Installation Manual

TSV-1000-oA

Subject to technical change

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SAFETY BY COMPETENCE

03/2024

Rockfall Protection Kit TSV-1000-oA
Helicopter or Crane Installation

1. Mark position of base plates and anchors.

2. Drill and set all anchors for bearing ropes. In doing so, it is extremely important to set the orientation of the anchor in accordance with the expected forces.

3. Excavate foundation.

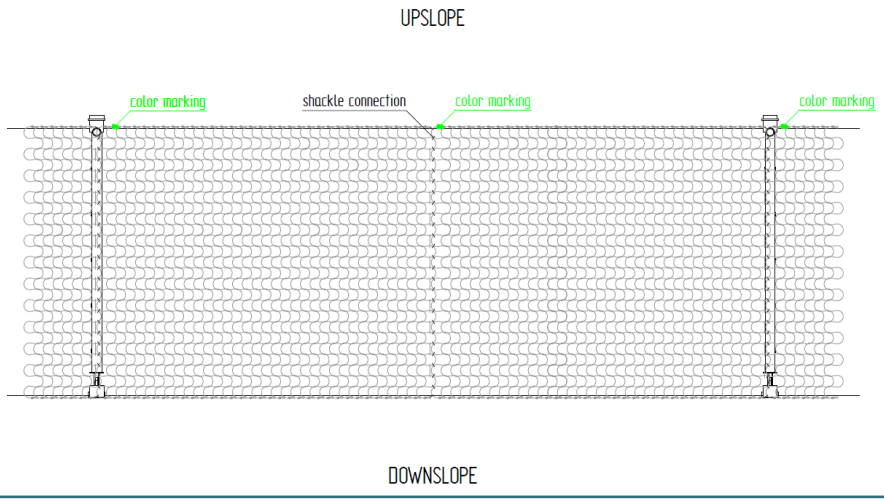
4. The foundation must be secured to the subsurface using anchors appropriate for the conditions. The connection of the post base to the foundation is made through the use of 3 mono bar anchors. These anchors are positioned using the supplied template. The foundation should be inclined approximately 5° downslope.

5. For systems using bar anchors, attach anchor eyes. Attach brake elements as per the detail schematics provided.

6. Layout posts at preparation site next to each other.

7. Attach the side stabilisation rope to the head of the end posts. Install the bolt of the shackle so that the bolt is always on the top.

8. Place net packages next to post. Insert a mounting bar (to be supplied by construction company) through the first net package, into the tube fixed to the post head and through the second net package. Fix the net packages to the post 2 – 3 times by wire. Caution: The correct orientation of the net package is crucial, as indicated by the coloured marking (always at the **TOP LEFT**).



9. Transport the post and net packages (steps 6 – 8) by helicopter/crane to the base plates. Stand the posts on the foundation and attach using washers and anchor nuts. Release the post from the helicopter/crane and repeat for the next post.

10. Lead the upper bearing rope from the brake element at the lateral anchor to the first post, through the rope guide at the head of the post and the net package to the first net package of the second post, through the rope guide and the second net package. Repeat from post to post until reaching the opposite lateral anchor or internal retention anchor. At the other end, the bearing rope should be secured to the brake element and subsequently the anchor, put under tension and clamped down with wire rope clips.

11. Lead the middle ropes from the brake element at the lateral anchor to the first post, through the middle rope guide and the net package to the first net package of the second post, through the rope guide and the second net package. Repeat from post to post until reaching the opposite lateral anchor or internal retention anchor. At the other end, the bearing rope should be secured to the brake element and subsequently the anchor, put under tension and clamped down with wire rope clips.

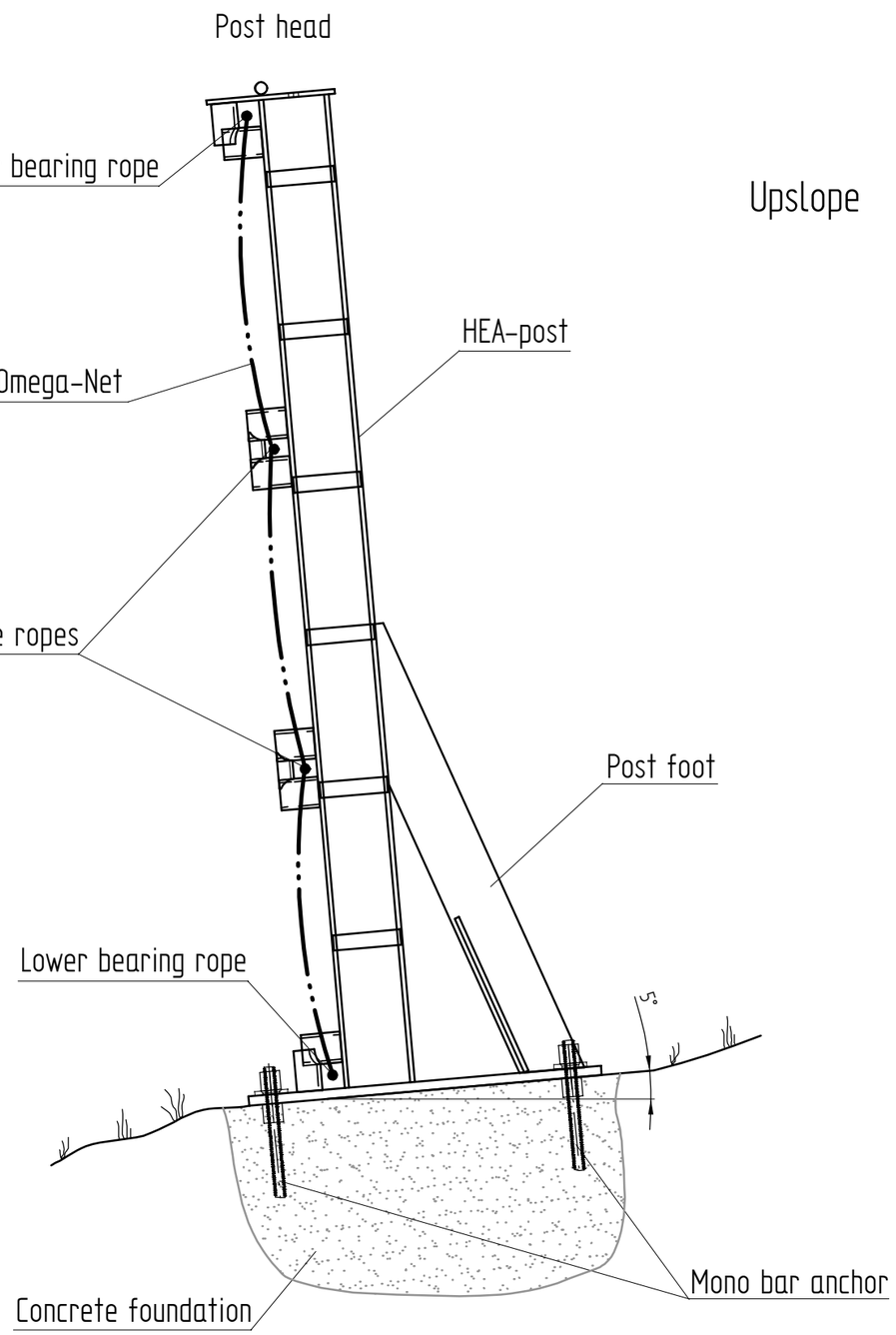
12. Install all ropes using thimbles and wire rope clips as per the appended standard table, remembering the saying “Never saddle a dead horse!” This also applies to all ropes installed in the next following steps.

13. Lead the lower bearing rope from the brake element at the lateral anchor to the first post, through the rope guide at the base of the post and the net package to the first net package of the second post, through the rope guide and the second net package. Repeat from post to post until reaching the opposite lateral anchor or internal retention anchor. At the other end, the bearing rope is attached as normal but is not put under tension.

14. Free the net packages and stretch the nets open like a curtain. Attach adjacent net panels and install the net border rope (see Installation of Omega-Net 7.5mm and Installation Omega-Net 7.5mm)

15. Re-stretch lower bearing rope and clamp down with wire rope clips.

16. Mount mesh layer, if required, using six connection points per square metre.



- tested with 1044 kJ
- Fixed base plate
- Without upslope retaining ropes
- Bearing and middle ropes
- Brake elements on bearing and middle ropes
- Omega-Net

				General tolerance:	Scale 1 : 20	TRUMER Schutzbauten GmbH
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					Date / Name	
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				Exam.	18.03.13 GS	
				Seen		
Stat.	Edit No.	Date	Name			
Weight				Material: Raw part: Semi finished part:	Drawing Nr.: 037-00-100-UE	Format / Page / from Pa.
Standard:				Alt. f.:	Repl. by:	

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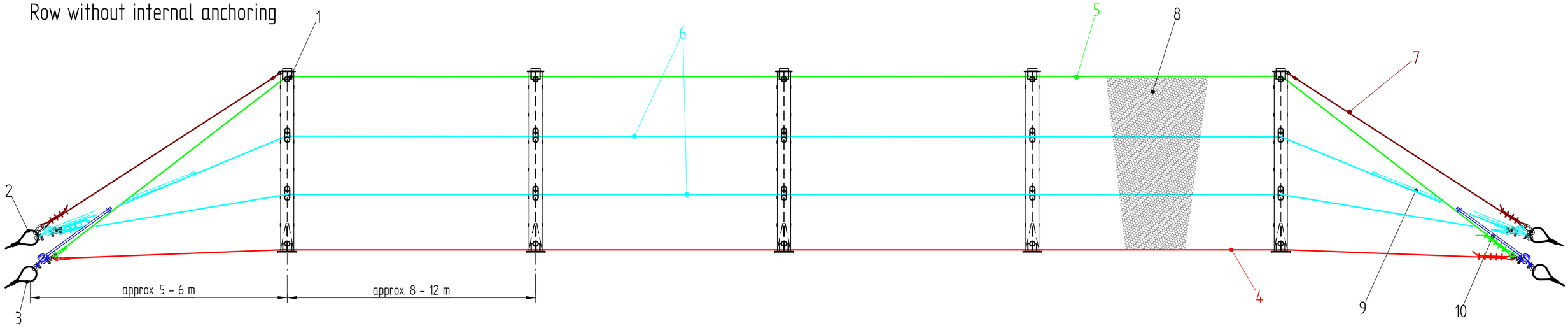
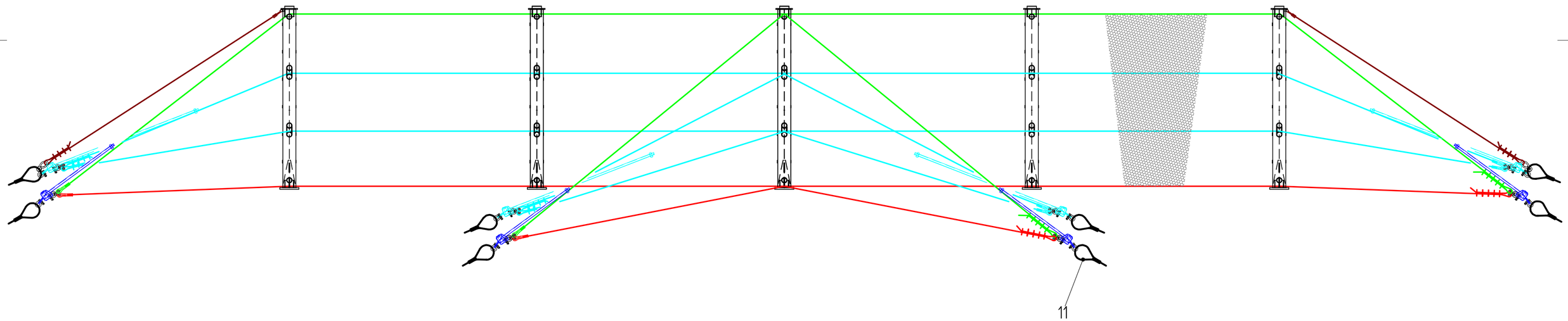
Row without internal anchoring



Row with internal anchorin



Legend

1. Post
2. Lateral anchor for middle ropes and side stabilisation rope
3. Lateral anchor for bearing ropes
4. Lower bearing rope (post foot)
5. Upper bearing rope (post head)
6. Middle ropes
7. Side stabilisation rope
8. Omega-Net 7.5/135
9. Brake element GDV 120/8-3000 for middle ropes
10. Brake element GDV 120/8-1500 for bearing ropes
11. Internal anchoring

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				Exam.	18.03.13	GS	TSV-1000-oA
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Stat.	Edit No.	Date	Name				Prj. No:
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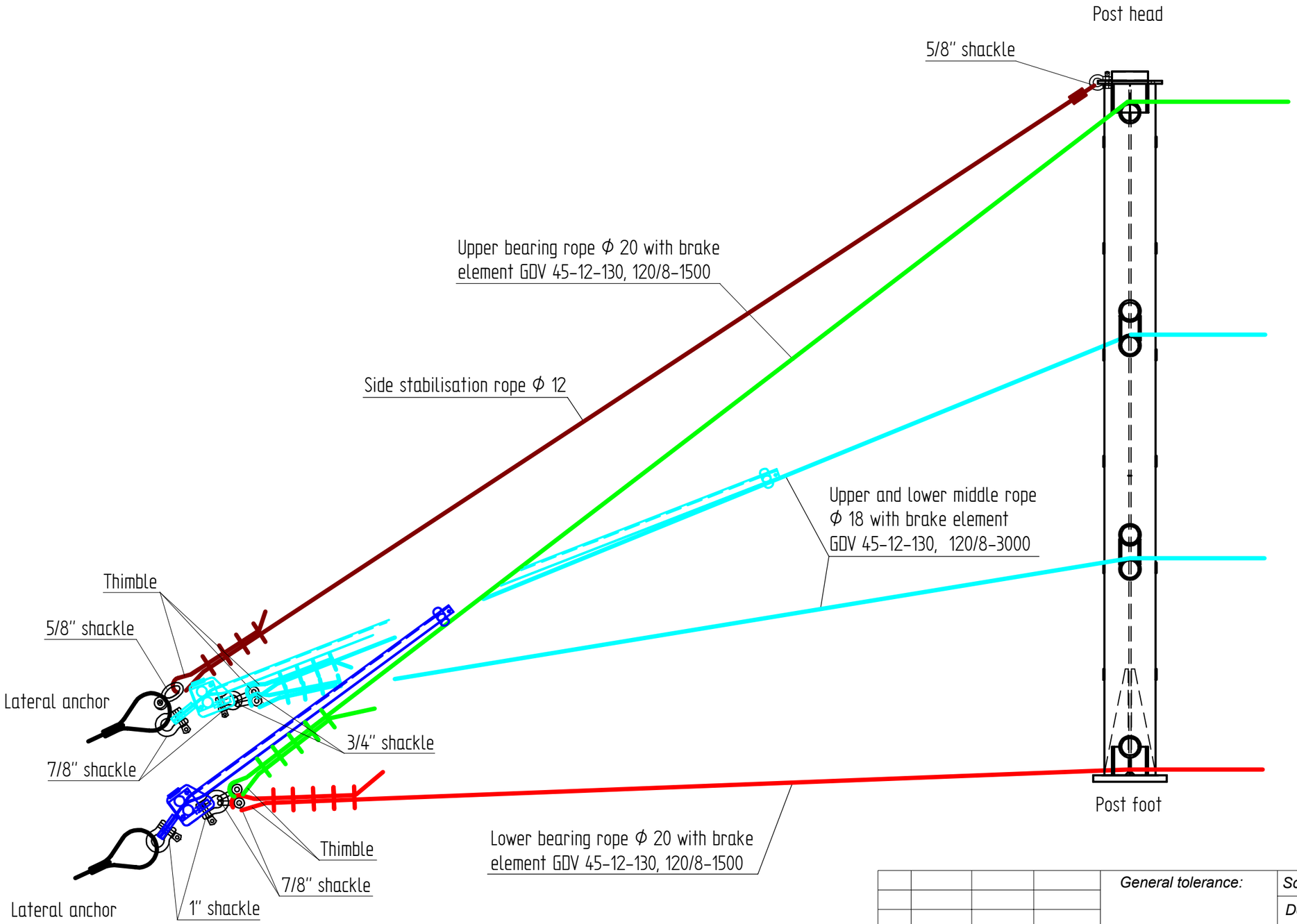

NOTE
The correct number of wire rope clips is detailed in the provided table and is defined by the diameter of the rope.
In general, thimbles are always used at connection points.

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					Date	Name
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				Exam.	18.03.13	GS
				Seen		
Stat.	Edit No.	Date	Name			

General tolerance:

Scale 1 : 20

Description:

Rockfall Protection System
TSV-1000-oA
Detail Lateral Anchoring

TRUMER Schutzbauten GmbH

Prj. No:

Weight

Standard:

Material:
Raw part:
Semi finished part:

Drawing Nr.: 037-00-206-UE

Format

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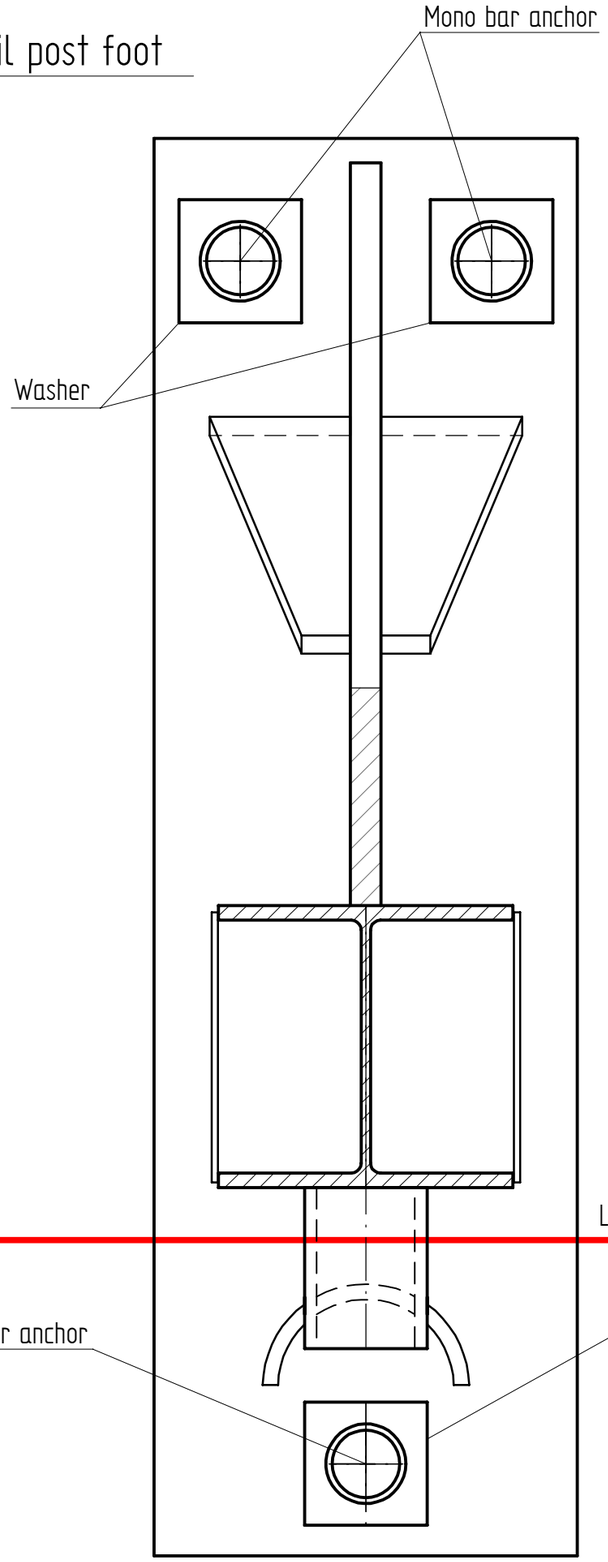
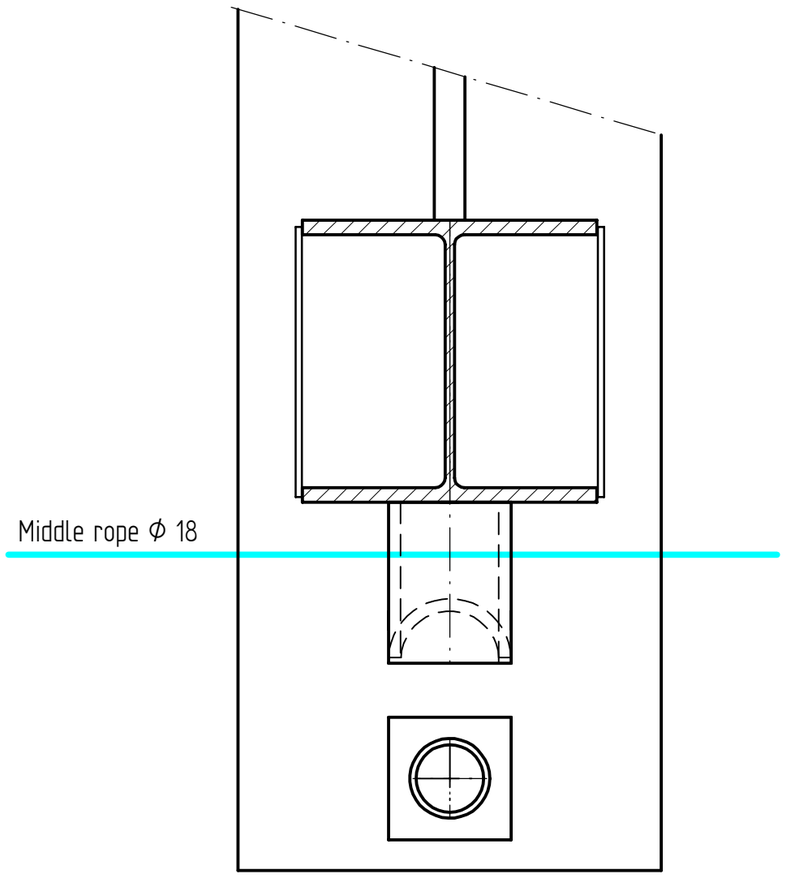
Upslope

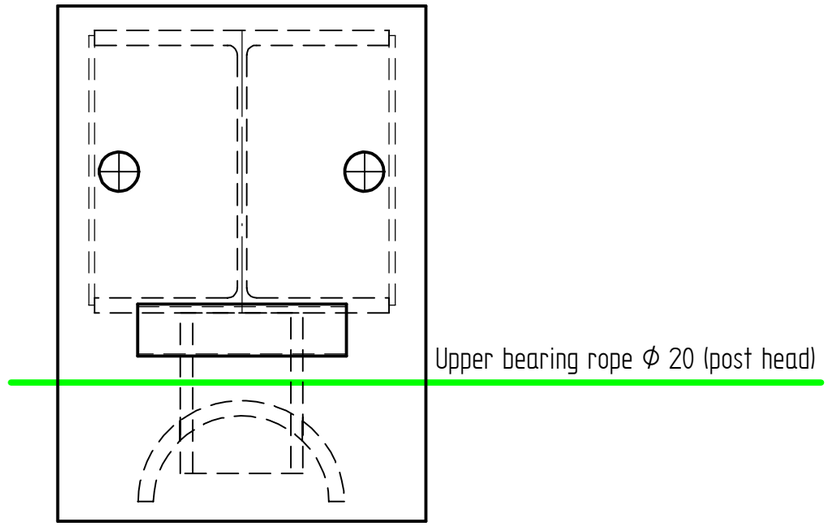
Detail post foot



Detail middle rope



Detail post head



Downslope

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				Exam.	18.03.13	GS
				Seen		
Stat.	Edit No.	Date	Name			
Weight				Material: Raw part: Semi finished part:	Drawing Nr.:	037-00-201-UE
Standard:					Format	Page / from Pa.
				Alt. f.:	Repl. by:	

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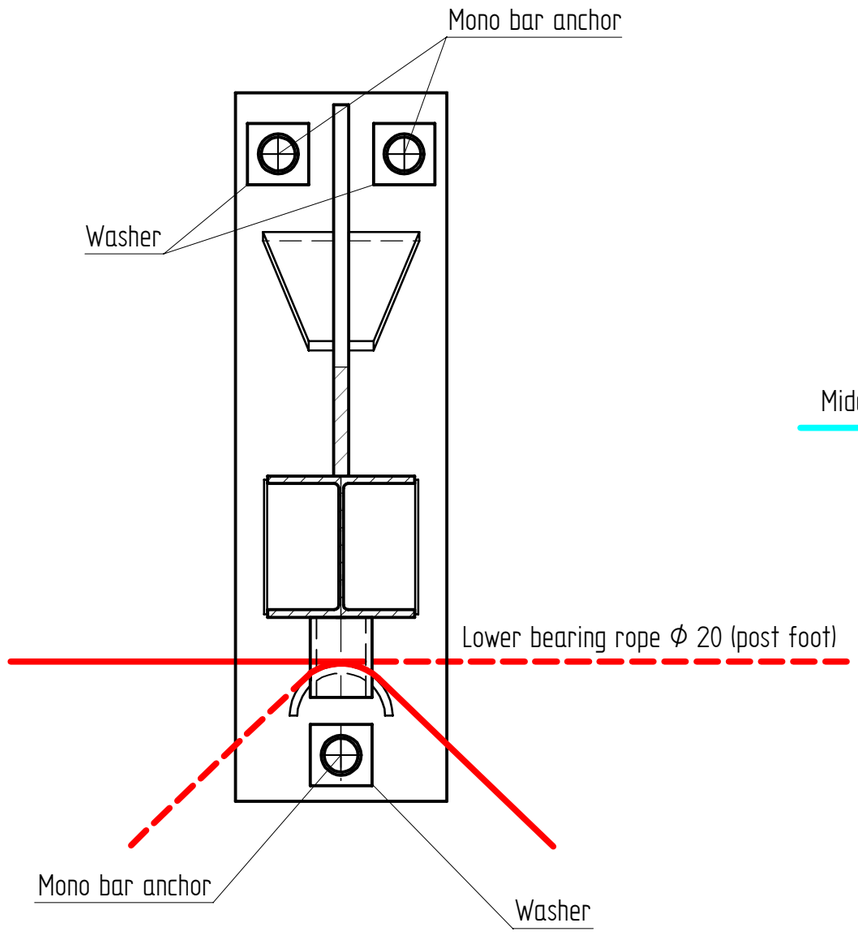
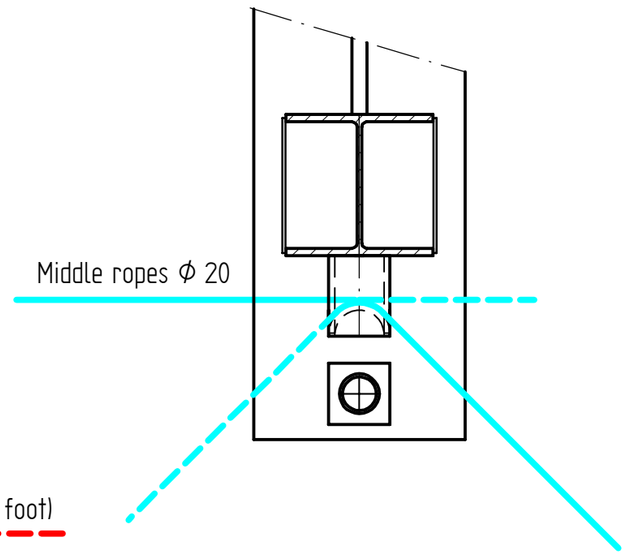
Prj. No:

Upslope

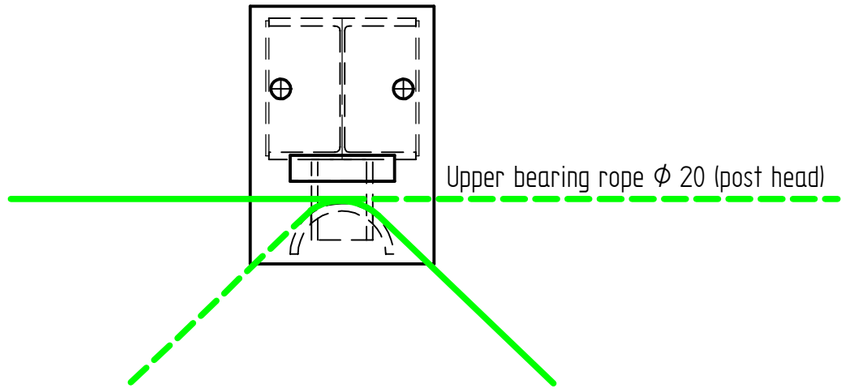
Detail post foot



Detail middle rope



Detail post head



Downslope

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				Exam.	08.04.13	GS	
				Seen			
Stat.	Edit No.	Date	Name				
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Standard:				Raw part:			Format / Page / from Pa.
				Semi finished part:			
				Alt. f.:			Repl. by:

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Prj. No:

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Installation of Omega-Net 7.5mm

Each net is marked with coloured paint at one corner. During installation, this marking must have the same orientation with respect to the fence line for each net in order to ensure that they are properly aligned. The correct orientation of the net package is crucial, as indicated by the coloured marking (always at the **TOP LEFT**).
All of the nets match one another, they all have the mark at the top left.

Connecting nets at the end posts

At the outer edges of each row, feed a one-sided pressed sewing/border rope through the Omega-Net and the guides for the middle ropes. At the top, the pressed loop must be fixed at the post head using a 1/2” shackle. At the bottom, the end of the sewing rope must be threaded through the guide of the lower bearing ropes and must be clamped down with wire rope clips.

Connecting adjacent panels

At a net seam located at a post, two strands of the Omega-Net found directly adjacent to the post on both the left and right sides are to be left out when threading the upper, lower and middle ropes through the net packages. By doing so, it is ensured that the net panels can move freely around the post during an impact.

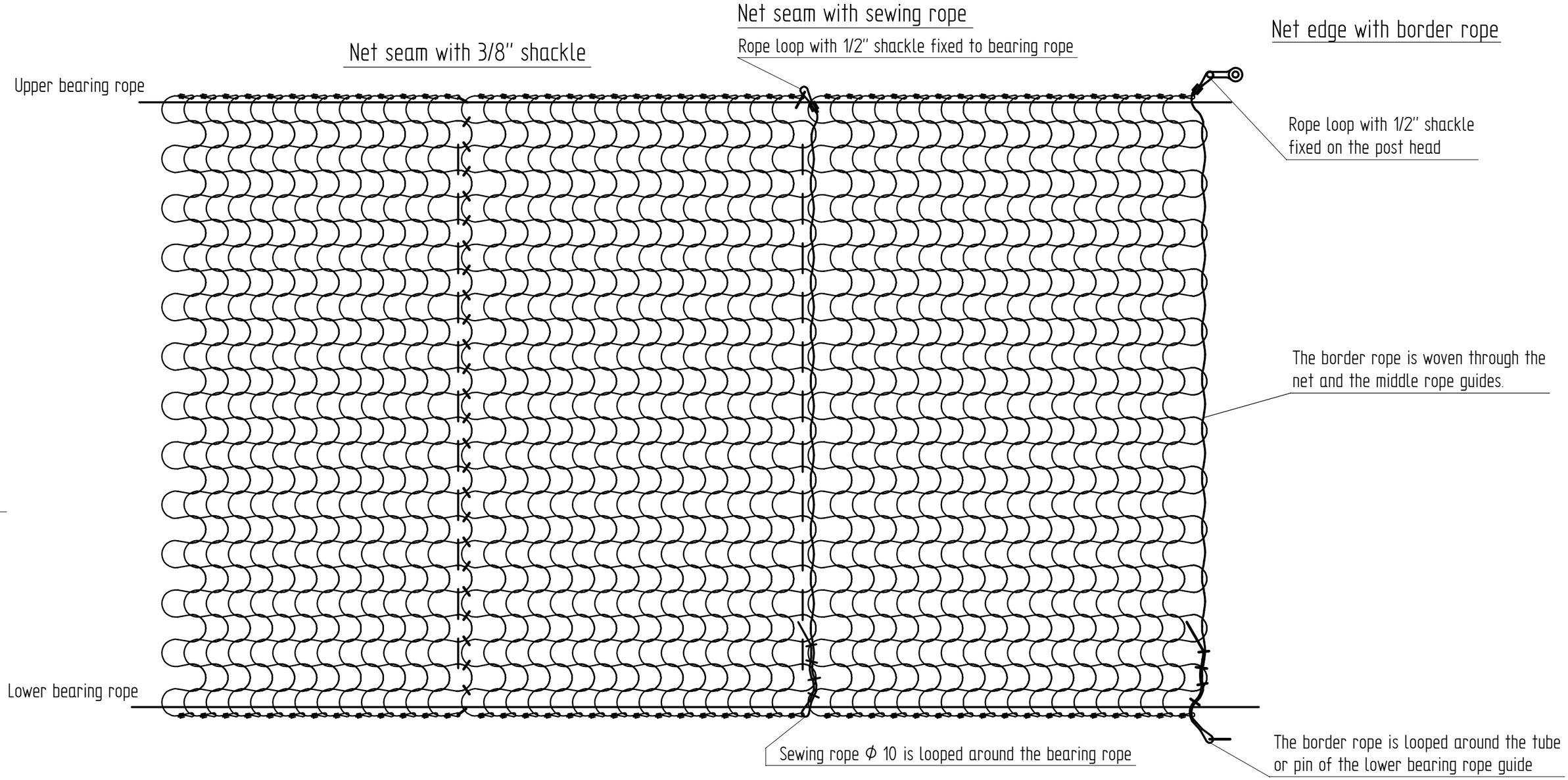
Depending on the type of connection selected for adjacent panels, one of the following methods will apply:

Connection using Sewing Rope

Feed a one-sided pressed sewing rope from the top down through both nets. At the top, hang the pressed loop into the upper bearing rope using a 1/2” shackle. At the bottom, the rope must be strapped to the lower bearing rope following the exact same path backwards and then must be clamped down with wire rope clips. It should be loosely mounted with approximately 10 cm leeway.

Connection using Shackles

Connect both nets using the appropriate shackle as per attached figure. Two shackles should be used for each rope arc.



Note
The correct number of wire rope clips is detailed in the provided table and is defined by the diameter of the rope connection points.

Für diese Zeichnung behalten wir uns alle Rechte nach DIN 34 vor

Zust.	Änd.-Nr.	Datum	Name	Allgemeintoleranzen:		
					Datum	Name
				Gez.	01.02.12	JS
				Gepr.	01.02.12	GS
				Ges.		
Gewicht:				Werkstoff: Rohteil: Halbzeug:		
Norm:				Ers. f.:		Ers. d.:

Maßstab: 1 : 20

Benennung: Installation Omega-Net 7.5mm

TRUMER Schutzbauten GmbH

Projekt Nr:

Zchng. Nr.: 903-53-185-VE

Format D

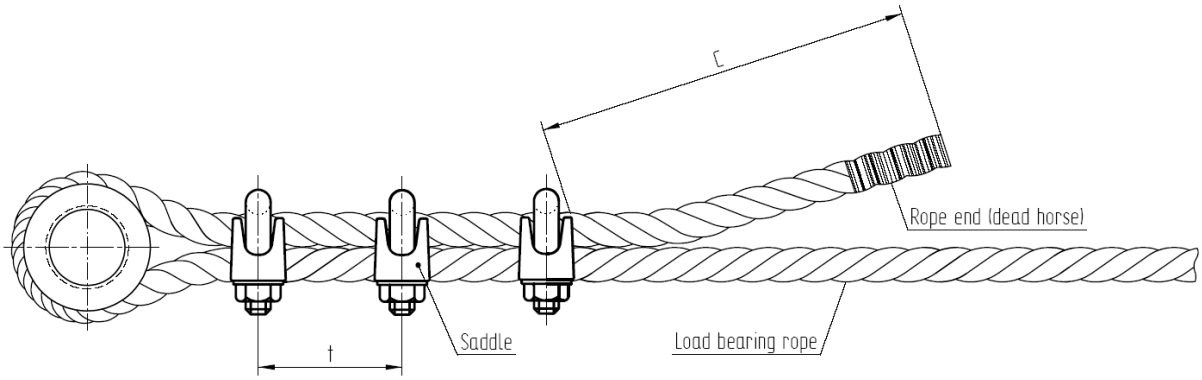
Blatt von Bl.

Installation of Wire Rope Clips

All wire rope clips must be visually inspected for defects prior to their use. Any defective clips should be discarded.

The given tightening moments are only valid if the threads and the surface making contact with the nut are greased!

The U-bolts must always be put on over the end of the rope that is not subject to stress (“Never saddle a dead horse “).



Rope Ø mm	Clip Size	Number of Clips	t[1] mm	C mm	Spanner Opening mm	Tightening Moment[2] Nm
3	NG 5	3	20 - 40	40	8	2
4	NG 5	3	20 - 40	40	8	2
6	NG 6,5	3	24 - 48	55	10	3,5
8	NG 8	4	30 – 60	70	13	6
10	NG 10	4	30 - 60	85	13	9
11	NG 12	4	36 - 72	100	16	20
12	NG 12	4	36 - 72	100	16	20
14	NG 16	4	48 - 96	150	21	49
16	NG 16	4	48 - 96	150	21	49
18	NG 19	4	48 - 96	150	21	68
20	NG 22	5	51 - 102	180	24	107
22	NG 22	5	51 - 102	200	24	107
24	NG 26	5	57 - 114	230	30	147

[1] t = Distance between wire rope clips = approx. 1 clip length
[2] Tightening moment is only valid for wire rope clips whose threads and surface making contact with the nut have been greased.

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DBA 300 white
DBA 400 blue
DBA 500 yellow
DBA 600 green
DBA 700 black
DBA 800 orange

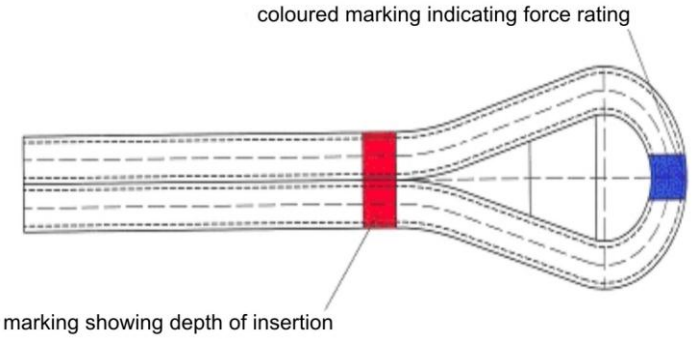

Table of forces

Type	Number of wires Ø 6mm	Cross Section As [mm²]	Mass G [kg/m]	Yield Load Fsk [kN]	Bearing Capacity [1] Rd = Fsk/1.35 [kN]	Break Load Fpk [kN]	Working Load [2] Fpk/2 [kN]
DBA 300	6	170	1,35	258	191	300	150
DBA 400	8	226	1,80	344	254	400	200
DBA 500	10	283	2,20	430	319	500	250
DBA 600	12	340	2,75	517	383	600	300
DBA 700	14	396	3,10	602	446	700	350
DBA 800	16	453	3,55	689	510	800	400

1) Measurement of the bearing capacity for an un-tensioned anchor as according to SIA 267 2003 Geotechnik
2) Working load = half of the braking load as per the “Richtlinien für den Lawinenverbau BUWAL/WSL (1990)“

Mass table

Mass [kg]	Length						
	2 m	**3 m**	**4 m**	**5 m**	**6 m**	**7 m**	**8 m**
DBA 300	8.0	9.5	11.0	12.5	14.0	15.5	17.0
DBA 400	9.0	11.0	13.0	15.0	17.0	19.0	21.0
DBA 500	10.0	12.5	15.0	17.5	20.0	22.5	25.0
DBA 600	11.0	14.0	17.0	20.0	23.0	26.0	29.0
DBA 700	12.0	15.5	19.0	22.5	26.0	29.5	33.0
DBA 800	13.0	17.0	21.0	25.0	29.0	33.0	37.0

Maintenance and Repairs

After the installation of a rockfall protection system, periodic inspection is required to ensure that it is in proper working order. A full visual inspection should be carried on a yearly basis, most appropriately shortly after the freeze-thaw season, at the very minimum. In addition, inspections are recommended following large natural events such as storms, debris flows and avalanches. The following points should be noted during the inspection:

- Net and Mesh:
  - Sag
  - Frayed cables
  - Broken cables
  - Debris build-up in nets requiring clearing
  - Damage to net seams
  - Corrosion

- Bearing, Middle, Retaining and Side Stabilisation Ropes:
  - Rope damage (frayed cables, completely broken, corrosion)
  - Wire rope clips (missing, displaced, cracked, completely broken, corrosion)
  - Shackle (missing, deformed, completely broken, corrosion)
  - Thimble (missing, deformed, completely broken, corrosion)

- Posts and Base Plates:
  - Deformation
  - Damage to rope guides
  - Corrosion

- Brake elements:
  - Stretched
  - Cracked
  - Broken
  - Corrosion

- Anchoring of the Base Plates and Ropes
  - Deformation
  - Failed (completely broken, pulled free)
  - Cracked
  - Corrosion
  - Verformung

Cleaning of the system should be carried out when material such as rock, boulders, windthrow, etc. are in the nets. Damaged components should be replaced with original parts from the manufacturer, Trumer Schutzbauten GmbH.

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Inspection Protocol:

Place/Row:
System:

Date:

Inspected by:

Net and Mesh:

Bearing, Middle, Retaining and Side Stabilisation Ropes:

Posts and Base Plates:

Brake Elements:

Anchors: