

OPERATING MANUAL

EVO™ Exoskeleton

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Patents/Patents Pending

For a list of patents and patents pending, refer to the Ekso Bionics website.

Disclaimer

Potentially serious injury may occur in connection with the use of Ekso EVO. Ekso Bionics, Inc. shall not be liable for any injury or damage suffered by any person, either directly or indirectly, as a result of the use or repair of Ekso EVO in violation of your contract with Ekso Bionics, Inc. Ekso Bionics, Inc. does not accept any responsibility for any damage caused to its products, either directly or indirectly, as a result of use and/or repair by unauthorized personnel.



WARNING: Potentially severe injury may occur from misuse. DO NOT use the Ekso EVO unless you are capable of protecting the safety of yourself and any other person in the vicinity. Ekso Bionics, Inc. is not responsible for any loss or damage that occurs in connection with your use of the Ekso EVO.

Standard Limited Warranty Against Defects in Materials and Workmanship

Ekso Bionics, Inc. warrants the EVO to be free of manufacturing defects in material and workmanship for a period of one year from the original date of purchase. Consumable parts including all soft goods (arm cuffs, hip belt pads, belt extensions, belt webbing, and torso support pad) with a demonstrable defect are covered by this same one-year warranty. Damage caused to these consumable parts due to normal wear and tear during the course of normal use is not covered by this warranty. The Standard Limited Warranty does not cover any repairs required as a result of user errors, accidents, misuse, neglect or operation outside of the device's intended use. The Standard Limited Warranty is void if the EVO is altered in any way or has not been used in accordance with the operator manual. Please review all product documentation for important product care and maintenance requirements.

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CHAPTER 1: INTRODUCTION

Repetitive work on the shoulders is the most common cause of lost workdays due to workplace injuries. EVO is an upper body exoskeleton that alleviates the burden of repetitive work and targets the shoulders. Based on collaboration and insights from Ekso's global install base and experience with its ground-breaking EksoVest technology, EVO is designed to improve the user experience and drive adoption.

Stacked link structure. EVO's patented stacked-link structure seamlessly follows the user's arm through the full range of motion while providing proper joint alignment. Extreme positions such as reaching directly overhead, across the body, or even into a back pocket are unrestricted.

Independent load path. Completely decoupled left and right shoulder support structures allow full flexibility of the user's torso and waist. With the EVO, twisting and bending to the side feel completely natural. The user's back is also completely unobstructed. This allows unrestricted airflow and leaves plenty of room for a safety harness.

Minimized body contact. EVO is designed to only contact the user's body where it is absolutely essential, while still staying firmly in place during use. The result is a more comfortable and breathable product, especially in hot environments.

Adjustable high force actuator. EVO's actuators are proven to be extremely durable with millions of cycles of testing and field data. The assistance level can be adjusted for the user and task by easily swapping out the compact gas springs. Different levels can be selected for each arm, allowing complete customization.

Light weight, no compromises. EVO strikes the optimal balance between device weight, functionality, assistance levels, and durability. Functionality is not sacrificed by this lightweight exoskeleton.

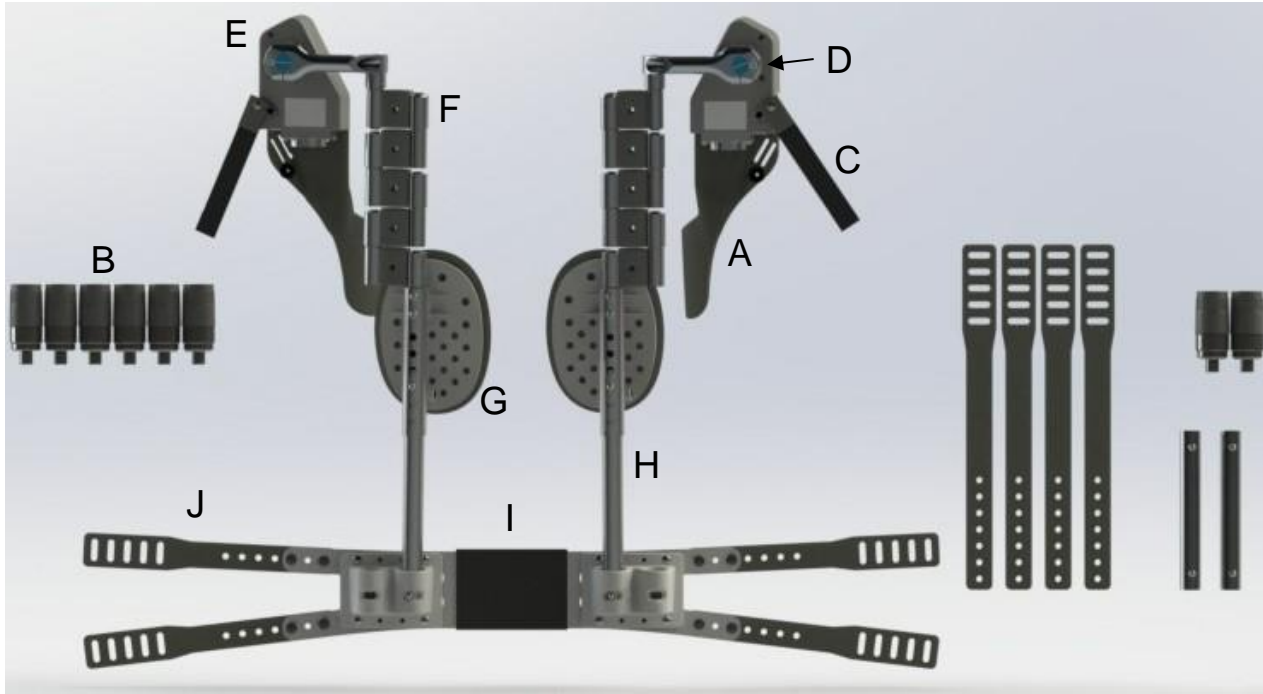
Compact storage. With the included durable, 26" tool bag-style case, EVO stores, ships and transports easily and conveniently. Interior storage bag pockets provide ample storage for accessories and other tools.



Scan this code for videos on how to get started using your EVO

CHAPTER 2: WHAT IS INCLUDED

The mechanical and hardware components of each EVO are identified in the following drawing and table.





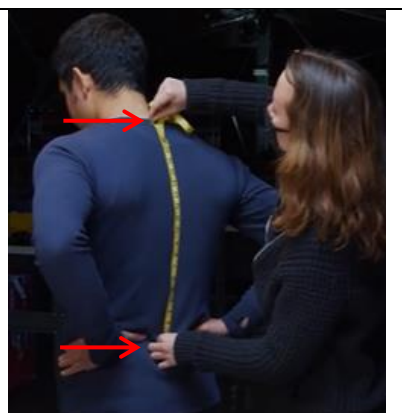
Component Identifier	Component Name
A	Arm Cuff Plate
B	Actuator Spring
C	ON/OFF Switch and Tether
D	Actuator Activation Zone Indicator
E	Actuator
F	Link Assembly
G	Torso Support Pad
H	Torso Tube
I	Waist Plate
J	Belt Extensions

CHAPTER 3: EVO SIZING AND FIT ADJUSTMENTS

EVO is designed to be custom fit for each operator (see MEASUREMENT AND FITTING INFORMATION below). Record the operator's measurements to find the ideal size configuration for a secure and comfortable fit.

MEASUREMENT AND FITTING INFORMATION

To find the initial size configuration for your EVO, take the measurements listed below using a flexible measuring tape. Use these measurements to look up the operator's correct size configuration according to the fitting guide tables. These values serve as a starting point, and additional adjustments may be required.

<p>Belt size</p> <p>Measure the distance around your back between your 2 hip/pelvic bones (the iliac crest). Be sure to make the measurement over your typical work clothes.</p>	<p>Measurement</p> <p>_____ inch (cm)</p>	 <p><i>Figure 1: Hip-to-Hip Measurement</i></p>
<p>Arm Cuff size</p> <p>Measure the circumference of your bicep at the widest point in a relaxed position. Be sure to make the measurement over your typical work clothes.</p>	<p>Measurement</p> <p>_____ inch (cm)</p>	 <p><i>Figure 2: Bicep Measurement</i></p>
<p>Torso Tube size</p> <p>Place your hands on your hips with your index finger resting on your hip bone. Extend your thumbs toward each other around the center of your back. Have an assistant measure the distance from the imaginary line between your thumbs to the bony protrusion at the base of your neck.</p>	<p>Measurement</p> <p>_____ inch (cm)</p>	 <p><i>Figure 3: Torso Measurement</i></p>

Fit Guide Tables

Table 1: Belt Size

	Hip Belt Slot Setting	Belt Size Measurement Hip-to-Hip Distance	
		in	cm
S/M WING	1	19 - 22.5	48.3 - 57.2
	2	22.5 - 24	57.2 - 61
	3	24 - 25.5	61 - 64.8
	4	25.5 - 27	64.8 - 68.6
	5	27 - 28.5	68.6 - 72.4
L/XL WING	1	28.5 - 30	72.4 - 76.2
	2	30 - 31.5	76.2 - 80
	3	31.5 - 33	80 - 83.8
	4	33 - 34.5	83.8 - 87.6
	5	34.5 - 36	87.6 - 91.4



Figure 4: Hip Belt Slot Positions

Table 2: Arm Cuff Size

Arm Cuff Size	Arm Cuff Measurement	
	in	cm
S	9 - 11.5	22.9 - 29.2
M	11.5 - 14	29.2 - 35.6
L	14 - 17	35.6 - 43.2
XL	17 - 20	43.2 - 50.8

Table 3: Torso Length

Lower Torso Tube Size	Upper Torso Tube Position	Torso Length	
		in	cm
SMALL TUBE	1	14 - 14.6	35.5 - 37
	2	14.6 - 15.2	37 - 38.5
	3	15.2 - 15.7	38.5 - 40
	4	15.7 - 16.3	40 - 41.5
	5	16.3 - 16.9	41.5 - 43
	6	16.9 - 17.5	43 - 44.5
LARGE TUBE	1	16.9 - 17.5	43 - 44.5
	2	17.5 - 18.1	44.5 - 46
	3	18.1 - 18.7	46 - 47.5
	4	18.7 - 19.3	47.5 - 49
	5	19.3 - 19.9	49 - 50.5
	6	19.9 - 20.5	50.5 - 52

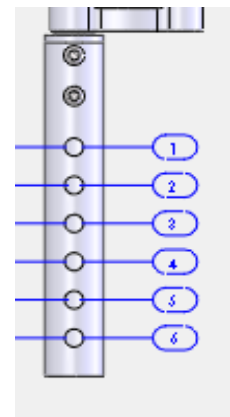


Figure 5: Upper Torso Tube Positions

CHAPTER 4: DONNING AND DOFFING EVO

Now that the EVO has been custom fit to the operator, it is time to put it on.

Donning EVO

1. Before putting on EVO, make sure to unbuckle the hip belt, loosen the hip belt webbing, and loosen the arm cuff straps.
2. Start by draping the EVO over your shoulders.
3. Secure the hip belt using the buckle. Position the hip pads so they are covering your hip bones, then tighten the belt by pulling on the webbing loops inward. The belt should be tight enough to avoid shifting, but not uncomfortable.
4. Slip each arm through the arm cuff. Use the pull handle strap to fully open the cuff to allow for easier insertion.
5. Tighten the three straps on each arm from bottom to top for a snug but comfortable fit.

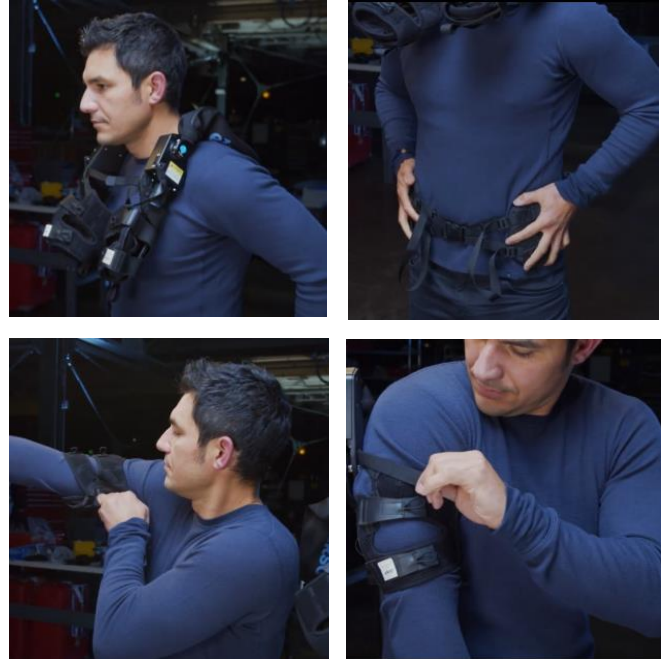


Figure 6: Donning EVO Steps

Doffing the EVO

1. 1. Undo and loosen the arm cuff straps. Use the pull handle strap to slide each arm out of the arm cuff.
2. 2. Drape the EVO arms over your shoulders.
3. 3. Loosen the hip belt webbing, then release the hip belt buckle.
4. 4. Lift EVO off your shoulders.
5. 5. Disassemble arms from the hip belt by pressing the silver buttons on the bottom of the torso tubes. Place all components back into the Ekso carrying bag.



Figure 7: Doffing Evo Steps

CHAPTER 5: TURNING EVO ON AND OFF

Each EVO arm has an ON / OFF switch (with tether) located on the actuator housing. Moving the switch to the ON position activates the spring support of the actuator. Take care if activating the switch while the EVO is not being worn, as the arm can raise up in an uncontrolled manner.

Turning EVO On

To turn EVO on, the operator must keep their arm fully down by their side. The switch on the actuator can then be flipped to the ON position. Do this for both arms before starting to use EVO.

Turning EVO Off

To turn EVO off, the operator must lower their arm fully to their side. The switch on the actuator can then be flipped to the OFF position. Do this for both arms before doffing EVO.



Figure 8: Turning EVO On






CHAPTER 6: INSTALLING AND CHANGING ACTUATOR SPRINGS

EXO Actuator Spring Support Levels

The force assistance level provided by EVO can be adjusted by changing the actuator springs in each arm. There are three (3) sets of actuator spring levels to choose from. Each spring level corresponds to an approximate amount of lift assist support.

The support level of each spring is shown on the spring's end cap. Level 1 provides the least amount of arm support, while Level 3 provides the most. The following table shows the different spring labels and the approximate lift support offered by each of the four different actuator springs.

Table 4: Spring Labels and Approximate Spring Support

Support Level 1	Support Level 2	Support Level 3	Support Level 4	Support Level 5
				
5 lb. (2.2 kg)	7.7 lb. (3.5 kg)	10.1 lb. (4.6 kg)	12.5 lb. (5.7 kg)	15.3 lb. (6.9 kg)

When sizing EVO, Ekso Bionics recommends beginning with a lower force spring and changing to a higher force level as needed.

Installing Actuator Springs

Installing/changing the actuator springs should be performed when the EVO is not being worn. To change the actuator springs, follow the steps below:

1. Secure one arm of EVO in the lowered (down) position. Flip the actuator switch to the ON position.
2. Carefully guide the EVO arm upwards to the fully raised (up) position.
3. Undo the snap fastener and strap near the spring.
4. Unscrew and remove the spring from actuator cylinder chamber.
5. Select the desired spring and insert into actuator cylinder chamber. Screw in the spring until hand-tight.
6. Carefully guide the EVO arm downwards into the fully lowered (down) position. Flip the actuator switch to the OFF position.
7. Repeat steps **Error! Reference source not found.** through 5 on opposite side as needed.



Figure 9: Installing Actuator Springs

CHAPTER 7: ADJUSTING THE ACTIVATION ZONE

EVO features an adjustable “activation zone”. The activation zone is the area in which EVO provides support to the operator’s arms while performing in-front and overhead work.

EVO offers three different activation zone settings:

- H (high) setting (usually for overhead work)
- “Standard” setting (marked by the middle line)
- L (low) setting (usually for in-front work).

The Figure shows how each setting changes the activation zone starting points and max support areas.

The table below lists the approximate angle (from 0° fully lowered position) for each activation zone starting point and max support point.



Figure 10: Activation Zone Settings

Table 5: Activation and Support Angles

Activation Setting	Degree (from 0°) for Starting Support Point (approximate)	Degree (from 0°) for Max Support Point (approximate)
Low Setting	15°	105°
Standard Setting	25°	115°
High Setting	35°	125°

As described in the following procedure, adjusting the activation zone must be done when the EVO is not being worn. Personal comfort and preference should always guide which activation zone setting to use for each arm.

To adjust the activation zone:

1. Secure one arm of the EVO in the down (lowered) position. Enable that actuator by flipping the switch to the ON position.
2. Carefully guide the EVO arm upwards to the fully raised (up) position.
3. Use T25 driver to loosen the top socket head cap screw on the end link. Loosen the screw approximately one-quarter turn.

Using the end link graphic as a guide, adjust the dial to H (high) or L (low) setting as desired; default adjustment will be set at the “standard” setting (middle line).

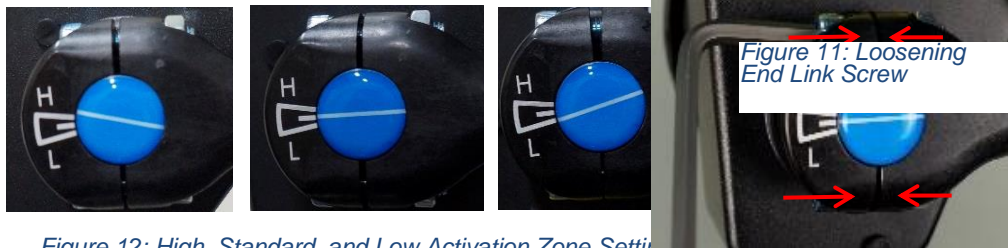


Figure 12: High, Standard, and Low Activation Zone Settings

When the indicator is at the desired setting, retighten the screw. The split clamp should be evenly spaced.

4. Carefully guide the EVO arm downwards into the fully lowered (down) position. Flip the actuator switch to the OFF position.
5. Repeat steps 1 through 6 on the opposite side, as needed.

Figure 13: Evenly Spaced Split Clamp

CHAPTER 8: FIT ADJUSTMENTS

Before the operator starts using the EVO, some fit adjustments may be required for maximum comfort. If the operator is feeling any discomfort, try the adjustments described below.

Table 6: Fit Adjustment Troubleshooting

Issue	Solution
You feel pressure near the elbow when you raise your arm.	Torso length likely too long. Try decreasing torso tube length by 1 notch
You feel tugging around your bicep / upper arm when you raise your arm.	Torso length likely too short. Try increasing torso tube length by 1 notch
Your arm is not aligned with the EVO actuator arm.	Make sure that hip belt is properly positioned and tightened. Adjust torso length if needed.
The arm cuff slides up and down on your arm.	The arm cuff straps are likely too loose. Readjust and tighten arm cuff straps as needed.
The webbing straps are digging into your waist.	Check the position of the hip pads, and adjust to ensure they are centered over your hip bones
The arm cuff is too tight no matter how it is adjusted.	If wearing extra layers, the padding in the arm cuff can be removed for a more accommodating fit. Otherwise, try swapping to a large arm cuff size.
You feel restricted when moving your arm across your body.	For operators with larger shoulders, try moving the arms of EVO from the inner lug position on the hip belt to the outer lug position.
You feel discomfort when moving your arm across your body.	If the arms of EVO are in the outer lug position on the hip belt, try moving them to the inner lug position.

Note: For the best fit and comfort, be sure that the tops of the actuators are slightly higher than the tops of the user's shoulders. Adjust the torso lengths if necessary to achieve proper alignment.



CHAPTER 9: MAINTENANCE AND TROUBLESHOOTING


Table 7: Maintenance and Additional Troubleshooting

Issue	Solution/Maintenance	Frequency of Maintenance
Soft goods are dirty and/or sweaty.	Wash soft goods in washing machine using laundry detergent and cold water; use a low-heat dryer cycle. Ensure that all Velcro straps are secured before washing. Ekso Bionics recommends washing and drying items in a mesh bag.	As needed from wear
Actuator springs are loose.	Hand tighten both actuator springs such that they are securely seated in the actuator base. DO NOT USE TOOLS TO TIGHTEN OR LOOSEN ACTUATOR SPRINGS.	Daily
Soft goods are damaged.	Examine all soft goods (arm cuffs, torso pads, hip pads, and lumbar pad) for wear or damage. Examine both sides of each soft good and all stitching for visible damage, discoloration, or deterioration; manually inspect the material with fingers to feel for wear, such as tearing, fraying, unevenness, or loose threads. Examine snaps, straps, and buckles for proper operation. If any damage or deterioration is discovered, discontinue use and contact Ekso Bionics for replacements	Weekly
Actuator spring does not thread in smoothly.	Inspect actuator spring threads. If dirty or dusty, clean with cloth and/or compressed air before inserting spring into actuator assembly.	As needed

CHAPTER 10: COMPONENTS AND ACCESSORIES

The items in the EVO Kit column are included with every EVO.

12 Components and Accessories

Item	Qty	Details	EVO Kit	Notes
EVO Arm Assembly	2	108830 (Right) 108831 (Left)	Included	
Large Torso Tube	2	108549	Included	
Hip Belt	1	108832	Included	
Large Belt Extensions	4	108701 (Large)	Included	
Arm Cuffs	8	108659 (Left S) 108658 (Right S) 108661 (Left M) 108660 (Right M) 108663 (Left L) 108662 (Right L) 108769 (Left XL) 108768 (Right XL)	One Pair Included	LEFT RIGHT
Actuator Springs	5	Level 1: 107199 Level 2: 107200 Level 3: 107201 Level 4: 107202 Level 5: 107235	One Set (2 Springs) Included	 (shipped in storage bag pockets)
<i>EVO Quick Start Guide</i>	1	108848	Included	
Storage Bag	1	108779	Included	