

## Original instructions



**AVANTI SERVICE LIFT**  
Maintenance and Installation Manual  
Model Service Lift SHARK L02



**Date of publication:**

1st Edition: 08/2016

Revision 2: 03/04/2017

**Manufacturer:**

AVANTI Wind Systems A/S

Rønnevangs Allé 6

3400 Hillerød Denmark

P: +45 4824 9024

F: +45 4824 9124

E: info@avanti-online.com

I: www.avanti-online.com

**Sales & Service:**

|           |                                    |                              |
|-----------|------------------------------------|------------------------------|
| Australia | Avanti Wind Systems PTY LTD        | P: +61 (0) 3 9585 1852       |
| China     | Avanti Wind Systems                | P: +86 21 5785 8811          |
| Denmark   | Avanti Wind Systems A/S            | P: +45 4824 9024             |
| Germany   | Avanti Wind Systems GmbH           | P: +49 (0) 41 21-7 88 85 - 0 |
| Spain     | Avanti Wind Systems SL             | P: +34 976 149 524           |
| UK        | Avanti Wind Systems Limited        | P: +44 0 1254 399923         |
| USA       | Avanti Wind Systems, Inc           | P: +1 (262) 641 9101         |
| India     | Avanti Wind Systems India (P) Ltd  | P: +91 95 00 173 492         |
| Brazil    | Avanti Brasil Sistema Eólicos LTDA | P: +55 85 9 9955-0090        |

Manufactured Under Process Patent NO.8,499,896.

® Registered in Europe

# Contents

|  | Page      |
|--|-----------|
| <b>1. Limited warranty.</b> .....                    | <b>5</b>  |
| <b>2. Introduction.</b> .....                        | <b>6</b>  |
| 2.1 Observations .....                               | 6         |
| 2.2 Symbols .....                                    | 6         |
| 2.3 Cautions .....                                   | 7         |
| 2.4 Terms and definitions .....                      | 7         |
| <b>3. Installation.</b> .....                        | <b>8</b>  |
| 3.1 WTG integration requirements .....               | 8         |
| 3.2 Cautions .....                                   | 8         |
| 3.3 Electrical connections .....                     | 8         |
| 3.3.1 Power cable .....                              | 9         |
| 3.3.2 Guard locking system .....                     | 10        |
| 3.4 Guiding, traction and safety wire ropes .....    | 10        |
| 3.4.1 Top platform .....                             | 10        |
| 3.4.2 Bottom platform .....                          | 10        |
| 3.5 Wire rope fix .....                              | 13        |
| 3.6 Danger zone sticker .....                        | 13        |
| 3.7 Inspection before first use .....                | 13        |
| <b>4. Maintenance</b> .....                          | <b>14</b> |
| 4.1 Recommended planning .....                       | 14        |
| 4.2 Alternative planning .....                       | 15        |
| 4.3 Cautions .....                                   | 15        |
| 4.4 Annual inspection .....                          | 15        |
| 4.4.1 Cabin .....                                    | 15        |
| 4.4.2 Traction hoist .....                           | 15        |
| 4.4.3 Fall arrest device .....                       | 16        |
| 4.4.4 Traction and safety wire ropes .....           | 16        |
| 4.4.5 Electrical cables .....                        | 17        |
| 4.4.6 Overload check and adjustment .....            | 17        |
| 4.4.7 Information signs and documents .....          | 17        |
| 4.5 Repairs .....                                    | 17        |
| 4.6 Ordering spare parts .....                       | 17        |
| Appendix A: Adjustment of the overload limiter ..... | 18        |
| Appendix B: Inspection Checklist .....               | 20        |
| Appendix C: Inspection Log Sheet .....               | 24        |
| Appendix D: AVANTI lift anchor .....                 | 28        |

# 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 Product<sup>1)</sup> 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.

<sup>1)</sup> 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

|   |                 |   |                                  |
|---|-----------------|---|----------------------------------|
|    | <b>DANGER!</b>  | IMMEDIATE or possibly imminent danger:                      | Death or severe injury!          |
|   | <b>DANGER!</b>  | IMMEDIATE or possibly imminent danger of hazardous voltage: | Death or severe injury!          |
|  | <b>CAUTION!</b> | Potentially hazardous situation:                            | Light injury or material damage. |

#### Additional instructions

|   |                   |  |                                  |
|---|-------------------|--|----------------------------------|
|  | <b>ATTENTION!</b> | Potentially dangerous situation:                 | Damage to equipment or workplace |
|  | <b>IMPORTANT!</b> | Useful tips for optimum working procedure        | None                             |
|  |                   | Reference to written specification/documentation |                                  |

## 2.3 Cautions

Use and daily inspection of the service lift shall only be performed by person who has gone through the relevant training associated with the Avanti service lift use and daily inspection and is in possession of a valid (non expired) certificate for the task. Installation and maintenance of the service lift shall only be performed by Certified technicians.

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 PFPE (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.

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 a certified technician.

All repairs to the traction, braking and supporting systems may only be performed by a certified technician.

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

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.

Service lift must be inspected by a certified technician before first use.

Service lift must be inspected at least once a year by a certified technician. 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.

The service lift shall not be used in case of fire in the tower.

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).



*Avoid injury – follow all instructions!*



*Owner must verify the need for third party service lift inspections with the local authority and comply with the standards specified.*

## 2.4 Terms and definitions

| Terms                       | Definitions  |
|-----------------------------|--|
| <b>Certified technician</b> | Person who has gone through the relevant training associated with the scheduled task from Avanti or from a certified trainer and is in possession of a valid (non expired) certificate for the task. |
| <b>User</b>                 | Person who has gone through the relevant training associated with the Avanti service lift use and daily inspection and is in possession of a valid (non expired) certificate for the task.           |

# 3. Installation

## 3.1 WTG integration requirements

| WTG component   | General integration requirements                                 |                              |
|-----------------|--|------------------------------|
| Power supply    | Type (400 V)   | 3 Phase + PE + N             |
|                 | Type (690 V)   | 3 Phase + PE                 |
|                 | Voltage (50/60 Hz)   | 400 V/ 690 V                 |
|                 | Fuses  | 16 A                         |
|                 | Protection   | According to EN 60204-1      |
| Platforms       | Minimum clearance around service lift                            | 50 mm                        |
| Evacuation way  | Means of evacuation shall be provided with a maximum distance of | 1000 mm                      |
| Platform fences | Minimum height   | 1100 mm                      |
|                 | Compliant to requirements of standard                            | EN 14122-3                   |
|                 | Fence door interlock system                                      | Trapped key or guard locking |
| Hoistway        | Maximum total travel height                                      | (1)                          |
| Top beam        | Forces capable to withstand                                      | Upon request from AVANTI     |

(1) 120 m, for send/call configuration, and hoist M508 (500 kg).

(1) 140 m, for send/call configuration, and hoist M508 (600 kg).

(1) 160 m, for automatic send configuration, and hoist M508 (500 kg).

Depending on travel path, dimensions may need to be larger in order to avoid collisions of travelling cable pulley with platforms. Other dimensions are possible upon request and design verification by AVANTI.

The WTG manufacturer shall put in place any other means necessary to ensure the safe use of the service lift according to AVANTI recommendations and its own risk assessment for the integration that shall include items which are not under AVANTI's scope.

## 3.2 Cautions



Please familiarise yourself with these instructions and the User's Manual

before installing the service lift. Ensure that all specified parts are present before commencing installation. No warranty is provided against damage and injury resulting from not following this "Maintenance and Installation Manual" and/or "User's manual", i.e. reconstruction or modification of equipment or use of nonoriginal parts which are not approved by the manufacturer.

Prior to installation, ensure that:

- Building sections involved will be able to withstand the service lift loads.
- All parts are available and fully functional.
- Travel zone is protected by fences at each platform.
- Walking way surfaces are dry and not slippery.

The customer must define the maximum allowable wind speed ensuring safe installation.

During installation tasks, personnel shall:

- Wear at least the following PFPE: fall arrest equipment if falling height is higher than 2 m, hand gloves, helmet, safety glasses, working gear.
- Use a hand winch attachable to the ladder when elevating heavy weights.
- Use a wire rope clamp or grip when lowering wire ropes, in order to avoid the risk of personnel losing the wire rope, and wire rope getting damaged or person being hit. The clamp shall be secured to a platform anchor point. The diameter of the clamps or grips shall match the diameter of the wire ropes.
- Not work at different levels if tasks involve risk of falling objects.

## 3.3 Electrical connections



Before making any connection, disconnect any power supply to the service lift and the fence interlock system.



For CE versions: the electrical connection of the system must be made in accordance with EN 60204-1.

The service lift installation must be protected against overload, overcurrent and earth fault / residual current according to EN60204-32.

The protections shall be supplied by the WTG manufacturer unless otherwise agreed with Avanti, who can deliver them as an option. In order to design the protections, the WTG manufacturer shall provide the following information : earthing system type, protection devices place upstream, short-circuit power and impedance of the electrical connection point.

On TN installations, a dual element fuse or a motor starter protector with a rated current according to below table shall be used.

SHARK L02 690V 3 phases+gnd 50Hz Y IN=3,2A

SHARK L02 690V 3 phases+gnd 60Hz Y IN=3,2A

SHARK L02 400V 3 phases+neutral+gnd 50Hz Y IN=5A

SHARK L02 400V 3 phases+neutral+gnd 60Hz Y IN=6,3A



On TT installations, in addition to requirements for TN installations, a 30mA residual current circuit breaker (or equivalent device) shall be used according to EN60204-01.

On IT installations, in addition to requirements for TN installations, an insulation monitoring device shall be used to monitor the earth connection impedance as it is required by EN60204-01

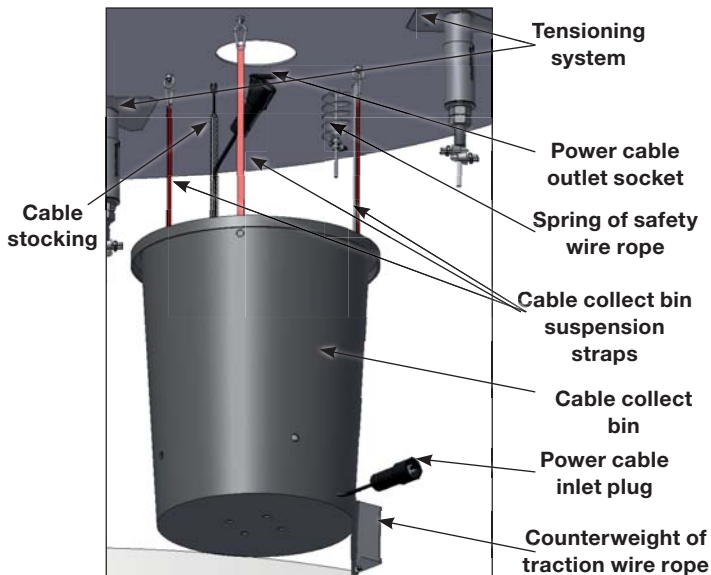


*When plugging the service lift to the power supply, ensure that supply phases are correct!*

### 3.3.1 Power cable

#### 3.3.1.1 Cable bin

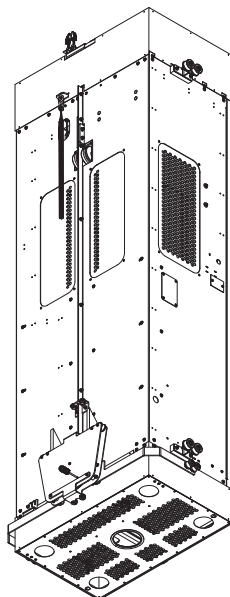
- Hang the cable collect bin underneath the power cable hole of the bottom platform using the straps supplied. Attach the straps on the holes.
- Cut the transport strips and tape holding the cable inside the bin and connect the cable stocking to the eyebolt underneath the service lift floor
- Connect the power cable outlet socket to the service lift inlet plug attaching the cable to the cabin with cable ties.



#### 3.3.1.2 Travelling cable <sup>1)</sup>

If optional travelling cable is used instead of standard cable bin:

- Install the junction box on the platform just above the mid tower's height.
- Cut the transport strips which hold the cable and connect the cable inlet to the junction box
- Uncoil the cable to the bottom platform (follow the same procedure described on 3.4.1 for wire ropes).
- Connect the power cable outlet socket to the service lift inlet plug as described on 3.4.2.4.

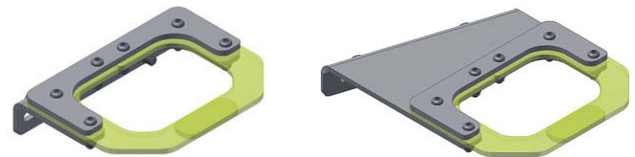


#### 3.3.1.3 Power cable guiding system <sup>1)</sup>

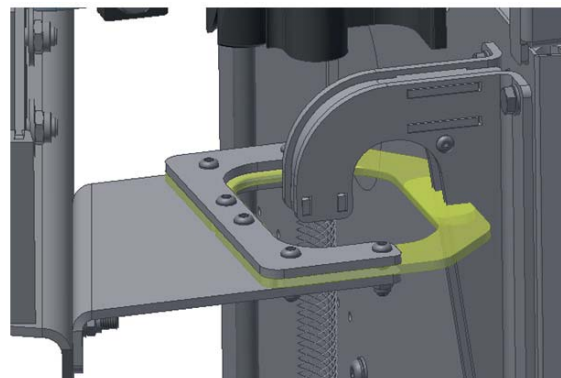
The lift is equipped with a Power Cable Support from which the power cable exits the cabin.



The cable bin is installed vertically aligned with the Power Cable Set outlet when the lift is on P0. Cable Guides are added to the platforms:



The system must be installed so that the Power Cable Set travels through the Cable Guides with no metal to metal contact.



<sup>1)</sup>Note: Optional for Shark L CE versions.

### 3.3.2 Guard locking system <sup>2)</sup>

- Install the guard locking control box on the bottom platform fence.
- Install the guard locking switch and its actuator on the fence door using the supplied hardware
- Install the lift detection switch on its bracket on the bottom fence toeboard and connect to the socket on the guard locking control box.
- Connect the power cable power inlet plug to the guard locking control box outlet.



<sup>2)</sup> Optional feature.

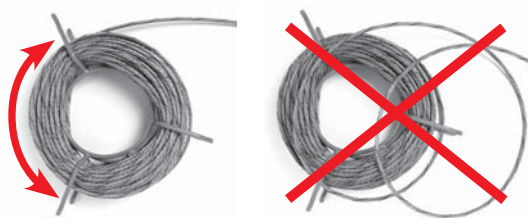
## 3.4 Guiding, traction and safety wire ropes

### 3.4.1 Top platform

Guiding, traction and safety wire ropes are attached to the suspension beam on the available holes.

To install them on the suspension beam:

- 1) Mount the guiding wire ropes ( 12 mm) and the traction and safety wire ropes ( 8 mm) using the shackles supplied for the suspension beam at the top of the tower, with the guide wire rope outermost on either side.
- 2) Fit the nuts and bolts on the shackles. Lock with cotter pins.
- 3) Fit the top limit device <sup>3)</sup> on the traction wire rope leaving at least 200 mm between top limit device <sup>3)</sup> and shackle. Adjust the final position during first run so that the service lift is levelled with the top platform when it stops.
- 4) Uncoil all wire ropes to the bottom of the tower.

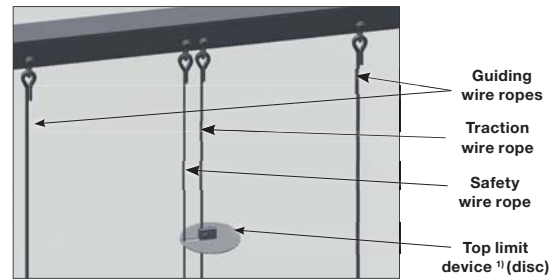


All wire ropes must be evenly uncoiled to prevent looping.

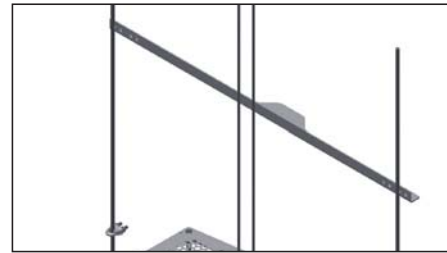


Do not pull wire rope over edges.

### 3.4.1.1 Top limit device <sup>3)</sup> (disc)

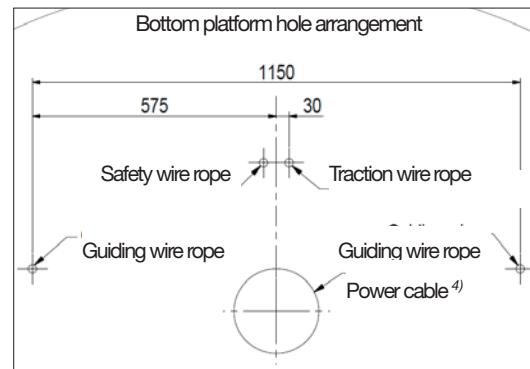


### 3.4.1.2 Top limit device <sup>3)</sup> (bar)



<sup>3)</sup>Note: Top limit device (disc) is mandatory if top obstruction device is not present. Top limit device (bar) is mandatory if top obstruction device is present.

### 3.4.2 Bottom platform



#### 3.4.2.1 Guiding wire ropes:

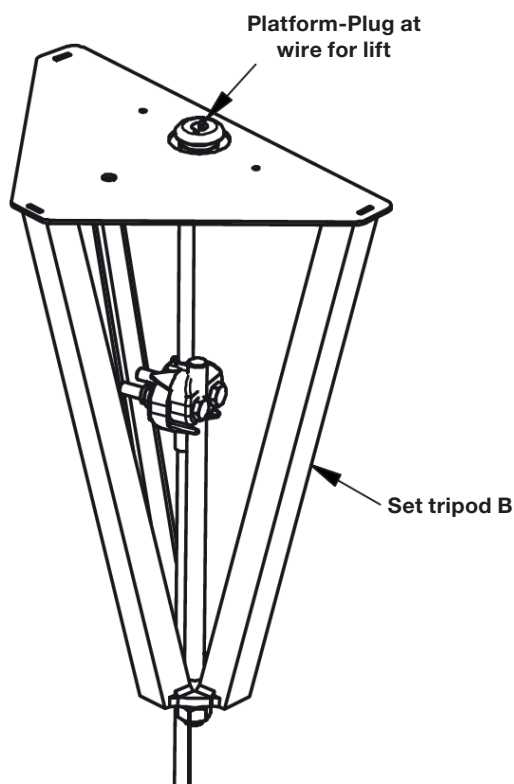
1) Feed the guiding wire ropes through the wire guides on the service lift.

2) Fit the correct number of wire rope fixes on the wire rope and feed through the wire rope guides. The wire rope fixes must be installed and adjusted during the first run.



<sup>4)</sup>Note: Power cable hole is only necessary when cable bin is installed.

3) Pull the guiding wire rope through the bottom platform and fasten it with the tensioning system. The tensioning system may vary depending on the tower configuration.



4) Attach the wire ropes to the tensioner:  
 a) Feed the wire ropes through the tensioning system.  
 b) Attach the wire rope to the tensioning system using the wire rope grips to allow for the first run.  
 c) Make a mark on the wire rope to ensure no sliding occurs at the wire rope grips and to use as a reference for checking stroke if necessary.

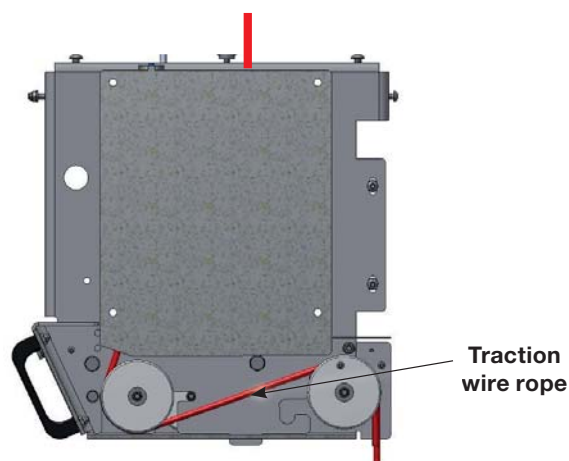
5) Perform final tension adjustment after first run:  
 a) Tension the wire ropes by turning the supplied nut until the desired tension.  
 b) Use the second nut to lock the assembly.



*Tensioning methods and tension values may vary depending on specific tower configurations*

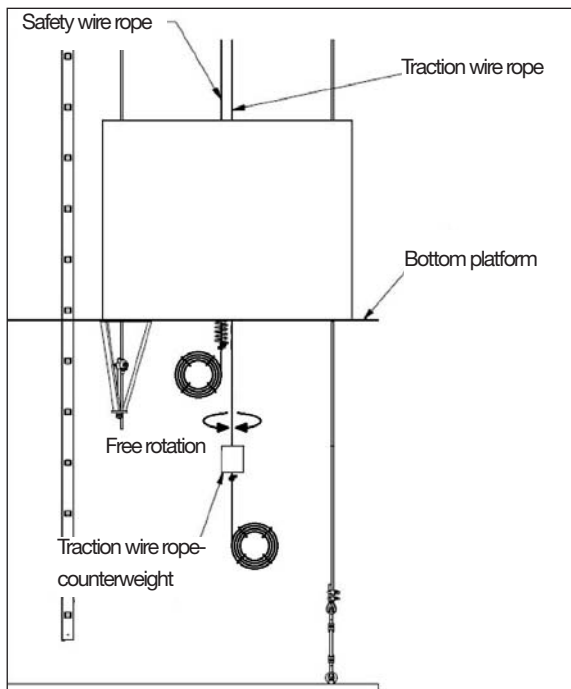
### 3.4.2.2 Traction wire rope

1) Open the maintenance cover on the back of the service lift.  
 2) Remove the lower rollers set.  
 3) Feed the wire rope between the two bushings of the slack rope sensor (if installed).  
 4) Feed the wire rope through the roof into the traction hoist's wire rope inlet opening.  
 5) Push the UP button of the cabin control box and feed wire rope through until the traction hoist starts pulling. Ensure that the wire rope can exit without obstruction! After passing the wire rope, assemble the lower rollers set.  
 6) Continue feeding the wire rope around the pulleys to the back of the lift.



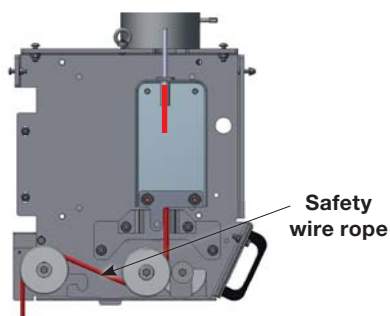
7) Feed the wire through the guide bushings (including pulley ones when using travelling cable).  
 8) Feed the wire rope through the platform holes.

9) Secure the 11 kg counterweight on the traction wire rope at least 600 mm below the bottom platform (See figure below). The remaining wire rope must be coiled and fastened with at least 3 strips. The counterweight and the excess of wire rope shall be able to rotate freely.



### 3.4.2.3 Safety wire rope

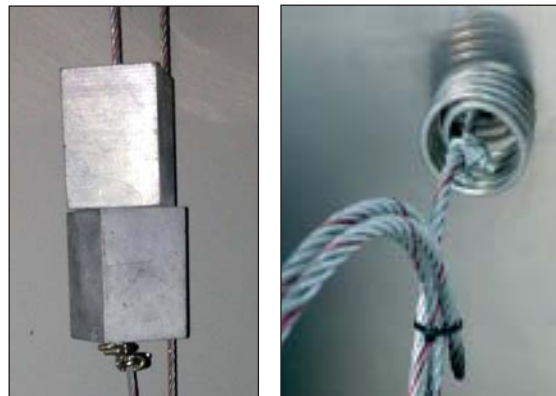
- 1) Open the maintenance cover on the back of the service lift.
- 2) Remove protection guard above rollers.
- 3) Feed the wire rope through the roof into the fall arrest device's wire inlet opening.
- 4) Pull the wire rope through the fall arrest device while turning the release lever clockwise.
- 5) Continue feeding the wire rope around the pulleys to the back of the lift.



- 6) Feed the wire rope through the guide bushings of the cabin.
- 7) Feed the wire rope through the guide bushings of the travelling cable pulley.
- 8) Feed the wire rope through the platform holes.
- 9) Feed the compression spring through the safety wire rope.

### 3.4.2.3.1 Safety wire rope tensioner system

The safety wire shall be fastened on the bottom with a counterweight or other system which will produce a tension force of at least 400 N. Some of the systems that could be used are shown in the following images.



If the push spring is installed follow this procedure:

- 1) Feed the safety wire rope through the bottom platform hole.
- 2) Ascend the service lift 50 cm.
- 3) Activate the fall arrest device.
- 4) Perform manual descent so that the weight of the service lift is transmitted to the safety wire rope.
- 5) Compress the spring to 40 mm and fix with cable ties.
- 6) Feed the safety wire rope through the compressed spring.
- 7) Pull the safety wire rope downwards by hand as much as possible.
- 8) Place and fasten the wire rope grip.
- 9) Put the cable ties so that the spring decompresses to 55 mm.

If the counterweights are installed follow this procedure:

- 1) Mount two 11 kg counterweights on the safety wire rope.
- 2) Secure them by using 2 wire clips.

To install other alternative system, please contact Avanti.

### 3.4.2.4 Travelling cable adjustment

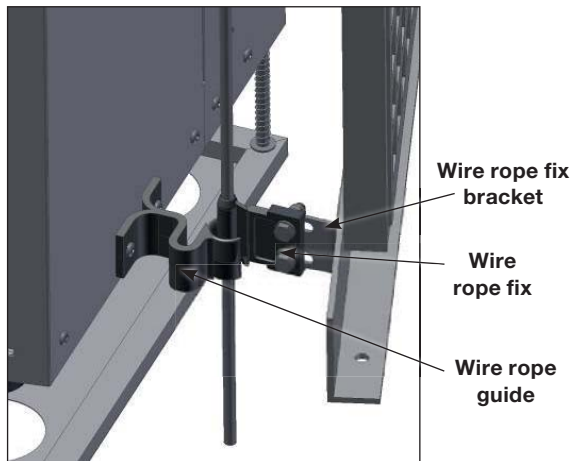
1. Guide the travelling cable through the travelling cable pulley.
2. Connect the outlet socket of the travelling cable to the inlet plug of the service lift using a cable stocking. Attach the shackle to the eyebolt on the back of the service lift.
3. Attach the travelling cable to the cabin by means of cable ties.

The travelling cable pulley should be adjusted to avoid collision or hits with cabin when lift is resting on buffers. The pulley also should not rest on the platform when the lift is in P0.

### 3.5 Wire rope fix

Wire rope fixes are installed and adjusted during the first run so that the centres of the wire rope fixes are in the centre of the service lift wireguides.

Wire rope fixes must be installed on each platform and as required along the tower (MAX. 30 m) to improve guiding to avoid collision with tower elements. Use the oblong holes on the wirefix brackets to align and adjust the wire rope fix position.



### 3.6 Danger zone sticker

Mount the “Danger Zone” sticker in the front door of the bottom platform fence. Make sure that the fence is clean and dry before attaching the sticker.

### 3.7 Inspection before first use



*Certified technicians must carry out an inspection before first use following the “Inspection checklist” Appendix.*



*The inspection before first use must be recorded for future reference filling the “Inspection Log Sheet” Appendix.*

# 4 Maintenance

All the inspections / maintenance operations (periodical or extraordinary) must be logged in the appropriate Inspection Appendix.

All inspections and service tasks made to the hoist and fall arrest device must be carried out by certified technicians. The relevant maintenance instructions are provided to each person during the training.

## 4.1 Recommended planning

Avanti recommends the following maintenance planning:

| Frequency  | Performed by         | Components                      |
|--|----------------------|---------------------------------|
| Daily  | User                 | Overall / Travel zone           |
|  |                      | Control and safety devices      |
|  |                      | Fall arrest device              |
| Annually   | Certified Technician | Overall / Travel zone           |
|  |                      | Control and safety devices      |
|  |                      | Cabin                           |
|  |                      | Traction hoist                  |
|  |                      | Fall arrest device              |
|  |                      | Overload limiter                |
|  |                      | Traction and safety wire ropes  |
|  |                      | Guiding system                  |
|  |                      | Electrical system               |
|  |                      | Information signs and documents |
|  |                      | Doors and hatches               |
|  |                      | Cabin control box               |
|  |                      | Safety switches                 |
|  |                      | Interlock system                |
| Platforms  |                      |                                 |
| Every two years  | Certified Technician | Fall arrest device              |
| Every five years or 50 hours (whatever occurs first)             | Certified Technician | Traction hoist                  |
| Every 20 years or 250 hours of operation (whatever occurs first) | At Avanti Workshop   | Traction hoist                  |
|  |                      | Fall arrest device              |

## 4.2 Alternative planning

Owners who strictly follow the maintenance program and the daily inspections, and can document it could decide with taking over the responsibility as well to provide the following alternative planning:

| Frequency   | Performed by         | Components                      |
|---|----------------------|---------------------------------|
| Daily   | User                 | Overall / Travel zone           |
|   |                      | Control and safety devices      |
|   |                      | Fall arrest device              |
| Annually  | Certified Technician | Overall / Travel zone           |
|   |                      | Control and safety devices      |
|   |                      | Cabin                           |
|   |                      | Traction hoist                  |
|   |                      | Fall arrest device              |
|   |                      | Overload limiter                |
|   |                      | Traction and safety wire ropes  |
|   |                      | Guiding system                  |
|   |                      | Electrical system               |
|   |                      | Information signs and documents |
|   |                      | Doors and hatches               |
|   |                      | Cabin control box               |
|   |                      | Safety switches                 |
|   |                      | Interlock system                |
| Platforms   |                      |                                 |
| Every ten years or every 125 hours of operation (whatever occurs first) | Certified Technician | Traction hoist                  |
|   |                      | Fall arrest device              |
| Every 20 years or 250 hours of operation (whatever occurs first)        | At Avanti Workshop   | Traction hoist                  |
|   |                      | Fall arrest device              |

## 4.3 Cautions

Before any maintenance task, ensure that walking way surfaces are dry and not slippery.

Before any maintenance operation, check that the service lift is properly out of service.

In case of a fault, do not use the service lift until it is solved. If required secure workplace.

During maintenance tasks, personnel shall:

- Wear at least the following PFPE: fall arrest equipment (when falling height is more than 2 m), hand gloves, helmet, safety glasses and working gear.
- Place cabin at bottom platform and disconnect power supply.
- Use an electricity measuring tool when performing inspection of electrical components.
- Use a hand winch attachable to the ladder when handling big/ heavy loads and shall be performed at least by 2 persons.
- Panel parts shall be removed to facilitate access to confined spaces.
- Use a cable grip when replacing travelling cable.
- Keep cabin doors closed when using a 3-step ladder.



Only certified technicians shall perform electrical installation tasks.



When plugging the service lift to the power supply, ensure that supply phases are correct!

## 4.4 Annual inspection

Have the entire system tested by a certified technician at least once a year, especially the traction hoist and the fall arrest device. However, it may be required more frequently depending on use and the conditions of use and operation.

The traction hoist and fall arrest device must be inspected according to intervals included in the sections 4.1 or 4.2 tables (see above). Hour counter is found in the main control box.



A certified technician must carry out the annual inspection following the appropriate Inspection Appendix.



Owner must ensure that the results of all annual and extraordinary inspections are logged in the appropriate Inspection Appendix.



In case of replacement of hoist, Fall Arrest Device and/or 8 mm. wire ropes, the operation/s and the related total hours of use of this/these component/s, must be logged in the appropriate Inspection Appendix.

### 4.4.1 Cabin

Inspect the cabin structure, joints, attachments and accessories.

### 4.4.2 Traction hoist

The traction hoist shall be maintained according to maintenance planning (please see sections 4.1 or 4.2). Relevant maintenance instructions are provided to each person during the training. These maintenance inspections must be only carried out by a certified technician.

### 4.4.3 Fall arrest device

The fall arrest device shall be maintained according to maintenance planning (please see sections 4.1 or 4.2). Relevant maintenance instructions are provided to each person during the training.

These maintenance inspections must be only carried out by a certified technician.



*If fall arrest device has engaged due to a dynamic fall, a certified technician must verify the safety of the fall arrest device, the wire rope, and wire rope fastenings.*



*After FAD has engaged, if the FAD damper has moved downwards, the FAD unit must be replaced by a certified technician.*

### 4.4.4 Traction and safety wire ropes



*The inspection of the wire ropes can be carried out from inside the cabin. To do so, open the maintenance cover. The cabin panel has a white sticker attached to it. This sticker makes the wire ropes' silhouette stand out and therefore facilitates the inspection of the wire ropes.*

Carry out the following inspections and adjust if necessary:

1. Inspect all the wire ropes along their entire length.
2. Pay special attention to the wire rope ends, parts of the wire ropes running over sheaves and wire ropes under frictional wear by external components.
3. When inspecting the wire ropes, consider the following points: type and number of wire breaks, position and time sequence of wire breaks, decrease of the wire rope diameter during operation, corrosion, abrasion, deformation, influence of heat, and operating time.
4. Check that the traction and safety wire ropes are fed correctly around the 2 wire rope guide wheels.
5. Check that the wire rope ends are coiled separately under the bottom platform and tied with at least 3 cable ties.
6. Check that the guiding wire rope tensioning system is correctly installed and that the wire rope locks and fixes are properly fastened.
7. Check that the compression spring on the safety wire rope is correctly installed and that the wire rope locks are properly fastened.
8. Check that the counterweight on the traction wire rope is properly fastened. The traction wire rope coil and counterweight shall be able to rotate freely. Do not attach them to a fixed part.
9. Check that the guiding wire ropes are correctly tensioned.



*Record any visible change of the condition of the wire ropes on the appropriate Inspection Appendix, and monitor closely throughout time.*

#### 4.4.4.1 Lubrication of the traction and safety wire ropes

1. Position the lift at the bottom platform.
2. Open the maintenance cover by unscrewing its screws.

3. Apply lubricant on the traction and safety wire ropes by means of a spray can.

4. While applying the lubricant, use the second hand to place and hold a cloth around both wire ropes. This way, the lubricant will be distributed uniformly on both wire ropes.

5. While the first user uses the spray can and the cloth, a second user presses and holds the UP button from inside the lift. This way, while the service lift ascends, the lubricant is applied along the complete length of the two wire ropes.

6. After applying the lubricant, leave the maintenance cover open and carry out a descent back to the bottom platform.

7. While descending, check that the two wire ropes have been properly and uniformly lubricated.

8. Once the service lift is at the bottom platform, clean off any lubricant accidentally applied on the cabin panels.

9. Finally, close the maintenance cover by screwing back its screws.



*Only use specialised wire rope lubricants. Do not use lubricants based on lithium soap grease or bitumen. Do not use disulphide-containing lubricants like Molycote ®.*

*Apply lubricant using a spray can, brush, drip applicator or pressurized device.*

*Pay special attention to sections of the wire rope where dehydration or denaturation of the lubricant can be seen.*

*Re-lubricate the wire ropes before they show signs of corrosion or run dry, and taking in mind that:*

- *A poor lubrication leads to corrosion and to a quick wear of components.*
- *An excessive lubrication leads to dirt agglomeration on the wire rope surface. As a result, this can lead to quick wear of wire rope, sheaves and drum.*
- *A correct lubrication keeps the efficiency factor of the wire rope, protects against corrosion, helps to elongate their lifetime significantly and ensures a safe operation.*

#### 4.4.4.2 Measuring of the wire rope diameter



*When measuring the diameter of the wire ropes, use a digital calliper with broad measuring faces.*



In general, measure the diameter of the wire rope at each WTG tower platform, and under the service lift, where the wire rope is less loaded. Specifically, if a wire rope wear is detected, measure on the affected area.



*Rotate the calliper around the wire rope to measure the minimum and maximum wire rope diameter at each measurement point.*



#### 4.4.4.3 Discard criteria



The discard criteria of the wire ropes should be based on ISO 4309: Cranes - Wire ropes - Care and Maintenance, inspection and discard.

Determine and eliminate the cause before installing a new wire rope.



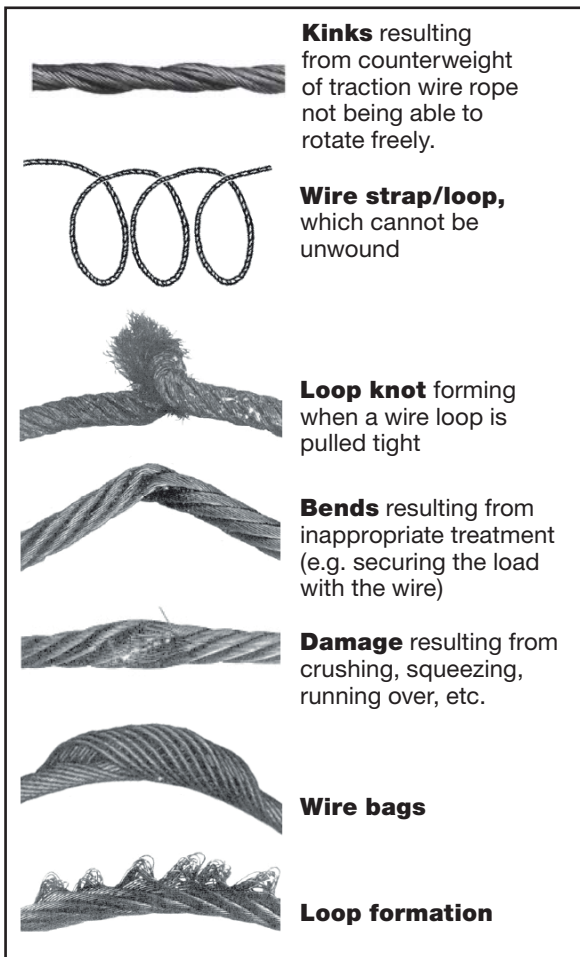
AVANTI recommends to replace the traction and safety wire ropes after 250 hours of operation corresponding with the refurbishment of the traction hoist and fall arrest device. Please check with your local authority regulations if it's mandatory in your case.

Check and replace the respective wire rope(s) if one of the following defects is found:

- For traction and safety wire ropes, there are more than one 4-wire strand break on a wire rope length of 250 mm.



- For guiding wire ropes, if there are more than one 8-wire strand break on a wire rope length of 360 mm.
- If there is severe corrosion on the surface or the inside.
- If there is heat damage, evident by the wire rope colour.
- For traction and safety wire ropes, if the wire rope diameter is less than 7,6 mm.
- For guiding wire ropes, if the wire rope diameter is less than 11,4 mm.
- If there is damage on the wire rope surface (see following figures for most common examples of wire rope damage).



#### 4.4.5 Electrical cables

Check and replace the power supply and control cables if the cable jacket or cable connections are damaged.

#### 4.4.6 Overload check and adjustment

Annual test: Test switches and perform overload test as specified in the "Adjustment of the overload limiter" Appendix.

#### 4.4.7 Information signs and documents

Verify availability and legibility of all data plates and information signs. Replace missing or illegible plates and signs!

#### 4.5 Repairs

Repairs to traction hoist equipment must ONLY be performed by AVANTI, and only using original spare parts. If the gearbox oil needs to be replaced, use one of the lubricants specified below, corresponding to the temperature range in which the traction hoist equipment is used.

- Amount required: 1,5 l
- Traction hoist: M508
- Oil: Mobil SHC 632.

Each oil has to be verified by AVANTI.

#### 4.6 Ordering spare parts

Only use original parts.

Spare part lists are available from AVANTI. Please indicate lift model when requesting a spare part list.

# Appendix A: Adjustment of the overload limiter

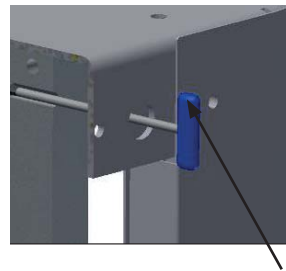
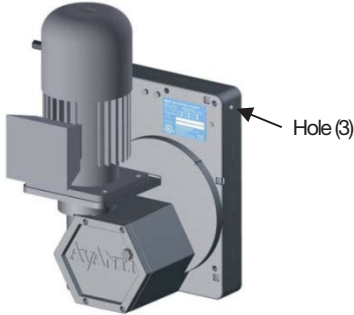


The adjustment of the overload limiter of the service lift shall be carried out only by AVANTI or by a certified technician.

For the tests, test weights shall be needed.



One turn of the tool (2) represents a change of approximately 40 kg of the triggering limit of the overload limiter.



Overload adjustment tool (2) with security Torx 40

## Automatic send configuration

| Travel distance (m) | Setup load (1) (kg) |
|---------------------|---------------------|
|                     | For Shark L02       |
| From 61 to 80       | 310                 |
| From 81 to 100      | 315                 |
| From 101 to 120     | 325                 |
| From 121 to 140     | 335                 |
| From 141 to 160     | 345                 |

## Send / call configuration

| Travel distance (m) | Setup load (1) (kg)           | Setup load (1) (kg)           |
|---------------------|-------------------------------|-------------------------------|
|                     | For Shark L02 + M508 (500 kg) | For Shark L02 + M508 (600 kg) |
| From 61 to 80       | 320                           | 320                           |
| From 81 to 100      | 330                           | 330                           |
| From 101 to 120     | 340                           | 340                           |
| From 121 to 140     | -                             | 350                           |

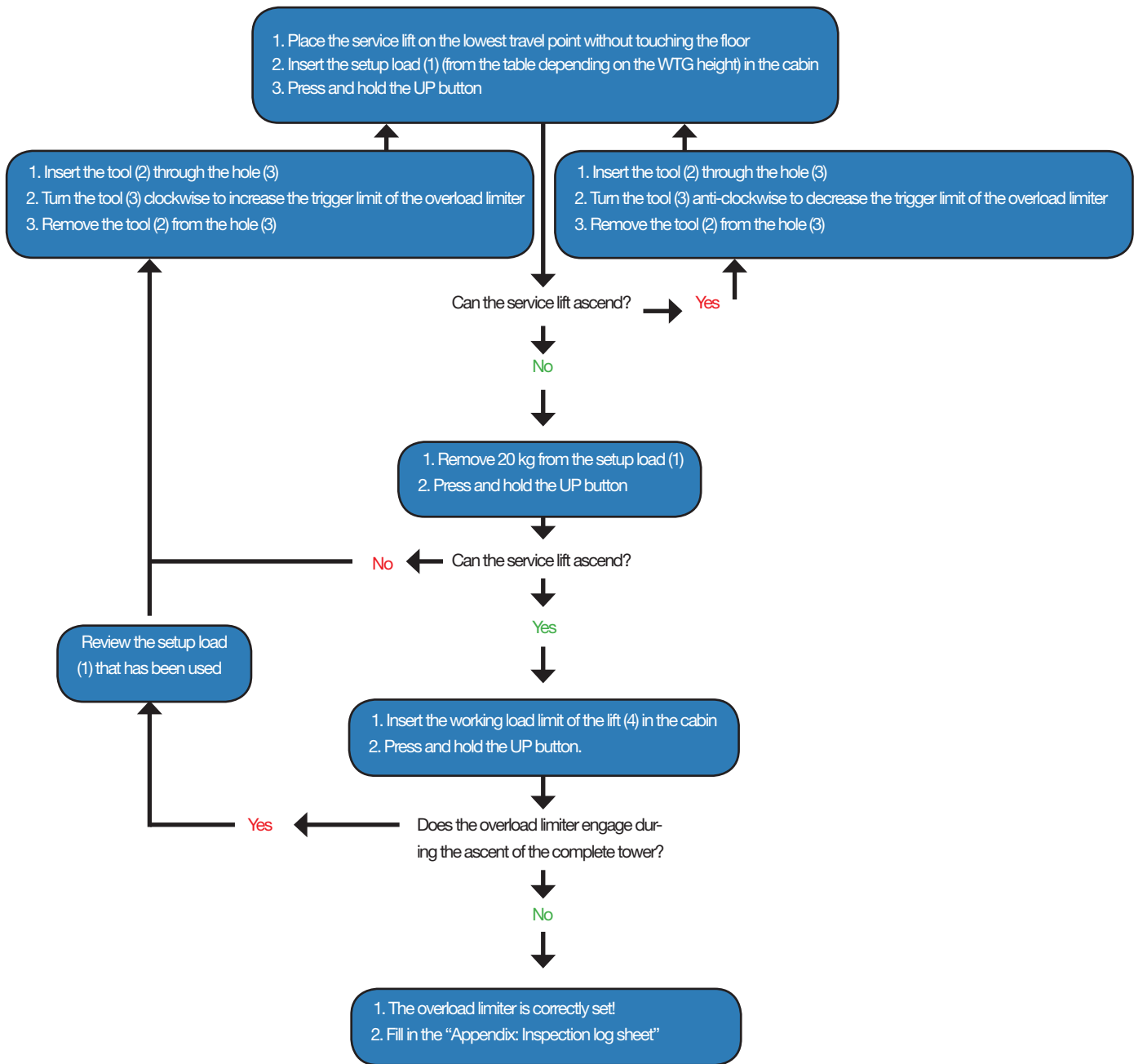
| WLL of lift (4) (kg) |
|----------------------|
| For Shark L02        |
| 240                  |



The overload limiter complies with EN 1808 8.3.5.5 1) since it will trigger before reaching a load of 1,25 times the working load limit of the hoist. In case that a third party inspector requests this test to be done, the load to be introduced in the cabin is as follows.  
 Overload test load = WLL hoist x 1,25 – Weight of lift Tolerance overload device (20 kg).  
 For Shark L 02 (M508 (500 kg)) = 420 kg.  
 For Shark L 02 (M508 (600 kg)) = 545 kg.



1) The EN1808 test load is only applicable to CE versions.



# Appendix D: AVANTI lift anchor

## D.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.

## D.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.

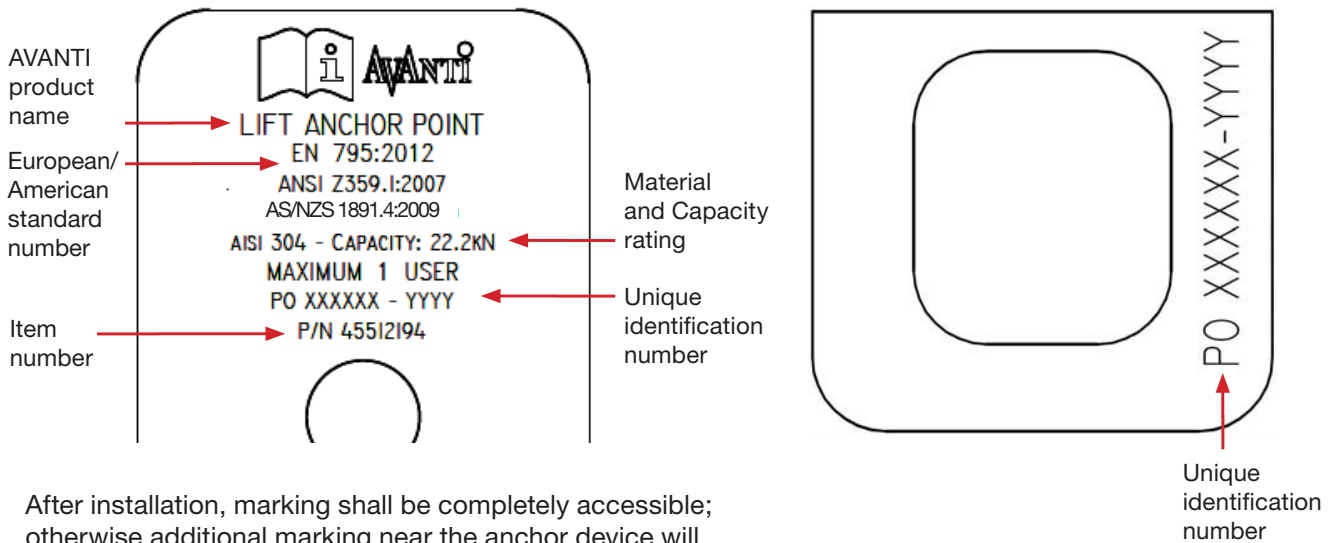
Only to be used for preventing vertical fall!

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.

## D.3 Marking

Marking on Lift Anchor plate:



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

## D.4 Installation

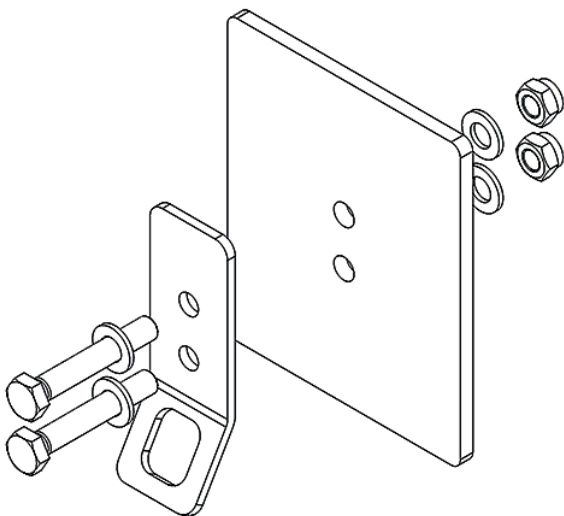
The installation must be performed by a certified technician following the instructions of this manual.

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".



## D.5 Inspection

After installation:

An inspection must be carried out by a certified technician 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 certified technician following the inspection form in this manual.

For the AVANTI LIFT ANCHOR the certified technician only needs to be trained in any metallic component covered by the European/American standard norms for fall arrest equipment.

## D.6 Inspection form

|                          |                      |             |
|--------------------------|----------------------|-------------|
| <b>PFPE Anchor:</b>      | Manufacturer:        | Avanti      |
|                          | Type / Model:        | Lift Anchor |
|                          | Identification no.:  |             |
| <b>Fixing structure:</b> | 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

No (Replace)

|  |  |
|--|--|
|  |  |
|--|--|

**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.

### D.7 Registration form of anchor

| Avanti lift Anchor                      | Identification no.:          | Avanti Wind Systems A/S<br>DK-3400 Hillerød<br>Tel:+45 48 24 90 24<br>Fax: +45 48 24 91 24<br>www.avanti-online.com |           |                             |
|---|------------------------------|---|-----------|-----------------------------|
| Date of purchase:                       | Date first put into service: |   |           |                             |
|   |                              |   |           |                             |
| Periodic examination and repair history |                              |   |           |                             |
| Date                                    | Reason for entry (per. exam) | OK / not OK   | Inspector | Periodic exam next due date |
|   |                              |   |           |                             |
|   |                              |   |           |                             |
|   |                              |   |           |                             |
|   |                              |   |           |                             |
|   |                              |   |           |                             |
|   |                              |   |           |                             |
|   |                              |   |           |                             |
|   |                              |   |           |                             |
|   |                              |   |           |                             |
|   |                              |   |           |                             |
|   |                              |   |           |                             |
|   |                              |   |           |                             |
|   |                              |   |           |                             |
|   |                              |   |           |                             |
|   |                              |   |           |                             |
|   |                              |   |           |                             |
|   |                              |   |           |                             |
|   |                              |   |           |                             |
|   |                              |   |           |                             |
|   |                              |   |           |                             |
|   |                              |   |           |                             |
|   |                              |   |           |                             |
|   |                              |   |           |                             |
|   |                              |   |           |                             |
|   |                              |   |           |                             |
|   |                              |   |           |                             |
|   |                              |   |           |                             |
|   |                              |   |           |                             |

