



INSTALLATION AND MAINTENANCE MANUAL – TYPE “A” SYSTEM WITH “OB” PILES

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INTRODUCTION

Liski, Thanks to its 50 years of experience in competitive and recreational skiing, is an Italian company active in both the national and international markets, offering a wide variety of products for preparing alpine skiing, snowboarding, freestyle, cross-country skiing, and biathlon race tracks, as well as signage and safety equipment suitable for any type of ski slope and ski resort. Liski is also present in Motorsport, football, the bike world, and other sports.

Liski's highest priority is the research of safe, high-performance materials, thanks to cutting-edge technologies and collaboration with World Cup circuit teams and ski resorts.

Since the beginning of its activity, the close synergy between universities and specialized research centres has guaranteed the preparation of safety materials, which are subject to laboratory crash tests, in addition to extensive field tests.

The LISKI A-net is a safety net compliant with Alpine Ski World Cup race classifications. Liski is a supplier to major national ski teams and important ski events around the world, such as the Winter Olympic Games and World Championships.

Every year, hundreds of thousands of kilometers of these systems are installed in many ski resorts around the world, and these nets save the lives of many people; we constantly receive numerous positive feedbacks from installation teams, race organizing committees, technical delegates, coaches, and anyone involved in the organization of ski races.

The design, production, and assembly of the LISKI A-net protection system are made in Italy, a synonym of quality and professionalism; these systems are very easy and quick to use and assemble; technical specifications and complete test documents can be requested by sending an email to: info@liski.it.

- 1) There is neither Italian legislation on these systems nor national and international sports regulations
- 2) The net is also compliant and certified for French regulations
- 3) The metal structure is dimensioned based on engineering studies with finite element static calculations validated by an industry professional.

INSTALLATION, MAINTENANCE AND DISASSEMBLY OF TYPE “A” PROTECTION SYSTEMS WITH “OB” PILES

Operations – In most cases, race organizers or ski resorts are responsible for the construction, maintenance, removal, and storage of the A-net systems.

The local race organization will play an important role in the installation, maintenance, and removal of the A-net systems. This may vary from location to location. Where there is a representative trained on the net systems, ensuring that the systems are installed correctly and all fall lines are adequately protected. For competitions, refer to the course homologation document and the FIS safety report (if available).

Slope Safety – The process of preparing, maintaining, and removing Type A systems can be very time-consuming.

If you are working in the area where the nets are to be installed, it is recommended to close the slope, or close a line along the net where you will be working, preferably 20 meters in diameter from the desired zone.

This will prevent public access in contact with unprotected structures, equipment, supplies, and staff who are in that area.

Snowmaking – There must be a representative of the installation team who will be in constant contact with the snowmaking coordinator to coordinate how much snow is needed to be ready to install the A-nets. Furthermore, make sure that when installing the nets or supports, there are no unwanted objects inside the ground (power cables, water pipes, timing conduits, etc.).

Management – The management team plays an important role in preparing the slope for an A-net installation, as well as in the maintenance and removal of these systems.

Volunteer Support – Installing an A-net is not an easy task. If possible, try to have as much personnel as possible, not only for the installation of the net but also to provide for its maintenance and removal. This will ensure that the work is done in a timely manner. The more people you have, the better; just make sure that everyone moves in a coordinated manner.

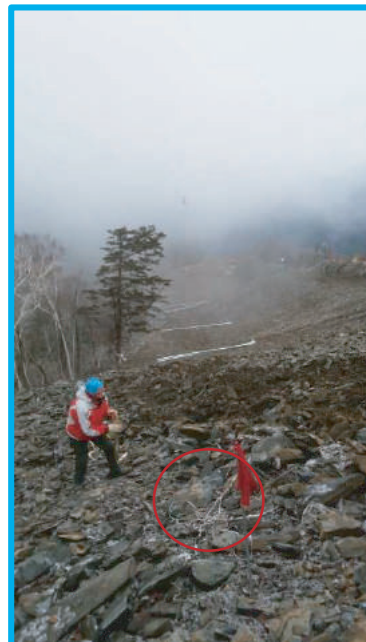
It is good to have a positive relationship with local departments. In some cases, departments such as ski lifts, ski schools, and many others can be added to the installation team temporarily to ensure there is strong support in installing, maintaining, and removing the A-nets.

It would be ideal for the entire team to already have experience in this field; it is very important that volunteers are always managed by a supervisor in the field. For those with no relevant

experience, it is recommended to attend World Cup races or international events to gain experience. All personnel (including volunteers) must be equipped with the required and necessary PPE (Personal Protective Equipment). The personnel involved must comply with occupational health and safety regulations.

REQUIRED PARTS

OB Pole References – It is recommended to position a reference (flag, brush, pole, etc.) in order to have a clear view of the distance and position between one pole and another.



Padding of Overhead Cables – They will be required at the beginning and end of each overhead cable. The rope covers provided and supplied by LISKI



z line– This will connect the net to the overhead cable.



A-Net – The number of nets depends on the length of the slope.

The height of the net and the mesh size vary depending on the use of the slope and its level of hazard.

Make sure that all nets are in good condition without tears or breaks.
Upon visual inspection, the nets must not show signs of aging due to time, thermal cycles, and radiation.



Glide Net – This is an important component for speed events (DH - SG mandatory) along the entire A-net.



The number required for all the supports mentioned above can be calculated based on the length of the system, while it is recommended to have spare parts for each part of the system.

Clamp – Necessary to lock the overhead cable to the anchorage. They are also to be used to secure the guy lines and thimbles. 3 clamps are recommended for each locking point.



Overhead Cable – The overhead cable must have the length of the net with an extra section upstream and downstream, in order to allow fixation to the anchorages.

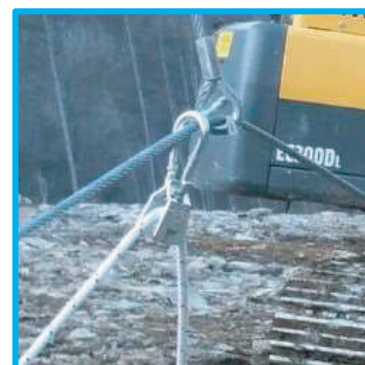


Snap Hook + Overhead Cable Fixing Plate – This is one of the devices that connects the lacing to the net and to the overhead cable. It is important to have a few extra snap hooks to be able to use them at the beginning and end of the section.

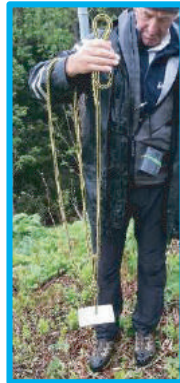


The distance between two snap hooks can vary depending on the height of the pole, or whether the system is located on a curve of the slope.

Pulley – This device is used to create the lacing and allow the rope to slide in order to tension the net. In the event of a fall, the rope passing through the pulley will be able to slide and thus absorb the impact.



Cookie – The cookie is a simple plate to which a rope approximately 2m long is connected. Before assembling the system, the cookie must be fixed in the snow. It is advisable to create a hole in the snow using an auger and insert the cookie into the desired position. Once fixed, let the rope come out of the snow, then connect it to the net.



It is recommended that the positioning of the cookie be aligned with the lower snap hook of the z line.

Potential ground cable + plates + small anchors...

Rope – Used to join the nets, and also to repair any tears or breaks in the net. Make sure it is made of the same material as the net.



Bungees – These will connect the glide net to the A-NET. Make sure that all bungees are in suitable condition for use on the system without cracks in the rubber.



REQUIRED TOOLS

Ropes – This will be used not only to pull and set a line for the cookies to be fixed, but also when the time comes to remove the nets. It is good to have a rope that can be cut and used to tie the regular net and the glide net.

Brushes/Pole – The brushes/poles will be used to set the rope line for the reference of the cookie fixing. They must be wooden brushes/poles redirected to the rope if there are curves in your net system.

It is always a good idea to also keep small tools on hand that can be brought onto the slope.

List of tools required for installation

Article Preparation	Photo	Qt.	Details
Off-road (pick-up) For transporting staff to the track		1 o 2	4-wheel drive
Radio		3 o 4	
Excavator with designated operator		1 o 2	

Helicopter for material transport onto the truck Material transport on the slope Track (optional)		1	The helicopter will allow for faster execution of the various tasks
Cable reel stands		3	Width 1m x height 1m
Straps (no. 5, 6m length + no. 5, 8m length)		5 o 6	
Shackle		10	Per il sollevamento pali (Elicottero)
Motorized drill with bits (no. 2 Ø 24mm + no. 2 Ø 28mm)		1 o 2	
Ratchet jack / Ratchet hoist		2	
Tirvit cable puller		4	
Cable pulling hoist		2 o 3	

Cutting shears		2	
18 V / 24 V Cordless drill (driver type)		2	
18 V / 24 V Cordless drill for cable cutting		1 o 2	
Pickaxe		3 o 4	
Mountain shovel		3 o 4	
Crowbar		2 o 3	
Iron bars Ø 22mm x Approx. 100cm length		10	
Toolbox with various wrenches		1 o 2 set	10", 11", 12", 13", 14"
Branch pruning chainsaw		1	

Jerry can		1	10L
Wood saw		2	
Pneumatic hammer		1	
Hand saw for metal		2	
Pliers		1 o 2	
Electrical tape		10	black
Pincers		2	For spliced cable cutting
Bolt cutter		2	

Mallet		2	
Harness		3 o 4	
Work tool belt		6 o 7	For all workers and supervisors
Helmet		6 o 7	For all workers and supervisors
Toolbox		1	opzional
Marker		5	
Work gloves		7	For all workers and supervisors

MATERIAL CHECK

When unpacking all supplies, be careful to separate them based on the net zones to be set up. This will make material management easier.

A-Net and Glide Net – Make sure that all assemblies are in excellent condition; any breaks or tears must be repaired before they are installed in the field. Repairing any net or glide net will be easier if done on flat ground compared to the installation area where there might be steep slopes. Make sure to bring a few extra sections of net in case additions or changes are needed.

Rope-covering mattresses – Make sure there are no tears or any other damage and prepare two for each section to be set up.

z line – Make sure that all lacings are free of cuts or damage and that the correct quantities of lacings are assembled for each net system.

Snap Hook – Make sure that the snap hook is in adequate condition for use without breakage, that it can be opened and closed properly, and that there is no damage to the latch pin.

Pulley – Make sure that the wheel in the pulley moves freely in both directions of rotation.

Cookies – Make sure that all cookie plates are intact and that they have a rope long enough to attach the net without problems.

Arrange the materials for each net section in such a way as to allow transport by truck and/or snowcats.

This should be done at the beginning of the season, ideally before snow arrives, so that all materials are ready when installation is to begin. Keep in mind that the installation site must not be in a location that interferes with artificial snowmaking (Snow cannons).

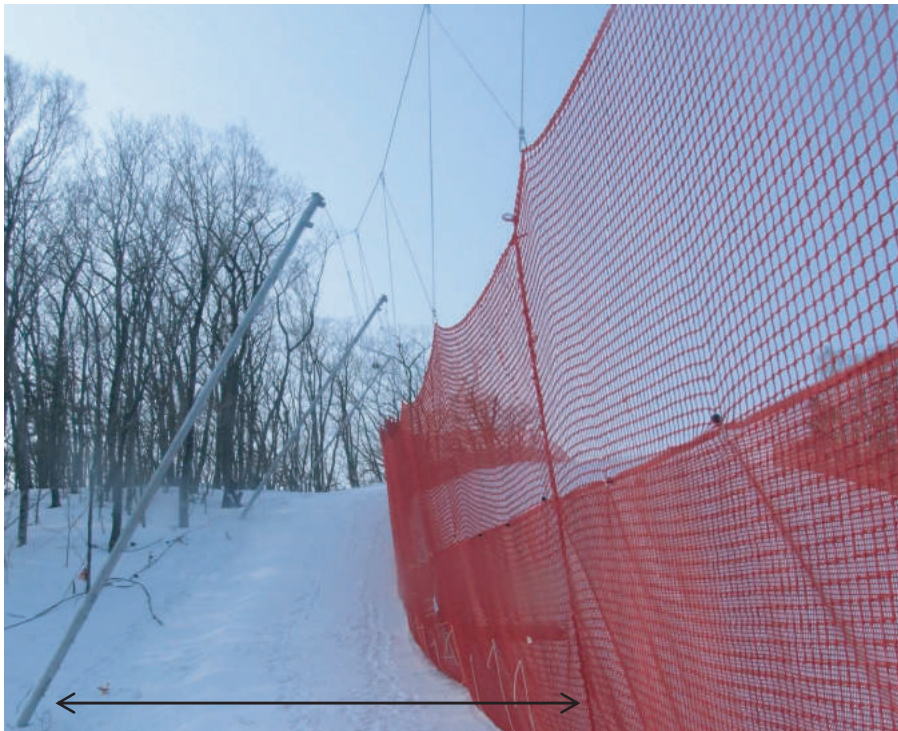
It is recommended to arrange all materials upstream relative to the positioning of the net system; this will easily allow downhill transport when there is enough snow.

WARNINGS

For a correct installation of A-nets, slope reconnaissance is important to evaluate the areas to be protected.

Series of IMPORTANT Evaluations to Consider:

1. Evaluate the slope gradient (inclination).
2. Consider the importance of the piste edge line whether it is straight or curved (favorable/unfavorable).
3. Assess the ground consistency
4. During the structuring phase of a slope, there may be embankments, tunnels, or reinforced earth.
5. Consider slope changes and compressions of lift structures (gondolas, chairlifts, ski lifts, etc.).
6. Evaluate the height of the poles based on the clearance (note 1*).
7. Evaluate the importance of the spacing between one pole and another based on the morphology of the slope (note 2*).



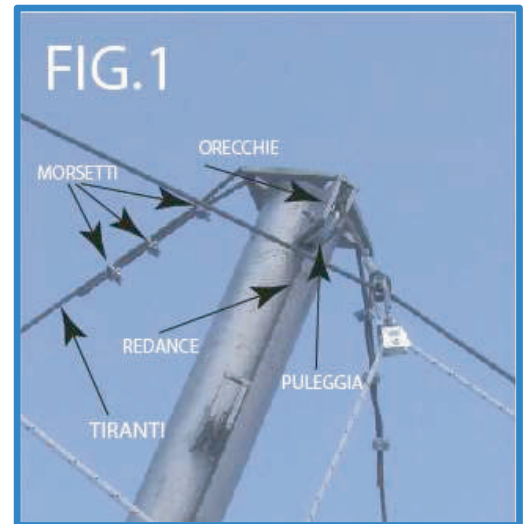
1*n.b. : The clearance is the distance from the net to the pole (obstacle).

- The clearance is 3.50 m for Slalom and Giant Slalom.
- The clearance is 5.50 m for DH and SG.

2*n.b.: The height of the poles can vary from 9 to 15 m.

POLE ASSEMBLY\n(REINFORCEMENT / REBAR)

- 1) Mount the pulley in the designated lugs provided.(Fig. 1)
- 2) Insert the thimble into the pulley and into the designated rings on the pole, and secure the cable with a clamp.(Fig. 1)
- 3) Mount the guy wires to the two side holes at the top of the pole, securing the cables with at least three cable clamps.(Fig. 1)
- 4) Normally, the guy wires are 25 m long.
- 5) Mount the pole base directly onto the pole, inserting the pin into the designated hole; secure the pin with a cotter pin.(Fig. 2)



TRANSPORT TO THE SLOPE

- 1) Transport the assembled pole to the slope using a heavy transport vehicle (helicopter, truck, excavator, etc.).
- 2) Position the pole at the predefined point with the pole base facing the edge of the slope.

POLE LIFTING

- 1) Prepare 2 anchors in the area where the pole base will be positioned.
- 2) Using the excavator, with a sling (or strap) of about 6 m sling the pole, and be careful to attach a 7/8 m lanyard to the sling to recover the sling itself once the pole is secured.(Fig. 3)
- 3) Route the upslope guy wire over the excavator arm, and bring the two guy wires to the anchor plates.



- 4) The excavator will raise the pole into the operating position.
- 5) Take into account the required clearance (distance between the net and the pole), estimating approximately 1 m of compressed snow on the ground.
- 6) Take into account the perpendicularity of the pole with respect to the slope gradient.
- 7) Once all necessary assessments have been made, secure the guy wires to the anchor plates prepared prior to raising the pole using at least three clamps.(Fig. 4)



- 8) Carefully evaluate the rotation of the pole, then insert the 4 ground stakes into the designated plate at the base and secure them to the ground.(Fig. 5)



- 9) Having already inserted the thimble at the top of the pole into its pulley, you will have the advantage of obtaining the exact plumb line.(Fig. 6)



Double Redance

- 1) All LISKI poles can be equipped with a double pulley and double redance to allow the use of a double overhead cable and double net.
- 2) With this thimble system, the overhead cable can be managed by lowering and raising it as needed without having to climb the pole anymore.

CAUTION

- 1) All anchors are very important to ensure a secure hold.
- 2) The anchor plates are secured with stakes.
- 3) The positioning of the anchors is very important: position the plates according to the cable tension.
- 4) Position the plates at least 6/10 m further back from the pole, and even more in extreme cases.

WINDBRACE

- 1) Position the plates 4/5 m in front of the pole.
- 2) Using a Ø 8 /10 cable about 6/8 m long, make a loop around the pole, corresponding to the lower ring, and then tie the cable to the plate using at least two clamps.



SECTION START AND END ANCHORS

- 1) Evaluate the start and end section anchor or anchors according to the solidity of the ground.
- 2) The further away you are with the start and end section anchors, the less load there will be on the first and last pole. It is important that the anchor is aligned with the overhead and ground cables.
- 3) In case of loose or crumbling ground, it is advisable to excavate 1 m, placing the plates (Deadman type), letting the anchoring cable protrude and connecting it to the overhead cable.



NET "A" INSTALLATION

MATERIALS

- 1) All the material needed for setting up net A must be brought uphill to the start of the section.
- 2) Place the overhead cable spool on the stand.
- 3) Unreel downhill, threading the overhead cable into the appropriate eye of the thimble, which will be about at head height.
- 4) Upon reaching the end of the section, leave a cable reserve of about 6/8 m. Leave the same reserve uphill, before cutting the cable.
- 5) Unreel the ground cable, taking the ideal line into account. No reserve is needed for the ground cable.
- 6) To secure the ground cable, use the small anchors which must be placed in the ground with a spacing of about 5 m.
- 7) Pull the ground cable after anchoring it upstream.
- 8) If there are 2 cables to secure the double net, the distance between one cable and the other is 80 cm.
- 9) Utilizzando i cookie non c'è bisogno del cavo a terra.

INSTALLATION

- 1) Proceed by unpacking the net and positioning it about 5 m upstream of the first pole.
- 2) Attach a carabiner to the overhead and ground cables upstream of the first pole at about 10 m, securing it with a clamp.

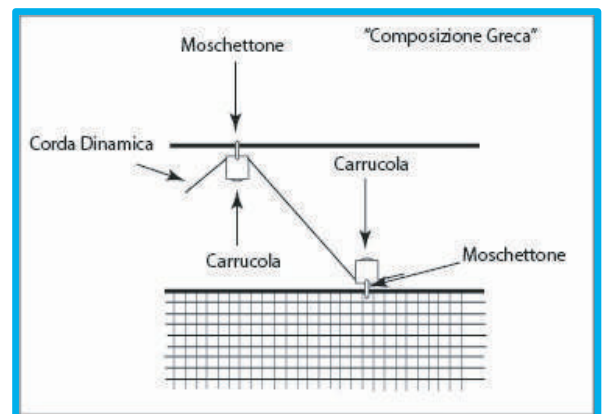


- 3) Before rolling out the net, secure or anchor the net to the carabiner using the dynamic rope.
- 4) Once the net is secured with the dynamic rope, proceed with rolling it out, keeping a distance of about 3/4 m from the overhead cable.

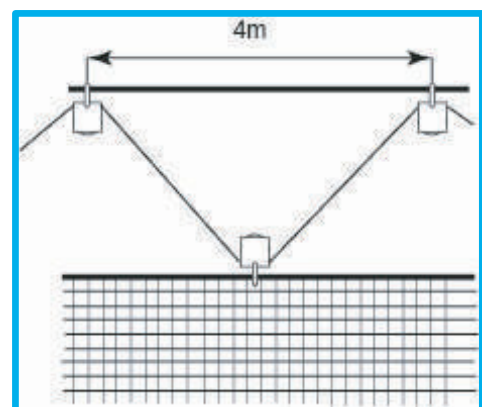
- 5) Keeping the net under tension downhill, connect the net sections using dynamic rope or cord.



- 6) Once the net is laid out, start again from upstream creating the zigzag pattern with the dynamic rope (pulleys/carabiners).



- 7) Start the zigzag pattern upstream of the first pole, keeping a dynamic rope reserve of 6/8 m. The spacing of the carabiners on the net will be about 4 m.



- 8) The spacing of the carabiners on the net may vary on a linear structure or in a curve.
- 9) The carabiner that will attach to the net must also attach to the perimeter rope.
- 10) The narrow part of the carabiner will hook onto the pulleys, while the wide part will hook onto the net and the overhead cable.
- 11) When attaching to the overhead cable and the net, pay attention to the direction of the pulley.
The hook opening must always face outward from the slope.
- 12) The z line must be managed directly from the ground, maintaining an equal distance between the cable and the net.
- 13) Uncoiling the dynamic rope is very important: insert a pipe through the spool of the dynamic rope and let it spin.
- 14) Inserting the dynamic rope into the pulley is facilitated by opening the side plates.
- 15) It is very important to interrupt the zigzag pattern every 3 poles, keeping a reserve of dynamic rope to manage the pattern.

NET LIFTING

- 1) Lift/pull the thimble all the way to the top of the pole, starting from the first upstream pole and proceeding downstream. Bring the thimble to the top of the pole and secure it with at least 2/3 clamps.
- 2) After lifting everything, check that the overhead cable is sufficiently tensioned. If not, tension it further (without overdoing it).
- 3) During lifting, check that the zigzag pattern is regular and properly set up.
- 4) Proceed by tying the net to the ground cable or use the clips (cookies).
- 5) Manage the tension of the net using the dynamic rope or thimble.

SLIDE NET

The sliding net normally measures 25m or 50m with a height of 2.25m and a 0.8cm plastic-coated mesh.

- 1) Installation is carried out by applying the sliding net to the base of Net A, ensuring an overlap of at least about 1m depending on the direction of the athlete.
- 2) Attach the sliding net to Net A using the appropriate bungee cords/elastic bands, maintaining a distance of at least 1m to 1.5m between them.
- 3) Rest the net on the snow cover with at least 15/20 cm of excess to cover it with snow. This way, in the event of a fall, the athlete will not pass under the sliding net.
- 4) It is recommended to apply the sliding net solely and exclusively on Net A and only during the event (competition) period.
- 5) For greater wind resistance, attach a few ties in the middle of the net.



ROUTINE MAINTENANCE DURING AND AT THE END OF THE SEASON

Once the assembly of the 'Type A Protection System' is completed, it must be periodically checked to prevent any issues.

During the winter season, with the slopes open to skiers, the issues may be:

- Heavy snowfall, which can easily partially or completely cover the net, causing a high load on the structure. At this point, the structures can bend or even break (even though they are well-dimensioned!), leaving the slope without adequate protection until the end of the season, as it is impossible to replace the poles of a system during the winter (see photo).
- Snowstorms or even medium/strong wind gusts can accumulate snow on the net, creating the same effect as heavy snowfall. Alternatively, they can clog the net meshes, creating a sail effect on the entire structure. The addition of the accumulated snow's weight and the wind can severely compromise the protection system.
- Scarcity of snow

Solutions:

- 1) Remove excess snow caused by heavy snowfall, snowstorms, or strong wind.
- 2) If removal is not possible due to a prolonged storm and heavy snow load in a short period of time, unhook the 10mm Ø dynamic rope used as a 'zigzag lacing' or the steel thimble cable of the poles.
- 3) If this operation is not possible, you will need to consider cutting the 10mm Ø dynamic rope to release the net from the structure. At this point, the system will not function as protection, but this will prevent damage to the structure.
- 4) As soon as possible, position 2 or 3 rows of 'Type B Protection System' as a provisional safety system.
- 5) Adjust the height of the net according to the snow thickness by adjusting the lacing.

During the spring/summer season, it is recommended to carry out a thorough inspection of:

Position and condition of the bases (OB poles) and of the plates for the upper/lower and tension cables. In any case, after EVERY heavy rain, it is important to inspect the slope, checking for any movement of the protection system components. Protect the net and dynamic ropes with anti-UV shading nets; to do this, all LISKI net systems allow raising or lowering NET A by means of the thimble of the protection structure.

PROCEDURE

- 1) Untie the net at the base
- 2) Lower the entire net system (z line, overhead cable) by means of the thimble until the overhead cable reaches head height.
- 3) Starting from the top, roll up the net from the bottom to the top, including the lacing as well, and secure everything with the cord. The cord or cable tie will tie the net, z line, and overhead cable together.
- 4) After unrolling the shading net, always starting from the top, position the net, the z line, and the cable, taking care to cover everything completely. Tie everything together with a cord or cable tie (forming the so-called 'salami').
- 5) If the net at head height causes a nuisance, it is recommended to raise everything back up.

