

MATE



**Exoskeleton for lumbar
support**

MATE-XB

CR82477000-en_01/2023.04



Instruction Handbook

Original instructions written in compliance with the essential health and safety requirement 1.7.4 of Annex I of Directive 2006/42/EC.

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1. INTRODUCTION

This chapter contains the following topics:

- [Preface](#);
- [Symbols used in the handbook](#);
- [Acronyms](#);
- [Product labeling and Declaration of Conformity](#);
- [Modification History](#).

1.1 Preface

Thank you for choosing MATE-XB.

This document provides instructions for the use, safety, installation, and maintenance of the MATE-XB. Additional languages are available upon request from the manufacturer.

All documentation supplied must be stored in the immediate vicinity of the area where the MATE-XB is in use, kept available to all persons working there and kept intact throughout its operational life.

The instructions in this handbook are intended for unqualified personnel and are sufficient to ensure correct and safe use of the device for the user.

- Read carefully before use.
- Follow the safety instructions.
- If you are not the only user, instruct all users on the proper and safe use of the product.

Contact COMAU S.p.A. for further assistance.

1.2 Symbols used in the handbook

Below are indicated the symbols that represent: **CAUTION** and **NOTES** and their meaning.



Indicates a situation in which a non-immediate or potential hazard is present that, if not avoided, could result in medium or low-level injury or health damage to the operator. Describes operations that require particular attention in order to avoid injury to the operator.



Indicates important information and/or describes those procedures whose non-observance or partial observance can cause damage to the machine or to the equipment connected to it.



The symbol indicates that the product should not be disposed of as unsorted waste but must be sent to separate collection facilities for recovery and recycling.

1.3 Acronyms

The following are acronyms and/or related descriptions, used in the handbook.

pDOF (passive Degrees Of Freedom)	Passive degrees of freedom
pHRI (physical Human-Robot Interface)	Physical Human-Robot Interface
TGB (Torque Generating Box)	Box containing the mechanism that generates assistive torque

1.4 Product labeling and Declaration of Conformity



The following Plate and Declaration of Conformity refer to the MATE-XB device as a whole.

In order to facilitate the consultation, below are reported:

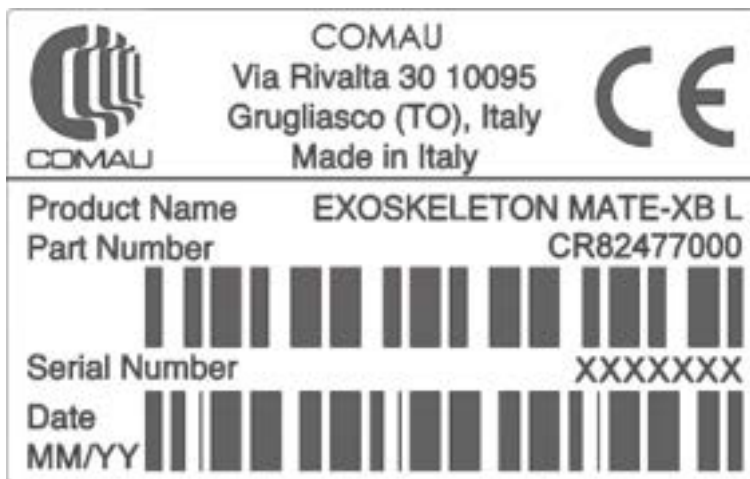
- Facsimile of the CE Marking found on the label of the MATE-XB (see [Fig. 1.1 - Facsimile of the Identification Plate with CE Marking \(38 mm x 24 mm\)](#) on page 8).
- Facsimile of the EC Declaration of Conformity (type II A) according to the Machinery Directive 2006/42/EC (see [Fig. 1.3 - Facsimile of the EC Declaration of Conformity](#) on page 10).

In any case, refer to the marking displayed on the product and to the original Declaration of Conformity.



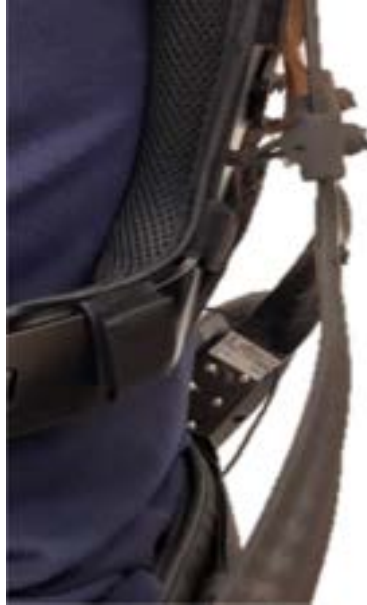
Changes made to the product by parties other than the manufacturer (COMAU) reduce COMAU's liability. In the most extreme case, the changes could result in invalidation of the CE certificate of conformity issued by COMAU. In this case, COMAU disclaims all liability.

Fig. 1.1 - Facsimile of the Identification Plate with CE Marking (38 mm x 24 mm)



This plate is affixed to the MATE-XB as shown in [Fig. 1.2 - Position of the Plate on MATE-XB on page 9](#).

Fig. 1.2 - Position of the Plate on MATE-XB



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Fig. 1.3 - Facsimile of the EC Declaration of Conformity

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DECLARATION of CONFORMITY			
DICHIARAZIONE CE DI CONFORMITA' - Direttiva 2006/42/CE - Allegato IA	EC DECLARATION OF CONFORMITY - DIRECTIVE 2006/42/EC - Annex IA	DÉCLARATION CE DE CONFORMITÉ - Directive 2006/42/CE - Annexe IA	EG-KONFORMITÄTSERKLÄRUNG - Richtlinie 2006/42/EG - Anhang IA
IL FABBRICANTE DICHIARA SOTTO LA SUA RESPONSABILITÀ CHE I PRODOTTI		DER HERSTELLER ERKLÄRT UNTER SEINER VERANTWORTUNG, DASS DIE PRODUKTE	
commercial name and model/type		year of construction:	
function		serial number:	
code		code release:	
IT	EN	FR	DE
SONO IN CONFORMITÀ CON I REQUISITI ESSENZIALI DI SICUREZZA DELLA DIRETTIVA 2006/42/CE.	ARE IN CONFORMITY WITH ESSENTIAL REQUIREMENTS OF THE DIRECTIVE 2006/42/CE.	SONT CONFORMES A L'ESSENCE ESSENTIELLES DE SÉCURITÉ APPLICABLES À LA DIRECTIVE 2006/42/CE.	ENTSPRECHEN MIT DER GRUNDLEGENDEN SICHERHEITSVORSCHRIFTEN DER RICHTLINIE 2006/42/EG.
Sono realizzati in conformità con la seguente principale norma: EN ISO 13482:2014 Robots and robotic devices - Safety requirements for personal care robots	Are manufactured in compliance with the following standards: EN ISO 13482:2014 Robots and robotic devices - Safety requirements for personal care robots	Ils ont été réalisés en conformité avec les normes: EN ISO 13482:2014 Robots and robotic devices - Safety requirements for personal care robots	Sie werden in Übereinstimmung mit den folgenden Normen hergestellt: EN ISO 13482:2014 Robots and robotic devices - Safety requirements for personal care robots
Persona giuridica autorizzata a compilare il Fascicolo Tecnico di:	Legal person authorized to compile the technical file is:	Personne morale autorisée à constituer le dossier technique est:	Die juristische Person, die befugt ist, die technischen Unterlagen zusammenzustellen, ist:
COMAU S.p.A. indirizzo: via Rivalta 30, Grugliasco	COMAU S.p.A. address: via Rivalta 30, Grugliasco	COMAU S.p.A. adresse: via Rivalta 30, Grugliasco	COMAU S.p.A. die Anschrift: via Rivalta 30, Grugliasco
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		NAME Pietro Otavio	
		SIGNATURE	
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commercial name and model/type	0	year of construction:	
function	0	serial number:	
code	0	code release:	0
ES ESTÁN DE ACUERDO CON LOS REQUISITOS ESENCIALES DE SEGURIDAD APPLICABLES A LA DIRECTIVA 2006/42/CE. Están realizados de conformidad con el siguiente estándares: EN ISO 13482:2014 Robots and robotic devices - Safety requirements for personal care robots Persona legal facultada para elaborar el expediente técnico es: COMAU S.p.A. Dirección: via Rivalta 30, Grugliasco COMAU se compromete de transmitir, en respuesta a un requerimiento debidamente motivado de las autoridades nacionales, la información a la máquina. Este compromiso incluye las modalidades de transmisión y no perjudicará los derechos de propiedad intelectual del fabricante de la máquina.	ZH 符合 2006/42/CE 指令的适用的基本要求 所有产品符合以下标准规范制定： EN ISO 13482:2014 机器人及机器人自动化产品 - 个人护理型机器人安全标准 编制技术文件的授权人员是： COMAU S.p.A. 地址：via Rivalta 30, Grugliasco 制造商应承诺：在收到国家主管部门的合理要求、充分理由和证明后，应不得向主管部门提供制造和产品信息。 COMAU 承诺向国家主管部门提供信息。此承诺包括信息传输的方式，且不会损害制造商的知识产权。	PL SPRZEMIAŁ ZASADNICZE WŁASNOŚCI BEZPIECZEŃSTWA DYREKTYWY 2006/42/WE. Czł. wykon. w. zgodn. z główną normą: EN ISO 13482:2014 Roboty i urządzenia robotyczne - Wymagania bezpieczeństwa dla robotów do pielęgnacji osób. Osoba prawem upoważniona do sporządzenia dokumentacji technicznej jest: COMAU S.p.A. adres zamieszkania: via Rivalta 30, Grugliasco Firma COMAU zobowiązuje się do dostarczenia, w odpowiedzi na należyte uzasadnione wnioski władz krajowych, informacji na temat maszyny. Zobowiązanie obejmuje sposób przekazywania danych i nie narusza praw własności intelektualnej producenta maszyny.	
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		SIGNATURE	

Modification History

The following table shows the history of the Handbook release, with related changes / improvements made.

Date	Edition of the Handbook	Contents
2023/04	01/2023.04	First release of the handbook

2. INFORMATION ON THE DEVICE

This chapter contains the following topics:

- [General description](#);
- [Technical features](#);
- [First use](#);
- [Compliant use](#);
- [Non-compliant use](#);
- [Individual use](#);
- [Environmental conditions of use](#);
- [Transport and storage of the device](#);
- [Warranty](#).



Comply with all requirements listed in this handbook to eliminate or control (where elimination is not possible) residual risks.



The MATE-XB must not be considered a medical device.

2.1 General description

The MATE-XB is a passive exoskeleton (i.e., without on-board motors and electronic components) which supports the user while working in a variety of positions, such as leg bending, back bending, and repetitive lifting of loads (see [Fig. 2.1 - Example of movements assisted by MATE-XB on page 14](#)). The device is designed to reduce back strain during these activities and improve the user's quality of work

Fig. 2.1 - Example of movements assisted by MATE-XB



Once the device is put on, the user can enable assistance and thus benefit from the support provided by the exoskeleton while maintaining freedom of movement. The device provides the same freedom of movement even when assistance is not enabled.

The MATE-XB is composed of:



	<p>5) Vest support structure with pad</p> <p>6) Sliding element for device height selection</p> <p>7) Connection element between vest and carbon fibre back structure (thoracic pDOF)</p> <p>8) Box containing the assistive mechanism (TGB)</p> <p>9) Assistance level selector switch</p> <p>10) Assistance enabling mechanism</p> <p>11) Thigh strap with pad</p>
	<p>12) Vest support structure with pad</p> <p>13) Vest support structure slot for chest width adjustment</p> <p>14) Carbon fibre back support structure</p> <p>15) Carbon fibre back structure slot for pelvis width adjustment</p> <p>16) Sliding element for device height selection</p> <p>17) Pelvic belt - back side</p> <p>18) Back strap for stabilisation</p> <p>19) Thigh strap</p> <p>20) Elastic cord for belt positioning</p>

2.2 Technical features

Feature	Description	
Size	L	XL
Mass	approx. 4.1 kg	approx. 4.2 kg
Operating temperature	0 to 45 °C (32 to 113 °F)	
Protection degree	IP54	
Noise during use	Less than 70 dB	

2.3 First use

During the first use, check that the box contains:

- Copy of the EC Declaration of Conformity
- Quick reference
- MATE-XB
- 6 mm Allen wrench

Before putting the MATE-XB on, it is very important to follow the guidelines for choosing the correct adjustment to maximise the comfort and effectiveness of the device for the user.

As an example, anthropometric size requirements that maximise (but do not constrain) comfortable wearing are given below:

- Height, 150-210 cm
- Pelvis width, 30-48 cm
- Thigh circumference, 35-80 cm

During the first use, it is recommended that you carefully check the correct wearing of the device as described in [par. 5.2 Procedure for dressing and undressing on page 34](#).

In some cases, getting used to the device may take some time; in those cases, it is suggested to start using the MATE-XB gradually. Depending on the user's feeling of comfort and perceived benefit, the usage time can be gradually increased until the entire work shift is covered.



If the user feels any discomfort while using the MATE-XB, he/she must remove the device and, if necessary, seek clarification from COMAU support.

2.4 Compliant use

The device is to be used by adults only, as a working tool for industrial use.

The device can be used only by persons properly instructed in the use and operation of MATE-XB.

The field of application of the MATE-XB involves lifting operations, or more generally, handling of loads involving bending of the torso. The device provides maximum support during frontal bending of the torso, as shown in [Fig. 2.1 - Example of movements assisted by MATE-XB on page 14](#), while partially supporting the user's upper body during twisting and forward movements of the torso.

The MATE-XB can be worn while sitting on a flat surface or on a chair (if the presence/distance between the armrests allows). However, it is recommended that you remove the device if you plan to remain in a sitting position for prolonged periods of time.

2.5 Non-compliant use

All uses that do not fall within the definitions of "compliant use" as stated in [par. 2.4 Compliant use on page 16](#).

The product cannot be used by:

- pregnant women;
- minors;
- people with skin disease or injury, inflammation, scars in the regions of the body in contact with the device (shoulders, chest, back, hips and thighs).

Consult the competent physician before using the MATE-XB, in case of:

- hernia;
- breast implants;
- hip prosthesis;
- knee prosthesis;
- recent surgery;
- Any condition deemed potentially incompatible with the use of the device.

Since the conditions listed above have not been tested, it is uncertain whether they will cause discomfort or expose to additional risks. The use of the MATE-XB could still be safe even in the presence of the above conditions. If in doubt, consult the competent physician.

The device cannot be used in an unsuitable workstation or environment. Experienced and qualified persons should check the work environment to identify any risks that could pose a danger to the user.

The following risks are possible:

- risk of unintentional impact with external objects or people;
- risk of unintentionally becoming entangled in fixed or moving objects;
- risk of being obstructed during the evacuation of a room;
- any other risks related to safety and ergonomics during use.

In addition:

- Do not use the device without training.
- Do not use the device without performing a specific adjustment.
- Do not use the device if damaged.
- Do not use the device when driving a vehicle.
- Do not use the device to lift loads heavier than allowed by law or company guidelines.
- Do not use the device to enhance individual performance.
- Do not use the device as a safety harness.
- Do not lift the device by grasping it by one of the thigh straps or boxes (TGB).
- Do not immerse the device in water or other liquids.

INFORMATION ON THE DEVICE

- Do not disassemble or remove parts from the device (except as specified in [par. 6.4 Procedure for removing the fabric parts on page 41](#)).
- Do not disassemble or open the TGB.

2.6 Individual use

COMAU recommends personal and individual use of the MATE-XB to maximise its effectiveness.

The same device can still be used by different users. In such a case, sanitisation is required before and after each use (according to the procedure described in [par. 6.3 Cleaning of fabric parts on page 40](#)). Each user must make the appropriate adjustments before use (see [Chap.4. - Adjustment on page 23](#)).

In case of doubts about the permitted uses of the MATE-XB, please contact COMAU for additional information.

2.7 Environmental conditions of use

The MATE-XB can be used both in outdoor areas (IP54 tested degree of protection) and indoors.



If you use the MATE-XB in particularly dusty or dirty environments, we recommend that you:

- clean the mechanical parts (as indicated in [par. 6.2 Cleaning of rigid parts on page 40](#));
- visually verify the integrity of the device;
- put on the device and check that there are no impediments in movement before enabling assistance (perform some torso bending and twisting and leg bending).

The MATE-XB can be used in environmental conditions that comply with the temperature range of 0 to 45°C (32 to 113°F); for example, do not expose the device to excessive sunlight.

The temperature operating range must be regarded as indicative. Contact COMAU if you intend to use the MATE-XB at different temperatures.



Wearing the MATE-XB at high temperatures may increase sweating which may be perceived as uncomfortable by the user but does not induce any dangerous condition for the user. The perception of discomfort may only discourage the use of the MATE-XB for an extended period of time.



Do not use or store the device in explosive environments or near heat sources.

2.8 Transport and storage of the device

The MATE-XB should be stored in a dry place, preferably hung on a clothes rack or placed on a flat surface of appropriate size.

Do not store the device in a humid environment where condensation occurs.

Do not lift and handle the device by grasping it by one of the thigh straps or TGB. For example, you can grasp it by the vest support structure or the carbon fibre back support structure.

It is recommended that the device be handled, transported, and stored with consideration of the technical specifications given in [par. 2.2 Technical features on page 15](#).



Handle the device with care, paying attention to people and surroundings.

2.9 Warranty

COMAU S.p.A. guarantees the quality of construction and materials of the MATE-XB exoskeleton for a period of 12 months from the date of delivery. This standard warranty does not cover defects attributable to user errors, incorrect use, negligence or willful misconduct, or damage resulting from any other activity excluded from the allowed uses of the device or otherwise contrary to the instructions contained in the Instruction Handbook.

3. SAFETY

This chapter contains the following topics:

- [Device certification](#);
- [General safety instructions](#)
- [Residual risks](#);
- [Modes of operation in case of emergencies](#).



Read the following safety information carefully before using the device. Follow the warnings and cautions to avoid injury to yourself or others and to avoid damage to the device.

3.1 Device certification

The MATE-XB device is a product of COMAU S.p.A. Via Rivalta 30, 10095 Grugliasco (TO).

- **Name:** MATE-XB
- **Release:** 1.0
- **Serial number:** found on the product label (see [3.2 General safety instructions on page 21](#)) placed on the inner surface of the exoskeleton
- **Certification:**
 - Machinery Directive 2006/42/EC
 - Standard EN ISO 13482:2014

3.2 General safety instructions

3.2.1 Risk of discomfort or pain

- Do not use the device in case of discomfort or pain.
 - Do not use the device until the pain is gone.
 - When the pain is gone, start using the device again and gradually increase the duration and frequency.
 - Do not use the device directly on the skin.
 - Remove the device if skin irritation arises.
-

3.2.2 Risk of loss of functionality, including sudden loss of support

- Use the device properly and do not make any changes to it.
- Use the device with care and only for its intended purpose.
- Do not use the damaged device.
- Check the integrity of the device (by visual inspection) before each use and in case it has been exposed to extreme stresses (e.g., following a fall).
- Be careful not to accidentally hit the assistance enabling mechanism while in use.
- Do not use flammable substances (e.g., matches, lighters, candles) near the device. The device is not fireproof.
- Do not expose the device to fire or other heat sources.
- Dry the device after using it, if wet or damp.
- Wipe the device with a damp cloth to remove any sand, dust and debris.
- Do not expose the device to inappropriate environmental conditions (see [par. 2.7 Environmental conditions of use on page 18](#)).



Contact COMAU for replacing damaged parts.

3.2.3 Risk of injury

- Pay attention that clothing or tools do not get caught in the device or between the device and the body.
- Wear appropriate clothing.
- Do not wear clothing or accessories that have loose ends (for example, necklaces or scarves).
- Do not keep bulky and/or rigid objects inside clothing or in pockets under the device. If something gets caught in the device, move slowly to free it and remove it.

- Improper use of the device may result in cutting or crushing injuries (see [par. 3.3 Residual risks on page 22](#)).
- Do not put your fingers on the pivot points while adjusting, using or carrying the MATE-XB.
- Do not let other people put their fingers on the device during use.
- Keep the device away from children and pets.

3.3 Residual risks

After having carefully considered all possible risks associated with the device, all necessary solutions were adopted to eliminate risks and limit hazards to exposed people.

On the device, although equipped with all the necessary systems to ensure its safe use, some risks remain that can be eliminated or reduced by the corresponding precaution.

All the necessary precautions to resolve some circumstances with residual risk have been given in this handbook.

In addition to the warnings and precautions in the handbook, the following residual risks are pointed out.



RESIDUAL RISK - PINCHING or FINGER CRUSHING

Where/when: the device in use may result in pinching/crushing of fingers in when:

- **approaching the fingers between the TGB and the thigh strap;**
- **approaching the fingers to the joint located on the upper part of the thigh strap.**

What not to do: do not bring your fingers close in the above configurations while using or carrying the MATE-XB. This warning also applies to people who may be around the user of the MATE-XB when the device is in use.

3.4 Modes of operation in case of emergencies

In case of emergencies (e.g., failure of the assistive mechanism, restricted trunk and/or leg movement, adverse environmental conditions), it is recommended that the MATE-XB be removed following the undressing procedures given in [par. 5.2.3 Removing procedure on page 37](#).

4. ADJUSTMENT

This chapter contains the following topics:

- [Pelvic belt adjustment](#);
- [Carbon fibre back support structure adjustment](#);
- [Adjustment of the vest chest straps](#);
- [Adjustment of assistance level](#).

Make the following adjustments before putting on and using the device:

1. Pelvic belt width and height;
2. Carbon fibre back support length;
3. Position of chest straps;
4. Level of assistance.



All the adjustments described below are intended to increase the comfort of use of the device. Sub-optimal adjustments do not compromise the efficiency of the device and its possibility of use; however, it is recommended that the procedure described below be followed in detail.



Make adjustments with the assistance disabled.

4.1 Pelvic belt adjustment

The pelvic belt can be adjusted in height and width in order to achieve alignment between the mechanical joint and the hip joint, and optimise user comfort.



Adjust the pelvic belt when the device is not put on.

4.1.1 Height adjustment

The height of the pelvic belt can be adjusted to maximise user comfort while maintaining the correct position of the assistive mechanism at the hip. For example, the pelvic belt (yellow line in Fig. 4.1) can be positioned lower or higher, keeping the assistive mechanism at the height of the user's hip (green line in Fig. 4.1).

Fig. 4.1 - Pelvic belt height



Perform the following steps to adjust the height of the pelvic belt:

	<ul style="list-style-type: none"> - Place the device on a supporting surface. - Remove the hip pad from the pelvic belt by acting on the hook and loop strap.
	<ul style="list-style-type: none"> - Separate the two parts by opening the hook and loop strap, to remove the plastic element.
	<ul style="list-style-type: none"> - With the help of the markings (white stitching), position the plastic element at the desired height. - Do not position the plastic element too low where there are no markings (white stitching).
	<ul style="list-style-type: none"> - Once the height of the belt has been set, close the two parts of the belt by pressing on the hook and loop strap.

	<ul style="list-style-type: none"> - Position the hip pad on the pelvic belt to cover the thigh strap connection element. - Repeat these steps on the other side of the pelvic belt.
--	--

4.1.2 Width adjustment

Perform the following steps to adjust the width of the back of the pelvic belt:

	<ul style="list-style-type: none"> - Position the device on a supporting surface, looking at the back of the device. - Widen the strap to be able to reach the back of the pelvic belt.
	<ul style="list-style-type: none"> - Open the back of the pelvic belt by acting on the hook and loop strap.
	<ul style="list-style-type: none"> - With the aid of the white stitching, choose the desired belt width by sliding the belt inside the belt loop.
	<ul style="list-style-type: none"> - Once the width of the back of the pelvic belt is set, press on the hook and loop strap and tighten the belt accordingly.

4.1.3 Check of the position of the pelvic belt

To check the correct positioning of the pelvic belt in accordance with the dimensions identified above (height and width), perform the following steps:

	<ul style="list-style-type: none"> – Put on the device, as specified in par. 5.2 Procedure for dressing and undressing on page 34. – Make sure the belt is comfortable and snug to the body. – Check that the robotic joint is aligned with the hip joint.
	<ul style="list-style-type: none"> – If the position of the robotic joint is incorrect, too high or too low (red line in figure), repeat the belt height adjustment (see par. 4.1.1 Height adjustment on page 24).
	<ul style="list-style-type: none"> – If the position of the robotic joint is incorrect, too far forward or too far backward (red line in figure), repeat the adjustment of the width of the back of the belt (par. 4.1.2 Width adjustment on page 25).



If the robotic joints are too far forward, we recommend tightening the back of the pelvic belt.

If the robotic joints are too far backward, we recommend widening the back of the pelvic belt.

4.2 Carbon fibre back support structure adjustment

The length of the carbon fibre back support structure can be adjusted in six different levels.

[Tab. 4.1](#) can help the user when putting on the device for the first time

Tab. 4.1 - Suggested carbon fibre back support structure length adjustment according to user's height

	User height [cm]	Back support length level
Size L	Up to 160	1*
	160 to 165	1
	165 to 170	2
	170 to 175	3
	175 to 180	4
	180 to 185	5
	Over 185	6
Size XL	180 to 185	1
	185 to 190	2
	190 to 195	3
	195 to 200	4
	200 to 205	5
	Over 205	6


The length level of the carbon fibre back support named 1 is obtained by changing the position of the thoracic pDOF as shown in [par. 4.1.2 Width adjustment on page 25](#).



Adjust the carbon fibre back support when the device is not put on.



ADJUSTMENT

Perform the following steps to adjust the length of the carbon fibre back support:

	<ul style="list-style-type: none"> – Place the device on a supporting surface. – Pull back the spring button (green arrow in figure).
	<ul style="list-style-type: none"> – Slide the carbon fibre back support until the desired level is reached.
	<ul style="list-style-type: none"> – Release the spring button.
<p>Repeat the steps on the opposite side.</p>	

The most suitable level is one that allows the user to move freely during a frontal bending of the torso: such movement is enabled by proper positioning of the connecting elements between the vest and the carbon fibre back support structure (thoracic pDOF).

To verify the correct positioning of thoracic pDOF, perform the following steps:

	<ul style="list-style-type: none">- Assume an upright posture with the device put on.- Check laterally the position of thoracic pDOF.- Use a mirror, take a picture or have someone help you.
 <p>No OK OK No OK</p>	<ul style="list-style-type: none">- Thoracic pDOF must be horizontal or point slightly downward.







If pDOF point upward, it is recommended that you select a lower level.
If pDOF point downward, it is recommended that you select a higher level.
Make sure the height setting is the same on the left and right sides.

4.2.1 Thoracic pDOF position change

Thoracic pDOFs connect the vest support structure to the carbon fibre back support structure through slots placed on the vest support structure.

To change the position of thoracic pDOF, perform the following steps:

	<ul style="list-style-type: none"> – Remove the pad of the vest support structure, as shown in par. 6.4.1 Removal of the vest support structure pad on page 42.
	<ul style="list-style-type: none"> – Remove the thoracic pDOF from the lower slot of the vest support structure.
	<ul style="list-style-type: none"> – Position the thoracic pDOF in the upper slot of the vest support structure. – Repeat the steps on the opposite side.
	<ul style="list-style-type: none"> – Reposition the pad of the vest support structure, as shown in par. 6.5.7 Fitting the vest support structure pad on page 52.

Re-check the correct position of the thoracic pDOFs as described in the previous description.



4.3 Adjustment of the vest chest straps

The position of the chest straps on the vest can be adjusted according to various body configurations by moving the straps on the vest.



Make the adjustment of the vest chest straps when the device is not put on.

Perform the following steps to adjust the position of the vest chest straps:

	<ul style="list-style-type: none">– Place the device on a supporting surface.– Remove the anchor strap from the vest stitching.
	<ul style="list-style-type: none">– Position the anchor strap and the chest strap in the desired position.
<p>Repeat the operation on the other side of the vest. If necessary, repeat the steps on both chest straps.</p>	

4.4 Adjustment of assistance level

Five different levels of assistance can be set on the MATE-XB. Level 1 and 5 provide minimum and maximum user assistance, respectively.



The assistance level value is a parameter that can be changed depending on the user who is wearing the device and the work activity performed.

The adjustment of the assistance level can be carried out when the device is put on.

Perform the following steps to adjust the assistance level:

	<ul style="list-style-type: none"> - Assume an upright posture with the MATE-XB put on. - Position the 6 mm Allen wrench in the hex seat on the assistive mechanism.
	<ul style="list-style-type: none"> - Turn the wrench so that the adjustment level indicator corresponds to the needed assistance level. - Turn the wrench toward level 5 for more support capacity and toward level 1 to reduce support capacity during lifting.
<p>Repeat these steps on the opposite side.</p>	

A non-optimal setting of the assistance level can generate inconvenience but no harm to the user.



Do not go directly from service level 5 to service level 1, or directly from level 1 to level 5, to avoid possible damage to the device.



If the thigh straps press uncomfortably on the thighs, set the assistance level to a lower value.

If the upper body bending movement is tiring, set the assistance level to a lower value. Make sure the assistance level is the same on the left and right sides.

5. USING THE DEVICE

This chapter contains the following topics:

- [Precautions for use](#);
- [Procedure for dressing and undressing](#);
- [Procedure for enabling assistance](#).

5.1 Precautions for use

Make sure you understand the safety instructions in Section 3.

Before use, prepare as follows:

- empty your pockets;
- remove uncomfortable accessories and clothing (e.g., necklaces or scarves);
- tie your hair up, if long or in contact with the device;
- ensure that there are no foreign bodies (e.g., dirt or debris) that restrict the use of the device (e.g., objects that hinder the sliding of the slot to select the width of the pelvis);
- make sure there are no visibly damaged or worn components.

5.2 Procedure for dressing and undressing

The MATE-XB is designed to be put on and taken off by a person independently.

When putting it on for the first time, it is necessary to be helped by a trained person who can speed up the understanding of the process, and help to find the best combination of the available adjustments.

Try putting on and taking off the device independently at least three times in the presence of a trained person so as to become familiar with the process.

5.2.1 Preliminary instructions

The user is encouraged to follow the preliminary directions below before putting on the MATE-XB:

- Do not position the device in direct contact with the skin, and make sure the clothing is appropriate: do not wear clothing that is too loose or too thick. We recommend the use of a well-close-fitting cotton t-shirt or shirt.
- Make sure the device is not enabled (the enabling mechanism must be in "O" position).






5.2.2 Steps to put on the device








Before putting on the MATE-XB:

- check that the device is clean and undamaged (by visual inspection), paying particular attention to the thoracic pDOF, the vest, TGBs, and back supports (the vest support structure and the carbon fibre back support structure);
- make sure that device assistance is not enabled;
- pay attention to the length of all belts and straps to reduce the risk of entrapment and tripping (e.g., tripping over the straps of the thigh straps).

To put on the MATE-XB, follow the steps below:

	<ul style="list-style-type: none"> – Loosen the straps of the vest. – Position the device in front of the body with the front of the pelvic belt, and the chest straps of the vest open.
	<ul style="list-style-type: none"> – Put the device on like a backpack, inserting the arms through the straps of the vest. – Position the straps over the shoulders.
	<ul style="list-style-type: none"> – Position the pelvic belt so that the robotic joint is positioned on the hip joint, and close the buckle. If necessary, tighten or loosen the front of the pelvic belt. For further dressing instructions, see par. 4.1 Pelvic belt adjustment on page 23. – When using the device, the belt must not slide down. If necessary, reposition the belt and tighten it.
	<ul style="list-style-type: none"> – Roll up the remaining length of the belt. Position it back in the elastic loop at the end of the belt.
	<ul style="list-style-type: none"> – Close the chest straps of the vest and tighten them.

USING THE DEVICE

	<ul style="list-style-type: none"> – Roll up the remaining lengths of the straps. Replace them in the elastic loop at the end of the straps.
	<ul style="list-style-type: none"> – If necessary, tighten the straps on the vest at the shoulders and chest.
	<ul style="list-style-type: none"> – Position the thigh strap's pads on the front side of the thighs. – Close the buckles and, if necessary, tension the straps.
	<ul style="list-style-type: none"> – Roll up the remaining length of the straps. Replace it in the elastic loop at the end of the straps.
	<ul style="list-style-type: none"> – Make sure the back stabilisation strap is placed under the glutes. If necessary, tighten the strap.



Before starting to use the device:

- ensure that the buckles on the thigh straps are fully closed to prevent the thigh straps from slipping off the thighs, potentially damaging the device;
- for all belts and straps, ensure that the remaining length is tucked into the elastic loops provided to reduce the risk of entrapment of the belts and straps.

5.2.3 Removing procedure



Before removing the device:

- **make sure you have disabled the assistance;**
- **pay attention to the length of all belts and straps to reduce the risk of entrapment and tripping (e.g., tripping over the straps of the thigh straps).**

To remove the MATE-XB, follow the steps below:

	<ul style="list-style-type: none"> - Open the buckles of the thigh straps and remove them from the thighs.
	<ul style="list-style-type: none"> - Open the chest straps of the vest.
	<ul style="list-style-type: none"> - Open the buckle of the pelvic belt - front side.
	<ul style="list-style-type: none"> - Slide off the vest straps and hold the device by grasping it by the carbon fibre back structure.



This undressing procedure can also be applied in the case of emergencies, as described in [par. 3.4 Modes of operation in case of emergencies on page 22](#).

5.3 Procedure for enabling assistance

Once the MATE-XB is put on, you can adjust the assistance level (see [par. 4.4 Adjustment of assistance level on page 32](#)) and enable the device.

Perform the following steps to enable MATE-XB assistance:

	<ul style="list-style-type: none"> - Assume an upright posture with the MATE-XB put on.
	<ul style="list-style-type: none"> - Check that "I" indicator located on the inside of the TGB is in the range defined by the white arrows located at the "O/I" values. - Otherwise, move your torso slightly forward or backward to place that indicator in the range defined above.
	<ul style="list-style-type: none"> - To enable assistance, turn the knob from the "O" value to the "I" value to the position signaled by a "click."
<p>Repeat the operation on the other side.</p>	



During the assistance enable procedure, be sure to perform a full knob movement to avoid potential damage to the device. Pay attention to the audible "click" at the completion of the knob movement.

To disable the assistance, assume an upright posture with the MATE-XB put on and turn the knob from the "I" value to the "O" value to the position signaled by a "click." Carry out this operation on both sides.

6. MAINTENANCE

This chapter contains the following topics:

- [Sanitisation](#);
 - [Cleaning of rigid parts](#);
 - [Cleaning of fabric parts](#);
 - [Procedure for removing the fabric parts](#);
 - [Procedure for fitting the fabric parts](#);
 - [Periodic checks](#);
 - [Spare parts list](#);
 - [Instructions for requesting interventions and ordering spare parts](#).
-

6.1 Sanitisation

To sanitise MATE-XB parts, we recommend the use of an alcohol fabric spray. To maximise the sanitisation of all parts, it is advisable to remove the fabric parts (see [par. 6.4 Procedure for removing the fabric parts on page 41](#)) and spray them separately.

Sanitisation can also be carried out on a daily basis.

6.2 Cleaning of rigid parts

Clean the rigid parts and exposed mechanical components of the MATE-XB device using a dry cloth or lightly soaked in neutral soap and water.

Do not use aggressive cleaning agents, gases, alcohol or diluents.

Any grease leaking from the enclosures is a sign of deterioration of the gaskets. As it is a food-grade grease, it can be removed without special precautions, but more careful maintenance should be carried out promptly.

6.3 Cleaning of fabric parts

All fabrics and padded parts can be removed and washed.

After daily use of the device, we recommend a frequency of washing approximately once a month.

Use the instructions described in [par. 6.4 Procedure for removing the fabric parts on page 41](#) to remove the washable parts from the device.

Use the following directions to wash the fabric parts of the wearable interface:

- wash by hand with water;
- do not bleach;
- dry in the open air;

- do not iron;
- do not dry clean;
- do not tumble dry;
- do not use fabric softeners.



Wash the various components individually using a laundry bag, making sure that the hook and loop strap connections are closed.

Once washed and dried, use the instructions described in [par. 6.5 Procedure for fitting the fabric parts on page 48](#) to reassemble the fabric parts on the device.

It is also possible to sanitise the fabric parts directly on the MATE-XB without removing them from the device, using a sanitising product as listed in the [par. 6.1 Sanitisation on page 40](#).

6.4 Procedure for removing the fabric parts

Removing the fabric parts requires separating the parts from constraints such as hook and loop strap and anchor straps.

The steps required to remove the fabric parts are shown for each element in the tables below.

Please note that for the complete removal of the fabric parts, it is important to follow the order of removal of the elements described below.



Remove fabric parts when the device is not put on.
Make sure that device assistance is not enabled.

6.4.1 Removal of the vest support structure pad

The pad is positioned on the vest support structure by means of four Velcro fasteners. To remove the pad:

	<ul style="list-style-type: none">– Open the Velcro fastener at the top of the pad.
	<ul style="list-style-type: none">– Open the Velcro fasteners located in the two central areas of the pad (above and below the structure slots).
	<ul style="list-style-type: none">– Open the Velcro fastener at the bottom of the pad.
	<ul style="list-style-type: none">– Remove the pad from the vest support structure.
Repeat the steps on the opposite side.	



6.4.2 Vest removal

The vest is connected to the vest support structure by means of anchor straps. To remove the vest:

	<ul style="list-style-type: none">– Remove the pad of the vest support structure, as shown in par. 6.4.1 Removal of the vest support structure pad on page 42.
	<ul style="list-style-type: none">– Remove the anchor strap of the shoulder straps from the slot of the vest support structure.
	<ul style="list-style-type: none">– Remove the thoracic anchor strap from the slot of the vest support structure.
<p>Repeat the steps on the opposite side.</p>	

6.4.3 Removal of the back strap for stabilisation

The back strap is connected to the TGB by means of the hook and loop strap to be inserted into the slots on plastic plates. To remove the back strap for stabilisation:

	– Open the hook and loop strap.
	– Slide it out of the rear slot on the plastic plate.
Repeat the steps on the opposite side.	




6.4.4 Removal of the hip pad

The hip pad is attached to the pelvic belt with the hook-and-loop strap. To remove the pad:

	– Detach the pad from the pelvic belt.
Repeat the steps on the opposite side.	




6.4.5 Pelvic belt removal

The pelvic belt is connected to the TGB by means of the hook and loop strap positioned on plastic plates. To remove the pelvic belt:

	– Open the two parts of the hook and loop strap.
	– Detach the pelvic belt from the plastic plate.
	– Remove the elastic belt stabilisation cord, as shown in par. 6.4.6 Removal of the elastic cord for belt positioning on page 46 .
Repeat the steps on the opposite side.	




6.4.6 Removal of the elastic cord for belt positioning

The elastic cord connects the pelvic belt to the TGB and the carbon fibre back structure. To remove the elastic cord for belt positioning:

	<ul style="list-style-type: none"> – Separate the pelvic belt from the plastic plates, as shown in par. 6.4.5 Pelvic belt removal on page 45.
	<ul style="list-style-type: none"> – Remove the elastic cord from the pelvic belt and TGB.
	<ul style="list-style-type: none"> – Slide the cord along the thigh strap until it is completely pulled out.
<p>Repeat the steps on the opposite side.</p>	

6.4.7 Thigh strap's pad removal

The pad is positioned on the thigh strap using a pouch and the hook and loop strap. To remove the pad:

	<ul style="list-style-type: none">- Open the hook and loop strap on the thigh strap.
	<ul style="list-style-type: none">- Remove the strap from the loop.
	<ul style="list-style-type: none">- Remove the pad from the thigh strap.
<p>Repeat the steps on the opposite side.</p>	

6.5 Procedure for fitting the fabric parts




To fit the fabric parts of the MATE-XB, it is important to carry out the steps in the following order.

6.5.1 Fitting the thigh strap's pad

To fit the pad on the thigh strap:

	<ul style="list-style-type: none"> – Open the hook and loop strap on the thigh strap.
	<ul style="list-style-type: none"> – Insert the pad into the thigh strap.
	<ul style="list-style-type: none"> – Insert the strap into the loop.
	<ul style="list-style-type: none"> – Close the hook and loop strap on the thigh strap.
<p>Repeat the steps on the opposite side.</p>	

6.5.2 Fitting the elastic cord for belt positioning

	<ul style="list-style-type: none">– Insert the elastic cord into the thigh strap.
	<ul style="list-style-type: none">– Slide the elastic cord over the plastic plate and TGB.
	<ul style="list-style-type: none">– Fit the pelvic belt as shown in par. 6.5.3 Fitting the pelvic belt on page 50 and insert the elastic cord into the two parts of the hook and loop strap.
<p>Repeat the steps on the opposite side.</p>	



6.5.3 Fitting the pelvic belt

To fit the pelvic belt:

	<ul style="list-style-type: none">– Insert the elastic cord into the pelvic belt.
	<ul style="list-style-type: none">– Open the two parts of the hook and loop strap.
	<ul style="list-style-type: none">– Position the plastic plate on the belt hook and loop strap.
	<ul style="list-style-type: none">– Insert the elastic cord into the two parts of the hook and loop strap (arrow in figure) and close them.
<p>Repeat the steps on the opposite side.</p>	

6.5.4 Fitting the back strap for stabilisation

To fit the back strap for stabilisation, perform the following steps:

	<ul style="list-style-type: none">– Open the hook and loop strap on the back strap for stabilisation.– Insert the back strap into the rear slot on the plastic plate.
	<ul style="list-style-type: none">– Close the hook and loop strap.
<p>Repeat the steps on the opposite side.</p>	

6.5.5 Fitting the hip pad



The hip pad serves to cushion the contact with the robotic joint and ensure comfort for the user.

Perform the following steps to fit the hip pad:

	<ul style="list-style-type: none">– Position the pad on the robotic joint and press to adhere the hook and loop strap.– Repeat the steps on the opposite side.
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6.5.6 Fitting the vest

To fit the vest on the support structure, perform the following steps:

	<ul style="list-style-type: none"> – Insert the thoracic anchor strap into the slot of the vest support structure.
	<ul style="list-style-type: none"> – Insert the anchor strap of the shoulder straps into the slot of the vest support structure.
<p>Repeat the steps on the opposite side.</p>	

6.5.7 Fitting the vest support structure pad

To fit the pad on the support structure of the vest, perform the following steps:

	<ul style="list-style-type: none"> – Open the Velcro fastener at the bottom of the pad. – Position the pad on the vest support structure.
	<ul style="list-style-type: none"> – Close the other three Velcro fasteners, using the hook-and-loop strap.
<p>Repeat the steps on the opposite side.</p>	

6.6 Periodic checks

Carrying out checks in compliance with the specified intervals guarantees long and reliable operation of the MATE-XB.

6.6.1 Inspection of the fabric parts

After one year of daily use of the device it may be necessary to replace some of the fabric parts.

To remove the worn-out fabric part, proceed as usual with cleaning and washing operations (see [par. 6.4 Procedure for removing the fabric parts on page 41](#)) and replace the damaged part with the original spare part listed in [par. 6.7 Spare parts list on page 54](#).

6.6.2 Inspection of the mechanical parts

After one year of daily use of the device, it is recommended to check that the following components are intact and free to move:

- thoracic pDOF;
- vest support structure slot for chest width adjustment;
- carbon fibre back structure slot for pelvis width adjustment;
- sliding element for device length selection;
- thigh straps.

It is also recommended to check the operation of the assistance level selector switch (switching it gradually from level 1 to level 5, and vice versa) and the assistance enable mechanism (switching it from O to I, and vice versa).

Please refer to COMAU for technical assistance and inspection (see [par. 6.8 Instructions for requesting interventions and ordering spare parts on page 55](#)).

6.7 Spare parts list

For the replacement of MATE-XB parts, use only original spare parts. Do not use spare parts for different purposes than those indicated.

There is a replacement kit for fabric parts for this device (see [Tab. 6.1 - Fabric parts kit on page 54](#)).

Tab. 6.1 - Fabric parts kit



The diagram shows the following components:

- 1: Two curved vest support pads.
- 2: A single vest with shoulder straps.
- 3: Two long, padded thigh straps.
- 4: A wide pelvic belt with a buckle.
- 5: A long, thin back strap with a buckle.
- 6: Two small, rectangular thoracic pDOF pads.
- 7: Two teardrop-shaped elastic cords.
- 8: Two oval-shaped hip pads.

Position	Description	Quantity
1	Vest support pad	2
2	Vest	1
3	Thigh strap pad	2
4	Pelvic belt	1
5	Back strap	1
6	Thoracic pDOF	2
7	Elastic cord	2
8	Hip pad	2

6.8 Instructions for requesting interventions and ordering spare parts

If the problem encountered is not on the list, or in cases where faults and/or improper situations cannot be resolved by the customer, it is recommended that you request the intervention of COMAU Service personnel.

Orders for spare parts or requests for repairs shall be placed via the Office:

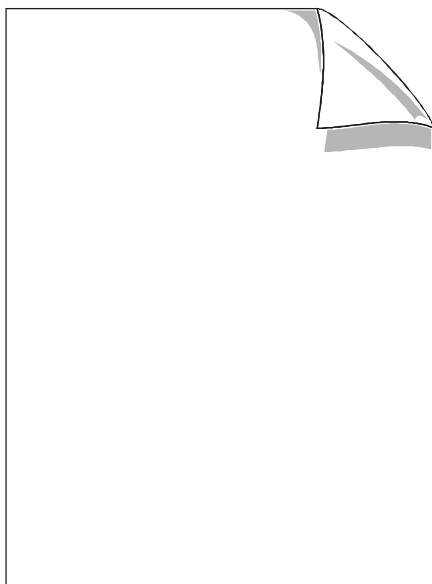
COMAU S.p.A.
Customer Service
Via Rivalta, 30
10095 Grugliasco (TO) - ITALIA
www.comau.com/it/contact-us/customer-service/

7. DISPOSAL



The disposal operations must be carried out in compliance with the law in force in the country where the MATE-XB is used.

If partial or total disposal of the MATE-XB is necessary, the parts to be disposed of must be collected separately (e.g. aluminium with aluminium and plastic with plastic).





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Original instructions

Made in Comau