

Passive Back, Arm and Leg Exoskeleton

UPLIFT™

User Manual

Generation 2



MAWASHI

SCIENCE & TECHNOLOGY



WARNING!

The *UPLIFT™ exoskeleton* system may cause risks to the users.

It is **imperative** to read this document and get proper training from a competent designated individual **before** using the system.

Avoiding this warning may result in severe(s) injury(ies).

Section 5 of this manual depicts exhaustive details about the proper and safe use of the *UPLIFT™ exoskeleton*.

It is essential to get familiar with this document before use, and a copy shall always be kept with the product.

In this document, the masculine is used indiscriminately, for the sole purpose of readability.

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To ensure working with the most up-to-date documentation, please refer to our website at www.mawashi.ca. Should assistance be required, the support team can be contacted directly at +1.888.629.2744 or support@mawashi.ca

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1.0 Product Description

1.1 Introduction to the *UPLIFT™ Exoskeleton*

The *UPLIFT™ exoskeleton* is designed to assist the user during various activities involving lifting and carrying tasks. This non-powered system requires no batteries and has three main modules that can simultaneously or individually assist the user's knees, back, and shoulders. Inspired by human biomechanics, this system contributes to improving the safety and health of workers by reducing the risks of injuries related to handling and manipulating loads. It achieves this by reducing the stresses applied to the user's musculoskeletal system when lifting and transporting objects.

As with any piece of equipment worn on the human body, it will be critical for the user to understand how these passive assistance modules work and to comprehend the various possible configurations of the exoskeleton to get the most out of its use. Additionally, just like any other equipment worn by an individual, a familiarization period is needed to acquire a level of ease and comfort necessary for the optimal use of the.

This user manual thoroughly explains how to use and configure the *UPLIFT™ exoskeleton*.

1.2 Overview of the UPLIFT™ Exoskeleton

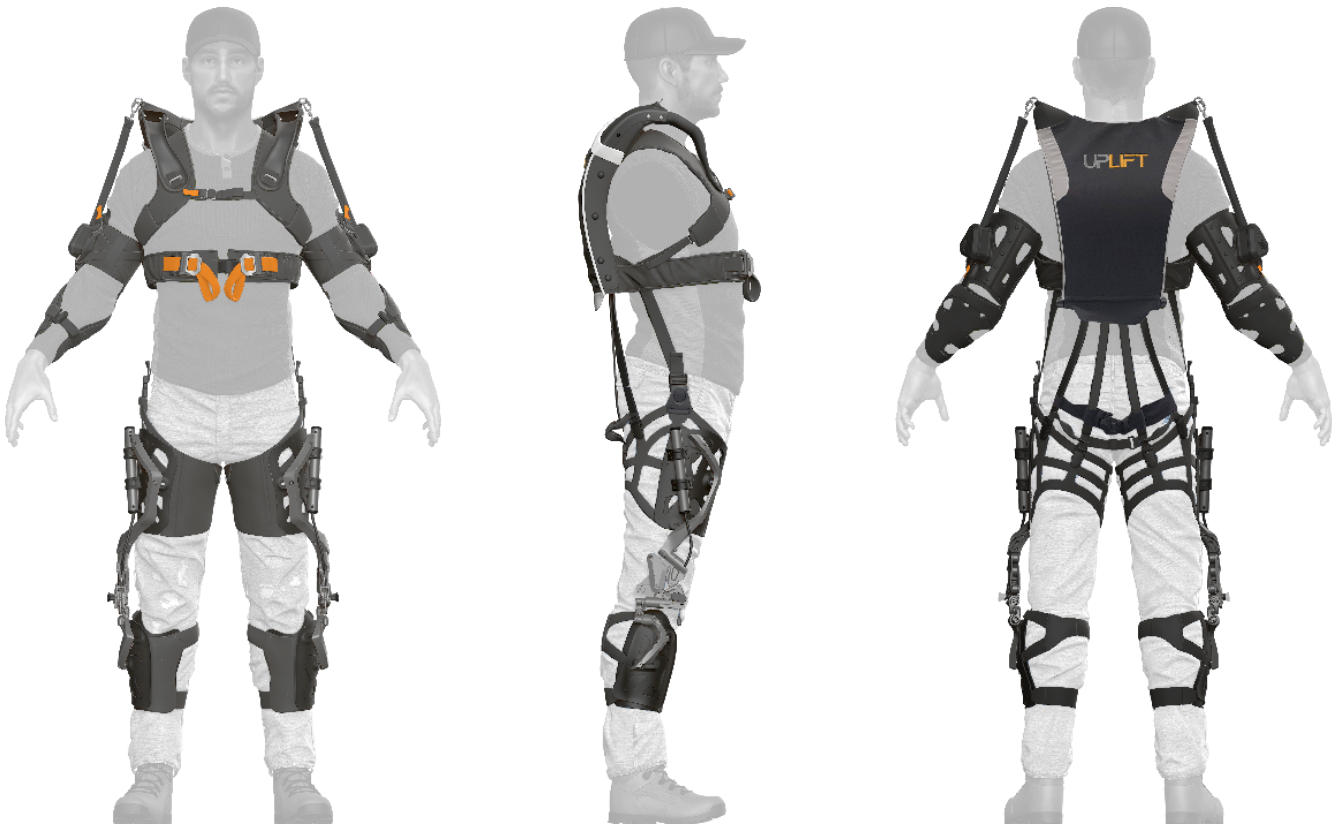


Figure 1 - UPLIFT™ Exoskeleton

1.3 Overview of the UPLIFT™ Exoskeleton Assistive Modules



Figure 2 - In yellow: UPLIFT™ Back Module
In green: UPLIFT™ Arm Module
In blue: UPLIFT™ Leg Module

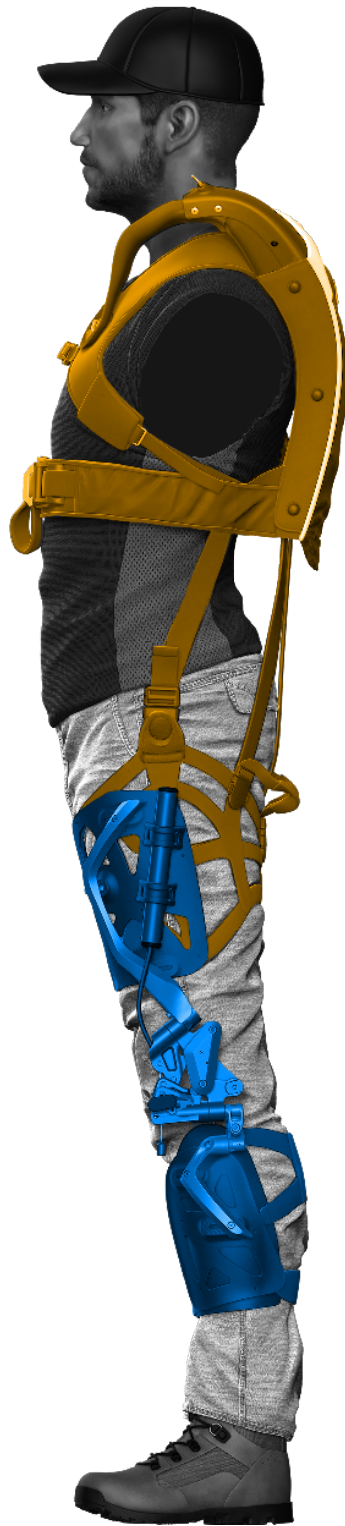


Figure 3 - In yellow: UPLIFT™ Back Module
In blue: UPLIFT™ Leg Module

1.4 Choosing Modules for the UPLIFT™ Exoskeleton

The UPLIFT™ exoskeleton is composed of three different modules (Back, Arms and Legs) and can be configured following the user’s needs. The figure below presents the four possible UPLIFT™ configurations.

It is important to note that the Back Module is required to use any other module.

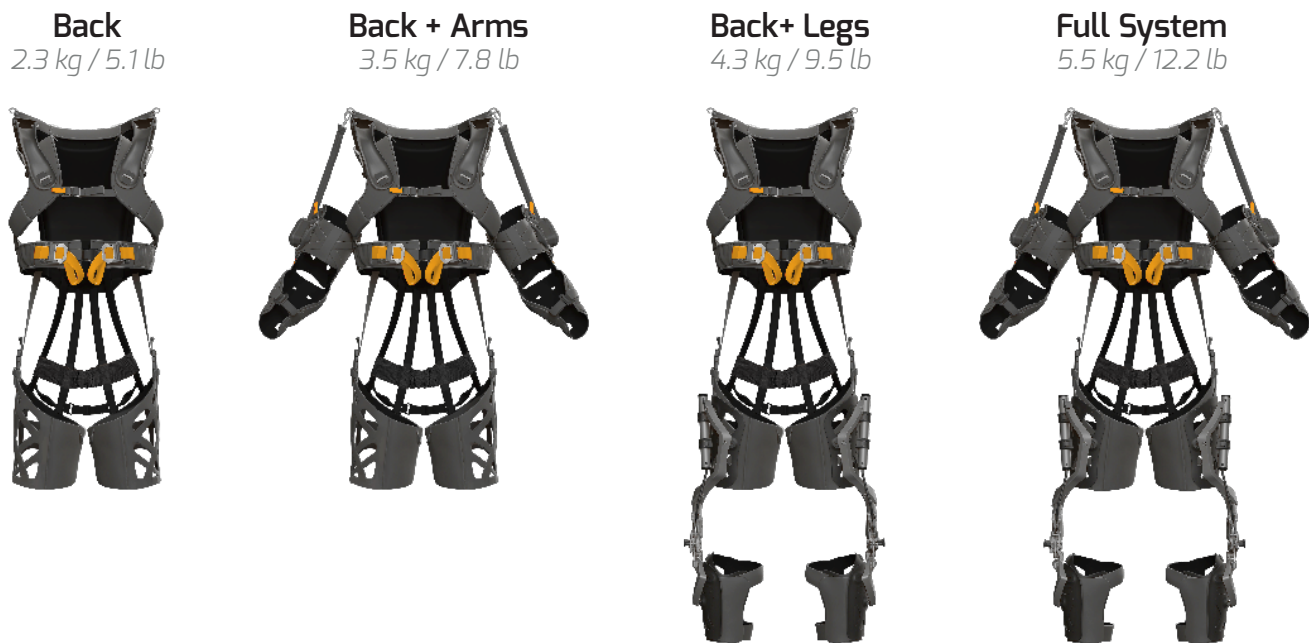


Figure 4 - UPLIFT™ Exoskeleton Configurations

2.0 Size Selection

The complete *UPLIFT™ exoskeleton* consists of three individually sizable modules, designed to be tailored to the user’s needs. In addition, some adjustments are available throughout the UPLIFT™’s modules to further adapt to each user’s unique morphology (refer to section “3.2 UPLIFT™ Adjustment”).

As the Back Module is required in all exoskeleton use cases, the user will need to select one of the 4 torso sizes and one of the 4 thigh harness sizes that best fit their morphology. If the user has chosen the Arm Module, he/she will also have to choose which arm harness size is best suited to their morphology. Please note that the sizing of the Leg Module reflects that of the thigh harness. The Leg Module in fact, does not require any additional size selection, as it replaces the thigh harness, the size of which is selected with the Back Module.

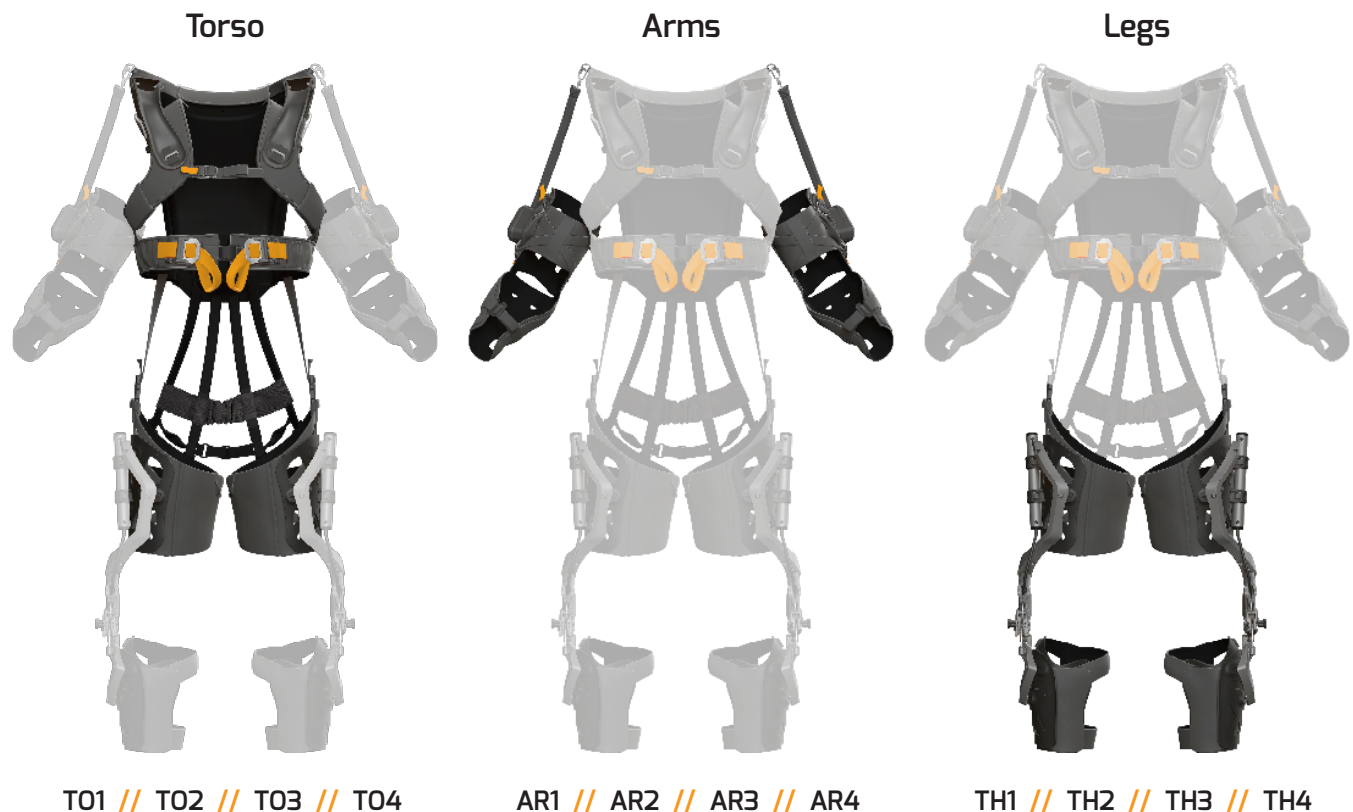


Figure 5 - Available modules sizes

This sizing strategy allows to fit users with distinct body measurements and morphological characteristics. It considers the natural variation in body proportions among individuals. For example, the exoskeleton can be tailored to fit an individual with a large torso and thin limbs.

The table below illustrates the critical measurements needed of the user that guide the selection of the appropriate subsystem size.

Body Measurements

gen-2.1



Back Coutour



Follow instructions on the supplied template. Mark which profile better follows the user's back.

A B

date

company

user name

user height cm ft-in

user weight kg lbs

This form is provided with both metric and imperial units. Please fill the one with whom you feel most comfortable with.

Abdominal Circumference



Measured at the height of the navel.

cm

in

Upper Chest Circumference



Measured just under the armpits.

cm

in

Thigh Circumference



Measured 20 cm / 8 in above the kneecap. On dominant side.

cm

in

Bicep Circumference



Measured on relaxed arm, at the bicep prominence. On dominant side.

cm

in

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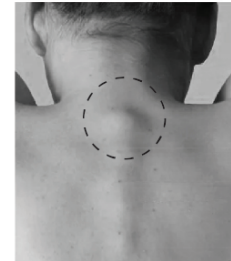
Figure 6 - Body Measurement form front

Body Measurements *instructions*
gen-2.1



Back Countour

Take the template received in the envelope and follow the printed instructions (*profile A* for French and *profile B* for English). Place the upper part of the template (indicated by *C7*) at the location of the 7th cervical vertebra. This vertebra is usually located at the same height as the shoulder and corresponds to the most prominent bone structure at the base of the neck. Try each profile on the user's back and select the one which better mimics the shape of the user's back (with the minimum distance between the profile and the user's back).



Upper Chest Circumference

Ask the subject to raise the arms and place the measurement tape under the armpits. Once done, the subject can lower their arms along their side in a natural posture. Measure the chest circumference once the inspiration phase is completed (we suggest allowing the subject to breathe four to five times before taking the measurement).

Abdominal Circumference

Ask the subject to raise the arms and place the measurement tape at the navel height. Once done, the subject can lower their arms along their side in a natural posture. Measure the abdominal circumference once the inspiration phase is completed (we suggest allowing the subject to breathe four to five times before taking the measurement). Ask the subject to relax their abdominal area during the measurement.

Bicep Circumference

Identify the most prominent portion of the dominant arm (or the middle point between the elbow and the shoulder). Ask the subject to raise this arm and place the measurement tape at that location. Then, ask them to lower it in a natural position and take the measurement with the arm relaxed.

Thigh Circumference

Identify the most prominent portion of the thigh (around the middle of the thigh, or at about 20 cm / 8 " above the knee). Ask the subject to stand evenly on both legs. Wrap the measuring tape around the thigh and note the measured circumference.

BACK			LEGS			ARMS		
	Back Profile	Upper Chest Circumference		Thigh Circumference			Biceps Circumference	
		cm / in		cm / in			cm / in	
T01	A	70.0 / 27.5 - 94.0 / 37.0	TH1	46.5 / 18.3	-	48.0 / 18.9	AR1	20.5 / 8.0 - 25.0 / 9.8
T02		94.0 / 37.0 - 130.0 / 51.2	TH2	48.0 / 18.9	-	55.0 / 21.6	AR2	25.0 / 9.8 - 31.0 / 12.2
T03	B	70.0 / 27.5 - 94.0 / 37.0	TH3	55.0 / 21.6	-	62.0 / 24.4	AR3	31.0 / 12.2 - 38.5 / 15.1
T04		94.0 / 37.0 - 130.0 / 51.2	TH4	62.0 / 24.4	-	70.0 / 27.5	AR4	38.5 / 15.1 - 42.0 / 16.5



v1.0

Figure 7 - Body Measurement form back

Finally, using the set of anthropometric measurements for a specific user, the previous tables provides the sizing charts to fit the user.

Currently, we recommend having a Mawashi representative verify the exoskeleton size selection and fit adjustment session to ensure an optimal fit of the exoskeleton on the user.

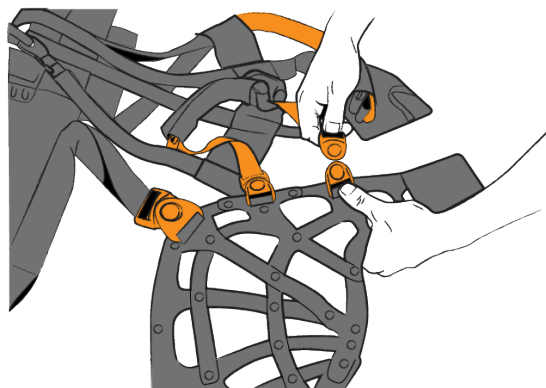
3.0 UPLIFT™ Exoskeleton Usage

3.1 UPLIFT™ Exoskeleton Donning

The illustrations in this section highlight the process of putting on (also known as donning) the exoskeleton. It is recommended to empty pant pockets before donning the exoskeleton for comfort and proper fit.

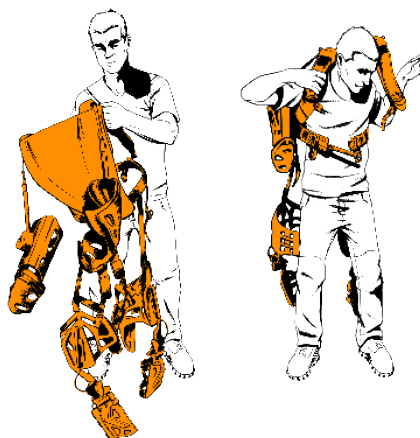
Step 1

Attach the thigh basket to the torso elastics (if not done already).



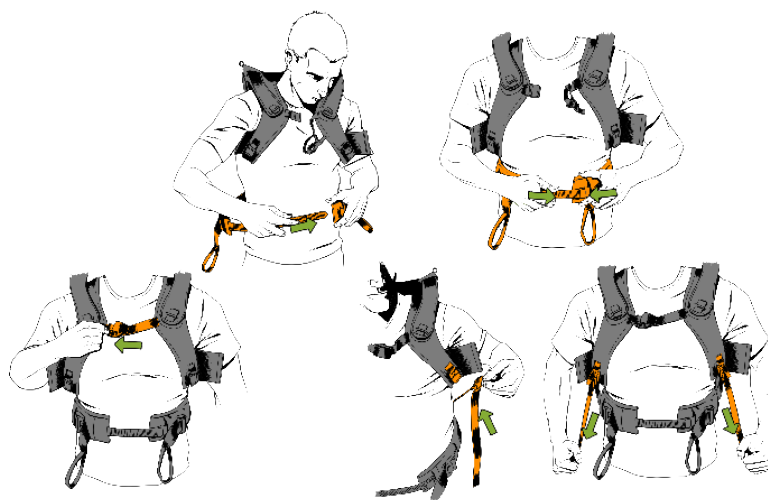
Step 2

Put on the torso harness.



Step 3

Buckle and adjust the length of the different straps of the torso harness.



Step 4

Close the flaps on the front attachments, tucking in it any exceeding strap.

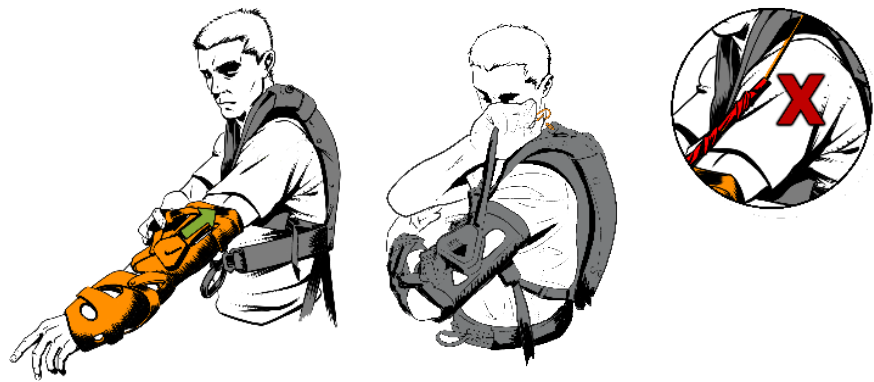
Avoid passing the strap under the back-tensioning system.



Step 5

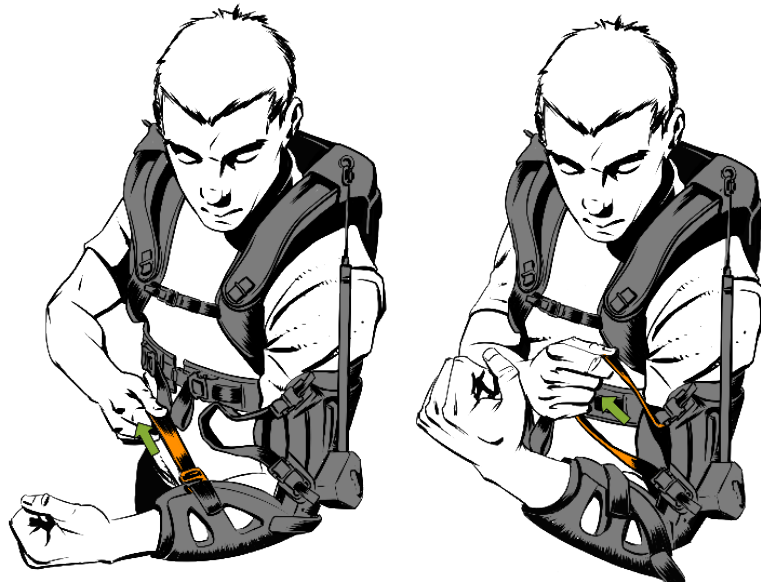
Put on the harness and secure the carabiner to the metal ring on the shoulder (if not done already).

Avoiding twisting the winding reel's mechanism's cable.



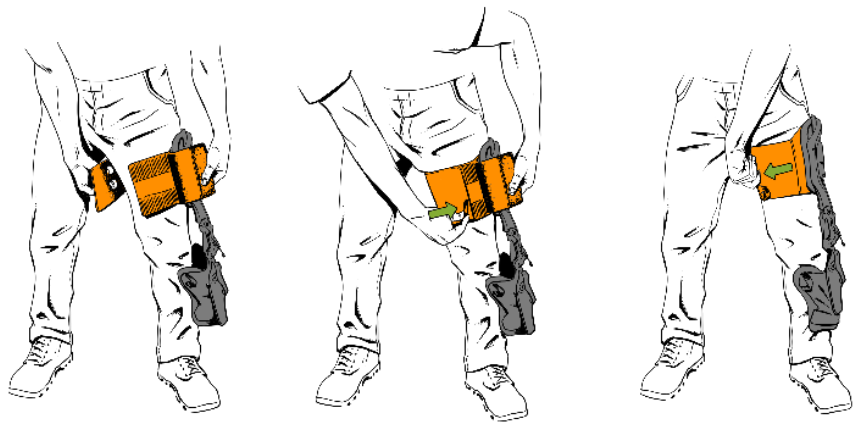
Step 6

Adjust the tension of the arm harness.



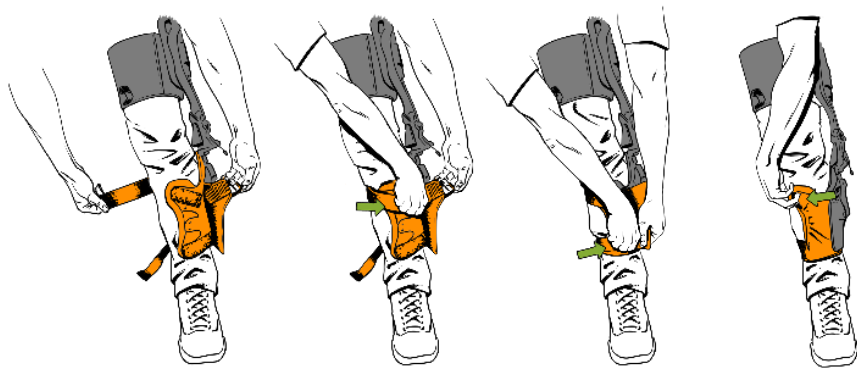
Step 7

Attach the thigh harness leaving room for muscle expansion.



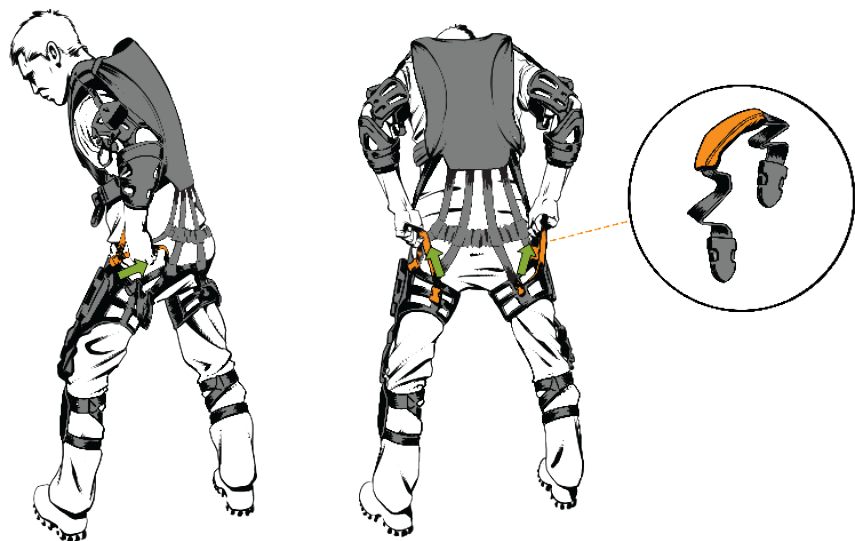
Step 8

Secure the shank harness attachment.







Step 9

Adjust the tension of the straps between the thigh harness and the back.



3.2 UPLIFT™ Exoskeleton Adjustment

In addition to the set of sized parts presented in Section 2.0, the UPLIFT™ platform incorporates several adjustment mechanisms to finely tune the exoskeleton configuration to suit the user’s morphology appropriately. The following table outlines the adjustment mechanisms that can be utilized to optimize the comfort and performance of the UPLIFT™ exoskeleton.

Adjustment Mechanism	When and How to Adjust
 <p data-bbox="509 590 690 664">Side straps: <i>sliding buckle</i></p>	<p data-bbox="871 864 1461 937">Adjust to evenly distribute the support surfaces on:</p> <ul data-bbox="920 959 1194 1155" style="list-style-type: none"> <li data-bbox="920 959 1093 993">// Shoulders <li data-bbox="920 1015 1043 1049">// Chest <li data-bbox="920 1071 1194 1106">// Sides of the Chest <li data-bbox="920 1127 1110 1162">// Lower Back <p data-bbox="871 1203 1461 1276">A light and comfortable contact on each of these areas is recommended.</p>
 <p data-bbox="509 944 715 1052">Shoulder straps: <i>hook and loop fasteners</i></p>	
 <p data-bbox="509 1297 690 1371">Chest strap: <i>sliding buckle</i></p>	
 <p data-bbox="509 1651 824 1759">Lumbar cushion position: <i>hook and loop fasteners</i></p>	<p data-bbox="871 1742 1370 1815">Adjust the height of the lumbar support according to the user’s preference.</p>



Waistband:
sliding fastener

Tighten slightly.
A loose fit is recommended.



Thigh harness:
hook and loop fasteners

Tighten and, if necessary, adjust the overlap angle according to the user's preference.

Shank harness:
hook and loop fasteners

Shank harness can be cut to remove excess strap length, making it easier for a specific user to wear the exoskeleton.

(Refer to Section 3.2.1)



Back thigh strap:
sliding buckle

Tighten to calibrate the function of the Back Module.

A very slight tension should be felt for secondary tasks, such as climbing stairs. This simplifies the degree of adjustment of the back support (see section 4.1). If necessary, loosen for seated tasks .

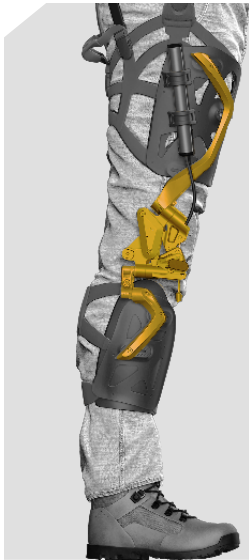
This strap can be adjusted in length.

(Refer to Section 3.2.1)



Lateral thigh strap:
sliding buckle

Tighten according to user's preference to stabilize the vertical position of the thigh harnesses and the Leg Module.



Transverse position of the thigh and leg metal structure:

sliding screws

These mechanisms allow for optimizing the support of the leg structure on the user. They also ensure the fluidity of the knee movements and foster user comfort.

Angular position of the knee mechanism:

hirth mechanisms retained by screws

Adjust these mechanisms according to the provided training or request the assistance of a Mawashi employee to make these adjustments.

Improper adjustments of the knee mechanism can lead to serious injuries.



Arm strap:

sliding buckle

Forearm strap:

sliding buckle

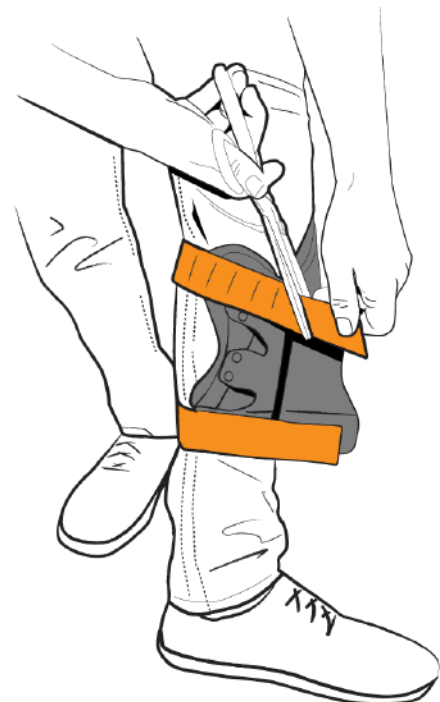
Tighten according to the user's preference.

3.2.1 Straps Length Adjustment

1. *Shank harness loop fastener:*

If the hook and loop fasteners on the leg harness are too long after donning, it is possible to cut the exceeding strap. Use the gray lines on the loop fastener straps as reference to cut the excess strap.

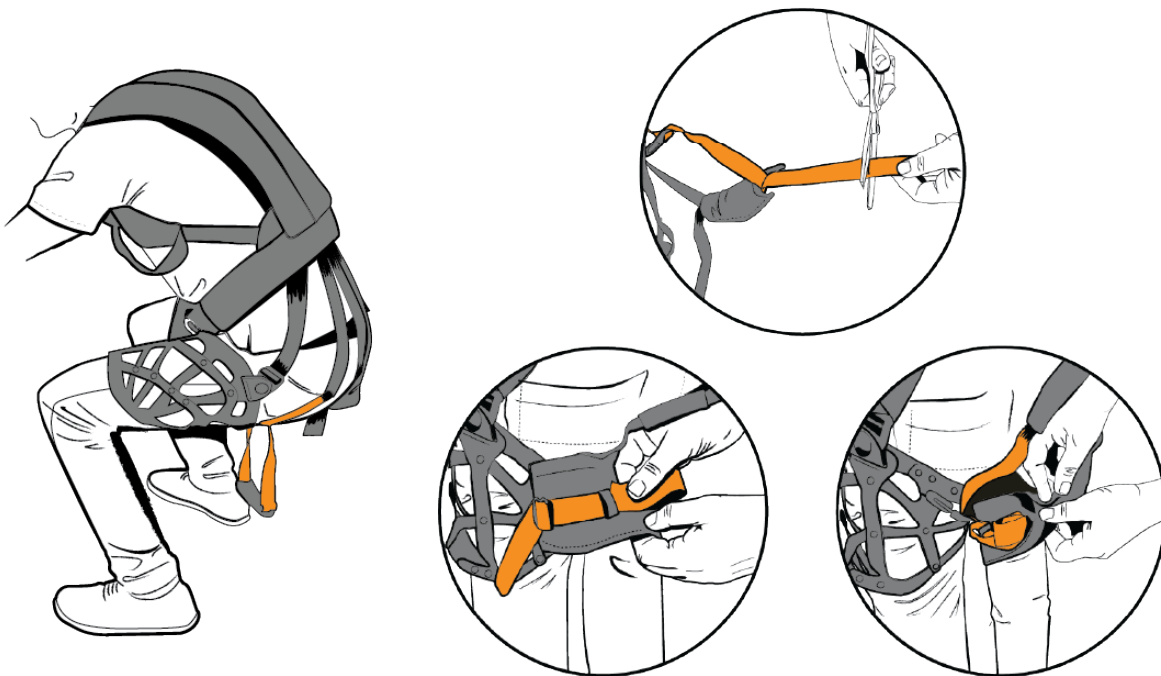
Do this only if the module is not shared with any other user!



2. Back Thigh Strap: Sliding Buckle Adjustment

To adjust the Back Module to the user's morphology, don the *UPLIFT™* exoskeleton (torso only with thigh harnesses). Tighten the back thigh straps until you feel a very slight tension for secondary tasks, such as climbing stairs or sitting. If the remaining length of the straps feels inconvenient and could pose a snag hazard, follow these steps to adjust their length:

- a. Loosen the back thigh strap until you are able to sit down comfortably and/or to perform a lunge without restriction. This is your maximum length;
- b. Take the length of the remaining straps, open the pocket on the back thigh strap and fold the straps into the pocket (cut the exceeding webbing if needed and if the exoskeleton is not shared with other users);
- c. Close the pocket with the hook and loop fasteners;
- d. Completely loosen the back thigh straps;
- e. Take off the thigh harness;
- f. Try to put on the thigh harnesses again. If it is difficult to wear the thigh harnesses start the process again from point a.



3.3 UPLIFT™ Exoskeleton Doffing

This section illustrates the process of taking off “doffing” the exoskeleton.

Step 1

Untie shank and the thigh harnesses.



Step 2

Untie arm harnesses.
Then remove the arm harnesses.



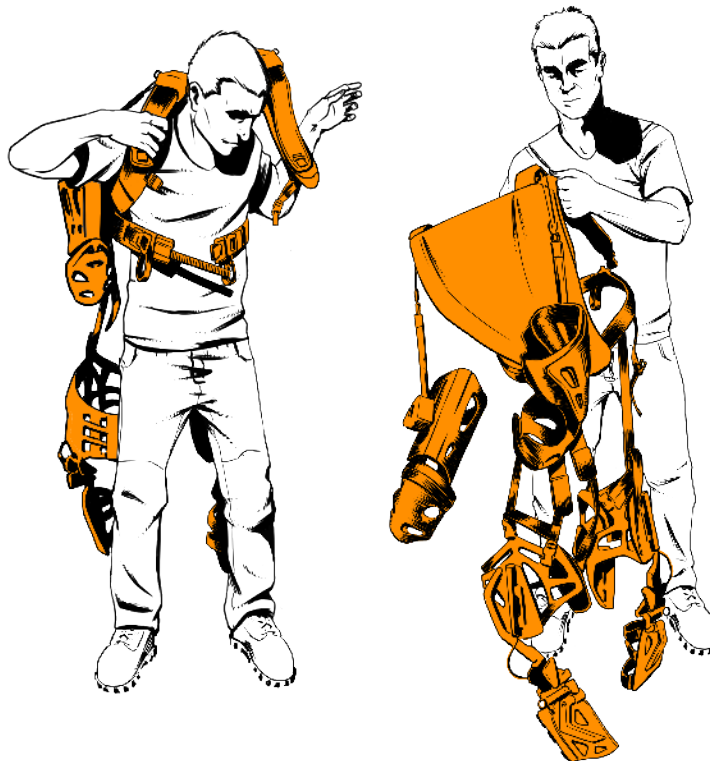
Step 3

Untie all torso harness attachments.



Step 4

Take off the exoskeleton.



4.0 Operation of the Assistance Modules

When to use the *UPLIFT™ exoskeleton* assistance

Task	Back Assistance	Arm Assistance	Leg Assistance
Bending	ON	ON // OFF	ON // OFF
Stooping	ON	ON // OFF	ON // OFF
Squatting	ON	ON // OFF	ON
Manipulate or lift load below the shoulder	ON	ON // OFF	ON // OFF
Manipulate or lift load above the shoulder	ON	ON	ON // OFF
Leaning forward	ON	ON // OFF	ON // OFF
Kneeling	ON	ON // OFF	ON // OFF
Walking short distances	ON	ON // OFF	ON // OFF



When NOT to use the *UPLIFT™ exoskeleton* assistance

Task	Back Assistance	Arm Assistance	Leg Assistance
Stepping on/off from equipment (such as chair lift, climb masters, etc.)	OFF	OFF	OFF
walking long distances	OFF	OFF	OFF
running	OFF	OFF	OFF
climbing stairs, ladders, or scaffoldings	OFF	OFF	OFF
sitting	OFF	OFF	OFF
operating equipment from a seated position	OFF	OFF	OFF
lying down	OFF	OFF	OFF
crawling	OFF	OFF	OFF
others awkward positions where the	OFF	OFF	OFF

UPLIFT™ exoskeleton assistance is not needed

The *UPLIFT™ exoskeleton* is not intended to be used:

- // Without training by Mawashi staff or other professionals recommended by Mawashi.
- // Without user fitting by Mawashi staff or other staff recommended by Mawashi.
- // To increase productivity.
- // To manipulate objects that cannot otherwise be manipulated safely by the user without the *UPLIFT™ exoskeleton*.

4.1 Use of the Back Module

The UPLIFT™ exoskeleton includes a module designed to assist the user's back. This mechanical system utilizes elastic bands that can be tensioned upon activation of the Back Module, helping to ease part of the load on the user's back.

To activate the Back Module and adjust the tension applied to the elastic bands, the user must pull on the straps of the tensioning system located on the abdominal belt.

This tension can be adapted to the user's needs.

To release the tension (deactivation of the Back Module), the user must pull on the rigid release buckles located on the abdominal belt while slightly leaning forward. This action allows the elastic bands to return to their original state.

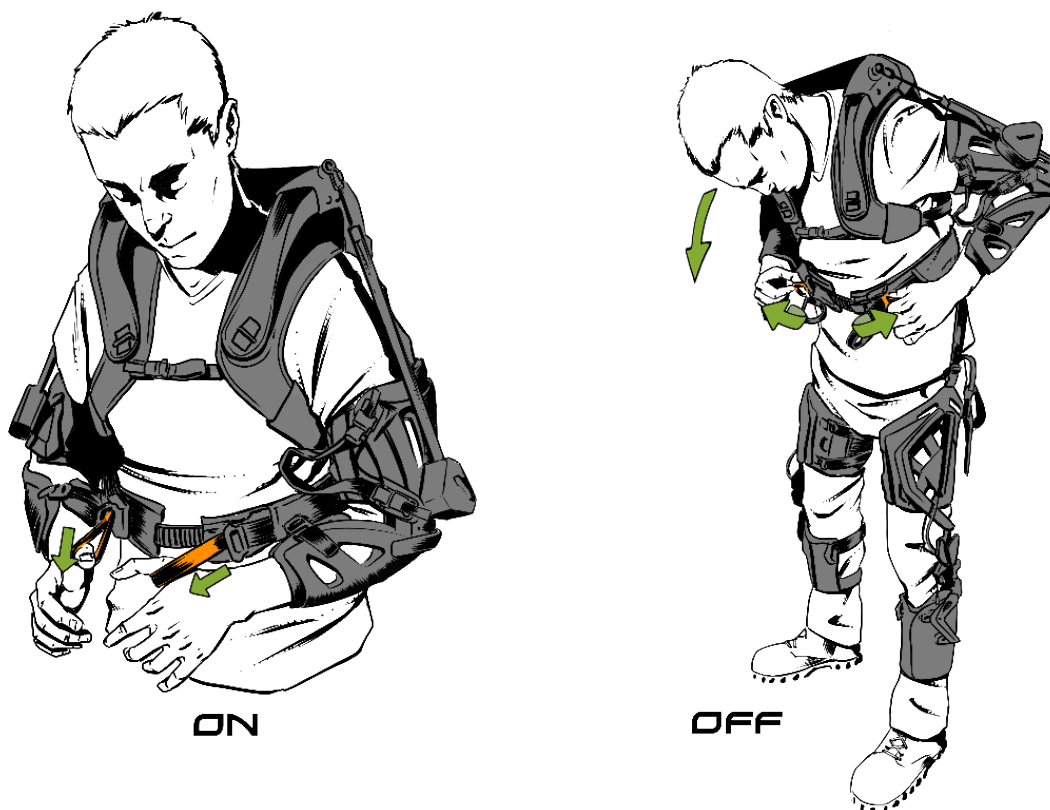


Figure 8 - Tension Adjustment in the Elastomeric Bands for Back Support.

4.2 Use of the Arm Module

The UPLIFT™ exoskeleton can be equipped with a shoulder assistive module: the Arm Module. This component uses tension applied to elastic elements, placed inside the torso, to provide partial support for the load on the user's shoulders.

To activate the Arm Module, follow these steps:

1. Lock the winding reel on the upper arms by pulling the activation switch inward towards the user.
2. Raise your arms. (You will hear a ticking noise coming from the winding reels.)



Figure 9 - Activation of the Arm Module

The amount of the assistance generated by the Arm Module varies with the orientation of the arms. The highest assistance is achieved when the arms are raised above the shoulder level. As the arms move downward, the assistance gradually decreases, reaching a minimum (near zero) when the arms are alongside the hips.

Additionally, the strength of this assistance can be tuned by the knobs located at the bottom of the torso. Turning the left knob clockwise and the right knob counter-clockwise to increase the level of assistance.

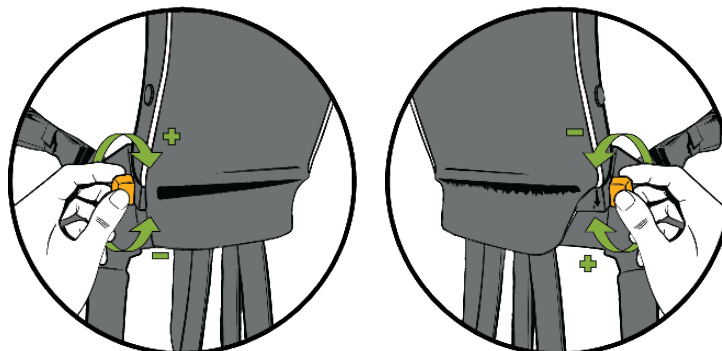
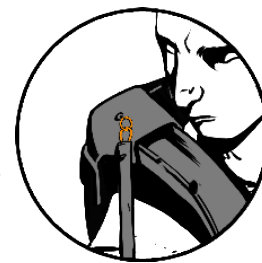


Figure 10 - Arm Module assistance adjustment

The level of shoulder assistance can also be increased by tensioning the elastic bands of the Back module, or more specifically, by pulling on the orange straps of the abdominal belt.

To deactivate the Arm Module, follow these steps:

1. Raise the arms to shoulder level or above.
2. Push the activation switch outward, towards the exterior of the body.
(Verify that the ring on the Arm Module cable moves back to its initial position).



This will release the winding reels, shutting off the shoulder assistance.

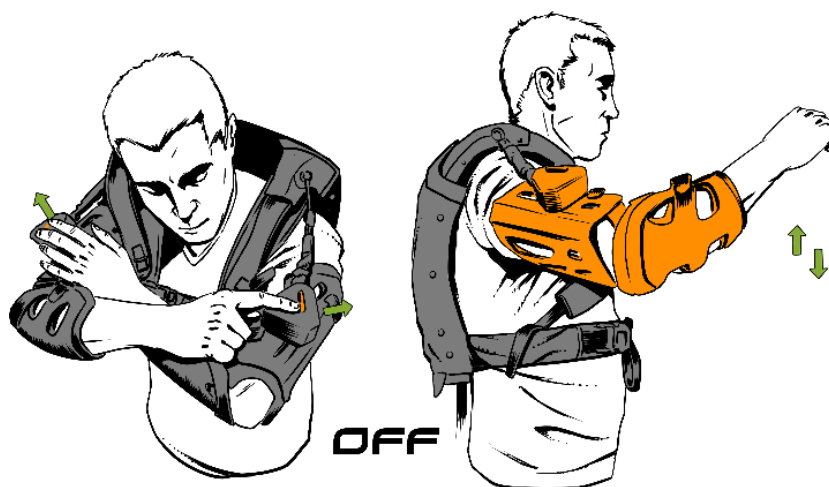


Figure 11 - Deactivation of the Arm Module



Figure 12 - Deactivation of the Arm Module

4.3 Use of the Leg Module

The UPLIFT™ exoskeleton includes a module designed to assist the user's knees when maintaining a squat or crouch position, or when standing up from it. This module helps support the user's weight and assists in returning to an upright position.

To activate the knee assistance, follow these steps:

1. Pull the spring-loaded mechanism.
2. Place the free end of the knee cable into the cavity of the knee mechanism.
3. Release the spring-loaded mechanism.

To deactivate the knee assistance, follow those steps:

1. Pull the spring-loaded mechanism.
2. Release the bottom end of the cable from the knee cavity.
3. Release the spring-loaded mechanism.
4. Place the knee cable end into the designated clip above the mechanism (third illustration in figure below) to prevent the knee cable from moving in the way of the knee mechanism.

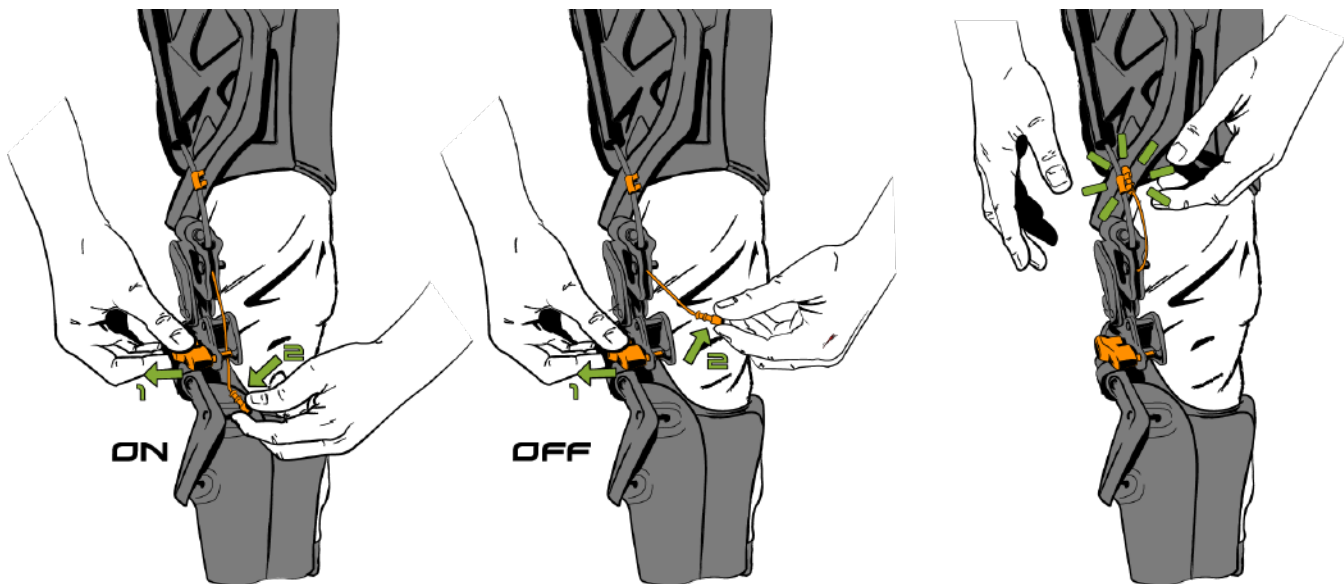


Figure 13 - Activation and Deactivation of the Leg Module

Additionally, the Leg Module allows the user to modulate the level of assistance and the initial angle at which the knee assistive system engages following the flexion of the user's legs.

Depending on the user's need for lower limb assistance, the user can choose between three different assistance levels, which are determined by the number on the metal part at the end of the knee cable.

As depicted in the figure below:

- // Configuration 1 provides the maximum assistance and earliest activation angle.
- // Configuration 2 provides medium assistance and median activation angle.
- // Configuration 3 provides the lowest assistance and latest activation angle.

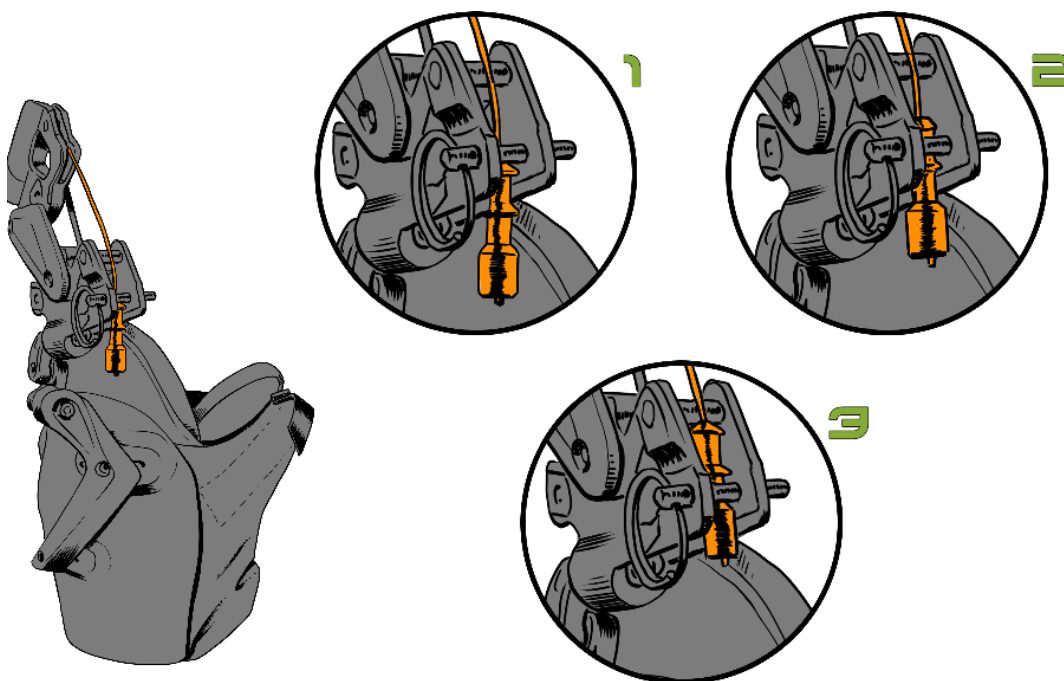


Figure 14 - The three Configurations of the Assistance Levels and Activation Angles for the Leg Module.

4.4 Familiarization with the UPLIFT™ Exoskeleton

If you are new to the UPLIFT™ exoskeleton, please contact Mawashi's Customer Support or consult a professional with experience in implementing exoskeletons in the workplace to obtain more technical information about deploying of such technology in your specific work environment.

As with other pieces of equipment worn on the body, it is necessary for a new user to become accustomed to the UPLIFT™ exoskeleton. Therefore, Mawashi recommends starting to use the UPLIFT™ exoskeleton for a limited period of time and gradually increasing the usage time based on the user's familiarity with this equipment. As a general guideline for the new UPLIFT™ exoskeleton users, Mawashi proposes the following schedule:

Day 1 and Day 2:

// Wear the UPLIFT™ Exoskeleton for up to 1 hour

Day 3 and Day 4:

// Wear the UPLIFT™ Exoskeleton for up to 2 hours, not necessarily consecutively

Day 5:

// Wear the UPLIFT™ Exoskeleton for up to half of the working day with breaks as needed

Day 6:

// If the user is familiar and comfortable with the UPLIFT™ Exoskeleton and has mastered the control of the assistance, he/she can now wear the UPLIFT™ Exoskeleton full time, according to the needs of the tasks performed.



The UPLIFT™ Exoskeleton is designed to help the users during the tasks involving the manipulation of the load. Moreover, it is designed also to allow the user to perform others secondary tasks without restriction, when assistive modules are deactivated.

However, Mawashi suggest to use the UPLIFT™ Exoskeleton only when necessary. The UPLIFT™ exoskeleton is not intended to use to increase productivity or to manipulate objects that cannot be otherwise safety handled without the UPLIFT™ Exoskeleton (for instance, very heavy or very large objects).

4.5 Maintenance

A maintenance sheet is provided in Annex A to facilitate the maintenance of your UPLIFT™ exoskeleton.

For its maintenance, the exoskeleton can be cleaned with a garden hose. Avoid using a pressure washer as it could damage the textile parts of the exoskeleton. Then, let it air dry. Make sure that everything is dry before use or storing.

In addition, paddings can be removed from the exoskeleton and machine washed (see Maintenance Sheet in Annex A and illustrations on how to remove these paddings).

Finally, it is recommended to periodically inspect and adjust the torque applied to certain screws (after 100 hours of use). The figures below highlight the bolts & screws that require a torque check and specify the proper torque value that should be applied.

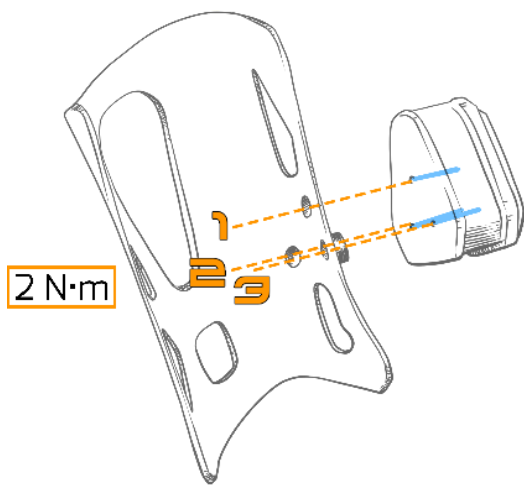


Figure 15 - Appropriate Torque Values for the Arm Assembly.

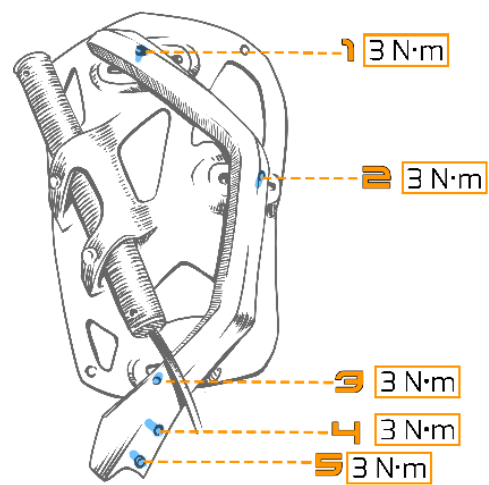


Figure 16 - Appropriate Torque Values for the Thigh Assembly.

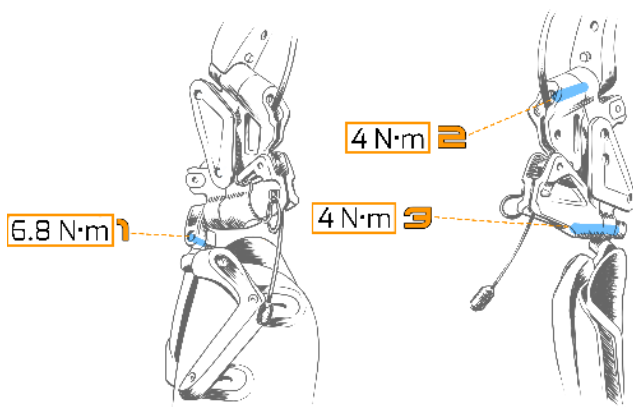


Figure 17 - Appropriate Torque Values for the Knee Assembly.

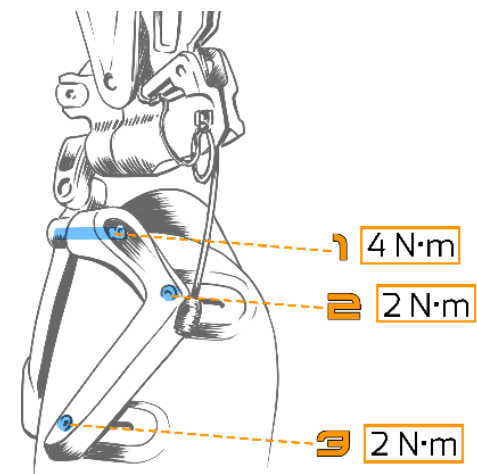


Figure 18 - Appropriate Torque Values for the Shank Assembly.



5.0 Warnings



The *UPLIFT™ exoskeleton* may not be suitable for all users and/or all use cases. Please read carefully the warnings below and should you have any questions, contact Mawashi Science & Technology.

<i>UPLIFT™ exoskeleton</i> Application Conditions		
Operational Conditions	Temperature	-10°C to +50°C (14°F to 122°F)
	Relative Humidity	0% to 100%
Storage and Transportation Conditions	Temperature	-32°C to +50°C (-26°F to 122°F)
	Relative Humidity	0% to 70%
Work Tasks and Object Handling	<ul style="list-style-type: none"> // This product is designed to assist tasks involving handling and manipulation of objects. // This product is designed to prevent musculoskeletal injuries and to reduce fatigue for individuals performing frequent handling and manipulation of objects. // The <i>UPLIFT™ exoskeleton</i> is not designed to increase the physical capacity of the user. // Keep the weights of objects handled within the range prescribed by applicable occupational health and safety regulations. 	

Warnings	<p>The <i>UPLIFT™ exoskeleton</i> does NOT increase strength. DO NOT lift loads that are heavier than you can typically lift without the <i>UPLIFT™ exoskeleton</i>. The <i>UPLIFT™ exoskeleton</i> does not prevent injuries that arise from inappropriate lifting techniques.</p> <p>This product has not and can't be evaluated for all possible masonry or warehousing work contexts. Use your judgement before using the <i>UPLIFT™ exoskeleton</i> to assist with a task, and if in doubt, always contact Mawashi Science & Technology.</p> <p>It is essential to assess the potential risks prior to integrate the exoskeleton in a real context of use. The implementation of the exoskeleton must be carried out with care, following the warning instructions.</p> <p>It is strongly recommended to integrate the use of the exoskeleton under the supervision of an occupational health and safety representative.</p> <p>Contact Mawashi if questions arise regarding the compatibility of the exoskeleton with the determinants of the work activity† to be performed.</p> <p>For recommendations concerning the deployment of exoskeletons in work contexts, consult the ASTM F3527 <i>Standard Guide for Assessing Risks Related to Implementation of Exoskeletons in Task-Specific Environments</i> and/or the INRS ED6315 (2018) guide entitled <i>Acquisition et intégration d'un exosquelette en entreprise - Guide pour les préventeurs</i> (in French only).</p> <p>†Determinants of the work activity: The set of factors that create an activity scenario. Examples: environment, personal protective clothing and equipment, machinery, tools, vehicles, time constraints, physical and mental demands, policies and procedures, interaction with others.</p>
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WARNINGS	
Biomechanical Risks	Instructions to follow
<p>The exoskeleton has passive modules to assist the back, shoulders and knees when performing the following operations:</p> <ul style="list-style-type: none"> // Bending // Squatting // Handling heavy objects with the arms <p>Each of these modules can be activated, deactivated, and adjusted according to the user's activity, the weight handled, as well as the user's morphology and preference.</p> <p>Wearing the exoskeleton with the assistance modules activated at all times can cause discomfort and, in the long run, overuse of the joints.</p> <p>Maintaining too much tension on the Back Module can cause fatigue and, in the long run, overuse of the back joints.</p>	<p>Wearing the exoskeleton should be limited to subjects whose anthropometric measurements are covered by the sizing chart provided in Section 2 of this guide.</p> <p>Follow the instructions provided in Section 3 of this guide to ensure proper fit of the assistive modules.</p> <p>Wearing the exoskeleton should be limited to properly trained individuals. Training on the proper use of the exoskeleton is one of the requirements to protect people from hazards and to ensure that the product is operated correctly and safely.</p> <p>It is not recommended to keep the assistance modules activated at all times. Disable the assistance modules when taking breaks, as well as when performing secondary tasks (such as walking, going up and down stairs, communicating with colleagues, etc.).</p>

WARNINGS	
<p>Wearing the exoskeleton with the Leg Module activated can affect the user’s balance when going up and down steps and during abrupt terrain transitions.</p> <p>Wearing the exoskeleton with the Arm Module activated can affect the user’s capacity and promptness to react to an emergency situation (ex: such as promptness to reach a machine emergency stop button).</p>	<p>It is recommended to adjust the tension of the Back Module according to the user’s preference and, if necessary, to vary this tension during the use of the exoskeleton.</p> <p>If the user experiences significant joint pain or discomfort during or as a result of using the exoskeleton, discontinue use of the exoskeleton, notify your supervisor and/or occupational health and safety officer, and follow applicable instructions.</p> <p>Avoid wearing the exoskeleton when working alone or in an isolated environment.</p>
Risks related to pre-existing medical conditions	Instructions to follow
<p>If you have any known medical condition, the exoskeleton could aggravate a pre-existing medical condition.</p>	<p>The exoskeleton should never be used by anyone with a diagnosed medical condition without the supervision and clearance of a physician .</p>
<p>The exoskeleton, notably its magnetic fasteners, could potentially damage a medical device with which it is not compatible.</p>	<p>The exoskeleton should never be used by a person using external medical devices.</p> <p>The exoskeleton should never be used by a person with a pacemaker.</p>
<p>The exoskeleton may cause allergic skin reactions or make skin conditions worse.</p>	<p>Wearing clothing under the exoskeleton is strongly recommended.</p> <p>The exoskeleton should not be worn by anyone with known skin allergies.</p> <p>If skin irritation occurs with use, discontinue usage and notify Mawashi.</p>
<p>The risks associated with the wearing of exoskeletons by pregnant women are not well understood.</p>	<p>The exoskeleton should not be worn by pregnant women</p>
Risks of incompatibility with personal protective clothing and equipment	Instructions to follow
<p>Wearing clothing over the exoskeleton may limit access to the control functions of assistive modules.</p> <p>Non-exhaustive tests have been performed and show no damage or risks of deterioration in the protective effectiveness of fall arrest harnesses, work helmets, kneepads and visibility vests.</p> <p>However, it is possible that the exoskeleton could affect the protective performance of some models of this equipment.</p>	<p>Wear thermal clothing, such as a jacket or windbreaker pants underneath the exoskeleton, to ensure access to the control functions of assistive modules.</p> <p>Wear the fall arrest harness following the instructions provided in Annex B. Conduct a compatibility assessment of the fall arrest harness model with the exoskeleton. If in doubt, contact Mawashi.</p> <p>Conduct a compatibility assessment of the work helmet and kneepad design with the exoskeleton. If in doubt, contact Mawashi.</p> <p>If other personal protective equipment is to be used during work tasks, check its compatibility with the exoskeleton. If in doubt, contact Mawashi.</p>

Risks related to loss of balance and working at height	Instructions to follow
<p>Wearing the exoskeleton on slippery, uneven, or unstable floor surfaces can increase the risk of loss of balance and falls.</p>	<p>Wear the fall arrest harness when there is a risk of falling from a height and in accordance with the regulations in force</p> <p>Avoid activating the Leg Module when working on slippery, irregular or unstable surfaces or when there is a risk of falling from a height.</p>
Risks caused by moving parts	Instructions to follow
<p>There is a crushing and shearing hazard between the following parts:</p> <ul style="list-style-type: none"> // Moving parts of the knee pivot. // Moving parts of the in the torso enclosure.  	<ul style="list-style-type: none"> // Avoid putting your fingers in the knee mechanism // Avoid putting your fingers into the torso mechanism under the torso cover. // Keep the mechanism covered at all time by the torso cover. // The torso cover should only be removed to perform maintenance on the exoskeleton. // NEVER perform maintenance of the exoskeleton while a user is wearing the exoskeleton. Always remove "doff" the UPLIFT™ exoskeleton before performing maintenance. // Make sure the assistance is disengaged before performing maintenance. // Handle the exoskeleton with care when donning, doffing and when handling it.
<p>The movement of mechanisms can be affected by the accumulation of debris or environmental elements.</p>	<p>The critical mechanisms are covered by textile/plastic elements to minimize the risks of debris infiltration. Be careful when using the exoskeleton in the presence of ice, mortar and debris.</p> <p>Before usage, check the mobility of the exoskeleton mechanisms by performing back, arm and knee movements with assistive modules turned on and off. If blockages are perceived, visually inspect the moving parts and remove accumulations.</p>

<p>Risk associated with the delayed retraction of the shoulder's assistance cable.</p>	<p>Verify that the ring on the cable coming out from the shoulder bridge is at the initial position (in contact with the shoulder bridge) once the arm assistance is off.</p> <p>If the previous condition is not met, there is a possibility of an unexpected fast retraction motion of the cable.</p> <p>The fast unexpected retraction of the cable could cause pinching of the fingers.</p> <p>The unexpected fast retraction of the cable could surprise the user, leading to uncontrolled reactions that may result in slips, trips, dropped tools, or other unpredictable responses.</p>
<p>Risk of breakage and mechanical wear</p>	<p>Instructions to follow</p>
<p>The application of excessive loads on the exoskeleton (fall, impact, improper storage, etc.) can cause breakage or premature wear of certain components and assemblies.</p>	<p>Do not hang the exoskeleton by the cables of the Back, Arm or Leg Modules.</p> <p>Follow the maintenance procedures described in Section 4.5 on a regular basis.</p> <p>If excessive loads (e.g., fall, impact,...) have been applied to the exoskeleton, visually inspect the system for cracks or signs of breakage. If cracks or breakage are observed, avoid using the exoskeleton. If in doubt, contact Mawashi.</p> <p>If during use, signs of failure are observed (e.g., cracks, perceived change in function), discontinue use and notify Mawashi.</p>
<p>Risks of exposure to heat sources and flames</p>	<p>Instructions to follow</p>
<p>Some components and functions may be damaged if exposed to direct flame, embers or direct heat.</p>	<p>Do not handle or use the exoskeleton near flames, embers or other sources of direct heat.</p>
<p>Risks of biological contamination</p>	<p>Instructions to follow</p>
<p>Like any equipment, if passed from person to person, the exoskeleton can be a platform for transmission of infectious diseases</p>	<p>To limit the transmission of infectious diseases, clean surfaces with a sanitizing free-alcohol spray bottle or wipes. Let dry between uses.</p>
<p>Risks related to the use in particular environments or in the presence of particular materials</p>	<p>Instructions to follow</p>
<p>Sparks may be created between the moving metal parts of the system</p> <p>Exoskeleton parts could react with active chemicals and, therefore, cause a risk of poisoning and/or damage to the exoskeleton.</p>	<p>Do not use in explosive environments</p> <p>Do not use the exoskeleton in the presence of active chemicals. If in doubt, contact Mawashi.</p>

6.0 Warranty

LIMITED WARRANTY: important this warranty is the customer's sole and exclusive warranty and replaces all other warranties or conditions, express or implied.

Mawashi warrants this the product's materials and workmanship to be free from defects and conforms in all material respects with Mawashi's specifications for the product. The warranty period is 12 months from the delivery of the product and covers only the mechanisms of the product. Specifically, this warranty does not cover the following:

- a. Failure or damage of Soft goods parts, cables and elastic elements
- b. Failure or damage resulting from misuse, abuse, negligence, shipping damage, failure to operate in accordance with Mawashi's instructions, accident, modification, unsuitable physical or operating environment, improper maintenance or improper storage; or
- c. Failure caused by a product for which the Mawashi is not responsible, or
- d. Failure or defects resulting from normal wear and tear, including color fading.

In the event any portion of the Product fails to conform to this warranty, Mawashi sole liability and customer's exclusive remedy for breach of said warranty, for any cause whatsoever, including negligence, irrespective of whether such defects or claims are discoverable or latent, shall be, at Mawashi option, to repair or provide replacement parts. Removal and reinstallation expenses and/or work and transportation charges are not part of this warranty and shall be the responsibility of the customer. Customer may not back charge Mawashi for warranty claims without the Mawashi's prior written consent. Product repaired, rebuilt or modified by the customer or other third parties without Mawashi's prior written consent carry no warranty, either express or implied. It is understood and agreed that some parts and/or materials included herein, such as, but not limited to, consumables, elastic elements, and soft goods parts, are by their nature and use expendable and replaceable under normal operating conditions and shall be warranted only as to their quality when new, but there is no warranty of the life of said expendable or replaceable parts and/or materials, express or implied. This warranty does not cover the effects of normal wear or use of the Product. This warranty is conditioned upon prompt notice of the particular warranty nonconformance within ten days of discovery, proper use and maintenance of the product, reasonable access being provided to Mawashi to inspect the product and no further damage to the product from acts.

6.1 Warranty Claims

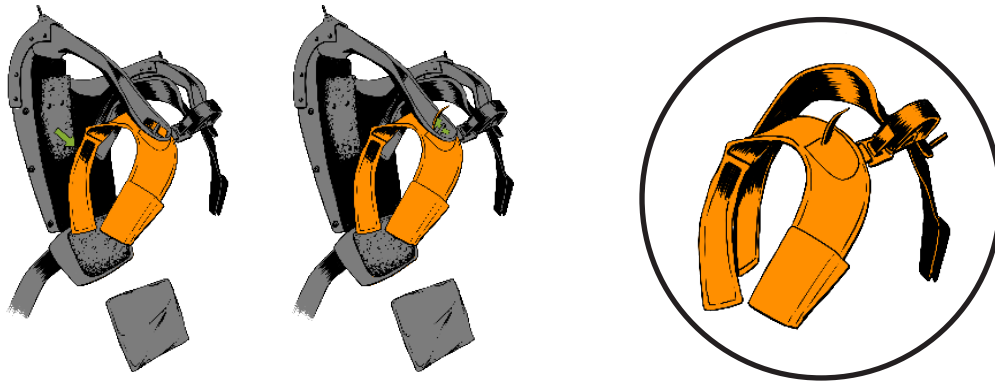
In the event of a defect covered by this warranty, the Customer shall promptly notify Mawashi by contacting our Customer Support team at info@mawashi.ca or by phone at +1.888.629.2744. The Customer may be required to provide proof of purchase, serial number, and other relevant information for the warranty claim process.

Annex A

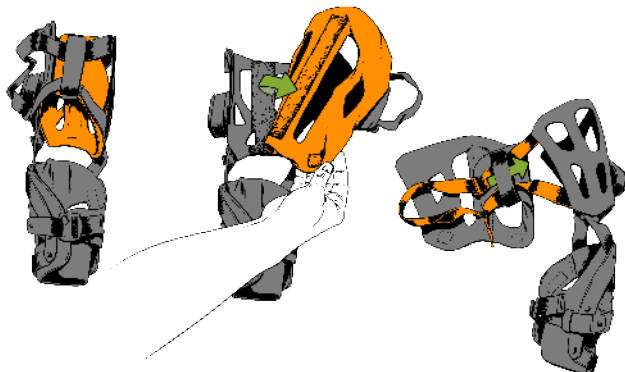
Maintenance Sheet

To ensure the proper functioning of your *UPLIFT™ exoskeleton*, the following actions should be performed periodically:

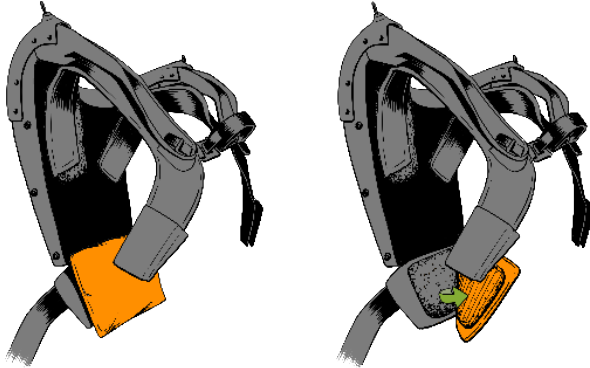
- // Perform a visual inspection of the system to detect possible anomalies:
 - a. Visible wear of the Arm Module cables.
 - b. Cracks in plastic parts.
 - c. Blockage by debris of the cable guides of the assistance cables.
- // Tighten the screws to the proper torque level after 100 hours of use with a torque wrench (refer to section "4.4 Maintenance").
- // Clean superficial stains and dirt on the main parts of each module with a wet washcloth.
- // Clean the webbing and attachment system with soapy water and washcloth.
- // Disinfect interior padding to prevent lingering odors using any popular brand of sportswear cleaner (alcohol-free).
- // Clean the following paddings in the washing machine:
 - d. Chest padding



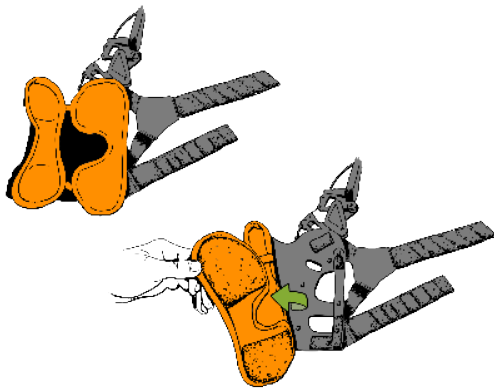
e. Biceps and Forearm paddings



f. Lumbar Padding



g. Shin Paddings



// Dust off the entire exoskeleton with compressed air to remove any remaining loose dirt or dust.

Alternatively – rinse the entire exoskeleton with a garden hose (NEVER use a pressure washers) and let it air dry (check that everything is dry before storing or using).

Annex B

Integration with the Fall Arrest Harness

In order to retain the protective features of the fall arrest harness, follow these steps:

1. Put on the entire fall arrest harness over the *UPLIFT™ exoskeleton*;
2. Place the torso-front components of the fall arrest harness underneath the *UPLIFT™ exoskeleton* waist band and chest strap;
3. Adjust the fall arrest harness according to the supplier's recommendations;
4. Close and adjust the *UPLIFT™ exoskeleton* waist band and chest strap.



CAUTION: Always check the compatibility of the fall arrest harness model with the exoskeleton before use. If in doubt, contact Mawashi Science & Technology.





MAWASHI

SCIENCE & TECHNOLOGY

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