

Invacare® Octave™



en **Bed**
Service Manual



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



Yes, you can.®

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This bed has been tested and approved according to IEC 60601-2-52.

This bed has undergone a risk analysis according to EN ISO 14971.

Invacare is certified according to ISO 9001 and ISO 13485.

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I General

I.1 Introduction

This service manual contains information about technical adjustments, technical data, descriptions of how accessories are mounted and slightly more advanced settings.

This must be read thoroughly by the responsible technician when adapting the bed.

All references to left and right are based on a person lying on his back in the bed, with his head in the head end.

 For pre-sale and user information, please see the user manual. The user manual can be found on Invacare's website.

I.2 Symbols in this manual

In this manual, warnings are indicated by symbols. The warning symbols are accompanied by a heading that indicates the severity of the danger.



WARNING

Indicates a hazardous situation that could result in serious injury or death if it is not avoided.



CAUTION

Indicates a hazardous situation that could result in minor or slight injury if it is not avoided.



IMPORTANT

Indicates a hazardous situation that could result in damage to property if it is not avoided.



Tips and Recommendations

Gives useful tips, recommendations and information for efficient, trouble-free use.



This product complies with Directive 93/42/EEC concerning medical devices. The launch date of this product is stated in the CE declaration of conformity.



Manufacturer of the product.

2 Safety

2.1 General warning



WARNING!

Risk of injury

There is a risk of entrapment of fingers in the bed moving parts.
 – Pay attention to your fingers.



IMPORTANT!

- Make sure that there is nothing under, over, or near the bed that can limit the movement of the bed or the mattress support, such as furniture, window frames and storage boxes.
- Do not roll over the mains cable.
- Do not bring mains cable into moving parts.
- Disconnect the plug from the mains before moving the bed.
- Make sure that no cables (mains or from other equipment) are jammed or damaged, when the bed is used.
- The bed must not be placed close to a direct heat source (fire place, radiator etc) and not in direct sunlight.

2.2 Mattresses



WARNING!

Safety aspects regarding combination of side rails and mattresses:

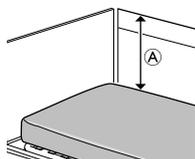
To get the highest possible safety level, when using side rails on the bed, the minimum and maximum measures for mattresses, must be respected.
 – For correct mattress measures see mattress table in chapter 7 *Technical data*, page 13.



WARNING!

Risk of entrapment and/or suffocation

- The user could get trapped and/or suffocate, if the horizontal space, between the mattress side and the inside of the side rail, is too big. Follow the minimum width (and length) of mattresses in combination with a side rail, as stated in the mattress table in chapter 7 *Technical data*, page 13 .
- Be aware that using very thick or soft mattresses (low density), or a combination of these, increases the risk.



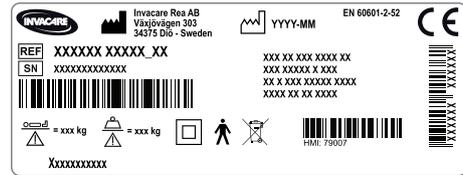
WARNING!

Risk of falling

The user can fall over the edge and get seriously injured, if the vertical distance $\text{\textcircled{A}}$ between the top of the mattress and the edge of the side rail/bed end, is too short. See image above.
 – Always keep a minimum distance $\text{\textcircled{A}}$ of 22 cm.
 – Follow the maximum mattress height in combination with the side rail as stated in the mattress table in chapter 7 *Technical data*, page 13.

2.3 Labels and symbols on the product

2.3.1 Product label



The product label is placed on the frame of the bed and contains the main product information, including technical data.

Symbols

	Serial Number
	Reference Number
	Manufacturer Address
	Manufacturing Date
	Max. User Weight
	Max. Safe Working Load
	CLASS II equipment
	Type B Applied Part
	WEEE conform
	This product complies with Directive 93/42/EEC concerning medical devices.

Abbreviations for technical data:

- lin = Incoming Current
- Uin = Incoming Voltage
- Int. = Intermittence
- AC = Alternating Current
- Max = maximum
- min = minutes

For more information about technical data, refer to 7 *Technical data*, page 13.

2.3.2 Other labels and symbols

	Refer to User Manual
	Definition of min. weight, min. height and min. body mass index of an adult user Refer to user documentation for the correct mattress measures.

3 Assembly

3.1 General safety information



WARNING!

Risk of injury or damage to property

- If the bed shows any sign of damages, do not use the bed.
- After each assembly, check that all fittings are properly tightened and that all parts have the correct function.
- The electrical equipment of the bed must not be dismantled or combined with other electrical equipment.



CAUTION!

Risk of injury

- There is a risk of entrapment or squeezing, while assembling or disassembling of the bed.
- The assembly of the bed and mounting of accessories must be done by qualified personnel.



IMPORTANT!

Receiving the bed

- When you receive the bed, check the packaging. If the packaging shows any signs of damage upon delivery, contact the shipping company.

Risk of condensation

- The bed should not be used until it has reached a temperature of 10-40° C.

3.2 Receiving the bed

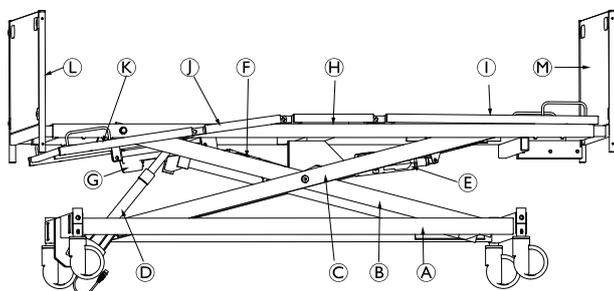
The bed will be delivered assembled on a trolley. The standard bed includes:

- Assembled bed on trolley
- Bed end fitting (2 pcs. incl. fixation)
- Wooden bed ends (2 pcs.)

The following accessories can be delivered with the bed:

- Pair of side rails Britt V or Line (standard in the UK)
- Wooden adapters for side rails (4 pcs. incl. fixation)
- Support handle
- Lifting pole (incl. fixation)
- Mattress support extension (incl. fixation)

Main parts of the standard bed



- Base **A** with central braking system
- Inner shear arm **B**
- Outer shear arm **C**
- Motor for height adjustment **D**
- Motor for backrest section **E**

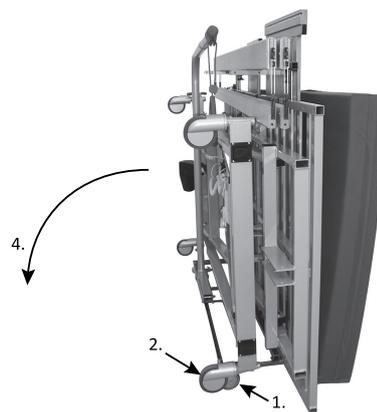
- Motor for thigh section **F** (with control unit)
- Motor for leg section **G**
- Top frame **H** incl. seat section
- Backrest section **I**
- Thigh section **J**
- Leg section **K**
- Bed end fitting **L**
- Wooden bed ends **M**

3.3 Assembling the standard bed



Two persons are required to assemble the bed.

Taking the bed from the trolley



1. Apply all 4 caster brakes of the trolley.
2. Apply the central brake system of the bed.
3. Remove the delivered equipment from the trolley.
4. Turn the bed with the trolley into horizontal position, standing on the bed casters. (two persons required)
5. Dismount the trolley from the bed.
6. Connect the bed to the mains. See also chapter Wiring.

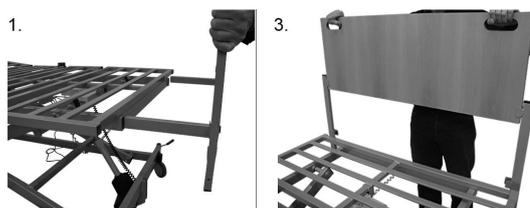
Assembling the bed ends



For an ergonomic working position, connect the bed to the mains and raise it to approx. 60 cm above floor level.



Kit includes: 2 bed ends, 2 bed end fittings, 8 screws



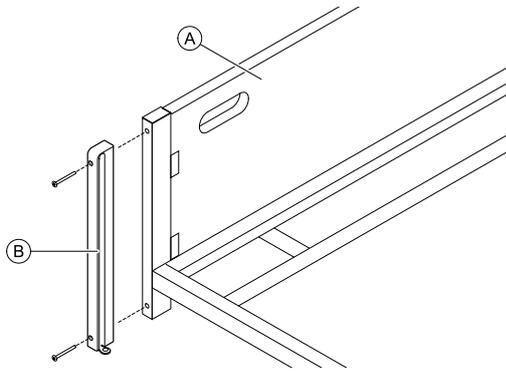
1. Push bed end fittings through the pipes on the top frame. (Visible insert pipe is about 4.5 cm).
2. Fix the bed end fitting with enclosed screws.
3. Slide the wooden bed end into the U-profile of the fitting.

3.4 Mounting the adapters for side rails



Kit includes: 4 wooden adapters; 8 mounting screws

The adapters are required in order to mount side rails to the bed.



1. Remove the cover caps on the bed ends (A).
2. Mount one adapter (B) to each side of each bed end. Fix each adapter with two screws.
3. Make sure that all screws are correctly tightened.

3.5 Britt V and Line side rail

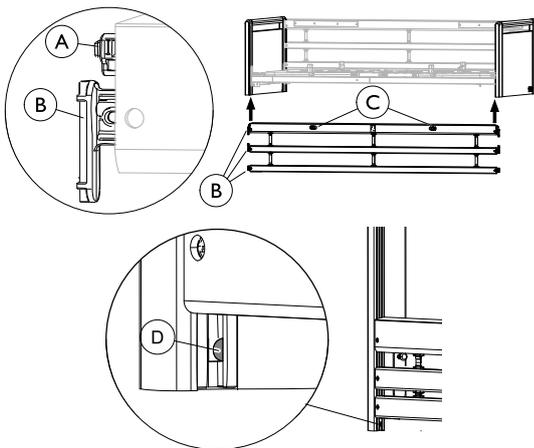


WARNING!

Risk of entrapment / suffocation

The user can get trapped or fall out of the bed if the side rail is not correctly mounted or damaged.

- Make sure that all gliding shoes are correctly guided into the bed end guideways.
- Make sure that all side rail bars are above the locking pin and properly locked.
- Make sure that the straps between the bars are not damaged or loose.



Mounting

1. Lift the upper bar in one end of the side rail. The release buttons (C) must face up/outwards.
2. Press in the locking pin (A) in the end of the side rail.
3. Guide the three gliding shoes (B) (in the end of the side rail bars) up into the bed end guideways, until they have all passed the locking pin (D).
4. Repeat steps 2 and 3 to mount the other side of the side rail.

Dismounting

1. Lower the side rail.
2. Lift the lower bar, in one end, to make the locking pin (D) visible and press it in with a screwdriver.
3. Lower all three bars, until they are out of the guideways.
4. Repeat steps 2 to 3 to dismount the other end of the side rail.

3.6 Mounting support handles

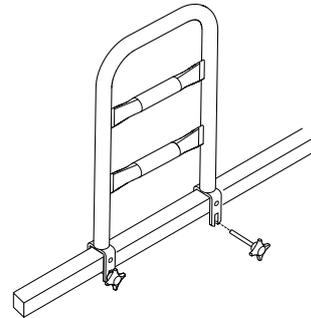


WARNING!

Risk of injury or damage

When placing the support handles in a wrong position, there's a risk that body parts are trapped between support handle and bed end.

- Place the support handle on the backrest section
- Do not place the support handle on the seat, thigh or leg section.
- Make sure, the distance between support handle and bed end is less than 4 cm or more than 32 cm.



1. Place the support handle on the tube of the backrest section.
2. Insert and tighten the finger screws.



When using the support handle for getting into a standing position, the backrest section should be horizontal.

3.7 Mounting the lifting pole



Kit includes: Lifting pole, 2 screws, 2 nuts



1. Push the lifting pole bottom piece in the fitting under the backrest section.
2. Insert the enclosed screws and tighten them with the nuts.

3.8 Mounting the mattress support extension (10 cm)

A mattress support extension can be mounted either in the head or foot end or in both ends.



CAUTION!

When the mattress support is extended, the side rails might be too short.

- Make sure that the length of the side rails fit to the length of the extended mattress support.



Kit includes: 1 mattress support extension, 4 screws



1. Remove bed end.
2. Remove the ferrules in the tube ends of the mattress support and slide the extension in the mattress support section.
3. Fix the assembly with the enclosed screws.
4. Mount the bed end in the outer position (4 screws per fitting). (Visible insert tube is about 14.5 cm).

3.9 Wiring

! **IMPORTANT!**

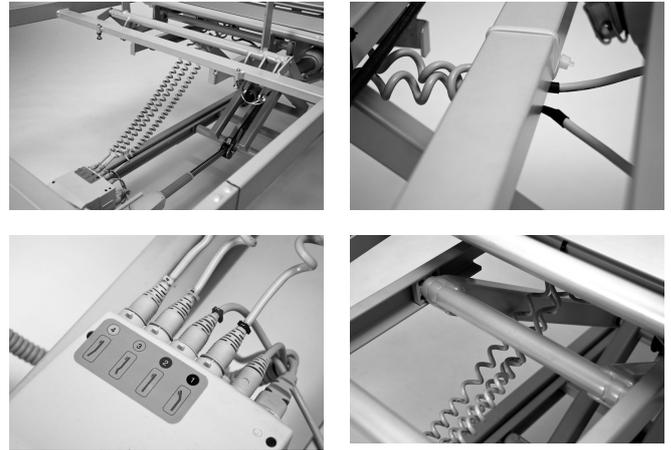
- The wires must be mounted in such a way that they are not hanging on the floor and do not block the casters.

IP Protection

The hand control, control unit and motors are protected according to IPx4 or IPx6.

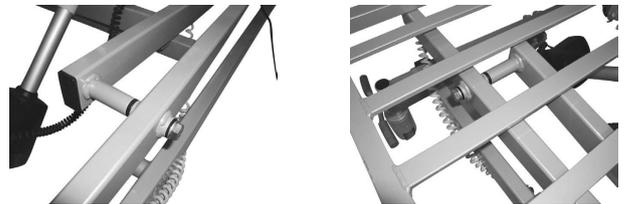
- To guarantee the IP protection, a locking cam must be installed on the control unit.

- Check the wiring by operating the motors of the bed to their outer positions.
- There is no risk of squeezing the wires when correctly installed.
- It is normal for cables to stretch slightly after some usage.
- The wires are equipped with plugs at both sections and can be replaced independently (except for the height motor).



3.10 Disassembling mattress support from base

Two persons are required to disassemble the mattress support from the base.



1. Dismount all accessories incl. bed end.
2. Lower the bed into the lowest position.
3. Dismount the height adjustment motor cable from the control unit.
4. Raise the back section to the highest position.
5. Loosen and remove the screws/nuts between mattress support and shear arms.
6. Lift the mattress support free from the guideway.
7. Lower the back section to the lowest position.
8. Remove the power plug from the bed and lift the mattress support off the shear arm.

4 Maintenance

4.1 General maintenance information

- !** **IMPORTANT!**
- The mattress support must be supported during service inspections, to prevent accidental lowering.
 - Only personnel who have received the necessary instructions or training may perform service and maintenance of the bed.
 - After reconditioning the bed, or if bed functions change, service must be carried out according to the check list.

A service contract can be made in the countries, where *Invacare*® has its own sales company. In certain countries *Invacare*® offers courses in service and maintenance of the bed. Spare parts lists and additional user manuals are available from *Invacare*®.

Before Use

- Ensure that all manual and electrical parts functions correctly and are in a secure state.
- Check, by raising and lowering the bed, that the shear arms run smoothly in the guideways.

After three months

- Ensure that all manual and electrical parts are functioning, and tighten bolts, screws, nuts, etc.

Every year

- We recommend a safety test comprising the motors' performance and mechanical state.

Every second year

- We recommend a service according to the below checklist after two years of normal use and then every second year.

 **Motors, hand control and control units** are serviced by exchanging the faulty part.

4.1.1 Checklist - Maintenance

Checkpoints

- Circlips, cotter pins and plastic fixing ring - properly locked and intact.
- Screws - tightened.
- Weldings - intact.
- Check the guideways - no bending.
- Check the guideways reinforcement - properly fastened.
- Side rail locking and moving system - properly locking and running smoothly.
- Castor fittings - tightened.
- Castor brakes - locking properly.
- Height adjustment motor - running properly.
- Backrest motor - running properly.
- Thigh section motor - running properly.
- Leg section motor - running properly.
- Wires - correctly wired and undamaged.
- Electric plugs - undamaged.
- Cable insulation and actuator housings – no cracks or damages.
- Damaged coating - repaired.
- Line side rail straps - not frayed or cracked.
- Accessories - correctly assembled and correct function.

4.2 Inspection after relocation - Prepare for new user

- !** **IMPORTANT!**
- When the bed has been relocated; before given to a new user it has to be thoroughly inspected.
- Inspection must be done by a trained professional.
 - For regular maintenance see maintenance chart.

4.2.1 Checklist - After relocation

Checkpoints

- Check the fittings between shear arm and mattress support (screws tightened properly).
- Check the locking of the motors (pipe pins correctly mounted).
- Check the electronic wiring for the motors (wires not squeezed).
- Check that the enclosing of the motors are intact (no cracks that enables fluids to pierce).
- Check the sections of the mattress support by using the hand control to activate all functions of the moving parts.
- Check the function of the brakes.
- Check the locking function(s) of the side rails.

4.3 Cleaning and disinfection

- !** **IMPORTANT!**
- Wrong fluids or methods can harm or damage you product.
- Follow instructions carefully for either Non-washable or Washable components.
 - Never use corrosive fluids (alkalines, acid, cellulose thinner, acetone etc)
 - Never use a solvent that changes the structure of the plastic or dissolves the attached labels.
 - Always make sure that the bed is carefully dried before taking it into use again.

4.3.1 Non-washable components

- !** **IMPORTANT!**
- Non-washable components cannot withstand washing with Jet based equipment.
- The washability of the components must be determined by authorized personnel.
 - If the components cannot withstand Jet base equipment or if it is unclear they have to be cleaned as non-washable components.

Electrical components

Method: Wipe off with a wet cloth or soft brush.

Max temp: 40 °C

Solvent/chemicals: Water

Metal components

Method: Wipe off with a wet cloth or soft brush.

Max temp: 40 °C

Solvent/chemicals: Household detergent or soap and water, 6-8 pH

Wood (including textile straps on side rails, if existing)

Method: Wipe off with a wet cloth or soft brush.

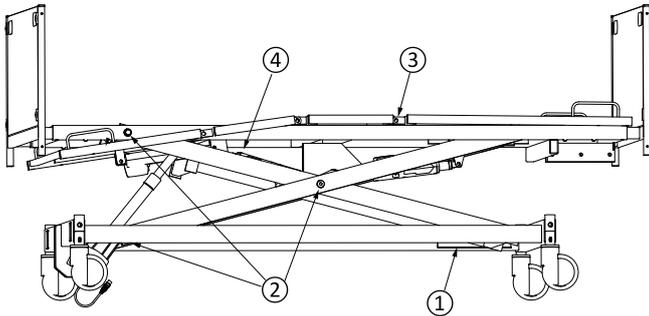
Max temp: 40 °C

Solvent/chemicals: Household detergent or soap and water, 6-8 pH

Textiles (including upholstery and mattresses)

Method: See attached label on each product.

4.4 Lubrication



We recommend lubricating the bed according to the following table:

	Part of bed	Lubrication method
1	Bearings for lifting- and shear arms	Oil (medically clean)
2	Motor suspension	Oil (medically clean)
3	Gliding shoes and guideways	Grease
4	Axles and rolls for shear arms (axle must be dismantled)	Grease

- !** **IMPORTANT!**
The gliding shoes in the Line side rails' gliding system move sluggishly if lubricated with oil.

4.5 Waste disposal

- i** Waste disposal/recycle must comply with the laws and regulations for waste handling in each country.

Invacare® is continuously working towards ensuring that the company's impact on environment, locally and globally, is reduced to a minimum.

We comply with the current environment legislation (e.g. WEEE and RoHS directive).

We only use REACH compliant materials and components.

- All wooden parts must be dismantled and sent for incineration.
- All electric parts must be dismantled and be disposed of as electric components.
- Plastic parts must be sent for incineration or recycling.
- Steel parts and castors must be disposed of as waste metals.

- !** **IMPORTANT!**
Accumulator back-up
– Old accumulators must be returned to Invacare® or recycled as car batteries

5 After Use

5.1 Waste disposal

 Waste disposal/recycle must comply with the laws and regulations for waste handling in each country.

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IMPORTANT!

Accumulator back-up
– Old accumulators must be returned to *Invacare*® or recycled as car batteries

5.2 Reuse

This product is suitable for reuse after the following has been performed:

- Inspection
- Cleaning



WARNING!

Risk of injury

For detailed information about inspection and cleaning; see the Service manual for this product.

- Always inspect the product according to the service instructions before transferring the product to a different user.
- If any damage is found do not use the product.

6 Troubleshooting

6.1 Troubleshooting electrical system


WARNING!
Risk of personal injury and damage to the product.

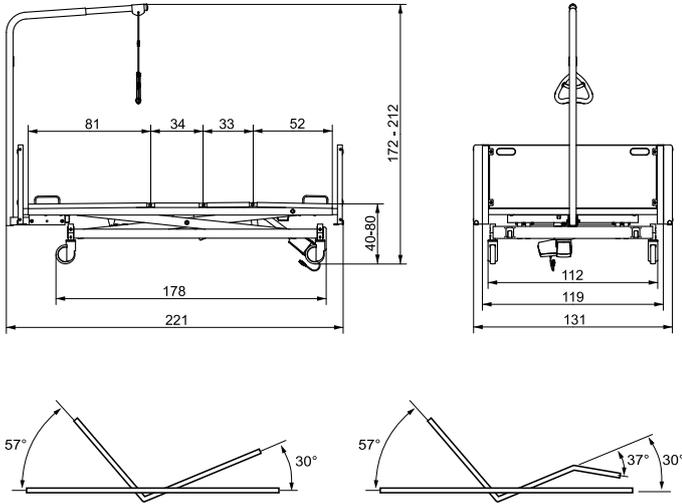
– The bed must be unplugged from the main power source before opening or repairing electrical parts.

Symptom	Possible cause	Remedy
Mains indicator does not light up	Mains are not connected	Connect mains
	Fuse in the control unit is blown	Replace the control unit
	Control unit is defective	Replace the control unit
Mains indicator lights up, but the motor is not running. The relay in the control unit makes a clicking noise.	Motor plug is not fully inserted into the control unit.	Insert the motor plug properly into the control unit
	The motor is defective	Replace the motor
	Motor cable is damaged	Replace the cable
	Control unit is defective	Replace the control unit
Mains indicator lights up, but the motor is not running. No relay sound is heard from the control unit.	Control unit is defective	Replace the control unit
	Hand control is defective	Replace the hand control
Control unit is in order except for one direction on one channel.	Control unit is defective	Replace the control unit
	Hand control is defective	Replace the hand control
Motor is running, but the piston rod does not move.	Motor is damaged	Replace the motor
The motor cannot lift full load.		
Motor noise, but no movement of piston rod.		
Piston rod operates inwards and not outwards.		

7 Technical data

7.1 Dimensions bed

- All measurements are stated in cm.
- All angles are stated in degrees.
- All measurements and angles are stated without tolerances, on a non-extended bed.



7.2 Weights

Max. User Weight (provided that the weight of the mattress + accessories do not exceed 35 kg)	350 kg
Safe Working Load (weight including mattress + accessories)	385 kg
Mattress support	72 kg
Base incl. shear arm	71 kg
Bed end fitting	5 kg/pc
Wooden bed end	8.5 kg/pc
Complete bed without accessories	170 kg
Wooden trims (2 pcs)	2 kg
Wooden side rail Britt V	7.5 kg/pc
Lifting pole	10 kg
Support handle	2 kg
Mattress (approximately)	8 kg

7.3 Allowed mattress sizes

Allowed mattress height and length depending on the side rail in use

Bed side rails	Allowed mattress sizes		
	Min height	Max height	Min length
Line/Line Extendable	15 cm	21 cm	200 cm
Britt V	15 cm	21 cm	200 cm

Allowed mattress width (for all side rails)

Bed width	Allowed mattress width
130 cm	116 – 120 cm

7.4 Environmental conditions

	Storage and transportation	Operation
Temperature	-10°C to +50°C	+5°C to +40°C
Relative humidity	20% to 75%	
Atmospheric pressure	800 hPa to 1060 hPa	

- Be aware that when a bed has been stored under low temperatures, it must be adjusted to operating conditions before use.

7.5 Electrical system

Voltage supply	Uin 230 Voltage, AC, 50 Hz (AC = Alternating current)
Maximum current input	lin max.3 Ampere
Intermittent (periodic motor operation)	10 % 2 min ON / 18 min OFF
Insulation class	CLASS II equipment
Type B Applied Part	Applied Part complying with the specified requirements for protection against electrical shock according to IEC60601-1.
Sound level	48 dB (A)
Degree of protection	The control unit, external power supply, motors and hand controls are protected according to IPx4 or IPx6 (depending on configuration). See bed product label and label on each electric device for correct IP class. The lowest IP-classification decides the overall classification of the bed. IPx4: The system is protected against water splashed from any direction. IPx6: The system is protected against water projected from any direction (not high pressure).

- The bed has no isolator (main switch). If the bed needs to be electrically disconnected, it has to be unplugged from the mains socket.

7.6 Electromagnetic compliance (EMC)

Guidance and manufacturer’s declaration – electromagnetic emission

The medical bed is intended for use in the electromagnetic environment specified below. The customer or the user of the bed should assure that it is used in such an environment.

Emissions test	Compliance	Electromagnetic environment - guidance
RF emissions CISPR 11(partly)	Group I	The medical bed uses RF energy only for its internal function. Therefore, its RF emissions are very low and are not likely to cause any interference in nearby electronic equipment.
RF emissions CISPR 11(partly)	Class B	The medical bed is suitable for use in all establishments including domestic establishments and those directly connected to the public low-voltage power supply network that supplies buildings used for domestic purposes.
Harmonic emissions IEC 61000-3-2	Class A	
Voltage fluctuations / flicker emissions IEC 61000-3-3	Complies	

Guidance and manufacturer’s declaration – electromagnetic immunity

The medical bed is intended for use in the electromagnetic environment specified below. The customer or the user of the bed should assure that it is used in such an environment.

Immunity test	IEC 60601-1-2 test level	Compliance level	Electromagnetic environment – guidance
Electrostatic discharge (ESD) IEC 61000-4-2	± 6 kV contact ± 8 kV air	± 6 kV contact ± 8 kV air	Floors should be wood, concrete or ceramic tile. If floors are covered with synthetic material, the relative humidity should be at least 30 %.
Electrostatic transient / burst IEC 61000-4-4	± 2 kV for power supply lines ± 1 kV for input/output lines	± 2 kV for power supply lines ± 1 kV for input/output lines	Mains power quality should be that of a typical commercial or hospital environment.
Surge IEC 61000-4-5	± 1 kV differential mode ± 2 kV common mode	± 1 kV differential mode ± 2 kV common mode	Mains power quality should be that of a typical commercial or hospital environment.
Voltage dips, short interruptions and voltage variations on power supply input lines IEC 61000-4-11	< 5% U _T (>95% dip in U _T) for 0,5 cycle 40% U _T (60% dip in U _T) for 5 cycles 70% U _T (30% dip in U _T) for 25 cycles < 5% U _T (>95% dip in U _T) for 5 sec	< 5% U _T (>95% dip in U _T) for 0,5 cycle 40% U _T (60% dip in U _T) for 5 cycles 70% U _T (30% dip in U _T) for 25 cycles < 5% U _T (>95% dip in U _T) for 5 sec	Mains power quality should be that of a typical commercial or hospital environment. If the user of the medical bed requires continued operation during power mains interruptions, it is recommended that the medical bed be powered from an un-interruptible power supply or a battery. U _T is the a. c. mains voltage prior to application of the test level.
Power frequency (50/60 Hz) magnetic field IEC 61000-4-8	3 A/m	3 A/m	Power frequency magnetic fields should be at levels characteristic of a typical location in a typical commercial or hospital environment.
Conducted RF IEC 61000-4-6 Radiated RF IEC 61000-4-3	3 V 3 V/m	3 V 3 V/m	Portable and mobile RF communications equipment should be used no closer to any part of the medical bed including cables, than the recommended separation distance calculated from the equation applicable to the frequency of the transmitter. Recommended separation distance: $d = \left[\frac{3,5}{V_1} \right] \sqrt{P}$ $d = \left[\frac{3,5}{E_1} \right] \sqrt{P}$ 80 MHz to 800 MHz

Immunity test	IEC 60601-1-2 test level	Compliance level	Electromagnetic environment – guidance
			$d = \left[\frac{7}{E_1} \right] \sqrt{P}$ <p style="text-align: right;">800 MHz to 2,5 GHz</p> <p>where P is the maximum output power rating of the transmitter in watts (W) according to the transmitter manufacturer and d is the recommended separation distance in metres (m).^b</p> <p>Field strengths from fixed RF transmitters, as determined by an electromagnetic site survey,^a should be less than the compliance level in each frequency range.^b</p> <p>Interference may occur in the vicinity of equipment marked with the following symbol:</p> 

^a Field strengths from fixed transmitters, such as base stations for radio (cellular/cordless) telephones and land mobile radios, amateur radio, AM and FM radio broadcast and TV broadcast cannot be predicted theoretically with accuracy. To assess the electromagnetic environment due to fixed RF transmitters, an electromagnetic site survey should be considered. If the measured field strength in the location in which the medical bed is used exceeds the applicable RF compliance level above, the medical bed should be observed to verify normal operation. If abnormal performance is observed, additional measures may be necessary, such as reorienting or relocating the medical bed.

^b Over the frequency range 150 kHz to 80 MHz, field strengths should be less than [V1] V/m.

At 80 MHz and 800 MHz, the higher frequency range applies.

Recommended separation distances between portable and mobile RF communications equipment and the medical bed

The medical bed is intended for use in an electromagnetic environment in which radiated RF disturbances are controlled. The customer or the user of the medical bed can help prevent electromagnetic interference by maintaining a minimum distance between portable and mobile RF communications equipment (transmitters) and the medical bed as recommended below, according to the maximum output power of the communications equipment

Rated maximum output of transmitter [W]	Separation distance according to frequency of transmitter [m]		
	150 kHz to 80 MHz $d = \left[\frac{3,5}{V_1} \right] \sqrt{P}$	80 MHz to 800 MHz $d = \left[\frac{3,5}{E_1} \right] \sqrt{P}$	800 MHz to 2,5 GHz $d = \left[\frac{7}{E_1} \right] \sqrt{P}$
0.01	0.12	0.12	0.23
0.1	0.37	0.37	0.74
1	1.17	1.17	2.33
10	3.69	3.69	7.38
100	11.67	11.67	23.33

For transmitters rated at a maximum output power not listed above the recommended separation, distance d in metres (m) can be estimated using the equation applicable to the frequency of the transmitter, where P is the maximum output power rating of the transmitter in watts (W) according to the transmitter manufacturer.

At 80 MHz and 800 MHz, the separation distance for the higher frequency range applies.

 These guidelines may not apply in all situations. Electromagnetic propagation is affected by absorption and reflection from structures, objects and people.

Invacare Sales Companies

Ireland:

Invacare Ireland Ltd,
Unit 5 Seatown Business Campus
Seatown Road, Swords, County
Dublin
Tel : (353) | 810 7084
Fax: (353) | 810 7085
ireland@invacare.com
www.invacare.ie

United Kingdom:

Invacare Limited
Pencoed Technology Park, Pencoed
Bridgend CF35 5AQ
Tel: (44) (0) 1656 776 222
Fax: (44) (0) 1656 776 220
uk@invacare.com
www.invacare.co.uk



Manufacturer:

Invacare Rea AB
Växjövägen 303
SE-343 71 Diö
Sweden

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