



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

INTRODUCTION

Liski, thanks to its 50 years of experience in the field of competitive and touristic skiing, is an Italian company active in the national and international market, with a great variety of products for the preparation of alpine skiing, cross-country skiing, snowboard racing slopes, and also with signs and safety equipment suitable for all types of ski slopes and ski areas.

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

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

LISKI "A" NET is a safety net conforming to the classifications of the Ski World Cup races. Liski is the supplier of the most important national ski teams and also of important ski events in the world such as the Olympic Winter Games and World Championships.

Hundreds of thousands of kilometers of these systems are installed every year in many ski resorts around the world, and these networks save the lives of countless people; we continuously receive numerous positive feedback from installation teams, competition organizing committees, technical delegates, coaches, and anyone involved in organizing ski races.

The design, production and assembly of the protection system with RETE B LISKI are done in Italy, synonymous with quality and professionalism; these systems are very easy and quick to use and assemble; the technical specifications and complete test documents can be requested by sending an email to: info@liski.it .

INSTALLATION, MAINTENANCE AND REMOVAL GUIDE OF “A” NET WITH “OB” POLES SAFETY SYSTEM

Operations – In most cases, the Resort Competitions and Events department will be the lead department of building, maintaining, and removal and storage of the A-Net systems. If this department does not exist, the local race organization will have a large role in the installation, maintenance, and removal of the net systems. This may change from location to location but no matter what, make sure that there is a representative educated in A-Net systems that can come and check to make sure that the systems are installed properly and up to standard, and that all fall lines are properly protected.

Track safety – The building, maintaining, and removal process of A-Net Systems can be a time consuming task.

****If you are looking to work on or in the area of the nets, it is advised to close the Ski Slope or to close a lane along the net where you will be working, preferably 20 meters off the desired anchor location. This will keep unwanted public from coming in contact with unprotected towers, equipment, supplies, and staff that are in the area.**

Snowmaking – There will need to be a representative of the build crew that is in constant contact with someone of snowmaking to make sure they know how much more snow will be needed to be ready to build the A-Net system. Also make sure that when mounting the nets or supports there are no unwanted objects inside the ground (high voltage cables, water pipes, etc.)

Management – This department is an important part of preparing the hill for an A-Net installation, and also the maintenance and removal of the system.

Volunteer Support – Setting up an A-Net system is not a small task. If possible, try to have as much support as possible to not only install the A-Net, but also maintain, and remove the A-net system as well. This will ensure that the job will get done in a timely manner. The more people you have the better off, just make sure everyone is moving at the same time.

It is good to have a positive relationship with your local resort's departments. In some cases, departments like skilifts, ski school, any many more can be added to the net building team on a temporary basis to ensure that there is a large workforce setting up, maintaining, and removing the A-Net systems.

It would be ideal all the working team has already some experience in matter. It's very important that Volunteers support will be always managed by a responsible person on site. Who doesn't have experiences in this case, it is advised to attend World Cup Races or International events to create his own experience.

REQUIRED PARTS

References for OB or PRO Pole - It is advisable to place a reference (flag, tuft, pole, etc.) in order to have a correct view of the distance and position between one pole and another.



Upper cable padding – It will need necessary at the start and finish of each sector.



Z - LINE – This will connect the net with the upper steel cable.



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

The height of the net and the size of the mesh vary according to the use of the ski slope and to its dangerousness.

Make sure all nets are in order without tears or breaks.



Slide Net – It's an important part for speed races (DH/SG mandatory) for all A Nets.



The necessary number for all support mentioned above, can be calculated in order to the length system, while is recommended to have stock for each part of the system. The same reason it is advised to have a stock to install the system quickly

U – Bolts Needful to connect the upper cable to the anchorage. They are also to be used to secure the tie rods and the redance. It is advised 3 u-bolts each locking



Upper Cable – The upper cable will be length like the net with an extra part, up–hill and down–hill to secure them to the anchorages.



Carabiners – This will be one of the devices that connect the Z- LINE to the net and to the upper cable. It is important have extra carabiners to be used at start and finish track.



The distance between two carabiners may change in order to the pole height, or if the net system is in a curve of the track.

Pulley – This device needs to create the z – line, and slide the dynamic rope for tensioning the net. More over in a falling way, the dynamic rope that passes through the pulley, can slide out and so adsorb the impact.



Cookie – The cookie is a simple plate which is connected a 2m rope. Before the system assembly the cookie must be secured into the snow. It is necessary create a hole in the snow with an auger and put the cookie in a desired position. After the securing, get out the rope from the snow in order to connect it later to the net.



The cookie should be aligned with the lower carabiner of the z – line.

Connection Rope – This will need to joint the nets together, and also to repair any tears or breaks of the net. Make sure that the connector rope is of the same material of the net.



Rubber bands – This item needs to connect the slide net to the A Net. Make sure that all the rubber bands are in a perfect condition, without cracks in the rubber.







TOOLS NEEDED









Disposable Ropes – This will be used not only for running out and setting a line for the cookies to be placed, but also when it comes time to remove the nets. It is good to have a rope that can be cut up, and used to tie the A Net and slide net.

Tuft / pole – The tuft/poles will need to set the line rope as a reference for the cookie securing. They must be bamboo tuft/poles redirecting to the rope if there will be curves in your system net.


It is always good to have even small tools on hand that can be taken to the track.








List of necessary tools for Safety System Set-up

Article preparation	Photo	Qt.	Details
Off-road (pick-up) for staff transportation to the track		1 or 2	4 wheels
Radio		3 or 4	
Excavators with driver		1 or 2	
Helicopter for transportation of material on track		1	The helicopter will allow you to be faster with the various jobs

Trimming stands for cables		3	Widht 1m x height 1m
Belts (n. 5 6m long + n. 5 8m long)		5 or 6	
schackle		10	for lifting poles (Helicopter)
Motor drill with bits (n° 2 Ø 24mm + n° 2 Ø 28mm)		1 or 2	
Ratchet hoist		2	
Ratchet Tirvit		4	
Hoist for cable pulling		2 or 3	
Shears for cutting		2	

Battery Drill 18 V / 24 V (screwdriver type)		2	
Battery Drill 18 V / 24 V for cable cutting		1 or 2	
Pickaxe		3 or 4	
Shovels for mountain		3 or 4	
Crowbar		2 or 3	
Iron tip bars Ø 22mm x Length 100cm approx.		10	
Case work with wrenches various types and sizes		1 or 2 set	10", 11", 12", 13", 14"
Chainsaws to cut branches		1	

Tank		1	10L
Saws for cutting wood		2	
Hammer drill		1	
Hacksaw for cutting iron		2	
Cutters		1 or 2	
Insulating tape		10	black
Pincers		2	For jointed cable cuts
shearing		2	

Hammer		2	
Harness Work		3 or 4	
Tools Working belts		6 or 7	For all workers e supervisors
Helmet		6 or 7	For all workers and supervisors
Equipment cover		1	opzional
Marker Pens		5	
Work gloves		7	for all workers, and supervisors

MATERIALS CHECK

When unpacking all supplies, take care to separate them according to the network areas to be set up. This will make material handling easier.

A Net & Slide net – Make sure that all sections are in full working; if it will be tears or damages, these must be repaired before to go on the track. Repairing any nets or sliding nets will be easier if done in a flat area than in the set up area where there may be steep slopes. Make sure to bring a few extra sections, in case of changes or addition.

Pads – Make sure there are no tears or any other damage and arrange two for each section to be set up.

Z-Line – Make sure that all z-lines are not cut or damaged, and that the proper amount of lines are staged for each net system.

Carabiners – Make sure that the latch can be opened and closed properly and there is no damage to the hinge that is on the latch.

Pulleys – Make sure the wheel in the pulley moves freely on both sides.

Cookies – Make sure all cookie plates are intact and have a rope long enough to anchor the net properly.

Try to stage supplies for each net system in a manner that allows transportation by trucks or snow cats. This will need to be done early in the season, ideally prior to snow on the hill, so that the supplies can be there and ready when the net systems installation begins. Keep in mind that stage locations need to be in a position that will not interfere with snow making.

All stage locations and supplies will need to be covered from the atmospheric events, so that they are accessible, when the installation begins. It is advised to stage all supplies up-hill from the net system locations, this will allow easy down-hill transportation once there is enough snow at the net system.

INSTALLATION

WARNING

For a proper A Net installation it is important the patrol of the slope to value the zone to protect.

Important value to consider:

- 1) Value the bend slope (inclination).
- 2) Consider the track line, if in straightaway or in curve way.
- 3) Value the consistency of the ground.
- 4) In a slope structure phase, it could be steep, tunnels or armed ground.
- 5) Consider the bend changes given by skilifts (cable cars, chairlifts, ski lifts, etc.)
- 6) Evaluate the height of the poles according to the “franco” (note 1*)
- 7) Evaluate the importance of the pitch between one pole and the other according to the morphology of the track. (note 2*)



1*n.b.: The distance between net and the pole:

- 3,50m for Slalom e Gigant Slalom
- 5,50m for DH e SG

2*n.b.: The height of the poles can change from 9 to 12/15 m

POLE ASSEMBLY

- 1) Assemble the pulley in the “ears” of the pole. (Fig.1)
- 2) Insert the redance in the pulley and in the rings on the pole.
Secure the cable with a U-bolt (Fig.1)
- 3) Assemble the rods at the top of the pole on the lateral holes blocking the cables with a minimum of three U-bolts. (Fig.1)
- 4) The tie rods are usually 25mm long.
- 5) Assemble the base directly on the pole, inserting the stud in the hole and then secure it with a cotter pin. (Fig.2)

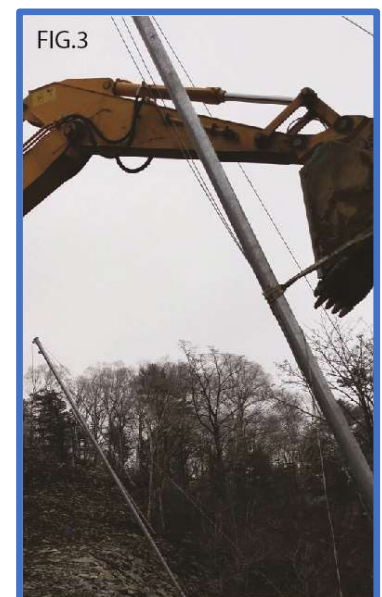


TRANSPORT ON SLOPE

- 1) Transport the armed pole on the slope using a heavy vehicle. (Helicopter, TIR, Excavator ecc.)
- 2) Position the pole at the predefined point with the base of the pole facing the edge of the track

POLE RAIS UP

- 1) Prepare 2 anchors in the area where the base of the pole will be positioned..
- 2) Using the excavator, with a band of about 6m harness the pole, and being careful to insert a 7/8 m cord to the band, for the recovery of the band itself once the pole has been fixed. (fig.3)
- 3) Pass the tie rod upstream over the excavator arm, and bring the two tie rods to the anchor plates.



- 4) The excavator will raise the pole up to the assessment point of the technician present.
- 5) Take into account the distance between net and pole, considering about 1m of compressed snow in the ground.
- 6) Take into account the perpendicularity of the pole according to the slope of the track.
- 7) After this evaluations, once all the necessary assessments have been made, block the tie rods to the anchoring plates prepared prior to raising the pole with at least three clamps.



- 8) Carefully evaluate the rotation of the pole, at which point insert the 4 pickets at the base in the special plate and secure them to the ground with an hummer (Fig.5)



- 9) Having already inserted the redance at the top of the pole in its pulley, you will have the advantage of having the exact lead. (Fig.6)



Double Redance

- 1) All LISKI poles are composed by double pulley, and double redance, to use them with double upper cable and double net.
- 2) With this redance system it is possible to manage the upper cable by lowering and raising it according to the needs without climbing the pole

WARNINGS

- 1) All the anchorage are very important to guarantee a safe hold.
- 2) Anchorage plates are secured with pickets.
- 3) The positioning of the anchorages is very important: position the plates according to the cable pull.
- 4) Positioning the plates at least 6/10m behind to the pole. In extreme cases even more.

BRACING CABLE

- 1) Positioning the plates 4/5m in front of the pole
- 2) Using the cable Ø 8 /10 about 6/8m long, turn the cable on the pole, at the bottom ring and then tie the cable to the plate with at least two clamps.



START AND FINISH TRACK ANCHORAGE

- 1) Evaluate the anchorages of start and finish track according to the ground solidity.
- 2) The further away you are with the anchors at the start and end of the section, the less load you will have on the first and last pole. It is important that the anchor is in line with the upper and lower cables.



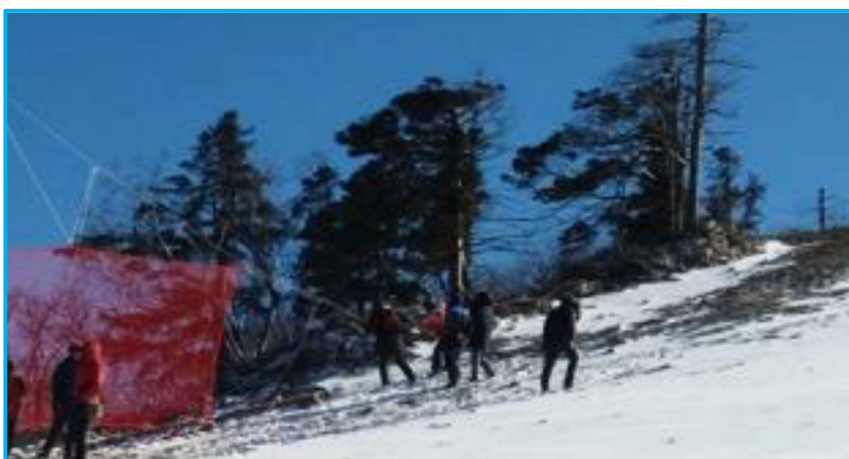
"A" NET INSTALLATION

MATERIAL

- 1) All material that will need to install the A Net, it will be brought uphill at the beginning of the section..
- 2) Positioning the upper cable on the trestles.
- 3) Spooling downhill to insert the upper cable into the specific buttonhole of the redance that it will be about the human height.
- 4) Arrived at the bottom, leave an extra cable about 6/8m long. Leave the same length uphill before cutting the cable.
- 5) Spooling the lower cable keeping in condieration the ideal line. For the lower cable it doesn't need the extra cable.
- 6) To secure the cable to the ground, use the small anchors that must be placed in the ground with a pitch of about 5m.
- 7) Tensioning the lower cabel, after anchored it uphill.
- 8) If the cables are 2 to secure the double net, the distance is 80cm.
- 9) Using the cookie we don't need the lower cable.

NET INSTALLATION

- 1) Unroll the net and positioning it at 5m uphill of the first pole.
- 2) Apply a carabiner to the upper and lower cable uphill from the first pole at about 10m distance, securing them with the U-bolts.

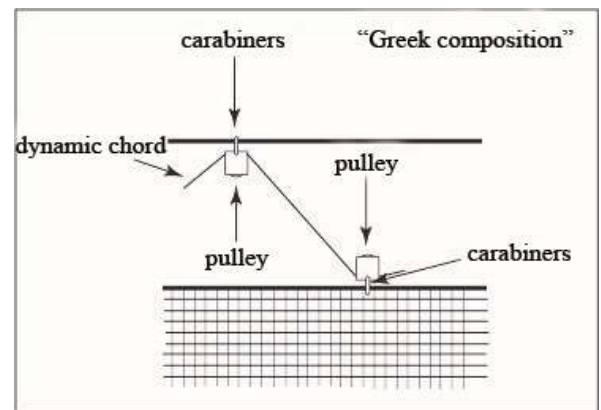


- 3) Before laying the net, secure or anchor the net with the dynamic rope to the carabiner.
- 4) After blocking the net with a dynamic rope, proceed with the laying keeping a distance from the aerial cable of about 3 / 4m.

- 5) keeping the net in tension downhill, connect the groups of nets with a dynamic rope or cord.

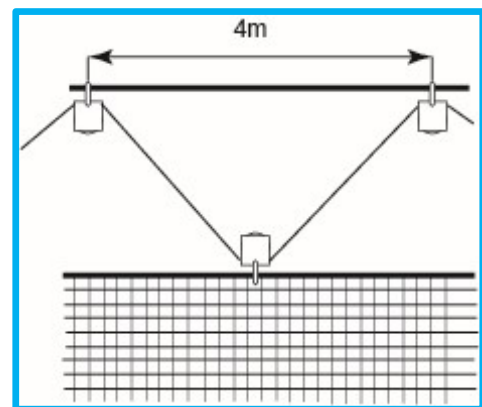
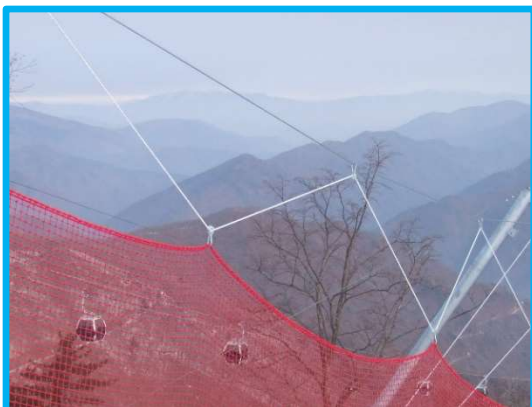


- 6) Once the net has been connected for all the length, start again from uphill creating the z-line with the dynamic rope (pulleys / carabiners).



- 7) Start the z-line uphill of the first pole, keeping 6 / 8m dynamic rope reserve

The distance between 2 carabiners on the net will be approx. 4m



- 8) The distance between two carabiners on the net can vary if the sector to be protected is in a straight line or in a curve.
- 9) The carabiner that will hook the net must also hook the perimeter rope.
- 10) The narrow part of the carabiner will joint with pulley, and the large part will joint with the net and the upper cable.
- 11) During the joining to the upper cable and the net, be carefull to the direction of the pulley. The opening of the hook must always be facing the outside of the track.
- 12) The z-line must be managed from the ground maintaining an equal distance between net and upper cable.
- 13) The spooling of the dynamic rope is very Important. Insert a tube in the dynamic rope, spool and make it turn.
- 14) The insertion of the dynamic rope into the pulley is facilitated by the opening of the cheeks.
- 15) It is important to interrupt the z-line every 3 poles, keeping the reserve of the dynamic rope for the management of the z-line.

RAISING UP THE NET

- 1) Riase/ Tensioning the redance until the top of the pole, starting from the first uphill pole and continueing downhill. Bring the redance until the top of the pole blocking it with at least 2/3 u-bolts.
- 2) After lifting everything, check that the upper cable is sufficiently taut. If not, pull it further (without exaggerating).
- 3) During the lifting, check that z-line is regular and ready for using.
- 4) Proceed joining the net with the lowline or using the cookies.
- 5) Manage the net tension with the dynamic rope or redance.

SLIDE NET

The slide net usually measures 25m or 50m by 2.25m height with a mesh with 0.8cm, plastified.

- 1) The implementation takes place by applying the sliding net to the base of A Net, taking into account overlapping it by at least 1m approximately depending on the direction of the athlete
- 2) Join the slide net to the A net with the rubber bands, with at least 1m / 1.5m distance between them.
- 3) Let the net rest on the snowpack with at least 15/20 cm of abundance to cover it with snow. In this way, in the event of a fall, the athlete will not pass under the sliding net.
- 4) It is advised to apply the slide net only to the A Net , and only in the period of the event (competition)
- 5) For a better grip in windy conditions, put some laces in the center of the net.



ORDINARY MAINTENANCE DURING AND AT THE END OF THE SEASON

Once the “Safety system type A” is assembled, it must be periodically controlled to avoid problems.

During winter season, with slopes open to skiers, the problems can 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 (although they are well sized!), leaving the ski 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 picture)
- Storms or even medium/strong wind can accumulate snow on the net, having the same effect of an heavy snowfall. Or it can “full” the meshes of the nets, creating a “sail” effect on the entire structure.. The addition of the weight of the accumulated snow and the wind can badly affect the safety system.

Solution:

- 1) Try to remove the excess of snow on the net in case of heavy snowfalls or storms/strong wind.
- 2) In case the removal is not possible due to long time storms and relative large amount of snow fall in short period, detach the dynamic rope Ø 10mm used for the “z-line” or the redance stell cable of the poles
- 3) If no detach is possible, please consider the possibility to cut the dynamic rope Ø 10mm to free the net from the structure. The system will not works as a protection then, but this will avoid damaging the structure.
- 4) As soon as possible put 2 or 3 rows of “Safety System Type B”, as provisional safety systems.

During spring / summer season please make a deep check on:

- Position and situation of bases (for OB poles) and all plates related to tension cables and upper/lower cables.
- In any case, after ANY important rain, it’s important to visit the slope, checking possible moving of the protection system components.
- Protect the net and the dynamic ropes by UV shading net; to do this, all the LISKI A-Net systems have the possibility to raise or lower the A-Net through the redance of the protection structure.

PROCESS

- 1) Unplug the net to the base.
- 2) Lower through the redances the entire net system (z-line, upper cable) until reaching the upper cable at eye level.
- 3) Starting from the top, rolling up the net from the bottom to the top including also the z-line and block them with a lace.
- 4) After unrolling the shading net, always starting from the top, position the net, the z-line and the upper cable, taking care to cover everything. Tie everything with a cord or tie (see picture)
- 5) If the net at eye level will cause discomfort, it is advisable to raise everything.

