

Original instructions



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AVANTI WORK CAGE

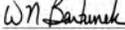
User's, Installation and Maintenance Manual
Model SHARK



UL 1322 certificate for Shark M, L & XL:

Certificate of Compliance	
Certificate Number	20101118-SA13063
Report Reference	SA13063, 2003 December 01
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	Page 1 of 1
	
<i>Issued to:</i>	AVANTI WIND SYSTEMS A/S HOGEVEJ 19 3400 HILLEROED DENMARK
<i>This is to certify that representative samples of</i>	DEVICES, SCAFFOLDING Service Cabin I, Service Cabin II, Shark L and Shark M
	<i>Have been investigated by Underwriters Laboratories Inc. (UL) or any authorized licensee of UL in accordance with the Standard(s) indicated on this Certificate.</i>
<i>Standard(s) for Safety:</i>	Safety for Fabricated Scaffold Planks and Stages, UL 1322 CAN/CSA-Z271-98 "Safety Code for Suspended Elevating Platforms."
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AECO certificate for Shark L equipped with M508 hoist:

	UL LLC Presents this	
AECO CERTIFICATE		
Certificate Number: 201603194787346002		
Date: 2016-03-19 To		
AVANTI WIND SYSTEMS A/S Rønnevangs Allé 6 3400 HILLEROED DENMARK		
For certification in accordance with the ASME A17.7-2007 / CSA B44.7-07 (Reaffirmed 2012) of the following Elevator Subsystem:		
Turbine Service Lift <small>(See addendum for details)</small>		
Effective from: March 19, 2016 Until March 19, 2019		
 Issued by: Andrew Eng AECO Certification Services	 Reviewed by: Daniel Posner AECO Certification Services	 Reviewed by: William N. Bartunek, PE AECO Certification Services
<small>Place this on the UL Classification Mark and Certificate Number on the product</small>		

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WORK CAGE
AS TO LOAD CAPACITY ONLY
12xz

This product is UL Classified.

See the complete Classification marking above.

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1. Limited Warranty

Avanti Wind Systems A/S warrants that commencing from the date of shipment to the Customer and continuing for a period of the longer of 365 days thereafter, or the period set forth in the standard AVANTI warranty, the Product¹⁾ described in this Manual will be free from defects in material and workmanship under normal use and service when installed and operated in accordance with the provisions of this Manual.

This warranty is made only to the original user of the Product. The sole and exclusive remedy and the entire liability of Avanti under this limited warranty, shall be, at the option of Avanti, a replacement of the Product (including incidental and freight charges paid by the Customer) with a similar new or reconditioned Product of equivalent value, or a refund of the purchase price if the Product is returned to Avanti, freight and insurance prepaid. The obligations of Avanti are expressly conditioned upon return of the Product in strict accordance with the return procedures of Avanti.

This warranty does not apply if the Product (i) has been altered without the authorization of Avanti or its authorized representative; (ii) has not been installed, operated, repaired, or maintained in accordance with this Manual or other instructions from Avanti; (iii) has been subjected to abuse, neglect, casualty, or negligence; (iv) has been furnished by Avanti to Customer without charge; or (v) has been sold on an "AS-IS" basis.

Except as specifically set forth in this Limited Warranty,

ALL EXPRESS OR IMPLIED CONDITIONS, REPRESENTATIONS AND WARRANTIES, INCLUDING, BUT NOT LIMITED TO, ANY IMPLIED WARRANTY OR CONDITION OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE, NON-INFRINGEMENT, SATISFACTORY QUALITY, COURSE OF DEALING, LAW, USAGE OR TRADE PRACTICE ARE HEREBY EXCLUDED TO THE MAXIMUM EXTENT PERMITTED BY APPLICABLE LAW AND ARE EXPRESSLY DISCLAIMED BY AVANTI. IF, PURSUANT TO ANY APPLICABLE LAW, TO THE EXTENT AN IMPLIED WARRANTY CANNOT BE EXCLUDED AS PROVIDED IN THIS LIMITED WARRANTY, ANY IMPLIED WARRANTY IS LIMITED IN TIME TO THE SAME DURATION AS THE EXPRESS WARRANTY PERIOD SET FORTH ABOVE. BECAUSE SOME STATES DO NOT PERMIT LIMITATIONS ON THE DURATION OF IMPLIED WARRANTIES, THIS MAY NOT APPLY TO A GIVEN CUSTOMER. THIS LIMITED WARRANTY GIVES CUSTOMER SPECIFIC LEGAL RIGHTS, AND CUSTOMER MAY HAVE OTHER LEGAL RIGHTS UNDER APPLICABLE LAWS.

This disclaimer shall apply even if the express warranty fails of its essential purpose.

In any cases of dispute the English original shall be taken as authoritative.

¹⁾Avanti service lift ("Product")

2. Introduction

2.1 Observations

Only trained people may use this lift.

This manual must be available to staff at all times during installation, maintenance and operation. Additional copies are available from the manufacturer upon request.

This manual, including, but not limited to, measurements, procedures, components, descriptions, instructions, recommendations and requirements, is subject to change without prior notice. Please check Avanti website/manuals for the latest revisions of the manuals.

Any additional cost related to or arising from any changes in the manuals does not entitle Customer to any form of compensation or other legal remedies.



The pictures and sketches in this manual may not reflect the product aesthetics, colours, arrangement precisely. This has no impact on the function or safety.

2.2 Symbols

Symbol	Signal word	Meaning	Possible injury if not observed
--------	-------------	---------	---------------------------------

Safety instructions



DANGER!

IMMEDIATE or possibly imminent danger:

Death or severe injury!



DANGER!

IMMEDIATE or possibly imminent danger of hazardous voltage:

Death or severe injury!



CAUTION!

Potentially hazardous situation:

Light injury or material damage.

Additional instructions



ATTENTION!

Potentially dangerous situation:

Damage to equipment or workplace



IMPORTANT!

Useful tips for optimum working procedure

None



VERSION!

Differentiation between CE versions and AECO version.



Reference to written specification/documentation

2.3 Cautions

Installation and/or maintenance and/or operation of the service lift and its suspension may be performed only by qualified personnel, hired by the employer for the job at hand.

Personnel must be at least 18 years of age. The staff must be familiar with the relevant accident prevention instructions and must have received proper training in these.

Personnel are obliged to read and understand this User's Manual.

Personnel shall wear PPE (safety helmet, full body harness, shock absorber, lanyard and slider) at all times.

A copy of the User's Manual must be handed out to the personnel and must always be available for reference.

If more than one person is entrusted with one of the above tasks, the employer shall appoint a supervisor in charge of the operation.

Electrical connection of the system must be made in accordance with EN 60204-1.

Self-locking nuts must be used at all times. The screw must extend from the nut by at least half of the thread diameter. The nut may not be used once it has become possible to loosen by hand!

If any damage or faults are found during operation, or if circumstances arise which may jeopardize safety: immediately interrupt the work in progress and notify the supervisor or employer!

All tests/repairs of electrical installations may only be performed by qualified electricians.

All repairs to the traction, braking and supporting systems may only be performed by qualified installers.

If any supporting parts are repaired or replaced, the operational safety of the system must be tested and verified by an expert.

Only original fault-free parts may be used.

Use of non-original parts will render the manufacturer's warranty void and any type approval invalid.

No modification, extension or reconstruction of the service lift is allowed without the manufacturer's prior written consent.

No warranty is provided against damage resulting from reconstruction or modification of equipment or use of non-original parts which are not approved by the manufacturer.

Before using the lift an inspection by the authorized inspection organisation must be carried out.

Service lift must be inspected at least once a year by an expert trained by AVANTI. In case of high operating frequency or severe conditions of use, more frequent inspection is required.

Service lift is designed for a lifetime of 20 years with an operating frequency of approximately 12.5 h/year (250 h in total).

Service lift may not be used by persons who are under the influence of alcohol or drugs which may jeopardize working safety.

Service lift shall ONLY be used when the turbine is not generating power.

All wind farm site specific rules must be followed. Service lift shall not be used during inclement weather, including wind speeds over 25 m/s (55.5 mph).

AECO service lift personnel shall be equipped with a wired or wireless two way communication device connected to a location staffed by authorized personnel.



Avoid injury – follow all instructions!



The tower owner must verify the need for third party service lift inspections with the local authority and comply with the standards specified.

3. Instructions

- a) Before and after using, check all parts for proper function and damage to component parts. Do not use a damaged or improperly functioning product.
- b) Any parts that have been exposed to excessive heat, as in the case of fire, should be immediately removed from service and destroyed due to loss of structural strength.
- c) Do not permit oil, grease, or slippery material to accumulate on climbing or gripping surfaces.
- d) Planks and stages are designed with rated working loads of 240 kg (533 lbs). The total combined weight of each worker and all materials should not exceed the rated working load. Do not overload.
- e) Erect the plank or platform so that the working or standing surface is level.
- f) Support plank or platform ends by stirrups, scaffold bearer members, trusses or other equipment intended for this purpose.
- g) Use guardrails, midrails, and toe boards as required by local, state, and federal regulations. Their use is recommended in all cases.
- h) Do not allow unstable objects, such as barrels, boxes, loose brick, tools, and debris to accumulate on the work surface.
- i) Do not use a ladder or other device to gain greater heights.
- j) Never climb onto a stage from a ladder unless both the stage and the ladder are secured from movement in all directions.
- k) Do not ride on top of a moving work cage. Tools, materials, and equipment should not be stored on planks or platforms that are being moved.
- l) Do not apply impact loads to any parts.
- m) Do not use acids or other corrosive substances on a plank or platform without consulting the plank or platform manufacturer for specific instructions.
- n) Before using, refer to manufacturer's instructions.

4. Description

4.1 Purpose

The work cage described in this User's Manual serves the following purposes:

- transportation of staff and material inside wind turbine systems, lettuce towers for wind turbines, and telecommunication towers.
- transportation for mounting, inspection and repairs.

The work cage may be used for transportation of two persons plus their tools and equipment to the most convenient height for performing work on the tower.

The work cage is designed for permanent installation in one specific tower.

The lift is not designed for use

- in silos,
- at drilling sites,
- as a permanently installed facade lift,
- as a crane lift,
- in environments with explosion hazards.

4.2 Scope

A work cage uses a traction hoist for ascending and descending on a wire secured to the building.

A fall arrest device secures the work cage to a separate safety wire.

Upward and downward travel is controlled from within the work cage in hand mode, from the remote control transmitter in remote mode (optional), or from the outside in the automatic mode (optional).

A lifting force limiter prevents upward travel in case of an overload of the traction hoist.

Two guide wires on either side of the work cage prevent it from swivelling/tilting.

4.3 Work cage models

This User's Manual and Installation Manual describes the following models:

- SHARK M Roller door with 533 Lbs (240Kg) lifting capacity.
- SHARK L Sliding/Double/Half roller door/4-door with 533 Lbs (240kg) lifting capacity.
- Shark AECO: size L, Sliding door with 533 Lbs (240kg) lifting capacity, AECO control box, travelling cable and tail line switch.

4.4 Temperature

Operating temperature
5°F to +140°F (-15°C to +60°C).

Survival temperature
-13°F to +176°F (-25°C to +80°C).

Low temperature kit is also available.
Operational temperature - low temperature kit
-13°F to +104°F (-25°C to +40°C).

4.5 Components

4.5.1 Cabin overview

Fig. 1a Shark L AECO

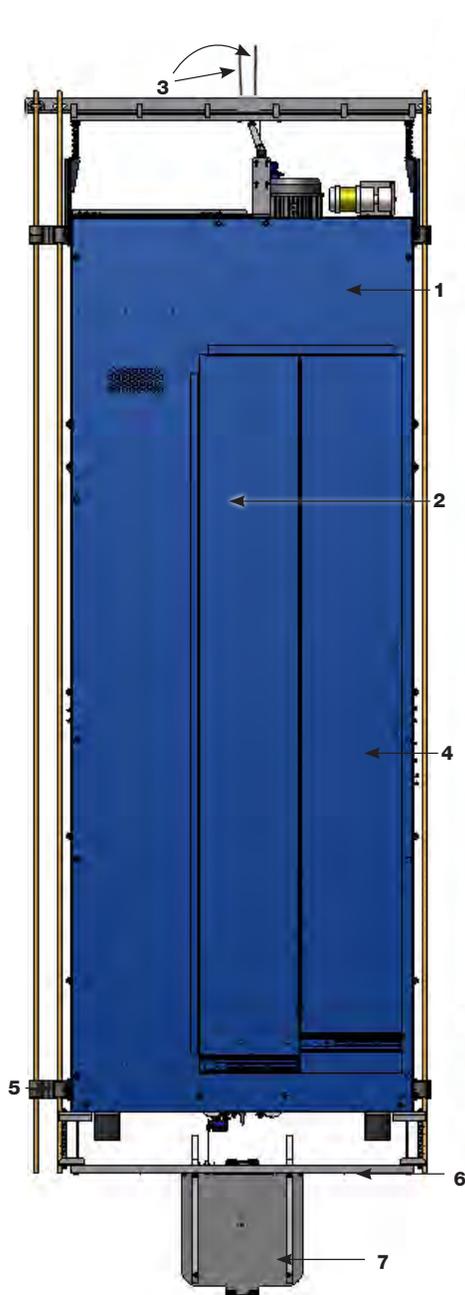


Fig. 1b Double door

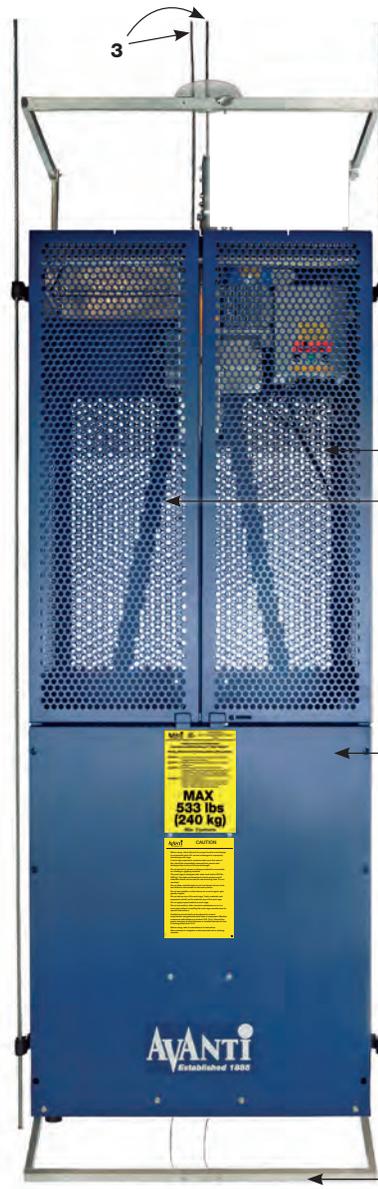


Fig. 1c Sliding door



- 1 Cabin
- 2 Double / Sliding door
- 3 Drive and safety wires
- 4 Guide wire
- 5 Wire guides
- 6 Bottom safety stop
- 7 Travelling cable

Fig. 1d SHARK L 4-door version



- 1 Cabin
- 2 4 door
- 3 Drive and safety wires
- 4 Guide wire
- 5 Wire guides
- 6 Bottom safety stop

Fig. 1e SHARK L Half roller door



- 1 Cabin
- 2 Roller door
- 3 Drive and safety wires
- 4 Guide Wire
- 5 Wire guides
- 6 Bottom safety stop

Fig. 1f SHARK M Roller door



- 1 Cabin
- 2 Roller door
- 3 Drive and safety wires
- 4 Guide Wire
- 5 Wire guides
- 6 Bottom safety stop

4.5.2 Cabin with fall arrest device, traction hoist, electrical control box and pendant control

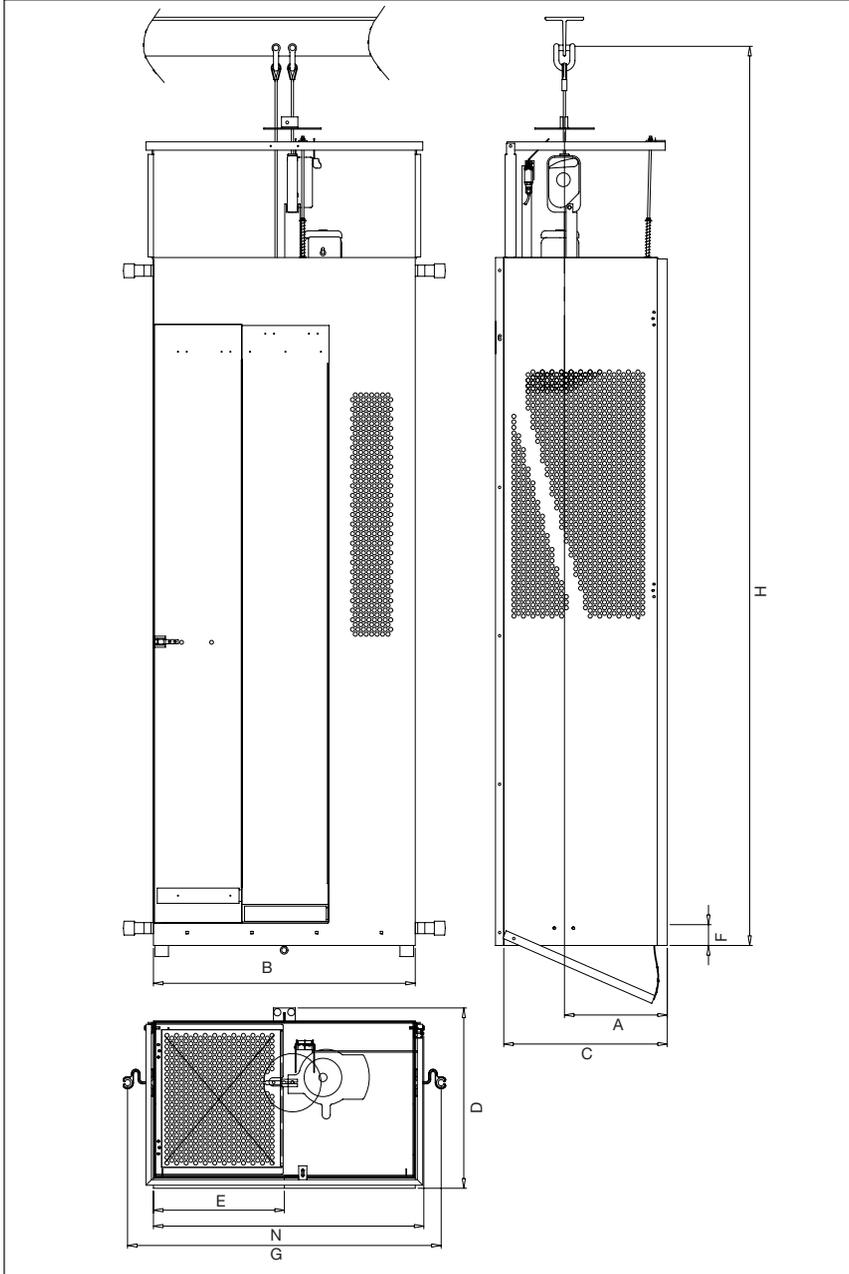
Fig. 2



- | | |
|---|--|
| 1 Cabin | 9 Override automatic operation switch (optional) |
| 2 Traction hoist | 10 Door stop switch |
| 3 Electrical control box | 11 Bottom safety stop |
| 4 Anchor point | 12 Shackle |
| 5 Fall arrest device | 13 Safety wire |
| 6 Cable connection (behind the work cage) | 14 Lifting wire |
| 7 EMERGENCY STOP button fixed (Inside cabin optional) | 15 Top stop disc for 17/18 |
| 8 Pendant control | 16 EMERGENCY limit stop switch |
| | 17 Operation limit stop switch |

4.5.3 Technical data for the work cage M and L

Fig. 3a Dimensions sliding door



Lifting capacity:

- Motor LE500P:
533 Lbs (240 kg)
(max 2 persons).

Weight of work cage:

L: 242 Lbs (kg 110)

To the weight of the work cage should be added the weight of the power supply cable.

approx. 0.22 Lbs per foot
(0.23 kg per m).

Standing height:

Under spine: 1980 mm

Under

Traction hoist: 2100 mm

Slide door opening:

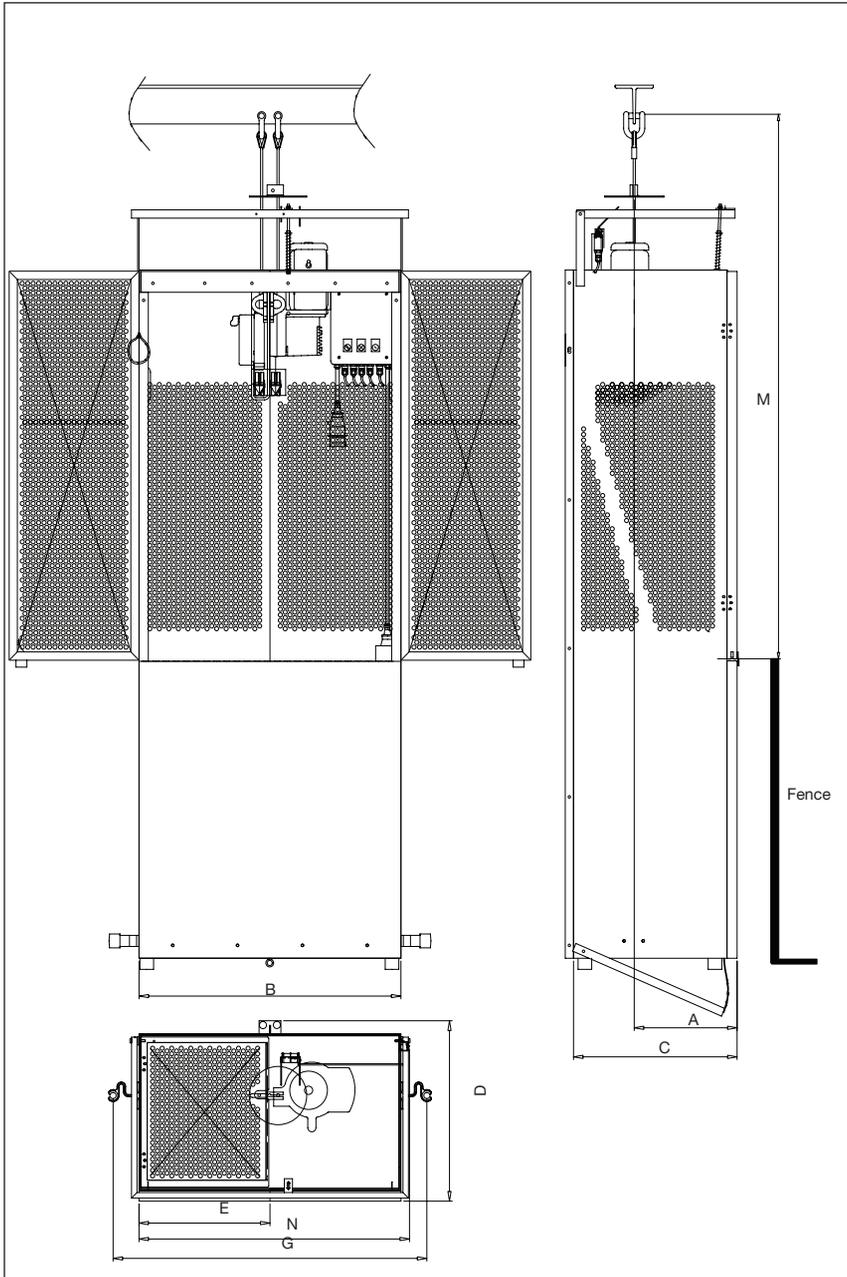
X : 550 mm

Dimensions in mm:

Shark	A	B	C	D	E	F	G ¹⁾	N	H
L	380	960	600	650	475	75	1020/1150	990	3500

¹⁾ Standard wire guide/narrow wire guide. (Details p. 46)

Fig. 3b Dimensions double door and half roller door



Lifting capacity:

- Motor LE500P:
533 Lbs (240 kg)
(max 2 persons).

Weight of work cage:

L: 242 Lbs (kg 110)

To the weight of the work cage should be added the weight of the power supply cable.

approx. 0.22 Lbs per foot
(0.23 kg per m).

Standing height:

Under spine: 1980 mm

Under

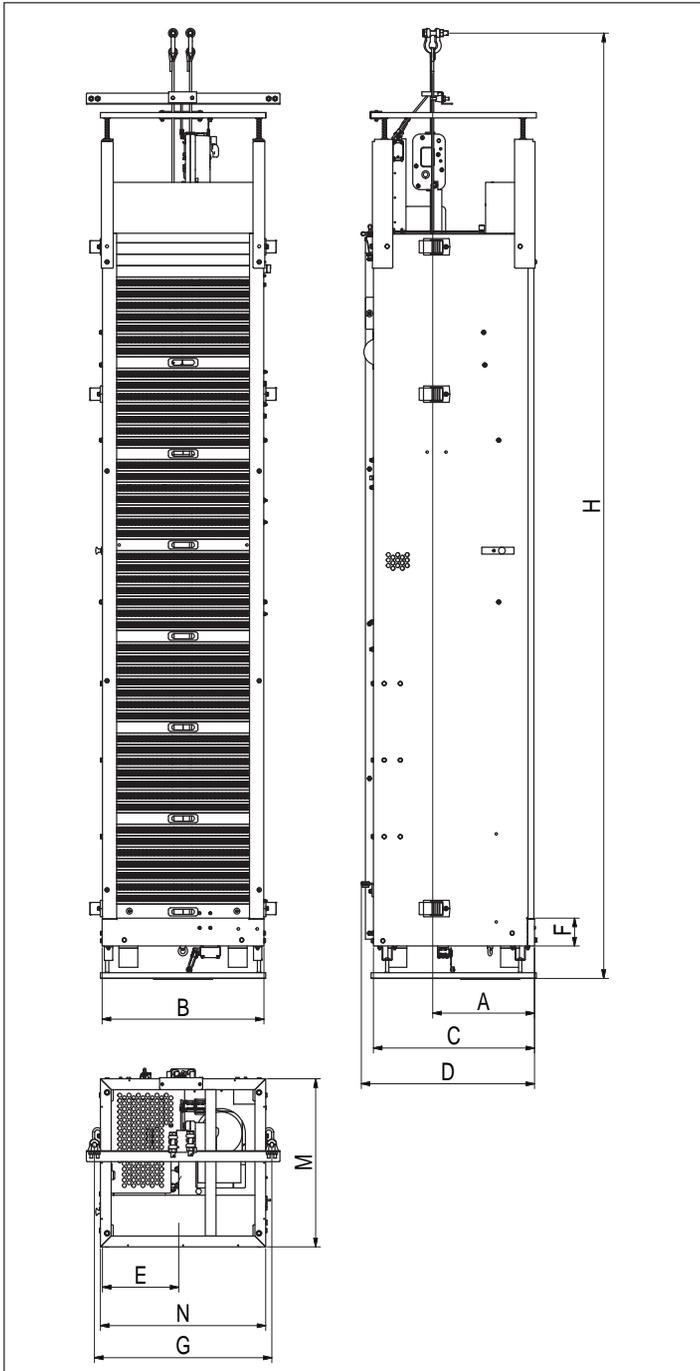
Traction hoist: 2100 mm

Dimensions in mm:

Shark	A	B	C	D	E	G ¹⁾	M	N
L	380	960	600	650	475	1020/1150	2400	990

¹⁾ Standard wire guide/narrow wire guide. (Details p. 46)

Fig. 3c Dimensions roller door



Dimensions in mm:

Shark	A	B	C	D	E	F	G ¹⁾	M/N	H
M	380	600	600	650	285	102	660	615	3500

¹⁾ Narrow wire guide.

Lifting capacity:

- Motor LE500P:
533 Lbs (240 kg)
(max 1 person).

Weight of work cage:

M: 290 Lbs (kg131)

To the weight of the work cage should be added the weight of the power supply cable.

approx. 0.22 Lbs per foot
(0.23 kg per m).

Standing height:

Under spine: 2108 mm

Under

Traction hoist: 2250 mm

4.5.4 Drive system, fall arrest device and controls

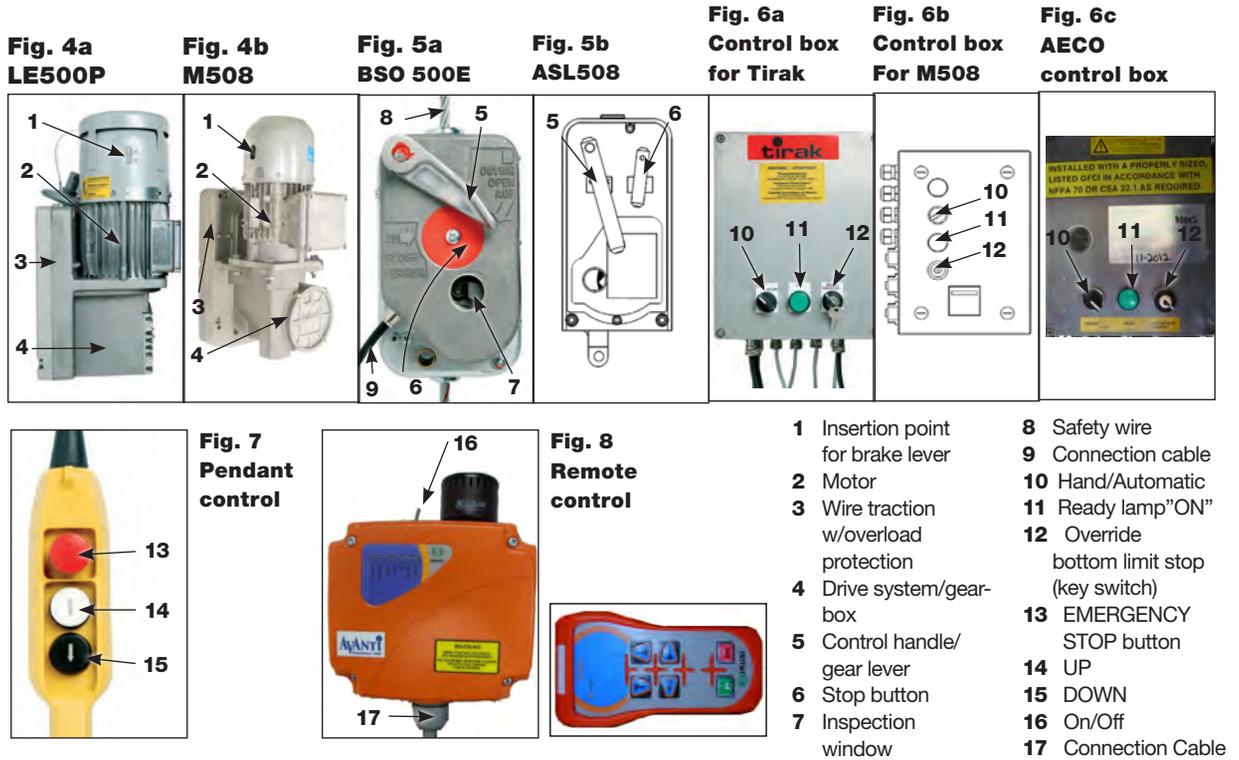


Table 1. Traction hoist

Construction in accordance with DIN 15 020.

Traction hoist sound/noise level emitted: max. 72 dB(A). Subject to technical change without notice.

Hoist	Lifting capacity	Wire speed	Effect	Rated current	Traction Hoist wire Ø	Unit weight approx.
Traction hoist type	Lbs (Kg)	Feet/min (m/min)	kW	A	mm	Lbs (kg) ¹⁾
LE502P 230V	1000 (450)	66 (21)	1.8	6.8	8.4	73 (33)
LE502P 400V	1000 (450)	66 (21)	1.8	4.5	8.4	73 (33)
LE502P 480V	1000 (450)	66 (21)	1.8	3.0	8.4	73 (33)
M508 400V	1100 (500)	66 (21)	1.8	4.9	8.4	50
M508 480V	1100 (500)	66 (21)	1.8	4.1	8.4	50

¹⁾ Weight without wire.

Installed with a properly sized, listed GFCI in accordance with NFPA 70 or CSA 22.1 as required.

Table 2. Fall arrest device

Fall arrest device	Lifting capacity	To max. wire speed	Safety hoist wire Ø	Unit weight approx.
Fall arrest device	Lbs (kg)	Feet/min (m/min)	mm	Lbs (kg)
BSO 500 Electrical	1100 (500)	35 (10)	8.4	10.3 (4.7)
BSO 504E	1100 (500)	70 (20)	8.4	10.3 (4.7)
ASL508	1100 (500)	105 (30)	8.4	15.34 (7)

Table 3. Traction, safety and guiding wire ropes

Wire rope type	Wire rope diameter	Surface Treatment	Mark/feature	Min. break resistance	Attached with	Anchoring	Tighten to
M500 / OSL 500 M508 / ASL 508	8.4 mm, 5x19	HDG	no	55 kN	2 t shackle, Form C	-	-
Guiding wire rope	12 mm	HDG	no	55 kN	2 t shackle	Min. every 35 m	2 to 4 kN

4.6 Safety devices

4.6.1 Primary brake

Electromagnetic motor brake (spring-loaded) brake which engages automatically

- on releasing the direction selector and
- on power failures.

4.6.2 EMERGENCY STOP

When the red EMERGENCY STOP (Pendant control) switch is pushed in emergencies, all control is interrupted. After remedying the fault, control is reactivated by turning the switch clockwise, until it pops out again.

4.6.3 EMERGENCY STOP fixed (optional)

Only in work cages with function AUTOMATIC installed. A backup switch to the pendant control EMERGENCY STOP switch situated on the right hand panel inside the work cage. Works like described above.

4.6.4 Override "automatic operation" switch

A switch situated inside the pendant control holder. It prevents the work cage from being controlled from the inside when the control is in automatic mode.

4.6.5 Phase monitoring relay

With three-phase power operation, the phase monitoring relay will interrupt operation when a faulty phase sequence is detected, preventing faulty assignment of UP/DOWN direction power which deactivates the limit stop switch and the lifting force limiter functions.

Remedy: Have an electrician switch two phases in the electric plug.

4.6.6 Mechanical lifting force limiter

The lifting force limiter is built into the wire traction system and will prevent upward travel in case of an overload. A warning signal (buzzer) is triggered which will stop only when the cause of the overload has been removed.

Possible reasons for activation of the limiter:

- The work cage is overloaded or
- The work cage encounters an obstacle during upward travel.

Operator intervention:

- Reduce the load to below the overload limit, or
- lower the work cage until it is free of the obstacle, and remove the obstacle before using the work cage again.

4.6.7 Fall arrest device

Hoistable personal transportation means must be equipped with a fall arrest device which will prevent the load from falling.

Fall arrest device Type BSO

The fall arrest device BSO is opened

manually. The speed of the safety wire passing through the device is continuously monitored, and the jaws automatically close in case of sudden excessive speed.

This protects the work cage against

- Lifting wire breaks and
- Hoist failures.

The fall arrest device can also be engaged manually in emergencies by pressing the EMERGENCY STOP switch. The window is used to monitor the centrifugal force mechanism's function during operation.

Fig. 8
Fall arrest device

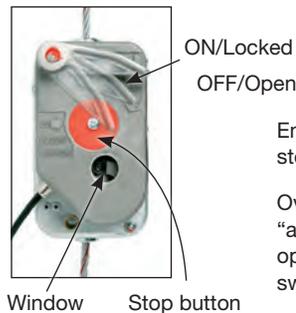
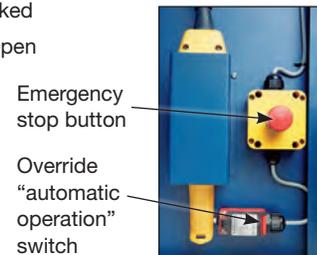


Fig. 9
Emergency stop and override bottom stop switch



Window Stop button

For information on required intervention when the secondary brake engages.

4.6.8 Sliding door lock

Sliding doors are closed by pushing the steel tap on the door into the red door lock switch. The door is unlocked by pushing the black button on the red door lock switch. From the outside the same button is reached through a hole.

4.6.9 Yellow flash (Optional)

Optional flashes can be mounted on the work cage. The flashes indicate when the work cage is in movement.

4.6.10 Emergency light (Optional)

An emergency light can be installed to illuminate inside the work cage with and without electric supply. The operation modes can be selected by means of a switch.

4.6.11 Door stop switch

4.6.11.1 Sliding door:

Sliding door is closed by pushing the actuator into the door guard locking switch. The switch is unlocked by pushing the green button if the cabin is located at a height corresponding to a platform. In case of an emergency evacuation between platforms, the interlock is unlocked by pushing its emergency release red button from outside the cabin as

Fig. 10a
Yellow flash



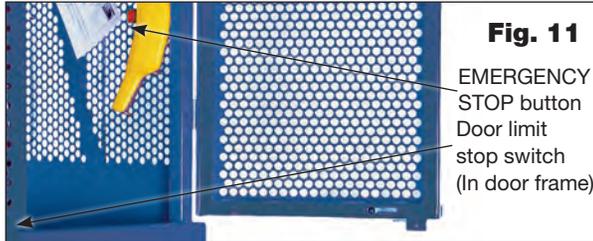
Fig. 10b



well as using a M5 triangular key from inside the cabin.

5.6.11.2 Double door:

A switch will interrupt control if the door is not closed properly.



4.6.11.3 Half roller door:

A switch will interrupt control if the door is not closed properly.

4.6.12 Trapped-Key interlock system (Optional):

Control is interrupted by turning the trapped-key switch to OFF and then the key is able to be taken out. The key allows the user to open the platform fence doors. See the Trapped-Key Interlock System Manual for further information.



ATTENTION!



When the top limit stop switch is engaged, activate the DOWN switch until the top limit stop switch is released.

4.6.13 Limit stop switch

4.6.13.1 Top limit stop switch

At the top of the cabin frame a top limit stop switch will stop upward travel when activated. Downward travel will still be possible. A top stop disc which activates the top stop switch is installed below the traction wire attachment.

Fig. 13a

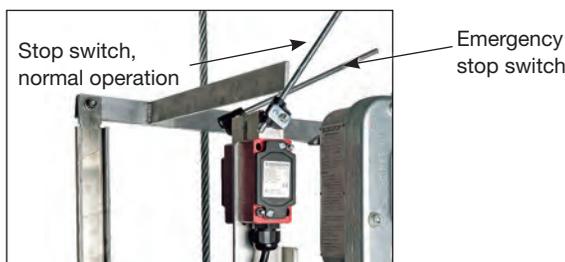


Fig. 13b



Fig. 13c



4.6.13.2 EMERGENCY top limit stop switch

Deactivates control if the top limit stop switch fails. Manual downward travel is possible.



Do not use the work cage until the top limit stop switch fault has been remedied.

4.6.13.3 Bottom safety stop

The bottom safety stop switch stops downward travel if the work cage
- encounters an obstacle or
- touches the ground.

Upward travel will be possible, for instance to remove the obstacle. In order to put the work cage on the ground, the contact plate's operation can be bypassed with the key switch in the control box. If it is possible to enter underneath the work cage a double button safety stop must be installed.

Fig. 14a

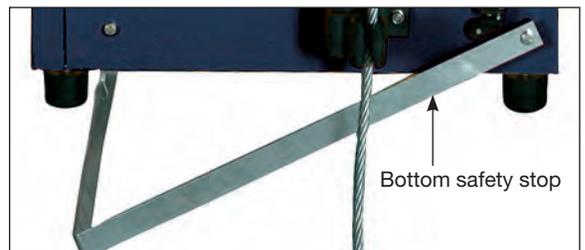


Fig. 14b



4.6.13.4 Top safety stop

The top safety stop switch stops upward travel if the work cage:

- Type 1: encounters an obstacle.
- Type 2: Besides, the switch works as top limit stop switch. A top stop end bar is installed below the guiding wire attachment and activates the top safety stop. In this case the top stop end bar replaces the top stop disc. Downward travel will be possible, for instance to remove the obstacle.

4.6.14 Safety devices for fences with door

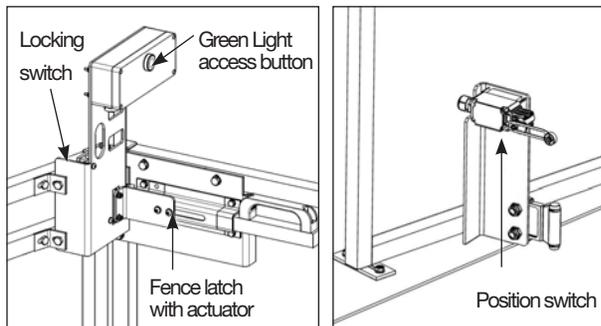
Safety devices for fences include devices to prevent people to access to the work cage area unless the work cage was in a safety condition of accessibility. Besides, the device guarantees the work cage doesn't move any moment the protected fence doors were open.

There are two types of safety devices for fences:

4.6.14.1 Guard Locking System

The Guard Locking System uses a system of security locking switches installed on the fences. Another position switch detects the right position of the work cage on the protected platform. The work cage cannot operate until all the protected fences are closed and locked.

The fences remain closed and locked until the work cage is stopped and properly positioned on the platform, actuating the position switch of the platform. In this position, the guard locking can be unlocked while pressing the green light button.



Consult the AVANTI Guard Locking System Manual for further information.

4.6.14.2 Trapped-key Interlock System

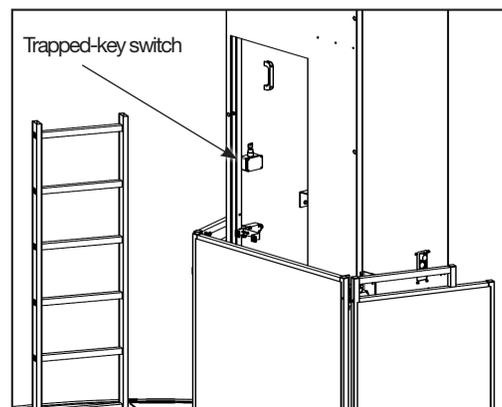
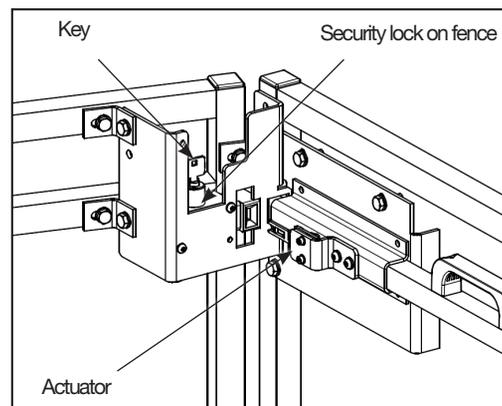
The Trapped-key Interlock System uses a system of security locks installed on the fences. These locks can be opened by using a key placed into the work cage.

The key also activates the On/Off general switch placed into the work cage cabin. The key is linked to the lift by means of a wire rope, and can not be detached from it except using cutting tools.

The key cannot be taken out from the On/Off general switch in the work cage, unless it is in Off position, and therefore, the work cage is stopped. In the same way, the key cannot be taken out from the fence lock unless the fence door is closed, and the door actuator is put into the door lock.

The fences remain closed and locked until the work cage is stopped on the platform, and the key is transferred from the work cage cabin to the fence lock.

Consult the AVANTI Trapped-key Interlock System Manual for further information.



4.6.15 AECO control box plug ¹⁾

AECO control box features a plug over its cover as an AECO compliant safety solution.

¹⁾Note: Only for AECO version.

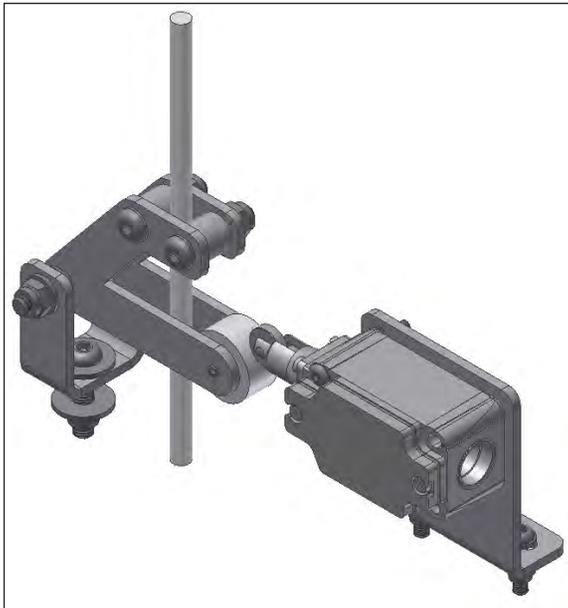


4.6.16 Slack rope sensor ¹⁾

Installed on the top of the service lift, over the traction hoist, when engaged it will remove power from service lift. It detects slack traction wire.

¹⁾Note: Optional feature.

Mandatory for AECO versions with M508.

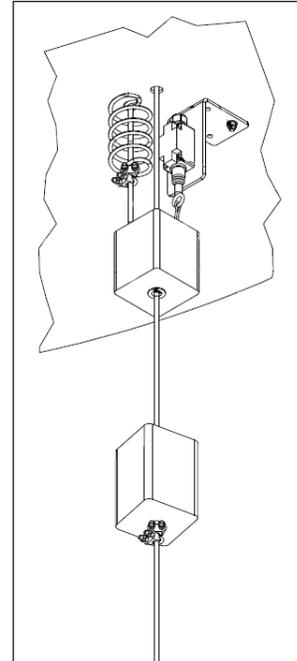


5.6.17 Tail line switch

It is installed below the bottom platform, when engaged it will remove power from service lift. It detects slack traction wire rope.

¹⁾Note: Optional feature.

Mandatory for AECO versions with Tirak.



5.6.18 Anchor points

AVANTI work cage is equipped with an anchor point for each user in the cabin. During operation user should hook up to the Anchor point. Further an optional safety bar can be mounted.

4.7 Other risks (hazards)



The following risks relating to the traction hoist and fall arrest device have not been specifically determined for the construction in question:

The safety function of the fall arrest device will only work if the safety wire between the wire attachment and the fall arrest device is tight (no loose wires!). Therefore, any loose safety wire must be secured with a tightening spring approx. 0.66 ft below the access platform.

5. Daily inspection by the supervisor

5.1 Work cage

- Before every operation, ensure that the traction hoist, the fall arrest device, and all auxiliary components (stoppers, wire guide wheels, etc.) are mounted in accordance with specifications and without any noticeable defects.
- Check whether the drive, and safety wires are feed correctly around the two wire guide wheels.
- Wire ends (of 9 ft or more in length) must be coiled separately at the floor and tied with strips at least 3 places.
- Check lifting capacity: (see the rating plate or section with traction hoist description) – the extra load (persons and materials!) must not exceed the maximum rated lifting capacity.
- Before every operation, record the hour meter reading on the product log.
- Before every operation, ensure the drive, safety, and guide wires are correctly tensioned according sections of tensioning of wires in the Installation Manual.

When the “bypass switch” is activated, it should be possible to take the work cage all the way down to the ground.

- Door stop switch: Open the doors – it should neither be possible to take the work cage up nor down.
- If optional function AUTOMATIC is installed. Set selector HAND/AUTOM. on AUTOM. Holding the handle the work cage should remain still if button UP or DOWN is activated.



*If any defects occur during work,
- stop working,
- if required secure the workplace
and
- remedy the defect!*



*Make sure that nobody is exposed
to danger below the work cage, for
instance from falling parts.
Suitable measures:
Pent roof or barriers.*

5.2 Operating area

- Ensure that there are no obstacles within the work cage’s operating area which may cause the cabin to be stuck or hit the ground.
- Ensure that all relevant and required protection measures below the cabin are in place. Such measures could include pent roofs or barriers to protect the staff against falling objects.

5.3 Control function

- Close doors. Push EMERGENCY STOP Button. Pushing button UP/DOWN the work cage should remain still. To restart, turn EMERGENCY STOP button clockwise. (If EMERGENCY STOP button fixed is installed test this button likewise.)
- Test the Operation limit stop switch: During upward travel, push the switch manually, and the work cage should stop immediately. Pushing the limit stop switch should enable the work cage to travel down again.
- Test EMERGENCY limit stop switch: During upward travel, push the switch manually, and the work cage should stop immediately. Following this, neither upward nor downward travel should be possible.
- Bottom safety stop. Take the work cage down; it should stop before the rubber feet of the cabin reaches the tower ground level.

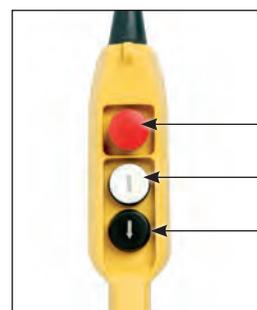
Fig. 14a
Electrical control box



Fig. 14b
AECO control box



Pendant control



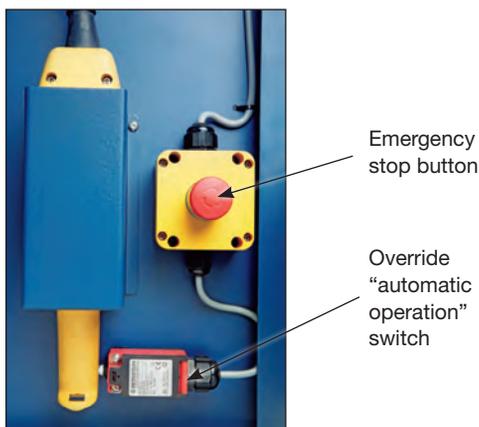
EMERGENCY STOP
UP
DOWN

5.4 Automatic operation control

Perform only this inspection if function AUTOMATIC is installed.

- a) Push EMERGENCY STOP button on pendant control. Turn HAND/AUTOM. switch on electrical control box to the right to activate automatic operation.
- b) Deactivate EMERGENCY STOP button by turning button clockwise. (Check EMERGENCY STOP button fixed is deactivated.) The work cage should stand still.
- c) It is forbidden to manipulate with the “override automatic” operation switch.
- d) With closed doors push UP and DOWN buttons. Neither upward nor downward travel should be possible (Switch in pendant control holder blocks operation).
- e) Push EMERGENCY STOP button on pendant control.
- f) Place pendant control in holder so it is operational from the outside.
- g) Leave cabin and close door.
- h) Deactivate EMERGENCY STOP button. The work cage should stand still.
- i) Push UP button. The work cage should travel upwards.
- j) Push EMERGENCY STOP button. The work cage stops.
- k) Turn EMERGENCY STOP button clockwise and push DOWN button. The work cage should travel downwards until emergency stop button stops the work cage.
- l) Remove pendant control from holder.
- m) Return HAND/AUTOM. button to HAND.
- n) Test that the UP and DOWN buttons works again.
- o) DO NOT try to activate the override “automatic operation” switch.

Fig. 15



5.5 Remote operation control

Perform only this inspection if remote control is installed.

- a) On the electrical control box switch HAND/AUTOM. Switch to hand.
- b) On top of the remote operation receiver switch the device on.
- c) Push upward arrow on remote operation transmitter. The work cage should ascend.
- d) Push downward arrow on remote operation transmitter. The work cage should descend.
- e) Once the test is complete, switch the remote operation function off.

5.6 Fall arrest device

- a) Engage the **fall arrest device** by pressing it's stop button - the handle should jump to position “ON” .
- b) Reopen the fall arrest device by pressing down on the lever – the lever must engage.
- c) During operation, regularly monitor the centrifugal force regulator relay's rotation by looking through the window.

5.7 Wires and suspension

- a) During operation: Checking of the **lifting and safety wires** – free passage through hoist and fall arrest device.
- b) When the work cage is at the top landing, inspect the **wire attachment** and all the building sections that suspend the work cage.

6. Instructions for use



Transportation of people in AUTOM. mode is forbidden.

6.1 Entry and exit

To ensure safe entry and exit:

- Lower the work cage onto the access platform until the contact plate is activated and the cabin stops, or: bring the work cage to a height corresponding to the correct level for exiting from the wind turbine's platform.
- Open the door and exit/enter the work cage through the door/over the cabin railing.

6.2 Stop/EMERGENCY STOP

- Release the direction selector; the work cage should stop
If it does not:
- Push the EMERGENCY STOP switch, and all controls should be disabled. Open the door and enter/exit the work cage through the door/over the cabin railing.

6.3 Normal operation

- Turn the red EMERGENCY STOP switch on the control box clockwise and the switch should pop out (Fig. 13 page 19). Do likewise with EMERGENCY STOP fixed (Fig. 9 page 17).
- To go up or down, push and hold the direction selector in the relevant direction.
- To place work cage on floor after the bottom safety stop has stopped the lift.
 - Turn override bottom safety stop switch (Fig. 6 page 16) clockwise and hold.
 - Push DOWN button until the work cage rests on the floor and let go.

6.4 Automatic

Only in work Cages with function AUTOMATIC installed.

- Push EMERGENCY button on pendant

control. Turn HAND/AUTOM. switch on power cabinet to activate automatic operation.

- Close door.
- Push UP or DOWN button respectively and the cabin starts ascending/descending.
- Remove pendant control from holder.
- Return HAND/AUTOM. button to HAND.

6.5 Remote operation

- On the electrical control box switch the HAND/AUTOM. switch to hand (fig. 7).
- On top of the remote operation receiver switch the device on (fig. 9).
- For ascending push upward arrow on remote operation transmitter.
- For descending push downward arrow on remote operation transmitter.
- Once the operation is complete, switch the remote operation function off.

6.6 Lifting force limiter

- In case of an overload, the work cage's upward travelling should be blocked, and a buzzer should sound in the connection cabinet.



Attempting to go up in an overloaded work cage is prohibited!

- Remove enough of the load to make the buzzer stop and enable upward travel.



On entering and starting the work cage, the buzzer may sound briefly. This is due to temporary load peaks occurring as the work cage takes off.

The control box is designed not to activate the buzzer or stop the work cage because of peak loads caused by the cabin swinging.

If the problem persists have an AVANTI expert adjust the overload limiter (Appendix A).

7. Manual operation (EMERGENCY)

If a power failure or an operation fault etc. interrupts the work cage, a manual EMERGENCY descent is possible.

7.1 EMERGENCY descent

- Open the manhole by pushing the lid in the roof and operate the work cage from above.
- On top of the work cage insert the lever into the break lever hole in front of the Traction hoist.
- Pull the lever upwards. The work cage moves downwards. The built-in mechanical overspeed limits the pace of descent.
- To stop, simply loosen the lever.
- After use, replace lever in roof hole.

For emergency situation only

Fig. 16a Tirak

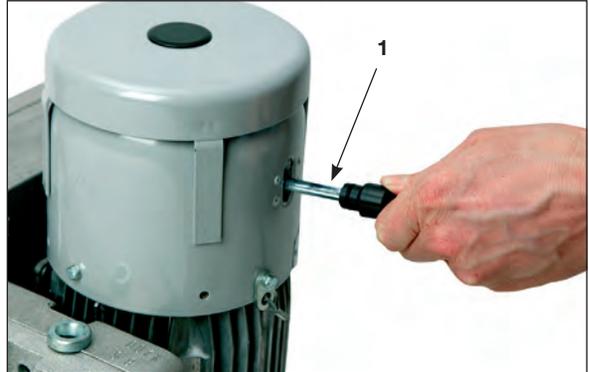


Fig. 16b M500 / M508

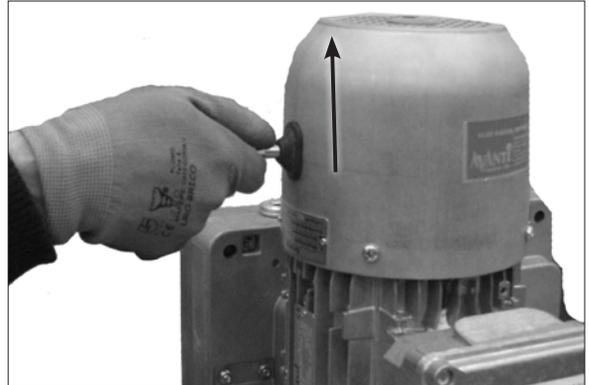


Fig. 17



7.2 Manual ascent for Tirak only



It is not possible for the M508 to manually ascend.

With the brake open, the work cage can be pulled upwards using the hand wheel.

- Remove the rubber cap.
- Mount the hand wheel [2] on the motor shaft and turn it counter clockwise with the brake [1] open.
- After use, retract the hand wheel and lever from the traction hoist and replace them in the roof holes. Replace the rubber cap.

8. What to do if the fall arrest device engages?

If the fall arrest device engages simply disengage by pushing down the lever until it clicks. However this is not possible if the work cage is hanging on the wire - if so, see below.



On lifting wire rope breaks or hoist failures, evacuate staff from the work cage.

The safety wire rope suspension and the attachment between the fall arrest device and the work cage are exposed to dynamic loads when a fall is blocked.

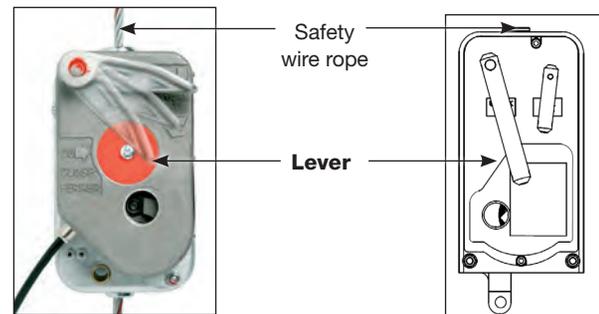
If the **fall arrest device has locked** and the work cage is **hanging on the wire rope** ascending is blocked. Do as follows:

- a) Remove the load on the safety wire rope by taking the work cage upwards
 - On power failures operate the work cage manually as explained in section 7.2.
- b) Manually open the fall arrest device by pressing down levers until they disengage. On ground level perform **test as specified in**

Installation Manual section 4. e) and User's Manual section 5.6 before resuming normal operation.

BSO

M508



When the work cage has returned to ground level, test the secondary brake function as specified in Installation Manual and User's manual.



Replace any defective fall arrest device components and return them for repair to the manufacturer.

9. Troubleshooting

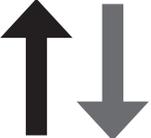
1. All tests and repairs of the electronic components should be performed by an **authorized electrician only!** The power chart is placed in the traction hoist's power cabinet.
2. Repairs on the traction hoist, the fall arrest device and on the system's supporting components should be performed by **qualified fitters only!**

Break-down	Cause	Solution
<p>The work cage will neither go up nor down!</p> 	 DANGER! <i>Attempting to use the work cage will jeopardise work safety!</i>	
	A1 The fixed EMERGENCY STOP button has been activated.	Deactivate the button in question by turning it clockwise until it pops out.
	A2 Wire loop on traction hoist. Damaged or defective wire or wire outlet causes problems.	Stop work immediately! Ask the supplier or manufacturer for help.
	A3 The fall arrest device is holding the work cage on the safety wire. a) Lift wire breakage b) Hoist failure	a) + b) Evacuate the work cage and follow the directions in section 9
	A4 work cage is stuck on an obstacle.	Carefully remove the obstacle. Test the operational safety of affected building sections. Inform the supervisor.
	A5 Failing power supply a) Control not switched on or deactivated. b) Grid voltage interrupted. c) With 3-phase motors: Phases switched in the supply, the built-in protection against phase switching blocks control. d) Supply between grid connection and control interrupted.	a) Turn EMERGENCY STOP switch to the right until it is released. b) Find the cause and wait for the power to return. c) Have an electrician switch 2 phases in the plug. d) Test and possibly repair the supply cable, guide wires, fuses, and/or wiring from the control box.
	A6 Limit stop switch functions a) EMERGENCY limit stop switch was hit. b) Close the doors and test the limit stop or is defective.	a) Manually take the work cage down until the limit stop switch is released. b) Door limit stop switch blocks switch.
	A7 Protection switch on overheating a) A phase is missing b) Lacking motor cooling c) Voltage too high/low	a) Test/repair fuses, supply and connection. b) Clean the hood. c) Measure voltage and power consumption on the loaded motor. If voltage deviates from specifications, use cable with increased dimensions.
	A8 Brake does not open (no click on on/off) a) Supply, braking coil or rectifier defective. b) Braking rotor closes.	a) Have an electrician test, repair/replace the supply, braking coil and rectifier. b) Return traction hoist for repair.



DANGER!

Unplug the power supply before opening the power cabinet.

Break-down	Cause	Solution
<p>The work cage will neither go up nor down</p> 	<p>A8 The HAND/AUTOM. switch is on AUTOM.</p>	<p>Turn the HAND/AUTOM. switch back to HAND.</p>
	<p>A9 The work cage is hung on an obstacle below it.</p>	<p>a) Evacuate the work cage b) Inform the supervisor c) Check the bottom safety stop connection/function. Replace if necessary d) Check the slack sensor rope ¹⁾ connection and function. Replace if necessary. <i>¹⁾Note: Only for AECO version.</i></p>
<p>work cage goes down but not up</p> 	 <p>DANGER! <i>Irresponsible behaviour jeopardises system safety!</i></p> <p>B1 work cage is stuck on an obstacle.</p>	<p>Carefully move the work cage downwards and remove the obstacle. Test the operational safety of affected platform components. Inform the supervisor.</p>
	<p>B2 Overload - Buzzer sounds in the connection cabinet.</p>	<p>Test and possibly reduce load until buzzer stops.</p>
	<p>B3 Limit stop UP:</p> <p>a) Limit stop defective or not connected. b) Operation limit stop was activated.</p>	<p>a) Test the limit stop connection/function. Replace if necessary. b) Move work cage down until the limit stop switch is released.</p>
	<p>B4 A phase is missing</p>	<p>Test fuses and power supply.</p>
	<p>B5 Fault in UP control circuit in control box or traction hoist</p>	<p>Test and possibly repair connections, wiring and relays.</p>
<p>Motor hums loudly or wire ropes squeak,</p>  <p>but the work cage can go both up and down.</p>	<p>C1 Overheating</p>	<p>For descriptions of individual causes and how remedy faults, see page 24 under item A5.</p>
	<p>C2 Wire ropes dirty</p>  <p>ATTENTION! <i>Further use of work cage may result in damage to the wire traction.</i></p>	<p>If possible, immediately replace the traction hoist and return it for test/repair at AVANTI.</p>



DANGER!

Unplug the power supply before opening the power cabinet.

Break-down	Cause	Solution
<p>work cage will go up but not down!</p> 	<p> DANGER! <i>Irresponsible behaviour threatens the system's safety!</i></p> <p>D1 The work cage has encountered or is stuck on an obstacle.</p>	<p>Carefully take the work cage up and remove the obstacle. Test the operational safety of affected platform components. Inform the supervisor.</p>
<p> DANGER! <i>Unplug the power supply before opening the power cabinet.</i></p>	<p>D2 The fall arrest device is holding the work cage on the wire.</p> <p>a) Excessive hoist speed b) Too low release speed on fall arrest device.</p>	<p>a) + b) Take the work cage upwards to relieve the safety wire. Open the fall arrest device by pressing the handle, and test its function. Functional test when the work cage is back on the ground: Replace the hoist and secondary brake and return them for testing.</p>
	<p> DANGER! <i>A defective fall arrest device will threaten the safety of the work cage! Replace immediately!</i></p>	<p>D3 Fault in down controller circuit on traction hoist</p>
	<p>D4 The slack rope sensor is holding the service lift on the traction wire.</p>	<p>a) The slack rope sensor has engaged: move the service lift upwards to disengage the device. b) The sensor is not properly installed: have a competent technician adjust the device correctly. c) The sensor is defective: replace it and return it for test/repair at AVANTI.</p>
<p>Green lamp not lit although operation is normal</p>	<p>E The lamp is defective</p>	<p>Have an electrician replace the bulb.</p>
<p>Hoist goes down when up button is pressed and down when down button is pressed.</p>	<p>F Two phases changed in the supply</p>	<p>Have an electrician switch the 2 phases in the plug.</p>



If these steps do not clarify the cause and remedy the fault: Consult a qualified electrician or contact the manufacturer.

10. Out of service

- a) **Securing the work cage:**
Bring the work cage all the way down, until the contact plate switch stops the cabin.
- b) **Switch off the power supply** to prevent inadvertent operation of the work cage: Push in the EMERGENCY STOP button fixed – all controls are now blocked. Mark the work cage “OUT OF SERVICE”. Contact the service technician for repair.

11. Removing wires for replacement



CAUTION!
Wear protective gloves when handling wire ropes.

11.1 Parking the work cage

Descend the work cage until bottom safety stop engages.

11.2 Wire rope ends

Beneath the access platform:

- a) Loosen and decoil all coiled and secured wire rope ends.
- b) Remove the weight and the tightening spring.

11.3 Removing the lifting wire rope

- a) Turn the “override bottom limit stop switch” key to the right and turn the direction selector towards DOWN until the cabin rests on the platform.
- b) After having removed the drive wire contra weight turn the travel direction selector towards “DOWN”. The wire rope now exits the traction hoist at the top.
- c) From above the traction hoist remove the wire rope by hand.

11.4 Removing the safety wire rope

- a) Keep the fall arrest device open and manually pull out the wire.
- b) Pull out the wire on top of the work cage.

Time (Performance)	Component
Daily: (Supervisor)	Attachment components traction hoist Control box Safety brake
Annually: (Expert)	Wires Electrical cable
Annually: (Expert)	Entire system
Annually, however at least every 250 hours of operation: (Expert)	Traction hoist
Annually: (Expert)	Fall arrest device

12.1 Yearly inspection

Have the entire system, especially the traction hoist and the fall arrest device tested by an AVANTI trained expert at least once annually however more frequently if required depending on use and the conditions of use and operation. The traction hoist and safety brake must be overhauled at an authorized work shop and furnished with new certificate for every 250 hours of operation (Time counter is found in the power cabinet).



ATTENTION!

If fall arrest device has engaged, an expert must verify the safety of the fall arrest device, the wire, and wire attachment.



The tower owner must ensure that results of all annual and extraordinary testing are logged (Appendix B).

12.1.1 Traction hoist

The traction hoist is largely maintenance free. Clean only when very dirty. During cleaning always ensure sufficient air supply.

Annual test:

- Ensure that no visual defects appear.
- Test emergency descent function
(See Users's Manual)

12.1.2 Fall arrest device

The fall arrest device is largely maintenance free. Clean only when very dirty. Keep free from dirt and lubricate often. Using too much oil will not harm the equipment or the gripping function.

Annual test:

- Test fall arrest device stop button.
- Test fall arrest device stop button reset.
- Release safety wire bottom attachment in tower and Perform wire acceleration test by hand (See Installation Manual).

12.1.3 Work cage

Annual test:

Inspect the work cage as specified in User's Manual.

Drive and Safety Wire Rope Replacement Recommendation is made to replace the drive and safety wire ropes after 250 hours of operation (approximately every 5 years) corresponding with the refurbishment of the traction hoist. Please check with your local authority regulations if it's mandatory in your case.

12.1.4 Suspension/Wires/Cables

Always keep the wires clean and slightly greasy. Use Belray wire rope lubricant, however, do **not** use bisulphide-containing lubricants like Moly-cote®.

Annual test:

- Check and replace the respective wire(s) if one of the following defects are found:
 - **8 wire strand breaks** or more on a wire length corresponding to 30 times the wire diameter.
 - Severe **corrosion** on the surface or inside.
 - **Heat damage**, evident by the wire colour.
 - **Reduction of the wire diameter** by 5% or more compare to the nominal wire diameter
 - **Damage on the wire surface** – See fig. 19 for most common examples of wire damage. These examples do not, however, replace the relevant provisions laid down by **ISO 4309!**
- Check and ensure all wires are mounted at the top and ground level in accordance to the mounting instructions (See Installation Manual).
- Power cables
Check and replace the supply and control cables if the cable jacket or cable connections are damaged.
- Wire guide wheels
Ensure wires are lead round guide wheels in accordance to mounting instructions (See Installation Manual).

Fig. 19

Wire strand breaks



Fig. 20 Wire diameter

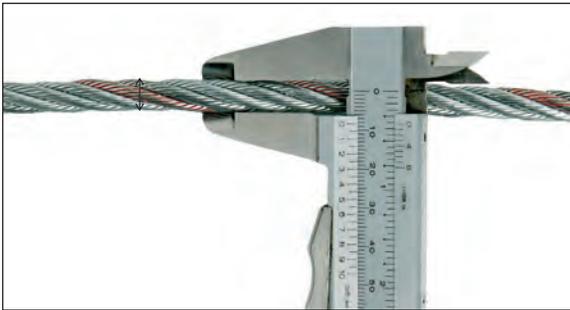


Fig. 21

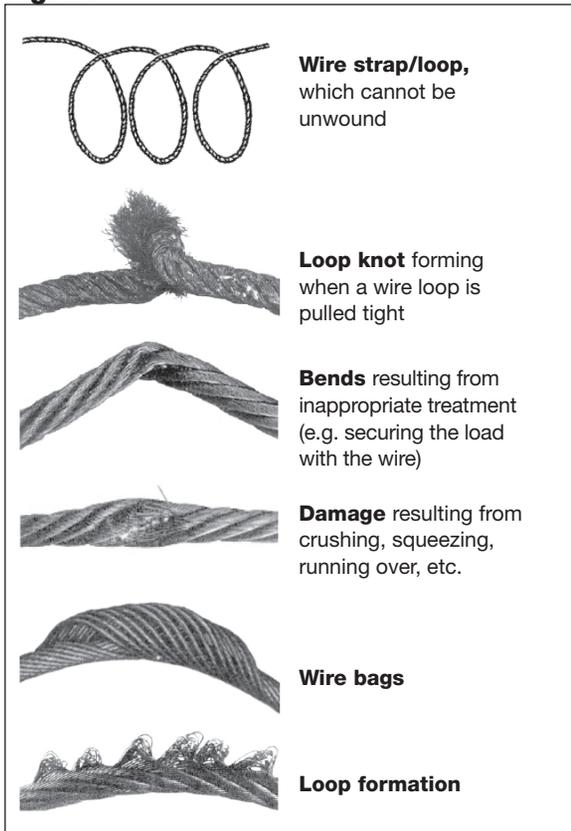


Table 4

Temperature range	5°F to 176°F (-15°C to 80°C)	-31°F to 104°F (-35°C to 40°C)
API specification	Synthetic oil	
	CLPPG or PGLP ISO VG 460 ¹⁾	CLPPG or PGLP ISO VG 100
Oil specification	Klübersynth GH6 460	Klübersynth GH6 100
¹⁾ Standard filling	Use of other synthetic oil only with approval by AVANTI.	

12.1.5 Switches / Overload limiter/information signs

Annual test:

Test switches as specified in User's Manual.

Test slack rope sensor ¹⁾:

- pull the drive wire rope by hand
- green light on bottom platform control box should turn off when switch is activated
- once you release drive wire rope, green light should be back on

Perform overload test as specified in Installation Guide.

Verify completeness and legibility of all rating plates and information signs. Replace missing or illegible plates and signs!

¹⁾Note: Only for AECO version.

12.2 Repairs

Repairs to traction hoist equipment may ONLY be performed by the manufacturer or a hoist service centre, and only using original spare parts.

If the gearbox oil needs to be replaced, use one of the lubricants specified in the following table, corresponding to the temperature range in which the traction hoist equipment is used.

Amount required:

traction hoist LE500P: **1.4 l.**

See table 4.

13. Ordering spare parts

13.1 Wire/ropes

In addition to the **item number** and **name of the spare part**, always state the **traction hoist type**, **wire diameter** and **production number**!

13.2 Motor and brake

In addition to the **item number** and **name of the spare part**, always state the **motor type** and the **type and coil voltage of the brake**!

13.3 Electric control

When ordering spare parts or making requests, always state the **electricity category** and **wiring chart number**. See the rating plate at the connection cabinet. There is a wiring chart in the connection cabinet and in the motor terminal box.

13.4 Fall arrest device

In addition to the **item number** and **name of the spare part**, always state the **fall arrest device type**, the **wire diameter** and work cage **serial no.**



A spare parts list is available from the supplier or directly from AVANTI.

13.5 Rating plate information signs

Verify the completeness and legibility of all rating plates/information signs. Replace missing or illegible plates/signs!

Installation Manual

Please familiarise yourself with these instructions and the User Manual (Model SHARK) before installing the work cage. Ensure that all specified parts are present before commencing installation.

No warranty is provided against damage and injury resulting from not following this “User’s Manual and Installation Manual” i.e. reconstruction or modification of equipment or use of non-original parts which are not approved by the manufacturer.

1. Assembling SHARK cabin

The work cage SHARK version sliding doors and version double doors are assembled close to their final mounting position as follows:

Installation holes have been pre-drilled. Bolts, nuts etc can be found in the plastic bags supplied.

1. Assemble the right, left and bottoms sections with the cabin resting on its back.
2. Mount the roof spine and then slide the roof into position and fit to the cabin.
3. Fit the wire guides.
4. Mount the traction hoist and secondary brake to the spine.
5. Attach the cabin front.
6. Mount the 4 bottom rubber feet to the bottom of the cabin.
7. Mount the operation limit stop switch and emergency limit stop switch on the roof using the contact bracket.
8. Attach the bottom safety stop beam including the wires that hold the bottom safety stop beam.
9. Bring the cabin to its upright position.
10. Mount the doors on the cabin. On the Double door version - remember to install the ground wire at the top hinge.
11. Mount the steps and handle inside the cabin.
12. Feed the power cable through the rear hole and fit the socket to the back using the strips.
13. Mount the bottom safety stop switch and adjust. Connect the switch cables to the power cabinet according to the color code. All wires are secured using strips (max 200mm between strips).

All bolts and nuts are stainless steel.

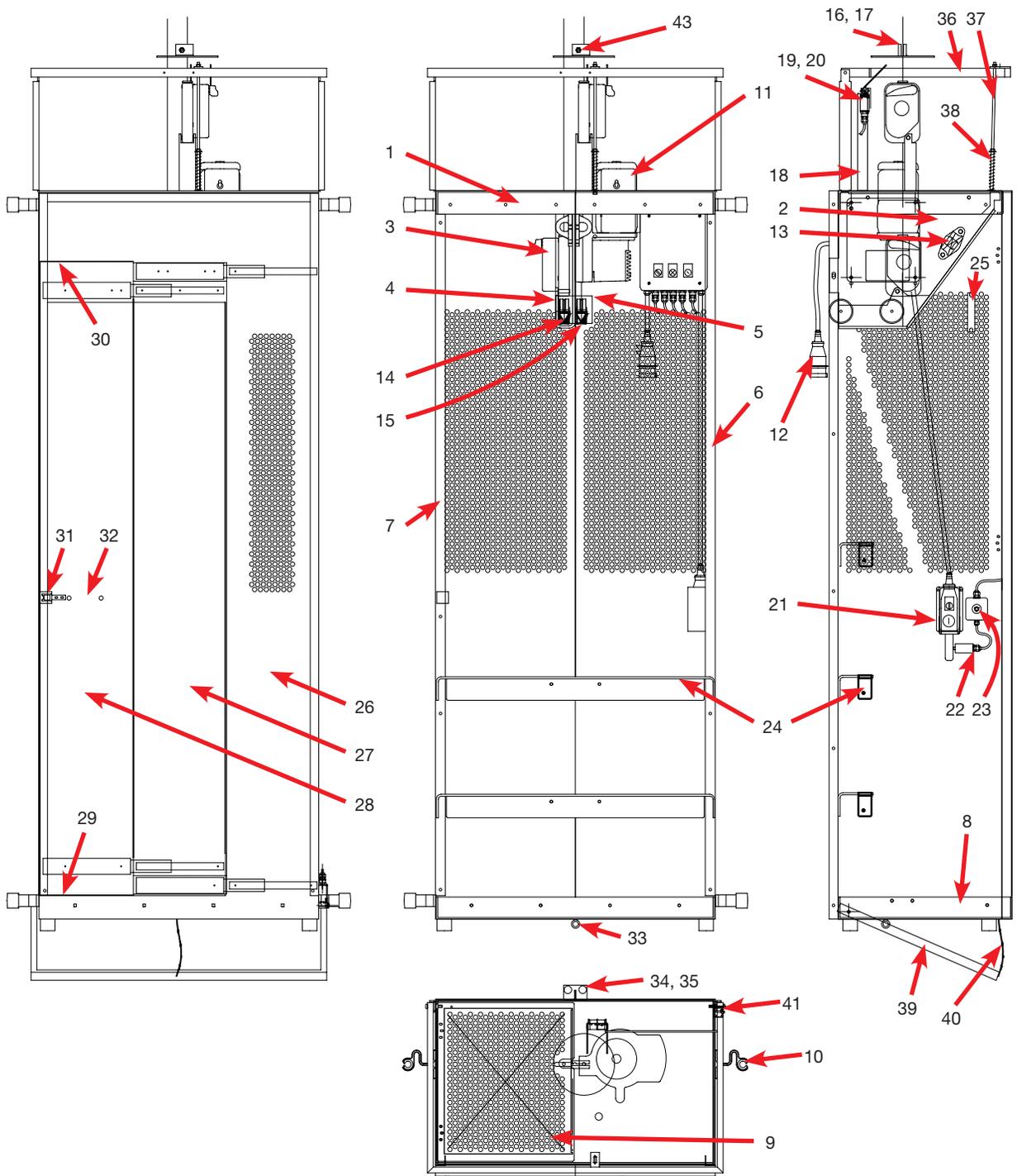


DANGER!

If it is possible to enter underneath the work cage a double bottom safety stop must be fitted. (See Installation Manual).

1.1 Parts list - Shark L Sliding door

Fig. 1



1.1 Parts list - Shark L Sliding door

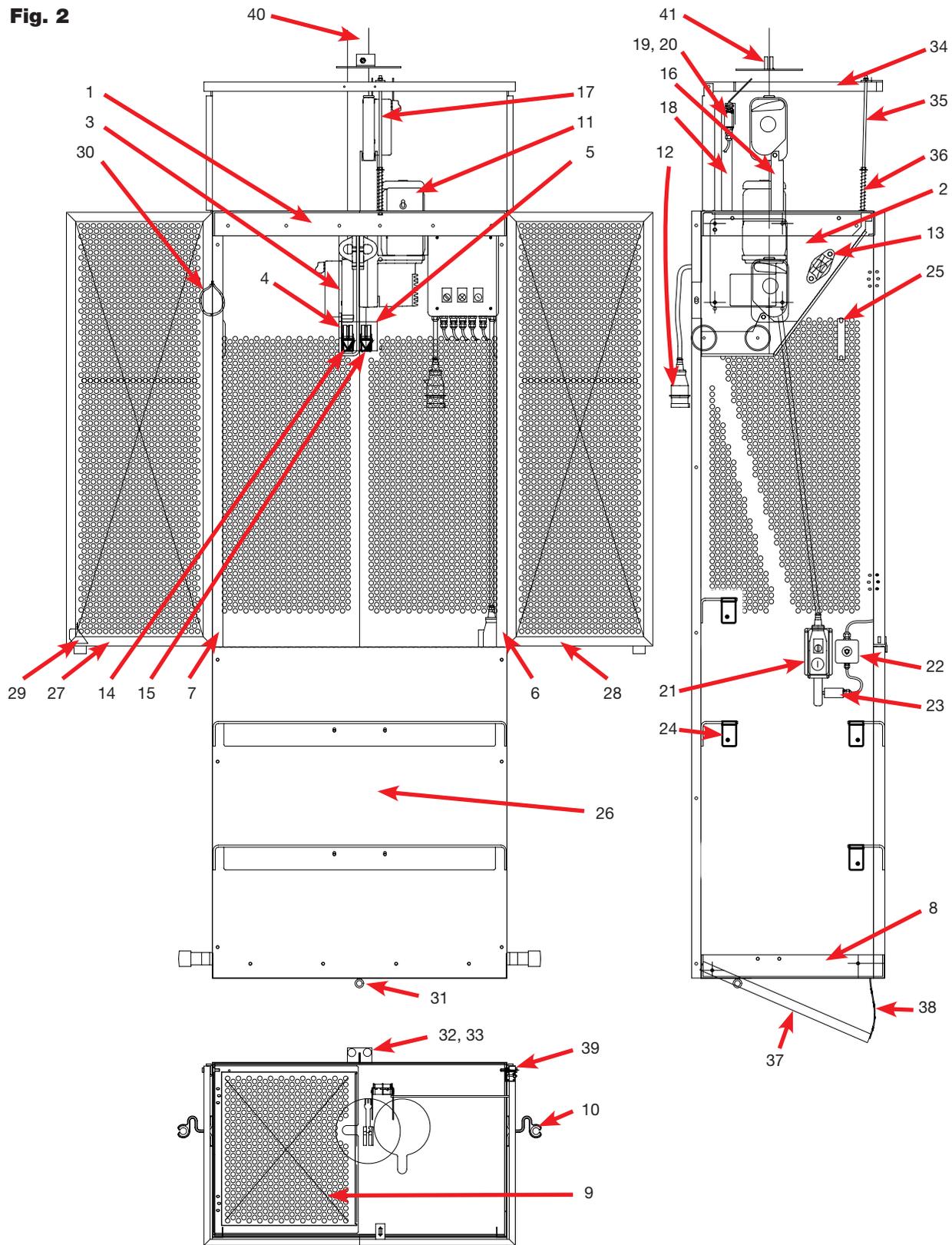
Pos.	Item no.	Part description	Pcs	Reference
1	45303112	Top(Shark L)	1	
2	45303107	Spine(Shark L)	1	
3	45108037	Fall arrest device BSO500E	1	
4	45303121	Guard small for Spine (Shark)	1	
5	45303120	Guard large for Spine (Shark)	1	
6	45303105	Cabin, right (Shark)	1	
7	45303106	Cabin, left (Shark)	1	
8	45303111	Bottom (Shark)	1	
9	45303117	Hatch (Shark)	1	
10	45511002	Wire guide	4	Install. fig. 14
11		Traction hoist, LE500P 230V, 400V or 480V Traction hoist, LE502P 230V, 400V or 480V	1	
12	45502082	Hubbell-plug, female 480V	1	
13	47870006/45512194	Anchor point, yellow	2	
14	45570001	Roller 1 for spine (Shark)	2	
15	45547002	Roller 2 for spine (Shark)	2	
16	45303101	Top stop disc	1	Manual fig. 2
17		Safety wire / Drive wire ø8	2	
18	45303145	Bracket for top switches+200mm	1	
19	45502071	Top stop switch (S1) /UL	1	Manual fig. 10
20	45502072	Emergency top stop switch (S13) /UL	1	Manual fig. 10
21	45303118	Pendant control holder (Shark)	1	Manual fig. 13b
22	45502074	Emergency stop button, Shark /UL	1	Manual fig. 13b
23		Override automatic operation switch		
24	45303116	Step (Shark)	3	
25	45512009	Handle for cabin, black	2	
26	45303153	Front for sliding door UL (Shark)	1	
27	45303154	Door-middel for Shark sliding door /UL	1	
28	45303155	Door-left for Shark sliding door /UL	1	
29	45303125	Door rail 1, Shark sliding door /UL	1	
30	45303126	Door rail 2, Shark sliding door /UL	1	
31	45502073	Door stop switch, Shark sliding door /UL	1	
32	45303124	Handle for Shark sliding door /UL	1	
33	79999562	Eye not, M8, FZV	1	
34	45303123	Angel for wirebush	1	
35	45512006	Guide for wirebush	2	

1.1 Parts list - Shark L Sliding door

Pos	Part no.	Part description	Pcs	Reference
36	45303143	Top stop bar /UL	1	
37	79999503	Threaded rod, M8, A2, m..	0,45	
38	45515004	Push spring for top safety stop	1	
39	45303128	Bottom stop bar (Shark)	1	
40	45512064	Wire Ø2,3mm, coated	0,62	
41	45502070	Bottom stop swich, Shark /UL	1	
		Guide wire Ø12mm	2	
	45512005	Schackle, 2 ton	2	Manual fig. 13
	45303100	Tripod	2	Install. fig. 8a
	45512060	Threaded rod, M16, FZV, L=330mm	2	Install. fig. 8a
	45515001	Push spring for safety wire	1	Install. fig. 12
	45512011	Contra weight 11 kg for drive wire	1	Install. fig. 12
	45512001	Cable bucket	1	
		Power cable 4G1,5 /UL	1	
	45502080	Hubbell-plug, male 480V	1	
	45512003	Cable suspension	1	Install. Fig 9
	45512056	Snap hook, Galv. L=70mm	1	Install. Fig 9
	45511001	Wirefix	10	Install. fig. 14
	45512010	Bracke for wirefix 70	10	Install. fig. 14
	45541105	Quick-guide, English	1	Manual fig. 21
	45541106	Quick-guide, Spanish	1	
	45541011	“Warning”, UL- & CSA-approved	1	Manual fig. 21
	45541012	“MAX 533 lbs”, UL- & CSA-approved	1	
	45541025	Warning sign - hook on to anchor point	1	
	45541040	Rating plate for Shark /UL	1	Manual fig. 21
	Optional			
	45511006	Click on wire fix	10	Manual fig. 9
	45511007	Click on wire guide	4	
	45502141	Remote control transmitter UL	1	
	45502139	Remote control receiver UL	1	
	45502146	Emergency light	1	
	45502075	Flash, yellow 277 V/UL	1	
	45502076	Base for flash	1	
	45502077	2nd base for yellow flash / UL	1	
	45303148	Fitting for UL-flash	1	
	35499010 / 35499021	Double bottom stop: Shark L / Shark XL	1	
	35499287	Roller wire guide	1	
	35499296	Top limit stop for top floating stop Shark L/XL	1	
	35499295 / 35499318	Top floating stop premounted Shark L / Shark XL	1	

1.2 Parts list - Shark L Double door

Fig. 2



1.2 Parts list - Shark L Double door

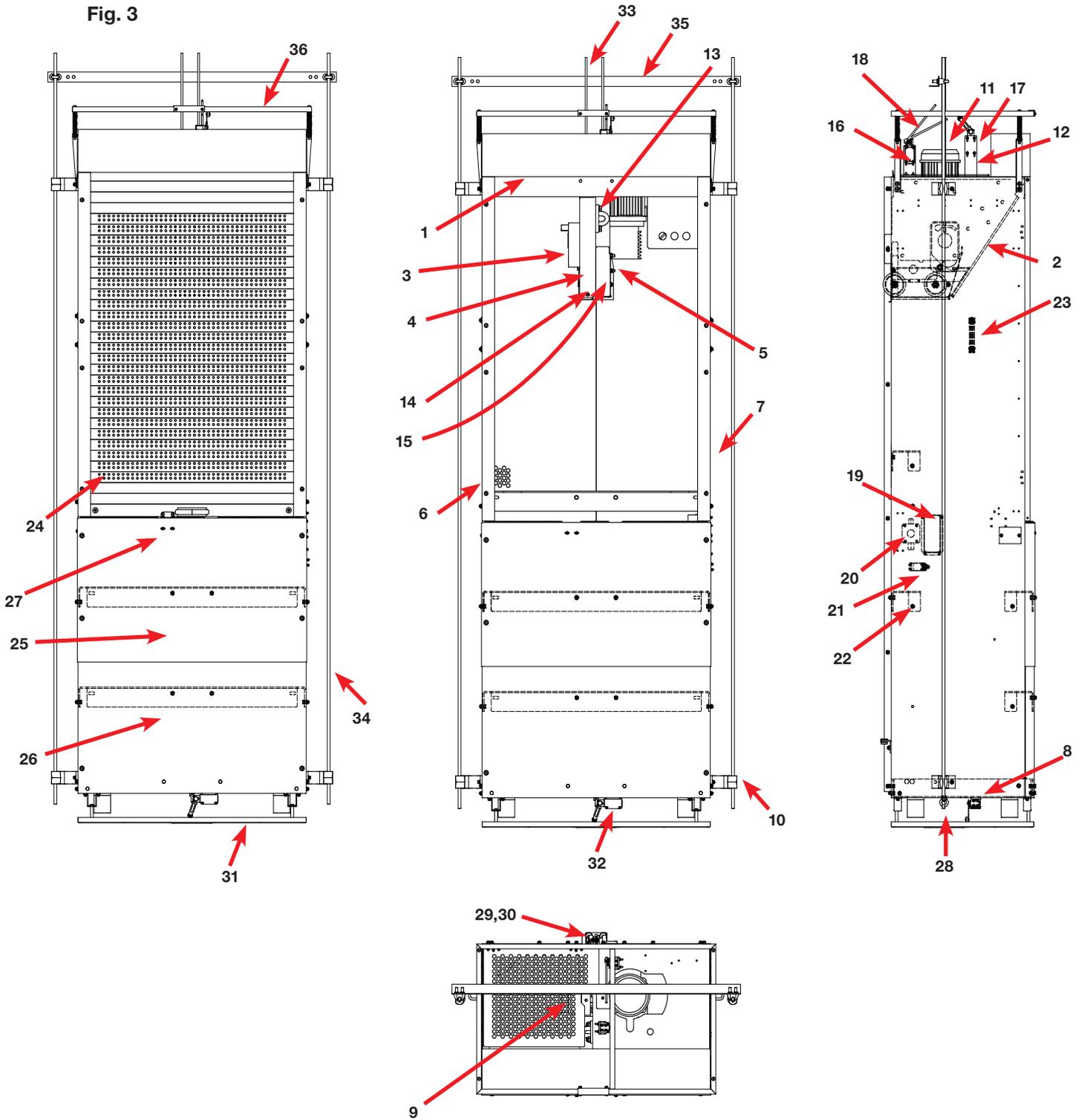
Pos	Part no.	Part description	Pcs	Reference
1	45303112	Top (Shark)	1	
2	45303107	Spine(Shark L)	1	
3	45108037	Fall arrest device BSO500E	1	
4	45303121	Guard small for Spine (Shark)	1	
5	45303120	Guard large for Spine (Shark)	1	
6	45303105	Cabin, right (Shark)	1	
7	45303106	Cabin, left (Shark)	1	
8	45303111	Bottom (Shark)	1	
9	45303117	Hatch (Shark)	1	
10	45511002	Wire guide	4	Install. fig. 14
11		Traction hoist, LE500P 230V, 400V or 480V Traction hoist, LE502P 230V, 400V or 480V	1	
12	45502080	Hubbell-plug, male 480V	1	
13	47870006/45512194	Anchor point, yellow	1	
14	45570001	Roller 1 for spine (Shark)	2	
15	45547002	Roller 2 for spine (Shark)	2	
16	45303146	Bracket for BSO500, UL	1	
17	45108038	Safety brake BSO500, UL	1	
18	45303145	Bracket for top switches+200mm	1	
19	45502071	Top stop swich (S1) /UL	1	Manual fig. 10
20	45502072	Emergency top stop switch (S13) /UL	1	Manual fig. 10
21	45303118	Pendant control holder (Shark)	1	Manual fig. 13b
22	45502074	Emergency stop button, Shark /UL	1	Manual fig. 13b
23		Override "automatic operation" switch	1	
24	45303116	Step (Shark)	4	
25	45512009	Handle for cabin, black	2	
26	45303108	Front for double door (Shark)	1	
27	45303109	Double door right	1	
28	45303110	Double door left	1	
29	45502078	Double door switch, Shark /UL	1	
30	45502007	Cable 1,5Q Flex yellow/green	0,55	
31	79999562	Eye not, M8, FZV	1	
32	45303123	Angel for wirebush	1	
33	45512006	Guide for wirebush	2	
34	45303143	Top stop bar /UL	1	
35	79999503	Threaded rod, M8, A2, m..	0,45	

1.2 Parts list - Shark L Double door

Pos	Part no.	Part description	Pcs	Reference
37	45303128	Bottom stop bar, (Shark)	1	
38	45512064	Wire Ø2,3mm, coated	0,62	
39	45502070	Bottom stop switch, Shark /UL	1	
40		Safety wire / Drive wire ø8	2	
		Guide wire Ø12mm	2	
	45512005	Schackle, 2 ton	2	Manual fig. 13
	45303100	Tripod	2	Install. fig. 8a
	45512060	Threaded rod, M16, FZV, L=330mm	2	Install. fig. 8a
	45515001	Push spring for safety wire	1	Install. fig. 12
	45512011	Contra weight 11 kg for drive wire	1	Install. fig. 12
	45512001	Cable bucket	1	
		Power cable 4G1,5 /UL	1	
	45502082	Hubbell-plug, female 480V	1	
	45512003	Cable suspension	1	Install. fig 9
	45512056	Snap hook, Galv. L=70mm	1	Install. fig 9
	45511001	Wirefix	10	Install. fig. 14
	45512010	Bracke for wirefix 70	10	Install. fig. 14
41	45303101	Top stop disc	1	Manual fig. 2
	45541105	Quick-guide, English	1	Manual fig. 21
	45541106	Quick-guide, Spanish	1	
	45541011	“Warning”, UL- & CSA-approved	1	Manual fig. 21
	45541012	“MAX 533 lbs”, UL- & CSA-approved	1	Manual fig. 21
	45541040	Rating plate for Shark /UL	1	Manual fig. 21
	Optional			
	35499033	4-door folding type, Shark /UL	1	
	35499011	Safety bar for sliding door	1	
	45511006	Click on wire fix	10	Manual fig. 9
	45511007	Click on wire guide	4	
	45502141	Remote control transmitter UL	1	
	45502139	Remote control receiver UL	1	
	45502146	Emergency light	1	
	45502075	Flash, yellow 277 V/UL	1	
	45502076	Base for flash	1	
	45502077	2nd base for yellow flash / UL	1	
	45303148	Fitting for UL-flash	1	
	35499010 / 35499021	Double bottom stop: Shark L / Shark XL	1	
	35499287	Roller wire guide	1	
	35499296	Top limit stop for top floating stop Shark L/XL	1	
	35499295 / 35499318	Top floating stop premounted Shark L / Shark XL	1	

1.3 Part list - Shark L / XL Half Roller door

Fig. 3



1.3 Part list - Shark L / XL Half Roller door

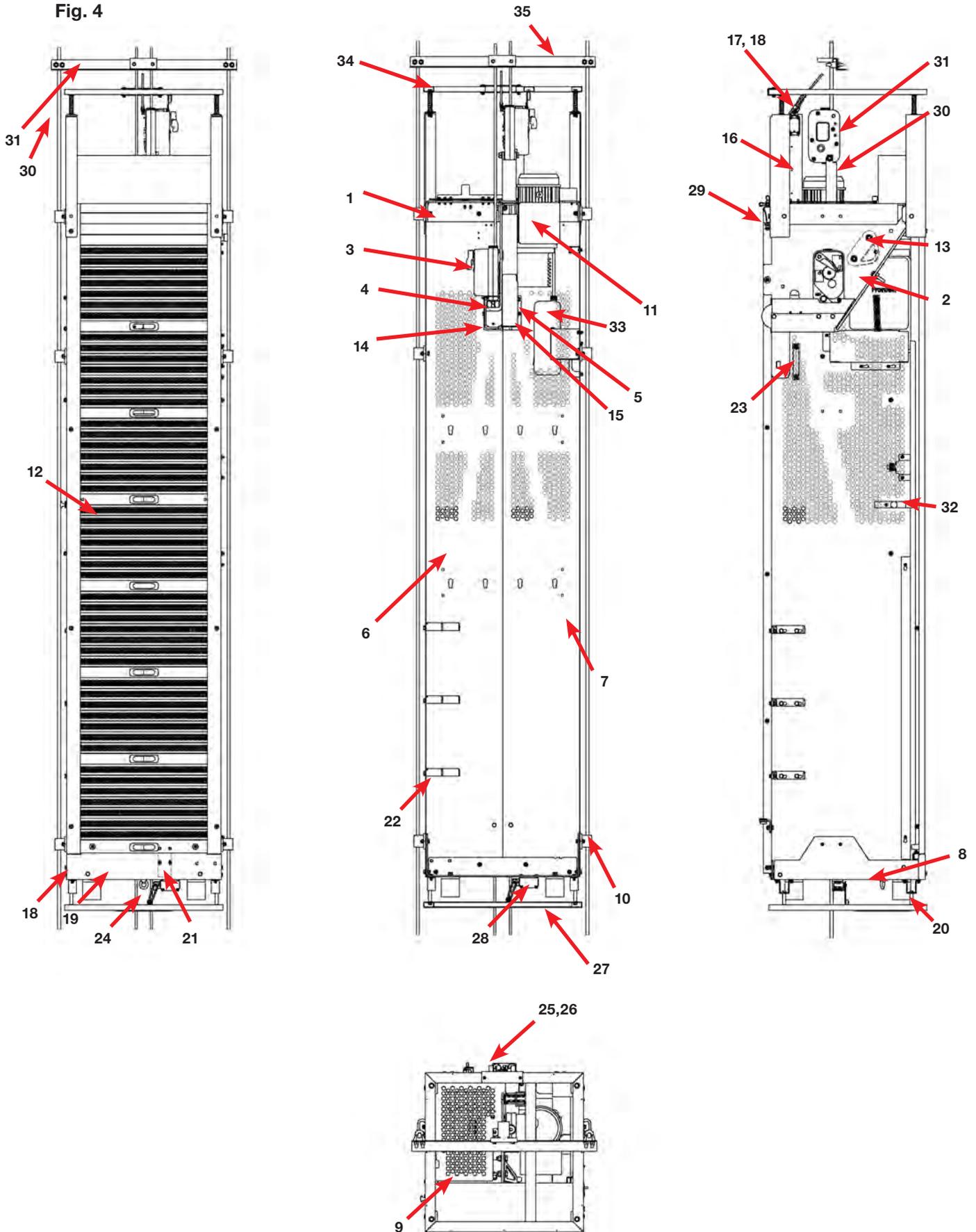
Pos	Part no.	Part description	Pcs	Reference
1	45303112 / 45303175	Top: Shark L / Shark XL	1	
2	45303107 / 45303177	Spine: Shark L / Shark XL	2	
3		Fall arrest device BSO500E	1	
4	45303121 / 45303176	Guard small for Spine: Shark L / Shark XL	1	
5	45303120 / 45303179	Guard large for Spine: Shark L / Shark XL	1	
11		Traction hoist, LE500P 230V, 400V or 480V Traction hoist, LE502P 230V, 400V or 480V	1	
14	45570001	Roller 1 for spine (Shark)	2	
15	45547002	Roller 2 for spine (Shark)	2	
6	45303105 / 45303180	Cabin, right: Shark L/Shark XL	1	
7	45303106 / 45303181	Cabin, left: Shark L / Shark XL	1	
8	45303111 / 45303178	Bottom: Shark L / Shark XL	1	
9	45303321	Hatch for half roller door	1	
10	45511002	Wire guide	4	
	45502082	Hubbell-plug, female 480 V	1	
12	45303369	Top stop switch bracket	1	
13	47870006/45512194	Anchor point, yellow/Spine Anchor	1	
16	45303119	Bracket for top switches	1	
17	45502194	Top stop switch (S1)	1	
18	45502036	Emergency top stop switch (S13)	1	
19	45303118	Pendant control holder (Shark)	1	
20	45502038	Emergency stop BOX	1	
21		Automatic operation switch	1	
22	45303116	Step (Shark)	4	
23	45512009	Handle for cabin, black	2	
24	35499272	Set half roller door	1	
25	45303156	Front fence top	1	
26	45303157	Front fence bottom	1	
27	45502150	Switch for half roller door	1	
28	79999562	Eye nut, M8, FZV	1	
29	45303123	Angle for wirebush	1	
30	45512006	Guide for wirebush	2	
31	35499294/35499317	Bottom stop full cover Shark L/Shark XL	1	
32	45502170	Bottom limit stop switch	1	
33		Safety wire/Drive wire Ø8	2	
34		Guide wire 12 mm	2	

1.3 Part list - Shark L / XL Half Roller door

Pos	Part no.	Part description	Pcs	Reference
	45512023	Counterweight 31 kg		
	45541011	"Warning", UL - & CSA approved	1	
	45541012	"MAX 533 lbs", UL & CSA approved	1	
	45512005	Shackle, 2 Tonnes	2	
	45303100	Tripod	2	
	45512060	Threaded rod, M16, FZV, L=330 mm	2	
	45515001	Push spring for safety wire	1	
	45512011	Counterweight 11 kg for drive wire	1	
	45512001	Cable bucket	1	
		Power cable 4G1,5 UL	1	
	45502080	Hubbell-plug, male 480 V	1	
	45512003	Cable suspension	1	
	45512056	snap hook, Galv. L=70mm	1	
	45511001	Wire fix	10	
	45512010	Bracket for wirefix 70	10	
	45303101	Top stop disc	1	
	45541120	Quick-guide, English	1	
	45541022	Quick-guide, Spanish	1	
	45541025	Warning sign - hook on to anchor point	1	
	45541040	Rating plate for Shark/UL	1	
	45303146	BSO holder	1	
	Optional			
	45511006	Click on wire fix		
	45511007	Click on wire guide		
	45502141	Remote control transmitter UL	1	
	45502139	Remote control receiver UL	1	
	45502146	Emergency light	1	
	45502075	Flash, yellow 277 V/UL	2	
	45502076	Base for flash	2	
	45502077	2nd base for yellow flash / UL	2	
	45303148	Fitting for UL-flash	2	
	35499010 / 35499021	Double bottom stop: Shark L / Shark XL		
35	35499287	Roller wire guide		
36	35499296	Top limit stop for top floating stop Shark L/XL	1	
	35499295 / 35499318	Top floating stop premounted Shark L / Shark XL	1	

1.4 Parts list - Shark M roller door

Fig. 4



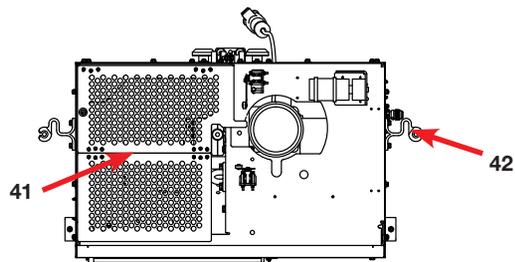
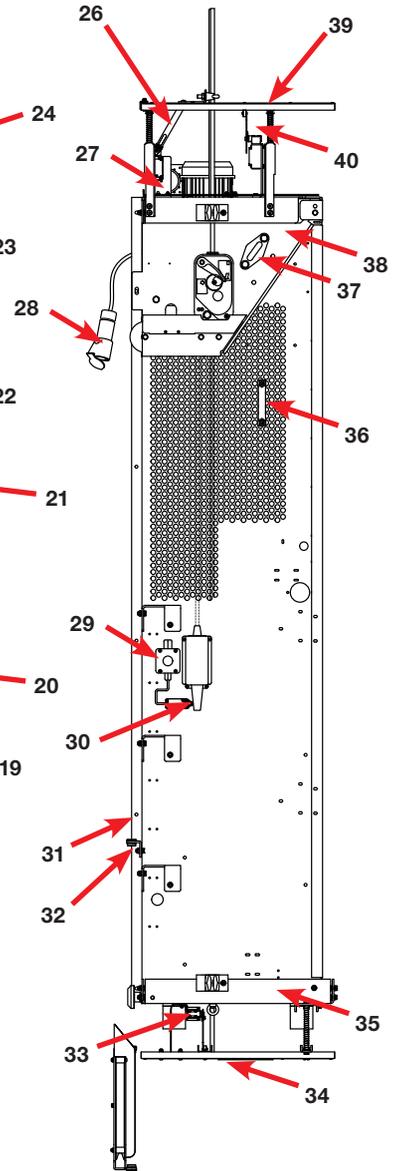
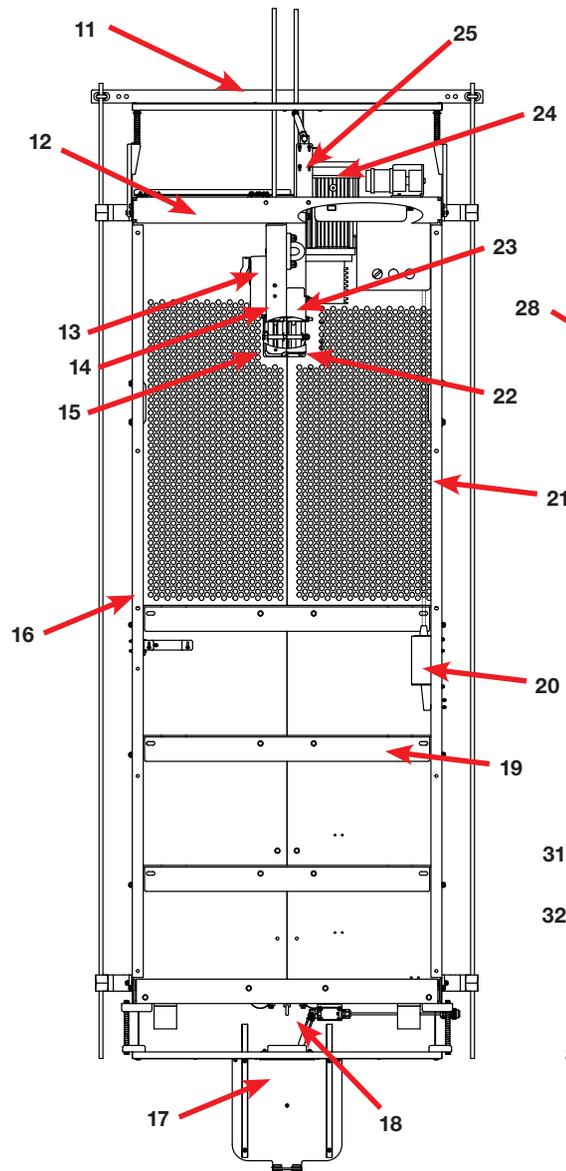
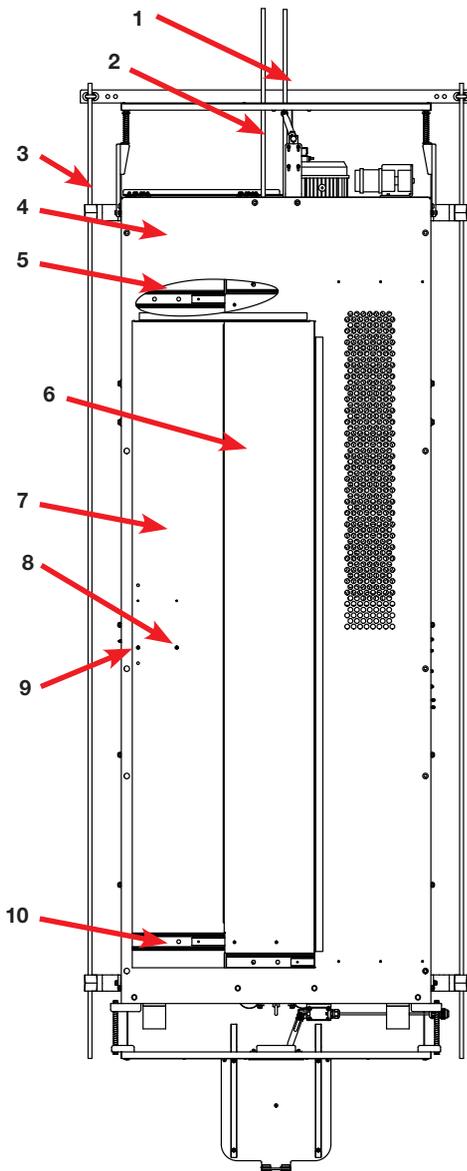
1.4 Parts list - Shark M roller door

Pos	Part no.	Part description	Qty	Reference
1	45303326	Top Shark M roller door	1	
2	45303107	Spine	1	
3		Fall arrest device BSO500E	1	
4	45303121	Guard small for Spine (Shark)	1	
5	45303120	Guard large for Spine (Shark)	1	
6	45303331	Cabin right Shark M GE	1	
7	45303332	Cabin left Shark M GE	1	
8	45303327	Bottom Shark M roller door	1	
9	45303325	Top hatch Shark M roller door	1	
10	45511002 / 45511003	Wire guide long / Wire guide narrow	4	Install. fig. 14
11		Traction hoist, LE500P 230V, 400V or 480V Traction hoist, LE502P 230V, 400V or 480V	1	
12	45512188	Roller door (Shark M)	1	
13	47870006/45512194	Spine Anchor	1	
14	45570001	Roller 1 for spine (Shark)	2	
15	45547002	Roller 2 for spine (Shark)	2	
16	45303340	Top stop switch bracket roller door	1	
17	45502165	Top stop switch S1	1	
18	45502166	Top limit switch S13	1	Manual fig. 10
19	45303333	Door switch bottom protection	1	Manual fig. 13b
20	45512183	Landing rubber feet 70x70	1	Manual fig. 13b
21	45502162	Roller door switch	1	
22	45303005	Step	4	
23	45512009	Handle for cabin, black	2	
24	79999562	Eye nut, M8, FZV 1	1	
25	45303123	Angle for wirebush 1	1	
26	45512006	Guide for wirebush 2	1	
27	35499281	Bottom safety stop premounted Shark M	1	
28	45502164	Bottom limit switch S2	1	
29	45502163	Hatch switch	1	
30	45303146	BSO holder	1	
31		Safety brake BSO 500, UL	1	
		Safety wire/Drive wire Ø8		
		Guide wire Ø12		

1.4 Parts list - Shark M roller door

Pos	Part no.	Part description	Qty	Reference
	45512005	Shacke, 2 tonnes		
	45303100	Tripod		
	45512060	Threaded rod, M16, FZV, L=330 mm		
	45515001	Push spring for safety wire		
	45512011	Contra weight 11kg for drive wire		
	45512001	Cable bucket		
		Rubber cable 4G1,5/5G1,5		
		Hubell-plug, female		
	45512003	Cable suspension		
	45512056	Snap hook, Galv. L=70 mm		
	45511001	Wirefix		
	45541120	Quick-guide, English	1	
	45541022	Quick-guide, Spanish	1	
	45541011	"Warning", UL - & CSA approved	1	
	45541012	"MAX 533 lbs", UL & CSA approved	1	
	45541027	Serial number plate Shark lift	1	
	35499285	Top stop end Shark M	1	
32	35499320	Set sliding latch roller door	1	
	Optional			
	45511006	Click on wire fix		
	45511007	Click on wire guide		
	35599003	Remote control kit	1	
33	45502146	Emergency light	1	
34	35499280	Top safety stop premoun. Shark M	1	
35	35499285	Top stop end Shark M	1	

1.5 Part list - Shark L AECO



1.5 Part list - Shark L AECO

Pos	Part no.	Part description	Qty	Reference
1		Drive wire Ø8mm	1	
2		Safety wire Ø8mm	1	
3		Guide wire Ø12mm	2	
4	45303153	Front for sliding door UL (Shark)	1	
5	45303126	Door rail 2, Shark sliding door /UL	1	
6	45303154	Door-middle for Shark sliding door /UL	1	
7	45303155	Door-left for Shark sliding door /UL	1	
8	45303124	Handle for Shark sliding door /UL	1	
9	45502037	Door stop switch, Shark sliding door /UL	1	
10	45303125	Door rail 1, Shark sliding door /UL	1	
11	35499296	Set top limit stop	1	Manual fig. 2
12	45303112	Top(Shark L)	1	
13	45108037 / 45408006	Safety brake BSO500E, UL / Avanti Safety Lock ASL 508 CE / UL	1	
14	45303107	Spine(Shark L)	1	
15	45303121	Guard small for Spine (Shark)	1	
15	45570001	Roller 1 for spine (Shark)	2	
16	45303106	Cabin, left (Shark)	1	
17	35499360	Pulley AVANTI Shark	1	
18	45502213	Bottom stop switch	1	
19	45303116	Step (Shark)	3	
20	45303118	Pendant control holder (Shark)	1	Manual fig. 13b
21	45303105	Cabin, right (Shark)	1	
22	45547002	Roller 2 for spine (Shark)	2	
23	45303120	Guard large for Spine (Shark)	1	
24		Traction hoist, LE500P 230V, 400V or 480V, 60Hz, UL / Traction hoist M508 400V or 480V, UL.	1	
25	45303369	Top stop switch bracket	1	
26	45502212	Emergency top stop switch (S13) /UL	1	Manual fig. 10
27	45303509	Contact bracket	1	
28	45502082	Hubbell-plug, female 480V	1	
29	45502038	Emergency stop, Shark /UL	1	Manual fig. 13b
30	45502062	Automatic mode switch	1	
31	45512006	Guidebush for pulling wire	2	
32	45303123	Bracket for wire support	1	
33	79999562	Eye not, M8, FZV	1	
34	35499357	Bottom stop full cover	1	
35	45303111	Bottom (Shark)	1	

1.5 Part list - Shark L AECO

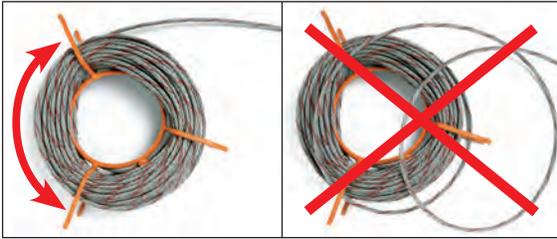
Pos	Part no.	Part description	Qty	Reference
36	45512009	Handle for cabin, black	2	
37	47870006/45512194	Anchor point, yellow, one person / two persons	1 / 2	
39	35499364	Set top floating stop	1	
40	45502343	Switch top floating stop (S1) UL	1	Manual fig. 10
41	35412016	Folding hatch	1	
42	45511002	Wire guide	4	Install. fig. 14
	45512005	Schackle, 2 ton	2	Manual fig. 13
	45303429	Tripod B	2	Install. fig. 8a
	45512060	Threaded rod, M16, FZV, L=330mm	2	Install. fig. 8a
	45515001	Push spring for safety wire	1	Install. fig. 12
	45512011	Contra weight 11 kg for drive wire	1	Install. fig. 12
		Power cable 4G1,5 /UL	1	
	45502080	Hubbell-plug, male 480V	1	
	45512003	Cable suspension	1	Install. Fig 9
	45512056	Snap hook, Galv. L=70mm	1	Install. Fig 9
	45511001	Wirefix		Install. fig. 14
	45512010	Bracket for wirefix 70		Install. fig. 14
	45541105	Quick-guide, English	1	Manual fig. 21
	45541011	"Warning", UL- & CSA-approved	1	Manual fig. 21
	45541012	"MAX 533 lbs", UL- & CSA-approved	1	
	45541025	Warning sign - hook on to anchor point	1	
	45541040	Rating plate for Shark /UL	1	Manual fig. 21
	45502146	Emergency light	1	
	35499367	Tail line switch system	1	
	Optional			
	45511006	Click on wire fix	10	Manual fig. 9
	45511007	Click on wire guide	4	
	45502141	Remote control transmitter UL	1	
	45502139	Remote control receiver UL	1	
	45502075	Flash, yellow 277 V/UL	1	
	45502076	Base for flash	1	
	45502077	2nd base for yellow flash / UL	1	
	45303148	Fitting for UL-flash	1	

2. Mounting of wires

2.1 Tower top

Wire lengths depend on tower height and should be specified when ordering. The coils are marked with length; check for accuracy prior to mounting. Do not pull wire over any edges. Uncoil correctly.

Fig. 5a



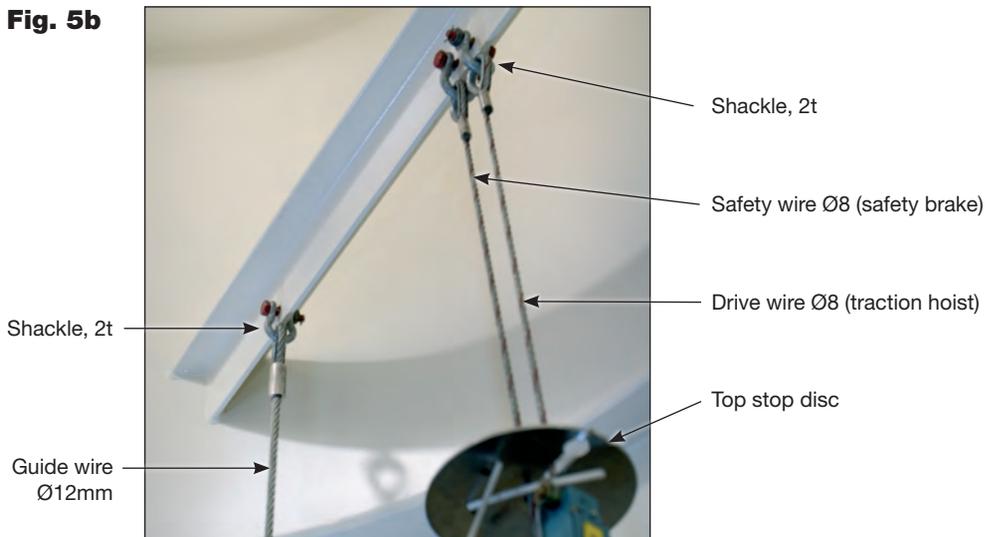
i All wires are evenly uncoiled to prevent looping.

! Do not pull wire over edges.

i Place all wire coils on the top platform when tower is raised or use the tower mounting crane to place the wires on the top platform before nacelle is mounted. (It may also be possible to use the internal tower crane to hoist wires).

- 1) The $\text{\O}12$ mm guide wire and the $\text{\O}8$ mm drive and safety wires are mounted using the shackles supplied for the suspension beam at the top of the tower, with the guide wire outermost on either side.
- 2) Nuts and bolts are mounted. Lock with cot-ters.
- 3) The top stop disc/bar is mounted on the suspension wire leaving at least 200mm (0.65 ft) between it and shackle.
- 4) All wires are led to the bottom of the tower.

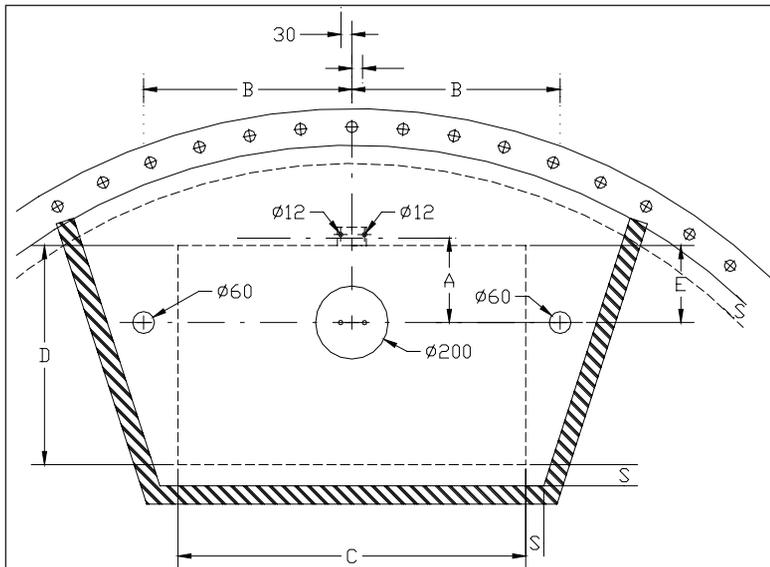
Fig. 5b



2.2 Measures for positioning of wires

Holes in base platform in the tower for wire bushing are positioned as outlined below.

Fig. 6



Minimum shaft clearance dimensions required for the work cage to run, and distance between the guide wires.

Dimensions:

Shark	A	B ¹⁾	C	D	E	S
M	250	395/330	600	600	220	50
L	250	575/510	960	600	220	50

1) Standard wire guide/narrow wire guide.

The holes are positioned with a tolerance of ± 5 mm (0.001 ft). Hole with diameter $\varnothing 200$ mm²⁾ are fitted with rubber edging.

²⁾ Note: $\varnothing 200$ mm hole not needed in case travelling cable present (AECO version).



Ensure that no obstacles are in the way of the work cage.



Ensure that work cage evacuation to the tower ladder is possible.

2.3 Securing the guide wire - ground level

i Before feeding guide wires through the platform place correct number of wire fix on wire and feed wire through wire guides. Wire fix are mounted during first run.

Feed the guide wire through the 2 times Ø60mm holes in the platform. Underneath the platform the guide wires are fastened and tightened using one of the following four methods.

Fig. 7 Wire fix

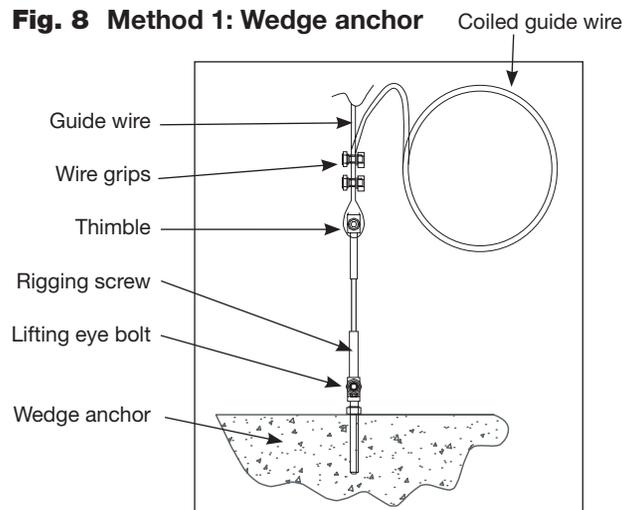


2.3.1 Wedge anchor

Mount wire following procedure below.

- 1) Drill two Ø16x75mm (0.25 ft) holes in the floor underneath the 2 Ø60mm (0.20 ft) holes in the platform.
- 2) Fasten the wedge anchors in the holes and mount an M16 lifting eyebolt.
- 3) After loosening the rigging screw as much as possible the rigging screw is fastened to the eyebolt in one end and the wire using wire grips in the other.
- 4) Tighten the wire
- 5) Excess wire is coiled and hung by means of wire strips. Use at least 3 strips.
- 6) Mount the second wire.

Fig. 8 Method 1: Wedge anchor



2.3.2 Tripod

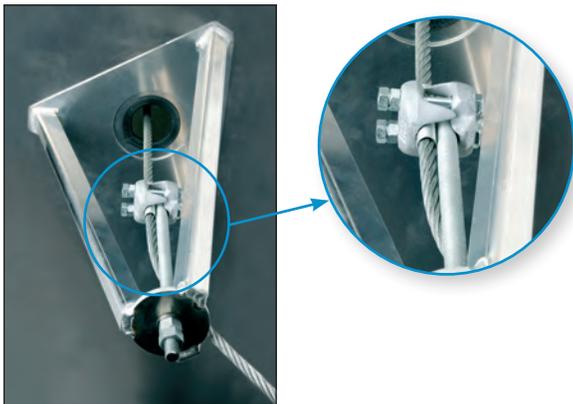
Pull the guide wire through the platform and fasten with tripod.

- 1) After feeding the guide wire through the platform continue feeding the wire through the tripod and the $\text{\O}16 \text{ mm} \times 1.5 \text{ mm}$ (0.005 ft) aluminium tube.
- 2) Lock the aluminium tube, the wire, and the treated rod using a wire locking device. Make sure to place the tube so no contact appear between wire and treated rod.
- 3) Tighten the bolts with 75 Nm.
- 4) Mount the second wire.

i Check the distance between wires so that the wire fix and wires are in the centre of the wire guides.

i Tighten the wire locking device after the first run.

Fig. 8a Method 2: Tripod



2.3.3 Steel beam

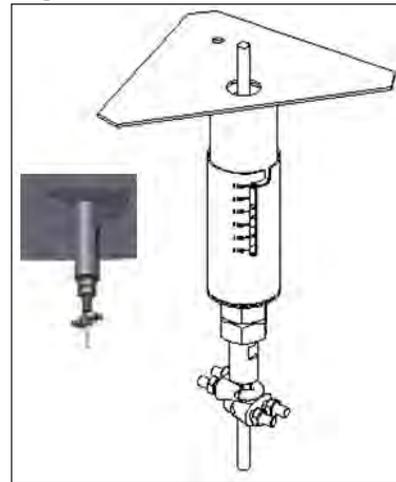
There may be a steel beam beneath the platform intended for work cage mounting. If so, use rigging screws for mounting the guide wire to the steel beam.

2.3.4 Graduated tensioner

- 1) Feed the guide wires through the guide wires on the work cage and the holes in the platform
- 2) Fit the correct number of wire fixes on the wire and feed through the wire guides. The wire fixes are fitted during the first run
- 3) Pull the guide wire through the platform and fasten with the tensioning system

- 4) Pre tighten the wires using the tensioning system
- 5) Final tightening shall be performed after the first run
 - a. Feed the wires through the tensioning system
 - b. Attach the wire to the tensioning system using the wire grips and make a mark on the wire before starting tensioning.
 - c. Tension the wires to 4000 N (the wire stretches approximately 50 N/mm) using the supplied nut. Use the second nut to lock the assembly.

Fig. 8b



2.3.5 Tensioning of the guide wires $\text{\O}12 \text{ mm}$

Tighten the wires by hand and mark with a water-resistant marker. Measure the distance to the floor.

- For 60 m (197 ft) long wires, stretch the wire 40 mm (0.13 ft).
- For 80 m (262.46 ft) long wires, stretch the wire 50 mm (0.16 ft)
- For 100 m (328.08 ft) long wires, stretch the wire 60 mm (0.19 ft).

For each additional 20 m (65.61 ft), stretch the wire by a further 10 mm (0.03 ft).

After some time it may be necessary to stretch 60 m wire by another 5mm (0.01 ft) and longer wire by a further 7-10 mm (0.02 - 0.03 ft) (all wires stretches after some time).

Once stretching is done, mark again the wires with a water-resistant marker so they can be checked in the future.

i This will tighten the wires to approximately 2000-4000 N.

2.4 Electrical connections

Connections



DANGER!

2.4.1 Power supply

The electrical connection of the traction hoist must be made in accordance with EN 60204-1.

The power supply must be protected by a fuse and an earth leak circuit breaker (30mA).

Disconnect the main power supply before handling power units.

Verify that the rated **grid and motor voltages** are identical. The three-phase motor is supplied in the following connection configurations:

230V	3 phases+gnd.	Δ	I = 4.8A	0.9 kW	10m/min
400V	3 phases+gnd.	Y	I = 3.5A	0.9 kW	10m/min
480V	3 phases+gnd.	Y	I = 2.0A	0.9 kW	10m/min
230V	3 phases+gnd.	Δ	I = 6.8A	1.8 kW	20m/min
400V	3 phases+gnd.	Y	I = 4.5A	1.8 kW	20m/min
480V	3 phases+gnd.	Y	I = 3.0A	1.8 kW	20m/min

Control voltage: 230 V

2.4.2 Supply cable

- The length of the cable depends on the height of the tower and the positioning of the power outlet. The cable length is found prior to ordering. The power cable is marked with length; check for accuracy before installing.
- Minimum cross-sectional dimension of the supply cable. Important with increased distance between grid connection, generator, and traction hoist, respectively:

For cable lengths up to...	
	190 m
1 hoist	1.5
Cable-cross sectional dimension [mm²]	

- Use heavy rubber cable ducts for fastening live wire on work cage.
- An installed generator will have to provide at least 2.5 times the output of the traction hoist.

Fig. 9a
Cable suspension



Fig. 9b
Power cabinet LE500P



Fig. 9c
AECO Control Box



2.4.3 Power connection

- Push the EMERGENCY STOP button
- Check that the various stop switches cables and fall arrest device cable are connected to the power cabinet according to colour code.

When using cable collect bin:

- Place or hang the cable collect bin underneath

the Ø200 mm (0.66 ft) hole in the platform.

d) Cut the transport strips and tape that holds the wire inside the bin and connect the cable suspension to the eyebolt underneath the work cage floor.

e) Connect the socket from suspended cable to the plug on the back of the work cage

f) If bottom platform control box is present, connect the free cable end to it following bottom platform control box section instructions. If no bottom platform control box, then connect the free cable end to the grid (25A Pre-fuse).

g) Turn the two EMERGENCY STOP buttons clockwise to deactivate.

Fig. 10a

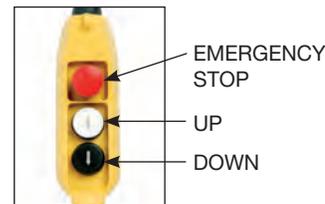


Fig. 10b



When using travelling cable:

c) Attach connection box on the middle of the tower.

d) Connect fixed cable to the connection box.

e) Connect the cable suspension to the support close to the connection box in the middle of the tower.

f) Connect the suspended cable to the connection box.

g) Take care about suspended cable: it shall be as straight as possible, with no twist along it.

h) Feed the cable through the pulley.

i) Adjust the length of the cable if necessary so it doesn't touch the floor when the cabin is on lowest landing platform.

j) Connect the cable suspension to the eyebolt on the back of the work cage.

k) Connect the socket from suspended cable to the plug on the back of the work cage.

l) If bottom platform control box is present, connect the free fixed cable end to it following bottom platform control box section instructions. If no bottom platform control box, then connect the free fixed cable end to the grid (25A Pre-fuse).

m) Turn the two EMERGENCY STOP buttons (Fig. 10a and Fig. 10b) clockwise to deactivate.

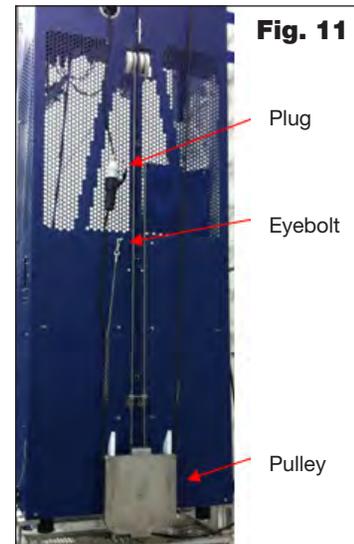


Fig. 11

2.4.4 Bottom platform control box¹⁾

- Engage main disconnect switch on bottom platform control box.
- Check that the switch cables are connected to the control box.
- Connect the power cable free end to the control box.
- Connect the supply cable to the control box.
- Connect the supply cable to the grid (25A Pre-fuse).
- Disengage main disconnect switch
- Green light on control box should lit

¹⁾ Note: Optional. Always present for AECO versions and also for non AECO ones including guard locking system on fences

2.5 Installation of drive and safety wire in work cage



Wear protective gloves when handling wires.

2.5.1 Drive wire installation

- Remove protection guard above rollers
 - Feed the wire through the roof into the slack rope sensor's ¹⁾ wire inlet, and into the traction hoist's wire inlet opening. (Right side seen from front of work cage).
- ¹⁾ Note. Only mandatory for AECO version.

- Push the UP button on the pendant control and feed wire through until the traction hoist starts pulling. **Ensure that the wire can exit without obstruction!**
- Continue feeding the wire underneath (round) the front guide wheel, over the back guide wheel, and through the back panel.
- Let the lift wire pass through until it is slightly tightened.
- Replace roller protection guard.
- Feed wire through platform floor.

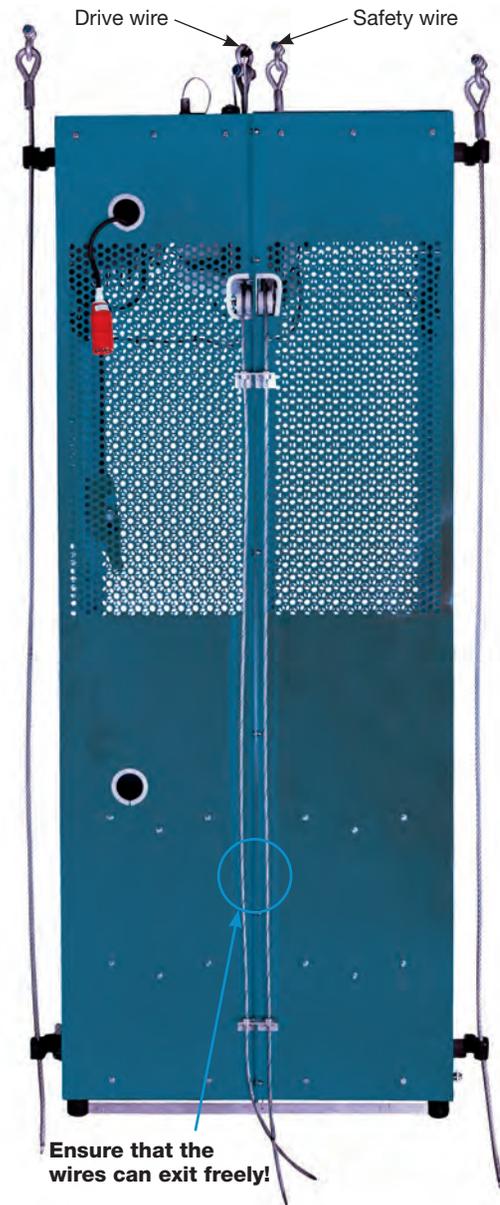
2.5.2 Safety wire installation

- Open the fall arrest device gripping device by pushing down the lever until it engages/clicks. Feed the safety wire through the roof hole above the fall arrest device and continue by feeding through the fall arrest device.
- Like the lifting wire, continue feeding the wire underneath (round) the front guide wheel, over the back guide wheel, and through the back panel.
- On the back of the work cage pull the safety wire to tighten it.
- Replace roller protection guard.
- Feed wire through platform floor.

IMPORTANT:

If the traction hoist does not start, two phases in the supply connection have been switched around – the built-in protection against phase switching blocks the control. Remedy: Have an electrician switch the two phases in the plug.

Fig. 12 Back side



Drive wire contra weight



Safety wire push spring



2.6 Securing the drive and safety wire

The drive wire is fastened beneath and the safety wire is fastened in one of three ways.

i Before fastening the safety wire carry out the safety brake test (See *Installation Manual*).

2.6.1 Drive wire counter weight

An 11kg (24.2 lbs) weight is mounted approximately 400mm (1.3 ft) below the floor onto the drive wire. Excess wire is coiled with at least 3 strips.

Fig. 13 Drive wire counterweight



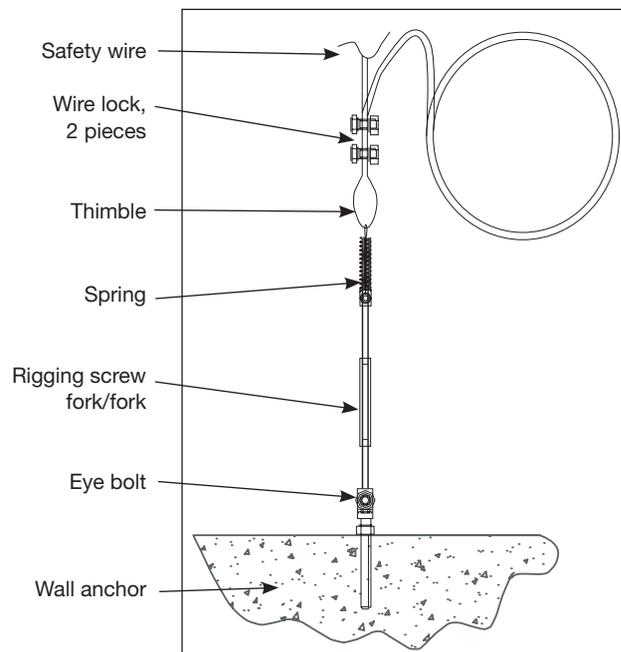
2.6.2 Safety wire - wedge anchor with spring

The wire is fastened using a rigging screw **with spring**. Mounting safety wire without spring will cause the fall arrest device block. Excess wire is coiled with at least 3 strips.

- At wire length of 60 m (197 ft) tighten the rigging screw so the wire stretches 9 mm (0.03 ft).
- At wire lengths of 100 m (328 ft), tighten the rigging screw so the wire stretches 15 mm (0.05 ft).

This will tighten the wire to approximately 88-100 Lbs (400-500 N).

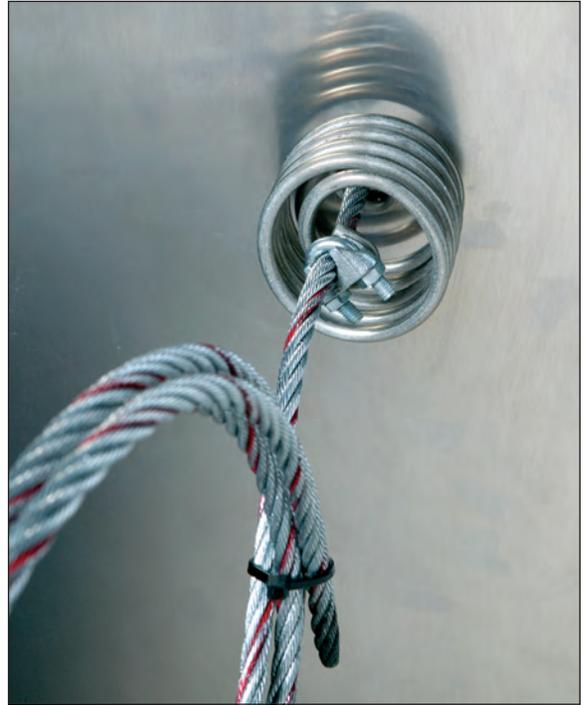
Fig. 14a Safety wire Method 1: Wedge anchor with spring



2.6.3 Safety wire – push spring

Underneath the platform the wire is fed through the two holes at each end of the push spring. The wire is then tightened as much as possible before being fastened with the wire locking device. If prior to mounting the spring was held tight by strips, cut them loose. If properly tightened, this will stretch the spring by approximately 15 mm (0.05 ft).

Fig. 14b Safety wire Method 2:
Push spring below platform



2.6.4 Steel beam

There may be a steel beam beneath the platform intended for work cage mounting. If so, use wire screws for mounting the safety wire to the steel beam.

2.7 Wire fix alignment

Having mounted the work cage, the wires, and the power, the wire fix fittings are adjusted during the initial ascent.

- a) Perform the tests prescribed in the User's Manual section 5 (page 19 ff.).
- b) Install wires as shown in Fig. 14

By means of the oblong holes in the wire fix fittings, adjust the fittings so that the two parts pass each other easily, when the work cage passes.



Wire fix shall be mounted on guide wires at all platforms with max. 30 m between each wire fix.



During the first run make sure the power cable untwists evenly.



If tripods are used for guide wire fixing tighten the wire locking device after the first run.

2.8 Adjustment of top stop disc (or bar)

The top stop disc (or bar) is adjusted so the top limit stop switch stops the work cage in alignment with the top landing platform, however at least 200 mm (0.65 ft) before contact with wire thimble.

The emergency limit stop switch is a backup. It is adjusted so it stops the work cage in case the operation limit stop switch fails (See User's Manual).

The emergency limit stop shuts off everything, just like an emergency stop. If the emergency limit stop is activated, lowering can only be done manually as described in the User's Manual. Manual lowering will activate the work cage again.

3. Danger zone! Sticker

Mount the sticker "Danger Zone" in the tower behind the work cage and the yellow marking ribbon on the floor. Make sure the wall and platform is clean and dry before attaching sticker and ribbon.



Make sure that nobody is exposed to danger below the work cage, for instance from falling parts.

Suitable measures: Pent roof or barriers.



The work cage is now ready for use. Prior to use, however, carry out the inspection specified in Installation Guide section 5!

4. Inspection before initial use

An officially recognised expert must:

- a) Inspect the work cage as specified in the User's Manual.
- b) carry out a test run with the maximum rated load.
- c) Overload test: The test load depends on the work cage motor. Load the cabin as follows: Motor LE500P: load 662 Lbs (kg 300) (125% of lifting capacity). When an attempt is made to start the work cage, the platform should stop, and the buzzer in the connection cabinet should sound.
– If not, see Appendix A: "Adjusting instructions for overload limiter".
- d) The guide, drive and safety wires as well as the top and bottom wire fastenings must be tested at full length as part of the initial test run.
- e) Testing of the **fall arrest device**:
 - 1) Engage the fall arrest device by pressing the stop button – the handle should jump to the "ON" position.
Should it nevertheless be possible to pull the safety wire upwards, the fall arrest device must be replaced and sent to the supplier for testing.
 - 2) Reopen the fall arrest device by pressing down on the lever. On top of the lift, pull up the safety wire with a quick jerk – the fall arrest device should now engage automatically; if it does not, replace it and return to the supplier for testing.



Before testing, the tightening spring beneath the access platform must be removed. Remember to secure it again after testing.



If the fall arrest device is engaged, it must not be possible to pull the safety wire upwards!

- f) If guide wires are mounted using the tripod now tighten the tripod wire locking device.

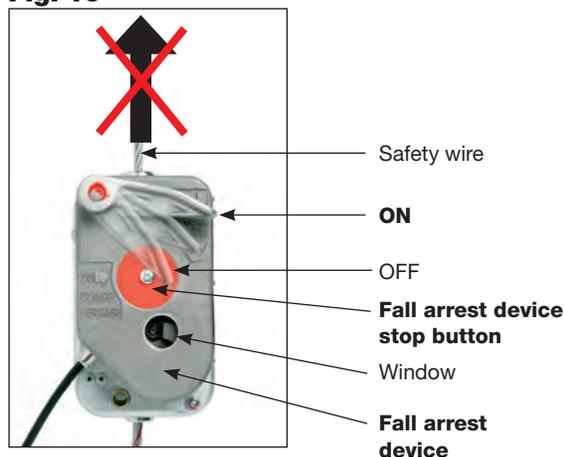


The results from this test must be recorded in writing and saved for later reference.

5. Disassembling

Disassemble in reverse order and dispose of in accordance with local authority regulations.

Fig. 16



Appendix A: Regulation of overload limiter



Avoid injuries by strictly following the instructions!

- a) Verification and/or adjustment of the overload device on the work cage can only be done by a qualified person, who must have been instructed by AVANTI to perform this task.
- b) Verification and/or adjustment must be performed under the supervision of the site foreman respectively another person authorized by the manufacturer.
- c) One copy of this instruction must be provided to the staff and always be available.
- d) Other alterations/modifications of the work cage than necessary for adjusting the overload device are not allowed, unless the manufacturer has agreed to in writing.
- e) AVANTI assumes no liability for damages due to retrofit/alterations on equipment or where non-original spare parts are used, especially the prescribed traction hoist wire rope, that the company has not approved in writing.
- f) The manufacturer of the work cage assumes no liability for damages due to retrofits and alterations on equipment or where non-original spare parts are used that the company has not approved in writing, and the USA/CAN approval becomes invalid.
- g) The result of the verification/adjustment of the overload device must be written down in the "Test report of annual inspection" and must be signed by the supervisor. If only adjusting takes place (no annual inspection) simply fill in point 5.9 and sign.

1 Purpose of this instruction

It may occur that the overload limiter inside the traction hoist of the work cage stops the upwards travel, although the work cage is not under overload.

In the case that other causes can be excluded by following the instructions of section 2.2, the overload limiter has to be adjusted according to section 3.2.

¹⁾ With older hoists you may need an allen key **size 6**.

2 Adjusting instruction

2.1 Preparation

Required tools/material:

- **Allen keys**, size 2 and 4 ¹⁾,
- **ballast** for applying the **test load**;
NOTE! Before driving to the work cage make sure, that the work cage can be loaded with the **admissible test load**, i. e. „safe working load“ + 25%:

 Before leaving for the tower make sure you bring the needed test load of 660-880 Lbs (300-400kg).

We recommend to:

- **weighing the person(s)**, who can climb into the work cage during the test procedure, **and**
- **bring enough weighed ballast** (sandbags or similar).

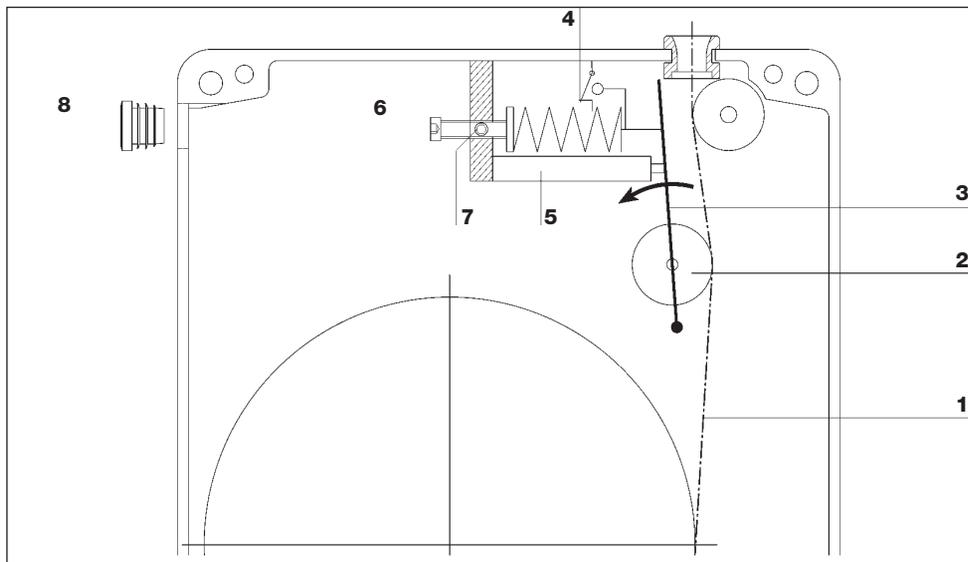
2.2 Exclusion of other causes

Before modifying the overload limiter settings **check if the upwards travel stopping is caused by other reasons:**

- a) If the cage is guided by wire ropes or ladder: Check for **obstructions** on the **guiding device(s)** and remove them.
- b) Check trouble-free **wire rope guiding** at **diverter pulley** or similar:
 - Is the rope nowhere blocked/squeezed?
 - Do the pulleys freely rotate? (Check with the work cage set to ground with no load on the ropes, or by a person from outside the cage, when going up and down.)
- c) When starting, does the **primary brake open?** You can hear the „klick-sound“, respectively feel a mechanical shock, when putting your hand on the motor fan cover.

In the cases b) and c) **have the trouble be corrected/repared by a qualified person.**

Fig. 17



3 Overload limiter

3.1 Function

The traction hoist wire rope under load (1) activates the lever (3) by means of the deflection pulley (2).

Under overload the limit switch (4) is activated, which stops the upwards travel and, on man-riding installations, activates a warning signal.

A hydraulic shock absorber (5) neutralizes the dynamic overload when starting the hoist.

3.2 Adjusting

- a) Apply the **Max work load (MWL)** (see work cage name plate) to the cage and close the door.
- b) Activate the control and push the UP-button. When **upwards travel is NOT possible**, go down to the parking position and adjust the setting of the overload limiter:
- c) Apply the **test load = MWL + 25%**
- d) Loosen set screw (7) in casing cover with Allen key (size 2).
- e) Remove the cap (8). Put Allen key (size 4¹⁾, 150 mm long) into the adjusting screw (6).
 - f) Turn the adjusting screw (6) clockwise, until the test load can be lifted.
 - g) **Step by step reduce the trigger point** of limit switch (4) by means of the adjusting screw (6), until the test load can no more be lifted:
 - 1) Turn the adjusting screw by **1/4 turn anti-clockwise** to reduce the trigger point;
 - 2) push UP-button
– **Upwards travel is still possible?**
YES: Stop, go down with the cage and repeat step 1).
NO: Continue with h).
 - h) Tighten set screw (7).
 - i) Take off the tools.
 - k) Insert the cap (8) to the casing hole.
 - l) Fill in the "Test report of annual inspection" check point 5.9 and sign.

¹⁾ With older hoists you may need an Allen key **size 6**.

Appendix B: Safety measures

General: The Service Lift/Work Cage is only to be used by personnel who has received instructions in operating the Lift/Cage in all predictable situations. These instructions can only be given by a person with the proper knowledge e.g Avanti Trainer or Trainer approved by Avanti. The following precautions and procedures are to be followed

during operation of, and if the Lift/Cage stops and the manual emergency descend cannot be performed.

Operating the Lift/Cage: Anyone going in the Lift/Cage must at all times wear PPE (safety helmet, full body harness, shock absorber, lanyard and fall protection system on the ladder).

EVACUATION of personnel from the Lift/Cage is only necessary in extreme situations. If necessary Avanti recommends the following procedures:

1. User(s) attaches shock absorber to the yellow anchor point(s) inside the cabin and open the door. (See Fig.1)
2. User(s) climbs on the ladder and establishes suitable safety with the shock absorber in the ladder area.(See Fig.2)
3. After safe anchoring in the ladder area, user(s) releases his anchor in the Cabin/Cage. (See Fig.3)
4. User(s) climbs to the other side of the ladder with proper safety technique and attaches runner/slider to the present fall protection system on the ladder. (See Fig.4)
5. User(s) can now climb safely up or down the ladder (See Fig.5)



Fig. 1

Fig. 2

Fig. 3

Fig. 4

Fig. 5

RESCUE of personnel from the Lift/Cage is only necessary in extreme situations. If necessary Avanti recommends the following procedures:

1. User is on the work side of the ladder with attached runner/slider to the present fall protections system on the ladder at the same level as the Service lift/Work Cage.
2. User attaches suitable safety with one of the shock absorber hook in the ladder area. After safe anchoring the ladder area, the runner is released from the Safety Rail. (See Fig 1)
3. User climbs to the other side of the ladder using the proper safety technique, opens the door (See Fig 2-3) and attaches the other shock absorber hook to the yellow point inside the Lift/Cage. (See Fig 4)
4. Check that the person to rescue is conscious or unconscious. (See Fig 5)
5. User transfers to the Lift/Cage with proper safety technique. When user is safe inside the cabin release his anchor from Safety ladder.



Fig. 1

Fig. 2

Fig. 3

Fig. 4

Fig. 5



The way to proceed and what to do in case of evacuation or rescue are unique and here described in general terms so do not depend on the type of Shark that you have as it does not depend on the type of door. Consequently, we have chosen the most representative photos of the model as an example.

Appendix E: AVANTI lift anchor

E.1 Caution

AVANTI LIFT ANCHOR is an anchor point used for protection against falls from heights intended for use with a full body harness approved according to EN 361 or Z359.1:2007 as applicable. Connection to the LIFT ANCHOR is only allowed by using self-closing connectors according to EN 362 or Z359.1:2007 as applicable.

Use in connection with other equipment than specified, may be potentially dangerous. User shall be equipped with a means of limiting the maximum dynamic forces exerted on the user during the arrest of a fall to a maximum of 6kN. In case of doubt, please contact AVANTI.

The maximum load that can be transmitted in service from the anchor device to the structure is 22.2 kN in $\pm 15^\circ$ vertical direction. The maximum deflection of the anchor point that can occur in service is 10mm.

AVANTI LIFT ANCHOR is tested and approved only to be mounted on AVANTI lifts. This manual always needs to be represented in language of sale and provided for use by all technicians. Activities at height are dangerous and may lead to severe injury or even death.

Gaining an adequate apprenticeship in appropriate techniques and methods of protection is important and is your own responsibility.

E.2 Danger

The AVANTI LIFT ANCHOR is for the use of one person only. It is strictly forbidden to carry out work if the person is in unfit mental or physical condition. Climbing and working under the influence of alcohol, drugs or any medication which can interfere with the safety are also much prohibited.

Users are obliged to read and understand this User Manual. Further they need to be properly equipped and instructed with the use of the necessary fall arrest equipment and emergency procedures in case of injury or sudden illness.

Users going to install AVANTI LIFT ANCHOR need to be familiar with the installation section of this manual. It's essential to the safety, that the user always attach the energy absorber as high as possible above his/her position, to minimize the fall distance most possible in case of a fall.

The position of the anchor point is crucial for fall arrest – the height of the fall, elongation of lanyard and energy absorber or pendulum movement of the user should be considered in order to minimize the risk of impact in obstacles in case of a fall. It's prohibited for the user to do many modifications or use non original Avanti components when assembling AVANTI LIFT ANCHOR.

Re-use of demounted AVANTI LIFT ANCHORS or parts is not allowed. Any changes or other uses beyond this manual are strictly forbidden.

Any changes or other uses beyond this manual are strictly forbidden. This documentation must be kept in the service lift for the purpose of subsequent examinations of the anchor device.

If there are any doubts to the safety of the AVANTI LIFT ANCHOR, or it isn't properly fixed, deformed or damaged with cracks or similar incompatible harms it may never be used – Please contact the manufacturer immediately. In case of corrosion the anchor immediately needs to be removed.

Observations:

Only to be used by instructed workers! Instructed workers must be aware, instructed and prepared to utilize site rescue plans.

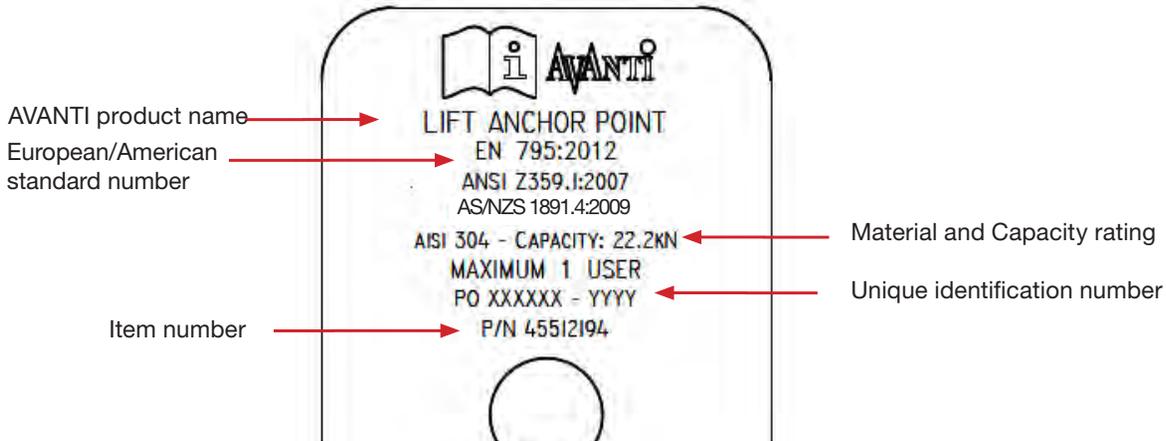
Only to be used for preventing vertical fall!

Only to be used for fall arrest, not to hoist or hang in goods or similar! Before attaching in the ANCHOR the user needs to check it is sitting fixed and screws are sitting tight and proper.

If AVANTI LIFT ANCHOR has arrested a fall it may never be used again. Part must be removed from service immediately.

E.3 Marking

Marking on Lift Anchor plate:



After installation, marking shall be completely accessible; otherwise additional marking near the anchor device will be necessary.

E.4 Installation

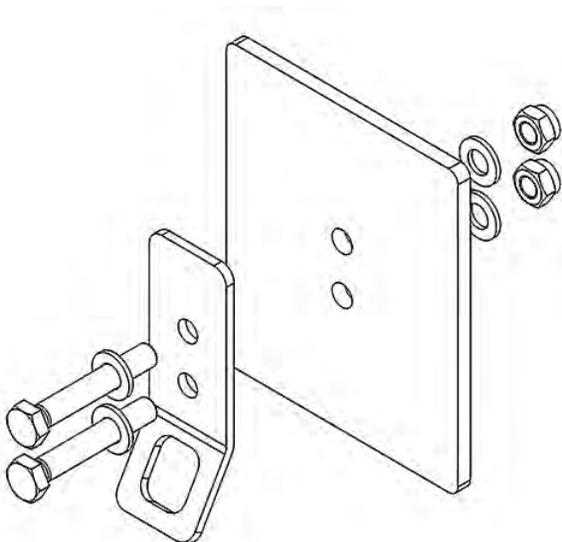
The installation must be performed by a competent person following the instructions of this manual.

AVANTI LIFT ANCHOR is tested and approved only to be installed on AVANTI lift. AVANTI LIFT ANCHOR made from AISI 304 Steel has to be screwed with two bolts DIN 933 A2-70 M12 mm, 4 washers DIN 125A A4 and self locking nuts DIN 985 A4 M12. In case of doubt, please contact AVANTI.

Before installing the AVANTI LIFT ANCHOR in heights, assure to be proper secured against fall from height by using relevant fall arrest equipment.

AVANTI LIFT ANCHOR:

1. Fix the anchor point to the structure using the supplied hardware as shown in the picture below.
2. Torque the nuts with 15 N·m (11 lb·ft).
3. Make sure the Anchor is fully seated and properly tightened.
4. Fill in "Installation form".
5. Carry out yearly inspection by following the procedure in the section "Inspection".



E.5 Inspection

After installation:

An inspection must be carried out by a competent person following the inspection form in this manual.

Before use:

Each time using the AVANTI LIFT ANCHOR the user inspects the ANCHOR visual and manually by twisting / pulling. Check the parts are properly fixed and free of deformities, damages, cracks or similar unacceptable defects.

Periodical examination:

A periodic examination at least every 12 month is essential for the safety of the AVANTI LIFT ANCHOR. The examination must be performed by a competent person following the inspection form in this manual.

For the AVANTI LIFT ANCHOR the competent person (authorized in writing by AVANTI) only needs to be trained in any metallic component covered by the European/American standard norms for fall arrest equipment.

E.6 Inspection form

PPE Anchor:	Manufacturer:	Avanti
	Type / Model:	Lift Anchor
	Identification no.:	
Fixing structure:	Lift serial no.:	
	Lift model:	
	Wind farm / WTG no.:	
Installed by:		
Installation company:		

	OK	not OK
1. Lift structure does not show any deterioration.		
2. Anchor locking screws are fully inserted and tightened with 15 N·m.		
3. Anchor does not show cracks, deformities, corrosion or other damages.		
4. Anchor installed on the lift structure according to the instructions.		
5. Anchor marking is clearly readable.		

Is the Anchor in good condition to be used?

Yes Needs Repair Replace

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Signature of competent:

Name of competent in capital letters:

Date:

If the AVANTI LIFT ANCHOR is found not OK, it must be removed / replaced by a new AVANTI LIFT ANCHOR! The result of the periodic examination must be recorded in the Registration form of anchor.

