Invacare® Typhoon
SERVICE MANUAL

This document contains information on:
Troubleshooting
Maintenance
Repair
Version: 26.11.09

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1 Introduction

1.1 General information

- All maintenance and overhaul work must be carried out in accordance with these repair instructions.
- Please observe all safety instructions.
- Information about operation or about general maintenance and care work should be taken from the electric vehicle Operating Manual.
- You can find information about ordering spare parts in the spare parts catalogue.
- Use only genuine Invacare® spare parts. Using parts from any other source will void the warranty!
- We reserve the right to make any alterations on the grounds of technical improvements.
- The electric vehicle may only be maintained and overhauled by qualified personnel.
- The minimum requirement for service technicians is relevant training, such as in the cycle or orthopaedic mechanics fields, or suitably long-term job experience.
  - Experience and knowledge of electrical measuring devices (Multimeter) is also a requirement.
  - Special Invacare training sessions are recommended.
- Alterations to the electric vehicle which occur as a result of incorrectly or improperly executed maintenance or overhaul work lead to the exclusion of all liability on the part of INVACARE.
- If you have any problems or questions please contact INVACARE SERVICE.

1.2 Notes on transport

- If the electric vehicle has to be shipped back to the manufacturer for major repairs, you should always use the original packaging for transport.
- You should also include as accurate a fault description as possible.

1.3 Important symbols in this manual

WARNING!
This symbol warns you of danger!
- *Always follow these instructions to avoid injury to the user or damage to the product!*

EXPLOSION HAZARD!
This symbol warns you of an explosion hazard, which, for example, can be caused by excessive tyre pressure in a pneumatic tyre!
- *Always follow the instructions to avoid injury to the user or damage to the product!*

BURN HAZARD!
This symbol warns you of burns due, for example, to leaking battery acid!
- *Always follow the instructions to avoid injury to the user or damage to the product!*

NOTE:
This symbol identifies general information which is intended to simplify working with your product and which refers to special functions.

Requirements:
- This symbol identifies a list of various tools, components and items which you will need in order to carry out certain work.

READ WELL BEFORE OPERATION!
This symbol advises you to read information carefully.

2 Safety and assembly instructions

These safety instructions are intended to prevent accidents during work and it is imperative that they are observed.

2.1 Before any inspection or repair work

- Read and observe this repair manual and the associated operating manual!
- Observe the minimum requirements for carrying out the work (see chapter entitled "General information")!

2.2 General safety information and notes on assembly / disassembly

Danger of injury by crushing!
- *Please note the heavy weight of some components. This applies especially to removal of drive units and batteries!*
- *Prop up the lifted electric vehicle with appropriate supports before starting the disassembly or assembly!*

Danger of fire and burns due to electrical short-circuit!
- *The electric vehicle must be switched off before removal of voltage-carrying components! To do this, disconnect the batteries!*
- *When making measurements on voltage-carrying components, avoid short-circuiting the contacts. Danger of fire and combustion!*

Danger of injury and damage to the vehicle can result from incorrect or incomplete maintenance!
- *Only ever use tools which are undamaged in good condition!*
- *Some moving parts have Teflon bushings! These parts must never be lubricated with grease!*
- *Never use standard nuts instead of self-locking nuts!*
- *Always use correctly dimensioned washers or spacers!*
- *Cable binders which have been cut off during disassembly should be replaced with new ones during reassembly!*
- *After completing maintenance work and before operating the electric vehicle, make sure all fixations are correctly secured! Check all parts for correct interlocking1*
- *Only operate the electric vehicle with correct tyre pressure (see Technical Specifications)!*
- *Check electrical components for correct functioning, incorrect polarity of cables can result in damage to the electronics!*
- *As a last check, always carry out a test-drive!*

Notes
Mark all current settings for the electric vehicle (seat, armrests, backrest etc.), and the cable connecting plugs associated, before any removals. This makes reassembly easier.
All plugs are fitted with mechanical safety devices which prevent release of the connecting plugs during operation. To release the connecting plugs the safety devices must be pressed in. When reassembling, ensure that these safety devices are correctly engaged.

WARNING: Any alteration to the drive programme can influence vehicle handling and the tipping stability of the electric vehicle!
- *Alterations to the drive programme may only be carried out by trained Invacare® dealers!*
- *Invacare® supplies all electric vehicles from the factory with a standard drive programme. Invacare® can only assume a warranty for the safe vehicle handling of the electric vehicle – in particular tipping stability - for this standard drive programme!*

3 Tightening torques

The tightening torques stated in the following table are dependent on the thread diameters for the nuts and bolts for which no special values are determined. All values apply to dry and grease-free threads.

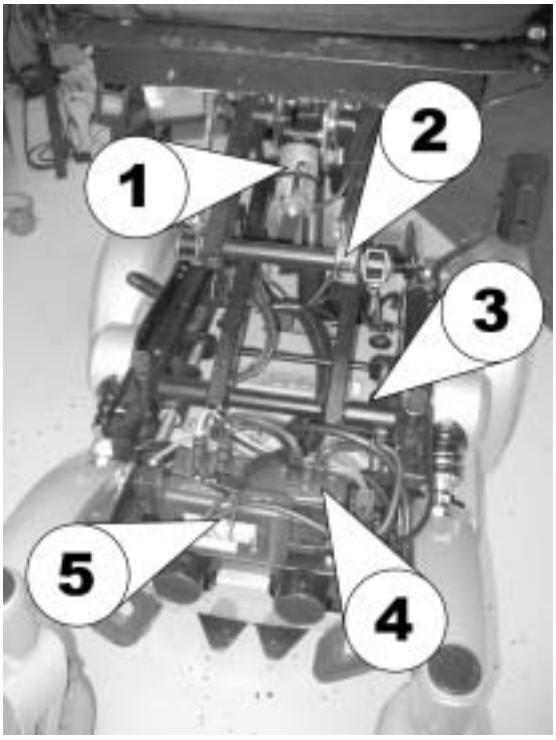
Thread	M4	M5	M6	M8	M10	M12	M14	M16
Tightening torque in Nm ±10%	3 Nm	6 Nm	10 Nm	25 Nm	49 Nm	80 Nm	120 Nm	180 Nm

Caution: All other nuts or plastic connectors not noted here must be tightened FINGERTIGHT!

4 Layout of components and modules

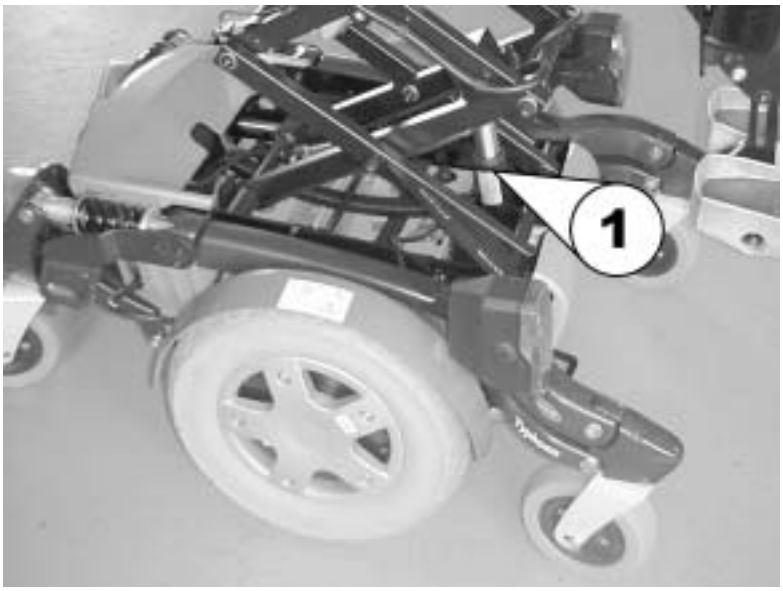
The following image shows the Typhoon from above rear, with the seat lifter raised and the rear cowling removed.

1 Seat tilt actuator
2 Seat-frame / rear cowling anti-collision switch
3 Speed-reduction switch
4 Power module
5 CLAM (Combined Light and Actuator Module)



The following image shows the Typhoon from the front right, with the lifter raised

1 Lifter actuator



5 Service plan (1x annually)

Component	Check	Action	Notes	✓
Armrests and side panels	• Armrest damage and fastening • Side panel damage and fixing	⇒ Tighten screws, replace padding if damaged ⇒ Tighten screws, replace side panels if damaged		
Seat unit / seat angle adjustment	• Cushion • Check seat angle adjustment	⇒ Replace covers / upholstery if damaged ⇒ Replace parts if damaged		
Backrest unit mechanical **Backrest unit electrical**	• Damage and seams • Fixings • Check cabling • Check function	⇒ Replace parts if damaged ⇒ Tighten screws ⇒ Replace cable or motor if necessary		
Frame (chassis) / battery box	• Check fixings, welded seams and battery box	⇒ Tighten screws, replace components		
Wheel suspension and wheels	• Check drive wheels for tight fit and side play	⇒ Adjust, replace wheel hubs	See "**Replacing a drive wheel**" on page 55	
	• Check steering wheels for tight fit, float, side play and correct torque (15 Nm +/- 1.5 Nm)	⇒ Replace wheels, wheel fork or wheel bearings	See "**Replacing the steering head bearings on** the front or rear castor wheels" on page 47	
	• Check pneumatic tyres on the drive wheels	⇒ Repair or replace if damaged	See "**Repairing a flat tyre (conventional motor)**" on page 52	
Drive units, disengager	• Check functions in drive and push modes • Check disengager	⇒ Replace motor if necessary ⇒ Tighten screws / nuts, adjust or replace if necessary		
Footrests	• Check welded seams, interlocking, screws, footplates	⇒ Tighten, replace if necessary		
Electrical footrests	• Check cabling • Check contacts • Check functions	⇒ Replace cable if necessary		
Lighting	• Check cabling • Check function	⇒ Replace bulbs or cables if necessary		
Batteries	• Check batteries for damage	⇒ Replace batteries if necessary	See "**Replacing the batteries**" on page 33	
	• Check battery charge	⇒ Charge batteries	See User Manual	

Component	Check	Action	Notes	✓
	• Check contacts and terminals for corrosion	⇒ Clean contacts and terminals	See "**Replacing the batteries**" on page 33 for Safety Information on working with batteries	
Remote / electronics	• Remote, status display blinking • Fixing • Cable, connecting plug • Joystick function • Power supply	⇒ Evaluate flash code ⇒ Tighten, replace ⇒ Replace ⇒ Replace joystick ⇒ Replace cable, connector plug or console		
Walking Beam	• Check spring for damage	⇒ Replace if damaged	See "**Replacing the Anti-Dive Spring**" on page 50	
Lifter	• Check correct function • Check function of the Stability Lock	⇒ Repair if necessary		
Driving Programme	• Check the programme version of the driving electronics. Is there a newer version available?	• Update the software.	See "Updating the " on page **44**	

6 Troubleshooting the Typhoon

6.1 Troubleshooting the Typhoon with ACS

If a problem occurs with the wheelchair, then please proceed as follows:

- Identify the possible cause of the fault by using the troubleshooting tables below.
- Check the Status Display on the remote. Identify the error code if it is flashing.
- Perform the necessary checks and repairs as recommended in the table below.

Note
For more information on troubleshooting the Typhoon with GB motors, please see the “Dynamic DX-GB-AS Power Module - Installation Manual”, Order Nr. 1441533

6.1.1 Diagnosing driving faults

PROBLEM	OTHER SYMPTOMS	POSSIBLE CAUSE	SOLUTION	REFERENCE
Wheelchair will not drive	Status display on remote lights up normally and does not show an error code	Drive motors may be disengaged	• Engage the drive motors	See User Manual
	Status display on remote does not light up	Batteries may be defective	• Replace the batteries	See "Replacing the batteries" on page 33
		Batteries may be completely discharged	• Charge the batteries	See User Manual
		Power supply to the remote may be interrupted	• Check the main fuse	See "Replacing the main fuse" on page 39
			• Check cables between modules for loose connections or damage	See "Checking the cables" on page 41
		Remote may be defective	• Exchange the remote on the wheelchair for a different one to eliminate the possibility that the remote may be the cause.	See "Replacing the ACS Remote" on page 42
	Status display on remote is flashing	Various causes	• Identify the error code	See "REM24 Error Codes and Diagnostic Codes" on page 16

PROBLEM	OTHER SYMPTOMS	POSSIBLE CAUSE	SOLUTION	REFERENCE
	Status display on remote flashes 2x, drive mode display shows "U"	Speed reduction switch on the lifter may be defective or disconnected	• Replace cable or switch	See "Adjusting and replacing the speed reduction switch" on page 46
Wheelchair does not drive smoothly	None	Batteries may be defective (voltage not stable)	• Replace the batteries	See "Replacing the batteries" on page 33
		Drive motor(s) may be defective	• Replace the drive motor(s)	See "Replacing a conventional drive motor" on page 18 and "Replacing and calibrating a GB drive motor" on page 22
Batteries cannot be charged	None	Batteries may be defective	• Replace the batteries	See "Replacing the batteries" on page 33
	LEDs on the charger are flashing	Charger may be defective	• Replace the charger	See User Manual of the charger
Wheelchair drives too slowly	Status display on remote flashes 2x, drive mode display shows "U"	Seat lifter is not in driving position (either too high or too low), and has activated the automatic speed reduction.	• Return seat lifter to driving position	See User Manual
		Speed-reduction micro-switch on the seat lifter may be badly adjusted	• Adjust the micro-switch	See "Adjusting and replacing the speed reduction switch" on page 46
	None	Remote may be defective	• Replace the remote	See "Replacing the ACS Remote" on page 42
		Batteries may be defective	• Replace the batteries	See "Replacing the batteries" on page 33

6.1.2 Diagnosing problems with electric actuators

In case an electric actuator will not function, identify the source of the problem using the following table:

PROBLEM	OTHER SYMPTOMS	POSSIBLE CAUSE	SOLUTION	REFERENCE
Electric Actuator does not function	Remote displays a flashing "E", status diode on the CLAM does not go out, even if the remote is switched off or disconnected	CLAM is defective	• Replace the CLAM	See "**Replacing components of the electronics**" on page 31
	None	Cable may be disconnected or damaged	• Check that the cable is not disconnected or damaged. If necessary, replace the cable	See "**Checking the cables**" on page 41
		Electric actuator may be defective	• Test the actuator	See "**Testing an actuator motor**" on page 45
		Remote may be defective	• Exchange the remote on the wheelchair for a different one to eliminate the possibility that the remote may be the cause.	See "**Replacing the ACS Remote**" on page 42

6.1.3 REM24 Error Codes and Diagnostic Codes

The drive electronics are capable of rectifying some errors automatically. In this case the status display will cease to flash. Please switch the remote on and off several times. Wait approx. 5 seconds each time before switching the remote on again. If this does not rectify the error, locate the error using the flash codes shown below.

Flash code:	Meaning:	Solution:	Notes
1 x flash	Module defective	• Replace defective module	See "**Replacing components of** the electronics" on page **31**
2 x flashes	Accessory error (e.g. actuator short-circuit)	• Check accessory connections, check accessories	See "**Testing an actuator motor**" on page **45**
	Lifter raised or lowered too far (seat not at driving height)	• If lifter is raised, lower in stages until the status display stops flashing. If lowered too far, raise lifter in stages until the status display stops flashing. If at all possible, only drive when the seat is at driving height.	See User Manual
3 x flashes	Connection on the left motor loose/defective	• Check plug-in connections.	See "**Checking the cables**" on page **41**
	Left motor defective.	• Check/replace motor	See "**Replacing and calibrating a GB** drive motor" on page **22**
4 x flashes	Connection on the right motor loose/defective	• Check plug-in connections.	See "**Checking the cables**" on page **41**
	Right motor defective.	• Check/replace motor	See "**Replacing and calibrating a GB** drive motor" on page **22**
5 x flashes	Fault/brake fault on left-hand motor. Connection loose/defective or motor defective.	• Check plug-in connections.	See "**Checking the cables**" on page **41**
	Left motor disengaged (GB-motors)	• Engage motor. Shut electronics down and then switch on again.	See User Manual
	Both motors disengaged (standard motors)	• Engage motors. Shut electronics down and then switch on again.	See User Manual
6 x flashes	Fault/brake fault on right-hand motor. Connection loose/defective or motor defective.	• Check plug-in connections.	See "**Checking the cables**" on page **41**
	Right motor disengaged (GB-motors)	• Engage motor. Shut electronics down and then switch on again.	See User Manual
7 x flashes	Battery dead	• Pre-charge battery	See User Manual

Flash code:	Meaning:	Solution:	Notes
8 x flashes	Battery voltage too high	• Switch lights on to lower battery voltage • Check battery charger	See User Manual of battery charger
9 or 10 x flashes	Faulty data transmission between modules	• -	Remove all electronic modules except the Power Module and the Remote. Re-attach modules one by one to determine which one is causing the fault. See "**Replacing components of** the electronics" on page **31**
11 x flashes	Motors overloaded / overheated	• Switch remote on and off / wait if necessary	-
12 x flashes	Module used has compatibility problems	• Remove incorrect module	See "**Replacing components of** the electronics" on page **31**

7 Repair Work

CAUTION: Risk of damage to the vehicle! Collisions can be caused if shim rings are removed from the drive wheels during installation work!

- *Shim rings are frequently placed between the drive shaft and the wheel hub to compensate tolerances. Collisions can be caused if these shim rings are removed and not re-installed! Please install all shim rings in exactly the same positions they were in before dismantling.*

7.1 Replacing a conventional drive motor

Find out here how to replace the conventional Typhoon drive units.

CAUTION! Danger of tipping over and crushing!

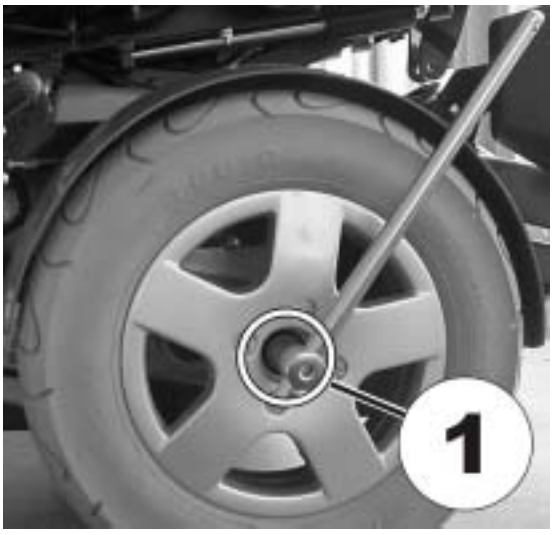
- *Secure the vehicle with wedges and a jack-up device to prevent it rolling and tilting, as it tends to do this following removal of a drive wheel.*

Pre-requisites:

- Small screwdriver
- 17 and 19mm ring wrenches
- 8mm and 13mm open-jawed wrenches
- 5mm and 10mm hexagon sockets
- Diagonal-nosed cutting pliers
- Hammer
- Material for jacking up the vehicle
- End cap for the Bowden cable
- Self-securing M12 nut

Please note
Please pay attention to the plain washers during dismantling. Put small parts aside in such a way that they can be re-fitted in the correct order

- Jack up the vehicle, for instance by placing a block of wood under the chassis
- Loosen the wheel cap carefully using a small screwdriver.
- Use a 19mm ring wrench to loosen the wheel nut (1).
- Pull the complete wheel from the wheel hub.

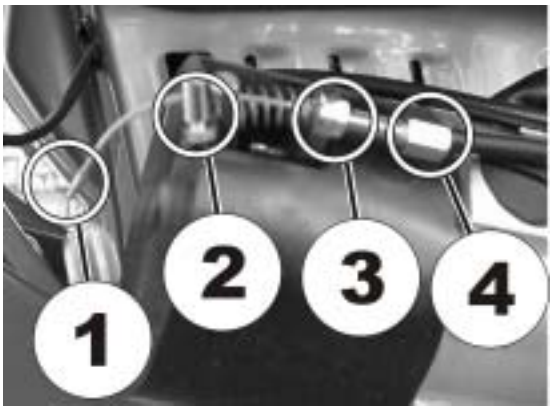


CAUTION! Danger of injury!

- *The open end of the Bowden cable can injure your hands. After this work step you can, for example, protect the end by lagging it with insulating tape.*

Please note
It is easy to lose the small uncoupling parts. It is wise to keep these in a safe place until they are required for reassembly.

- Cut off the end cap on the Bowden cable (1) using diagonal-nosed cutting pliers. In doing so, please leave the Bowden cable as long as possible.
- Loosen the check screw (2).
- Loosen the counternut (3).
- Remove the tapped bush (4).
- Pull the entire Bowden cable through both lugs on the drive unit.

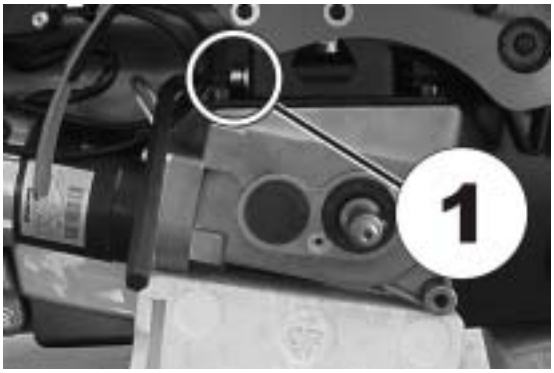


- Press in the retaining clips (1) and in doing so pull the electronic panelling upward and to the rear applying slight pressure to the handle (2).

- Pull the motor connector (1) out of the electronics (2).
- The motor connector for the left-hand drive unit is to be found in the electronics on the far left side.
-

Please note
A great number of turns are required in order to unscrew the bolt.

- Secure the drive unit against falling out by placing a wooden block or styrofoam block underneath.
- Unscrew the bolt (1) in the drive unit suspension using a 10 mm hexagon socket.

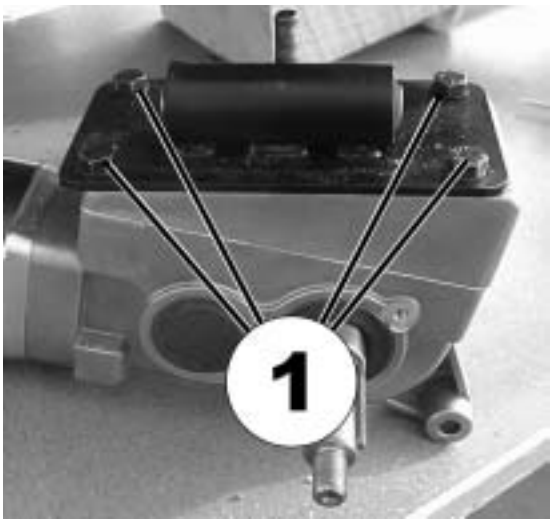


Please note
Make a note of the number of turns needed to loosen the nut. This number of turns determines the wheel camber. Incorrect wheel camber leads to one-sided wheel wear and can reduce driving power.

- Insert a 17mm box wrench from the top through the opening in the chassis (1).
- Loosen the nut.
- Remove the entire drive unit from the suspension in a downward direction.

- Remove the guiding lug for Bowden cables (1) using a 5mm hexagon socket.
-

- Unscrew the four screws (1) on the bedding plate using a 13mm open-jawed or ring wrench.



CAUTION! Fire hazard! Cables can be pinched and chafed.
- *Please ensure correct cable layout! The motor cable must be secured on the panelling by means of a plastic ring and may not protrude into the lifter area*

CAUTION! Risk of accident.
- *Use a new self-securing wheel nut and tighten it applying 60 Nm.*

Please note
Only tighten the suspension nut using the noted number of turns. This sets the wheel camber. Incorrect wheel camber leads to one-sided wheel wear and can reduce driving power.

- The drive unit is installed in the reverse order.

7.2 Replacing and calibrating a GB drive motor

The next two sections describe how to replace a GB motor, and then calibrate the new one. We recommend reading through the instructions once before beginning work.

NOTE – First check whether the vehicle is equipped with puncture-proof tyres or pneumatic tyres!
Depending on whether the vehicle is equipped with puncture-proof tyres or pneumatic tyres, the process of disassembly and re-assembly will be different! You can recognise puncture-proof tyres by the fact that they do not have a valve!

7.2.1 Replacing the motor

CAUTION! Danger of the wheelchair tipping over or rolling away!
- *Secure the wheelchair from tipping over by propping it up with a wooden block under the battery box that is long and wide enough! Using a wooden block that is too short or too high could cause the wheelchair to tip over!*
- *Switch the wheelchair off at the remote!*

EXPLOSION HAZARD!
On a vehicle with pneumatic tyres, the wheel will explode if you do not let the air out of the tyre before removing the wheel!
- *Always let the air out of the tyre before removing it (press in the pin in the middle of the valve)!*

Injury hazard! The wheelchair will drive erratically if the GB Motors are not calibrated after being replaced!
- *Make sure to calibrate the GB Motors after replacing them!*

Injury hazard! If the bolts that hold the wheel have been insufficiently tightened, or if the threaded holes in the rim have been damaged during assembly by excessive tightening, then the wheel can loosen when driving!
- *When reassembling the drive wheels, position the screws in their holes by hand!*
- *Do not use electrical or pneumatic screwdrivers!*
- *Tighten the Allen screws at a torque of 25 Nm!*
- *Make sure the Nordlock washers are replaced exactly the way they were removed!*

NOTE CONCERNING WARRANTY ON GB-MOTORS:
If within such warranty period motors are proven to be defective, the motors will be repaired or replaced at Invacare's absolute discretion. This warranty does not include labour or shipping charges. Neither does the warranty apply to physical damage nor unauthorised repairs.
Invacare's sole obligation and your exclusive remedy under this warranty is limited to such repair and/or replacement.

Requirements:

- Wooden block to prop up the vehicle
- Allen key 6mm
- Allen key 4mm
- Small flat-bladed screwdriver
- Circlip pliers
- Loctite 243
- 2x combination wrench 13mm
- Hammer
- Chisel
- Torque wrench
- One new hexagonal dome headed bolt, M8, 20mm long, 5mm key size

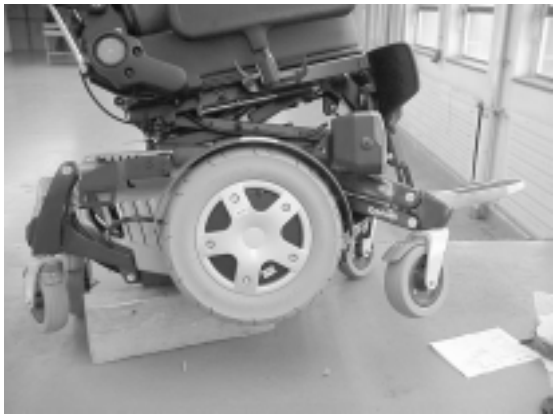
Additional parts and tools for working on puncture-proof tyres

- Tyre lubrication (soap-based)
- 3 screws M8 x 30 mm (for preliminary positioning of the rim during assembly)

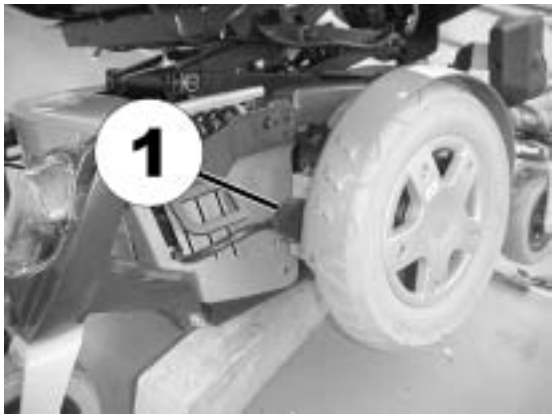
Note

Pay attention to small pieces, and the order in which the components are disassembled. Arrange them in an orderly fashion so they can easily be assembled again in the right order.

- Prop up the wheelchair by lifting it up on the side that you want to work on and then placing the wooden block underneath the battery box on that side.



- Use the small flat-bladed screwdriver to loosen the screws that hold the motor cable connection and disconnect the cable.



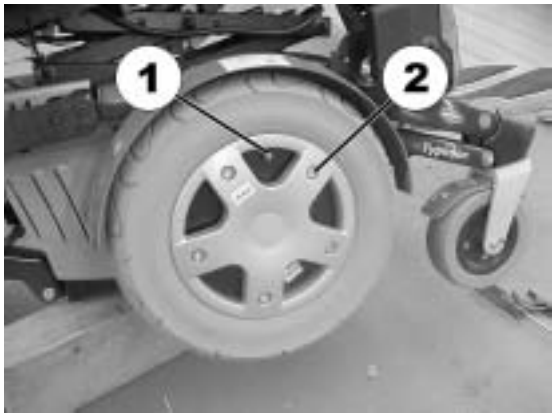
7.2.1.1 Disassembling the tyre and rim on a vehicle with pneumatic tyres

EXPLOSION HAZARD!

On a vehicle with pneumatic tyres, the wheel will explode if you do not let the air out of the tyre before removing the wheel!

- *Always let the air out of the tyre before removing it (press in the pin in the middle of the valve)!*

- Unscrew valve cap.
- Depressurise tyre by pressing in the pin in the valve (1).
- Unscrew 5 screws (2) using the 6mm Allen key.
- Remove the wheel rim half with the inner tube.

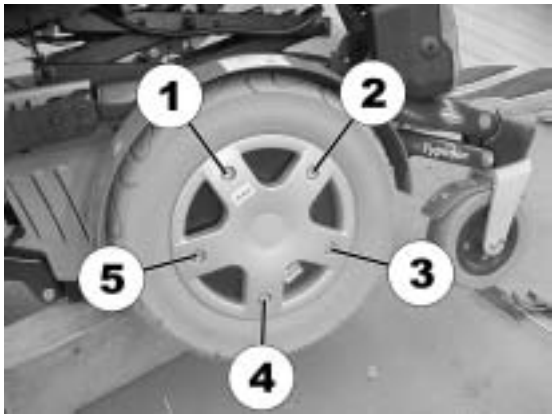


7.2.1.2 Disassembling the rim and the tyre on a vehicle with puncture-proof tyres

WARNING! Danger of damage to the motor if the screws are not loosened and removed in the correct sequence!

- *Make sure you loosen and remove the screws in the correct sequence!*

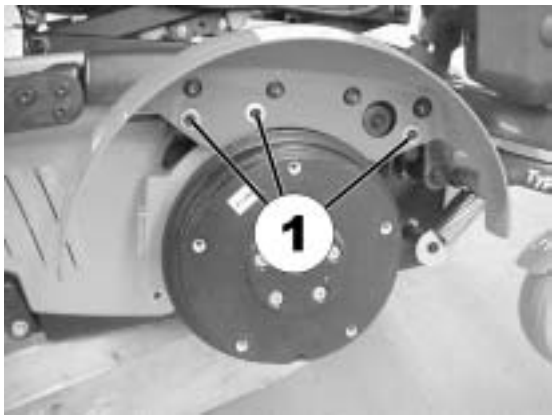
Screws 1 to 5 must be loosened and removed in a particular sequence in relation to each other. There is no pre-defined numbering for the screws. There is, for example, no screw with the pre-defined number "1". For this reason, you can start with any screw. This will then be "number 1". "Number 2" is then the screw next to it in a clockwise direction, "3" is the next and so on.



- Loosen and remove screws 1 and 3, using the 6mm Allen key.
- Loosen screws 2, 4 and 5 a single turn each, one after the other, going from screw to screw in a clockwise direction, until they have all been completely loosened and removed..
- Remove the rim-half and the puncture-proof inlay from the wheel.

7.2.1.3 Proceed with removing the motor

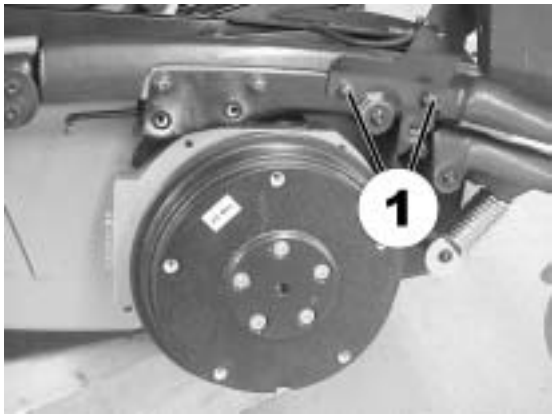
- Remove the three screws that hold the fender, using the 4mm Allen key.



You will need to remove the entire upper half of the walking beam to replace the motor. To do this, you need to remove one of the pins (1) that hold the walking beam. The pins are secured with snap-rings from the inside.

- Use the circlip pliers or, alternatively, the small screwdriver to open and remove the snap-ring that secures the pin.

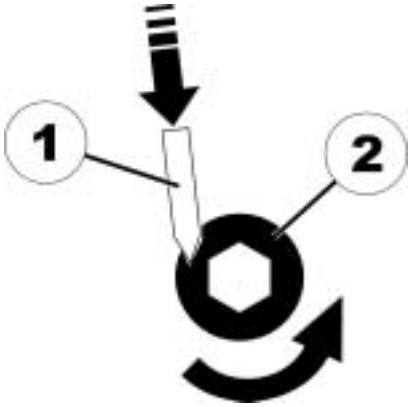
- Use the two combination wrenches to loosen the bolts that hold the mounting plate for the headlight (1).
- Remove the headlight with the mounting plate and tuck it up under the seat to get it out of the way.



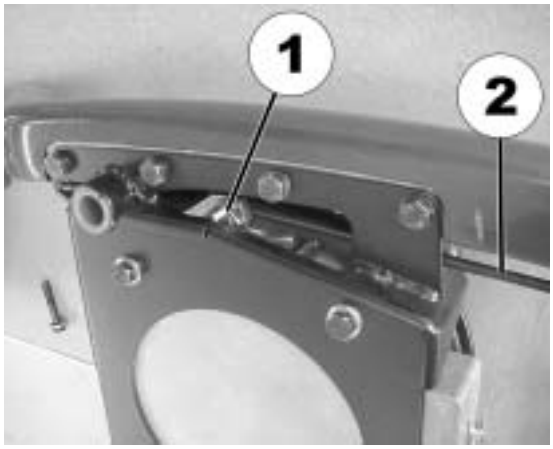
The bolt that holds the upper arm of the walking beam at it's pivotal point (1) is secured with Loctite, so you will not be able to remove it simply by inserting an Allen key and turning. It will need some subtle persuasion with a hammer and chisel.

- Use the hammer and chisel to get the bolt started turning. After it has turned one or two revolutions, then it can be removed the rest of the way using the 5mm Allen key.

- The illustration at the right shows how to position the chisel (1) on the head of the screw (2) to get it started turning.



- Use the small screwdriver to carefully remove the clip that holds the emergency declutching latch (2) in place.



- Remove the bolts that hold the motor on the mounting plate, using the combination wrench 13mm.

- The drive unit is re-assembled in the reverse order.
- The original bolt that held the walking beam at the pivot point will probably be severely damaged, so use a new one. Use some Loctite 243 on the new bolt.
- Tighten the wheel screws to 25 Nm.

7.2.1.4 Reassembling the rim and the tyre on a vehicle with pneumatic tyres

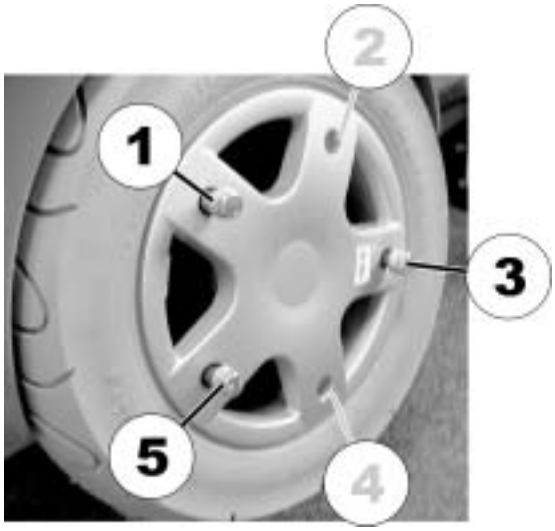
- Re-position the inner-tube in the tyre.
- Re-fit the rim-half.
- Position the screws and tighten them a little.
- Fill the inner-tube with a little air.
- Tighten the screws that hold the rim.
- Check to make sure the tyre is fitted snugly to the rim.
- Pump up the tyre to 3 Bar air pressure.
- Check again to make sure the tyre fits rim correctly.
- Screw on the valve cap.

7.2.1.5 Reassembling the rim and the tyre on a vehicle with puncture-proof tyres

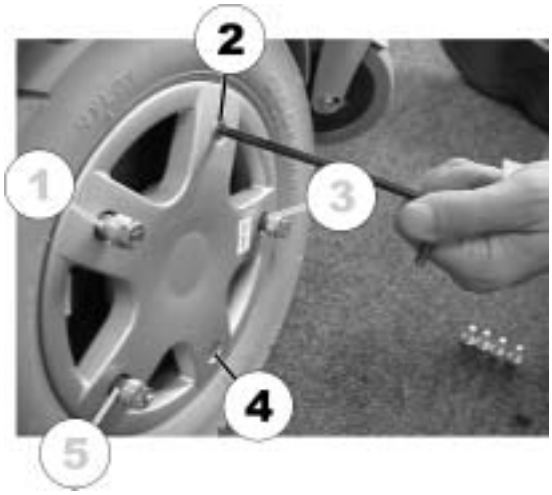
- To reassemble a tyre with a puncture-proof core, you will need to coat the inner and outer edges of the tyre (1 and 3) and the inner surface of the puncture-proof inlay (2) with tyre lubrication.

- Push the tyre with the puncture-proof inlay onto the motor (rotor casing)

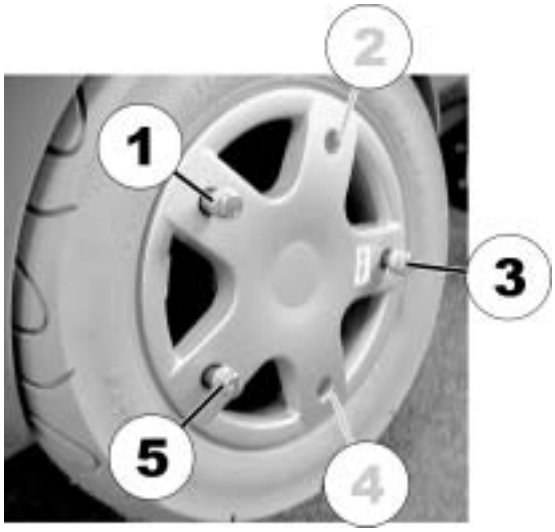
- Position the rim-half in the tyre. The holes for the screws in the rim-half and the ones in the rotor casing need to be aligned with each other. It can be helpful to align the notch in the rim-half and the one in the rotor casing where the valve would usually be, using them as a positioning guide.
- Insert the three M8 x 30mm screws at positions 1, 3 and 5 and tighten them by hand.
- Tighten screws 1, 3 and 5 **one turn,** one after the other, going from screw to screw in a clockwise direction, until 8 Nm are attained. (if necessary, check this value with a torque wrench). **This is necessary to pull the rim up flush with the rotor casing in a straight manner, not crooked.**



- Position two of the original M8 x 25 screws mm at positions 2 and 4 and tighten them by hand (max. 8 Nm).



- Remove the temporary M8 x 30 mm screw at **Position 5**: Re-position the original M8 x 25 mm screw and tighten by hand (max. 8 Nm).
- Remove the temporary M8 x 30 mm screw at **Position 1**: Re-position the original M8 x 25 mm screw and tighten by hand (max. 8 Nm).
- Remove the temporary M8 x 30 mm screw at **Position 3**: Re-position the original M8 x 25 mm screw and tighten by hand (max. 8 Nm).
- Tighten all screws to 25 Nm.



7.2.2 Calibrating GB motors

The following sections explain the calibration process with the handheld programming device.

Injury hazard! The wheelchair starts to move in an uncontrolled manner if one or both of the drive wheels is touching the ground during calibration!

- *It is absolutely imperative to get BOTH drive wheels off the ground before calibrating, not just on one side!*

Requirements:

- Dynamic DX HHP" handheld programming device

- Prop up the wheelchair with wooden blocks. The drive wheels must not be touching the floor or the work surface.
- Connect the programming device. Programming device displays:

The programming device shows the following:	You should enter this:
DX HHp V1.20 Select a language... GB D NL S	"GB"
View or edit System? YES ? DIAG TECH	"TECH"
Technician mode Enter Password 000 EXIT D1 D2 D3	Enter code "592" with keys D1 to D3, then select "EXIT".
Technician mode Master JS Module JOYSTICK CALIBRATION EXIT YES NEXT	"NEXT"
** MAIN MENU ** View or edit GB Power Module ? NEXT YES	"YES"
GB Controller Torque XX % EXIT NEXT DOWN UP	"NEXT"
GB Controller Tremor Damping XX % EXIT NEXT DOWN UP	"NEXT"
GB Controller Speed Progression XX % EXIT NEXT DOWN UP	"NEXT"
GB Controller Turn Progression XX % EXIT NEXT DOWN UP	"NEXT"
GB Controller Calibrate Motors? EXIT NEXT YES	"YES"

The programming device shows the following:	You should enter this:
GB MOTOR CALIBRATION Wheels will move! Drive wheels raised? EXIT YES	"YES" (if drive wheels have been raised)
GB MOTOR CALIBRATION Chair will drive! Are wheels raised? EXIT YES	"YES" (if drive wheels have been raised)
GB MOTOR CALIBRATION -BEGIN- to start. Wheels will drive! EXIT BEGIN	"BEGIN" (if drive wheels have been raised)
GB MOTOR CALIBRATION in progress Please wait.	No entry required. Wait till end of calibration.
GB MOTOR CALIBRATION Successful! EXIT	"EXIT"

- Separate the programming device from the wheelchair. Calibration is complete.

7.3 Replacing components of the electronics

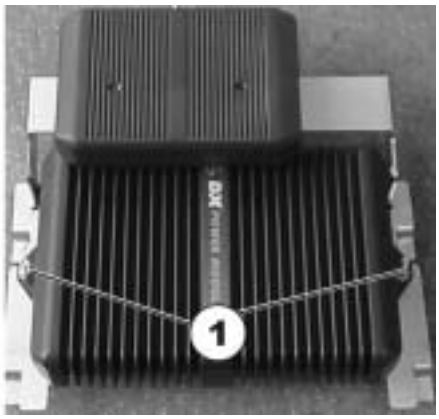
Find out here how to replace the Typhoon electronic components.

Pre-requisites:
- Large and small crosstip screwdrivers
- 8 mm open-jawed or ring wrench

- Press in the retaining clips (1) and in doing so pull the electronic panelling upward and to the rear applying slight pressure to the handle (2).

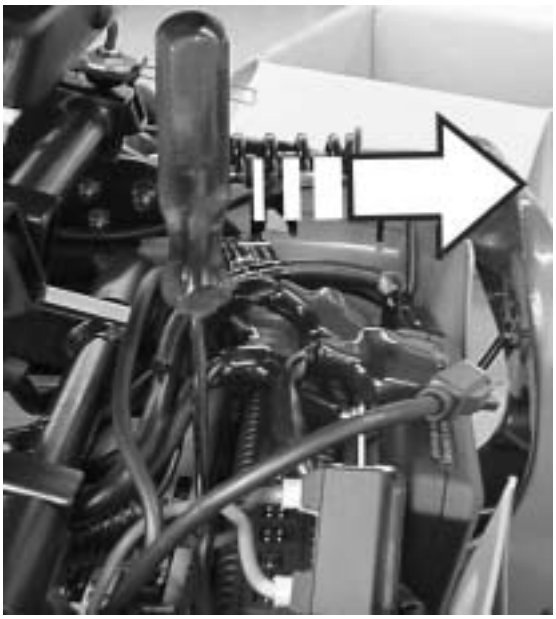
- Remove all connectors from the module to be replaced.
-

- In order to remove the power module loosen both nuts (1) using an 8mm open-jawed or ring wrench.



- Press in the retaining clip (1) using a small crosstip screwdriver and slide the Clam from the electronic carrier in the direction of the arrow.

- The drive unit is installed in reverse order.
- To allow the electronic carrier to lock into place correctly, increase the distance between the chassis and the battery using a large crosstip screwdriver.



7.4 Replacing the batteries

Find out here how to replace the Typhoon batteries.

CAUTION! Risk of chemical burns!
- *Please look out for damaged batteries or ensure that you do not damage the batteries. Leaking acid can cause chemical burns to the skin and eyes.*
- *If acid should come into contact with the skin, rinse immediately using plenty of fresh water.*
- *If acid should get into the eyes, rinse immediately using plenty of fresh water and consult a physician.*

CAUTION! Danger of crushing!
- *Secure the lifter against unintentional folding by using the mechanism intended for this purpose. The great weight of the lifter can cause serious injuries if it drops down.*
- *Check whether the battery belts are damaged and lift the batteries carefully.*

CAUTION: Risk of fire and burns if battery poles are short-circuited!
- *When replacing the batteries the battery poles MUST NOT come into contact with metal parts of the wheelchair causing bridging!*
- *Be sure to replace the battery pole caps after the batteries have been replaced!*

CAUTION! Environmental contamination!
- *Used batteries should not be disposed of with domestic waste and outdoors. Please dispose of the batteries professionally by giving them to your local harmful substance point of acceptance.*

Pre-requisites:
- 11mm open-jawed wrench
- 5mm and 6mm hexagon sockets
- Diagonal-nosed cutting pliers
- Water-resistant marker
- Cable binder
- Replacement battery (ies)
- Optional new battery belts

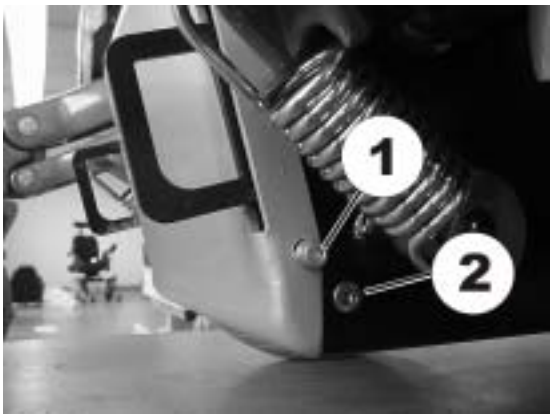
Please note
It is easier to carry out a few work steps with the assistance of another person, in particular when lifting the lifter and unlocking the retaining mechanism.

- Move the lifter to the uppermost position.
- Raise the lifter further by pulling the piston rod of the actuator towards the front (to unfasten the piston rod head from its socket) and simultaneously pulling the seat upwards, so that the retaining mechanism (1) locks into place.
- Check whether the retaining mechanism (1) is fully locked into place.
- Move the regulating motor to the lowest position. The regulating motor slides out of the upper guiding device.

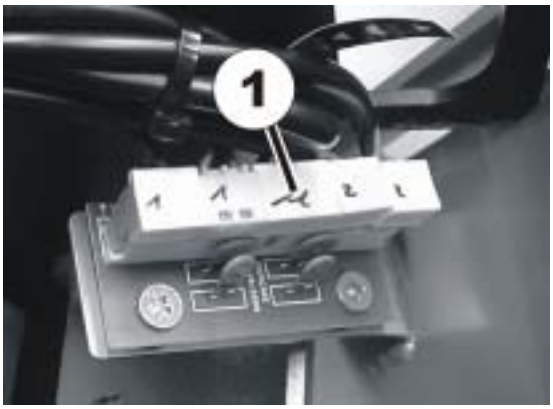
CAUTION! Cables can pull off!

- *Remove the front panelling carefully on vehicles with a lighting system, as the light circuit board is attached to it. Hold on to the panelling until you have marked and released all connectors.*

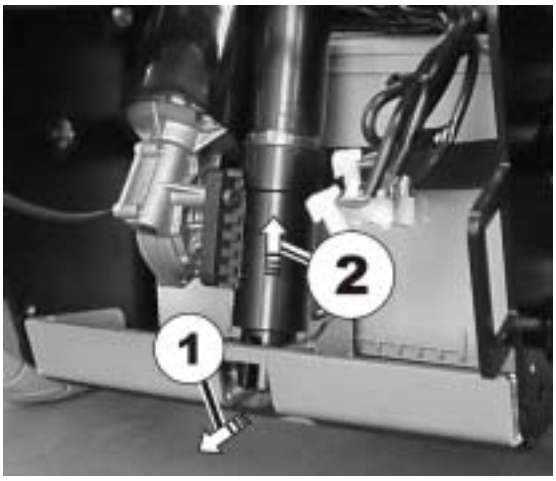
- Unscrew the screws (1) and (2) on both sides of the vehicle using a 5 or 6mm hexagon socket.
- Remove the front panelling to the front and hold with one hand or lay aside carefully.



- Mark the connectors on the light circuit board using a water-resistant marker so that they can be re-fitted in the right position.
- Remove the five connectors.
- Lay the front panelling aside.



- Open the plug-in connection on the regulating motor cable.
- Pull the nest together with the regulating motor slightly to the front (1) and then lift (2). Now remove the regulating motor and the nest completely.



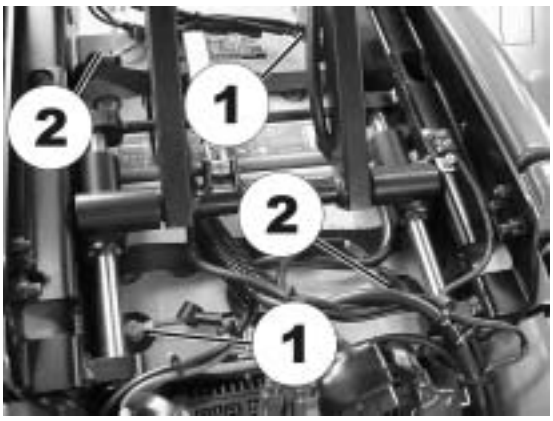
- Press in the retaining clips (1) and in doing so pull the electronic panelling upward and to the rear applying slight pressure to the handle (2).

CAUTION! Electronics can be damaged!
- *Disconnect all electronic components from the batteries before commencing work on the batteries.*

- Disconnect all plugs from the electronic components.

CAUTION! Fire hazard! Cables can be pinched and chafed.
- *Please pay attention to the cable routing during dismantling so that the cables can be re-fitted in this position. The cable binders may only then be opened.*

- Remove all pole caps from the poles.
- Unscrew the screws (1) on the minus poles using an 11mm open-jawed wrench.
- Unscrew the screws (2) on the plus poles using an 11mm open-jawed wrench.



CAUTION! Danger of crushing!
- *The batteries are very heavy. Please ensure that they do not hit the ground when being removed from the chassis.*

- Pull the battieres out to the front using the carrying belt
- Remove the battery inserter and carrying belt from the battery.

CAUTION! Fire hazard! Cables can be pinched and chafed.
- *Please ensure correct cable layout! They may not protrude into the lifter area. Use cable binders if necessary.*

When installing new batteries, make sure there are no cables between the front batteries and the actuator of the lifter! They could get damaged when the lifter is operated!

WRONG!

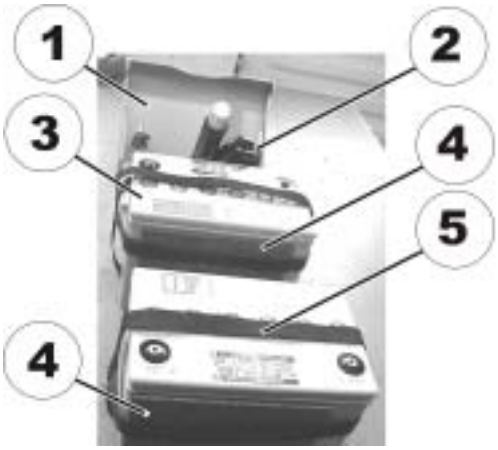
RIGHT!

- Installation is carried out in the reverse order.

Please note
The battery inserters can be inserted between the battery and the carrying belt. They are thus easier to install.

Please note
The battery poles on the rear battery must point backward and those on the front battery to the front. The batteries cannot be connected in any other fitting direction

- Assemble in accordance with this installation sequence:
- Push the batteries (3) together with the carrying belt (5) and battery inserter (4) into the chassis.
- Push the regulating motor (2) together with the nest into the chassis and allow to lock into place in the bottom plate. Secure using lateral Allen screws.
- Insert the connectors on the light circuit board in the correct order. Apply the front panelling (1) and secure using lateral Allen screws.

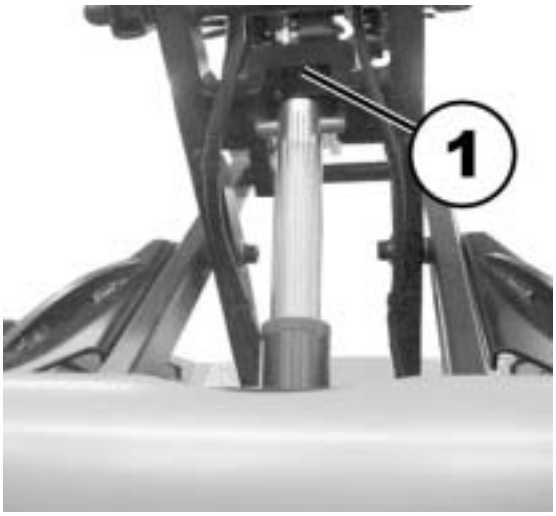


Please note
The pole caps jam to a certain extent. This is intentional so that water cannot reach the poles, thus causing a short circuit.

- Screw the battery cable onto the plus and minus pole. Slide the pole caps over the poles
- Plug all cables into the electronic components.
- Check that all connectors are fitted firmly.
- Check the cable routing. No cable should be able to protrude into the lifter area.

CAUTION! Danger of crushing!
- *Please ensure that the regulating motor slides into the upper guiding device.*

- Move the regulating motor to the uppermost position and ensure that it slides into the upper guiding device (1).



- Raise the lifter slightly and unlock the retaining mechanism (1). The entire lifter load is now on the regulating motor again.

- Test all vehicle functions.
- Check the charge status of the new batteries and charge fully if necessary.

7.5 Replacing the main fuse

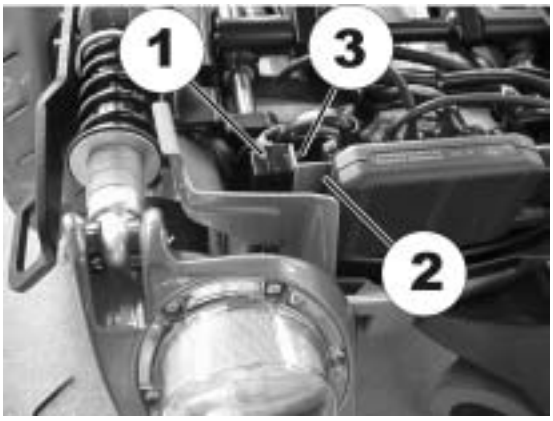
CAUTION! Fire hazard!
- *Only ever use an original strip fuse and permissible strength of current.*
- *In the event that the main fuse has burnt out, remedy the cause before fitting a new fuse.*

Pre-requisites:
- 8mm ring or open-jawed wrench
- Replacement fuse
- Small flat screwdriver

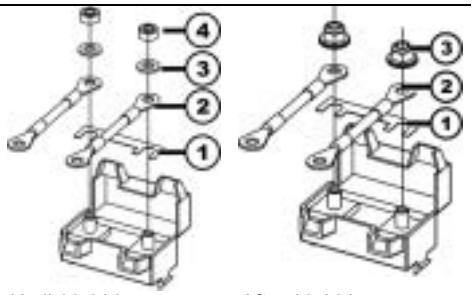
Please note
In case the fuse holder is damaged, this can be replaced completely together with the battery cables.

- Press in the retaining clips (1) and in doing so pull the electronic panelling upward and to the rear applying slight pressure to the handle (2).

- Remove the fuse holder (1) from the electronics holder (2). For this purpose, press in the plastic clips (3) lightly using a small flat screwdriver.



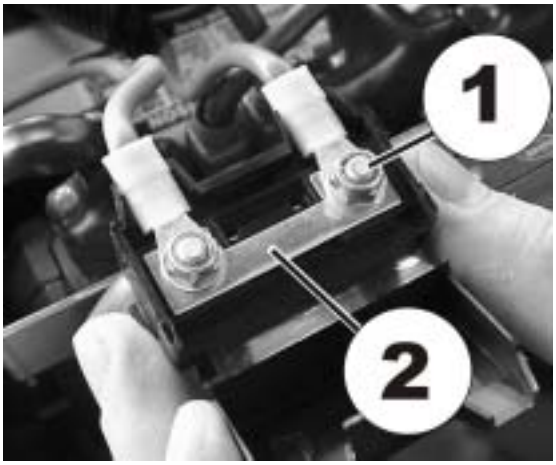
WARNING: Danger of fire exists if the fuse is incorrectly assembled!
- *Only ever assemble the fuse in the order shown in the illustration at right!*
- *Always tighten nuts to between 3.3 and 3.5 Nm!*



Until 03.2004
1. Fuse
2. Fuse compartment
3. Washer
4. Nut M5

After 03.2004
1. Fuse
2. Fuse compartment
3. Nut DIN 6923

- Open the cover on the fuse holder.
- If the strip fuse (2) has burnt out, look for the cause and remedy. The main fuse may only be replaced when the fault has been remedied.
- Use an 8mm open-jawed or ring wrench to unscrew the nuts (1) on the strip fuse (2).
- Insert a new strip fuse (2) and secure using both nuts (1). Close the cover on the fuse holder.



- Lock the fuse holder into place in the electronics holder until you hear a click.
- Close the electronic panelling.
- Check all vehicle functions.

7.6 Checking the cables

Find out here how you can check the plug connections on the Typhoon electronics.

Pre-requisites:
- None

- Move the lifter to the uppermost position.
- Press in the retaining clips (1) and in doing so pull the electronic panelling upward and to the rear applying slight pressure to the handle (2).

- Check all cables for signs of damage and crushing.
- Pull each connector lightly. It may not come away from the bush.
- If a connector is loose, use slight pressure to press the connector into the bush. It must lock into place.
- Check whether the connector is fitted firmly. If not, please repeat the work step.

- Press in the retaining clips (1) and in doing so close the electronic panelling applying slight pressure from the top.

- Check all vehicle functions.

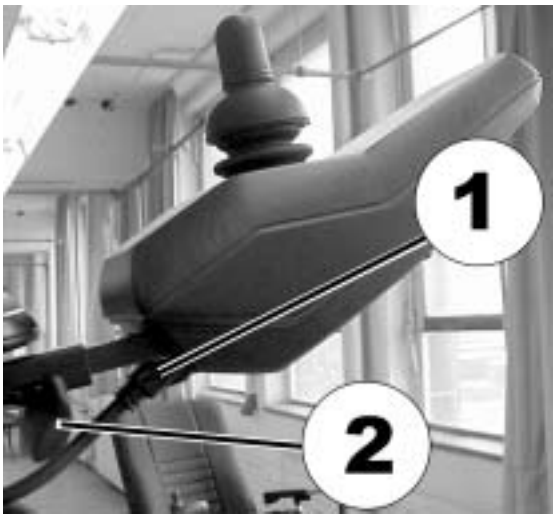
7.7 Replacing the ACS Remote

Pre-requisites:
- Phillips screwdriver
- To modify a drive programme you will need: Programming software or a Handheld Programmer and the Installation Manual of the ACS Electronics, available from Invacare®.

NOTE
All ACS remotes are supplied with a standard drive programme. If the driving programme has been customised, then you will have to perform this customisation again, after installing the new electronic module.

WARNING: Every alteration to the drive programme can influence vehicle handling and the tipping stability of the wheelchair!
- *Alterations to the drive programme must only be carried out by trained Invacare®-dealers!*
- *Invacare® can only assume a warranty for the safe vehicle handling of the wheelchair – in particular tipping stability - for unaltered standard drive programmes!*

- Switch off the remote.
- Pull the bus cable (1) out of the remote.
- Loosen the thumb screw (2).
- Pull the remote and the remote holder out of the guiding device.



- Unscrew both remote holder screws (1) using the crosstip screwdriver.

- Installation of the remote is carried out in reverse order.
- Update the software, in case a newer version is available.
- Customise the driving programme with the programming software, if required.
- Check all vehicle functions.

7.8 Updating the driving program

The driving programs for electric wheelchairs are continually updated and improved by Invacare®. For this reason, you should check whether the version number is still up to date each time a wheelchair comes in for repairs, and also during regular inspections.

If a newer version is available, the driving program must be updated. The procedure for updating the driving program is described in the user manual of the Wizard software.

NOTE
The electronic system is supplied with a standard drive program. If the driving program has been customised, you have to perform this customisation again, after installing the new driving program.

WARNING: Every alteration to the drive program can influence vehicle handling and the tipping stability of the wheelchair!

- *Alterations to the drive program must only be carried out by trained Invacare®-dealers!*
- *Invacare® can only assume a warranty for the safe vehicle handling of the wheelchair – in particular tipping stability - for unaltered standard drive programs!*

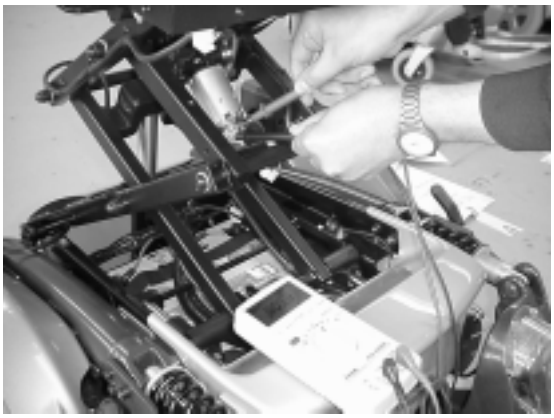
Pre-requisites:

- Dynamic® Wizard software
- User manual for the Wizard software
- For further information on other requirements - such as the minimum system configuration of the PC to be used for programming, necessary programming cables - see the user manual of the Wizard software. You find the latest version of the user manual in the download area on http://www.dynamiccontrols.com/.

7.9 Testing an actuator motor

Requirements:
- Multimeter

- Check the electrical resistance of the actuator. If it is close to infinite, then the motor is likely to be burnt out. If it is less than 1Ω, then motor has a short-circuit. In either case, the motor needs to be replaced.



7.10 Adjusting and replacing the speed reduction switch

Find out here how you can adjust and replace the switch that reduces the speed when in the upper lifter position.

Pre-requisites:
- Small pliers

- Move the lifter to the upper and lower position several times. In doing so check whether the contact switches.
- If the contact does not switch, bend the plate (1) slightly.
- If the contact is faulty, replace the entire cable harness.

- Check all vehicle functions.

7.11 Replacing the steering head bearings on the front or rear castor wheels

CAUTION! Incorrect reassembly can damage the bearings or cause the steering wheels to fall out!

- *The single-row angular ball bearing races are not the same on both sides! For this reason there is only one correct way to fit them! It is imperative that you observe the reassembly information!*

Requirements:

- Small flat-bladed screwdriver
- Allen key 3mm
- Socket wrench 19mm
- Torque wrench

7.11.1 Front Castor Wheels

- Prop up the wheelchair by lifting it up on the side that you want to work on and then placing the wooden block underneath the battery box on that side.

- Carefully remove the black plastic cap (1) that covers the end of the steering head tube, using the small flat-bladed screwdriver.

- Loosen and remove the 19 mm nut using the socket wrench. Hold the wheel so it does not rotate while removing the nut.
- Pull the steering head shaft down and out of the steering head tube.
- Remove the washer and the bearing race from the top of the tube. The other bearing race should be on the shaft.

IMPORTANT REASSEMBLY INFORMATION!
The pictures show the wide rim on the outside of the bearing race (A) and the narrow rim on the inside (B).

The bearings must always be assembled so that the narrow rims are facing each other (inwards)! The steering head bolt and the nut must always press against the wide rims from the outside! Otherwise the bearings will be forced out apart by the pressure of the bolt!

The steering wheels should swivel freely after assembly, but there should be no play in the bearings.

- First tighten the nut to 20 Nm +/- 2 Nm.
- Loosen the nut a little.
- Retighten to 15 Nm +/- 1.5 Nm

7.11.2 Rear Castor Wheels

- Use the Allen key 3mm remove the screws that hold the clear plastic cap of the rear light.

- Carefully remove the black plastic cap (1) that covers the end of the steering head tube, using the small flat-bladed screwdriver.

- Loosen and remove the 19 mm nut using the socket wrench. Hold the wheel so it does not rotate while removing the nut.
- Pull the steering head shaft down and out of the steering head tube.
- Remove the washer and the bearing race from the top of the tube. The other bearing race should be on the shaft.

IMPORTANT REASSEMBLY INFORMATION!
The pictures show the wide rim on the outside of the bearing race (A) and the narrow rim on the inside (B).

The bearings must always be assembled so that the narrow rims are facing each other (inwards)! The steering head bolt and the nut must always press against the wide rims from the outside! Otherwise the bearings will be forced out apart by the pressure of the bolt!

The steering wheels should swivel freely after assembly, but there should be no play in the bearings.

- First tighten the nut to 20 Nm +/- 2 Nm.
- Loosen the nut a little.
- Retighten to 15 Nm +/- 1.5 Nm

7.12 Replacing the Anti-Dive Spring

CAUTION! Danger of the wheelchair tipping over or rolling away!

- *Secure the wheelchair from tipping over by propping it up with a wooden block under the battery box that is long and wide enough! Using a wooden block that is too short or too high could cause the wheelchair to tip over!*
- *Switch the wheelchair off at the remote!*

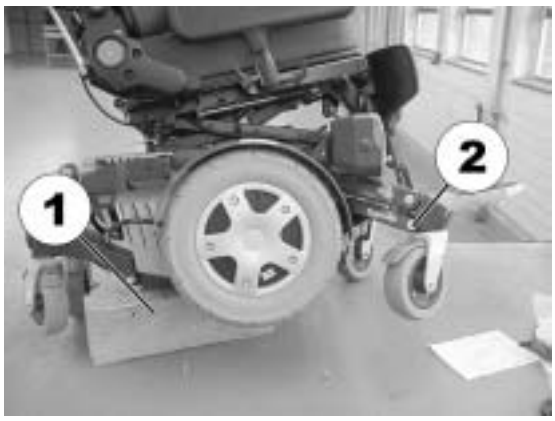
Requirements:

- 5 mm Allen key
- Circlip pliers

Note

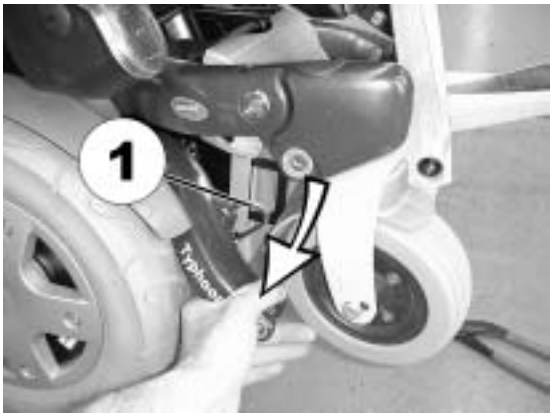
Pay attention to small pieces, and the order in which the components are disassembled. Arrange them in an orderly fashion so they can easily be assembled again in the right order.

- Prop up the wheelchair by lifting it up on the side that you want to work on and then placing the wooden block underneath the battery box on that side (1).
- To access the spring, you will need to remove the lower pin (2) that holds the walking beam.



- The pin is secured with a circlip from the inside (1).
- Open the circlip protecting the pin using the circlip pliers and remove it.

- Push the lower half of the walking beam down so that the tension on the spring (1) is released.
- Remove the upper end of the spring from the hole in walking beam.



- Use the Allen key 5mm to remove the bolt (1) that holds the retainer plate that secures the lower end of the spring.
- The spring can now be replaced.

- Reassembly is done in reverse order.

7.13 Repairing a flat tyre (conventional motor)

CAUTION! Danger of the wheelchair tipping over or rolling away!

- *Secure the wheelchair from tipping over by propping it up with a wooden block under the battery box that is long and wide enough! Using a wooden block that is too short or too high could cause the wheelchair to tip over!*
- *Switch the wheelchair off at the remote!*

CAUTION! Injury hazard! If the wheel has been insufficiently tightened during assembly, it can become loosened during driving!

- *When reassembling the drive wheels, tighten the Allen screws at a torque of 30 Nm!*
- *Secure all screws using a suitable blocker (e.g. Loctite 243)!*

Requirements:

- Allen key spanner 5 mm.
- Torque wrench
- Repair kit for tyre repair or a new inner tube.
- Talcum powder
- Screw blocker Loctite (e.g. Loctite 243)

Note
Pay attention to small pieces, and the order in which the components are disassembled. Arrange them in an orderly fashion so they can easily be assembled again in the right order.

- Prop up the wheelchair by lifting it up on the side that you want to work on and then placing the wooden block underneath the battery box on that side.

- Unscrew the 4 bolts that hold the wheel (1), using the 5mm Allen key.
- Remove the wheel from the hub.

- Unscrew valve cap.
- Let the air out of the tyre completely by pressing the pin in the centre of the valve in.
- Remove the 5 cylinder head screws (back of the wheel, 2.
- Remove the rim halves from the tyre.
- Remove the inner tube from the tyre.
- Repair inner tube and replace, or insert a new one.

NOTE
If the old inner tube is to be repaired and re-used, and has become wet during repair, you can make replacement easier by sprinkling the inner tube with a little talcum powder.

NOTE
Re-assembly is done in reverse order. Ensure that the tyre is replaced on the same side and in the same travel direction as it was previously mounted.

- Insert the wheel rim halves from outside into the tyre.
- Pump a little air into the inner tube.
- Insert the cylinder head screws in the rim and tighten the wheel rims firmly. Make sure the inner tube does not get pinched between the rims halves!
- Ensure that the tyre outer is seated correctly.
- Pump the tyre up to the prescribed pressure.
- Check that the tyre is seated correctly once again.
- Screw the valve cap back on.
- Refit the wheel.

7.14 Repairing a flat tyre (GB motor)

CAUTION! Danger of the wheelchair tipping over or rolling away!

- *Secure the wheelchair from tipping over by propping it up with a wooden block under the battery box that is long and wide enough! Using a wooden block that is too short or too high could cause the wheelchair to tip over!*
- *Switch the wheelchair off at the remote!*

EXPLOSION HAZARD!

The wheel will explode if you do not let the air out of the tyre before removing the wheel!

- *Always let the air out of the tyre before removing it (press in the pin in the middle of the valve)!*

Injury hazard! If the wheel has been insufficiently tightened, or if the threaded holes in the rim have been damaged during assembly by excessive tightening, then the wheel can loosen when driving!

- *When reassembling the drive wheels, position the screws in their holes by hand!*
- *Do not use electrical or pneumatic screw drivers!*
- *Tighten the Allen screws at a torque of 25 Nm!*
- *Make sure the Nordlock washers are replaced exactly the way they were removed!*

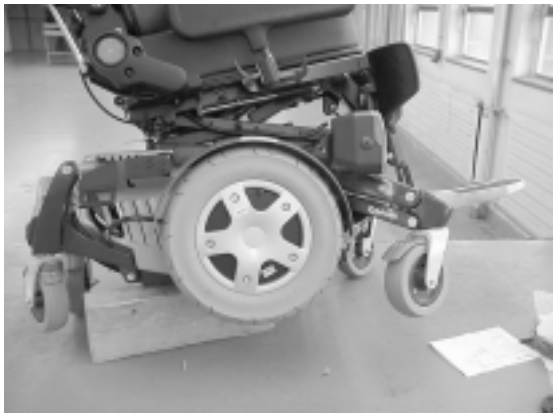
Requirements:

- Allen key 6 mm.
- Torque wrench
- Repair kit for tyre repair or a new inner tube.
- Talcum powder
- Screw blocker Loctite (e.g. Loctite 243)

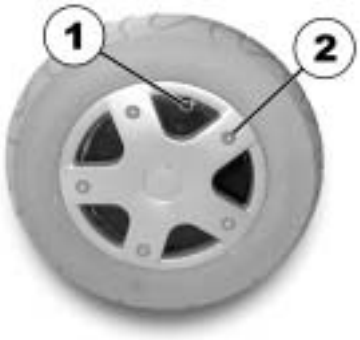
Note

Pay attention to small pieces, and the order in which the components are disassembled. Arrange them in an orderly fashion so they can easily be assembled again in the right order.

- Prop up the wheelchair by lifting it up on the side that you want to work on and then placing the wooden block underneath the battery box on that side.



- Unscrew valve cap.
- Depressurise tyre by pressing in the pin in the valve (1).
- Unscrew 5 screws (2).
- Remove the wheel rim halves.
- Remove the inner tube from the tyre.



NOTE
If the old inner tube is to be repaired and re-used, and has become wet during repair, you can make replacement easier by sprinkling the inner tube with a little talcum powder.

NOTE
Re-assembly is done in reverse order. Ensure that the tyre is replaced on the same side and in the same travel direction as it was previously mounted.

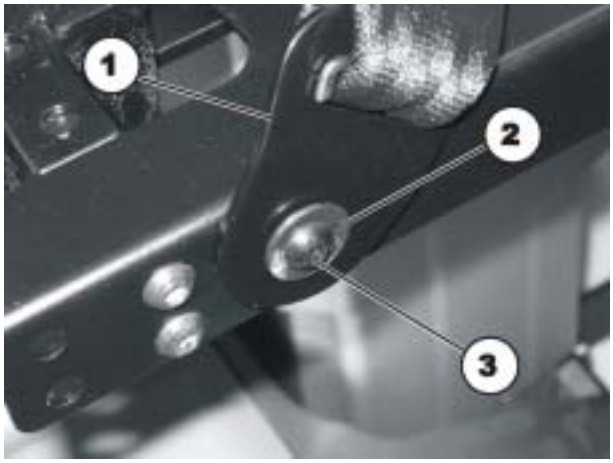
- Repair inner tube and replace, or insert new.
- Replace the inner tube in the tyre.
- Insert the wheel rim halves once again.
- Insert the screws and tighten slightly.
- Pump a little air into the inner tube.
- Tighten the wheel screws to 25 Nm.
- Ensure that the tyre outer is seated correctly.
- Pump the wheel up to its prescribed pressure
- Check that the tyre is seated correctly once again.
- Screw the valve cap back on.

7.15 Replacing a drive wheel

Note
For information on how to remove a drive wheel on a Typhoon with either standard or GB motors, please see the sections on repairing flat tyres.

7.16 Replacing the safety belt

Requirements:
- 10 mm socket spanner
- 4 mm Allen key



Dismantling the safety belt:

- Remove the plastic cap (5).
- Loosen the bolt (3) and the associated nut (in the figure this is covered) with a 4 mm Allen key and a 10 mm socket spanner.
- Remove the nut incl. the washer.
- Remove the screw incl. the safety belt, the washer (2) and the washer arranged behind.

Note
Another nut is fixed between the two washers (2) and (4) as a spacer so that the belt mounting can rotate freely.

- Replace the safety belt (1).

Refitting the safety belt:

- Refit the parts in reverse order.