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# Legal

#### Safety

Please read and understand all instructions carefully. Failure to comply with the instructions listed below may result in product failure or personal injury.

Check frame functionality before each use

The user needs to make sure the frames are securely mounted to the belt and the top of the harness. Gently trying to pull on the connectors before use is advised. Also, while wearing the Skelex, moving the arms forward, sideways and overhead in a controlled manner is advised. Always ensure that the exoskeleton is correctly attached and secured to your body. Do not make movements that create uncomfortable pressure on any part of your body.

Always wear safety goggles or eye protection when using the exoskeleton.

#### Safety Precautions

Unstable support can cause the exoskeleton to bind, causing loss of control and injury.

If you lose control, your arm or shoulder may get trapped and it may cause injury.

Avoid being caught in between the exoskeleton and walls or posts.

If one of the arm straps becomes detached, slowly move your arms down or up and reattach the arm strap.

Do not grasp the exoskeleton or place your hands too close to the moving shoulder parts. Always be aware of the location of the exoskeleton's structural parts to avoid hitting your body or damaging external structures.

Textile parts may get dirty after prolonged use. Moveable parts could become entangled with clothing and injury may result, so use caution.

### Discontinue use and contact your supplier ....

- when experiencing physical complaints or negative side-effects,
- when wearing the Skelex becomes less comfortable,
- when a part is dysfunctional (for example: a buckle or a hinge),
- if you notice visible damage.

Sometimes the solution is to pause and restart getting used to the product. Just stop and remove the Skelex. Build up the frequency and duration of the usage again.

## Skelex and your physical condition

The Skelex is not safe for use by individuals with one of the following conditions:

- a pacemaker,
- breast implants,
- removal of the axillary lymph nodes,
- clavicle injury,
- shoulder injury (e.g. Frozen shoulder)

Individuals with one of the following conditions should contact a physician prior to using the Skelex. For example, it can be advised to do an extra slow build-up of the wearing time:

- Shoulder dislocation
- Shoulder muscle rupture
- Shoulder pain during overhead work.

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2



#### Calamities

If CPR or a defibrillator has to be used on someone wearing a Skelex, the Skelex must first be disengaged. Removing the arms can be done by pulling on the loops at the end of the strap. Move the Skelex arms up and undo the chest strap and Velcro belt.

#### Avoid dangerous situations

The Skelex is only intended for professional use.

Only use a Skelex that fits and is sized to your body.

Do not use any flammable substances (e.g. matches, lighters, candles) in the vicinity of the product. The materials used in the Skelex are not flame retardant.

#### Activities to be avoided during the use of Skelex

It is not advised to perform the following activities with Skelex:

- Running,
- Climbing,
- Driving any vehicle outside.

#### User environment

#### Work Area

Keep your work area clean and well lit. Cluttered benches and dark areas invite accidents. Do not operate the exoskeleton in explosive environments, such as in the presence of flammable liquids, gases, or dust. Keep by-standers, children, and visitors away while operating the exoskeleton. Distractions can cause you to lose control.

### Wear appropriate clothing

Dress appropriately. Do not wear loose clothing or jewellery. Contain long hair. Keep your hair, clothing, and gloves away from moving parts. Loose clothes, jewellery, or long hair can be caught in moving parts.

If your clothing becomes ensnared in the SkelEx hinge, move your arms forward and remove the clothing from entrapment.

Make sure there are no hard objects in your clothing or pockets that could become pinned underneath the Skelex.

Use safety equipment. Always wear eye protection. Dust mask, non-slip safety shoes, hard hat, and hearing protection must be used if the conditions require.

#### Avoid moisture, dust and damages

The Skelex must be kept dry. The moving parts of the Skelex must be kept free of any fluids.

The mechanical parts of the Skelex must be kept free of sand and other debris.

Do not stand on (parts of) the Skelex.

Do not place any heavy objects on (parts of) the Skelex.

#### Beware of jamming

Misuse can lead to entrapment, with possible injuries.

Never place your hands or fingers near the Skelex hinge!





#### Beware of bystanders

Avoid situations where people might attempt to grab the Skelex, which could lead to a dangerous situation. Also be aware of your surroundings. The straps and Skelex springs can become entangled or hooked on things that stick out. Keep the Skelex away from children and pets.

#### User environment

The Skelex is designed for indoor use.

The Skelex may not be used or stored in direct sunlight.

The Skelex may not be used in a setting where the ambient temperature is lower than 0 °C or higher than 40 °C.

## Personal Safety

Stay alert, be mindful of what you are doing and use common sense when operating the Skelex. Do not use the device while tired or under the influence of drugs, alcohol, or medication. Lack of attention while operating the exoskeleton may result in serious personal injury. Keep hands away from moving parts.



Do not overreach. Always keep proper footing and balance. Proper footing and balance enable better control of the exoskeleton in unexpected situations.

#### Gradually increase use

Gradually increase first use of the Skelex: from 2 hour a day, 4 hours a day, 6 hours a day, onwards to the maximum time of 8 hours a day. Pause the use of Skelex if you feel hindrance.

### Recommended use

For optimal use of Skelex, a standing posture is advised. Primary Skelex 360 is designed for repetitive and static manual work at shoulder level and above. The Skelex 360 is not a lifting device. Also, sitting against a backrest or laying on the floor with Skelex 360 is possible, but not recommended.

#### Use and Care

Check for misalignment or binding of moving parts, breakage of parts, and any other condition that may affect the exoskeleton operation.

If damaged, have the exoskeleton serviced before using. Accidents might be caused by poorly maintained exoskeletons. Use only parts that are recommended by the manufacturer for your model.

Keep attachment points dry, clean and free from oil and grease.



#### Maintenance

Regularly check (according to extent of use) for visible damage, whether all parts are still securely attached without play and functioning of the adjustments.

Make sure that the exoskeleton is correctly maintained. After every use, check for tears and/or damage. Height and width adjustments, as well as other moving parts, need to be checked every four weeks to ensure proper and safe functioning of the exoskeleton. Refer to the Maintenance Instructions for period checks.

#### Repair

For customer service and repair, please contact your supplier.

#### Service

Service must be performed only by qualified repair personnel. Service or maintenance performed by unqualified personnel could result in risk of injury.

When servicing the device, use only identical replacement parts. Follow instructions in the manual of the service parts.

Use of unauthorized parts of failure to follow Maintenance Instructions may create a risk of injury. Certain cleaning agents may damage plastic, metal or textile parts.

#### Cleaning

To clean the Skelex, use a moist cloth, lukewarm/hot water and a mild cleaning product (no cleaning products that contain solvents).

Make sure no water gets into the moving parts. Never immerse the Skelex in water.

Do not use any solvents, bleach, polisher or detergent.

#### Storage and Transportation

As the exoskeleton has textile and metal parts, it needs to be stored in a dry environment. Apply the same storage and transport approach for the exoskeleton that is recommended and used for any power tool.

When transporting the device, make sure that the arm supports are detached from the harness. Also unload the arm supports by placing them in most upward position.

When the Skelex is not being used, preferred method of storage is to hang it on a coat hanger or in a clothes locker. Make sure that it is stored in a dry place.

#### Disposal

Please contact the supplier if you no longer need the product or if it needs to be disposed of on account of depreciation. The supplier will ensure that it is disposed of properly.

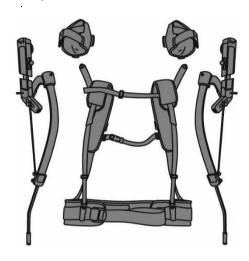


# Functionality + Technical specifications

## Technical specifications

Skelex consists of two frames, a detachable washable harness and two arm cups. The two frame halves contain carbon fibre springs that provide the lifting power. The shoulder hinges make the movement of the arms feel weightless. When the arms are down, the force is minimized, allowing your arms to stay relaxed. The force adjustments allow for stepless adjustment of support.

## Exploded view Skelex 360



#### **SPECIFICATIONS**

DIMENSION SHIPPING AND	W: 800 * D 380 * H 180 mm
STORING PACKAGE	
TOTAL WEIGHT INCLUDING FABRICS	2.7 kg.
SUPPORTING FORCE	Adjustable
LOWEST SUPPORT SETTING	0.5 kilogram per arm.
BALANCES	
MAXIMUM SUPPORT SETTING	3.5 kilogram per arm.
BALANCES	
MODE	Dual arm and single arm possible
PADDING	Synthetic mesh: Breathable and

User dimensions (cm)	minimum	maximum
Shoulder width	42	58
Torso length	44	55
Pelvic circumference	84	128
Upper arm circumference	20	42



washable



## Support

Skelex supports arms during static and dynamic work at and above shoulder level. The supporting force counteracts the gravitational force on the arms. When the Skelex support is correctly initiated, the arms should feel balanced and weightless within normal arm movement.



#### Freedom of movement

The Skelex 360 allows normal human arm movements. Due to the low friction hinges and joints, the movement of the users are unhindered. Full horizontal arm movements are possible with continue support. Also, torso movements like bending, squatting and rotation are unhindered.



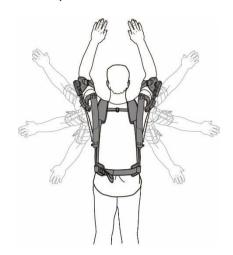


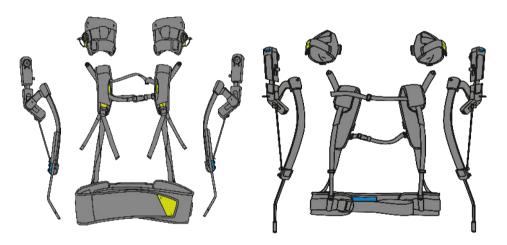
# Usage

## Setting up the Skelex 360 exoskeleton

Setup the Skelex 360 exoskeleton by following the steps below. Attach the frames to the harness and mount the arm cups to the end of the arms.

## Components of Skelex 360 exoskeleton





Parts in package

1x Left frame

1x Left arm cup (Medium)

1x Right frame

1x Right arm cup (Medium)

1x Harness including belt

1x instruction manual

1x Quick start guide

1x Warranty card, end user.

Front Back

## **Quick Start Guide**



## Manual



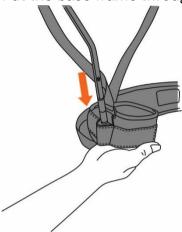
## Warranty card



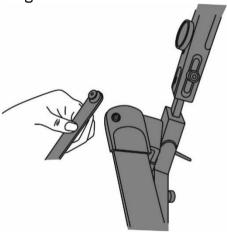
Assemble the Skelex by following next steps:



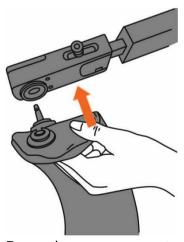
Put the base frame through strap loop



Plug the bottom of the frames on the corresponding belt pockets



MINAX connection



Press the arm cups onto the arm until you hear a click and check if it is fixed correctly.



## Wearing the Skelex 360 exoskeleton

Before putting the Skelex 360 exoskeleton on, set it to your personal body size. Correct sizing will increase the fit, function, improve the range of motion and will provide the best arm support when working. After proper sizing it is also much easier to put the Skelex 360 exoskeleton on.

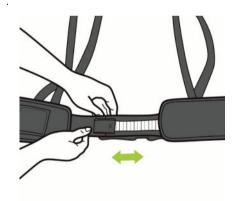
## Adjusting the size

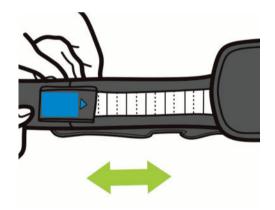
Follow the next easy steps to measure your torso length, waist dimension and arm size. Afterwards adjust the belt width, frame height, arm length and select the corresponding arm cup size prior to putting it on.

Skelex 360 exoskeleton belt width - halve hip circumference



Measure the distance from your left side to right side in centimetres Measure around your





Adjust the width of the Skelex belt so your measurement is visible next to the indicator in centre of the belt.

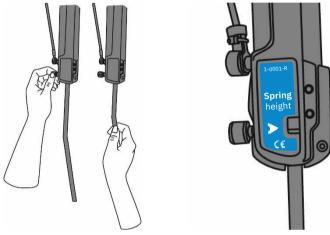


## Skelex 360 exoskeleton height – Torso length



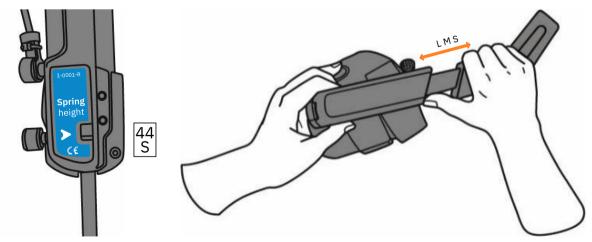


Measure the straight <u>vertical distance</u> from your ventral hip bone to the top of the shoulder. Take the measurement in centimetres. You feel the ventral hip bone with your fingertips if you have your hands on your waist. Only measure in a straight line, do not curve over shoulder.



Adjust the length of the Skelex 360 frames. Unscrew the locking screw and adjust the height until your body measurement in cm. is visible the window.

The range of the adjustment is possible from 44 to 55 cm If your body measurement exceeds this range in adjustment, try the setting that is closest to your body measurement.

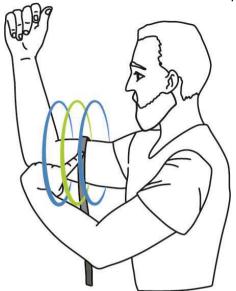


Skelex advises to set the arm length, visible in the height adjustment window, next to the height adjustment setting.

To adjust the Skelex 360 exoskeleton arm length, loosen the thumb screw and adjust the length by moving the arm relative to the Skelex hinge. Afterwards, tighten the thumbscrew.



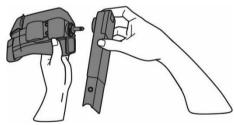
Skelex 360 exoskeleton Arm cup size – Arm biceps circumference



Measure the circumference of your upper arm. Keep your upper arm horizontal and take the measurement halfway your arm or on the largest part of your biceps muscle.

Use the table below to select the arm cup that fits your arm measurement best. If there are two possibilities, Skelex advises to use the larger size arm cup. If your measurement is not on the table, use the arm cup that is closest to your arm measurement and be aware of possible discomfort during use.

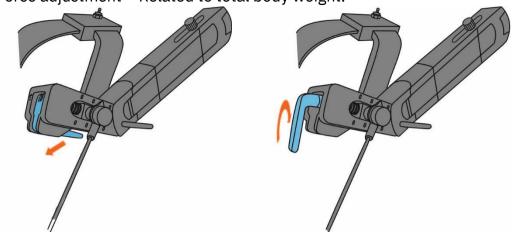
Skelex arm cup size and upper arm circumference dimensions.			
Arm circumference	Arm cup size		
200 - 280 mm	Small		
270 - 350 mm	Medium		
<i>340 - 420 mm</i> Large			



To remove the arm cup, press on the button at the end of the Skelex arm and pull out the arm cup. Place the correct arm cup into the Skelex arm in the correct orientation and push it in until it is locked in place. Check the lock by trying to pull the arm cup from the arm.



Force adjustment – Related to total body weight.



Skelex advises to adjust the supporting force according to your body weight.

Body weight	Adjustment setting
50	1 <sup>st</sup>
65	2 <sup>nd</sup>
80	3 <sup>rd</sup>
95	4 <sup>th</sup>

Open the blue lever at the end of the Skelex hinge and rotate it until the force indicator is at the desired position. When a heavy tool is used for longer periods of time, it is possible to use a higher supporting force. Skelex advises to increase the force by one step maximum.



## Putting the Skelex 360 on

Before putting the Skelex 360 exoskeleton on, make sure the belt, frames and arms are correctly sized to your body dimensions. Follow the steps described at 'Adjusting the size'.

## Open buckles and loosen all straps

Open the Velcro from the belt, open the chest strap buckle, loosen the shoulder straps and open the arm cup straps.

Put the Skelex 360 harness on like a backpack



Put the Skelex 360 exoskeleton on like a backpack by holding it at the shoulder straps.

## Close the belt



Close the belt with some tension with the elastic parts on the pelvic bones. Make sure the belt is symmetrically on your left and right hip



Close the chest strap



Close the chest strap at a comfortable height and tighten the strap so the shoulder straps are away from the arm pit.

Tighten straps



Tighten shoulder straps for a comfortable fit.

Check for constrained clothing



Move your arms vertically up and fully to the side to check your range of motion. The Skelex 360 harness can obstruct clothing movement.



Engage the Skelex 360 arm support.



Pull arm cup down by pulling on the loop at the end of the strap.

Place the upper arm in the cup



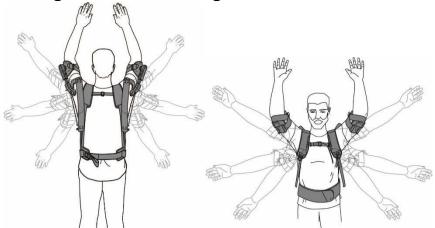




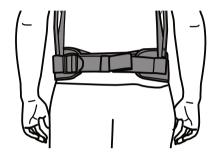




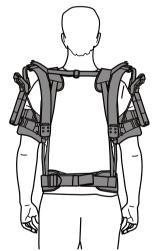
Checking the fit and fine-tuning



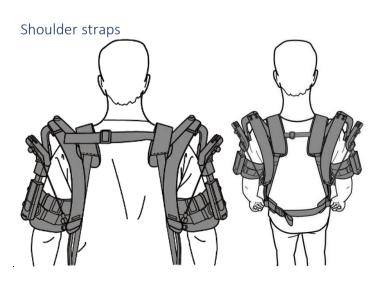
Belt position and belt orientation



Make sure the belt is on your pelvic bones and it is not sliding down when the arms are lifted.

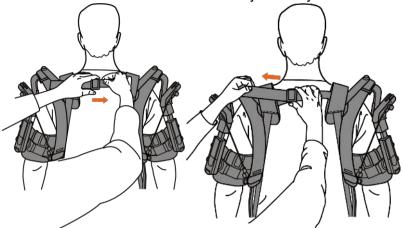


Also check the position of the belt hinges. They must be <u>symmetrical and slightly to the rear</u>. When you move your arms down, you should not touch the belt hinges.





Skelex 360 shoulders should barely touch your shoulders when the arms are forward.



Adjust the strap at the back to move the shoulders closer or away from your shoulders.

Skelex 360 hinge position



Check if the hinge is on the side of your shoulder.

Clearance above shoulder



When the arms are down, there must be about 2 finger thickness space between the <u>top of the shoulder and the spring</u>.

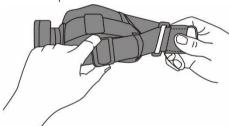


Arm cup position



The arm cup should be on the furthest halve on the upper arm, but should not touch the <u>sensitive bones</u> near the elbow. Remove and reposition the arm cup when necessary. Adjusting the Skelex arm length might be necessary with some users if the problem keeps arising.

Arm strap tension



The arm strap is only present to make sure your arm is in continuous contact with the Skelex arm cup. Do not over tighten.

Freedom of movement



With the Skelex fully on and checked for fitting, move your arms and rotate your torso. This will help you in determining the range of arm and torso movement when wearing the Skelex 360 exoskeleton. Keep the movements form your work in mind when you check the freedom of movement. Also check if the amount of support is sufficient for the work you do.



## Taking off and storing

When removing the Skelex, the order of the steps is equally important as the sequence to putting it on. To minimise the risk of injury, follow the next step in this sequence.

Remove the arm cup



Remove the arm strap by pushing the lock in the direction of the Skelex arm and hold on to the strap



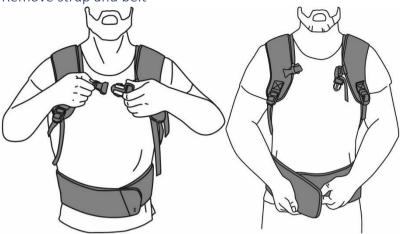
Keep the arm strap in your hand and guide the arm cup upward after removing your arm.



Slowly guide the Skelex arm towards the top. Do the same for the other arm.







Open the chest strap and belt

Take off like a backpack



Remove the Skelex like a backpack

## Storing of the exoskeleton

Store the Skelex 360 exoskeleton by placing it on a clean flat surface, in the shipping box or hanging it on a cloth hanger. Take care of the arms that are sticking out.

For longer duration of storage or transportation, Skelex advices to place the Skelex 360 exoskeleton back in the shipping box. For an easy fit it is necessary to set the Skelex 360 to the smallest setting.

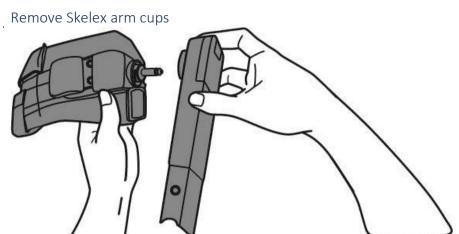
## Pictures of Skelex box



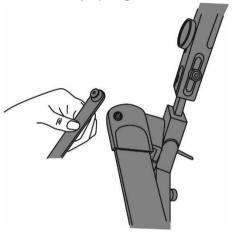


# Removing fabrics

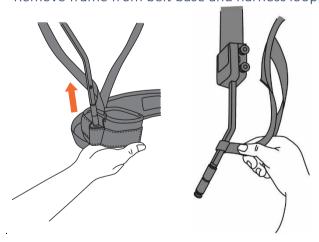
The fabrics can be removed from the Skelex 360 frames. This can be done for hygiene or washing of the fabrics.



Dethatch top spring



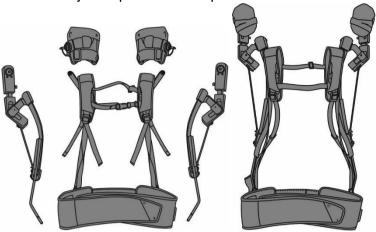
Remove frame from belt base and harness loop.



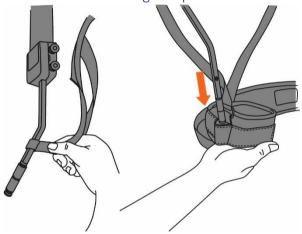


# Reassembling the Skelex 360

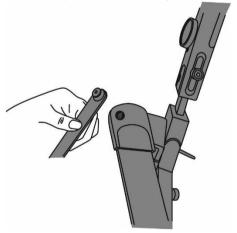
Place every component as in pictured



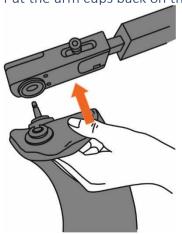
Put Skelex frame trough loop in the fabric and put the base of the frame on the belt.



Attach top of frame to top of harness



Put the arm cups back on the skelex arm





Maintenance instructions
Daily pre-use checks



Check <u>cable</u> ends and protection lining for damages



Check front and back of <u>carbon spring</u> for cracks and delamination



Check if the <u>hinges</u> of the frames move without friction



Check if the <u>belt hinge</u> and spring connectors are properly connected



Check if the <u>harness</u> is not extremely damaged







Check if the <u>arm cup</u> is in one piece and the lock of the strap is functional. Check if the arm cup is fasted to the Skelex 360 arm.

Weekly, every 5 day uses checks



Check if the fabrics are clean and all straps still run freely



Check <u>force adjustment</u> travel and ease of use. Move the Skelex frame and check that there are <u>no weird noises</u>



Remove the frames from the harness and check the functionality of the connections



## Cleaning and lubricating

#### Harness:

If necessary, the harness can be washed. Use light detergent in washing machine, no bleach, max 30°C, do not tumble dry but hang to dry.







#### Frames:

Frames can be cleaned with a damp cloth with some non-aggressive detergent.

#### Lubricating:

Skelex 360 uses dry run bearings that do not need lubrication.

#### Troubleshoot

If the Skelex 360 exoskeleton is not fitting right or if it feels uncomfortable during use, find the issue written below and follow the steps to find a solution.

## The springs touch the top of shoulders

Description of trouble: With some users or use cases it is possible that the Skelex 360 exoskeleton touches the top of the shoulder during work overhead or when the arms are moving down.

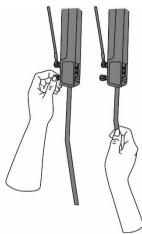


Spring touching the shoulder when arm is moved upward



Correct position of spring, two fingers between spring and shoulder





Check and verify that the Skelex 360 exoskeleton is sized correctly and that the exoskeleton fits properly by going through previous steps describing sizing, putting on and finetuning. If the trouble still arises, try increasing the height of the frame, together with adjustment of the harness. Unscrew the height adjustment thumbscrew and increase the height by 2 cm.

## The springs are to high above the shoulders.

Description of trouble: With some users or use cases it is possible that the springs of the Skelex 360 exoskeleton are too high. This results in lower functionality, restricted range of movement and possibility of hurting the head of the user.

## The spring is to high above the shoulder

Check and verify that the Skelex 360 exoskeleton is sized correctly and that the exoskeleton fits properly by going through previous steps describing sizing, putting on and finetuning. Also make sure the shoulder straps are loosely resting on the shoulders when the arms are down. First decrease the height of the frame of the Skelex 360 exoskeleton so the space between the shoulder and exoskeleton is 2 fingers thick.

Secondly, rearrange the shoulder straps so they are resting on the shoulder with the connector of the springs vertical above the shoulder.

If the trouble still arises, try repositioning the belt at a lower position including adjustments to the length of the shoulder straps and position of the Skelex shoulder harness.



The Skelex 360 frame halves feel loose during movement

Description of trouble:

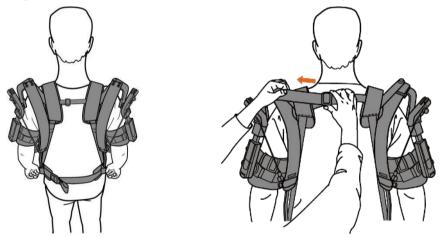
With some users or use cases the frame halves feel like they are inefficient constraint. This is felt by a loose fit of the Skelex 360 exoskeleton frames that do not move together with the user and feel like they have a will of their own.



Skelex position on the side of the shoulder.

If this trouble arises it is possible that the width of the Skelex is too large. Increase the straps connecting to the spring.

If the trouble continuous to arise it is possible that the arm is not secured enough in the arm cup. Either increase the tension of the arm strap or use a smaller size arm cup.



Adjusting the width of the Skelex 360 shoulders.

#### Irritation arm area

Description of trouble: With some users or use cases it is possible that the arm area that is in contact with the arm cup may feel irritated. Material used in the arm cup is Neoprene: a knit fabric with a rubber like core that may contain latex.

When the user gets an irritating reaction from wearing the arm cups, immediately stop using the Skelex 360 exoskeleton. Always check if the irritation is caused by high pressure or sheer from straps or arm cup or is resulting from an allergic reaction. If an allergic reaction causes the irritation, discontinue Skelex 360 use and seek medical attention for cause analysis and future health management.

If pressure or sheer caused the irritation, let the skin recover before proceeding Skelex use. Relocate the arm cup and don't overtighten the straps. When the user feels the arm cup sliding over the arm during use, the Skelex 360 arm length may be set too large. Shorten the arm length accordingly so the arm cup is not sliding anymore.

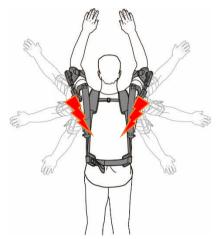
For some users it is possible to continue using the Skelex 360 exoskeleton when they wear a thin and tight long-sleeved shirt. Also wearing a piece of tube bandage on the upper arm reduces the changes of irritation to the arms.



### Frames touching back area

Description of trouble: With some users or use cases it is possible that the user feels the frames touching the back when the arms are moved horizontally outward.

For these users it may help that they wear the Skelex 360 exoskeleton belt on a narrower width. Remove the belt and tighten the belt at the back. Adjust about 4 cm and close the belt again with some comfortable tension. Also, a proper active/proud stature may help in some users that experienced touching of the back.



Springs touching the back when arms are moved outward



Wear the Skelex 360 with a narrower belt width.





With some users or use cases, wearing the Skelex 360 with a crouched posture will increase the possibility of the frames hitting the back

Wearing the Skelex 360 with an <u>active posture</u> will decrease the possibility of the frames hitting the back



#### Feeling that the arms have to be pushed down

With some users or use cases it is possible that the user feels as if the Skelex360 exoskeleton have to be pushed down every time. This can feel more tiering than lifting the arms without exoskeleton and occurs more in dynamic tasks at shoulder level or higher. For these users Skelex advises to decrease the supporting force so they do not have to push down so much. It is also possible to change the force of one arm.







Lower the support force if the user experiences that the arms must be pushed down when working with the Skelex 360 exoskeleton

# Repair

### Damage to harness and arm socks

Unintended use or extreme environments can cause damage to the detachable harness, straps

and arm socks. When the harness is damaged and safe usage is no longer possible, a

replacement harness is available. Contact Skelex dealer for options of a replacement

harness.

## Damage to the frames

Unintended use, extreme environments or accidents can cause damage to the Skelex frames.

Contact Skelex dealer to check if a replacement or repair of a Skelex is possible.

## Damage to the transportation box.

If the transportation box is damaged or lost, it is possible to order a new Skelex transportation

box. Contact Skelex dealer to discuss your options.

For all contact with Skelex dealer or Skelex, keep the Skelex serial number at hand. Locate the Skelex 360 serial number on the height adjustment sticker.





# **PARTLIST**

PartList:The partlist consists of all sub-assemblies that are considered as spareparts, that can be ordered for SX360.

	PartNo.	Item Description	
	100-0037	Armcup Interface Left	
	100-0041	Armcup Interface Right	
$\mathbb{C}$	100-0038	Arm cup Assy Left	
<b>(</b>	100-0040	Armcup Assy Right	
	200-0138	Passive Hinge Cover Left	
	200-0152	Passive Hinge Cover Right	
	200-0164	Arm Sock SX360 Medium Left	
	200-0165	Arm Sock SX360 Medium Right	
	200-0168	Belt Fabric SX360	
	200-0169	Fabric Backpack SX360	
T T	100-0042,200-0164,200- 0165,100-0036,100-0047	Harness SX360 + Arm Socks + Harness Connectors	



	PartNo.	Item Description	
	200-0160	Spring Cap Bottom Right	
	200-0154	Spring Cover Top Right	
8	200-0128	Spring Cap Bottom Left	
	200-0111	Spring Cover Top Left	
02	999-0032,2x200-0054	Steel Cable + Covers	
	999-0121-1	Arm Length Adjustment Knob (M3)	
	999-0121-0	Height Adjustment Knob (M4)	

For the new releases of the Product, Skelex will provide the Preferred Dealer an updated partlist.

## Contact

Skelex Scheepsbouwweg 8 – Kavel G4 Info@skel-ex.com www.skelex.com

