not designed for use as a safety device withstanding high stress loads such as auto or aircraft safety belts. If signs of wear appear, the belt MUST be replaced IMMEDIATELY.

Invacare products are specifically designed and manufactured for use in conjunction with Invacare accessories. Accessories designed by other manufacturers have not been tested by Invacare and are not recommended for use with Invacare products.

⚠ WARNING CONTINUED

The drive behavior initially experienced by the user may be different from other chairs previously used. This power wheelchair has Invacare's SureStep® technology, a feature that provides the chair with optimum traction and stability when driving forward over transitions and thresholds of up to 2-inches.

The following warnings apply specifically to the SureStep Feature.

- **DO NOT use on inclines greater than 9°.**
- **DO NOT use on inclines with wet, slippery, icy or oily surfaces. This may include certain painted or otherwise treated wood surfaces.**
- **DO NOT traverse down ramps at high speed. Doing so will reduce traction and increase stopping distance.**
- **The end user's weight can materially affect traction on sloped surfaces. Great care should be taken when traversing such slopes.**

To determine and establish your particular safety limits, practice use of this product on various sloping surfaces in the presence of a qualified healthcare provider before attempting active use of this wheelchair. Other general warnings listed within this document also apply.

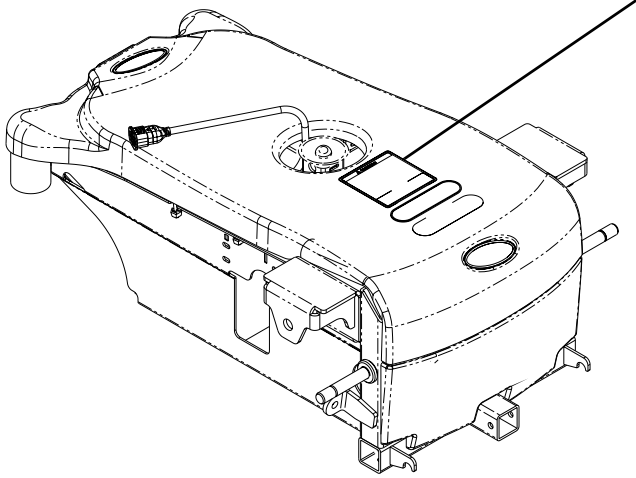
Wheelchairs should be examined during maintenance for signs of corrosion (water exposure, incontinence, etc.). Electrical components damaged by corrosion should be replaced IMMEDIATELY.

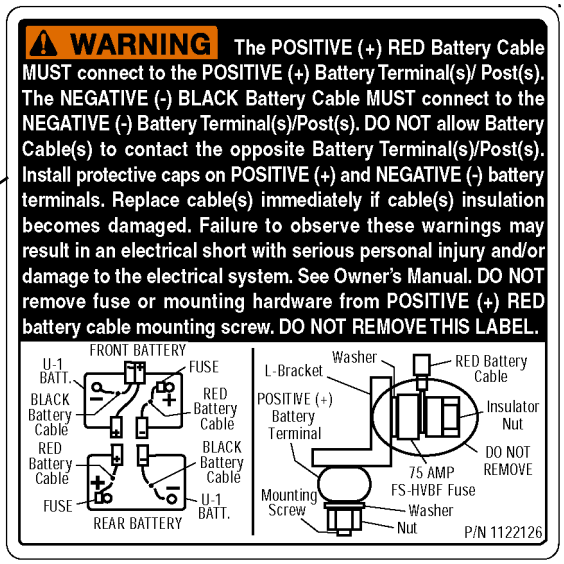
Wheelchairs that are used by incontinent users and/or are frequently exposed to water may require replacement of electrical components more frequently.

LABEL LOCATION

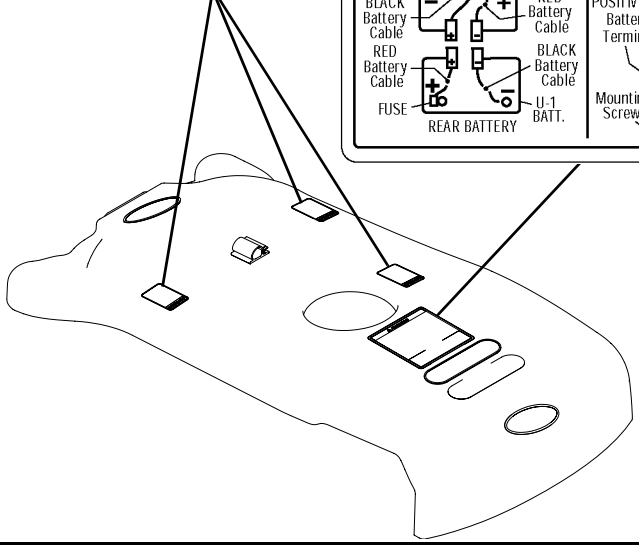
The serial number label is located inside of the front frame. The top shroud and front battery need to be removed to view the label.

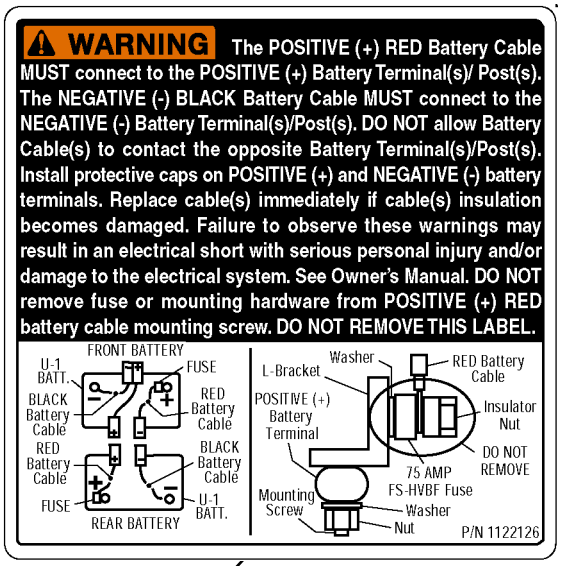
M50/M51 Wheelchairs

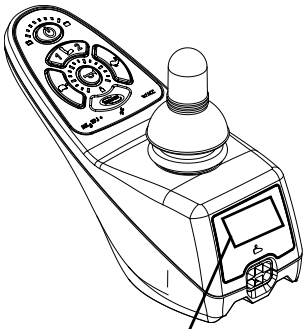




M61 Wheelchairs







TYPICAL PRODUCT PARAMETERS

	MEDIUM BACK	SEMI-RECLINE BACK			OFFICE STYLE, SEMI-RECLINE BACK	ASBA
SEAT WIDTH RANGE:	18 inches	16 inches	18 inches	20 inches	18 inches	16 - 20 inches
SEAT DEPTH:	16 - 18 inches	16 - 18 inches		18 - 20 inches	16 - 18 inches	16 - 20 inches
BACK HEIGHT:	16½ inches	19 inches			23½ inches (w/ headrest) 18¾ inches (w/o headrest)	16 - 20 inches
BACK ANGLE RANGE:	95° to 100° in 5° increments	90 to 114°			90 to 115°	80° to 100° in 5° increments
UPHOLSTERY:	Light Grey Vinyl	Light Grey Vinyl, Grey Cloth, Tan Vinyl			Charcoal Grey Vinyl	Black Nylon Back with Seat Pan
SEAT-TO-FLOOR WITH FOOTBOARD (M50/M51):	20 to 24 inches				19 to 23 inches	17-21 inches
WITH FRONT RIGGINGS (M50/M51):	22 to 24 inches				19-23 inches	19-21 inches
WITH ELEVATING SEAT (M61):	21-23 inches + up to 5 inches of Elevate				19 to 21 inches + up to 5 inches of Elevate	17 to 19 inches + up to 5 inches of Elevate
OVERALL WIDTH:	24 inches (Without Joystick)					
OVERALL HEIGHT:	35 to 43¾ inches				41½ inches	
OVERALL LENGTH:	34 inches (With Footboard Folded) 39½ inches (With Footboard Extended)					
DRIVE WHEELS/ TIRES:	10 x 3-inch (Flat Free inserts)					
CASTER:	6 x 2-inch Front/Rear w/Precision Sealed Bearings					
FOOTRESTS/ LEGRESTS:	Flip Up, Depth and Height Adjustable, Footboard, Swingaway Front Rigging, Elevating Legrest					
***WEIGHT** W/O BATTERIES: W/BATTERIES (U1):	145 to 170 lbs 192 to 217 lbs					
SHIPPING BASE W/O BATTERIES: BASE WITH BATTERIES: MEDIUM BACK: SEMI-RECLINE: OFFICE STYLE: ASBA (20 X 20 X 20):	107 lbs 154 lbs 40 lbs 64 lbs 44 lbs 48 lbs					

	MEDIUM BACK	SEMI-RECLINE BACK	OFFICE STYLE, SEMI-RECLINE BACK	ASBA
ARMRESTS:	Adjustable Width, Angle, Heights and Depth			
BATTERIES:	U1 - Quantity 2			
WEIGHT LIMITATION:	300 lbs			
PERFORMANCE SPEED: TURNING RADIUS: **RANGE (VARIABLE):	 0 to 4.3 m.p.h. 19½ inches up to 12 miles			

**NOTE: Includes seating systems and accessories.*

***NOTE: Values for range are calculated for maximum chair weight rating using largest batteries applicable (U1), per test procedures described in ANSI/RESNA WC/VOL2-1998 Section 4 and meet federal reimbursement requirements for this product. While considered typical, they are derived based on certain ideal conditions. Variances in battery condition, user weight, usage pattern or overall terrain conditions will result in actual values for range that differ from these stated values. Users should become accustomed to how their unique conditions impact their individual results. Users should become familiar with the battery discharge indicator on the joystick to determine the range of their wheelchair. Refer to Battery Charger Operation on page 105 for more information about the battery discharge indicator.*

SECTION 1—GENERAL GUIDELINES

⚠ WARNING

SECTION 1 - GENERAL GUIDELINES contains important information for the safe operation and use of this product. DO NOT use this product or any available optional equipment without first completely reading and understanding these instructions and any additional instructional material such as Owner's Manuals, Service Manuals or Instruction Sheets supplied with this product or optional equipment. If you are unable to understand the Warnings, Cautions or Instructions, contact a healthcare professional, dealer or technical personnel before attempting to use this equipment - otherwise, injury or damage may occur.

Controller Settings/Repair or Service

Set-up of the Electronic Control Unit is to be performed only by a qualified technician. The final adjustments of the controller may affect other activities of the wheelchair. Damage to the equipment could occur if improperly set-up or adjusted.

Wheelchairs should be examined during maintenance for signs of corrosion (water exposure, incontinence, etc.). Electrical components damaged by corrosion should be replaced IMMEDIATELY.

Wheelchairs that are used by incontinent users and/or are frequently exposed to water may require replacement of electrical components more frequently.

Operation Information

Performance adjustments should only be made by professionals of the healthcare field or persons fully conversant with this process and the driver's capabilities. Incorrect settings could cause injury to the driver, bystanders, damage to the chair and to surrounding property.

After the wheelchair has been set-up, check to make sure that the wheelchair performs to the specifications entered during the set-up procedure. If the wheelchair does not perform to specifications, turn the wheelchair Off IMMEDIATELY and reenter set-up specifications. Repeat this procedure until the wheelchair performs to specifications.

ALWAYS shift your weight in the direction you are turning. DO NOT shift your weight in the opposite direction of the turn. Shifting your weight in the opposite direction of the turn may cause the inside drive wheel to lose traction and the wheelchair to tip over.

DO NOT shift your weight or sitting position toward the direction you are reaching as the wheelchair may tip over.

DO NOT engage or disengage the motor release levers until the power is in the Off position.

DO NOT operate on roads, streets or highways.

DO NOT climb, go up or down ramps or traverse slopes greater than 9°.

DO NOT attempt to move up or down an incline with a water, ice or oil film.

DO NOT attempt to drive over curbs or obstacles. Doing so may cause your wheelchair to turn over and cause bodily harm or damage to the chair.

DO NOT leave the power button in the On position when entering or exiting your wheelchair.

DO NOT stand on the frame of the wheelchair.

DO NOT stand on the flip-up footboard, otherwise damage may occur. When getting in or out of the wheelchair, make sure that the flip-up footboard is in the upward position.

ALWAYS wear your seat positioning strap. The seat positioning strap is a positioning belt only. It is not designed for use as a safety device withstanding high stress loads such as auto or aircraft safety belts. If signs of wear appear, belt MUST be replaced IMMEDIATELY.

Before performing any maintenance, adjustment or service verify that On/Off switch on the joystick is in the Off position.

Avoid storing or using the wheelchair near open flame or combustible products. Serious injury or damage to property may result.

ALWAYS keep hands and fingers clear of moving parts to avoid injury.

NEVER leave an unoccupied wheelchair on an incline.

DO NOT attempt to lift the wheelchair by any removable (detachable) parts. Lifting by means of any removable (detachable) parts of the wheelchair may result in injury to the user or damage to the wheelchair.

Make sure the detent balls of the quick-release pin are fully released beyond the outer edge of the tube before operating the wheelchair. Otherwise, injury and/or damage may result.

Keep detent balls clean.

Tire Pressure

DO NOT release wheelchair from service unless it has the proper tire pressure (P.S.I.). DO NOT overinflate the tires. Failure to follow these recommendations may cause the tire to explode and cause bodily harm. The recommended tire pressure is listed on the side wall of the tire.

Batteries

The warranty and performance specifications contained in this manual are based on the use of deep cycle gel cell or sealed lead acid batteries. Invacare strongly recommends their use as the power source for this unit.

Carefully read battery/battery charger information prior to installing, servicing or operating your wheelchair.

Charging Batteries

⚠ DANGER

When using an extension cord, use only a three wire extension cord having at least 16 AWG (American Wire Gauge) wire and the same or higher electrical rating as the device being connected. Use of improper extension cord could result in risk of fire and electric shock. Three prong to two prong adapters should not be used. Use of three prong adapters can result in improper grounding and present a shock hazard to the user.

NEVER attempt to recharge the batteries by attaching cables directly to the battery terminals.

DO NOT attempt to recharge the batteries and operate the wheelchair at the same time.

DO NOT operate wheelchair with extension cord attached to the AC cable.

DO NOT attempt to recharge the batteries when the wheelchair has been exposed to any type of moisture.

DO NOT attempt to recharge the batteries when the wheelchair is outside.

DO NOT sit in the wheelchair while charging the batteries.

DO NOT attempt to recharge batteries using both the on-board battery charger and an independent battery charger (plugged into the joystick charger port) at the same time. Doing so will reduce the life of the batteries.

Read and carefully follow the manufacturer's instructions for each charger (supplied or purchased). If charging instructions are not supplied, consult a qualified technician for proper procedures.

Ensure the pins of the extension cord plug are the same number, size, and shape as those on the charger.

DO NOT under any circumstances cut or remove the round grounding plug from the charger AC cable plug or the extension cord plug.

Grounding Instructions

DO NOT, under any circumstances, cut or remove the round grounding prong from any plug used with or for Invacare products. Some devices are equipped with three-prong (grounding) plugs for protection against possible shock hazards and fire. Where a two-prong wall receptacle is encountered, it is the personal responsibility and obligation of the customer to contact a qualified electrician and have the two-prong receptacle replaced with a properly grounded three-prong wall receptacle in accordance with the National Electrical Code. If you must use an extension cord, use only a three-wire extension cord having the same or higher electrical rating as the device being connected. In addition, Invacare has placed RED/ORANGE warning tags on some equipment. DO NOT remove these tags.

Rain Test

Invacare has tested its power wheelchairs in accordance with ISO 7176 "Rain Test." This provides the end user or his/her assistant sufficient time to remove his/her power wheelchair from a rain storm and retain wheelchair operation.

DO NOT leave power wheelchair in a rain storm of any kind.

DO NOT use power wheelchair in a shower.

DO NOT store power wheelchair in a damp area for an extended period of time.

Direct exposure to excessive rain or dampness may cause the chair to malfunction electrically and mechanically, may cause the chair to prematurely rust and/or may damage the upholstery.

Check to ensure that the RED and GREY battery terminal caps are secured in place, joystick boot is not torn or cracked where water can enter and that all electrical connections are secure at all times.

DO NOT use the wheelchair if the joystick boot is torn or cracked. If the joystick boot becomes torn or cracked, replace IMMEDIATELY.

Weight Training

Invacare does not recommend the use of its wheelchairs as a weight training apparatus. Invacare wheelchairs have not been designed or tested as a seat for any kind of weight training. If occupant uses said wheelchair as a weight training apparatus, Invacare shall not be liable for bodily injury and the warranty is void.

Weight Limitation

The M50, M51 and M61 wheelchairs with SureStep have a weight limitation of 300 lbs.

SECTION 2—EMI INFORMATION

⚠ WARNING

CAUTION: IT IS VERY IMPORTANT THAT YOU READ THIS INFORMATION REGARDING THE POSSIBLE EFFECTS OF ELECTROMAGNETIC INTERFERENCE ON YOUR POWERED WHEELCHAIR.

Electromagnetic Interference (EMI) From Radio Wave Sources

Powered wheelchairs and motorized scooters (in this text, both will be referred to as powered wheelchairs) may be susceptible to electromagnetic interference (EMI), which is interfering electromagnetic energy (EM) emitted from sources such as radio stations, TV stations, amateur radio (HAM) transmitters, two way radios, and cellular phones. The interference (from radio wave sources) can cause the powered wheelchair to release its brakes, move by itself, or move in unintended directions. It can also permanently damage the powered wheelchair's control system. The intensity of the interfering EM energy can be measured in volts per meter (V/m). Each powered wheelchair can resist EMI up to a certain intensity. This is called its "immunity level." The higher the immunity level, the greater the protection. At this time, current technology is capable of achieving at least a 20 V/m immunity level, which would provide useful protection from the more common sources of radiated EMI.

There are a number of sources of relatively intense electromagnetic fields in the everyday environment. Some of these sources are obvious and easy to avoid. Others are not apparent and exposure is unavoidable. However, we believe that by following the warnings listed below, your risk to EMI will be minimized.

The sources of radiated EMI can be broadly classified into three types:

1) **Hand-held Portable transceivers (transmitters-receivers with the antenna mounted directly on the transmitting unit. Examples include: citizens band (CB) radios, "walkie talkie", security, fire and police transceivers, cellular telephones, and other personal communication devices).**

NOTE: Some cellular telephones and similar devices transmit signals while they are ON, even when not being used.

2) **Medium-range mobile transceivers, such as those used in police cars, fire trucks, ambulances and taxis. These usually have the antenna mounted on the outside of the vehicle; and**

3) **Long-range transmitters and transceivers, such as commercial broadcast transmitters (radio and TV broadcast antenna towers) and amateur (HAM) radios.**

NOTE: Other types of hand-held devices, such as cordless phones, laptop computers, AM/FM radios, TV sets, CD players, cassette players, and small appliances, such as electric shavers and hair dryers, so far as we know, are not likely to cause EMI problems to your powered wheelchair.

⚠ WARNING

Powered Wheelchair Electromagnetic Interference (EMI)

Because EM energy rapidly becomes more intense as one moves closer to the transmitting antenna (source), the EM fields from hand-held radio wave sources (transceivers) are of special concern. It is possible to unintentionally bring high levels of EM energy very close to the powered wheelchair's control system while using these devices. This can affect powered wheelchair movement and braking. Therefore, the warnings listed below are recommended to prevent possible interference with the control system of the powered wheelchair.

Electromagnetic interference (EMI) from sources such as radio and TV stations, amateur radio (HAM) transmitters, two-way radios, and cellular phones can affect powered wheelchairs and motorized scooters.

FOLLOWING THE WARNINGS LISTED BELOW SHOULD REDUCE THE CHANCE OF UNINTENDED BRAKE RELEASE OR POWERED WHEELCHAIR MOVEMENT WHICH COULD RESULT IN SERIOUS INJURY.

1) **Do not operate hand-held transceivers (transmitters receivers), such as citizens band (CB) radios, or turn ON personal communication devices, such as cellular phones, while the powered wheelchair is turned ON;**
2) **Be aware of nearby transmitters, such as radio or TV stations, and try to avoid coming close to them;**
3) **If unintended movement or brake release occurs, turn the powered wheelchair OFF as soon as it is safe;**
4) **Be aware that adding accessories or components, or modifying the powered wheelchair, may make it more susceptible to EMI (NOTE: There is no easy way to evaluate their effect on the overall immunity of the powered wheelchair); and**
5) **Report all incidents of unintended movement or brake release to the powered wheelchair manufacturer, and note whether there is a source of EMI nearby.**

Important Information

1) **20 volts per meter (V/m) is a generally achievable and useful immunity level against EMI (as of May 1994) (the higher the level, the greater the protection);**
2) **This device has been tested to a radiated immunity level of 20 volts per meter.**
3) **The immunity level of the product is unknown.**

Modification of any kind to the electronics of this wheelchair as manufactured by Invacare may adversely affect the EMI immunity levels.

SECTION 3—SAFETY INSPECTION/TROUBLESHOOTING

Safety Inspection Checklists

Initial adjustments should be made to suit the end user's personal body structure, needs, and preferences. After initial setup, perform these procedures every time the product is serviced.

All Wheelchairs

CAUTION

As with any vehicle, the wheels and tires should be checked periodically for cracks and wear, and should be replaced.

- ❑ Ensure that the wheelchair rolls straight (no excessive drag or pull to one side).
- ❑ Ensure that the arms are secure but easy to release and adjustment levers engage properly.
- ❑ Ensure that adjustable height arms operate and lock securely.
- ❑ Ensure armrest pads sit flush against arm.
- ❑ Ensure seat is secured to wheelchair frame.
- ❑ Ensure seat release latch is functional. Replace if necessary.
- ❑ Clean upholstery and armrests.
- ❑ Ensure no excessive side movement or binding occurs when drive wheels are lifted and spun when disengaged (freewheeling).
- ❑ Inspect caster assembly has proper tension when caster is spun. Caster should come to a gradual stop.
- ❑ Loosen/tighten caster locknut if wheel wobbles noticeably or binds to a stop.
- ❑ Ensure casters are free of debris.
- ❑ Ensure all caster/wheel/fork/headtube fasteners are secure.
- ❑ Inspect tires for flat spots and wear.
- ❑ Ensure all fasteners on clothing guards are secure.
- ❑ Seat and/or back upholstery have no rips and do not sag. Replace if necessary.
- ❑ Inspect seat positioning strap for any signs of wear. Ensure buckle latches. Verify hardware that attaches strap to frame is secure and undamaged. Replace if necessary.
- ❑ Ensure wheel mounting nuts are secure on drive wheels.
- ❑ Check pneumatic tires for proper inflation.
- ❑ Inspect motor brushes and gearbox coupling.

- ❑ Ensure seat is secured to wheelchair frame.
- ❑ Ensure seat release latch is not worn and is functional. Replace if necessary.
- ❑ Ensure arm pivot points are not worn and/or loose. Replace if necessary.
- ❑ Inspect for any loose hardware on the wheelchair.
- ❑ Inspect charger AC power cord for damage. Replace if necessary.
- ❑ Check that all labels are present and legible. Replace if necessary.
- ❑ Inspect electrical components for signs of corrosion. Replace if corroded or damaged.

Additional Requirements for M61 Wheelchairs

- ❑ Make sure elevate operates smoothly and properly.
- ❑ Make sure elevate systems drive with reduced speed when seat is in elevated position.

Troubleshooting

NOTE: For additional troubleshooting information and explanation of error codes, refer to the individual electronics manual supplied with each wheelchair.

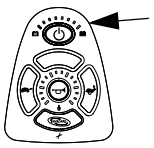
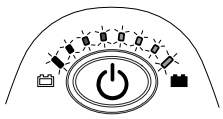
Wheels

WHEELCHAIR VEERS LEFT/RIGHT	SLUGGISH TURN/ PERFORMANCE	CASTERS FLUTTER	SQUEAKS AND RATTLES	LOOSENESS IN WHEELCHAIR	WHEELCHAIR 3 WHEELS	SOLUTIONS
X	X	X				If pneumatic, check tires for correct and equal pressure.
X	X	X	X			Check for loose stem nuts/bolts.
X		X				Check that casters contact ground at the same time.

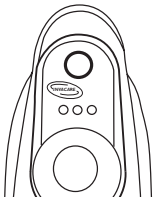
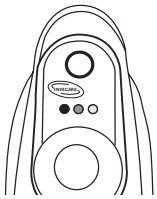
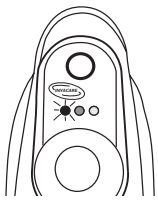
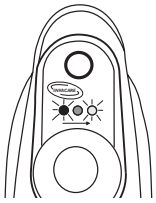
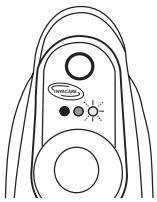
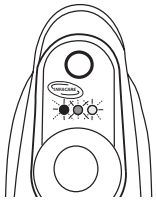
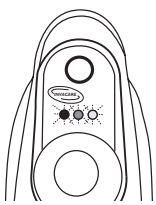
About Joystick Diagnostics

The joystick information gauge and the service indicator give indications of the type of fault or error detected by the control module. When a fault is detected, the wheelchair may stop and not drive. The LEDs on the information gauge may flash in a particular pattern or the service indicator light will flash. The number or type of flashes indicates the nature of the error. If multiple errors are found, only the first error encountered by the control module will be displayed.

SPJ+ Information Gauge Display Diagnostics

DISPLAY 	DESCRIPTION	DEFINITION	COMMENTS
	All LEDs are off.	Power is off.	
	All LEDs are on.	Power is on.	Fewer than three LEDs on implies reduced battery charge.
	Left RED LED is flashing.	Battery charge is low.	The batteries should be charged as soon as possible.
	Left to Right “chase” alternating with steady display.	Joystick is in programming, inhibit and/or charging mode.	The steady LEDs indicate the current state of the battery charge.
	All LEDs are flashing slowly.	Joystick has detected Out-of-Neutral-at-Power-Up mode.	Release the joystick back to Neutral.

SPJ Information Gauge Display Diagnostics

DISPLAY	DESCRIPTION	DEFINITION	COMMENTS
	All three LEDs are Off.	Power is Off.	
	All three LEDs are On.	Power is On.	Fewer than three LEDs On implies reduced battery charge.
	RED LED is flashing.	Battery charge is low.	The batteries should be charged as soon as possible.
	Left to Right "chase" alternating with steady display.	Joystick is in programming, inhibit and/or charging mode.	The steady LEDs indicate the current state of the battery charge.
	GREEN LED is flashing.	Joystick is in Speed Limit mode.	The current state of battery charge will be displayed at the same time.
	All LEDs are flashing slowly.	Joystick has detected Out-of-Neutral-at-Power-Up mode.	Release the joystick back to Neutral.
	All LEDs are flashing quickly.	Joystick has detected a fault.	Joystick uses Flash codes to indicate faults.

Diagnostic Codes

NUMBER OF FLASHES	DIAGNOSTICS CODE	ERROR CODE DESCRIPTION	SUB CODE*	DETAILS OF ERROR CODE	POSSIBLE SOLUTION
1	E 01	User Fault	00	Stall Timeout or user error.	Release joystick to neutral and try again.
2	E02	Battery Fault	00	Recharge batteries or replace.	Check the batteries and cable. Try charging the batteries. Batteries may require replacing.
3	E03	Left Motor Fault	00	Left Motor Short Circuit	Check the left motor, connections and motor cable.
			01	Left Motor Open Circuit	
			02	Left Motor Connection Fault B-	
			03	Motor Terminal Connected to B+	
			04	Left Motor Voltage Fault	
			05	Left Motor Bridge Fault	
			06	Too Many Hardware Current Limit Events	
			07	Current Offset Out of Range	
			08	Hardware Current Limit Fault	
4	E04	Right Motor Fault	00	Right Motor Short Circuit	Check the right motor, connections and motor cable.
			01	Right Motor Open Circuit	
			02	Right Motor Connection Fault B-	
			03	Motor Terminal Connected to B+	
			04	Right Motor Voltage Fault	
			05	Right Motor Bridge Fault	
			06	Too Many Hardware Current Limit Events	
			07	Current Offset Out of Range	
			08	Hardware Current Limit Fault	

NUMBER OF FLASHES	DIAGNOSTICS CODE	ERROR CODE DESCRIPTION	SUB CODE*	DETAILS OF ERROR CODE	POSSIBLE SOLUTION
5	E05	Left Park Brake Fault	00	Left Park Brake Drive-Time Test Failed	Check the left park brake connections and cable.
			01	Left Park Brake Output Enabled When Wheelchair Idle	
			02	Left Park Brake Output Did not Enable When Entering Drive Mode	
			03	Left Park Brake fault during power-up testing	
			04	Left park brake feedback low during drive (park brake short)	
6	E06	Right Park Brake Fault	00	Right Park Brake Drive-Time Test Failed	Check the right park brake connections and cable.
			01	Right Park Brake Output Enabled When Wheelchair Idle	
			02	Right Park Brake Output Did not Enable When Entering Drive Mode	
			03	Right Park Brake fault during power-up testing	
			04	Right park brake feedback low during drive (park brake short)	
7	E07	Remote Fault	00	Local SR Fault (CPU, EEPROM, etc.)	Check the communications bus, connections and wiring. Replace the remote.
			01	Joystick fault at the remote	
			02	Speed pot fault at the remote	

NUMBER OF FLASHES	DIAGNOSTICS CODE	ERROR CODE DESCRIPTION	SUB CODE*	DETAILS OF ERROR CODE	POSSIBLE SOLUTION
8	E08	Controller Fault	00	Controller fault	Check connections and wiring. Replace power module.
			01	RAM fault	
			02	ROM fault	
			03	CPU fault	
			04	EEPROM fault	
			05	Watchdog fault	
			06	Stack fault	
			07	Software fault	
			08	Power-up testing fault	
			09	Relay fault or precharge fault	
			10	Bridge fault or disable all fault	
			11	Electronics fault: Thermistor	
			12	Calibration setting fault	
9	E09	Communications Fault	00	Remote connection lost	Check connections and wiring. Replace Bus cable.
			01	Low communication mode	
10	E10	General Fault	00	General fault	Check all connections and wiring. Contact Invacare Technical Service.
11	E11	Incompati-ble/incorrect Remote	00	Incompatible/incorrect Remote	Wrong type of remote connected. Ensure the branding of the joystick matches that of controller unit.

Motor/Gearbox/Brake

SYMPTOM	PROBABLE CAUSE	SOLUTIONS
Motor makes a clicking noise.	Bad bearings.	If bearings are bad, replace motor. Refer to Removing/Installing the Motor on page 112.
	Raised commutator plate inside of motor.	Ohm out motor and replace motor if high reading is present. Normal reading is .5-5 Ohms. Refer to Motor Testing on page 31 or Removing/Installing the Motor on page 112.
Grinding noise or motor is locking up.	Bad bearings. Bad Gears.	Replace motor/gearbox. Refer to Removing/Installing the Motor on page 112.
Motors stall and starts up again.	Current Rollback.	Stop driving and let electronics cool.

SYMPTOM	PROBABLE CAUSE	SOLUTIONS
Motor chatters or runs erratically, or only one motor turns.	Damaged connector or worn brushes. Bad motor or gear box.	Ohm out motors. Check brushes and replace brushes if necessary. Replace motor/gearbox if high reading is present. Normal reading is 0-5 Ohms. Refer to Motor Testing on page 31, Replacing Motor Brushes on page 116 or Removing/Installing the Motor on page 112.
	Motor release lever is disengaged.	Engage motor release levers. Refer to Engaging/Disengaging Motor Release Lever on page 114.
	Controller malfunction.	Check for error codes with programmer. Refer to electronics manual.
Wheelchair veers to the left or right when driving on level surface.	Uneven tire pressure. Motors out of balance.	Inflate tires. Replace tires if worn. Use programmer to balance motors.
Gearbox is leaking Fluid.	Bad seal around drive shaft. Loose hardware.	If seal is bad, replace motor/gearbox. Remove motor brushes and inspect for grease contamination. Replace motor/gearbox if contamination is found. Refer to Replacing Motor Brushes on page 116 or Removing/Installing the Motor on page 112. If loose hardware is found retighten hardware.
Excessive clicking coming from motor/gearbox.	Bad bearing in motor or gearbox.	Replace motor/gearbox. Refer to Removing/Installing the Motor on page 112.
	Loose wheel hardware.	Tighten hardware, (use removable Loctite™ on hardware). Follow torque settings in this manual.
Rough driving.	Gearbox shaft movement or bent shaft.	Replace motor/gearbox. Refer to Removing/Installing the Motor on page 112.
Motor Stutters.	Poor connection or worn brushes.	Check DCL connectors. Check brushes and replace if necessary. Refer to Replacing Motor Brushes on page 116.
Motor Fails to start after initial installation.	Battery voltage is too low. Bad Connection. Brake Disengaged.	Check batteries and recharge if necessary. Refer to Charging Batteries on page 104. Check connector. Engage brake.

SYMPTOM	PROBABLE CAUSE	SOLUTIONS
Motor is running then fails to restart when stopped.	Heavy load on the motors forcing controller into the current rollback mode.	Leave power On and allow controller to count down, and recharge the batteries overnight with power On.
	Blown fuse in battery wiring harness.	Replace battery wiring harness. Refer to Connecting/Disconnecting Battery Cables on page 101.
	Damaged motor.	Replace brushes if necessary, or replace motor/gearbox if internal damage is determined. Refer to Replacing Motor Brushes on page 116 or Removing/Installing the Motor on page 112.
		Ohm out motor to check for possible internal damage (worn out brushes may be possible). Refer to Motor Testing on page 31 or Replacing Motor Brushes on page 116.
	Controller power stage board or relays may be damaged.	Replace controller or send to Invacare for repair. Refer to Replacing the Controller on page 125.
Motor runs but loses power.	Controller senses heavy load and has entered the current rollback mode.	Stop driving and let electronics cool.
	Batteries are going bad.	Replace batteries. Refer to Removing/Installing Batteries from/into Battery Tray on page 99.
Wheelchair loses all power while driving.	Bad Connection on wheelchair.	Turn power "Off", wait 10 seconds and turn power back "On". Check joystick connection. Check battery connection and fuses.

Battery

SYMPTOM	PROBABLE CAUSE	SOLUTIONS
Batteries won't charge.	Blown battery fuse or damaged cables. Batteries sat discharged too long.	Check cables for damage or replace battery wiring harness. Refer to Connecting/Disconnecting Battery Cables on page 101. Replace batteries. Refer to Removing/Installing Batteries from/into Battery Tray on page 99.
Short Charge Time	One or both batteries may be bad (if batteries charge up to soon).	Check each battery and replace if needed. Refer to Removing/Installing Batteries from/into Battery Tray on page 99.

SYMPTOM	PROBABLE CAUSE	SOLUTIONS
No power to wheelchair motors.	Bad connection or blown fuse. Check Joystick connection. Batteries are dead.	Check all connections and housings for damage. If you have blown fuse a new battery wiring harness must be purchased. Refer to Connecting/Disconnecting Battery Cables on page 101. Check battery voltage and replace if necessary. Refer to Removing/Installing Batteries from/into Battery Tray on page 99.
	Loose battery connections.	Check battery cable connections, may have vibrated loose when driving on rough terrain.
Corroded battery wiring connections.	Possible water, salt, or urine damage.	Replace battery wiring harness. Refer to Connecting/Disconnecting Battery Cables on page 101.

Battery Charger

SYMPTOM	PROBABLE CAUSE	SOLUTIONS
No LED's on Charger	Charger not plugged into outlet, or disconnected from wiring harness on wheelchair.	Make sure the charger is plugged into the outlet and check the wiring on the wheelchair.
	No AC power at outlet.	Check for AC power with digital volt meter.
	Damaged power cord.	Check for damage on the power cord, replace if damaged or send to Invacare for repair.
	Charger LED's burnt out.	Send charger to Invacare for repair.
	Charger may have internal fuse that is blown.	Remove charger cover and check for fuses. il fuses are present, Ohm out fuses and replace if necessary. Refer to Replacing the On-Board Battery Charger Fuse on page 108.
Batteries won't charge.	Blown battery fuse in wiring harness, or charger.	Check battery wiring harness fuse on the wheelchair. Replace battery wiring harness if fuse is blown. Refer to Connecting/Disconnecting Battery Cables on page 101. Check fuse in the charger. Refer to Replacing the On-Board Battery Charger Fuse on page 108.
	Charger not plugged into outlet.	Make sure charger is plugged into the outlet.
	No AC power at the outlet.	Check for AC power with a digital volt meter.
	Charger Power cord may be damaged, or the connector may be damaged.	Check for damage and replace if necessary, or send in for repair.
	Charger may have internal damage.	Charge batteries with known good charger.
	Battery voltage too low for charger to start charging cycle.	Replace batteries. Refer to Removing/Installing Batteries from/into Battery Tray on page 99.

SYMPTOM	PROBABLE CAUSE	SOLUTIONS
Batteries have short driving range during a single charge. Battery Gauge falls off faster than normal.	Consumer not charging batteries long enough.	Instruct consumer to charge for 8-10 hours minimum.
	Batteries may be weak.	Perform load test or check "Battery Quality Menu" with the programmer. Refer to electronics manual. Refer to Field Load Test on page 30.
	Check programming settings.	Torque setting and power level setting may be too high. Refer to electronics manual.
	Heavy load on motors.	Chairs weight distribution may be offset (wheelchair may be front loaded).

M61 Only

SYMPTOM	PROBABLE CAUSE	SOLUTIONS
Wheelchair slows or stops while driving and the Seat Function I indicator is lit.	Elevating seat is elevated.	Return seat to its lowest position. Refer to Elevating the Seat on page 37.
	Elevating seat sensor is damaged.	Examine elevating seat sensor. Replace if necessary. Refer to Removing/Installing the Actuator Switch Sensor on page 97.

Checking Battery Charge Level

The following "Do's" and "Don'ts" are provided for your convenience and safety.

DO	DON'T
Read and understand this manual and any service information that accompanies a battery and charger before operating the wheelchair.	Don't perform any installation or maintenance without first reading this manual.
Move the wheelchair to a work area before opening battery box or installing service batteries.	Don't perform installation or maintenance of batteries in an area that could be damaged by battery spills.
Recharge as frequently as possible to maintain a high charge level and extend battery life.	Don't make it a habit to discharge batteries to the lowest level.
Follow recommendations in this manual when selecting a battery or charger.	Don't use randomly chosen batteries or chargers.
Fully charge new batteries before using.	Don't put new batteries into servcie before charging.
Use a carrying strap to remove, move or install a battery.	Don't tip or tilt batteries.
Push battery clamps on the terminals. Spread clamps wider if necessary.	Don't tap on clamps and terminals with tools.
Use ONLY a GEL charger for a GEL battery or "Sealed" battery.	Don't mismatch your battery and chargers.

Field Load Test

NOTE: For this procedure, refer to FIGURE 3.1 on page 31.

Old batteries lose their ability to store and release power, due to increased internal resistance. This means that as you try to take power from the battery, some of that power is used up in the process of passing through the battery, resulting in less voltage at the posts. The more power drawn, the lower the voltage available. When this lost voltage drops the output 1.0 volts under load (2.0 for a pair), replace the batteries.

To spot this problem, test batteries under load.

Use a digital voltmeter to check battery charge level at the charger connector. The charger connector is located on the joystick.

NOTE: Read these instructions carefully and the manufacturer's instructions on the digital voltmeter before using the digital voltmeter.

1. Ensure that power is Off.
2. Make sure battery is fully charged. An extremely discharged battery will exhibit the same symptoms as a bad one.
3. Remove the footrests from the wheelchair. Refer to Front Riggings/FootBoard on page 73.
4. Connect the voltmeter leads to the charger port on the wheelchair as shown in FIGURE 3.1. Most digital voltmeters are not affected by polarity, however, analog meters (meters with swinging needles) can be and should be used carefully. A good meter reading should be 25.5 to 26 VDC.

⚠ WARNING

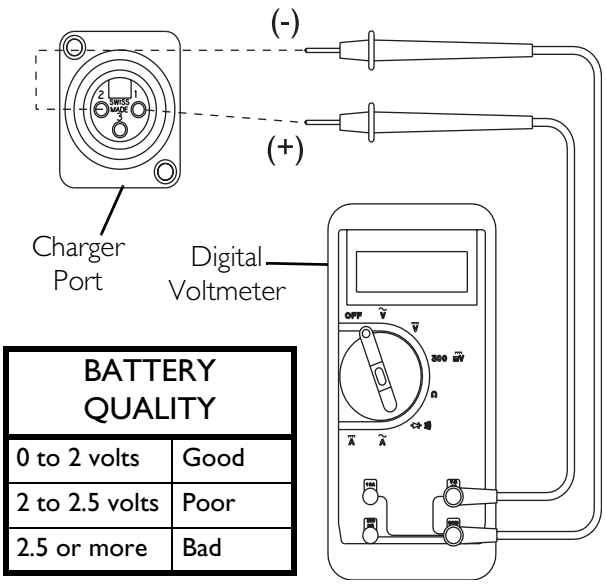
When performing STEPS 5 and 6, ensure feet are clear from casters and wall, otherwise injury may result.

5. Sit in wheelchair and place feet against a wall, workbench or other stationary object.
6. Turn the power On and carefully push the joystick forward, trying to drive the wheelchair through the stationary object.

NOTE: Performing STEP 6 puts a heavy load on the batteries as they try to push through the stationary object. If the wheels spin, have two individuals (one on each arm) apply as much downward pressure as possible on the arms of the wheelchair.

7. Read the meter while the motors are straining, no longer than 3-4 seconds, to determine the voltage under load.

NOTE: If the voltage drops more than 2 volts from a pair of fully charged batteries while under load, they should be replaced regardless of the unloaded voltages.



BATTERY QUALITY	
0 to 2 volts	Good
2 to 2.5 volts	Poor
2.5 or more	Bad

FIGURE 3.1 Field Load Test

Motor Testing

NOTE: For this procedure, refer to FIGURE 3.2.

1. On the 4-pin motor connector, locate the two contacts in the RED and BLACK housings.
2. Set the digital multimeter to measure resistance (ohms).
3. Measure the resistance between the two motor contacts.

NOTE: A normal reading is between .5 and 5 ohms. A reading of 0 ohms or in excess of 15 ohms indicates a problem. High readings are generally caused by bad connections and/or damaged brushes. Contact Invacare.

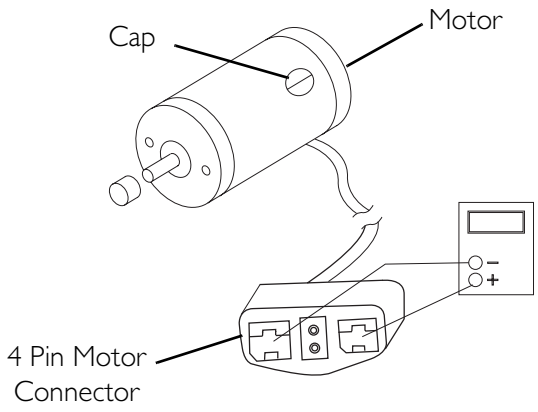


FIGURE 3.2 Motor Testing

SECTION 4—WHEELCHAIR OPERATION

⚠ WARNING

After any adjustments, repair or service and before use, make sure that all attaching hardware is tightened securely - otherwise injury or damage may result.

Set-up of the Electronic Control Unit is to be performed only by a qualified technician. The final adjustments of the controller may affect other activities of the wheelchair. Damage to the equipment could occur if improperly set-up or adjusted.

Turning the Power On/Off

M50 and M51 Wheelchairs Manufactured Before 8/15/05

NOTE: For this procedure, refer to FIGURE 4.1.

1. Turn the power On by moving the On/Off switch up or down. The switch automatically retracts back to center position.

NOTE: After turning power On, all indicators will light briefly and the display gauge will indicate one of the following:

- *The Current Battery Charge - Information gauge shows all LEDs lit or partial LEDs lit. Refer to table in Information Gauge Display on page 40.*
- *Out Of Neutral At Power Up - Information Gauge shows all LEDs flashing slowly. This occurs when the power is turned On when the joystick is out of neutral. This feature prevents sudden and unexpected movements of the power chair.*

2. Turning the power Off can be achieved by moving the On/Off switch up or down. The switch automatically retracts back to center position.

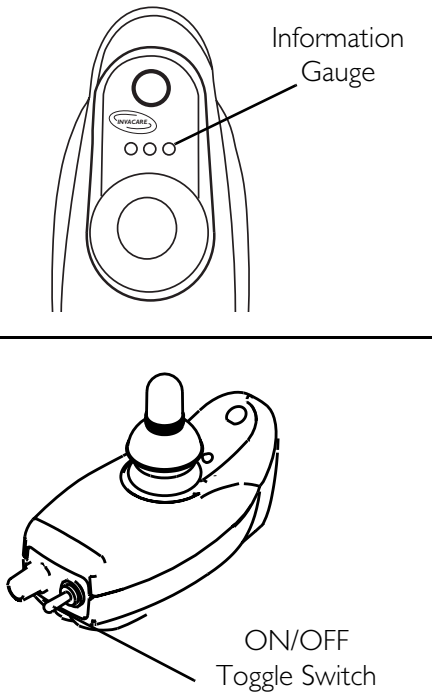


FIGURE 4.1 Turning the Power On/Off - M50 and M51 Wheelchairs Manufactured Before 8/15/05

M50/M51 Wheelchairs Manufactured After 8/14/05 and all M61 Wheelchairs

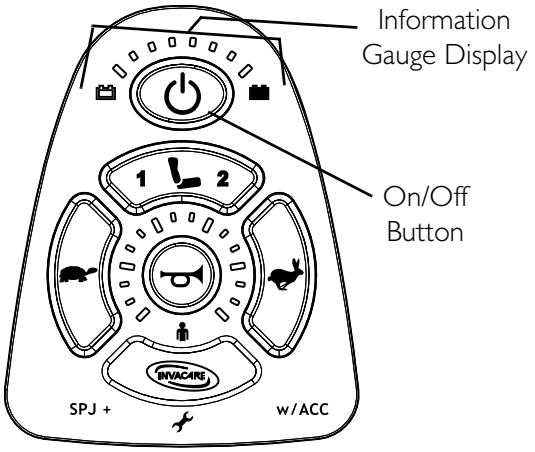
NOTE: For this procedure, refer to FIGURE 4.2.

1. Turn the power On by pressing the On/Off button.

NOTE: After turning power On, the battery gauge indicators will light briefly. One of the following will occur after that:

- *The current battery charge will be indicated on the information gauge display.*
- *Lock Mode will be indicated by all LEDs flashing briefly and the information gauge LEDs chasing slowly from right to left. If this occurs, press the horn button two times within ten seconds to unlock the joystick.*

2. Turning the power Off by pressing the On/Off button.



NOTE: SPJ+ w/ACC joystick shown. SPJ+ joystick works the same way.

FIGURE 4.2 Turning the Power On/Off - M50/M51 Wheelchairs Manufactured After 8/14/05 and all M61 Wheelchairs

NOTE: If the joystick has been programmed for lock mode, holding the On/Off button down for four seconds will lock the joystick. The LEDs will flash briefly and the horn will sound a short beep.

Using the Joystick to Drive the Wheelchair

⚠ WARNING

DO NOT operate wheelchair on an incline while in an elevated position. Otherwise, the wheelchair may tip over and injury or damage may occur.

NOTE: For this procedure, refer to FIGURE 4.3 on page 34.

The joystick provides smooth control of speed and direction. It is equipped with 360 degrees of mobility for ease of operation. The joystick is spring-loaded, and automatically returns to the upright (neutral) position when released. Pushing the joystick in a given direction causes the chair to move in that direction.

The joystick has proportional control, meaning that the further it is pushed from the upright (neutral) position, the faster the wheelchair moves or the seat elevates/lowers. The maximum speed, however, is limited by the speed setting.

To slow the wheelchair to a stop, simply release the joystick. The wheelchair has automatic speed and direction compensation to minimize corrections.

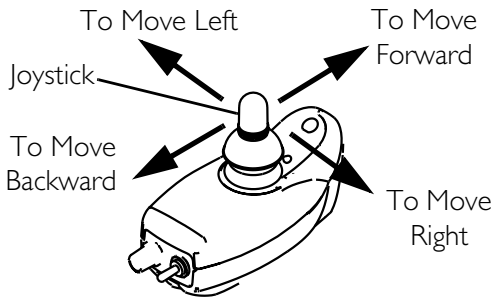
When first learning to drive, select a slow speed and try to drive the wheelchair as slowly as possible by pushing the joystick slightly forward. This exercise will help you learn to utilize the full potential of the proportional control and allow you to start and stop smoothly.

To drive the wheelchair, perform the following:

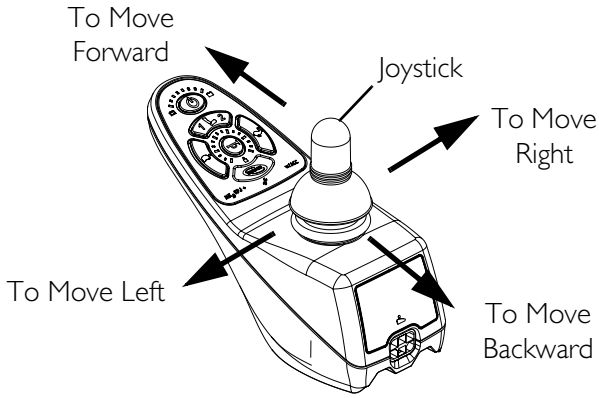
1. Turn the power On. Refer to Turning the Power On/Off on page 32.
2. Adjust speed. Refer to Adjusting the Speed on page 35.
3. Maneuver the joystick in the following manner:

MOVEMENT	ACTION
FORWARD	Push forward on the joystick.
REVERSE	Pull back on the joystick.
Turn RIGHT	Move the joystick RIGHT.
Turn LEFT	Move the joystick LEFT.
STOP	Release the joystick and the wheelchair will quickly slow down.

M50 and M51 Wheelchairs Manufactured Before 8/15/05



M50/M51 Wheelchairs Manufactured After 8/14/05 and All M61 Wheelchairs



NOTE: SPJ+ w/ACC joystick shown. SPJ+ joystick works the same way.

FIGURE 4.3 Using the Joystick to Drive the Wheelchair

Adjusting the Speed

M50 and M51 Wheelchairs Manufactured Before 8/15/05

NOTE: For this procedure, refer to FIGURE 4.4.

1. Turn the speed control knob to adjust the speed:
   - Clockwise - Increase speed.
   - Counterclockwise - Decrease speed.

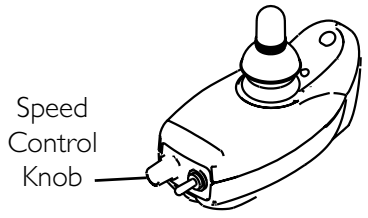


FIGURE 4.4 Adjusting the Speed - M50 and M51 Wheelchairs Manufactured Before 8/15/05

M50/M51 Wheelchairs Manufactured After 8/14/05 and All M61 Wheelchairs

NOTE: For this procedure, refer to FIGURE 4.5 on page 36.

1. Perform one of the following:
   - Adjust Speed in 20% Increments (5 Speed Mode) - Press the tortoise button ( ) or hare button ( ) to decrease/increase the speed in 20% increments. The larger bars in the speedometer will light.
   - Adjust Speed in Smaller Increments (VSP Mode) - Perform the following steps:
     i. Press and hold both the tortoise button ( ) and hare button ( ) until the joystick beeps.
     ii. Perform one of the following:
       - Press the tortoise button ( ) or hare button ( ) to decrease/increase the speed in 20% increments. The larger bars in the speedometer will light.
       - Press and hold the tortoise button ( ) or hare button ( ) to decrease/increase the speed in smaller increments. The smaller bars in the speedometer will light.

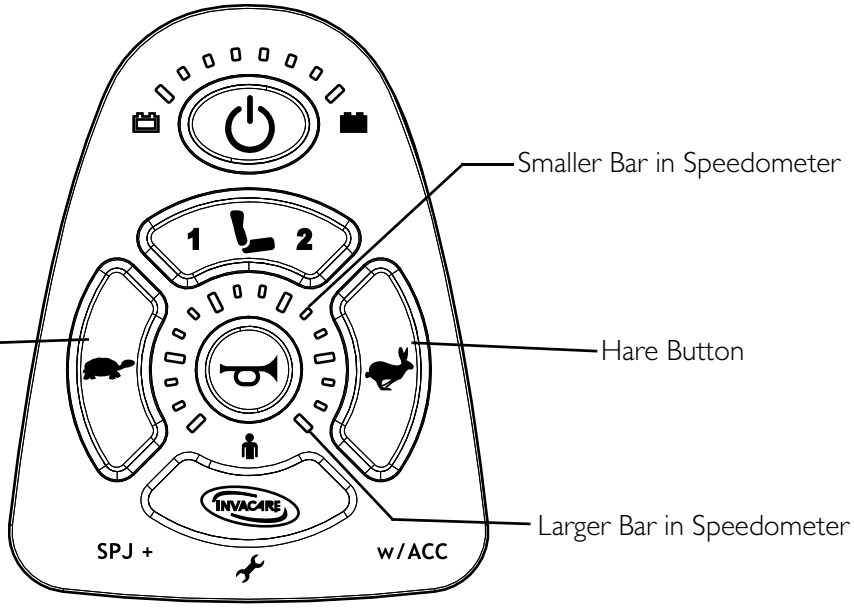


FIGURE 4.5 Adjusting the Speed - M50/M51 Wheelchairs Manufactured After 8/14/05 and All M61 Wheelchairs

Using the Horn

M50 and M51 Wheelchairs Manufactured Before 8/15/05

NOTE: For this procedure, refer to FIGURE 4.6.

1. Press the horn button located above the information gauge on the joystick housing.

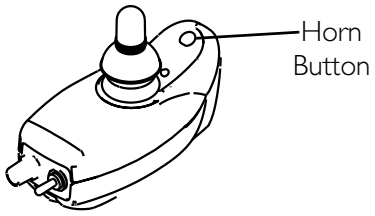


FIGURE 4.6 Using the Horn - M50 and M51 Wheelchairs Manufactured Before 8/15/05

M50/M51 Wheelchairs Manufactured After 8/14/05 and All M61 Wheelchairs

NOTE: For this procedure, refer to FIGURE 4.7.

1. Press the horn button located in the center of the speed indicator. The horn will sound for as long as the button is pressed.

NOTE: SPJ+ w/ACC joystick shown. SPJ+ joystick works the same way.

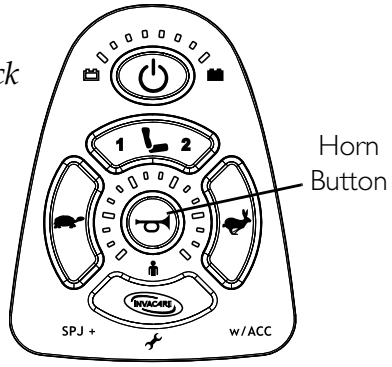


FIGURE 4.7 Using the Horn - M50/M51 Wheelchairs Manufactured After 8/14/05 and All M61 Wheelchairs

Elevating the Seat

⚠ WARNING

DO NOT operate wheelchair on an incline while in an elevated position. Otherwise, the wheelchair may tip over and injury or damage may occur.

DO NOT operate the elevate function near or under a fixed object such as a table or desk.

Use only the MK5™ NX w/ACC or MK660 w/ACC controller to activate the elevate function. DO NOT use any other actuator controls. Such devices may result in excess heating and cause damage to the actuator and associated wiring and could cause a fire, death, physical injury or property damage. If such devices are used, Invacare shall not be liable and the limited warranty is void.

The elevated seat option is equipped with a speed reduction safety mechanism. While the seat is in an elevated position, the safety feature slows the speed of the wheelchair by 80%. If the wheelchair operates at maximum speed while in an elevated position, DO NOT operate the wheelchair. Have the wheelchair serviced IMMEDIATELY by a qualified technician.

NOTE: For this procedure, refer to FIGURE 4.8.

NOTE: This procedure applies to M61 wheelchairs only.

1. Make sure the wheelchair is on a level surface.
2. Press the mode button to switch from driving mode to elevate mode.

NOTE: The LED will light up with a circle around it.

3. Move the joystick:
   - Forward - Elevates the seat.
   - Backward - Lowers the seat.

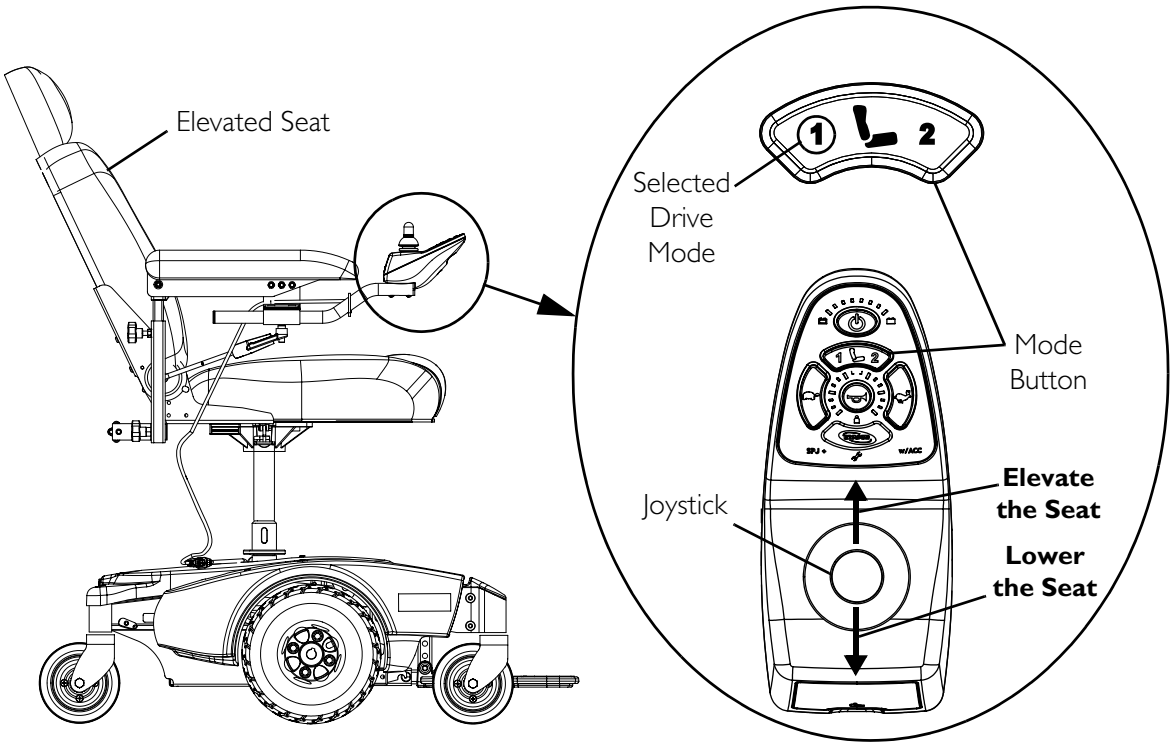


FIGURE 4.8 Elevating the Seat

SPJ™ Joystick Switches and Indicators

NOTE: For the following information, refer to FIGURE 4.9.

NOTE: The SPJ joystick is used on M50 and M51 wheelchairs manufactured before 8/15/05 only.

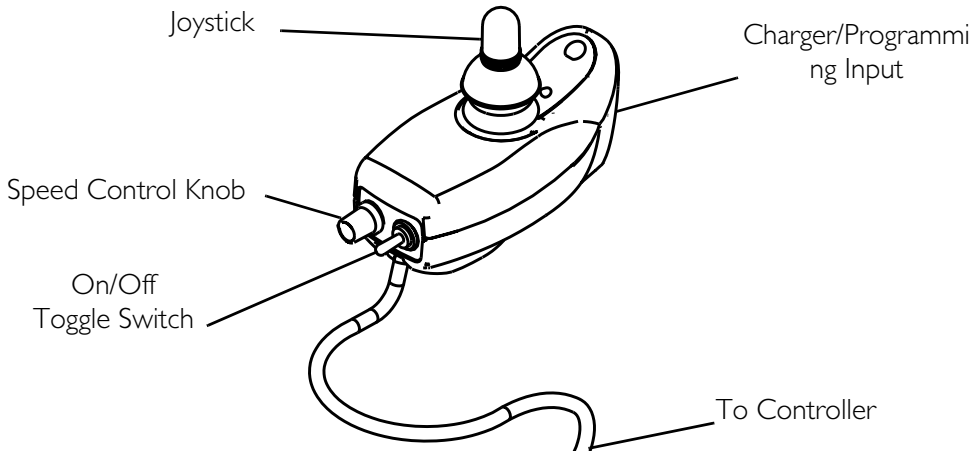


FIGURE 4.9 SPJ™ Joystick Switches and Indicators

On/Off Toggle Switch

This toggle switch is located at the back of the joystick housing.

Speed Control Knob

The speed control knob is located on the back of the joystick housing. This rotary switch is used for controlling the speed and acceleration of the wheelchair.

1. Turn the switch clockwise to increase the speed of the wheelchair.
2. Turn the switch counterclockwise to decrease the speed of the wheelchair.

Joystick

The joystick has proportional drive control, meaning that further the wheelchair is pushed from the upright (neutral) position, the faster it moves. Your top speed, however, is limited by the setting of the speed-control knob and programmed settings.

To slow the wheelchair to a stop, simply release the joystick. The wheelchair has automatic speed and direction compensation to minimize corrections.

Charger/Programming Input

Located at the front of the joystick housing. This provides easy access for charging the wheelchair batteries. This port also serves as the Remote Programmer Communication connection.

Information Gauge Display

Located on the front of the joystick housing, it provides the following information to the user on the status of the wheelchair -

1. Power is On.
2. True state-of-battery-charge, including notification of when the battery requires charging:
   A. GREEN LED is lit, indicating well charged batteries.
   B. Only AMBER LEDs are lit, indicating batteries are moderately charged. Recharge batteries before taking a long trip.
   C. Only RED LED is lit, indicating batteries are running out of charge. Recharge batteries as soon as possible.

The Information Gauge display also serves as a system diagnostic device when a fault is detected by the control module. A specific number of flashes of the LEDs indicate the type of fault detected. Refer to SPJ Information Gauge Display Diagnostics on page 22.

SPJ+ and SPJ+ w/ACC Joystick Switches and Indicators

NOTE: For the following information, refer to FIGURE 4.10.

NOTE: SPJ+ joysticks are used on M50/M51 wheelchairs manufactured after 8/14/05.

NOTE: SPJ+ w/ACC joysticks are used on M61 wheelchairs.

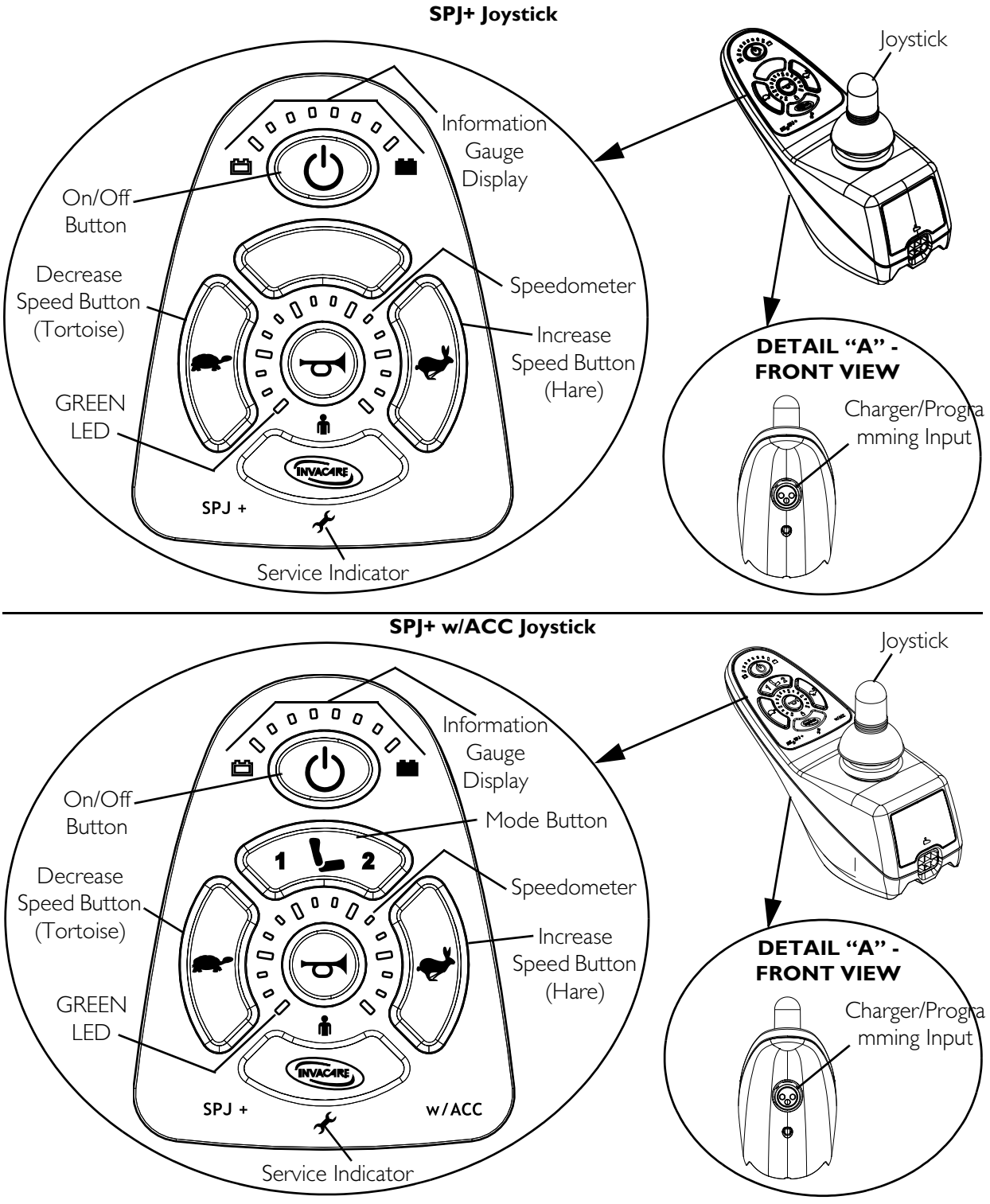


FIGURE 4.10 SPJ+ and SPJ+ w/ACC Joystick Switches and Indicators

On/Off Button

This button is located at the front of the joystick housing. It is used to turn the wheelchair On and Off, to remove the joystick from sleep mode (if programmed) and to lock or unlock the joystick (if programmed).

Speedometer

The speedometer is used to show the maximum speed. The right-most LED indicates current maximum speed setting. The bottom left GREEN LED flashes to indicate that the joystick is in speed limit mode. Speed limit mode limits the drive speed to a pre-programmed value, typically when the seat has been elevated and the wheelchair is required to drive at 20% speed.

Speed Control Buttons

The speed control buttons (tortoise button ( ) and hare button ( )) are used to set and adjust the maximum speed.

1. To adjust the speed, perform one of the following:
   - Adjust Speed in 20% Increments (5 Speed Mode) - Press the tortoise button ( ) or hare button ( ) to decrease/increase the speed in 20% increments. The larger bars in the speedometer will light.
   - Adjust Speed in Smaller Increments (VSP Mode) - Perform the following steps:
     i. Press and hold both the tortoise button ( ) and hare button ( ) until the joystick beeps.
     ii. Perform one of the following:
       - Press the tortoise button ( ) or hare button ( ) to decrease/increase the speed in 20% increments. The larger bars in the speedometer will light.
       - Press and hold the tortoise button ( ) or hare button ( ) to decrease/increase the speed in smaller increments. The smaller bars in the speedometer will light.

Mode Button

NOTE: The mode button is present on the SPJ+ w/ACC joystick only.

Press the mode button to switch from driving mode to elevate mode. Refer to the wheelchair owner's manual for elevating seat operating instructions.

Joystick

The joystick has proportional drive control, meaning that further the joystick is pushed from the upright (neutral) position, the faster the wheelchair or seat moves. Your top speed, however, is limited by the programmed settings.

To slow the wheelchair to a stop, simply release the joystick. The wheelchair has automatic speed and direction compensation to minimize corrections.

Charger/Programming Input

The charger/programming input is located at the front of the joystick housing. This provides easy access for charging the wheelchair batteries. This port also serves as the Remote Programmer Communication connection. Driving is prevented while the system is charging.

Service Indicator

The AMBER service indicator will light when an error or fault occurs. Refer to electronics manual supplied with wheelchair.

Information Gauge Display

Located on the front of the joystick housing, it provides the following information to the user on the status of the wheelchair -

1. Power is On.
2. True state-of-battery-charge, including notification of when the battery requires charging:
   A. GREEN LEDs are lit, indicating well charged batteries.
   B. AMBER LEDs are lit, indicating batteries are moderately charged. Recharge batteries before taking a long trip.
   C. RED LEDs are lit, indicating batteries are running out of charge. Recharge batteries as soon as possible.

The Information Gauge display also serves as a system diagnostic device when a fault is detected by the control module. A specific number of flashes of the LEDs indicate the type of fault detected. Refer to the table for the diagnostic indications of the wheelchair status.

SECTION 5—ARMS

⚠ WARNING

After any adjustments, repair or service and before use, make sure that all attaching hardware is tightened securely - otherwise injury or damage may result.

Before performing any maintenance, adjustment or service verify that On/Off switch on the joystick is in the Off position.

Removing/Installing Van Seat Arm

NOTE: For this procedure, refer to FIGURE 5.1 on page 45.

NOTE: Reverse this procedure to install the adjustable width arms.

1. If necessary, disconnect the joystick. Disconnecting/Connecting the Joystick on page 123.
2. Loosen lock knob that secures the adjustable width arm to the arm support tube.
3. Remove the adjustable width arm from the arm support tube.
4. If necessary, repeat STEPS 1-3 to remove the remaining adjustable width arm.

Adjusting Van Seat Arm Width

⚠ WARNING

Increasing the width of the arms may affect the overall width of the wheelchair. Ensure that there is enough clearance when attempting to pass through doorways or other tight spaces, otherwise serious injury or damage may result.

NOTE: For this procedure, refer to FIGURE 5.1 on page 45.

1. Loosen the two lock knobs that secure the adjustable width arms to the arm support tube.

NOTE: Both adjustable width arms should be adjusted to the same distance away from the arm support tube.

NOTE: Changing the width of the adjustable width arms may also effect the overall width of the wheelchair.

2. Reposition adjustable width arms until desired width is achieved.
3. Securely tighten the two lock knobs that secure the adjustable width arms to the arm support tube.

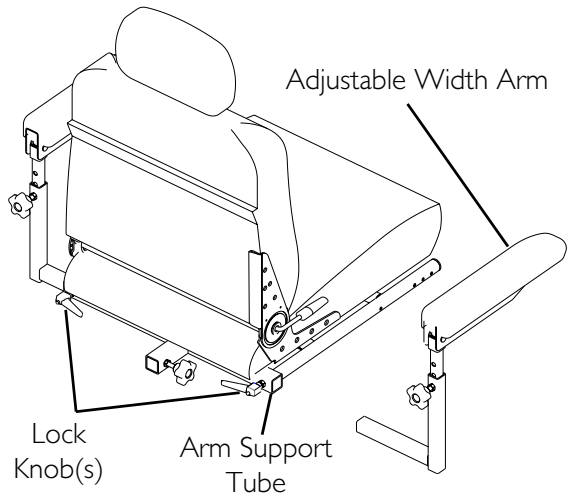


FIGURE 5.1 Removing/Installing Van Seat Arm and Adjusting Van Seat Arm Width

Adjusting Van Seat Arm Angle

⚠ WARNING

Pinch point may occur when adjusting the arm angle position.

NOTE: For this procedure, refer to FIGURE 5.2 on page 46.

1. Lift-up the armrest.
2. Loosen the jam nut.
3. Adjust the socket screw up or down to the desired arm angle position.
4. Tighten the jam nut.
5. To determine the same angle for the opposite armrest, count the exposed threads after the jam nut has been tightened.
6. Repeat STEPS 1-5 for opposite armrest, if necessary.

Adjusting Van Seat Arm Height (Adjustable Height Arms Only)

NOTE: For this procedure, refer to FIGURE 5.2 on page 46.

1. Remove the lock knob that secures the armrest to the arm frame assembly.
2. Adjust the armrest to one of five positions in 1-inch increments.
3. Reinstall the lock knob that secures the armrest to the arm frame assembly and tighten securely.

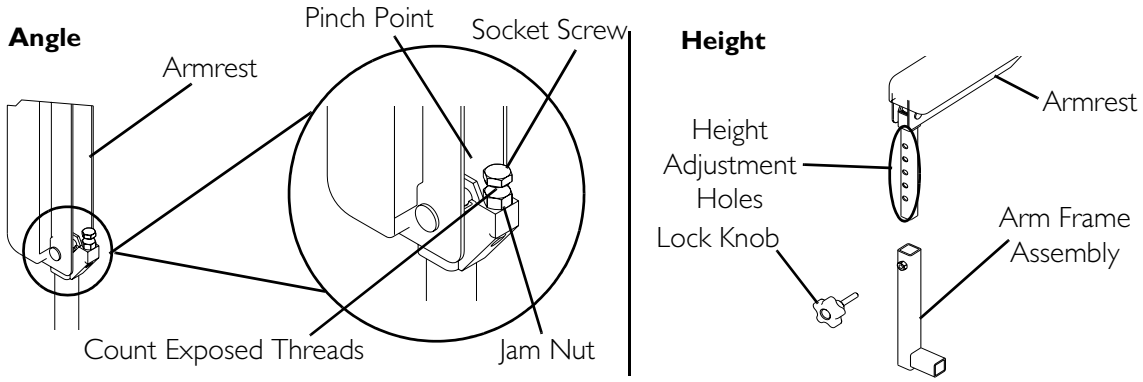


FIGURE 5.2 Adjusting Van Seat Arm Height (Adjustable Height Arms Only)

Replacing Van Seat Armrest Assembly

NOTE: For this procedure, refer to FIGURE 5.3.

1. If necessary, remove the joystick. Removing/Installing the Joystick on page 120.
2. Remove the mounting screw, washers and locknut that secure the existing armrest assembly to the arm post.
3. Position the new armrest assembly on the armrest post and secure with the mounting screw, washers, and locknut. Refer to FIGURE 5.3 for correct hardware orientation.
4. If necessary, install the joystick. Removing/Installing the Joystick on page 120.
5. Repeat STEPS 1-4 for the opposite armrest assembly, if necessary.

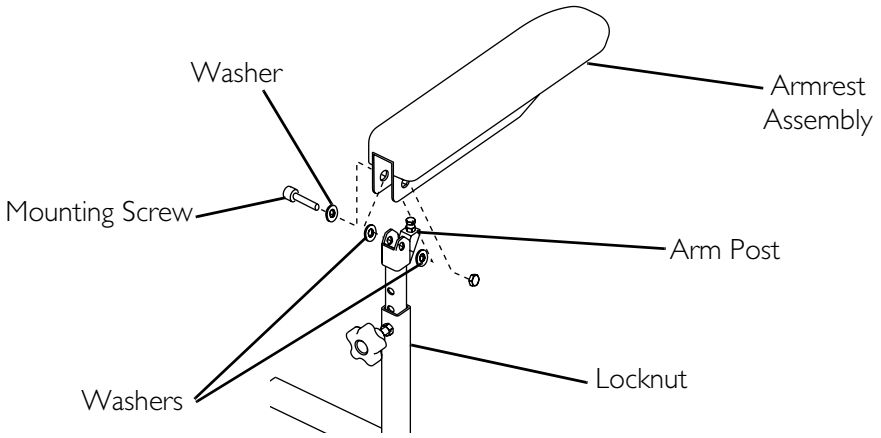


FIGURE 5.3 Replacing Van Seat Armrest Assembly

Removing/Installing Flip Back Armrest

⚠ WARNING

Make sure the flip back armrest release levers and height adjustment levers are in the locked position before using the wheelchair.

NOTE: For this procedure, refer to FIGURE 5.4.

NOTE: Flip back armrest release lever MUST be in unlocked position when placing armrest into the arm sockets.

NOTE: Reverse this procedure to install the flip back armrest.

1. If necessary, disconnect the joystick. Disconnecting/Connecting the Joystick on page 123.
2. Unlock flip back armrest by pulling flip back armrest release lever into the unlocked (horizontal) position.
3. Remove quick release pin securing the flip back armrest to the wheelchair frame.
4. Pull up on the flip back armrest and remove the armrest from the arm sockets.
5. Repeat STEPS 1-4 for the opposite flip back armrest, if necessary.

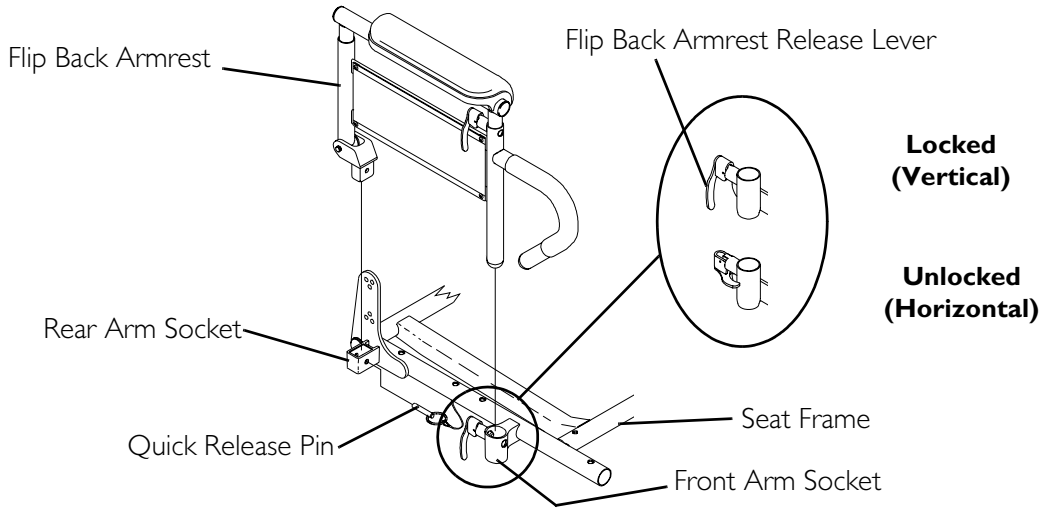


FIGURE 5.4 Removing/Installing Flip Back Armrest

Adjusting the Flip Back Armrest Height

⚠ WARNING

Make sure the flip back armrest release levers and height adjustment levers are in the locked position before using the wheelchair.

NOTE: For this procedure, refer to FIGURE 5.5.

1. Unlock top of flip back armrest by pulling height adjustment lever into the up (horizontal) position.
2. Adjust top of the flip back armrest to the desired height.
3. Lock top of flip back armrest by pushing height adjustment lever into the down (vertical) position.
4. Lift up on flip back armrest to make sure the armrest is locked in place.
5. Repeat STEPS 1-4 for opposite flip back armrest, if necessary.

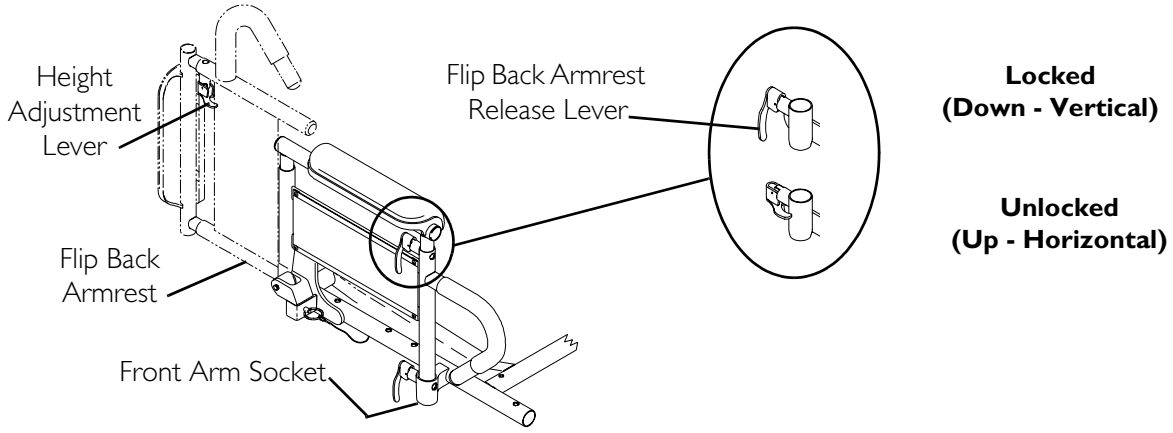


FIGURE 5.5 Adjusting the Flip Back Armrest Height

SECTION 6—VAN SEAT

⚠ WARNING

After any adjustments, repair or service and before use, make sure that all attaching hardware is tightened securely - otherwise injury or damage may result.

Before performing any maintenance, adjustment or service verify that On/Off switch on the joystick is in the Off position.

Adjusting the Back Angle

Semi-Recline Back Angle

NOTE: For this procedure, refer to FIGURE 6.1.

1. Lift up on the release handle and adjust seat to desired angle.
2. Let go of the release handle to lock the back in position.

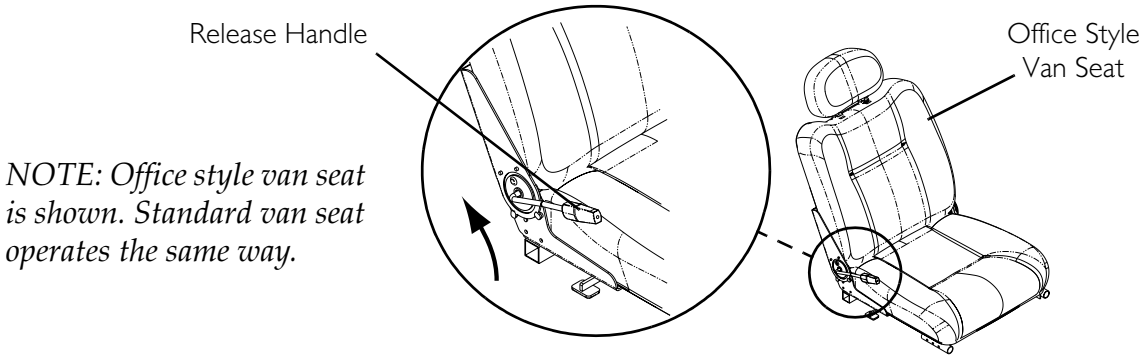


FIGURE 6.1 Adjusting the Back Angle - Semi-Recline Back Angle

Fold Down Back Angle

NOTE: For this procedure, refer to FIGURE 6.2 on page 50.

1. Remove the two shoulder bolts and locknuts from the seat hinges on either side of the seat.
2. Select one of the four back angle positions as shown in Detail "A" of FIGURE 6.2.
3. Reinstall and tighten the two shoulder bolts and locknuts through the desired back angle setting on each seat hinge.

NOTE: Both seat hinges should be set to the same back angle setting.

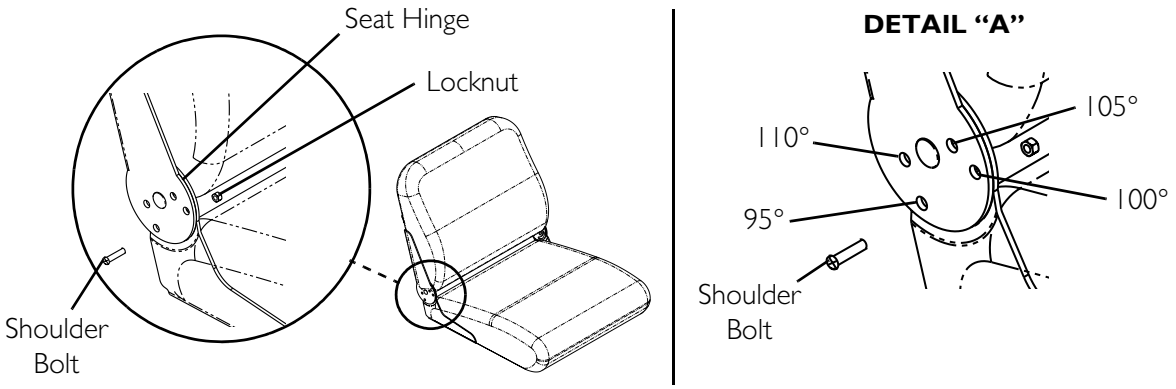


FIGURE 6.2 Adjusting the Back Angle - Fold Down Back Angle

Adjusting the Headrest (Semi-Recline Only)

NOTE: For this procedure, refer to FIGURE 6.3.

1. To raise the headrest, lift the headrest up to the desired position.
2. To lower the headrest, push the release tab towards the front of the wheelchair. Lower the headrest to the desired position.

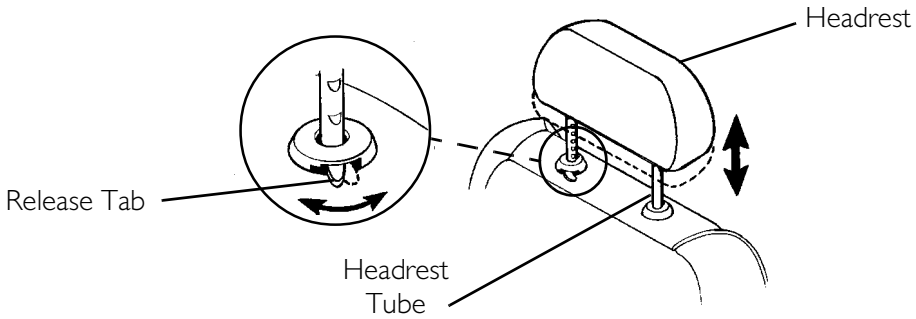


FIGURE 6.3 Adjusting the Headrest (Semi-Recline Only)

Removing/Installing the Seat Assembly

NOTE: For this procedure, refer to FIGURE 6.4 on page 51.

Removing

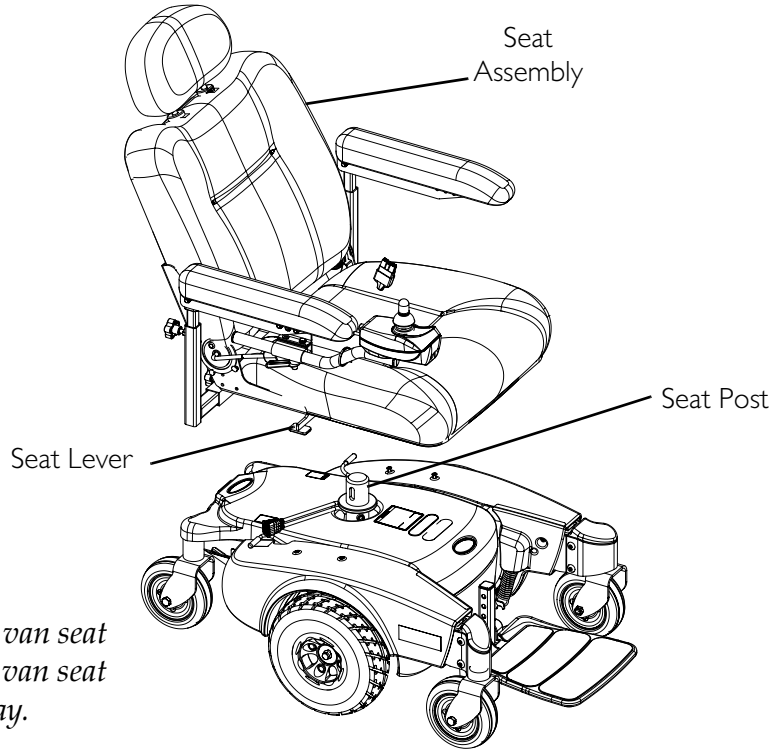
1. Disconnect the joystick. Refer to Disconnecting/Connecting the Joystick on page 123.
2. Fold down the seat back.
3. Pull the seat lever up and lift the seat assembly up and away from the seat post.

Installing

1. Align the seat pivot with the seat post.
2. Pull the seat lever up and lower the seat assembly on the seat post.

NOTE: If necessary, slightly twist seat assembly back and forth to lock it in place.

3. Release the seat lever.
4. Pull the seat assembly up to ensure that it is locked in place.
5. Connect the joystick. Refer to Disconnecting/Connecting the Joystick on page 123.



NOTE: Office style van seat is shown. Standard van seat installs the same way.

FIGURE 6.4 Removing/Installing the Seat Assembly

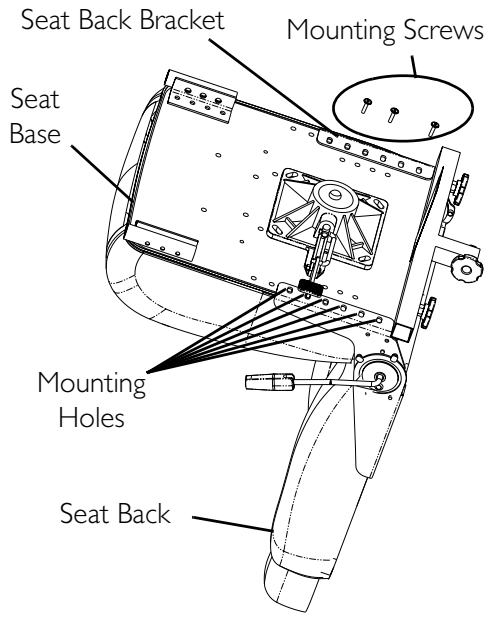
Adjusting Seat Depth

NOTE: For this procedure, refer to FIGURE 6.5 on page 52.

1. Remove the seat. Refer to Removing/Installing the Seat Assembly on page 50.
2. Perform one of the following:
   - For Standard Van Seat -
     i. Remove the seat base from the seat assembly. Refer to Adjusting Seat Position on Seat Base on page 56.
     ii. Go to STEP 3.
   - For Office Style Seat - Go to STEP 3.
3. Remove the six mounting screws located under the seat that secure the seat back assembly in place.
4. Adjust seat back assembly to desired position and reinstall the six mounting screws. Securely tighten.

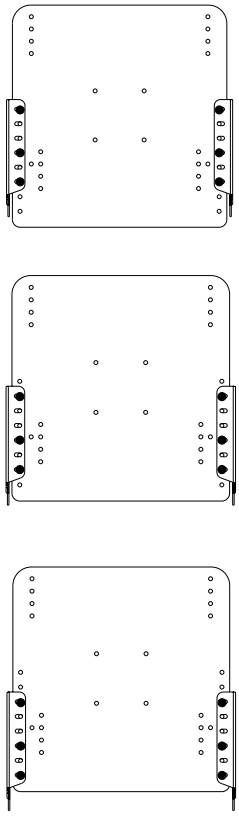
NOTE: Refer to Detail "A" of FIGURE 6.5 for proper seat depth positions. For example, to achieve maximum seat depth, the front mounting hole on the seat back bracket aligns with the third hole on the seat base.

5. Perform one of the following:
   - For Standard Van Seat -
     i. Install the seat base onto the seat assembly. Refer to Adjusting Seat Position on Seat Base on page 56.
     ii. Go to STEP 6.
   - For Office Style Seat - Go to STEP 6.
6. Reinstall the seat base onto the seat assembly. Refer to Adjusting Seat Position on Seat Base on page 56.
7. Reinstall the seat. Refer to Removing/Installing the Seat Assembly on page 50.



NOTE: Office style van seat is shown. Standard van seat adjusts the same way.

DETAIL "A" - SEAT DEPTH POSITIONS



Minimum Seat Depth

Seat Depth	Seat Size
16 inch	16 X 18 inch
16 inch	18 X 18 inch
18 inch	20 X 20 inch
18 inch	22 X 20 inch

Middle Seat Depth

Seat Depth	Seat Size
17 inch	16 X 18 inch
17 inch	18 X 18 inch
19 inch	20 X 20 inch
19 inch	22 X 20 inch

Maximum Seat Depth

Seat Depth	Seat Size
18 inch	16 X 18 inch
18 inch	18 X 18 inch
20 inch	20 X 20 inch
20 inch	22 X 20 inch

FIGURE 6.5 Adjusting Seat Depth

Adjusting the Seat Height

M50/M51 Wheelchairs

NOTE: For this procedure, refer to FIGURE 6.6.

NOTE: The seat can be adjusted to five height positions in 1-inch increments.

1. Remove the seat. Refer to Removing/Installing the Seat Assembly on page 50.
2. Remove the mounting screw that secures the seat post to the support tube.

⚠ WARNING

Refer to the table in FIGURE 6.8 on page 57 for proper seat post mounting positions. For users over 220 lbs - Mounting holes 3, 4 and 5 (in FIGURE 6.6) MUST be used with the seat in the 1-inch back position (FIGURE 6.8). Refer to Adjusting Seat Position on Seat Base on page 56.

3. Adjust the seat post to desired mounting position.
4. Reinstall mounting screw. Securely tighten.
5. Reinstall the seat. Refer to Removing/Installing the Seat Assembly on page 50.

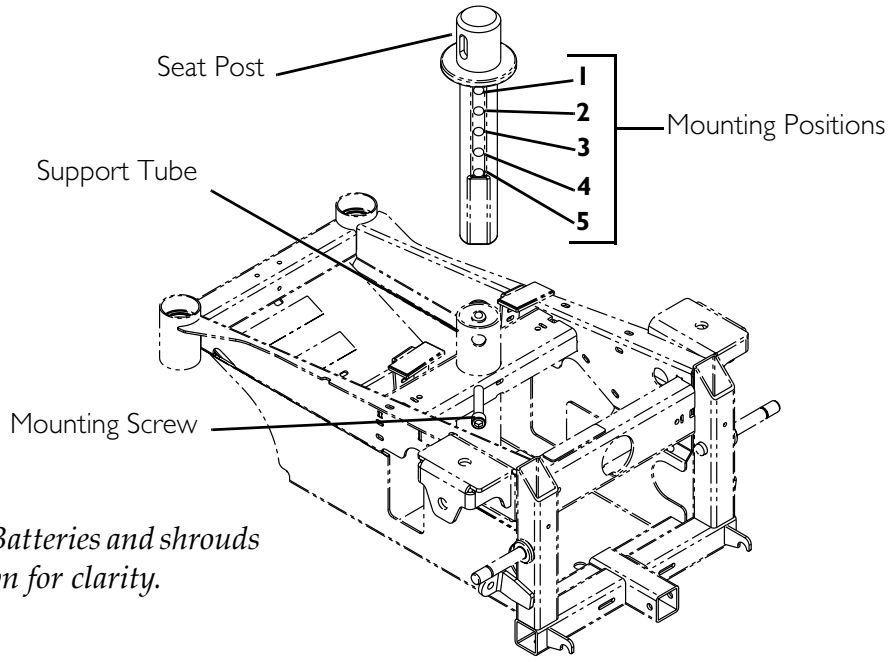


FIGURE 6.6 Adjusting the Seat Height - M50/M51 Wheelchairs

M61 Wheelchairs

NOTE: For this procedure, refer to FIGURE 6.7 on page 55.

NOTE: Seat height can be increased by one or two inches. Use the chart to determine the desired height of the seat.

INCREASE IN SEAT HEIGHT	SETS OF SEAT SPACERS	TOTAL NUMBER OF SPACERS	LENGTH OF MOUNTING SCREWS
1 inch	1	2	2½-inches (Office Style Van Seat) 2-inches (Standard Van and ASBA Seat)
2 inch	2	4	3½-inches (Office Style Van Seat) 3-inches (Standard Van and ASBA Seat)

NOTE: A maximum of two sets of spacers can be installed.

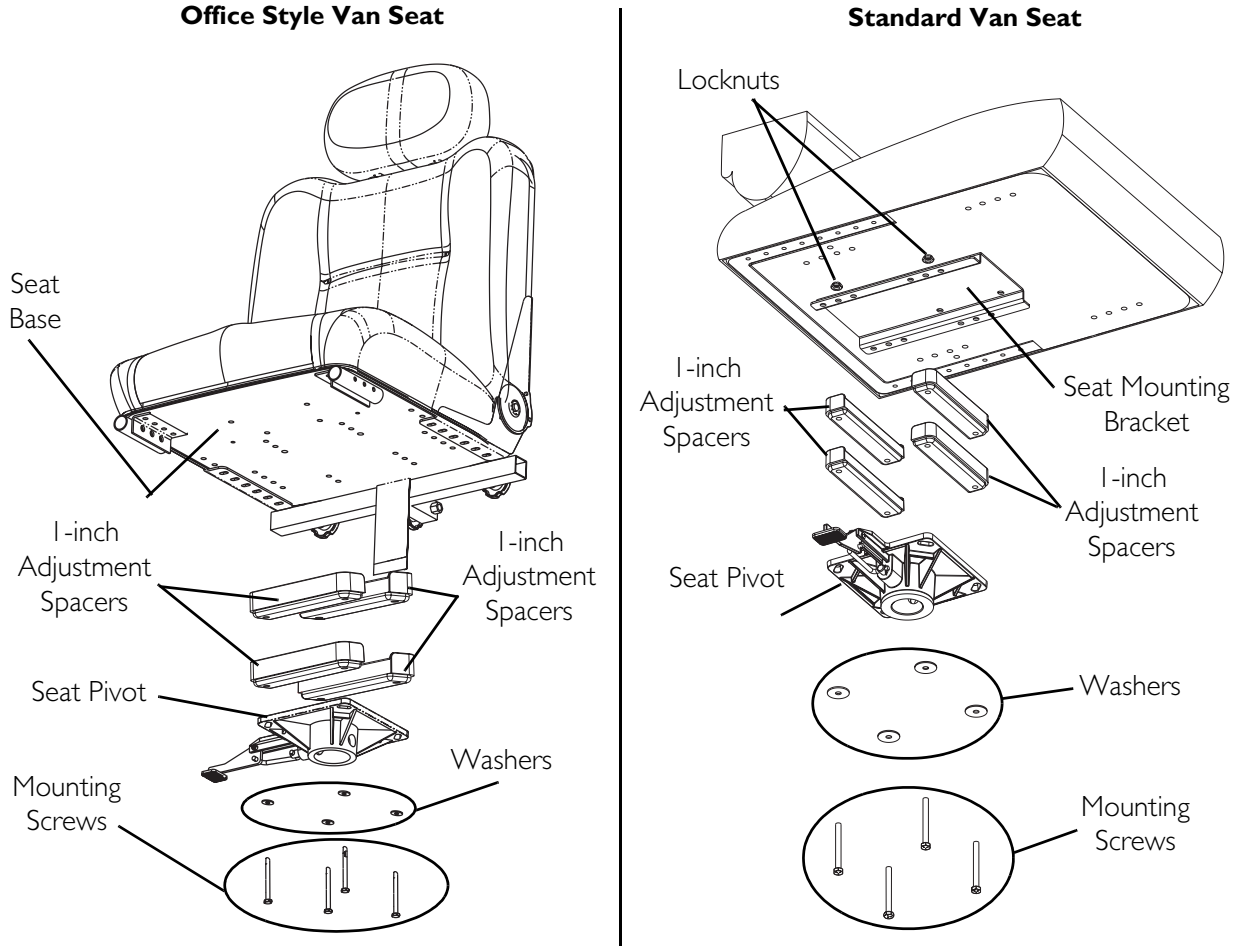
1. Remove the seat. Refer to Removing/Installing the Seat Assembly on page 50.
2. Perform one of the following:
   - For Standard Van Seats - Remove the four mounting screws, washers, and locknuts securing the seat pivot and four 1-inch adjustment spacers to the seat mounting bracket.
   - For Office Style Van Seats - Remove the four mounting screws and washers securing the seat pivot and four 1-inch adjustment spacers to the seat base.
3. Perform one of the following:
   - To Reduce Seat Height by One Inch - Remove one set of 1-inch adjustment spacers to achieve desired height.
   - To Reduce Seat Height by Two Inches - Remove both sets of 1-inch adjustment spacers to achieve desired height.
4. Perform one of the following:

NOTE: The seat comes installed with four 1-inch spacers secured by either 3-inch or 3½-inch mounting screws. 1-inch, 2-inch, and 2½-inch mounting screws are supplied with the seat.

   - For Seat Height Reduced by One Inch -
     i. Align the mounting holes on the seat pivot with the mounting holes on the adjustment spacers and either the seat mounting bracket on standard van seats or the seat base on office style van seats.
     ii. Install the seat adapter to seat base using the 2-inch mounting screws and existing washers and locknuts (if required). Securely tighten.
   - For Seat Height Reduced by Two Inches -
     i. Align the mounting holes on the seat pivot with the mounting holes on the adjustment spacers and either the seat mounting bracket on standard van seats or the seat base on office style van seats.
     ii. Install the seat adapter to seat base using the 1-inch mounting screws and existing washers and locknuts (if required). Securely tighten.
5. Reinstall the seat. Refer to Removing/Installing the Seat Assembly on page 50.

CAUTION

Spacers should be placed in orientation shown, otherwise they will interfere with the seat lever.



NOTE: Three-inch and three-and-a-half mounting screws shown. One-inch and two-inch mounting screws are supplied with the seat.

FIGURE 6.7 Adjusting the Seat Height - M61 Wheelchairs

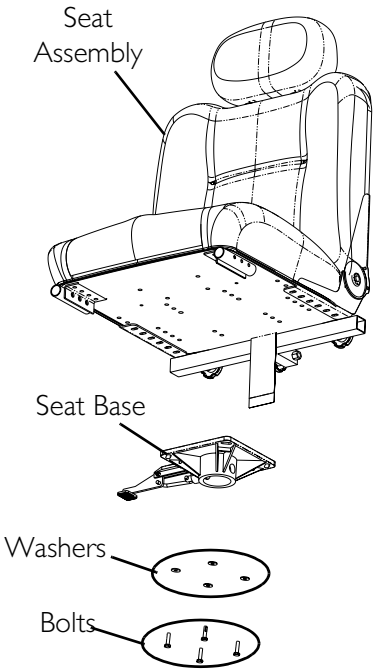
Adjusting Seat Position on Seat Base

⚠ WARNING

Refer to the table in FIGURE 6.8 for proper seat post mounting positions. For users over 220 lbs - seat MUST be in the 1-inch back position (FIGURE 6.8) when using seat post mounting holes 3, 4 and 5 (FIGURE 6.6). Refer to Adjusting the Seat Height on page 53.

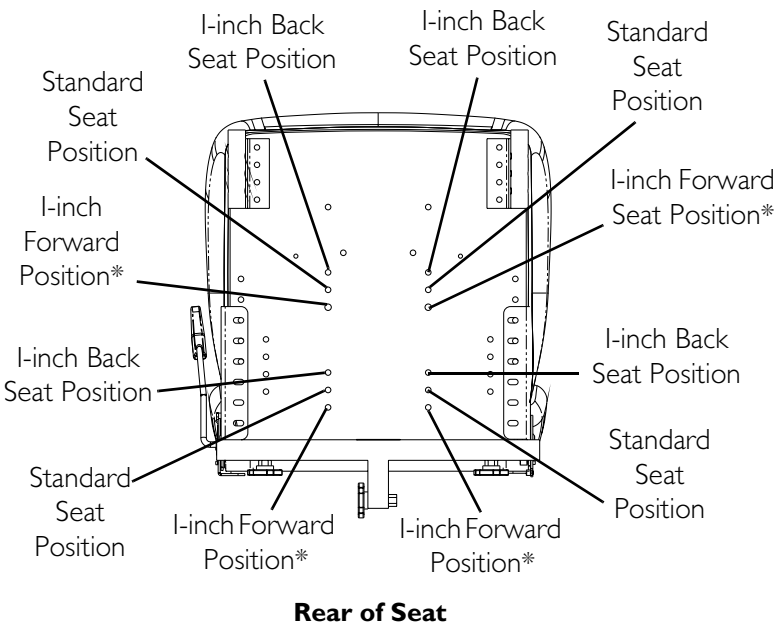
NOTE: For this procedure, refer to FIGURE 6.8 on page 57.

1. Remove the seat. Refer to Removing/Installing the Seat Assembly on page 50.
2. Remove the four mounting screws and washers securing the seat pivot to the seat base (FIGURE 6.8).
3. Separate the seat pivot from the seat base.
4. Refer to FIGURE 6.8 to determine the correct mounting holes to achieve the desired seat position.
5. Align the mounting holes on the seat pivot (determined in STEP 4) with the mounting holes on the seat base.
6. Using the four mounting screws and washers, secure the seat base to the seat assembly. Securely tighten.
7. Reinstall the seat. Refer to Removing/Installing the Seat Assembly on page 50.



NOTE: Office style van seat is shown. Standard van seat adjusts the same way.

DETAIL "A" - SEAT POSITION



**NOTE: For users over 220 lbs - DO NOT use 1-inch forward position.*

DETAIL "B" - PROPER SEAT POSITIONS FOR 18-INCH DEEP BACK SETTING

Legend: Y - Use N/A - DO NOT Use

WEIGHT LIMITATION	SEAT POST MOUNTING HOLE	1-INCH BACK	STANDARD	1-INCH FORWARD
300 LBS	1	Y	Y	N/A
	2	Y	Y	N/A
	3	Y	N/A	N/A
	4	Y	N/A	N/A
	5	Y	N/A	N/A
220 LBS	1	Y	Y	Y
	2	Y	Y	N/A
	3	Y	N/A	N/A
	4	Y	N/A	N/A
	5	Y	N/A	N/A
150 LBS	1	Y	Y	Y
	2	Y	Y	Y
	3	Y	Y	Y
	4	Y	Y	Y
	5	Y	Y	Y

FIGURE 6.8 Adjusting Seat Position on Seat Base

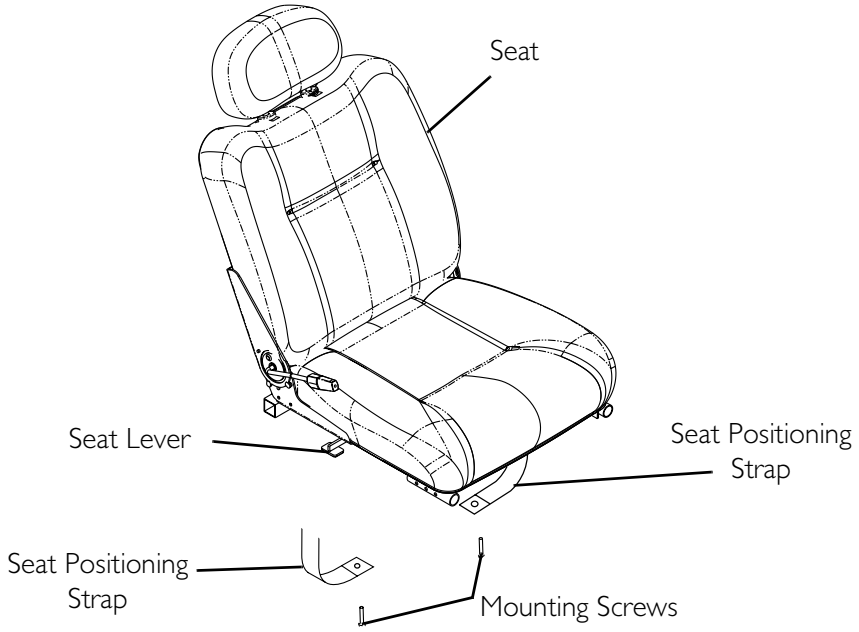
Replacing the Seat Positioning Strap

⚠ WARNING

ALWAYS wear your seat positioning strap. The seat positioning strap is a positioning belt only. It is not designed for use as a safety device withstanding high stress loads such as auto or aircraft safety belts. If signs of wear appear, belt MUST be replaced IMMEDIATELY.

NOTE: For this procedure, refer to FIGURE 6.9.

1. Remove the two mounting screws that secure the seat positioning straps to the seat frame.
2. Remove the two halves of the seat positioning strap from the rear seat frame.
3. Reposition the two new seat positioning strap halves underneath seat rails.
4. Reinstall the two mounting screws that secure the seat positioning straps to the seat frame. Securely tighten.



NOTE: Office style van seat is shown. Standard van seat adjusts the same way.

FIGURE 6.9 Replacing the Seat Positioning Strap

SECTION 7—ASBA SEAT

⚠ WARNING

After any adjustments, repair or service and before use, make sure that all attaching hardware is tightened securely - otherwise injury or damage may result.

Before performing any maintenance, adjustment or service verify that On/Off switch on the joystick is in the Off position.

Removing/Installing the Seat Assembly

NOTE: For this procedure, refer to FIGURE 7.1 on page 60.

Removing

1. Disconnect the joystick. Refer to Disconnecting/Connecting the Joystick on page 123.
2. Fold down the seat back.
3. Pull the seat lever up and lift the seat assembly up and away from the seat post.

Installing

1. Align the seat pivot with the seat post
2. Pull the seat lever up and lower the seat assembly on the seat post.

NOTE: If necessary, slightly twist seat assembly back and forth to lock it in place.

3. Release the seat lever.
4. Pull the seat assembly up to ensure that it is locked in place.
5. Connect the joystick. Refer to Disconnecting/Connecting the Joystick on page 123.

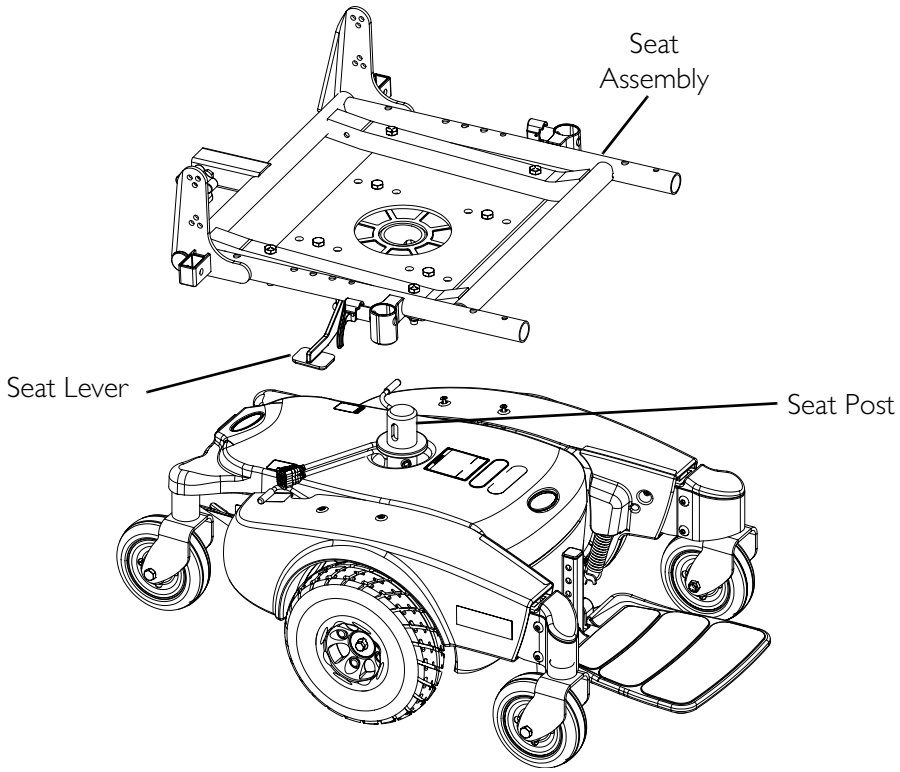


FIGURE 7.1 Removing/Installing the Seat Assembly

Adjusting the Seat Height

M50/51 Wheelchairs Only

NOTE: For this procedure, refer to FIGURE 7.2 on page 61.

NOTE: The seat can be adjusted to five height positions in 1-inch increments.

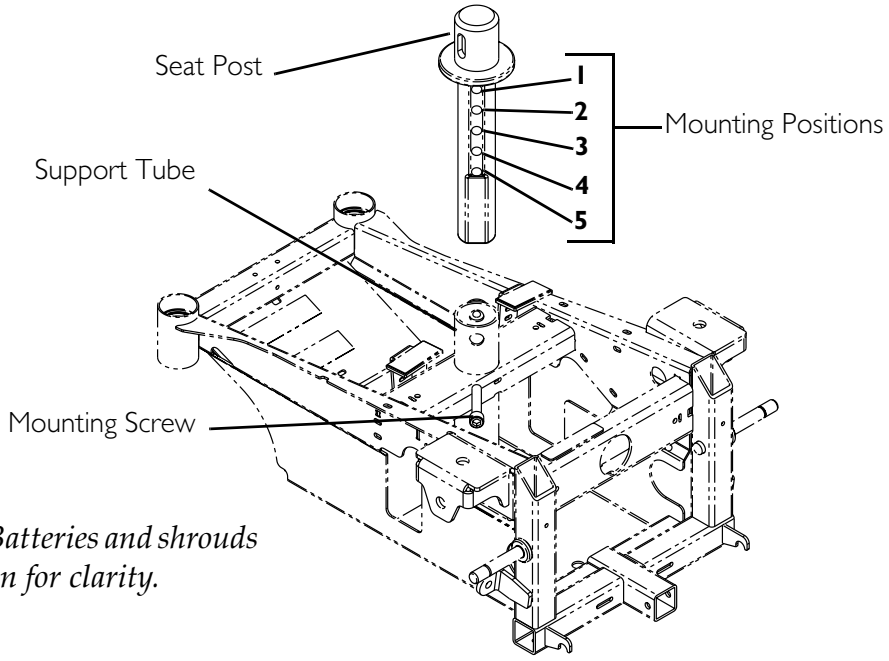
1. Remove the seat. Refer to Removing/Installing the Seat Assembly on page 59.
2. Remove the mounting screw that secures the seat post to the support tube.

⚠ WARNING

Refer to the table in FIGURE 7.2 on page 61 for proper seat post mounting positions. For users over 220 lbs - Mounting holes 3, 4 and 5 (in FIGURE 7.2) MUST be used with the seat in the 1-inch back position (FIGURE 7.2). Refer to Adjusting the Seat Position on page 65.

3. Adjust the seat post to desired mounting position.

4. Reinstall mounting screw. Securely tighten.
5. Reinstall the seat. Refer to Removing/Installing the Seat Assembly on page 59.



NOTE: Batteries and shrouds not shown for clarity.

WEIGHT LIMITATION	SEAT POST MOUNTING HOLE	SEAT DEPTH		
		1-INCH BACK	STANDARD	1-INCH FORWARD
300 LBS	1	Y	Y	N/A
	2	Y	Y	N/A
	3	Y	N/A	N/A
	4	Y	N/A	N/A
	5	Y	N/A	N/A
220 LBS	1	Y	Y	Y
	2	Y	Y	N/A
	3	Y	N/A	N/A
	4	Y	N/A	N/A
	5	Y	N/A	N/A
150 LBS	1	Y	Y	Y
	2	Y	Y	Y
	3	Y	Y	Y
	4	Y	Y	Y
	5	Y	Y	Y

FIGURE 7.2 Adjusting the Seat Height - M50/51 Wheelchairs Only

M61 Wheelchairs

NOTE: For this procedure, refer to FIGURE 7.3 on page 63.

NOTE: The seat comes installed with two sets of two 1-inch spacers. To reduce the seat height by 1 inch, one set of the 1-inch spacers MUST be removed. To reduce the seat height by 2 inches, both sets of the 1-inch spacers MUST be removed.

1. Remove the seat. Refer to Removing/Installing the Seat Assembly on page 59.
2. Remove the four mounting screws, washers, and locknuts securing the seat pivot and four 1-inch adjustment spacers to the seat frame plate.
3. Perform one of the following:
   - To Reduce Seat Height by 1 Inch - Remove one set of 1-inch adjustment spacers to achieve desired height.
   - To Reduce Seat Height by 2 Inches - Remove both sets of 1-inch adjustment spacers to achieve desired height.
4. Perform one of the following:

NOTE: The seat comes installed with four spacers secured by 3-inch mounting screws. 1-inch and 2-inch mounting screws are supplied with the seat.

   - For Seat Height Reduced by 1 Inch -
     i. Align the mounting holes on the seat pivot with the mounting holes on the adjustment spacers and the seat frame plate.
     ii. Install the seat adapter to seat frame plate using the 2-inch mounting screws and the existing washers and locknuts. Securely tighten.
   - For Seat Height Reduced by 2 Inches -
     i. Align the mounting holes on the seat pivot with the mounting holes on the adjustment spacers and the seat frame plate.
     ii. Install the seat adapter to seat frame plate using the 1-inch mounting screws and the existing washers and locknuts. Securely tighten.
5. Reinstall the seat. Refer to Removing/Installing the Seat Assembly on page 59.

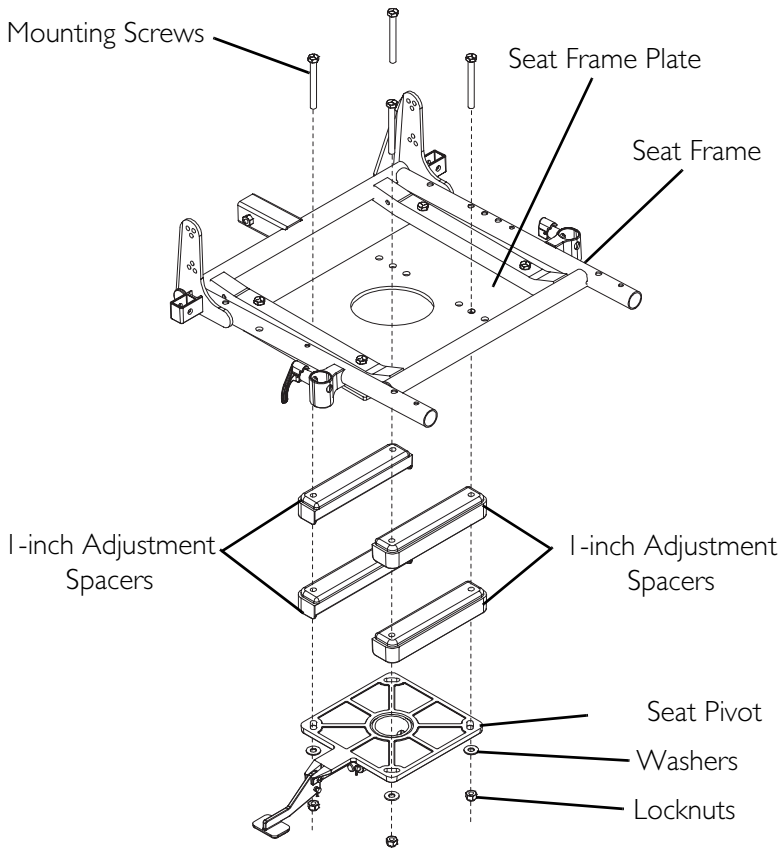


FIGURE 7.3 Adjusting the Seat Height - M61 Wheelchairs

Removing/Installing the Seat Pan

NOTE: For this procedure, refer to FIGURE 7.4 on page 64.

NOTE: Note of the position and orientation of the mounting hardware, seat positioning straps and quick release pin tabs for installing of the seat pan.

NOTE: Reverse this procedure to install the seat pan. Torque locknuts to 75-inch-lbs.

1. Perform one of the following:
   - Remove seating system. Refer to manufacturers seating system installation instructions.
   - Remove cushion by pulling up to release hook and loop strips. Remove cushion from seat pan.
2. Remove the two rear mounting screws, quick release pin tabs, spacers and locknuts that secure the seat pan and seat positioning straps to the seat frame.

NOTE: The two front mounting screws, spacers and locknuts also secure the front rigging support tubes to the seat frame.

3. Remove the four mounting screws, locknuts and four spacers securing the seat pan to the seat frame (FIGURE 7.4).
4. Remove the seat pan from the seat frame.

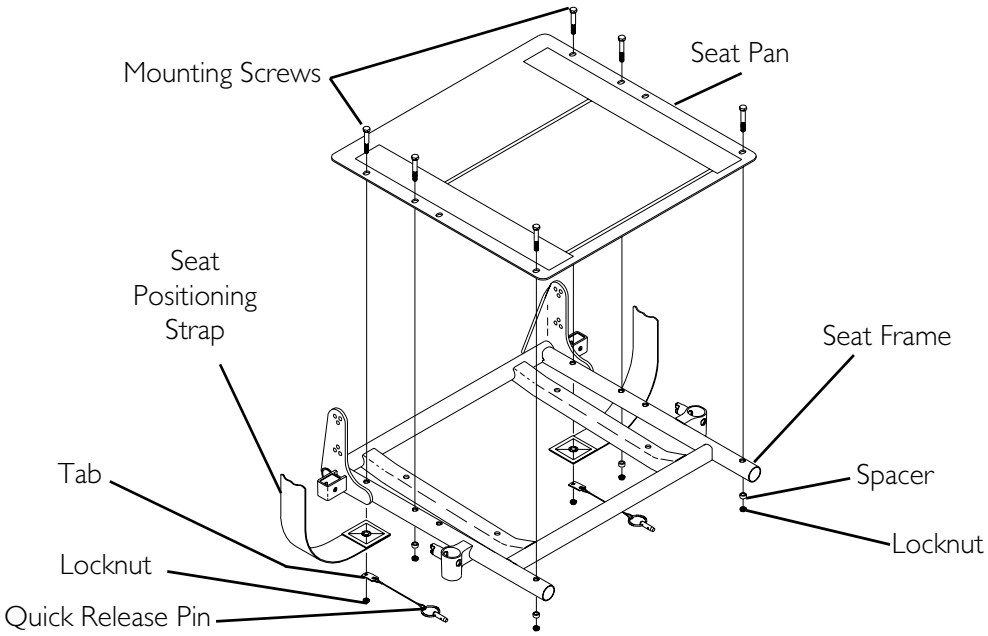


FIGURE 7.4 Removing/Installing the Seat Pan

Adjusting the Seat Width

The ASBA seat width cannot be adjusted and the seat frame must be replaced to achieve a change in seat width for the user. Refer to Removing/Installing the Seat Pan on page 63.

Removing/Installing the Seat Frame

NOTE: For this procedure, refer to FIGURE 7.5 on page 65.

Removing

1. Remove the accessories installed in the accessory tube. Refer to Accessories on page 128.
2. Remove the arms. Refer to Removing/Installing Flip Back Armrest on page 47.
3. Remove the four hex screws and locknuts securing the seat frame to the seat frame plate.
4. Remove the seat frame from the seat frame plate.

Installing

1. Position the seat frame onto the seat frame plate.
2. Secure the seat frame to the seat frame plate using the four hex screws and locknuts. Torque to 13 ft-lbs.
3. Install the arms. Refer to Removing/Installing Flip Back Armrest on page 47.

4. Install the accessories, if necessary. Refer to Accessories on page 128.

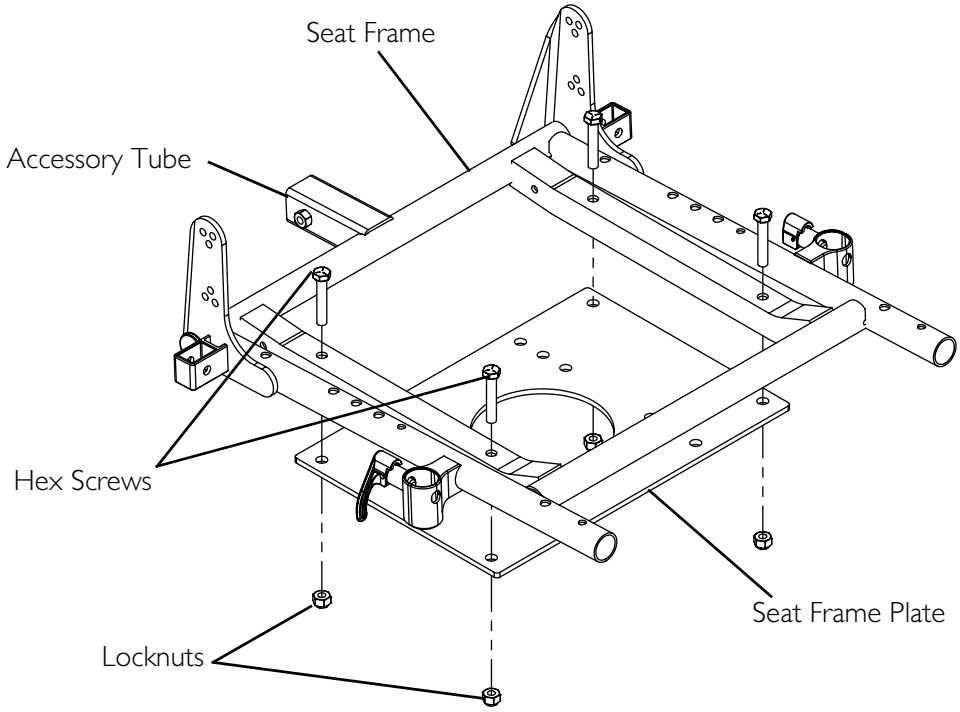


FIGURE 7.5 Removing/Installing the Seat Frame

Adjusting the Seat Position

NOTE: For this procedure, refer to FIGURE 7.6 on page 66.

NOTE: The seat is shipped from the factory in the standard position. The seat can be moved 1-inch forward or 1-inch rearward. See Detail "A").

1. Remove the four mounting screws, washers and locknuts securing the seat frame plate and 1-inch adjustment spacers* to the seat pivot.

**NOTE: M61 wheelchairs may have up to two sets of 1-inch adjustment spacers between the seat frame plate and the seat pivot.*

2. Reposition the seat frame plate, 1-inch adjustment spacers* and seat pivot to align the mounting holes with the desired seat adjustment position (Detail "A").
3. Secure the seat frame plate and 1-inch adjustment spacers* to the seat pivot using the four mounting screws, washers and locknuts. Torque to 13 ft-lbs ± 20%.

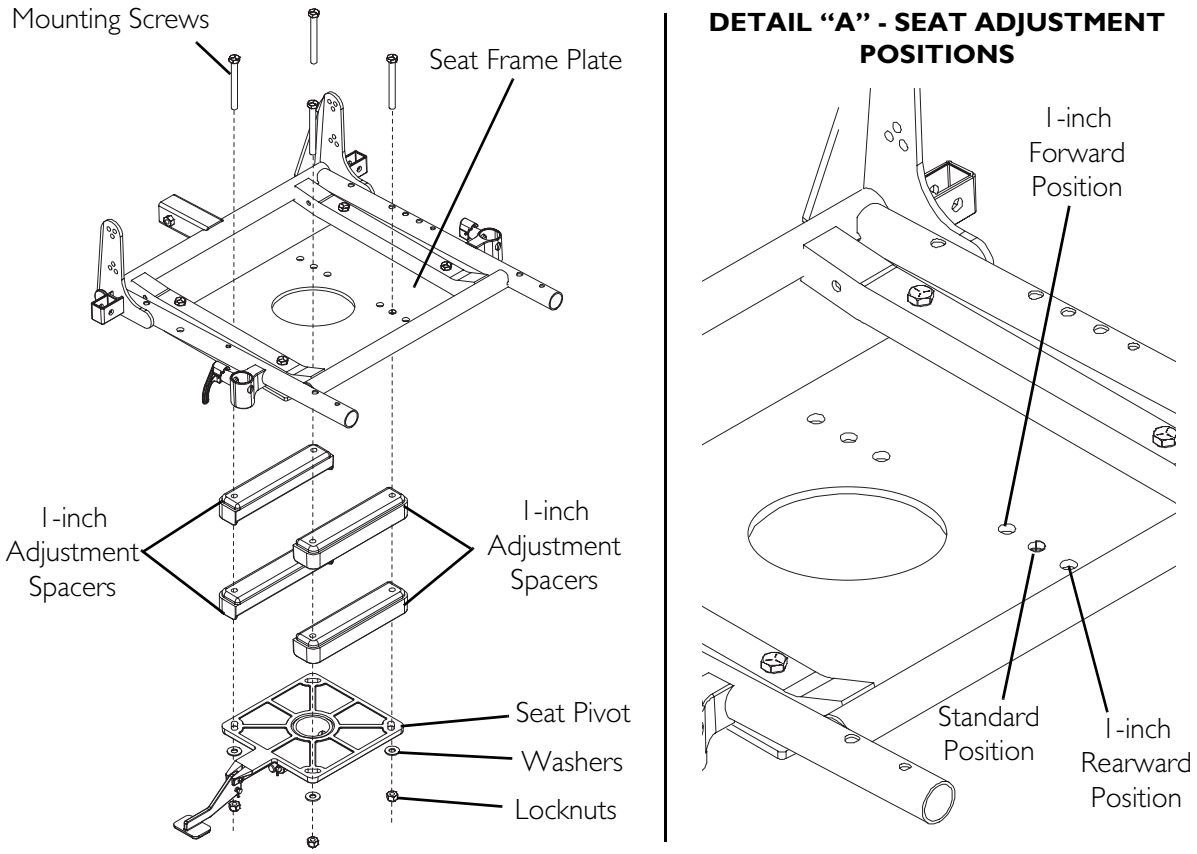


FIGURE 7.6 Adjusting the Seat Position

Removing/Installing the Seat Positioning Strap

NOTE: For this procedure, refer to FIGURE 7.7 on page 67.

1. Remove the seat cushion from the seat pan.
2. Move the flip back armrests out of the way.
3. Remove the two mounting screws, quick release pin tabs, spacers, and locknuts that secure the seat pan and seat positioning straps to the seat frame.
4. Remove the two halves of the seat positioning strap from the rear seat frame.
5. Reposition the two new seat positioning strap halves underneath seat rails.
6. Reinstall the two mounting screws, quick release pin tabs, spacers, and locknuts that secure the seat pan and seat positioning straps to the seat frame and torque to 75 in-lbs.
7. Reinstall the seat cushion onto the seat pan.

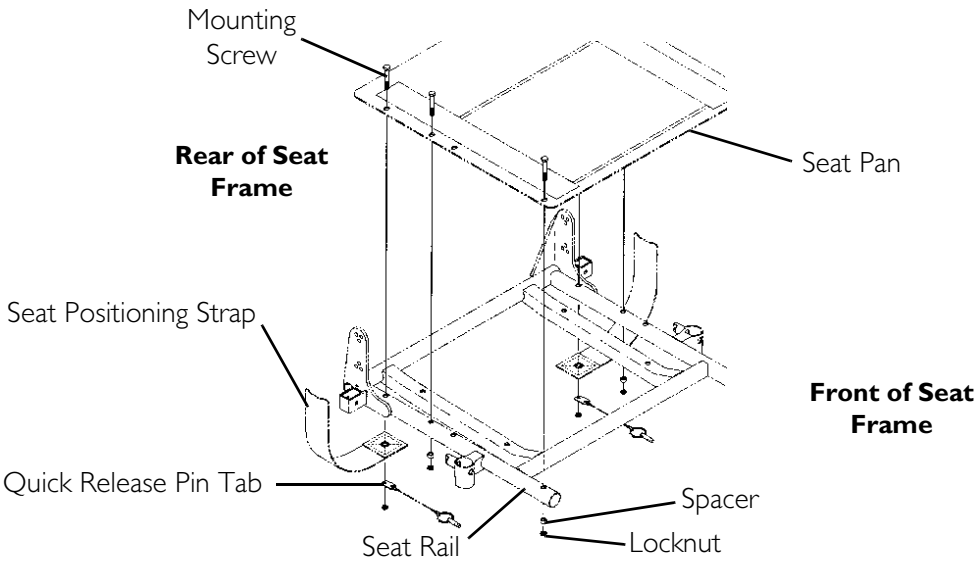


FIGURE 7.7 Removing/Installing the Seat Positioning Strap

Removing/Installing the Back Upholstery

NOTE: The back canes MUST be removed when removing/installing the back upholstery. Refer to Removing/Installing/Changing the Back Cane Height on page 67.

Removing/Installing/Changing the Back Cane Height

NOTE: For this procedure, refer to FIGURE 7.8 on page 70.

NOTE: If changing the back height, new back upholstery may be needed as well. Refer to the following chart to determine if new back upholstery is needed:

NOTE	BACK UPHOLSTERY HEIGHT
If back height required is within the range of the original back upholstery height, only new back canes will be needed.	16 to 17 inches
	18 to 19 Inches
If the back height required is NOT within the range of the original back upholstery height, new back upholstery, and back canes will be required	20 inches
	21 to 22 inches

NOTE: Existing hardware and inserts will be reused.

NOTE: Take note of position and orientation of mounting hardware for reinstallation.

Removing

1. Remove flip back armrest from the wheelchair. Refer to Removing/Installing Flip Back Armrest on page 47.

NOTE: Note the back angle before disassembly for proper reinstallation.

2. On the side of wheelchair with armrest removed, remove one of the mounting screws, washer, coved washer and locknut that secures the back cane to the seat frame.
3. Cut the tie-wraps that secure the bottom of the existing back upholstery to the seat frame.
4. Thread the mounting screw removed in STEP 2 through the back cane from the inside of the wheelchair to hold the insert in place.
5. Remove the remaining mounting screw, washer, coved washer and locknut that secures the back cane to the seat frame.
6. Repeat STEPS 1-4 for the opposite side of the wheelchair and remove back assembly from wheelchair.
7. Remove the two mounting screws and washers that secure the existing back upholstery to the back canes.
8. If present, release hook and loop strap securing the back upholstery to the back canes.
9. Remove the two mounting screws used to keep inserts in the back canes in STEP 3. Set mounting screws and inserts aside.
10. Loosen, but DO NOT remove, the two mounting screws and locknuts securing the spreader bar to the back canes.
11. Grasp the hand grip and slide the back cane out of the spreader bar (if applicable) and the back upholstery.

Installing

NOTE: If replacing back upholstery, discard existing back upholstery and perform this procedure using new back upholstery.

NOTE: If replacing back canes, discard existing back canes and perform this procedure using new back canes.

NOTE: Spreader bar is required on ALL back heights between 20-24-inches. Spreader bar is required on back heights 16, 17, 18, or 19 ONLY if the width or depth of the chair exceeds 19 inches. Refer to FIGURE 7.8 for proper spreader bar location on back canes.

1. Slide one back cane into back upholstery and through spreader bar (if applicable).
2. Position insert into bottom of back cane.
3. From inside of wheelchair, thread a mounting screw through the back cane to hold the insert in position when installing the back assembly.
4. Repeat STEPS 1-3 for remaining back cane.

NOTE: If changing the back angle, refer to Adjusting the Back Angle on page 71 to determine the proper mounting holes for the desired back angle.

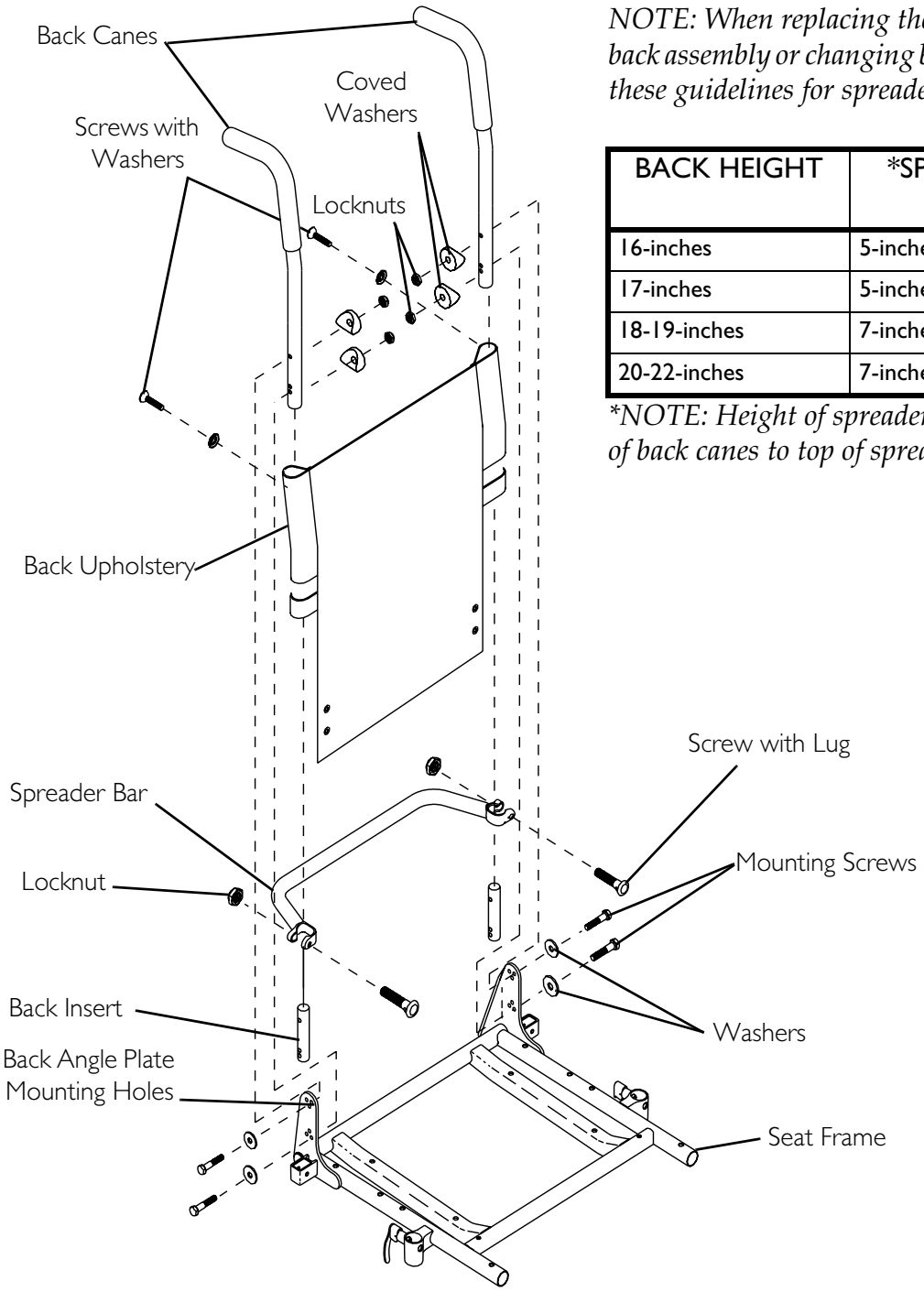
5. Position back assembly between the back angle plates (FIGURE 7.8).
6. On one side of wheelchair, align back cane mounting holes with the desired mounting holes of the back angle plate.

7. Remove the two mounting screws used to keep inserts in the back canes in STEP 3. Set mounting screws and inserts aside.

⚠ WARNING

The back canes MUST be fastened securely to the seat frame BEFORE using the wheelchair. Torque to 75-inch-lbs.

8. From outside of wheelchair, secure the back cane to the back angle plate using two mounting screws, washers, coved washers and locknuts (FIGURE 7.8). Use Loctite 242 and torque to 75-inch-lbs.
9. Repeat STEPS 6-8 on opposite side of wheelchair.
10. Secure the top of the back upholstery to the back canes with the two existing mounting screws.
11. Using two new tie-wraps, secure bottom of back upholstery to the seat frame.
12. If necessary, reposition the spreader bar at the correct height for the corresponding back height and torque the mounting hardware to 60-inch-lbs (FIGURE 7.8).
13. If present, secure back upholstery hook and loop straps around back canes.
14. Reinstall the flip back armrest onto the wheelchair. Refer to Removing/Installing Flip Back Armrest on page 47.



NOTE: When replacing the back upholstery, back assembly or changing back height, follow these guidelines for spreader bar height:

BACK HEIGHT	*SPREADER BAR HEIGHT
16-inches	5-inches
17-inches	5-inches
18-19-inches	7-inches
20-22-inches	7-inches

**NOTE: Height of spreader bar from bottom of back canes to top of spreader bar clamp.*

FIGURE 7.8 Removing/Installing the Back Upholstery

Adjusting the Back Angle

NOTE: For this procedure, refer to FIGURE 7.9 on page 72.

1. Remove the flip back armrests from the wheelchair. Refer to Removing/Installing Flip Back Armrest on page 47.
2. Remove the mounting screw, washer, coved washer and locknut from the top mounting hole of back angle plate and back cane (FIGURE 7.9).

NOTE: To avoid losing the insert in each back cane, thread the mounting screw through the cane from the inside of wheelchair to hold the insert in place.

3. Remove the mounting screw, washer, coved washer and locknut from the bottom mounting hole of the back angle plate and back cane.
4. Reposition the back canes into the correct mounting holes of the back angle plate to obtain a back angle between 80° and 100° in 5° increments.
5. Starting with the bottom mounting hole, use the two mounting screws, washers, coved washers and locknuts to secure the back cane with insert to the back angle plate.
6. Torque mounting screws to 75-inch-lbs.
7. Reinstall the flip back armrests onto the wheelchair. Refer to Removing/Installing Flip Back Armrest on page 47.

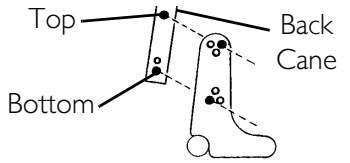
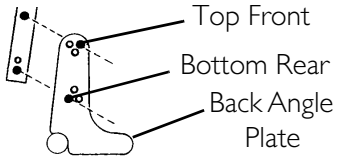
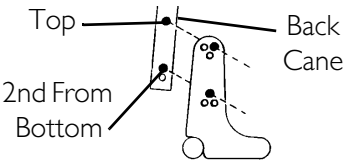
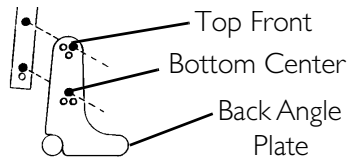
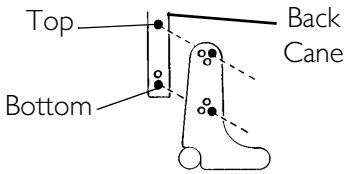
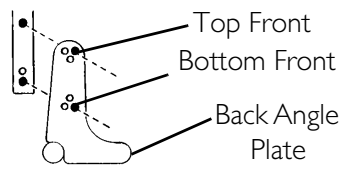
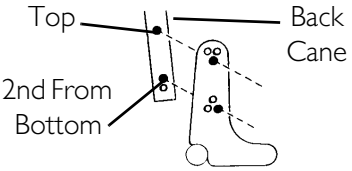
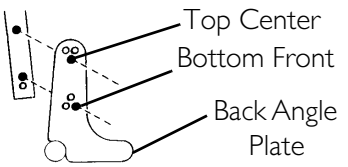
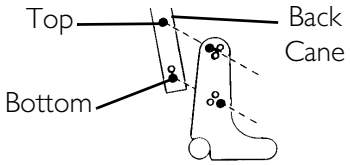
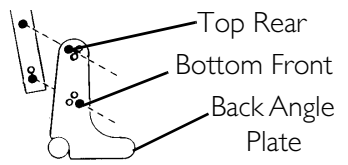
ANGLE	BACK CANE MOUNTING HOLE	BACK ANGLE PLATE HOLE
80°		
85°		
90°		
95°		
100°		

FIGURE 7.9 Adjusting the Back Angle

SECTION 8—FRONT RIGGINGS/ FOOTBOARD

⚠ WARNING

After ANY adjustments, repair or service and before use, make sure all attaching hardware is tightened securely - otherwise injury or damage may result.

Before performing any maintenance, adjustment or service verify that On/Off switch on the joystick is in the Off position.

DO NOT stand on the flip-up footboard or front riggings. When getting in or out of the wheelchair, make sure that the flip-up footboard or footplates are in the upward position.

Limited Clearance Between Footboard and Caster - The user's feet MUST remain on the footboard while operating the chair. If the user's feet are allowed to rest off the side of the footboard they may come in contact with the caster possibly resulting in injury.

Installing/Removing Front Riggings

CAUTION

If front riggings are used, then the seat MUST be adjusted to the highest mounting position - otherwise damage may occur.

NOTE: For this procedure, refer to FIGURE 8.1 on page 74.

Installing

1. If necessary, remove the footboard. Refer to Removing/Installing the Footboard Assembly on page 78.
2. Turn front rigging to the side (open footplate is perpendicular to wheelchair) and position mounting holes in the front rigging hinge plates with hinge pins on the wheelchair frame.
3. Install the front rigging hinge plates onto the hinge pins on the wheelchair frame.
4. Push the front rigging towards the inside of the wheelchair until it locks into place.

NOTE: The footplate will be on the inside of the wheelchair when locked in place.

5. Repeat STEPS 1-4 for opposite side of wheelchair.

Removing

1. Push the front rigging release lever inward and rotate the footrest outward.
2. Lift up on front rigging and remove from the wheelchair.
3. Repeat STEPS 1-2 for opposite side of wheelchair.

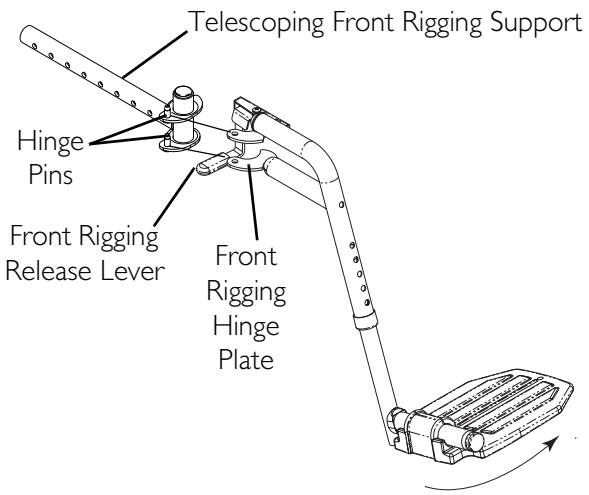


FIGURE 8.1 Installing/Removing Front Riggings

Adjusting Footrest Height

Model PHWH93 Front Riggings

NOTE: For this procedure, refer to FIGURE 8.2.

1. Remove any accessory from the front rigging(s).
2. Remove the front rigging from the wheelchair. Refer to Installing/Removing Front Riggings on page 73.

NOTE: Lay front rigging on a flat surface to simplify procedure.

3. Remove the hex bolt, coved washers and locknut that secure the lower footrest to the footrest support.
4. Reposition the lower footrest to the desired height.
5. Reinstall hex bolt, coved washers and locknut that secure lower footrest to footrest support. Tighten securely.
6. Repeat STEPS 1-5 for the opposite side of the wheelchair footrest, if necessary.
7. Reinstall the footrest(s) onto the wheelchair. Refer to Installing/Removing Front Riggings on page 73.

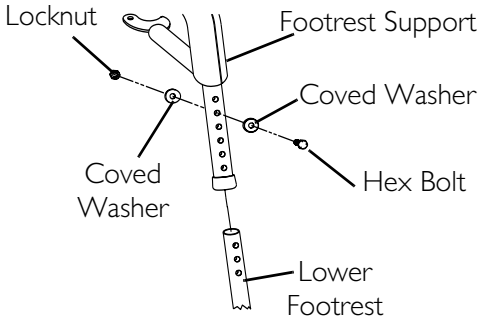
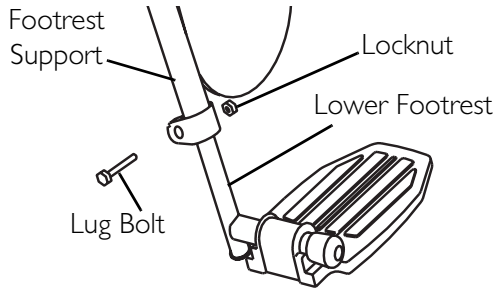


FIGURE 8.2 Model PHWH93 Front Riggings

Model PH904A and PHAL4A Front Riggings

NOTE: For this procedure, refer to FIGURE 8.3.

1. Loosen, but DO NOT remove the lug bolt and locknut that secure the lower footrest to the footrest support.
2. Reposition the lower footrest to the desired height.
3. Securely tighten the lug bolt and locknut that secure the lower footrest to the footrest support.
4. Repeat STEPS 1-3 for the opposite side of the wheelchair footrest, if necessary.



NOTE: PH904A style front rigging shown. PHAL4A front rigging adjust the same way.

FIGURE 8.3 Model PH904A and PHAL4A Front Riggings

Replacing Heel Loops

NOTE: For this procedure, refer to FIGURE 8.4.

1. Note the position of hex bolt, coved washers and locknut for reinstallation.
2. Remove the hex bolt, coved washers and locknut that secure the lower footrest to the footrest support.
3. Remove the lower footrest.
4. Remove the mounting screw, spacer and locknut that secure the existing heel loop to the lower footrest.
5. Slide the existing heel loop off the lower footrest.
6. Replace heel loop.
7. Reverse STEPS 1-6 to reassemble.

NOTE: When securing heel loop to lower footrest, tighten the mounting screw and locknut until the spacer is secure.

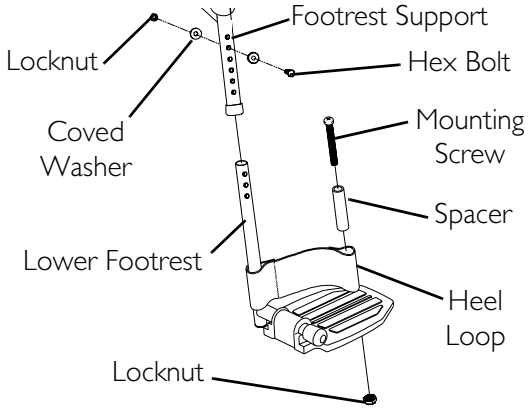


FIGURE 8.4 Replacing Heel Loops

Raising/Lowering Elevating Front Riggings

NOTE: For this procedure, refer to FIGURE 8.5.

1. Perform one of the following:
   - Raising - Pull back on the release lever and raise front rigging to the desired height.
   - Lowering - Support front rigging with one hand away from the release lever. Push release lever downward with other hand.

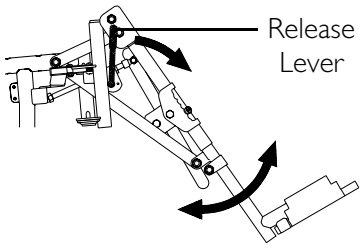


FIGURE 8.5 Raising/Lowering Elevating Front Riggings

Adjusting/Replacing Telescoping Front Rigging Supports

Van Seats

NOTE: For this procedure, refer to FIGURE 8.6 on page 77.

NOTE: When adjusting the telescoping front rigging support depth, ensure the footplate does not interfere with the caster wheel rotation.

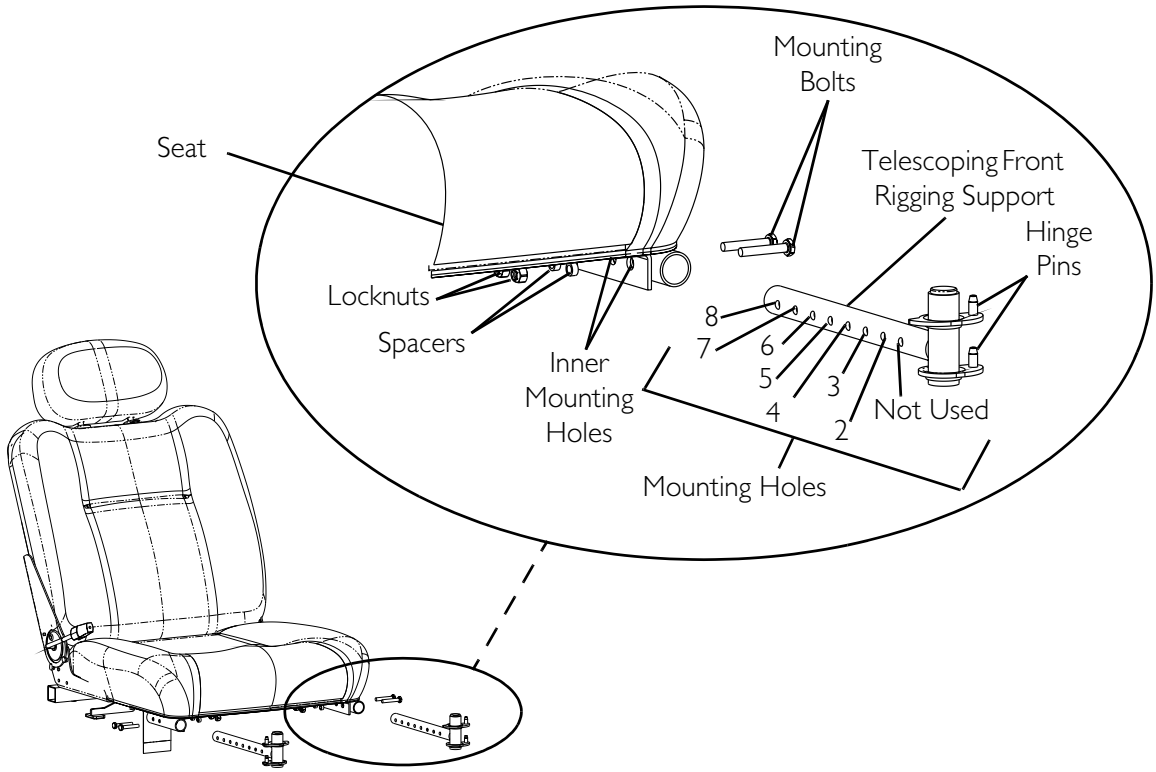
NOTE: Telescoping front rigging supports may be extended up to 2-inches from the wheelchair frame in 1-inch increments. This adjustment does not affect seat depth.

NOTE: When installing the front rigging support tubes, ensure that the hinge pins are on the outside of the chair facing away from the seat frame.

1. Remove the seat assembly. Refer to Removing/Installing the Seat Assembly on page 50.
2. Remove the two socket bolts, spacers and locknuts that secure telescoping front rigging support to the seat frame.
3. Perform one of the following:
   - Adjusting - Align the appropriate mounting hole of the telescoping front rigging support with the front mounting hole in the seat frame tubes to achieve the desired depth (FIGURE 8.6).
   - Replacing - Perform the following:
     i. Remove the existing telescoping front rigging support from the wheelchair frame.
     ii. Insert the new telescoping front rigging support into the seat frame.
     iii. Align the appropriate mounting hole of the telescoping front rigging support with the front mounting hole in the seat frame tubes to achieve the desired depth (FIGURE 8.6).

NOTE: The footplate will be on the inside of the wheelchair when locked in place.

4. Using the two socket bolts, spacers and locknuts, secure the telescoping front rigging support to the seat frame.
5. If necessary, repeat STEPS 2-4 on remaining telescoping front rigging support.
6. Reinstall the seat assembly. Refer to Removing/Installing the Seat Assembly on page 50.



FRONT RIGGING MODEL	STANDARD POSITION	1 INCH OUT	2 INCHES OUT
PHW93	Holes 4 and 5	Holes 5 and 6	Holes 6 and 7
PH904A and PHAL4A	Holes 3 and 4	Holes 4 and 5	Holes 5 and 6

FIGURE 8.6 Adjusting/Replacing Telescoping Front Rigging Supports

ASBA Seat

NOTE: For this procedure, refer to FIGURE 8.7 on page 78.

1. Remove the two mounting screws, spacers and locknuts that secure the telescoping front rigging support to the seat frame.
2. Perform one of the following:
   - Slide existing telescoping front rigging support to one of three depth positions.
   - Remove existing telescoping front rigging.

3. Secure telescoping front rigging at desired depth with existing two mounting screws, spacers, and locknuts. Securely tighten.

NOTE: The two telescoping front rigging supports can be positioned at different depths.

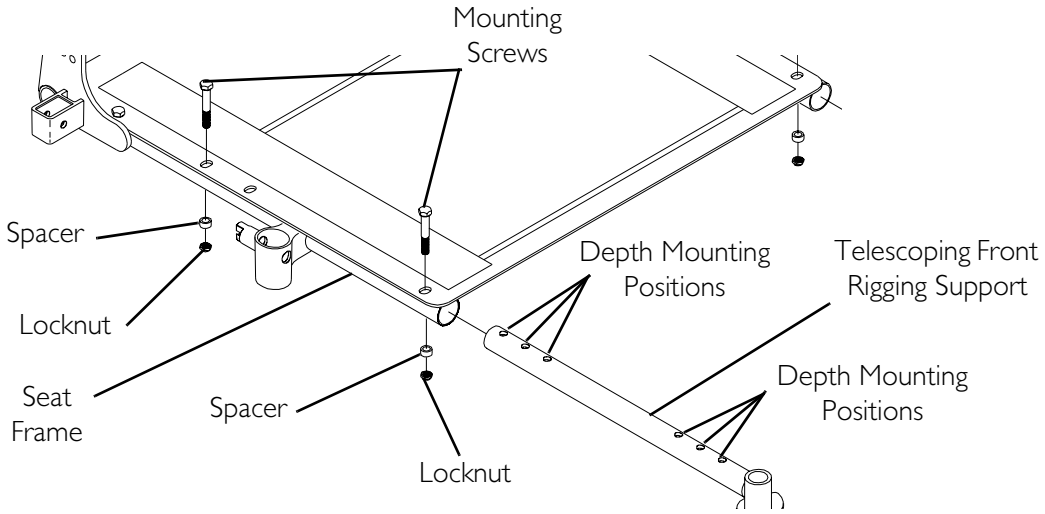


FIGURE 8.7 Adjusting/Replacing Telescoping Front Rigging Supports

Removing/Installing the Footboard Assembly

⚠ WARNING

Pinch point may occur when rotating the footboard assembly.

NOTE: For this procedure, refer to FIGURE 8.8 on page 79.

Removing

1. Remove the quick release pin that secures the footboard assembly to the wheelchair frame by depressing the button while sliding the pin out.
2. Remove the footboard assembly from the wheelchair frame.

Installing

⚠ WARNING

Make sure the detent balls of the quick-release pin are fully released beyond the outer edge of the tube before operating the wheelchair. Otherwise, injury and/or damage may result.

Keep detent balls clean.

1. Position the footboard assembly onto the wheelchair frame so that the mounting hole in the wheelchair frame aligns with the desired mounting hole in the footboard assembly.
2. Install the quick release pin by depressing the button while sliding the pin in. Ensure that the detent balls of the quick release pin are fully released beyond the outer edge of the tube (Detail "A" of FIGURE 8.8).

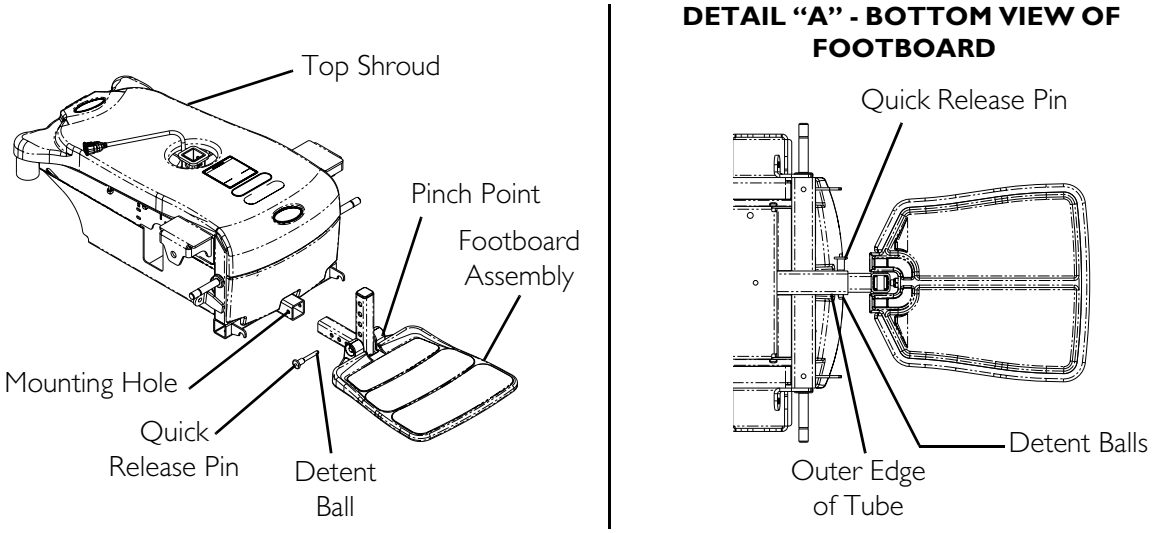


FIGURE 8.8 Removing/Installing the Footboard Assembly

Adjusting the Footboard Assembly

Angle

NOTE: For this procedure, refer to FIGURE 8.9 on page 80.

1. Loosen the jam nut and set screw located underneath on the backside of the footplate.
2. Adjust the set screw in or out to obtain the desired footboard assembly angle.
3. Thread the jam nut and washer inward until it is flush with the footboard bracket.
4. Securely tighten the jam nut and washer to secure the mounting screw in place.

Bottom View of Footboard

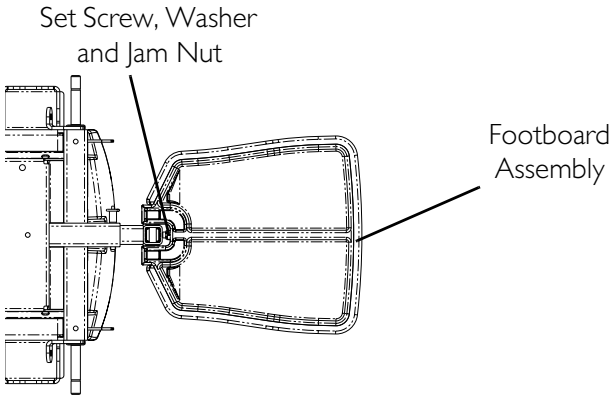


FIGURE 8.9 Adjusting the Footboard Assembly - Angle

Depth

NOTE: For this procedure, refer to FIGURE 8.10.

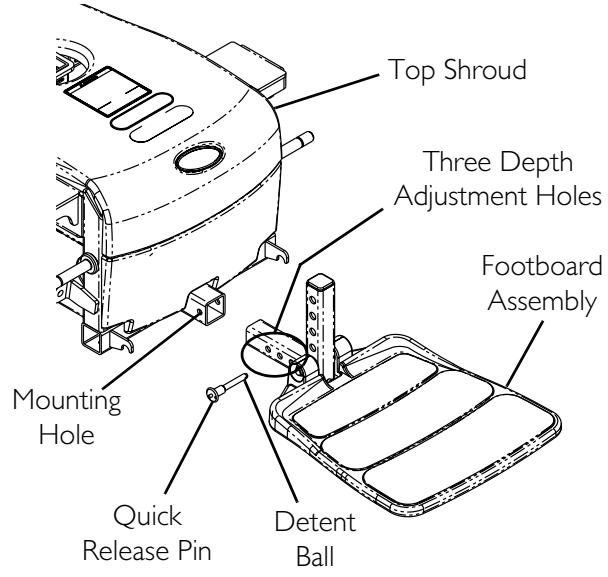
1. Remove the quick release pin that secures the footboard assembly to the wheelchair frame.

⚠ WARNING

Make sure the detent balls of the quick-release pin are fully released and beyond the outer edge of the tube before operating the wheelchair. Otherwise, injury and/or damage may result.

Keep detent balls clean.

2. Adjust footboard to one of three mounting positions.
3. Install the quick release pin. Make sure the detent balls of the quick-release pin are fully released and beyond the outer edge of the tube (Detail "A").



DETAIL "A" - BOTTOM VIEW OF FOOTBOARD

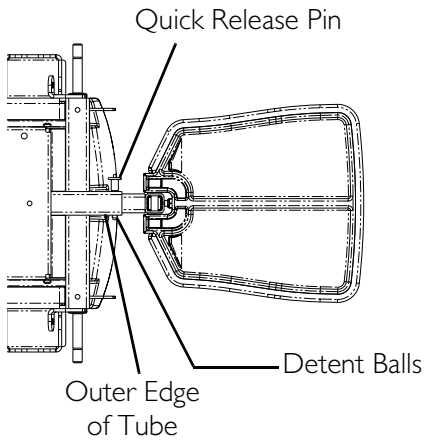


FIGURE 8.10 Adjusting the Footboard Assembly - Depth

SECTION 9—WHEELS

⚠ WARNING

After ANY adjustments, repair or service and before use, make sure all attaching hardware is tightened securely - otherwise injury or damage may result.

Before performing any maintenance, adjustment or service verify that On/Off switch on the joystick is in the Off position.

Replacing the Front/Rear Casters

NOTE: For this procedure, refer to FIGURE 9.1.

NOTE: Front and rear casters are replaced in the same manner.

NOTE: When replacing the front/rear casters, it is necessary to brace the caster to prevent spinning.

1. Remove the mounting screw, two washers and locknut that secures the caster to the fork.
2. Remove the caster and discard.
3. Secure new caster to fork with existing mounting screw, two washers and locknut. Securely tighten.

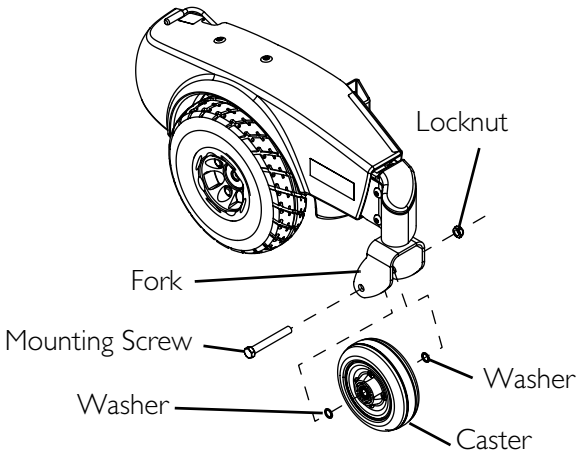


FIGURE 9.1 Replacing the Front/Rear Casters

Adjusting Caster Assembly

NOTE: For this procedure, refer to FIGURE 9.2.

1. Lift up front edge of the dust cover and remove from head tube.
2. To properly tighten caster assembly and guard against flutter, perform the following check:

NOTE: Two people are recommended to perform this STEP - one to tip wheelchair back and one to inspect/adjust the caster assembly.

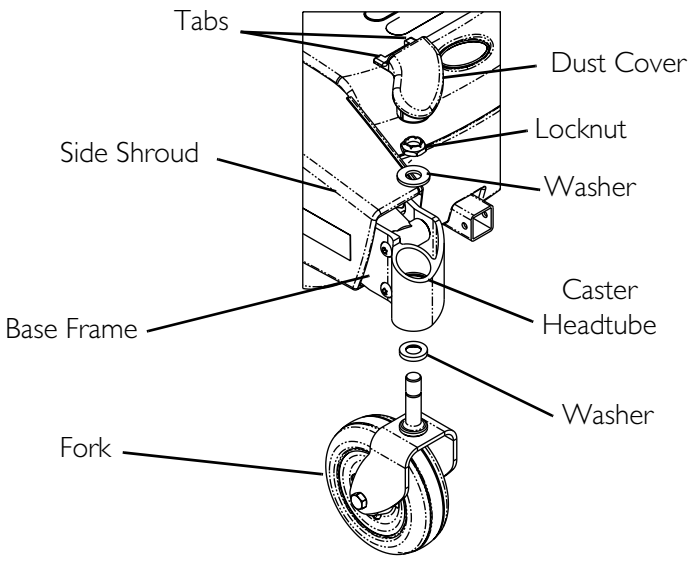
   A. Tip back the wheelchair.

   B. Pivot both caster assemblies to top of their arc simultaneously.

   C. Let casters drop to bottom of arc (casters should swing once to one-side, then IMMEDIATELY rest in a straight downward position).

   D. Adjust locknuts according to freedom of caster swing.

3. Test wheelchair for maneuverability.
4. Readjust locknuts if necessary, and repeat STEPS 1-3 until correct.
5. Snap dust cover into the caster headtube ensuring that the tabs are under the plastic side shrouds.



NOTE: Front caster shown. Rear caster installs the same way.

FIGURE 9.2 Adjusting Caster Assembly

Removing/Installing the Front/Rear Caster Assemblies

NOTE: For this procedure, refer to FIGURE 9.2.

NOTE: Front and rear caster assemblies are replaced in the same manner.

Removing

1. Remove the dust cover.
2. Remove locknut and washer securing caster assembly to the headtube.

Installing

1. Insert threaded post of caster assembly into headtube.
2. Using washer and locknut, secure caster assembly to head tube.
3. Snap dust cover into the headtube.

Removing/Installing the Front Headtube Assembly

NOTE: For this procedure, refer to FIGURE 9.3.

NOTE: Take note of position and orientation of headtube and mounting hardware for installation.

NOTE: Reverse this procedure to install the front headtube assembly.

1. Remove the dust cover.
2. Remove the two top mounting screws and bushing that secure the headtube to the walking beam.
3. Remove the two bottom mounting screws and bushing that secure the head tube to the pivot tube.
4. Remove the headtube from the walking beam and pivot tube.

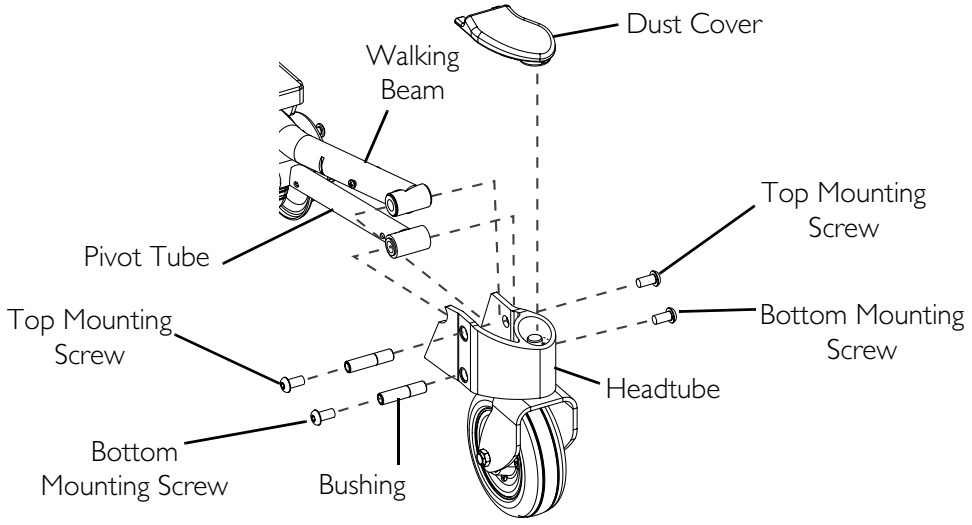


FIGURE 9.3 Removing/Installing the Front Headtube Assembly

Removing/Installing the Drive Wheel

NOTE: For this procedure, refer to FIGURE 9.4 on page 85.

Removing the Drive Wheel

1. Fold down tab of existing locking tab washer (Detail "A" of FIGURE 9.4).
2. Remove mounting bolt and locking tab washer (Detail "B" of FIGURE 9.4). Discard existing locking tab washer.
3. Remove the wheel from the drive shaft. If necessary, use wheel puller to remove the drive wheel from the drive shaft.

Installing the Drive Wheel

NOTE: Ensure keystock is in the cutout on the drive shaft (Detail "B" of FIGURE 9.4). The keystock MUST line up with the wheel hub cutout.

CAUTION

DO NOT apply more than a one-inch (in length) thin film of anti-seize compound to the drive shaft. Applying more than one-inch (in length) can cause the anti-seize compound to leak resulting in damage to flooring (carpet, tile, etc.).

1. Apply an anti-seize compound to drive shaft and keystock.
2. Align the keystock in the drive shaft with the cutout in the wheel hub and position the wheel on to the drive shaft (Detail "B" of FIGURE 9.4).

⚠ WARNING

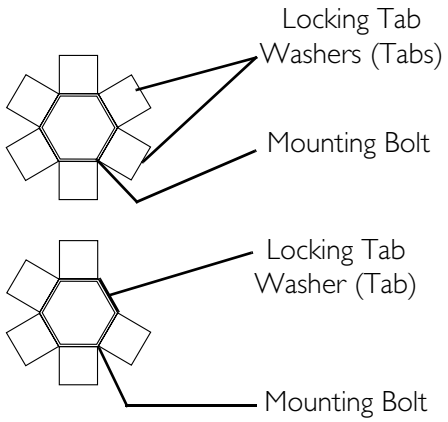
Failure to properly install locking tab washer can result in wheel separation and potential user injury or property damage. When replacing wheels ALWAYS use a new locking tab washer. DO NOT reuse locking tab washers.

NOTE: The locking tab of the locking tab washer MUST be inserted into the cutout in the rim and hub (Detail "B" of FIGURE 9.4).

3. Using the mounting bolt, washer and new locking tab washer, secure the wheel to the drive shaft (Detail "B" of FIGURE 9.4).
4. Fold one tab of the locking tab washer up so that the tab rests against one side of the mounting bolt (Detail "A" of FIGURE 9.4)

DETAIL "A"

NOTE: Locking tab washer shown with all tabs folded down to remove/install the mounting bolt.



NOTE: Locking tab washer shown with one tab folded up to secure the mounting bolt.

DETAIL "B"

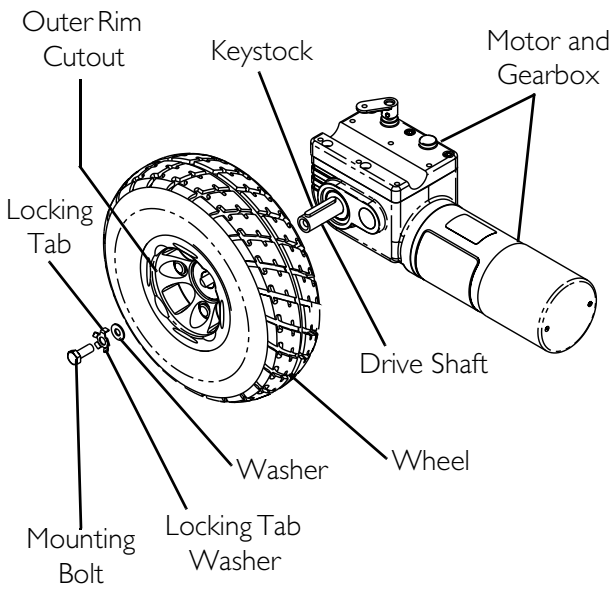


FIGURE 9.4 Removing/Installing the Drive Wheel

Replacing the 2-Piece Wheel Rim and/or the Foam Filled or Pneumatic Tires

NOTE: For this procedure, refer to FIGURE 9.5 on page 86.

NOTE: When replacing the 2-piece wheel rim, DO NOT remove tire. Replacement 2-piece wheel rims are shipped assembled with a new tire. Refer to Removing/Installing the Drive Wheel on page 84 to remove the existing and install the new 2-piece wheel rim and tire.

⚠ WARNING

When replacing the hub of a pneumatic tire, ALWAYS deflate tire before removing/installing hub - otherwise, injury or damage may occur. Failure to observe this warning can result in sudden, violent rim separation and possible injury.

1. Deflate existing pneumatic tire.
2. Remove the four existing mounting screws, locknuts and washers that secure the existing outer rim and inner rim.
3. Separate the two halves of the rim and remove the existing tire. Discard existing tire.

NOTE: When installing the new pneumatic tire, if necessary, place the inner tube into the tire.

NOTE: When installing the outer rim into a pneumatic tire ensure the valve stem of the inner tube protrudes through the stem opening in the outer rim.

4. Insert the outer rim and inner rim into the new/existing tire.
5. Insert the hub into the inner rim and align the four mounting holes of the hub, inner rim and outer rim.

6. Using the four mounting screws, lock washers and hex nuts, secure the outer rim to the inner rim and hub. Torque hex nuts to 160 - 200-inch-lbs.
7. If pneumatic, fill tire to correct air pressure as noted on tire side wall.

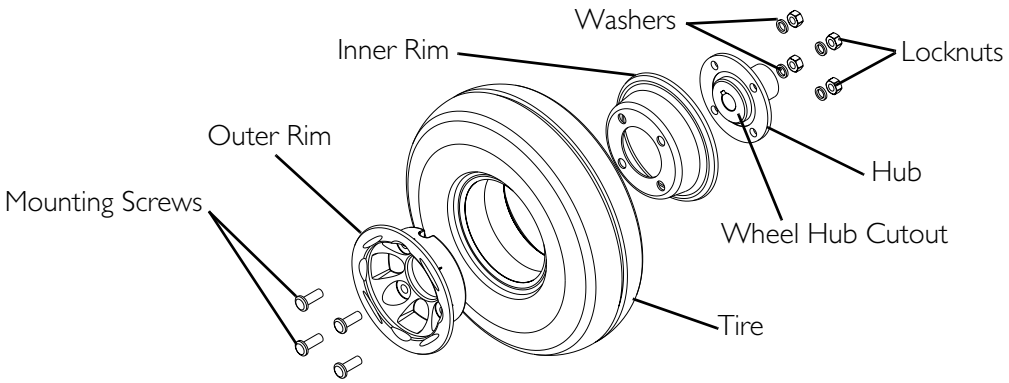


FIGURE 9.5 Replacing the 2-Piece Wheel Rim and/or the Foam Filled or Pneumatic Tires

SECTION 10—SHROUDS AND FRAME

⚠ WARNING

After any adjustments, repair or service and before use, make sure that all attaching hardware is tightened securely - otherwise injury or damage may result.

Before performing any maintenance, adjustment or service verify that On/Off switch on the joystick is in the Off position.

To prevent cracking the plastic shroud material, DO NOT overtighten the mounting screws.

Removing/Installing the Top Shroud

NOTE: For this procedure, refer to FIGURE 10.1 on page 88.

Removing

1. Disconnect the joystick. Refer to Disconnecting/Connecting the Joystick on page 123.
2. M61 Wheelchairs Only - Remove the joystick cable from the clip on the top shroud.
3. Remove the seat. Refer to Removing/Installing the Seat Assembly on page 50.
4. Remove the top shroud by pulling it up off the base frame.

Installing

1. Pull joystick cable through the center hole in the top shroud.
2. Place the top shroud on the base frame and push downward to engage the hook and loop straps.
3. M61 Wheelchairs Only - Secure the joystick cable using the clip on the top shroud.
4. Install the seat assembly. Refer to Removing/Installing the Seat Assembly on page 50.
5. Connect the joystick. Refer to Disconnecting/Connecting the Joystick on page 123.

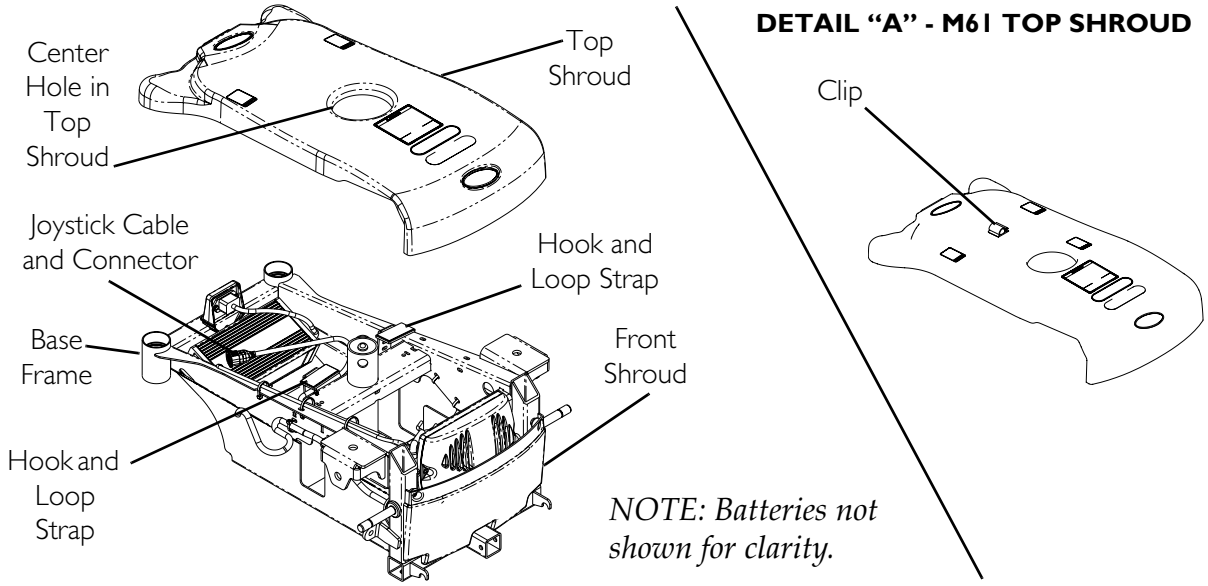


FIGURE 10.1 Removing/Installing the Top Shroud

Removing/Installing the Side Shrouds

NOTE: For this procedure, refer to FIGURE 10.2 on page 89.

Removing

1. Remove the two screws securing the side shroud to the frame.
2. Remove the side shroud from the frame.

Installing

1. Position the side shroud onto the frame.
2. Align the shroud mounting holes with the mounting holes in the frame.
3. Secure the side shroud to the frame using the two screws. DO NOT overtighten.

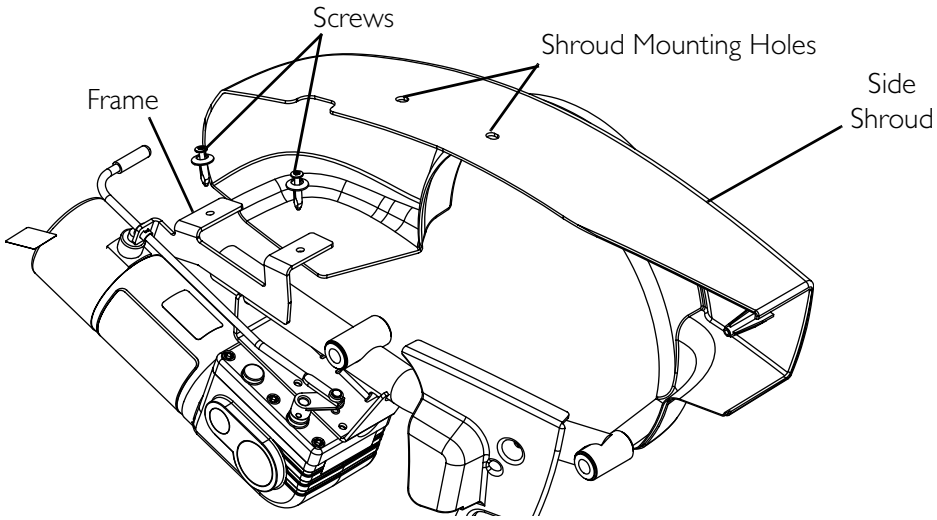


FIGURE 10.2 Removing/Installing the Side Shrouds

Removing/Installing the Front Shroud

NOTE: For this procedure, refer to FIGURE 10.3 on page 90.

Removing

1. Remove the two screws securing the top of the front shroud to the frame.
2. Remove the front shroud fo the frame.

Installing

1. Insert the tabs at the bottom of the front shroud into the slots in the bottom of the frame.
2. Secure the top of the front shroud to the frame using the two screws. DO NOT overtighten.

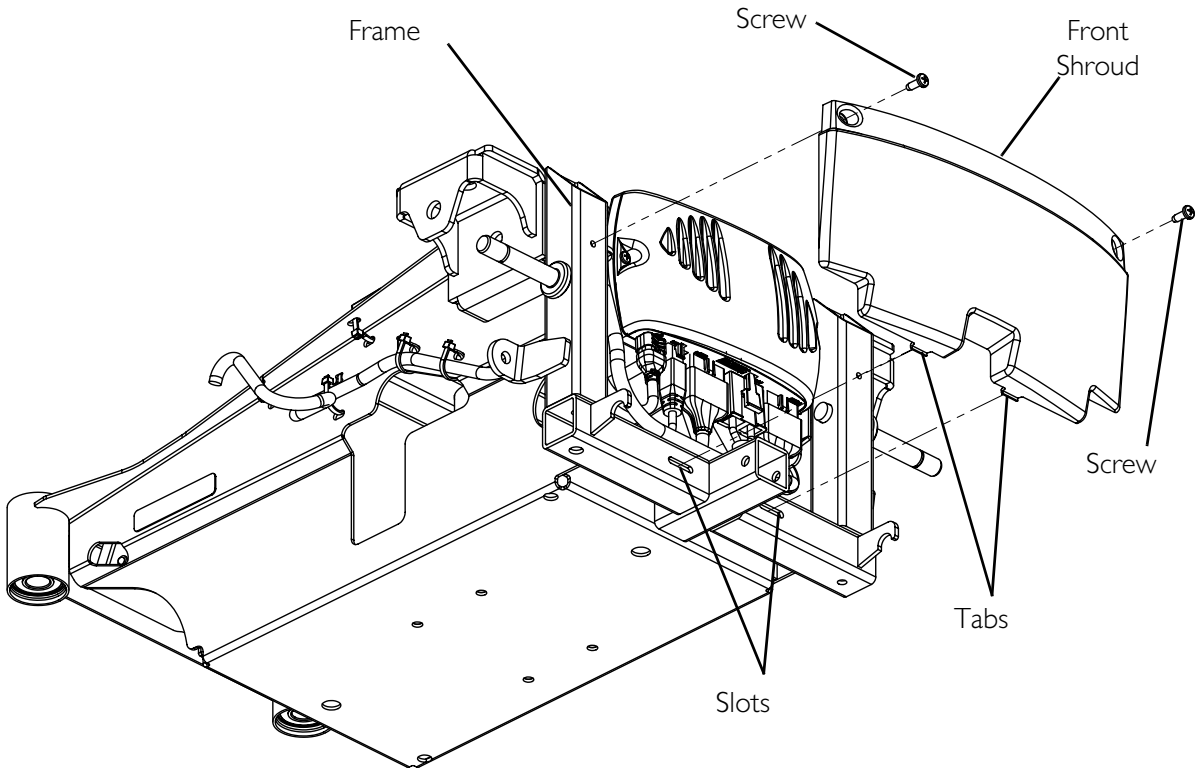


FIGURE 10.3 Removing/Installing the Front Shroud

Removing/Installing the Inner Shrouds

NOTE: For this procedure, refer to FIGURE 10.4 on page 91.

Removing

1. Remove the walking beam. Refer to Removing/Installing the Walking Beam on page 93.
2. Remove the large screw and locknut securing the inner shroud to the walking beam.
3. Remove the small screw securing the the inner shroud to the side shroud (if present).
4. Remove the inner shroud.

Installing

1. Position the inner shroud on the walking beam.
2. Use the small screw to secure the inner shroud to the side shroud. DO NOT overtighten.
3. Insert the large screw through the large mounting hole in the inner shroud and the walking beam.
4. Use the locknut to secure the inner shroud to the walking beam. DO NOT overtighten.
5. Install the walking beam. Refer to Removing/Installing the Walking Beam on page 93.

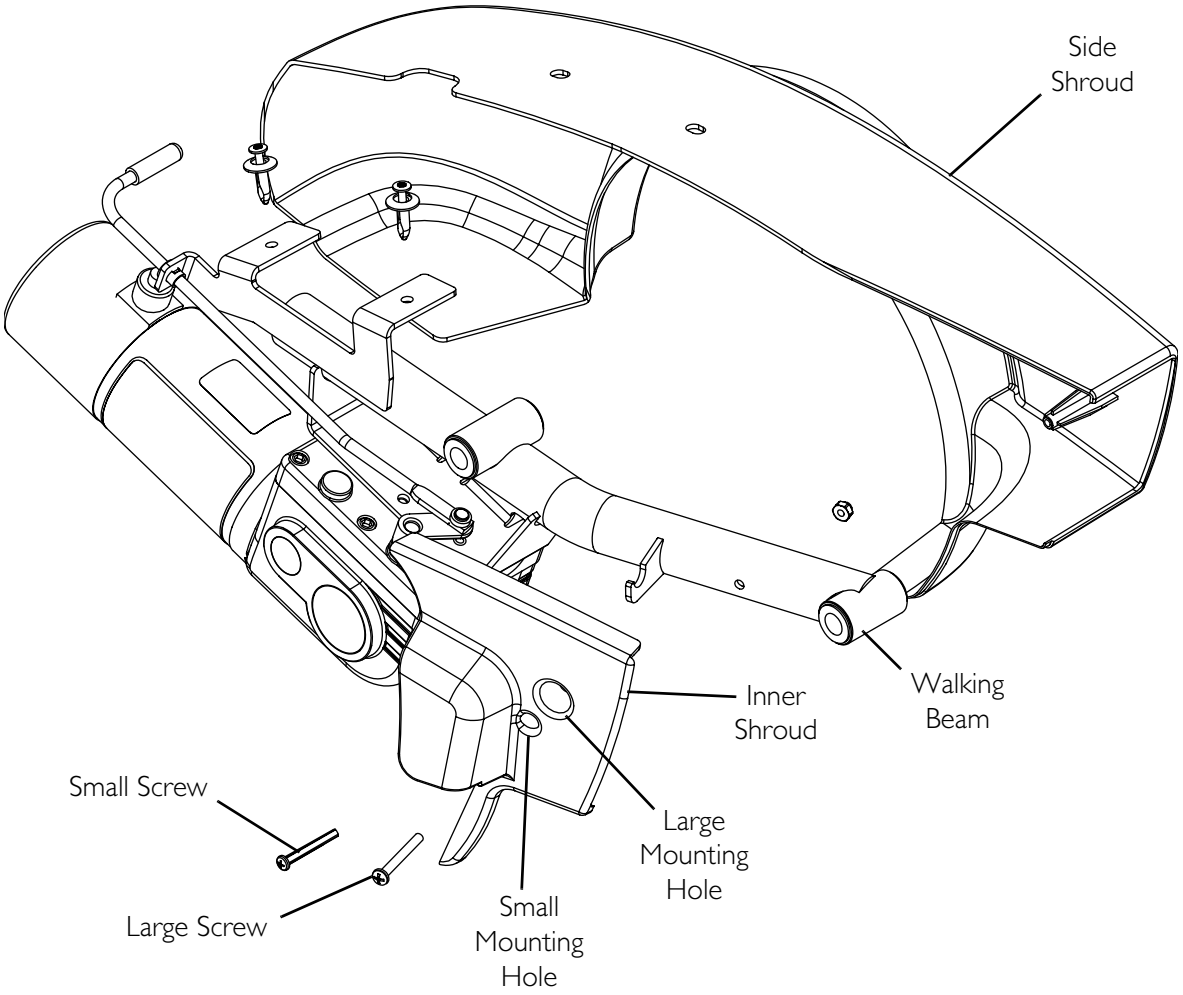


FIGURE 10.4 Removing/Installing the Inner Shrouds

Removing/Installing the Pivot Tube

NOTE: For this procedure, refer to FIGURE 10.5 on page 92.

Removing

1. Remove the front headtube assembly. Refer to Removing/Installing the Front Headtube Assembly on page 83.
2. Remove the side shroud. Refer to Removing/Installing the Side Shrouds on page 88.
3. remove the locknut, two small washers and large washer securing the rear of the pivot tube to the threaded post.
4. Remove the pivot tube from the frame.

NOTE: The front and rear bushings may fall out of the pivot tube when it is removed. Retain these for installation.

Installing

1. If necessary, insert one bushing into each end of the pivot tube.
2. Position the pivot tube onto the pivot post.

NOTE: Ensure the opposite end of the pivot tube is parallel to the end of the walking beam. If necessary, reposition the pivot tube.

3. Secure the end of the pivot tube to the pivot post using the two small washers, the large washer and the locknut. Torque to 90 in-lbs ± 20%.
4. Install the front headtube assembly. Refer to Removing/Installing the Front Headtube Assembly on page 83.

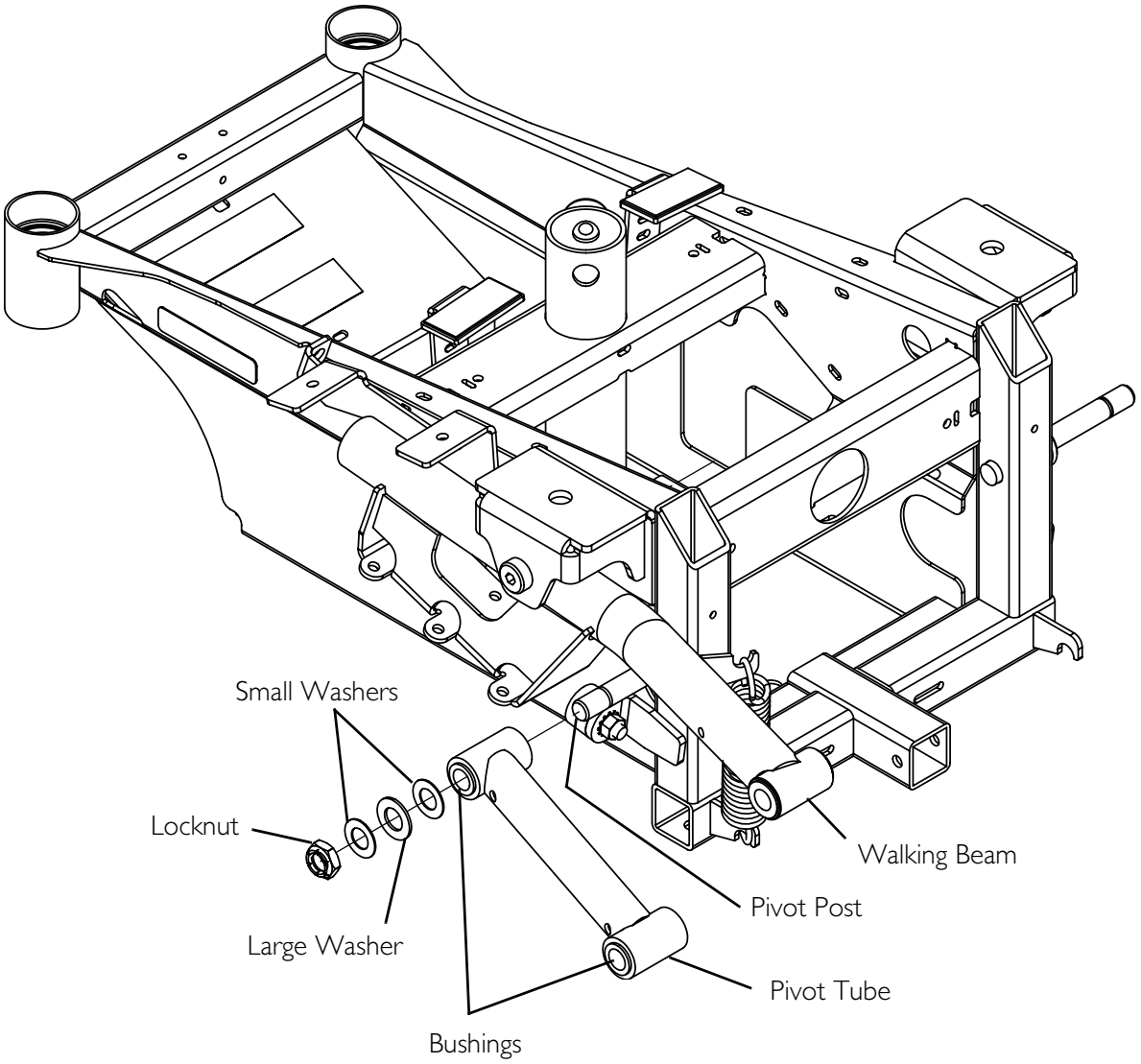


FIGURE 10.5 Removing/Installing the Pivot Tube

Removing/Installing the SureStep Spring

NOTE: For this procedure, refer to FIGURE 10.6.

Removing

1. Unhook the SureStep spring from the hooks on the walking beam and the frame.

Installing

1. Position the SureStep spring on the hook on the frame.
2. Position the top of the SureStep spring onto the hook on the walking beam.

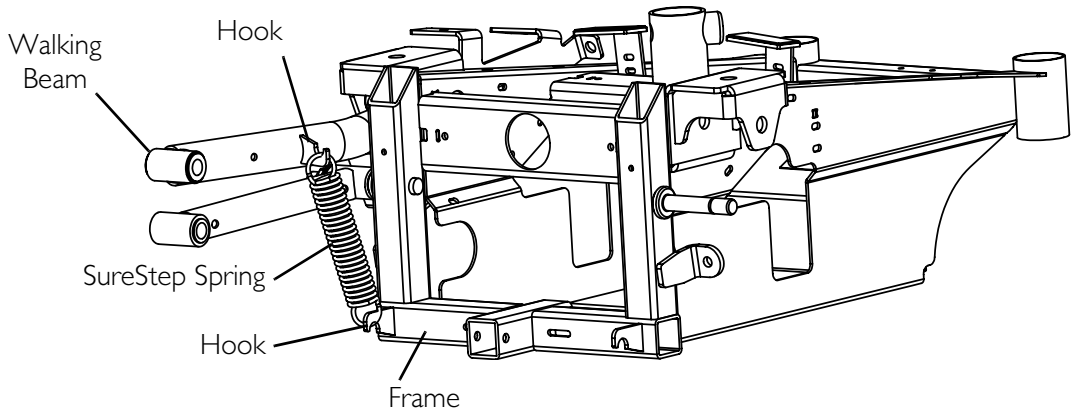


FIGURE 10.6 Removing/Installing the SureStep Spring

Removing/Installing the Walking Beam

NOTE: For this procedure, refer to FIGURE 10.7 on page 94.

Removing

1. Remove the front headtube assembly. Refer to Removing/Installing the Front Headtube Assembly on page 83.
2. Unhook the top of the SureStep spring from the hook on the walking beam.
3. Remove the shoulder screw and locknut securing the walking beam to the frame bracket.
4. Remove the walking beam from the frame.

Installing

1. Position the walking beam into the frame bracket.
2. Secure the walking beam to the frame using the shoulder screw and locknut. Torque to 23 ft-lbs ± 20%.

3. Hook the top of the SureStep spring to the hook on the walking beam.
4. Install the front headtube assembly. Refer to Removing/Installing the Front Headtube Assembly on page 83.

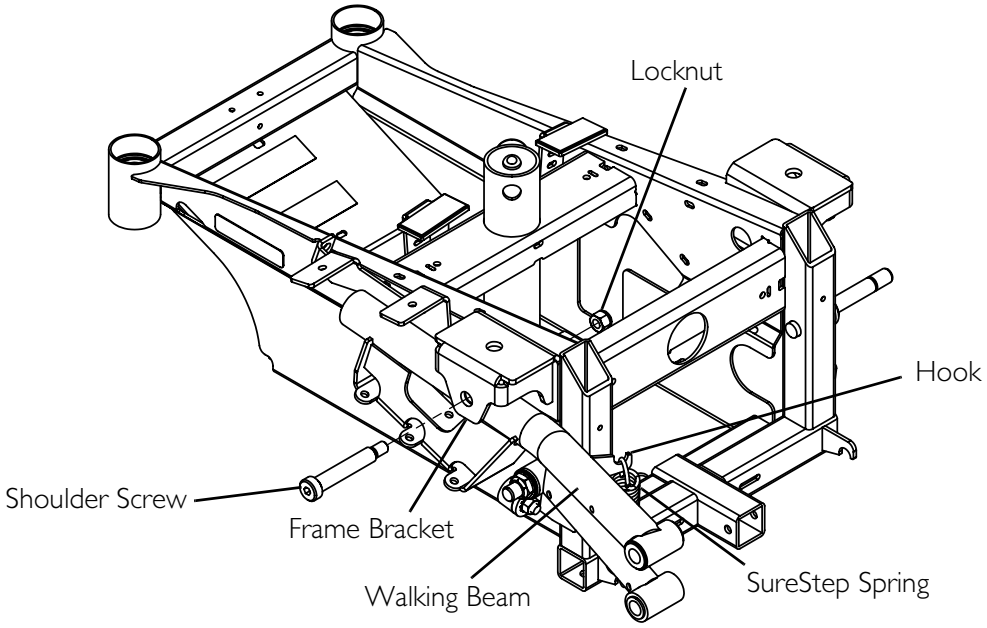


FIGURE 10.7 Removing/Installing the Walking Beam

Removing/Installing the Elevate Actuator

NOTE: For this procedure, refer to FIGURE 10.8 on page 96.

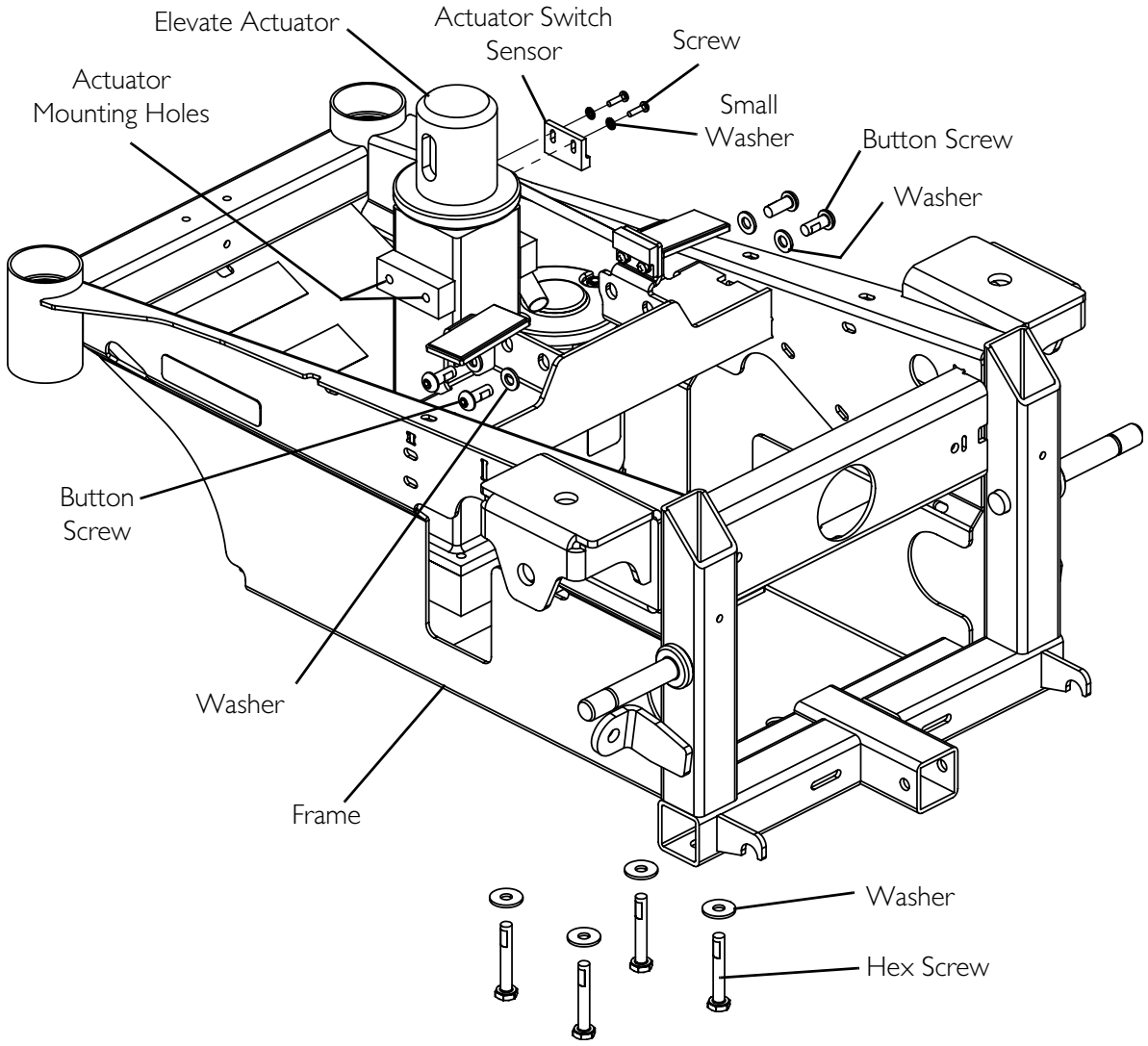
NOTE: This procedure applies to M61 wheelchairs only.

Removing

1. Remove the seat. Refer to one of the following procedures:
   - Van Seats - Refer to Removing/Installing the Seat Assembly on page 50.
   - ASBA Seats - Refer to Removing/Installing the Seat Assembly on page 59.
2. Remove the batteries. Refer to Removing/Installing Batteries from/into Battery Tray on page 99.
3. Disconnect the actuator connector from the controller connector (Detail "A").
4. Cut the three tie-wraps securing the actuator cable to the frame (Detail "A").
5. Remove the four hex screws and washers securing the elevate actuator to the bottom of the frame.
6. Remove the four button screws and washers securing the elevate actuator to the top of the frame.
7. Remove the two screws and small washers securing the actuator switch sensor to the elevate actuator.

Installing

1. Secure the actuator switch sensor to the elevate actuator using the two screws and small washers. Tighten securely.
2. Secure the elevate actuator to the top of the frame using the four button screws and washers. Torque to 75 in-lbs ± 20%.
3. Secure the elevate actuator to the bottom of the frame using the four hex screws and washers. Torque to 75 in-lbs ± 20%.
4. Connect the actuator connector to the controller connector (Detail "A").
5. Secure the cables to the frame using three tie-wraps in the locations shown in Detail "A".
6. Install the batteries. Refer to Removing/Installing Batteries from/into Battery Tray on page 99.
7. Install the seat. Refer to one of the following procedures:
   - Van Seats - Refer to Removing/Installing the Seat Assembly on page 50.
   - ASBA Seats - Refer to Removing/Installing the Seat Assembly on page 59.



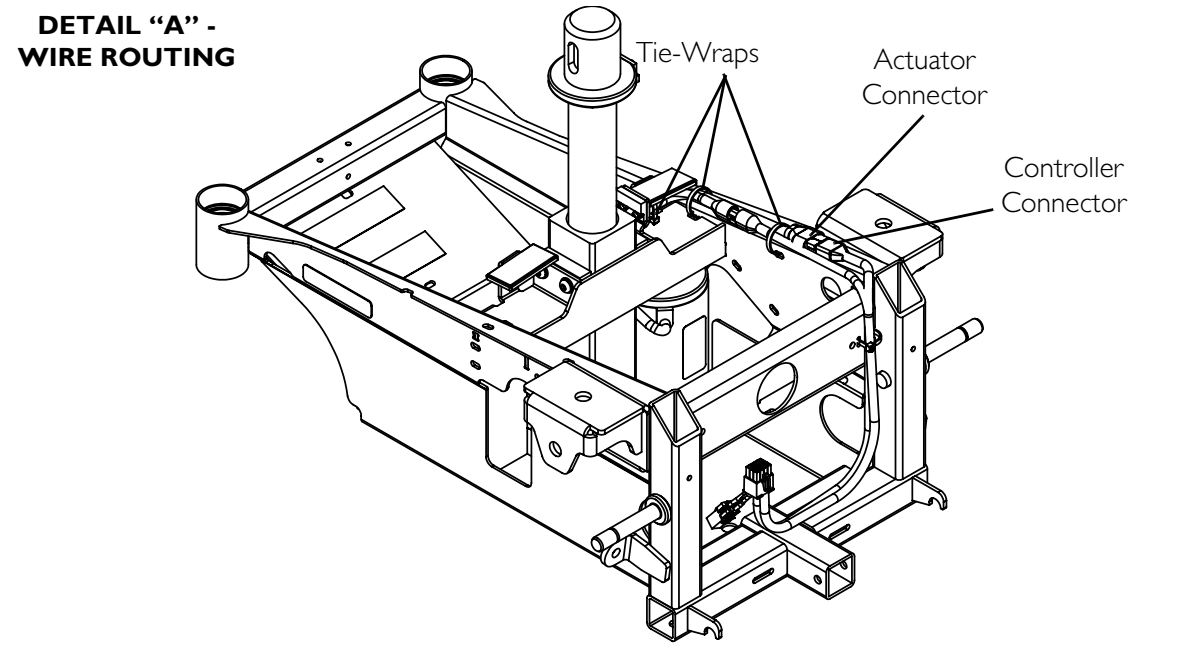


FIGURE 10.8 Removing/Installing the Elevate Actuator

Removing/Installing the Actuator Switch Sensor

NOTE: For this procedure, refer to FIGURE 10.8 on page 96.

NOTE: This procedure applies to M61 wheelchairs only.

Removing

1. Elevate the seat. Refer to Elevating the Seat on page 37.
2. Remove the seat. Refer to one of the following procedures:
   - Van Seats - Refer to Removing/Installing the Seat Assembly on page 50.
   - ASBA Seats - Refer to Removing/Installing the Seat Assembly on page 59.
3. Remove the batteries. Refer to Removing/Installing Batteries from/into Battery Tray on page 99.
4. Remove the two screws and small washers securing the actuator switch sensor to the elevate actuator.

Installing

1. Secure the actuator switch sensor to the elevate actuator using the two screws and small washers. Tighten securely.
2. Install the batteries. Refer to Removing/Installing Batteries from/into Battery Tray on page 99.
3. Install the seat. Refer to one of the following procedures:
   - Van Seats - Refer to Removing/Installing the Seat Assembly on page 50.
   - ASBA Seats - Refer to Removing/Installing the Seat Assembly on page 59.

SECTION 11—BATTERIES

Warnings For Handling and Replacing Batteries

⚠ WARNING

After any adjustments, repair or service and before use, make sure that all attaching hardware is tightened securely - otherwise injury or damage may result.

Make sure power to the wheelchair is Off before performing this section.

The use of rubber gloves is recommended when working with batteries.

Invacare strongly recommends that battery installation and battery replacement ALWAYS be done by a qualified technician.

U1 batteries weigh 24 pounds each. Use proper lifting techniques (lift with your legs) to avoid injury.

Use U1 batteries only. Failure to use the correct battery size and/or voltage may cause damage to your wheelchair and give you unsatisfactory performance.

ALWAYS use a battery handle/lifting strap when lifting a battery. It is the most convenient method and assures that the battery acid will not spill. It also helps to prolong the life of the battery.

DO NOT tip the batteries. Keep the batteries in an upright position.

NEVER allow any of your tools and/or battery cables to contact both battery posts at the same time. An electrical short may occur and serious personal injury or damage may occur.

The POSITIVE (+) battery cable MUST connect to the POSITIVE (+) battery terminal, otherwise serious damage will occur to the electrical system.

Connect same color connectors to each other (RED to RED, BLACK to BLACK).

DO NOT remove fuse or mounting hardware from POSITIVE (+) battery cable mounting screw. To replace the fuse, obtain and replace battery harness with fuse.

Wheelchairs should be examined during maintenance for signs of corrosion (water exposure, incontinence, etc.). Electrical components damaged by corrosion should be replaced IMMEDIATELY.

Wheelchairs that are used by incontinent users and/or are frequently exposed to water may require replacement of electrical components more frequently.

NOTE: If there is battery acid in the bottom of the battery tray or on the sides of the battery, apply baking soda to these areas to neutralize the battery acid. Before reinstalling the existing or new battery, clean the baking soda from the battery tray or battery being sure to avoid contact with skin and eyes. Determine source of contamination. NEVER install/reinstall a battery with a cracked or otherwise damaged case.

Using the Proper Batteries

NOTE: For this procedure, refer to FIGURE 11.1.

1. Place battery on ground/flat surface.
2. Visually draw a horizontal and vertical centerline through the middle of battery (FIGURE 11.1).
3. Position the battery so that the terminals are above the horizontal centerline.
4. Visually inspect the battery to ensure the correct position of the POSITIVE and NEGATIVE terminals (FIGURE 11.1).

⚠ WARNING

Batteries with terminal configuration as shown below MUST be used. Batteries that have the reverse terminal configuration MUST NOT be used - otherwise injury and damage may occur.

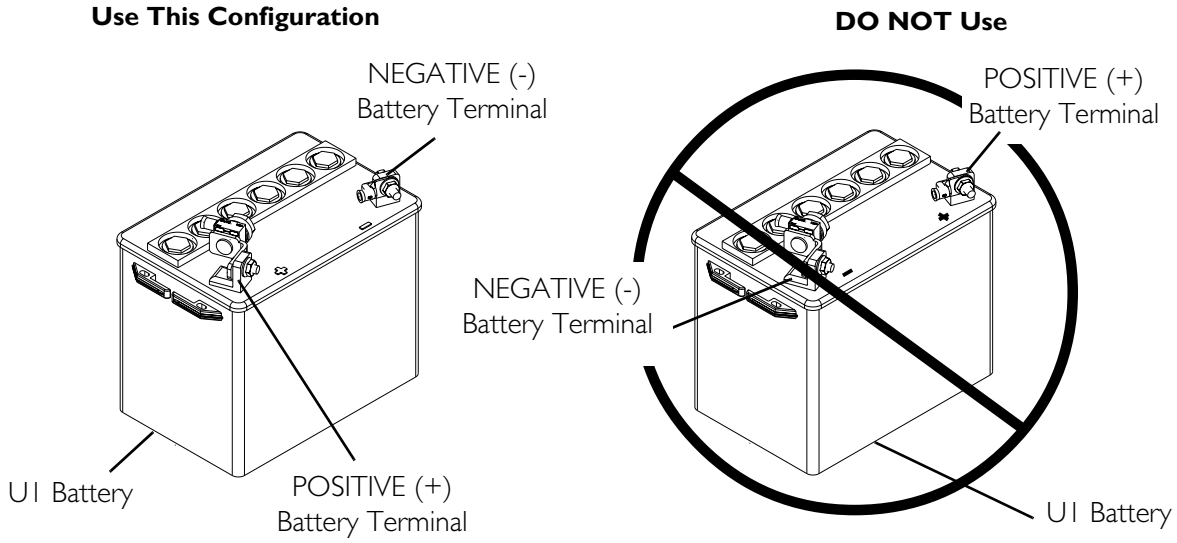


FIGURE 11.1 Using the Proper Batteries

Removing/Installing Batteries from/into Battery Tray

⚠ WARNING

ALWAYS use the battery handle when lifting the battery. It is the most convenient method and assures that the battery acid will not spill. It also helps to prolong the life of the battery.

DO NOT tip the batteries. Keep the batteries in an upright position.

NOTE: For this procedure, refer to FIGURE 11.2 on page 101.

NOTE: If there is battery acid in the bottom of the battery tray or on the sides of the battery, apply baking soda to these areas to neutralize the battery acid. Before reinstalling the existing or new battery, clean the baking soda from the battery tray or battery being sure to avoid contact with skin and eyes. Determine source of contamination. NEVER install/reinstall a battery with a cracked or otherwise damaged case.

NOTE: Have the following tools available:

TOOL	QTY	COMMENTS
7/16-INCH (6PT) BOX WRENCH	1	Not Supplied
DIAGONAL CUTTERS	1	Not Supplied

Removing

1. Place the wheelchair in a well ventilated area where work can be performed without risking damage to carpeting or floor covering.
2. Verify the joystick On/Off switch is in the Off position and disconnect joystick cable (not shown). Refer to Disconnecting/Connecting the Joystick on page 123.
3. Remove the seat. Refer to one of the following procedures:
   - Van Seats - Refer to Removing/Installing the Seat Assembly on page 50.
   - ASBA Seats - Refer to Removing/Installing the Seat Assembly on page 59.
4. Remove the top shroud. Refer to Removing/Installing the Top Shroud on page 87.
5. Disconnect the front battery from the controller (BLACK connector).
6. Disconnect the rear battery from the front battery (RED and BLACK connectors).
7. Lift rear and front battery out of the battery tray using the battery handles.

Installing

1. Verify the joystick On/Off switch is in the Off position and disconnect joystick cable. Refer to Disconnecting/Connecting the Joystick on page 123.
2. Position the front battery in the front of the battery tray.
3. Position rear battery in rear of battery tray.

NOTE: Ensure that both batteries are properly seated and resting on the battery tray.

4. Connect the rear battery to the front battery (RED and BLACK connectors).
5. Connect the front battery to the controller (BLACK connector).
6. Reinstall the top shroud. Refer to Removing/Installing the Top Shroud on page 87.
7. Reinstall the seat. Refer to one of the following procedures:
   - Van Seats - Refer to Removing/Installing the Seat Assembly on page 50.
   - ASBA Seats - Refer to Removing/Installing the Seat Assembly on page 59.

8. Connect joystick cable (not shown). Refer to Disconnecting/Connecting the Joystick on page 123.

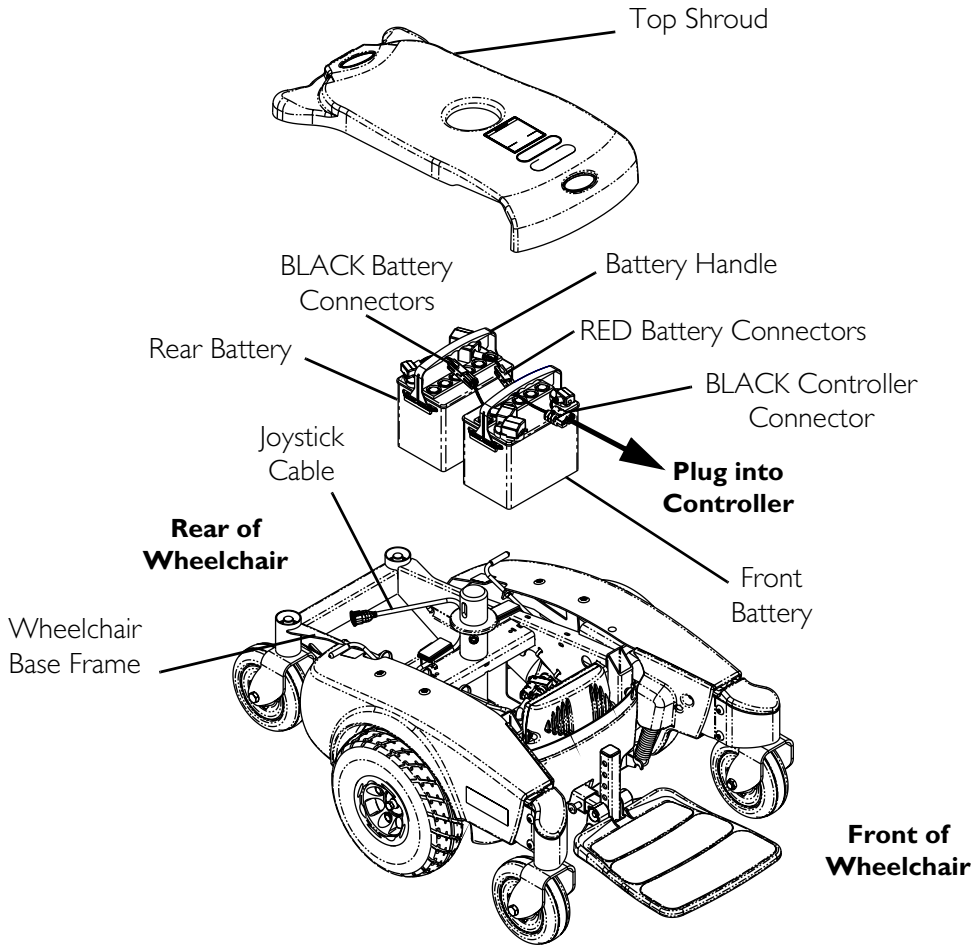


FIGURE 11.2 Removing/Installing Batteries from/into Battery Tray

Connecting/Disconnecting Battery Cables

Connecting Battery Cables

⚠ WARNING

NEVER allow any of your tools and/or battery cables to contact both battery terminals at the same time. An electrical short may occur and serious personal injury or damage may occur.

Connect same color connectors to each other (RED to RED, BLACK to BLACK).

DO NOT remove fuse or mounting hardware from POSITIVE (+) battery cable mounting screw. To replace the fuse, obtain and replace battery harness with fuse.

The POSITIVE (+) battery cable MUST connect to the POSITIVE (+) battery terminal, otherwise serious damage will occur to the electrical system.

The use of rubber gloves is recommended when working with batteries.

⚠ WARNING

Battery terminal configuration as shown in Detail "A" of FIGURE 11.3 MUST be used. Batteries that have the terminal configuration reversed MUST NOT be used - otherwise serious injury or damage may occur.

Install protective caps on POSITIVE (+) and NEGATIVE (-) terminals.

All battery terminal covers (two on the front battery and two on the rear battery) MUST be installed prior to use.

CAUTION

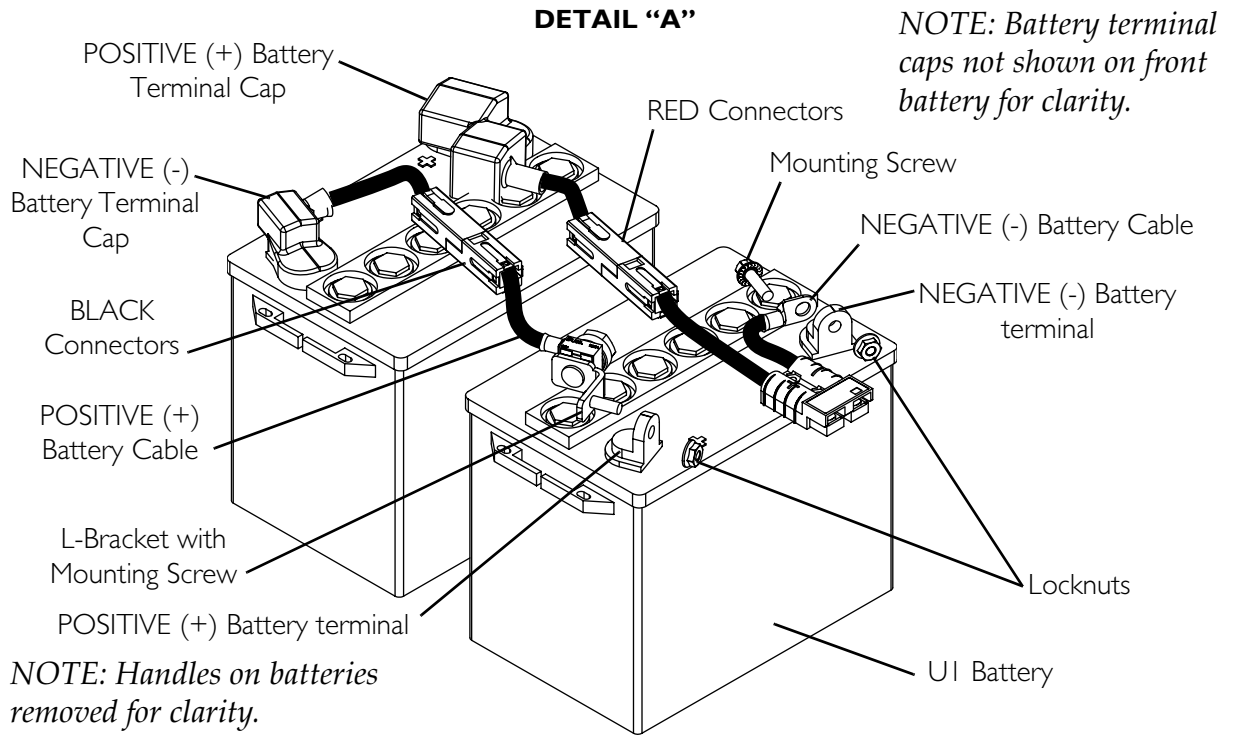
When connecting the battery cables to the battery, the battery cables MUST be connected to the battery terminals, as shown in Detail "A" of FIGURE 11.3 (depending on battery type), otherwise damage to the battery cable may result when installing battery terminal caps.

NOTE: For this procedure, refer to FIGURE 11.3 on page 103.

1. Secure the battery cables to the battery terminals as described below. Securely tighten. Refer to Detail "A" of FIGURE 11.3:
   A. Secure NEGATIVE (-) battery cable to the NEGATIVE (-) battery terminal using the mounting screw and the locknut.
   B. Secure the POSITIVE (+) battery cable to the POSITIVE (+) battery terminal using the L-bracket with mounting screw and the locknut.
2. Verify all battery cables are correctly installed and securely tightened.
3. Slide terminal caps down battery cables and onto battery terminals.
4. Secure each terminal cap in place with a tie-wrap [use tie-wraps 11-1/2-inches long] (Detail "B" of FIGURE 11.3).
5. Position the batteries into the wheelchair. Refer to Removing/Installing Batteries from/into Battery Tray on page 99.

NOTE: New batteries MUST be fully charged before using, otherwise the life of the batteries will be reduced.

6. If necessary, charge the battery. Refer to Charging Batteries on page 104.



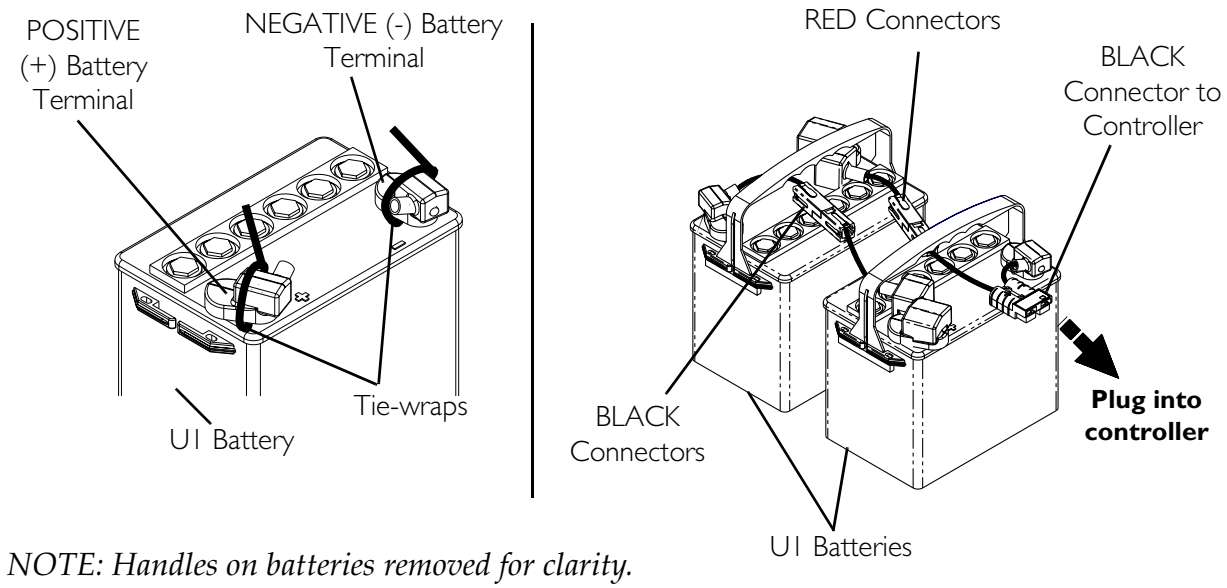


FIGURE 11.3 Connecting/Disconnecting Battery Cables

Disconnecting Battery Cables

⚠ WARNING

The use of rubber gloves is recommended when working with batteries.

NEVER allow any of your tools and/or battery cables to contact both battery terminals at the same time. An electrical short may occur and serious personal injury or damage may occur.

NOTE: For this procedure, refer to FIGURE 11.3 on page 103.

1. Remove the seat. Perform one of the following:
   - Van Seat - Refer to Removing/Installing the Seat Assembly on page 50.
   - ASBA Seat - Refer to Removing/Installing the Seat Assembly on page 59.
2. Remove the batteries. Refer to Removing/Installing Batteries from/into Battery Tray on page 99.
3. Cut the tie-wrap that secures the battery terminal cap in place (Detail "B" of FIGURE 11.3).
4. Slide terminal caps up onto the battery cables (FIGURE 11.3).
5. Disconnect POSITIVE (+) battery cable from the POSITIVE (+) battery terminal (FIGURE 11.3).
6. Disconnect NEGATIVE (-) battery cable from NEGATIVE (-) battery terminal (FIGURE 11.3).

Charging Batteries

⚠ WARNING

NEVER attempt to recharge the batteries by attaching cables directly to the battery terminals.

DO NOT attempt to recharge the batteries and operate the wheelchair at the same time.

DO NOT attempt to recharge the batteries when the wheelchair has been exposed to any type of moisture.

DO NOT attempt to recharge the batteries when the wheelchair is outside.

DO NOT sit in the wheelchair while recharging the batteries.

DO NOT attempt to recharge the batteries using both the on-board battery charger and an independent battery charger (plugged into the joystick charger port) at the same time. Doing so will reduce the life of the batteries.

Read and carefully follow the individual instructions for each charger (supplied or purchased). If charging instructions are not supplied, consult a qualified technician for proper procedures.

CAUTION

New batteries MUST be fully charged prior to initial use of the wheelchair.

ALWAYS charge new batteries before initial use or battery life will be reduced.

As a general rule, you should recharge your batteries as frequently as possible to assure the longest possible life and to minimize required charging time. Plan to recharge them when you do not anticipate using the wheelchair.

Basic concepts which will help you understand this automatic process are:

The amount of electrical current drawn within a given time to charge a battery is called "charge rate". If, due to usage, the charge stored in the battery is low, the charge rate is high. As a charge builds up, the charge rate is reduced, and the battery charger rate decreases to a "trickle charge".

NOTE: If the batteries need to be charged more often or take longer to charge than normal, they may need to be replaced. Contact a qualified technician.

NOTE: The batteries can be charged using the on-board battery charger or by plugging an independent battery charger into the port located on the front of the joystick.

Battery Charger Operation

⚠ WARNING

Read and carefully follow the manufacturer's instructions for each charger (supplied or purchased). If charging instructions are not supplied, consult a qualified technician for proper procedures.

NEVER leave the charger unattended when the charger circuit breaker is tripping.

⚠ DANGER

Use of improper extension cord could result in risk of fire and electric shock.

On-Board Battery Charger

⚠ DANGER

When using an extension cord, use only a three wire extension cord having at least 16 AWG (American Wire Gauge) wire and the same or higher electrical rating as the device being connected. Use of improper extension cord could result in risk of fire and electric shock. Three prong to two prong adapters should not be used. Use of three prong adapters can result in improper grounding and present a shock hazard to the user.

⚠ WARNING

Ensure the pins of the extension cord plug are the same number, size, and shape as those on the charger.

DO NOT, under any circumstances, cut or remove the round grounding plug from the charger AC cable plug or the extension cord plug.

NOTE: For this procedure, refer to FIGURE 11.4 on page 107.

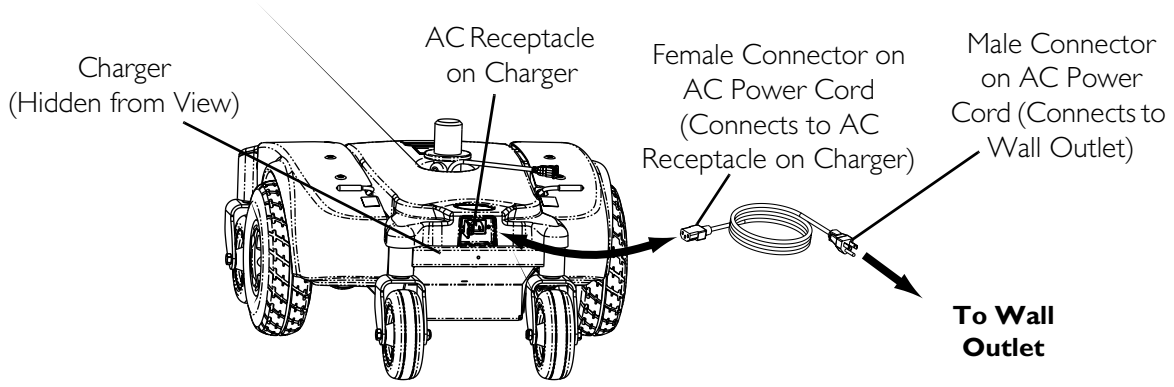
NOTE: The On/Off LED indicator light and the charger LED indicator light are located on the top of the charger on the rear of the wheelchair. Open rear shroud to view indicator lights.

NOTE: If the batteries are completely discharged, the charger will not charge them. Replace the batteries. Refer to Removing/Installing Batteries from/into Battery Tray on page 99.

1. Plug the female connector of the AC power cord (supplied) to the AC receptacle on the charger and plug in the male connector on the AC power cord into the wall outlet.
2. The On/Off LED indicator is blinking RED, this is abnormal. Unplug AC power cord from the on-board battery charger and wall outlet. Charger may need to be replaced. Refer to Replacing the On-Board Battery Charger Fuse on page 108.
3. When the On/Off LED indicator light is Off, charger is Off.
4. When the Charge LED indicator light is YELLOW, the batteries are charging.
5. When the Charge LED indicator light is solid GREEN, the batteries are fully charged (as their condition will allow).
6. When charging is complete, unplug the male connector of the AC power cord from the wall outlet and then unplug the female connector of the AC power cord from the AC receptacle on the charger.

⚠ WARNING

DO NOT operate wheelchair with AC power cord attached to the wheelchair.



ON/OFF INDICATOR	STATUS
SOLID RED	Charger On
"BLINKING" RED	Abnormal
LED "OFF"	Charger Off

CHARGING INDICATOR	STATUS
YELLOW	Charging
SOLID GREEN	Fully charged

FIGURE 11.4 On-Board Battery Charger

Charging Using An Independent Charger Plugged Into The Joystick

⚠ WARNING

Read and carefully follow the individual instructions for each charger (supplied or purchased). If charging instructions are not supplied, consult a qualified technician for proper procedures.

DO NOT attempt to recharge the batteries using both the on-board battery charger and an independent battery charger (plugged into the joystick charger port) at the same time. Doing so will reduce the life of the batteries.

CAUTION

Only use a charger approved by Invacare when charging through the joystick on this wheelchair model.

DO NOT use an independent charger with an output rating of over 8A (Amps). Otherwise, damage may occur.

NOTE: For this procedure, refer to FIGURE 11.5.

NOTE: The charger port located on the front of the joystick requires the use of an independent charger. The independent charger is NOT supplied with the wheelchair.

1. Attach the battery charger connector to the charger port on the front of the joystick.
2. Plug the charger's AC power cord or extension into the grounded 110-volt wall outlet.
3. When charging is complete, turn charger Off.
4. Disconnect output cable from joystick charger port.

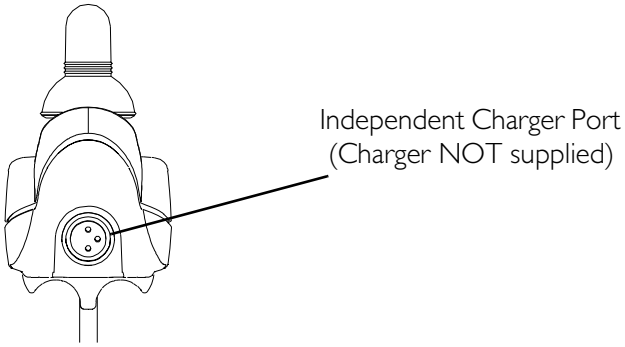


FIGURE 11.5 Charging Using An Independent Charger Plugged Into The Joystick

Replacing the On-Board Battery Charger Fuse

⚠ WARNING

DO NOT replace the battery charger fuse with anything other than a 250V 47 Amp fuse. Otherwise, equipment damage and/or personnel injury may occur.

DO NOT attempt to remove the battery charger fuse with power applied to the wheelchair. Otherwise, equipment damage and/or personnel injury may occur.

NOTE: For this procedure, refer to FIGURE 11.6 on page 109.

NOTE: The output of the battery charger is fused with a 250V, 4 amp fuse. The fuse holder is located on the left side of the charger as it is mounted to the wheelchair. This fuse should be checked first before replacing the battery charger for improper operation. If it has been determined the charger should be replaced. Refer to Replacing the On-Board Battery Charger on page 109.

NOTE: If the batteries are completely discharged, the charger will not charge them. Replace the batteries. Refer to Removing/Installing Batteries from/into Battery Tray on page 99.

1. Turn Off power and disconnect joystick. Refer to Disconnecting/Connecting the Joystick on page 123.
2. Remove top shroud. Refer to Removing/Installing the Top Shroud on page 87.

3. Remove the fuse holder from left side of charger next to battery charger cable and perform one of the following:
   - If fuse is bad, replace with new 250V, 4 amp fuse.
   - If fuse is good, replace charger. Refer to Replacing the On-Board Battery Charger on page 109.
4. Connect joystick and turn power On. Refer to Disconnecting/Connecting the Joystick on page 123.
5. Perform one of the following:
   - If wheelchair functions, install top shroud. Refer to Removing/Installing the Top Shroud on page 87.
   - If wheelchair does not function, replace charger. Refer to Replacing the On-Board Battery Charger on page 109.

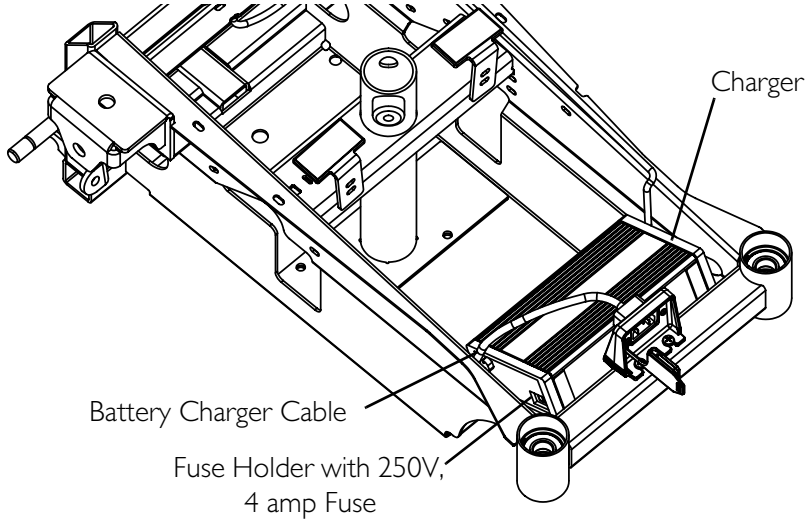


FIGURE 11.6 Replacing the On-Board Battery Charger Fuse

Replacing the On-Board Battery Charger

⚠ WARNING

DO NOT replace the battery charger fuse with anything other than a 250V 4 Amp fuse. Otherwise, equipment damage and/or personnel injury may occur.

DO NOT attempt to remove the battery charger with power applied to the wheelchair. Otherwise, equipment damage and/or personnel injury may occur.

NOTE: For this procedure, refer to FIGURE 11.7 on page 111.

NOTE: Take note of position and orientation of battery charger cables and tie-wraps for reinstallation.

NOTE: The output of the battery charger is fused with a 250V, 4 amp fuse. The fuse holder is located at the left side of the charger as it is mounted to the wheelchair. This fuse should be checked

first before replacing the battery charger for improper operation. Refer to Replacing the On-Board Battery Charger Fuse on page 108.

1. Remove the top shroud. Refer to Removing/Installing the Top Shroud on page 87.
2. Remove the rear battery from the wheelchair. Refer to Removing/Installing Batteries from/into Battery Tray on page 99.
3. Disconnect the battery charger connector (Detail "B") from the controller connector (not shown).

NOTE: The battery charger is secured to the frame with two hook and loop strips (Detail "B").

4. Remove the four tie-wraps securing the battery charger connector cable to the wheelchair frame (Detail "A").
5. Remove the two screws and locknuts securing the battery charger plug to the bracket (Detail "B").
6. Pull existing charger away from wheelchair frame to release the hook and loop strips and remove the existing charger from the wheelchair frame (Detail "B").
7. Remove the hook and loop strips from the underside of the existing charger.
8. Install the hook and loop strips onto the underside of the new charger.
9. Place the new battery charger against the wheelchair frame, ensuring that the hook and loop strips properly engage.
10. Secure the battery charger plug to the bracket using the two screws and locknuts. Torque to 75 in-lbs.
11. Route the battery charger connector cable to the right side (from the rear of the wheelchair) of the battery charger body (Detail "B").
12. Connect the battery charger connector (Detail "B") to the controller connector .
13. Using four tie-wraps, secure the charger cable to the wheelchair frame (Detail "A").
14. Install the rear battery. Refer to Removing/Installing Batteries from/into Battery Tray on page 99.
15. Install the top shroud. Refer to Removing/Installing the Top Shroud on page 87.
16. Test the on-board charger for proper operation by performing the following steps:
    A. Connect the battery charger to an outlet.
    B. Locate pins 1 and 2 in the joystick charger port at the front of the joystick housing (Detail "C").
    C. Use a digital multimeter to check the voltage at pins 1 and 2.

    NOTE: Voltage should start to increase after 30 seconds. This indicates that the batteries are being charged.

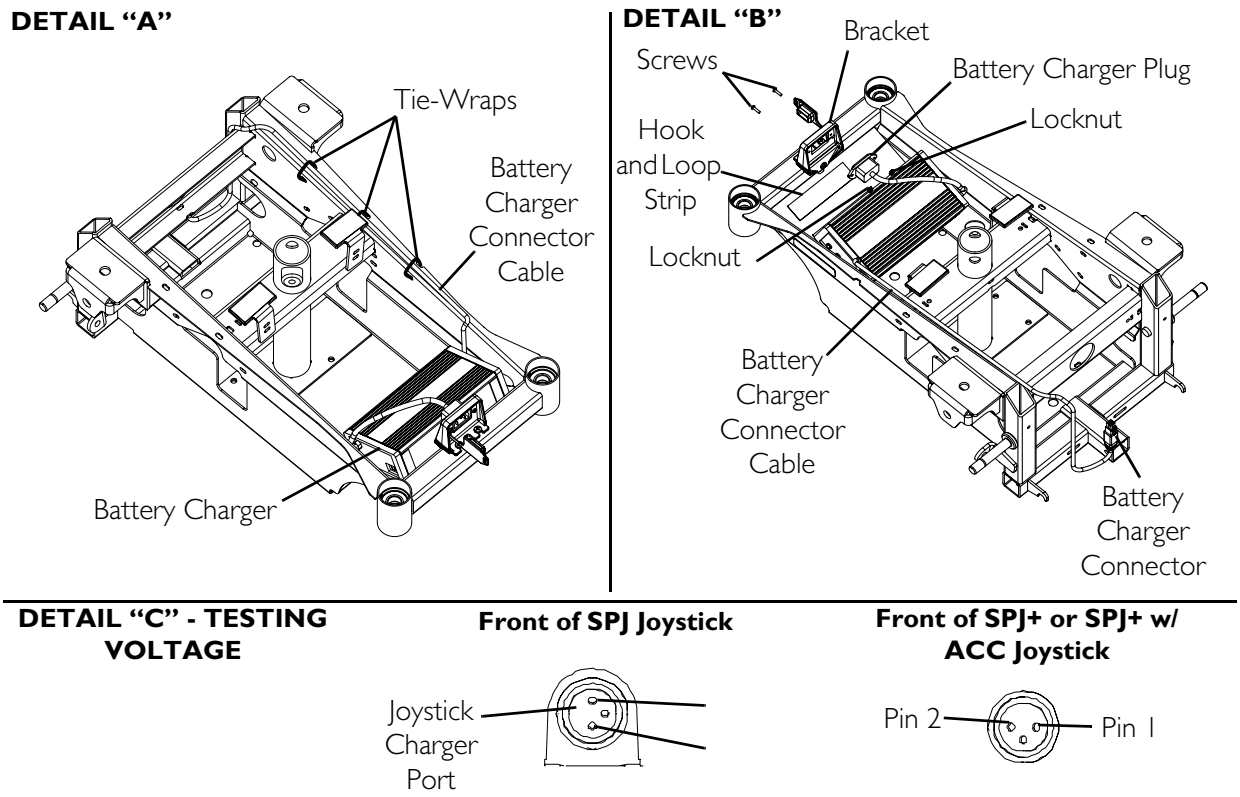


FIGURE 11.7 Replacing the On-Board Battery Charger

SECTION 12—MOTORS

⚠ WARNING

After ANY adjustments, repair or service and before use, make sure that all attaching hardware is tightened securely.

ALWAYS turn the wheelchair power Off before repairing or servicing the wheelchair, otherwise injury or damage may occur.

Removing/Installing the Motor

NOTE: For this procedure, refer to FIGURE 12.1 on page 113.

NOTE: Reverse this procedure to install the motor.

NOTE: Removing walking beam from the wheelchair, while not necessary, may improve access to the motor. Refer to Removing/Installing the Walking Beam on page 93.

1. Remove the seat. Refer to one of the following procedures:
   - Van Seats - Refer to Removing/Installing the Seat Assembly on page 50.
   - ASBA Seats - Refer to Removing/Installing the Seat Assembly on page 59.
2. Remove the front battery. Refer to Removing/Installing Batteries from/into Battery Tray on page 99.
3. Remove the drive wheel. Refer to Removing/Installing the Drive Wheel on page 84.
4. Remove the side shroud. Refer to Removing/Installing the Side Shrouds on page 88.
5. Remove the front shroud. Refer to Removing/Installing the Front Shroud on page 89.
6. Cut all tie-wraps securing the motor lead to the frame.
7. Disconnect the motor lead connector from the controller (Detail "A").
8. Remove the cotter pin to disconnect the motor release lever. Refer to Removing/Installing the Motor Release Lever on page 115.
9. Using a 5 mm ball head 10-inch T-handle allen wrench, remove the three long mounting screws and three short mounting screws securing the motor to the walking beam (FIGURE 12.1).

NOTE: Long mounting screws are used on the same side of the motor as the drive shaft.

10. Remove the motor from the walking beam.
11. Position the new motor against the walking beam.
12. Loosely install all screws except the front inside short screw.
13. Install the front inside short screw.
14. Tighten the three long screws and three short screws.
15. If necessary, repeat STEPS 3-14 for the motor on the other side.

16. Reverse STEPS 1 - 8 to reassemble the base.

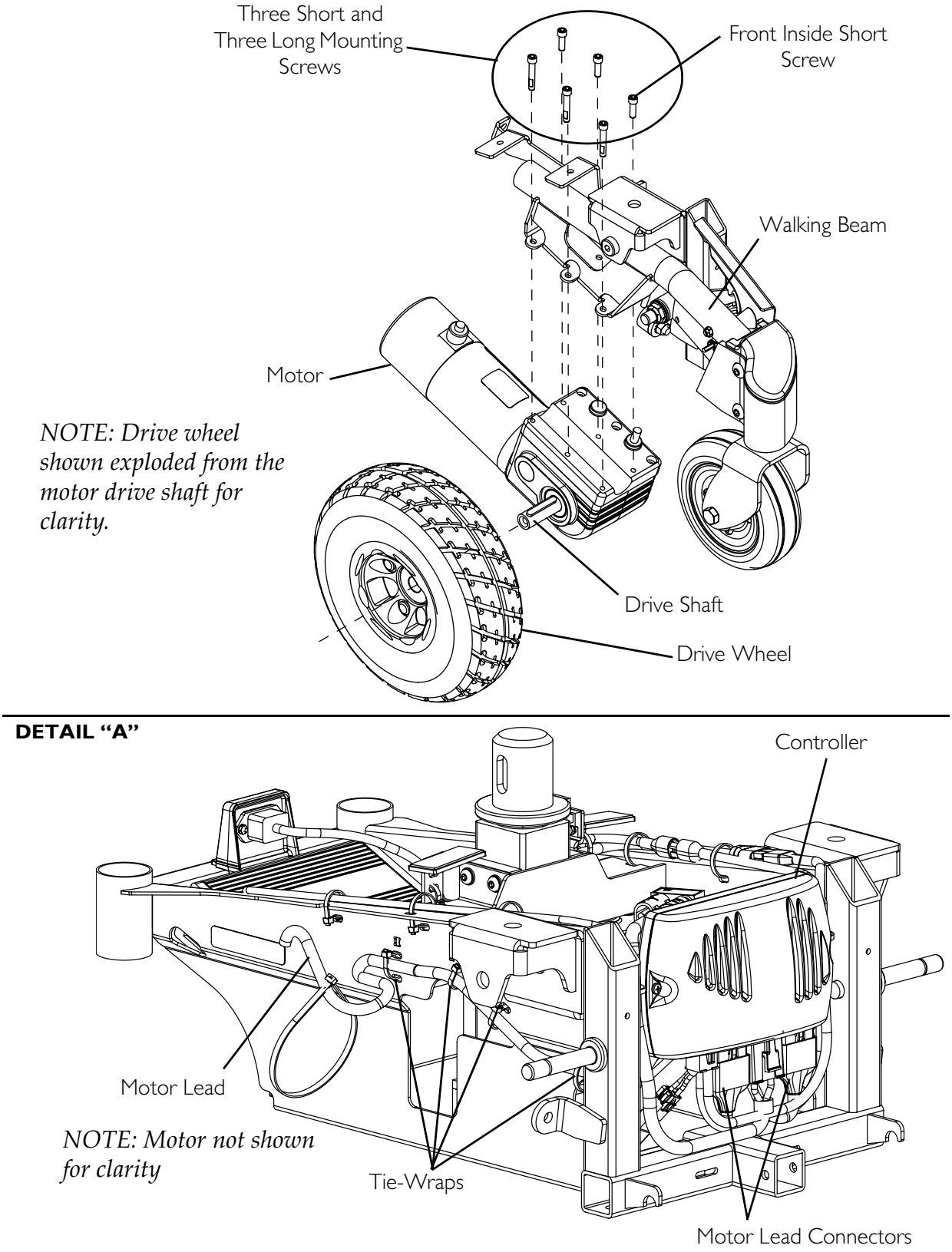


FIGURE 12.1 Removing/Installing the Motor

Engaging/Disengaging Motor Release Lever

⚠ WARNING

DO NOT engage or disengage the motor release lever until the On/Off switch on the joystick is in the Off position.

CAUTION

Ensure both motor release levers are fully engaged before driving the wheelchair

NOTE: For this procedure, refer to FIGURE 12.2.

NOTE: The motor lock disengagement/engagement allows freewheeling or joystick controlled operation. Freewheeling allows an attendant to maneuver the wheelchair without power.

1. Locate the motor release handles on the motors protruding through the top shroud on the rear of the wheelchair.
2. Perform one (1) of the following:
   - To Disengage the Motor Release Levers - Pull the motor lock lever towards the rear of the wheelchair (freewheel position).

   NOTE: This allows the chair to freewheel for pushing, if necessary.

   NOTE: It may be necessary to rock the wheels slightly until the motor release lever disengages.

   - To Engage the Motor Release Levers - Push the motor lock handles towards the front of the wheelchair (drive position).

   NOTE: This allows the motors to drive the wheels.

   NOTE: It may be necessary to rock the wheels slightly until the motor release lever engages.

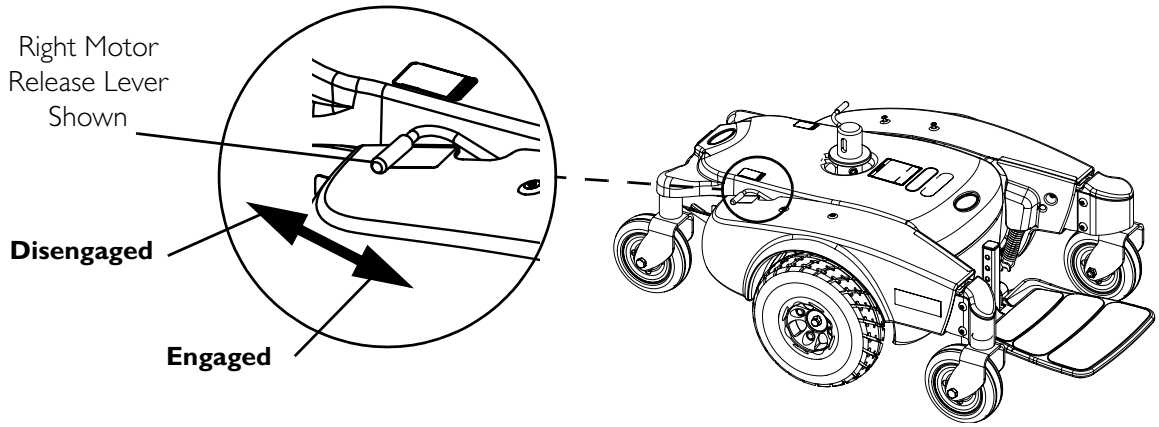


FIGURE 12.2 Engaging/Disengaging Motor Release Lever

Removing/Installing the Motor Release Lever

NOTE: For this procedure, refer to FIGURE 12.3.

NOTE: Reverse this procedure to install the motor release lever.

1. Remove the side shroud. Refer to Removing/Installing the Side Shrouds on page 88.
2. Remove the cap (not shown) from the motor release lever.
3. Remove the cotter pin, washer and mounting pin securing the motor lock to the motor release lever. Set cotter pin and mounting pin aside (Detail "A").
4. Grasp the motor release lever by the end that attaches to the motor lock.
5. Pull the motor release lever through the lever support on the inside of the walking beam (Detail "B").

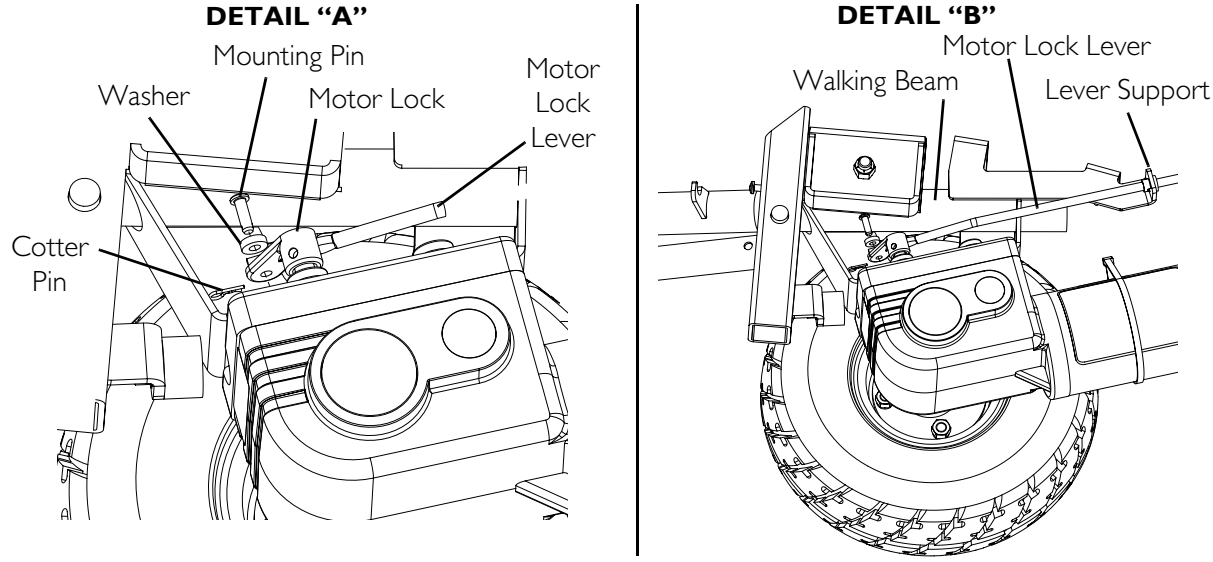


FIGURE 12.3 Removing/Installing the Motor Release Lever

Replacing Motor Brushes

NOTE: For this procedure, refer to FIGURE 12.4 on page 118.

1. Turn power Off.
2. Disengage motors. Refer to Engaging/Disengaging Motor Release Lever on page 114.
3. Remove the two end cap screws on the end cap. Refer to Detail "A.
4. Remove the end cap and locate the brush assembly on each side of the motor. Refer to Detail "B".

CAUTION

Use caution when removing the screw and washer that attaches the shunt wire to the motor. DO NOT discard the screw and washer. The screw and washer are not available as service parts.

5. Remove the mounting screw and washer that mounts the shunt wire to the motor assembly. DO NOT discard the mounting screw and washer. Refer to Detail "C" .

CAUTION

When removing the existing brushes, ensure that the spring retainer is not removed and/or discarded. The spring retainer is not available as a service part.

6. Release the tension on the brush spring retainer with a small screwdriver and position the screwdriver in place to hold the spring retainer. Refer to Detail "D".
7. Remove the motor brush and perform the following:
   A. Inspect the commutator (not shown) for damage.
   B. Inspect the motor brush thoroughly for excessive wear or chips in the brush and any discoloration in the shunt wire and perform one of the following:
      - If motor brush is in good condition, (i.e., the end of the brushes are smooth and shiny and shunt wire is not discolored), reinstall existing brush back into brush holder.
      - If motor brush is in bad condition, brush is worn or damaged, discard IMMEDIATELY and install new brush into brush holder.
8. Remove the screwdriver to release spring retainer so as to hold brush in place.
9. Attach the shunt wire to the motor housing using the mounting screw and washer (removed in STEP 5). Securely tighten.
10. Replace the motor end cap and secure using the two end cap screws.

NOTE: Repeat STEPS 1-10 for the opposite motor.

11. If new motor brush was installed, perform the following process:

NOTE: This process, also called Brush Burn-in or Finger Printing Process, is necessary to seat the brush to the commutator plates inside the motor for optimum performance of the motor.

⚠ WARNING

DO NOT leave the wheelchair unattended while performing this procedure - otherwise damage to wheelchair and/or property may occur.

NOTE: This procedure MUST be performed with little or no load on the motor.

A. Put the wheelchair on blocks so that the drive wheels do not contact the ground.

NOTE: For steps B and D, use a rubber band to hold the driver control in the direction needed or program the chair for latched driving. Refer to the electronics manual for latched programming instructions.

B. Run the motors forward for one hour.

C. Turn motors Off and allow 30 minutes for motors to cool off.

D. Run the motors in reverse for one hour.

E. When process is complete, remove wheelchair from blocks and test drive the wheel chair.

NOTE: If wheelchair still does not perform properly, call Technical Service at 1-800-832-4707.

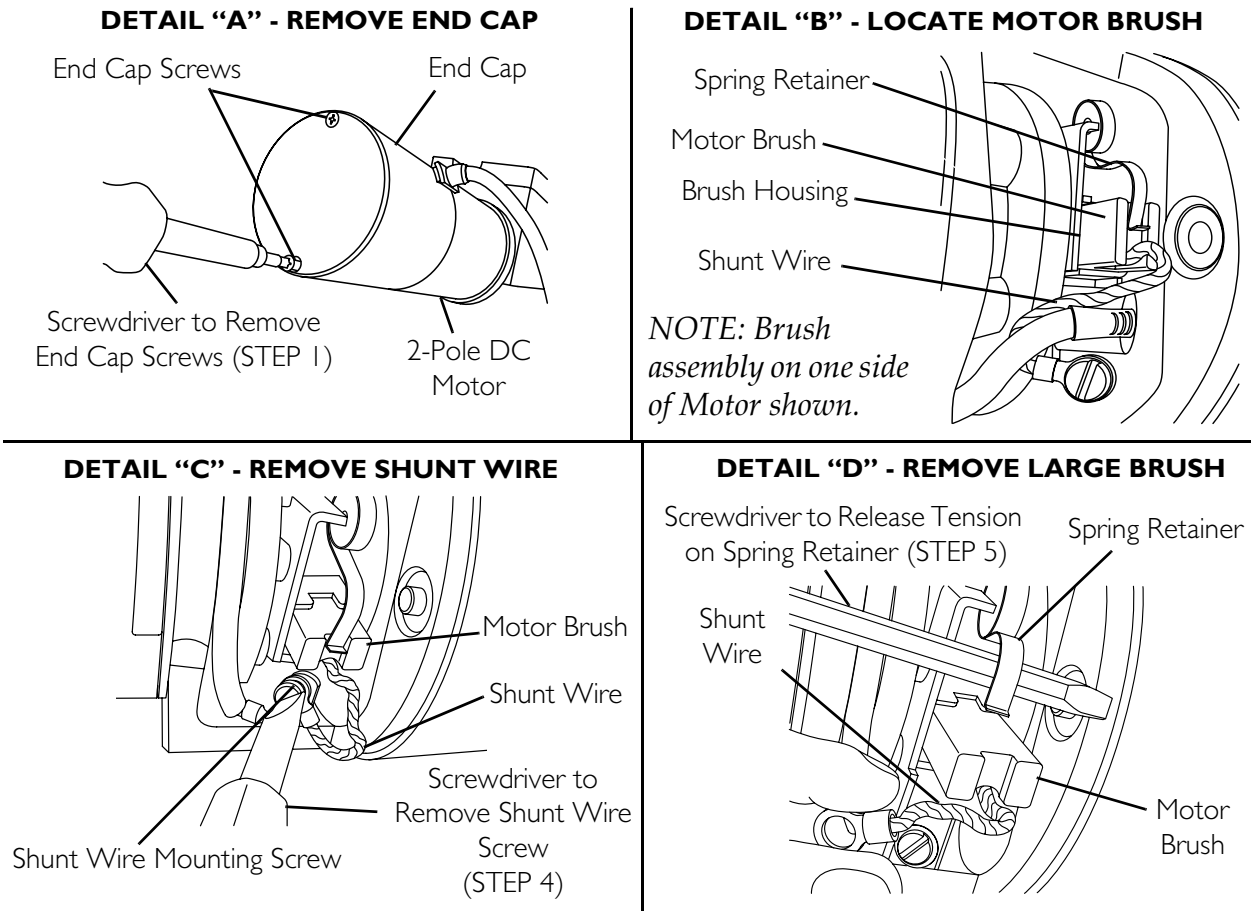


FIGURE 12.4 Replacing Motor Brushes

Electro-Mechanical Parking Brake Testing

NOTE: For this procedure, refer to FIGURE 12.5 on page 119.

NOTE: This procedure should only be performed on wheelchairs with conventional motor/gearbox assembly.

1. Engage the motor release lever. Refer to Engaging/Disengaging Motor Release Lever on page 114.
2. On the four-pin motor connector, locate the side by side connectors in the black housings.
3. Set the digital multimeter to read ohms.
4. Measure the resistance between the two brake contacts.
   - A normal reading is between 45-100 ohms depending on the motor.
   - A reading of 0 ohms (W) or a very high reading; i.e., MEG ohms or O.L. (out of limit) indicates a shorted brake or an open connection respectively. If either condition exists, send the motor to Invacare Technical Service for inspection/repair.

⚠ WARNING

A shorted electro-mechanical brake will damage the brake output section in the controller. DO NOT connect a shorted electro-mechanical brake to a good controller module. A shorted brake MUST be replaced.

NOTE: A bad motor can damage the controller module but a bad controller will NOT damage a motor.

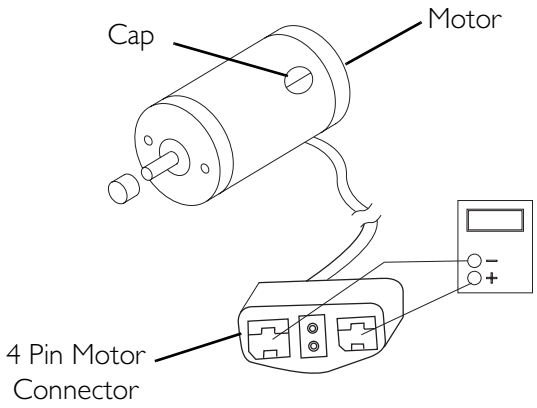


FIGURE 12.5 Electro-Mechanical Parking Brake Testing

SECTION 13—ELECTRONICS

⚠ WARNING

After any adjustments, repair or service and before use, make sure that all attaching hardware is tightened securely - otherwise injury or damage may result.

Before performing any maintenance, adjustment or service verify that On/Off switch on the joystick is in the Off position.

Removing/Installing the Joystick

NOTE: For this procedure, refer to FIGURE 13.1 on page 121.

Removing

1. Disconnect the joystick. Refer to Disconnecting/Connecting the Joystick on page 123.
2. Cut the tie-wraps that secure the joystick cable to the arm.
3. Loosen the adjustment lock lever to release the joystick mounting tube from the mounting bracket. Refer to FIGURE 13.1.
4. Remove the joystick and joystick mounting tube from the mounting bracket.

Installing

1. Slide joystick mounting tube through the mounting bracket to the desired position.
2. Tighten the adjustment lock lever to secure the joystick mounting tube to the mounting bracket on the other arm.
3. Tie-wrap the joystick cable to the arm as shown in FIGURE 13.1.
4. Connect the joystick. Refer to Disconnecting/Connecting the Joystick on page 123.

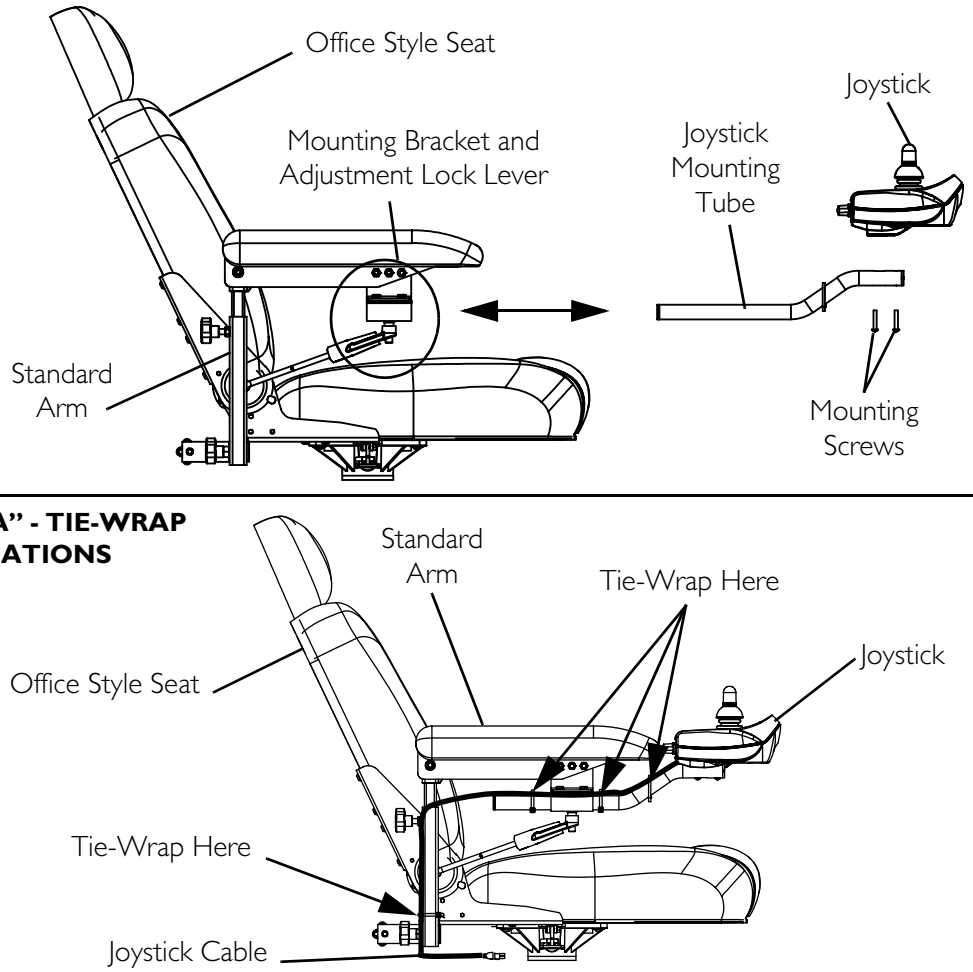


FIGURE 13.1 Removing/Installing the Joystick

Repositioning the Joystick Mounting Bracket

Van Seat

NOTE: For this procedure, refer to FIGURE 13.2 on page 122.

NOTE: Take note of position and orientation of mounting hardware for reinstalling the joystick assembly.

1. Turn the adjustment lock lever to release the joystick mounting tube from the mounting bracket.
2. Remove the joystick from the wheelchair.
3. Remove the three hex mounting screws, spacers and locknuts that secure the mounting bracket to the three mounting holes on the arm frame.

NOTE: The mounting bracket is mounted to the inside of the arm frame.

4. Reposition the mounting bracket on the opposite arm frame.

5. Using the three hex mounting screws, spacers and locknuts secure the mounting bracket to the three mounting holes of the arm frame.
6. If necessary, perform the following to reposition the adjustment lock:
   A. Slide the adjustment lock from the mounting bracket.
   B. Rotate adjustment lock 180° and slide adjustment lock over the opposite end of the mounting bracket.
7. Slide joystick mounting tube through the mounting bracket to the desired position and secure adjustment lock to tube by turning lever on adjustment lock.

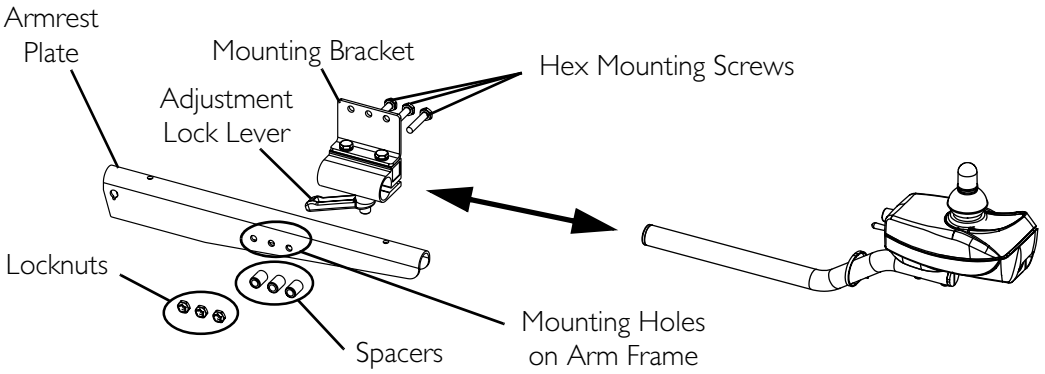


FIGURE 13.2 Repositioning the Joystick Mounting Bracket

ASBA Seat

NOTE: For this procedure, refer to FIGURE 13.3 on page 123.

1. Turn the lever on the adjustment lock to release the adjustment lock from joystick mounting tube.
2. Remove the joystick from the wheelchair.
3. Remove the three hex screws that secure joystick mounting bracket, the threaded hole half clamp and the opened hole half clamp to the arm tube.
4. Reposition the threaded hole half clamp and opened hole half clamp on the opposite arm tube. Make sure threaded hole half clamp is on the inside of arm tube.
5. While holding the two half clamps, install the front hex screw into the two half clamps. Securely tighten.
6. Line up mounting holes of the joystick mounting bracket with the mounting holes in the two half clamps.
7. Secure the joystick mounting bracket to the two half clamps with the remaining two hex screws.
8. Slide tube through the bracket to the desired position.
9. Slide adjustment lock over end of tube and secure adjustment lock to tube by turning lever on adjustment lock.

NOTE: If adjustment lock does not fit over tube, rotate 180°.

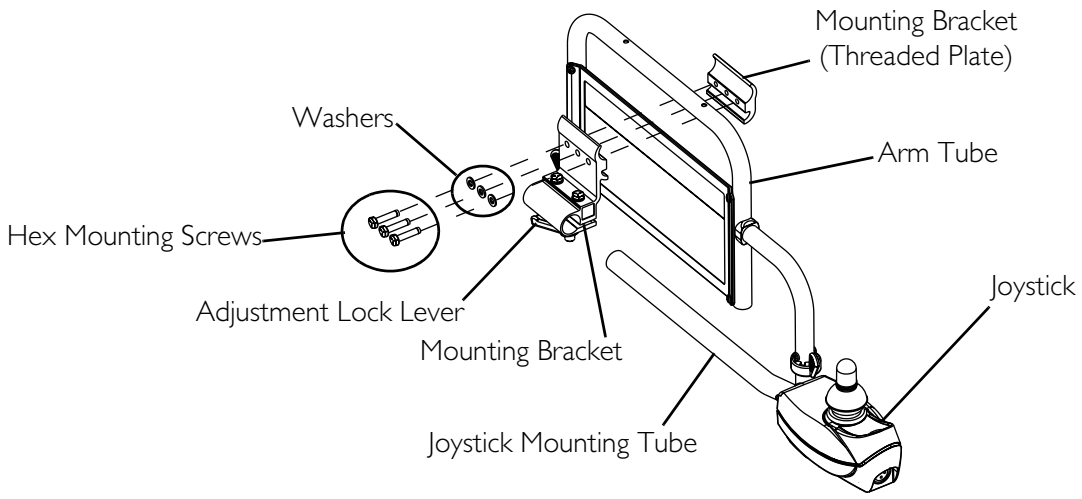


FIGURE 13.3 Repositioning the Joystick Mounting Bracket - ASBA Seat

Disconnecting/Connecting the Joystick

NOTE: For this procedure, refer to FIGURE 13.4 on page 124.

Disconnecting

1. Hold the light GREY collar portion of the joystick connector with one hand and the controller connector on the wheelchair in the other and disconnect them by pulling them apart.

Connecting

CAUTION

The joystick connector and controller connector fit together in one way only. DO NOT force them together.

1. Hold the light GREY collar portion of the joystick connector with one hand and the controller connector on the wheelchair in the other and align them.
2. Lightly push to engage the joystick connector and the controller connector.

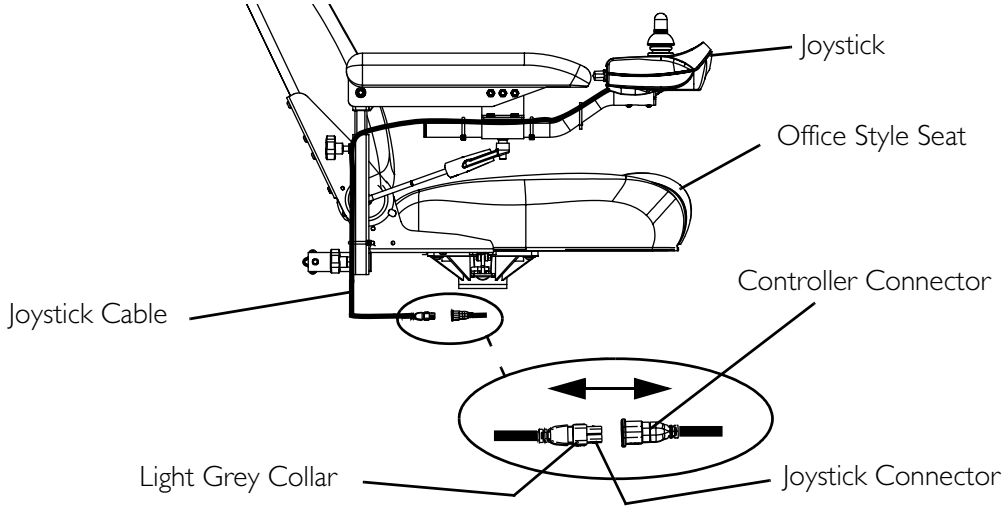


FIGURE 13.4 Disconnecting/Connecting the Joystick

Adjusting the Quad-Link Retractable Mount

NOTE: This procedure is for quad-link retractable mounts manufactured before 4/7/06. For quad-link retractable mounts manufactured after 4/6/06, refer to the quad-link instruction sheet, part number 1134844.

Adjusting Lock/Release Tension

NOTE: For this procedure, refer to FIGURE 13.5 on page 125.

NOTE: The amount of force required to lock and release the quad-link can be adjusted by changing the position of the spring loaded ball plungers located on the underside of each Swivel Block.

1. Loosen the ¼-inch locknut.
2. With a slotted screwdriver, turn the ball plunger clockwise to increase tension and counterclockwise to decrease tension.

CAUTION

DO NOT adjust the ball plungers too deep into the swivel blocks or damage to the ball plunger and swivel links will occur. The ball plungers should be adjusted so that a "click" can always be heard when the swivel links are extended and retracted.

3. Once the desired tension is achieved, hold the position of the ball plunger with a slotted screwdriver and tighten the lock nut.
4. Repeat STEPS 1-3 for the other ball plunger.

CAUTION

DO NOT over-tighten the locknut, otherwise damage to the ball plunger will occur.

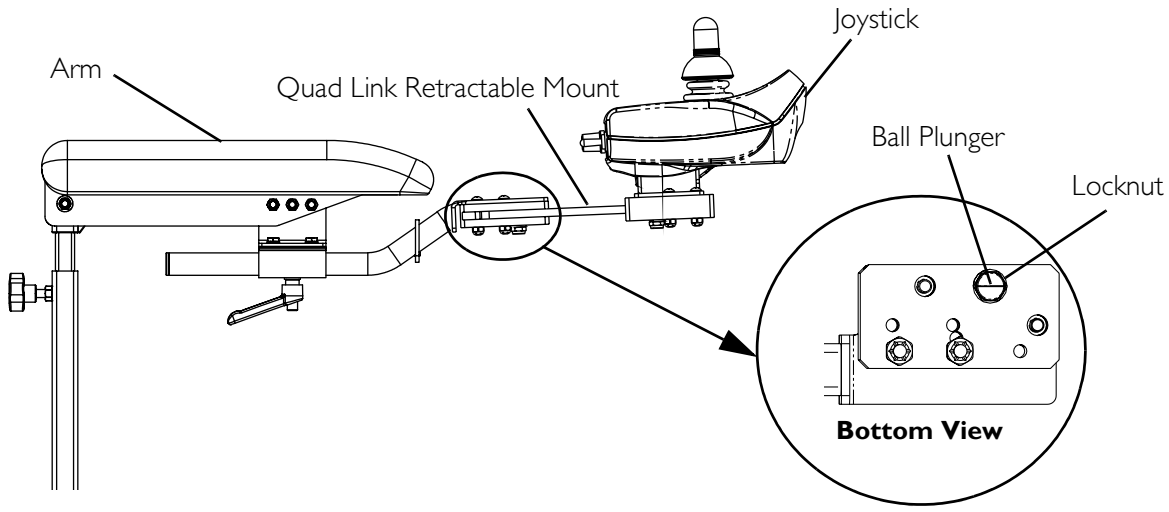


FIGURE 13.5 Adjusting Lock/Release Tension

Replacing the Controller

⚠ WARNING

DO NOT attempt to perform this procedure with any power supplied to the wheel chair. The joystick and batteries MUST be disconnected prior to beginning to remove the controller module. Otherwise, equipment damage and/or personnel injury may occur.

NOTE: For this procedure, refer to FIGURE 13.6 on page 126.

NOTE: There are four cables connected to the MK5-NX controller module. There are five cables connected to the MK5-NX w/ACC or MK660 w/ACC controller module. These cables must be disconnected before the controller can be removed.

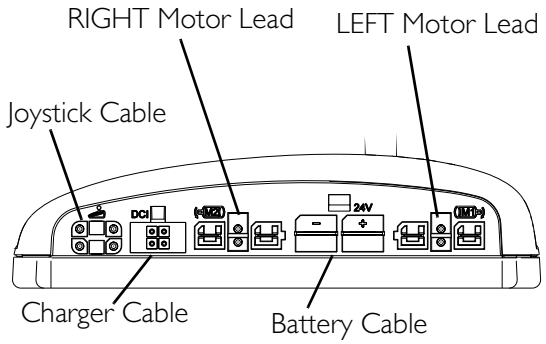
NOTE: Take note of position and orientation of the controller, cables, connectors and mounting hardware for reinstallation of controller.

1. Remove the seat. Refer to one of the following procedures:
   - Van Seats - Refer to Removing/Installing the Seat Assembly on page 50.
   - ASBA Seats - Refer to Removing/Installing the Seat Assembly on page 59.
2. Remove the top shroud. Removing/Installing the Top Shroud on page 87.
3. Remove the front battery from the wheelchair. Refer to Removing/Installing Batteries from/into Battery Tray on page 99.
4. Remove the front shroud. Refer to Removing/Installing the Front Shroud on page 89.
5. Remove the footboard. Refer to Removing/Installing the Footboard Assembly on page 78.
6. Disconnect the right and left motor leads from the controller (Detail "A" or Detail "B").

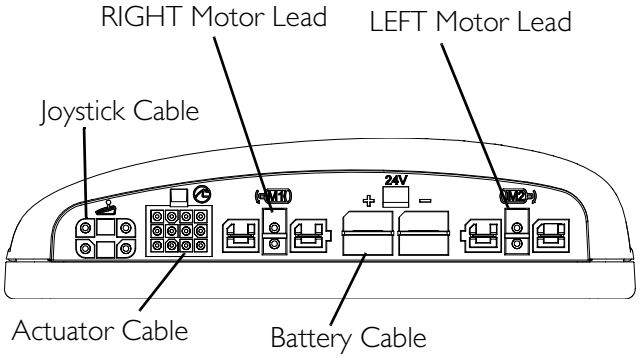
7. Perform one of the following:
   - Non-elevating seats - Disconnect the controller charger cable from the controller (Detail "A").
   - Elevating seats - Disconnect the actuator cable from the controller (Detail "B").
8. Disconnect the battery cable from the controller (Detail "A"or Detail "B")
9. Disconnect the joystick cable from the controller (Detail "A" or Detail "B").
10. From inside the wheelchair frame, remove the two mounting screws and locknuts that secure the existing controller to the wheelchair frame.
11. Remove the existing controller from wheelchair frame.
12. Reverse STEPS 1-8 to install new controller.

NOTE: Route the joystick cable (not shown) through the hole in the top shroud (not shown) when installing the new controller.

DETAIL "A" - CONTROLLER FOR NON-ELEVATING SEAT



DETAIL "B" - CONTROLLER FOR ELEVATING SEAT



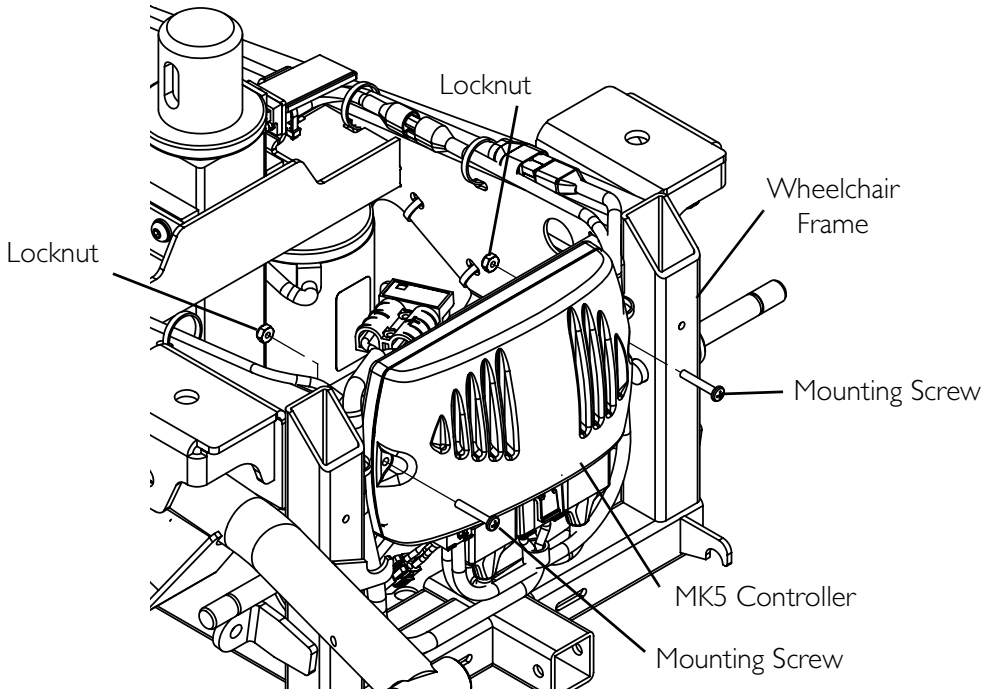


FIGURE 13.6 Replacing the Controller

Wire Routing

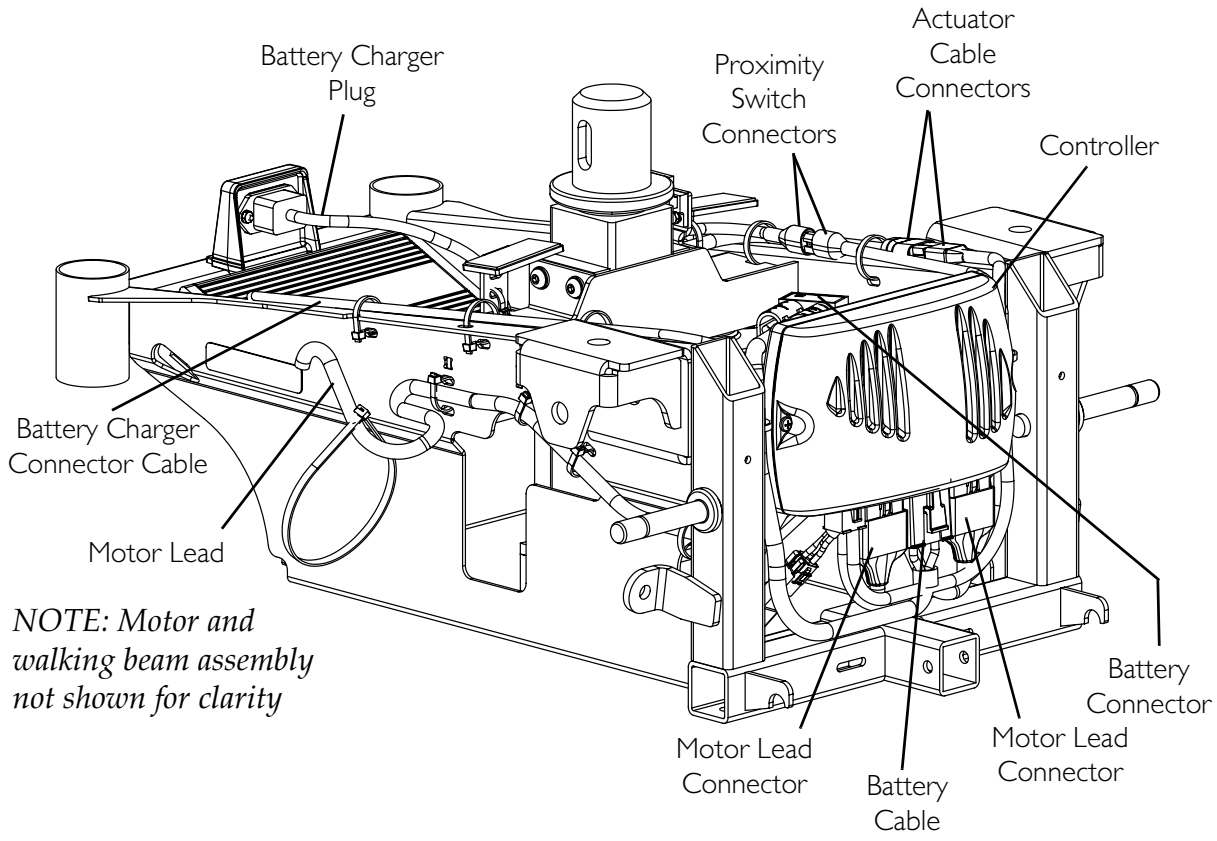


FIGURE 13.7 Wire Routing

SECTION 14—ACCESSORIES

⚠ WARNING

After any adjustments, repair or service and before use, make sure that all attaching hardware is tightened securely - otherwise injury or damage may result.

Before performing any maintenance, adjustment or service verify that On/Off switch on the joystick is in the Off position.

Installing/Removing the Crutch/Cane Holder

⚠ WARNING

The installation of the crutch/cane holder onto the back of the seat significantly increases the length of the wheelchair. When turning the wheelchair or swiveling the wheelchair seat, it is important to take note of this increased length - otherwise, injury and/or damage to the surrounding property may result.

NOTE: For this procedure, refer to FIGURE 14.1.

NOTE: The Crutch/Cane Holder and Oxygen Holder all install into the accessory tube. Only one of these may be installed at a time.

NOTE: To remove, reverse the following procedure.

Installing

1. If necessary, loosen but DO NOT remove the mounting knob.
2. Install the crutch/cane holder into the accessory tube located on the back of the seat.
3. Thread the mounting knob into the welded nut on the accessory tube. Securely tighten.
4. Align slot on base with hook on crutch/cane holder and slide base down into position.

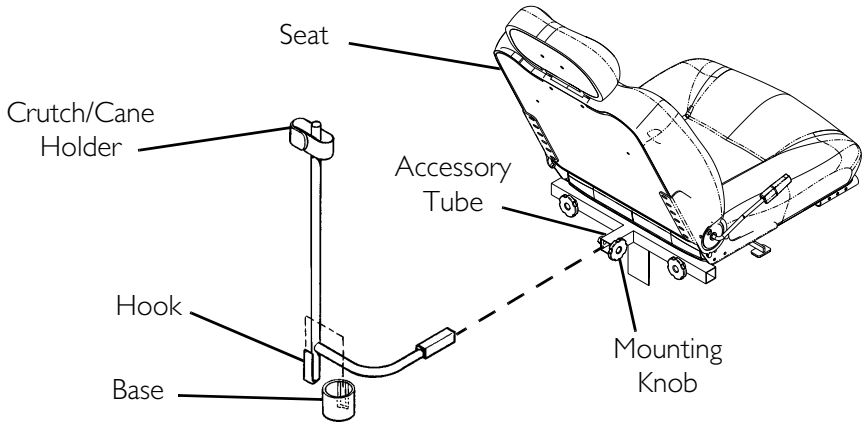


FIGURE 14.1 Installing/Removing the Crutch/Cane Holder

Installing/Removing the Oxygen Holder

⚠ WARNING

Contact your oxygen supplier for instructions in the use of oxygen. Extreme care MUST be exercised when using oxygen in close proximity to electric circuits.

The Invacare oxygen holder is designed to be used in conjunction with oxygen cylinder models MD15 and ME24 only.

To maintain safety, use only Invacare oxygen cylinder accessories (i.e. regulator, oxygen demand devices).

DO NOT use the oxygen holder for anything other than its intended purpose of supporting an oxygen cylinder - otherwise, injury or damage may occur.

DO NOT attempt to modify the oxygen holder to fit any other type of wheelchair. The oxygen holder was designed specifically for Invacare wheelchairs only.

The installation of the oxygen holder onto the back of the wheelchair seat significantly increases the length of the wheelchair. When turning the wheelchair it is important to take note of this increased length - otherwise, injury or damage may occur.

When using nasal or masked type administering equipment, oxygen or air tubing MUST be routed and secured properly to ensure that the tubing does not become entangled, kinked or severed. If necessary, loosen but DO NOT remove the mounting knob.

NOTE: For this procedure, refer to FIGURE 14.2.

NOTE: Reverse the following procedure to remove the oxygen holder.

NOTE: The O_2 holder assembly can be mounted on the RIGHT or LEFT side of the seat back. Determine the appropriate side prior to installation.

1. Remove the top and bottom mounting screws and washers securing the upper hinge to the seat. Retain screws to install the O_2 holder.
2. Align the O_2 holder mounting holes with the mounting holes in the upper hinge and seat back as shown in FIGURE 14.2.
3. Using the two mounting screws and washers removed in STEP 1, secure the O_2 holder to the upper hinge and seat back. Securely tighten.

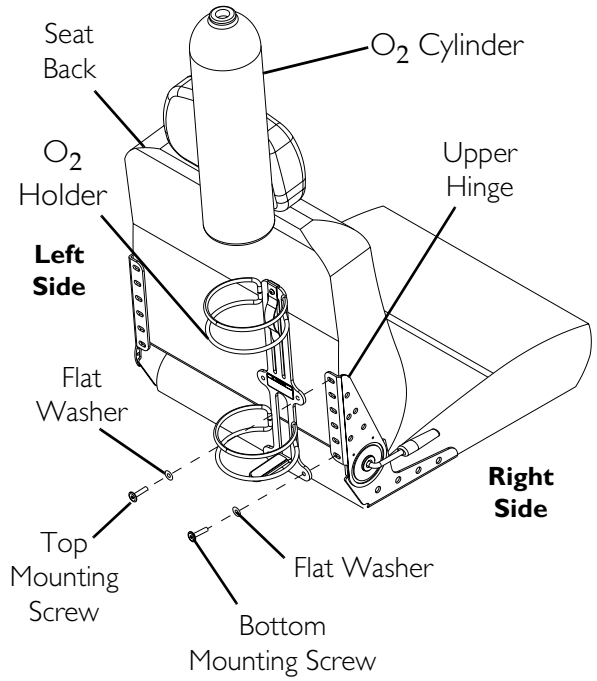


FIGURE 14.2 Installing/Removing the Oxygen Holder

Installing/Removing/Using the Walker Holder

⚠ INSTALLATION WARNINGS

After any adjustments, repair or service and before use, make sure that all attaching hardware is tightened securely.

The installation of the walker holder onto the back of the wheelchair seat increases the length of the wheelchair up to nine inches. When turning the wheelchair it is important to take note of this increased length - otherwise, injury and/or damage to surrounding property may result.

NOTE: For this procedure, refer to FIGURE 14.3.

Installing/Removing the Walker Holder

NOTE: Reverse this procedure to remove the walker holder.

1. If necessary, loosen but do not remove the mounting knob.
2. Install the walker holder into the accessory tube.
3. Thread the mounting knob into the welded nut on the accessory tube. Securely tighten.

Using the Walker Holder

1. Fold walker. Refer to instructions provided with the walker.

NOTE: Walker MUST be folded before using walker holder.

2. Hang folded walker on walker holder hooks.
3. Secure walker with hook and loop straps.

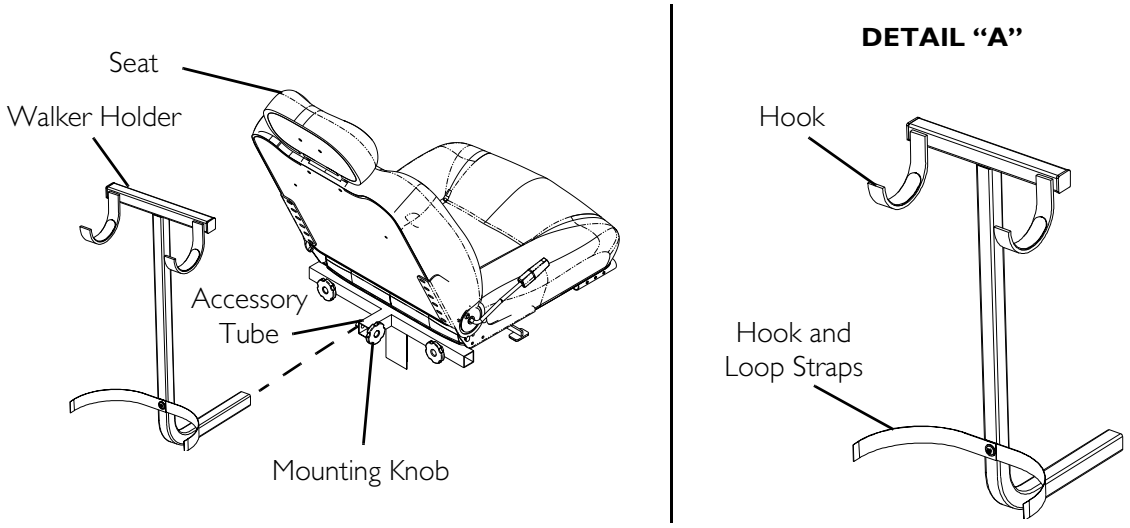


FIGURE 14.3 Installing/Removing/Using the Walker Holder

LIMITED WARRANTY

For warranty information, please refer to the original owner's manual which came with this product, or contact Invacare for more information.

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