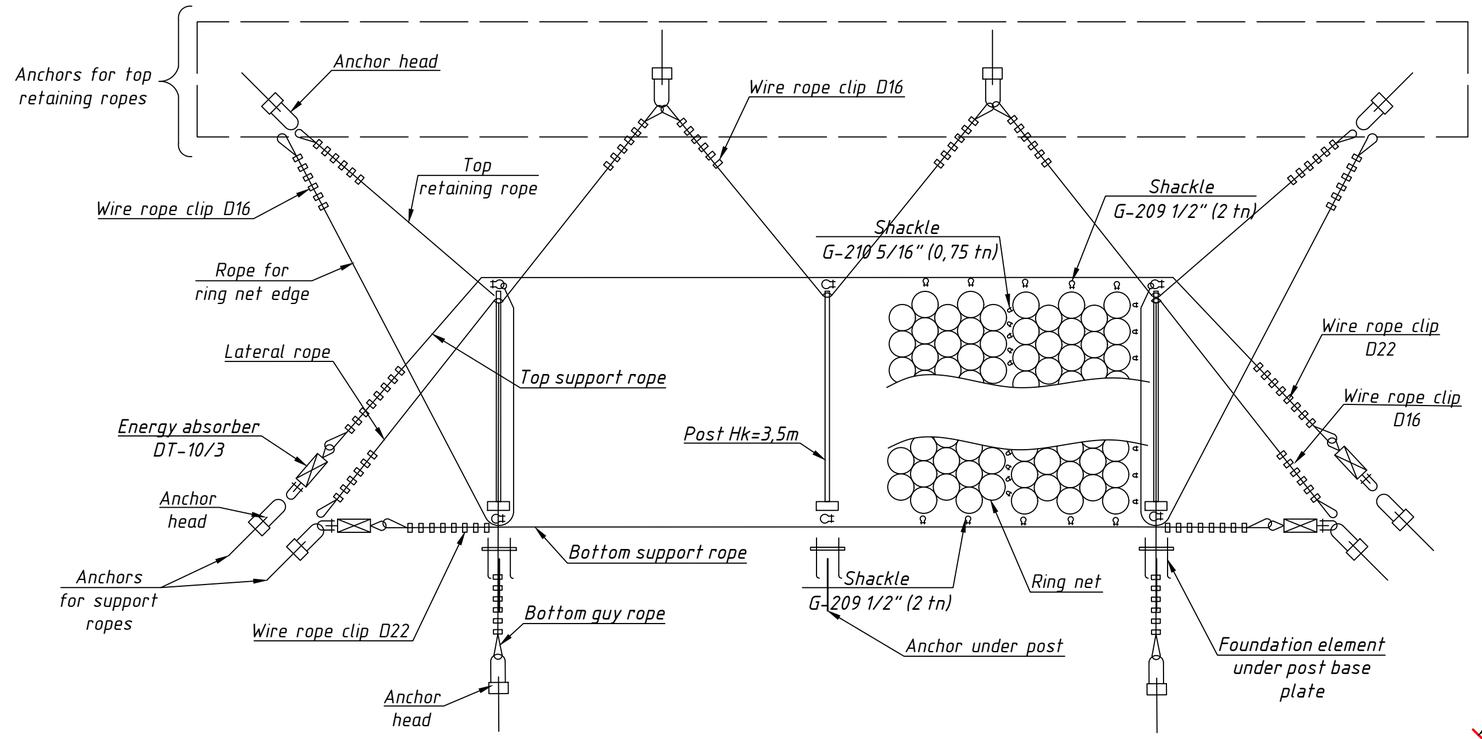
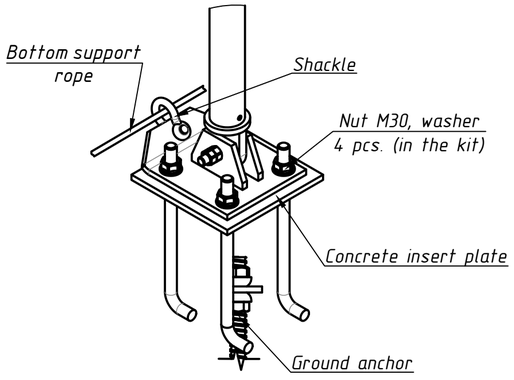


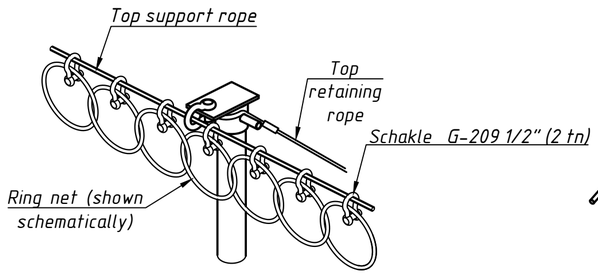
nstallation steps:

1. *Install ground anchors, install foundations for posts together foundation elements, install anchor heads.*
2. *Secure posts on foundation screws with M30 nuts and washers.*
3. *Secure energy absorbers to the anchor heads with shackle.*
4. *Install posts in working position with top and bottom guy ropes, lateral ropes.*
5. *Using the wire rope clips, adjust the length of the guy ropes according to the post design position.*
6. *Stretch the top and bottom support ropes.*
7. *Position the mounting shackles on the top and bottom support ropes in accordance with the number of rings in panel per section.*
8. *Attach the support ropes to the energy absorbers with shackles, pass through the shackles on posts*
9. *Fasten the ring net panels to support ropes with shackles. Connect panels to each other with shackles.*
10. *Fasten the loop of the rope for ring net edge to the post top, then run the rope along the post, then wind it through the bottom shackle and attach to the outermost anchor head in the upper row of anchors.*

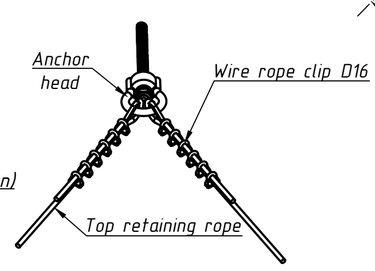
Mounting the post to foundation elements

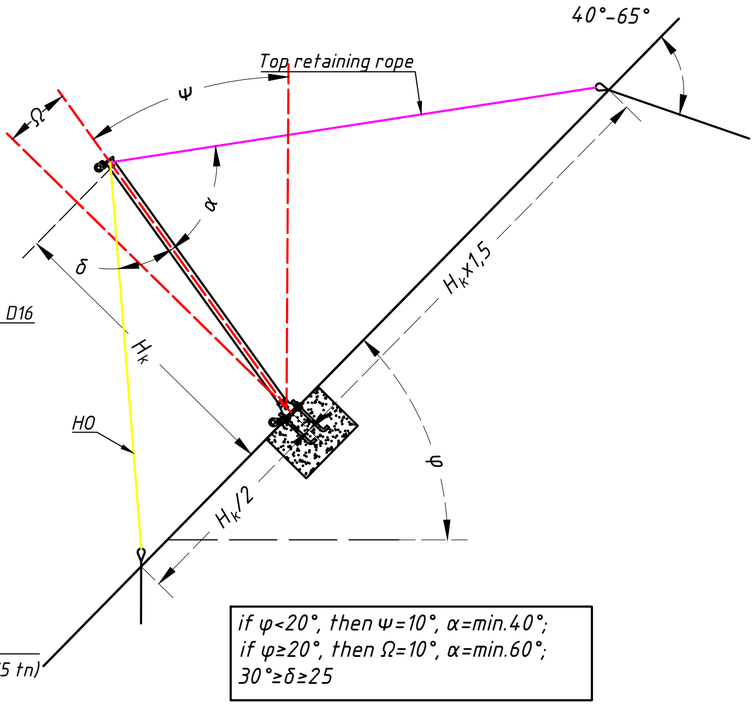


Mounting of top retaining ropes to the post; mounting of ring net panels to top support rope



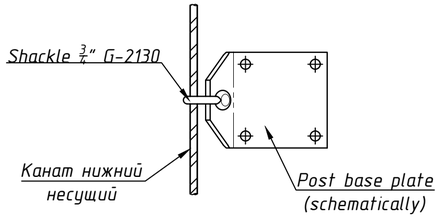
Mounting of top retaining ropes to anchor head



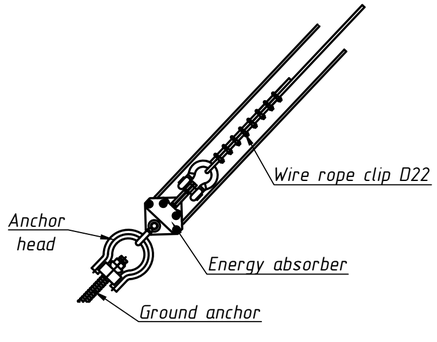


if φ<20°, then Ψ=10°, α=min.40°;
if φ≥20°, then Ω=10°, α=min.60°;
30°≥δ≥25

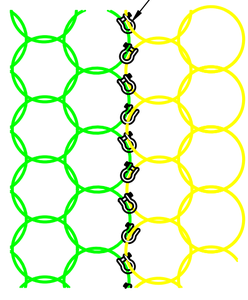
Mounting of bottom support rope to post base plate



Mounting of top and bottom support ropes to energy absorbers



Ring net panel connection



Изм.	Кол. уч.	Лист	N° док.	Sign	Date	Rockfall protection barrier GB-1000A, H_k=3,5 m			
						Layout of barrier structural elements	Stage	Sheet	Sheets
								1	
						LLC "Geo-Barrier"			

Format A2

Seq No.	Item	Standard	Weight [kg]	Comments
1	Post Hк=3,5m	ГБ-1200.35.000	92,34	in kit: shackle 4,75 tn G-2130 – 2 pcs., foundation elements: concrete insert plate, 4 pcs. – foundation bolt M30-500 with nuts and washers
2	Ring net	2,5.25.7/6, ТУ 1275-001-75212412-04	93,6	panel size 16 x 26 rings (or 3,78x5,25 m)
3	Bottom support rope	Ø20-Г-1-ОЖ-180, GOST 3064-80	1,96	1 rope per rope belt
4	Top support rope			
5	Top retaining rope	16-Г-1-Ж GOST 7669-80	17,18	L=13 м; loop – free end; loop diameter not less than 300 mm; sling with termination of the ends of the rope by crimping with an aluminum sleeve; 2 retaining ropes per post, 3 retaining ropes per post if barrier line turns in downslope direction >25°
6	Bottom guy rope	16-Г-1-Ж GOST 7669-80	16,03	L= 12 м; loop diameter not less than 300 mm; sling with termination of the ends of the rope by crimping with an aluminum sleeve; 1 pcs. per post
7	Lateral rope	16-Г-1-Ж GOST 7669-80	16,03	L= 12 м; loop diameter not less than 300 mm; sling with termination of the ends of the rope by crimping with an aluminum sleeve; 1 pcs. per border post, 2 pcs. per post when barrier line turns in upslope direction >15°
8	Rope for ring net edge	16-Г-1-Ж GOST 7669-80	22,9	L=18 м; loop diameter not less than 300 mm; sling with termination of the ends of the rope by crimping with an aluminum sleeve; 1 pcs. per each edge of ring net in the beginning and end of barrier line
9	Wire rope clip	D22, DIN 1142	0,68	8 pcs. per rope end tie
10	Wire rope clip	D16, DIN 1142	0,43	6 pcs. per rope end tie
11	Shackle	G-209 1/2" (2 tn)	0,4	1 pcs. per each ring
12	Shackle	G-210 5/16" (0,75 tn)	0,11	2 pcs. per each ring in ring net juncture
13	Energy absorber DT-10/3	DT-10/3, СТО 022-75212412-2017	29,3	in kit: shackle G210 1"-1 pcs., G2150 1"-1 pcs.
14	Anchor head	АН-III-40, ТУ 1270-008-75212412-16	6,6	for ground anchors with outer diameter Ø40 mm
15	Ring net panel	СС-2,5.25.7/6, ТУ 1275-001-75212412-04	180,0	Additional ring net panel under bottom support rope; panel size 16x50 rings (3,78x10,05 m)
16	Ring net panel	СС-2,5.25.7/6, ТУ 1275-001-75212412-04	25,2	Additional panel for turnings of barrier line; panel size 16x7 rings (3,78x1,45 m)

* The length of the guys may vary depending on the slope, to be specified when design.

Изм.	Кол. уч.	List	№ doc.	Sign.	Date

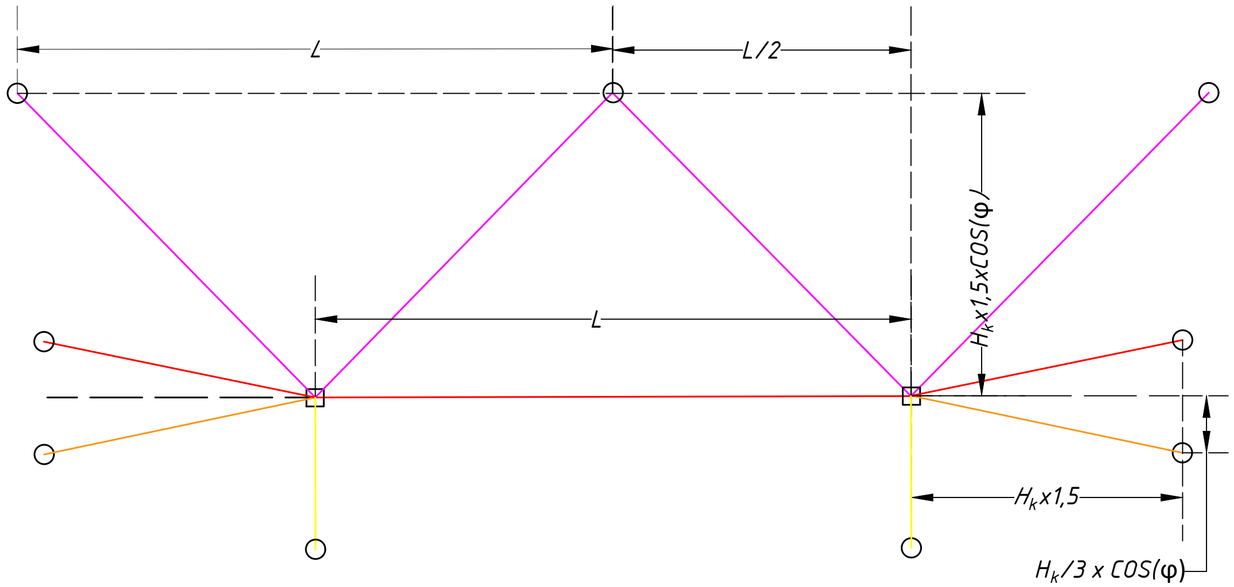
Rockfall protection barrier GB-1000A, H_k=3,5 m

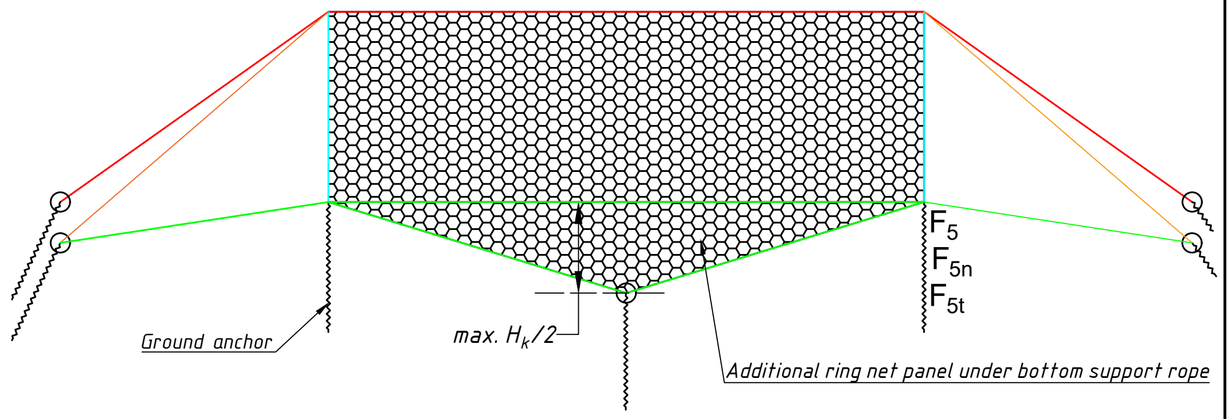
Specification

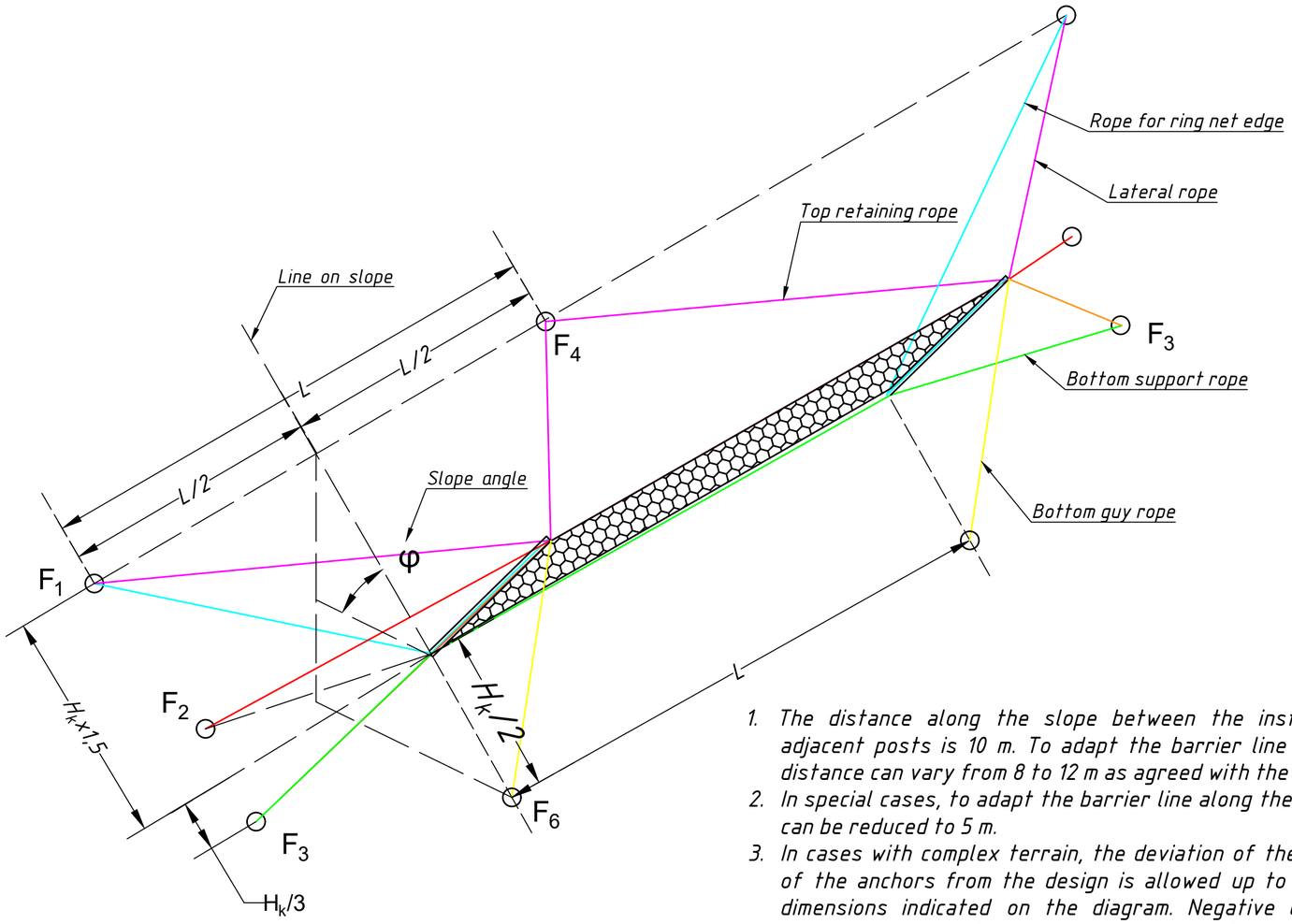
Stage	Sheet	Sheets
	2	

LLC "Geo-Barrier"

Format A4







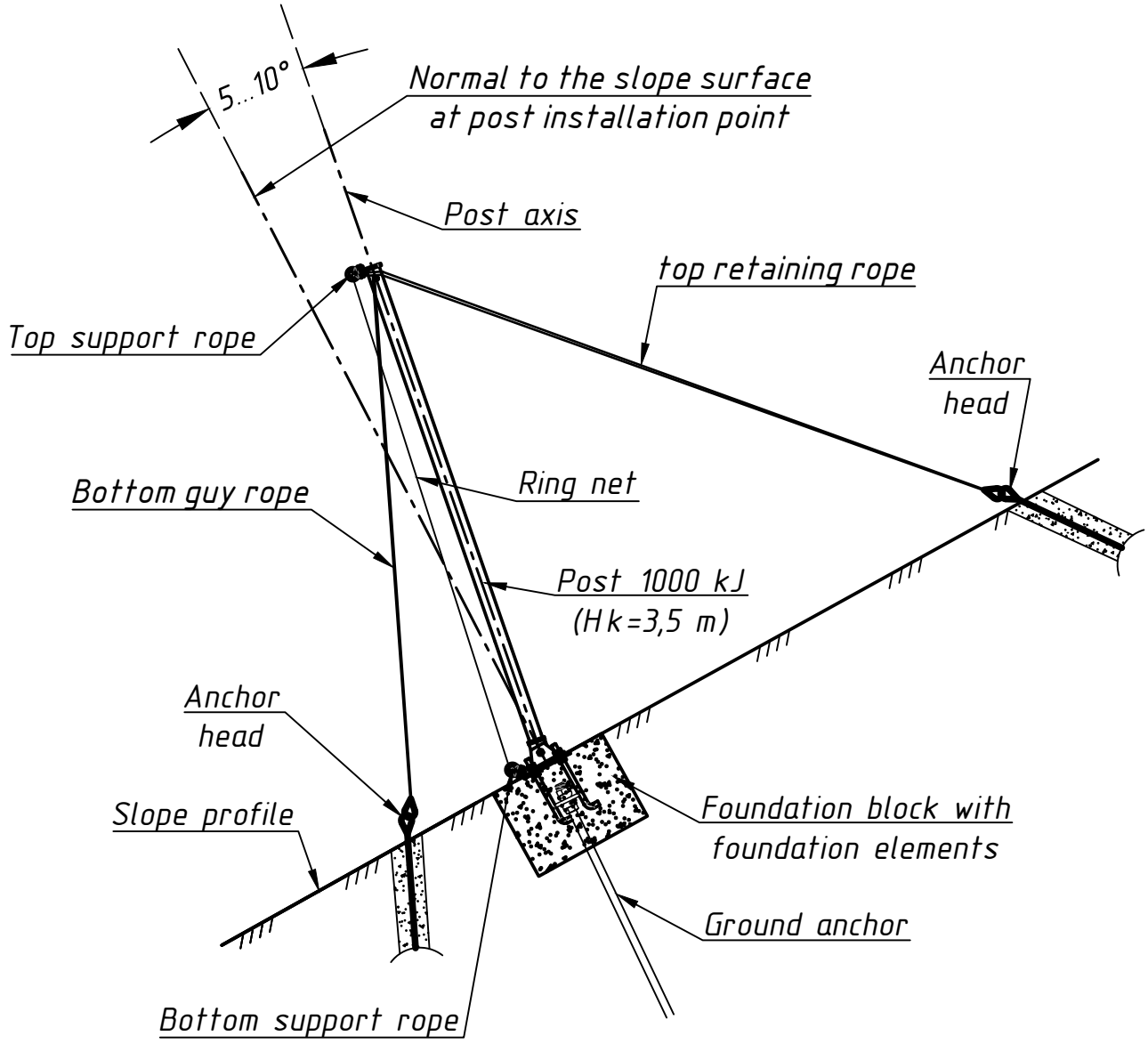
1. The distance along the slope between the installation points of adjacent posts is 10 m. To adapt the barrier line to the terrain, the distance can vary from 8 to 12 m as agreed with the manufacturer.
2. In special cases, to adapt the barrier line along the relief, the distance can be reduced to 5 m.
3. In cases with complex terrain, the deviation of the installation points of the anchors from the design is allowed up to +1 m in plan to the dimensions indicated on the diagram. Negative deviations are not allowed. In case of deviations, you must first make sure that the lengths of the wire ropes are sufficient.

Max. lenght of ropes, H_k=3.5 m		
rope	max. lenght [m]	comments
Bottom support rope	8.0	from post base plate to attached location
Top support rope	9.5	from post head to attached location
Lateral rope	9.5	from post head to attached location
Rope for ring net edge	9.5	from post base plate to attached location
Top retaining rope	10.5	from post head to attached location
Bottom guy rope	9.0	from post head to attached location

Anchor forces , H_k=3.5 m		
Anchor	[kN]	force type
F_1	80	pulling in rope direction
F_2	115	pulling in rope direction
F_3	155	pulling in rope direction
F_4	85	pulling in rope direction
F_5	140	full force to the foundation
F_{5n}	100	a compressive force to the foundation
F_{5t}	95	shear force under post tangential to surface
F_6	65	pulling in rope direction

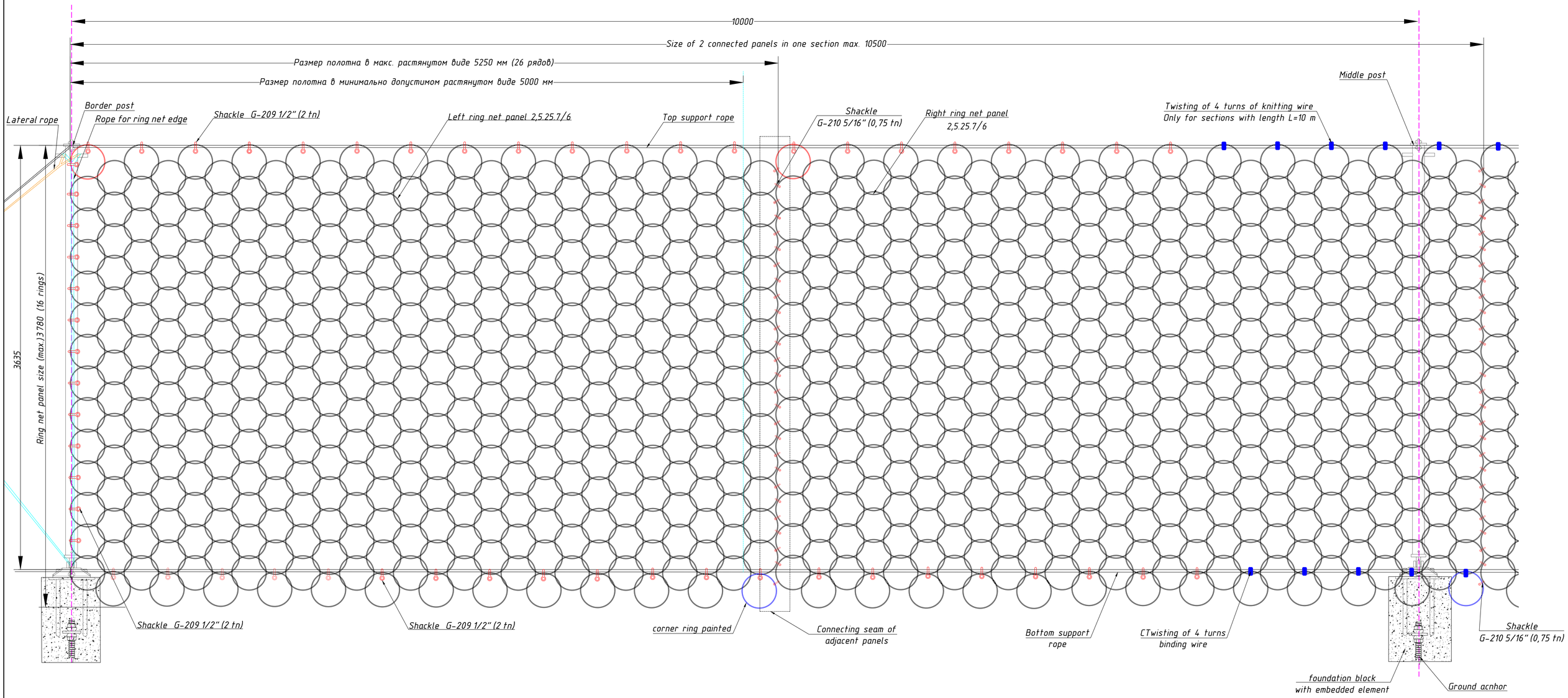
Изм.	Кол. уч.	Лист	№ док.	Подп.	Дата	Rockfall protection barrier GB-1000A, H_k=3,5 m			
						Installation dimensions. Forces on anchors	Стадия	Лист	Листов
								3	
							LLC "Geo-Barrier"		

Format A2



Изм.	Кол. уч.	Лист	№ док.	Подп.	Дата	Rockfall protection barrier GB-1000A, H_k=3,5 m		
							Стадия	Лист	Листов
								4	
						LLC "Geo-Barrier"			

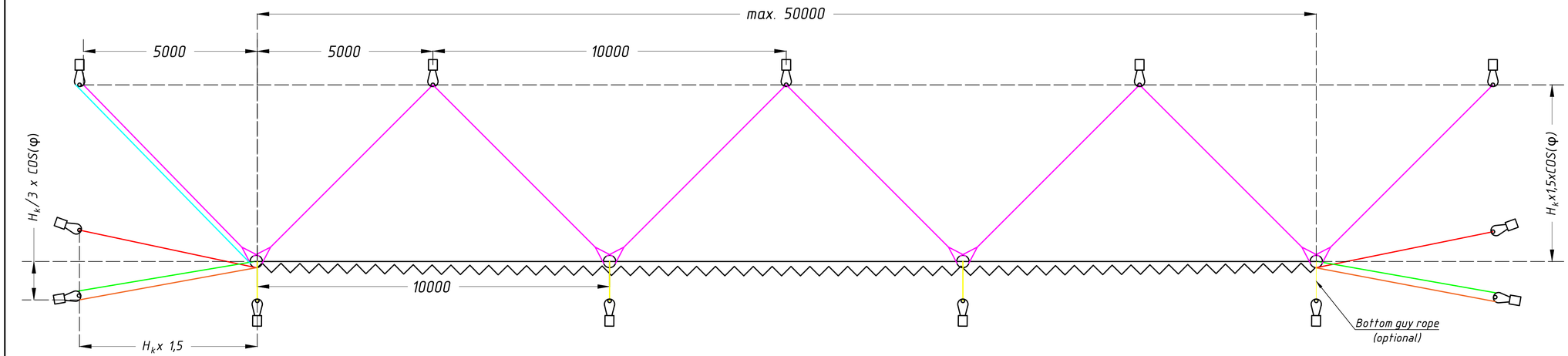
Format A4



1. Ring net panels manufactured with a margin to the standard size L = 10 m of the barrier section. In maximum stretched state margin of length of ring net panels in section is 500 mm,of height - one ring. The reserve of nets is needed for adaptation of the barrier line to uneven terrain, for change in direction and height differences of the line of the barrier, for deviation of the posts axis from each other.
2. It is not necessary to specifically stretch ring nets to their maximum possible size, it is enough that under normal conditions the two connected panels are no shorter than the standard section.
3. Ring net panels in folded bundles are connected to the tops of the posts. The orientation of the panels relative to the barrier section must be verified by multi-colored rings located in the corners of each panel. The red ring should be located in the upper left corner, blue - in the lower right. The upper rings in the folded bundle attached to the post connected by shackles to the already stretched top support rope.
4. The upper rings in the folded suspended ring net bundle are fastened with shackles to the already stretched top support rope.
5. The left panel moves apart like a curtain from the left to the right (to center of section) along the top support rope, the right panel - from right to the left (center of section).
6. The left panel at the edge of the barrier line connected with omega shackles to the rope for ring net edge, after left and right ring net panels stretched to each other and connected by connecting shackles.
7. To connect ring net panels with 6 contacts structure between each other - 2 pcs shackles per each ring in a seam needed.
8. Corner ring of ring net panels forbidden to connect with shackles to shackles for support ropes at top and bottom of border and middle posts.
8. The lower rings of the panel connected with omega-shaped shackles to the bottom support rope. If the ring net panel was stretched under the influence of gravity and the lower row of rings turned out to be superfluous (below the bottom support rope), then rings in the next row connected to the bottom rope. It is not necessary to specifically stretch the panels to this state.
9. Connection of panels to to the top and bottom support ropes near middle post is carried out with help of strandings from 3-4 turns of a binding wire (around 300 N/mm2) (with hands) according to the scheme. It is forbidden to fasten these rings with shackles. When rock hits the section, the soft wire strands should breaks and ring net have a space reserve for sliding and extension along the support ropes inside the section. If barrier line change direction at post position, then with binding wires should be connected only one ring to the left and one to the right from the post. For shortened sections of the barrier with a length L = 5-8 m - all rings must be connected only with shackles, it is forbidden to use the binding wires for short sections.
10. The rope for ring net edge at the bottom of the post is passed through the same shackle as the bottom support rope. The loop of the rope slips over the top of the post.

Изм.	Кол. уч.	Лист	№ док.	Подп.	Дата	Rockfall protection barrier GB-1000A, H_k=3,5 m			
						Mounting of ring net panels	Стадия	Лист	Листов
								5	
						LLC "Geo-Barrier"			

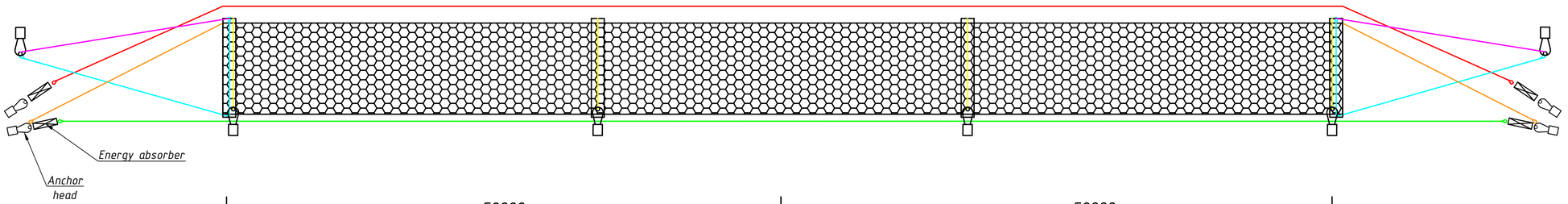
Format A0

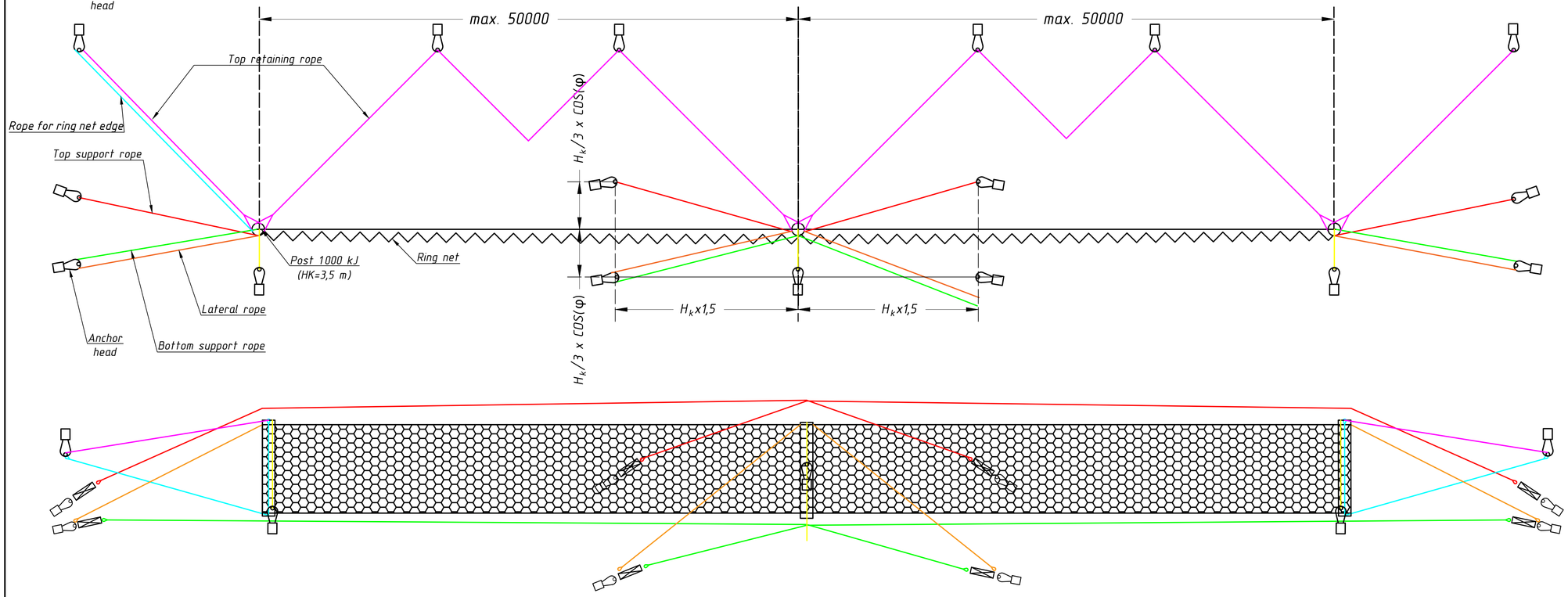


The distance along the slope between the installation points of adjacent posts is L = 10 m. To adapt the barrier line along the relief, a deviation of 9–11 m is permissible.

In special cases with sharply dissected terrain permitted L = 5 m.

For inside (upslope) rotations of the barrier line, bottom guy ropes must be installed to the rotation posts (and 2 posts closest to them). At the design stage, the bottom guy ropes are considered for all posts in barrier line. The ability not to install a bottom guy rope can be determined only at the stage of direct marking of drilling points for anchors in the field.





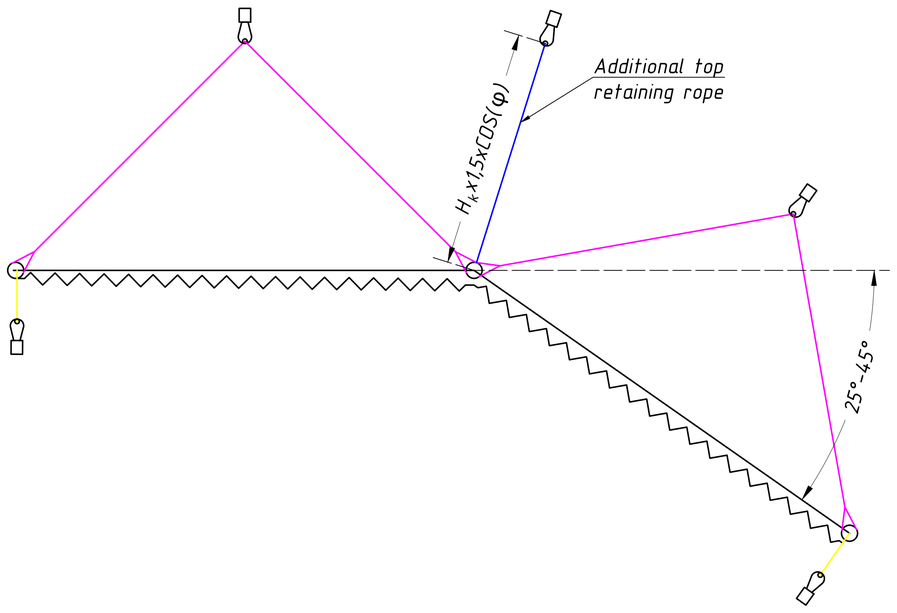
The maximum length of the barrier line without breaking the top and bottom support ropes is 50 m.

When the barrier line lengths is more than > 50 m, the top and bottom support ropes are cutted and connects to ground anchors. The ring net panel remains unified.

Изм.	Кол. уч.	Лист	№ док.	Подп.	Дата	Rockfall protection barrier GB-1000A, H_k=3,5 m			
						Scheme of placement of ground anchors, guy wires and support ropes	Стадия	Лист	Листов
								6	
							LLC "Geo-Barrier"		

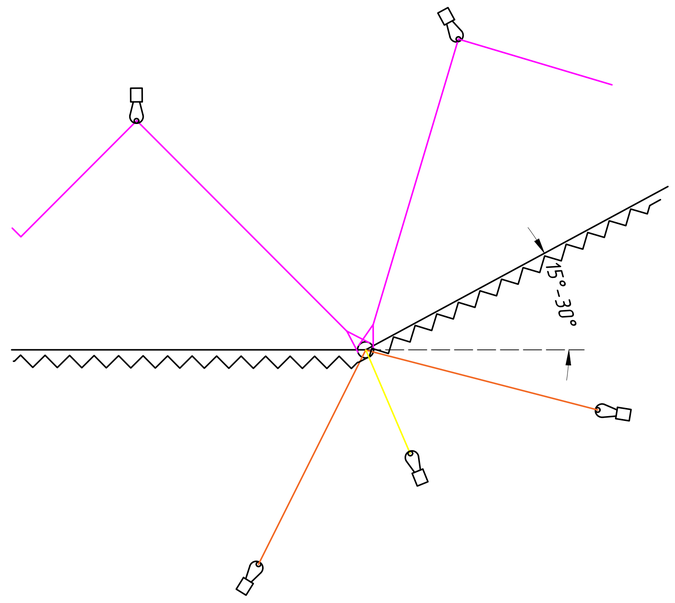
Format A1

Turn of the barrier line outward (downslope) at an angle 25°–45°



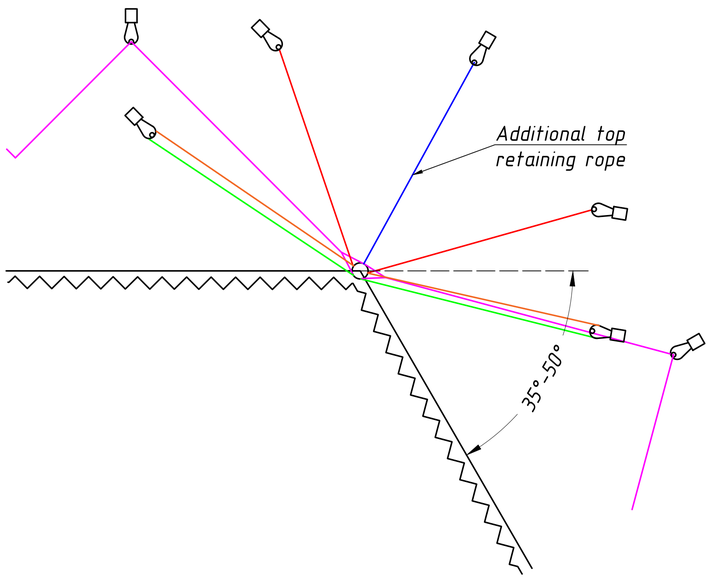
The inner side of the barrier is the side looking up the slope, the outer side – down the slope.
When the barrier line is turned outward by an angle of 25 ° <α <35 °, an additional top retain rope (blue) is installed on the rotary post. At smaller angles, an additional rope is not required. An anchor for an additional top retain rope is installed in the center of the angle formed by adjacent top retain ropes.

Turn of the barrier line inward (upslope) at an angle 15° – 30°



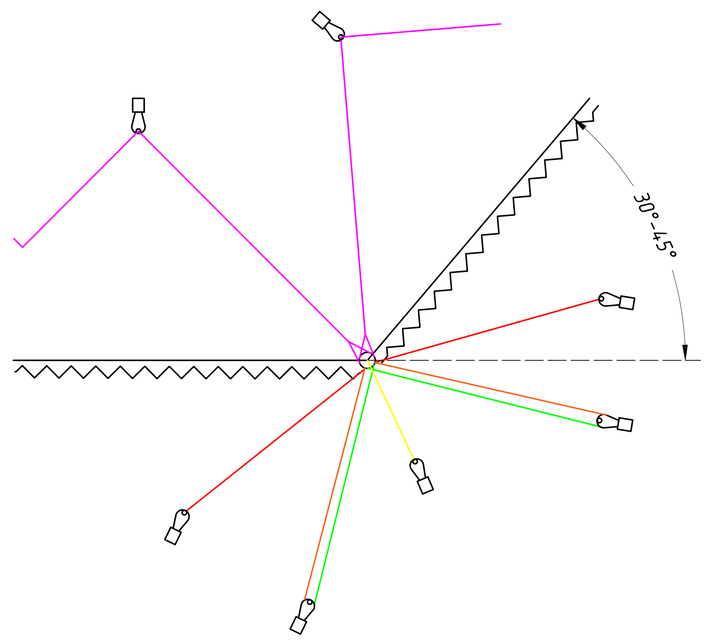
When the barrier line is turned inward by an angle of 15 ° <α <30 °, 2 additional lateral ropes (orange) are installed on the rotary post.

Turn of the barrier line outward (downslope) at an angle >45°



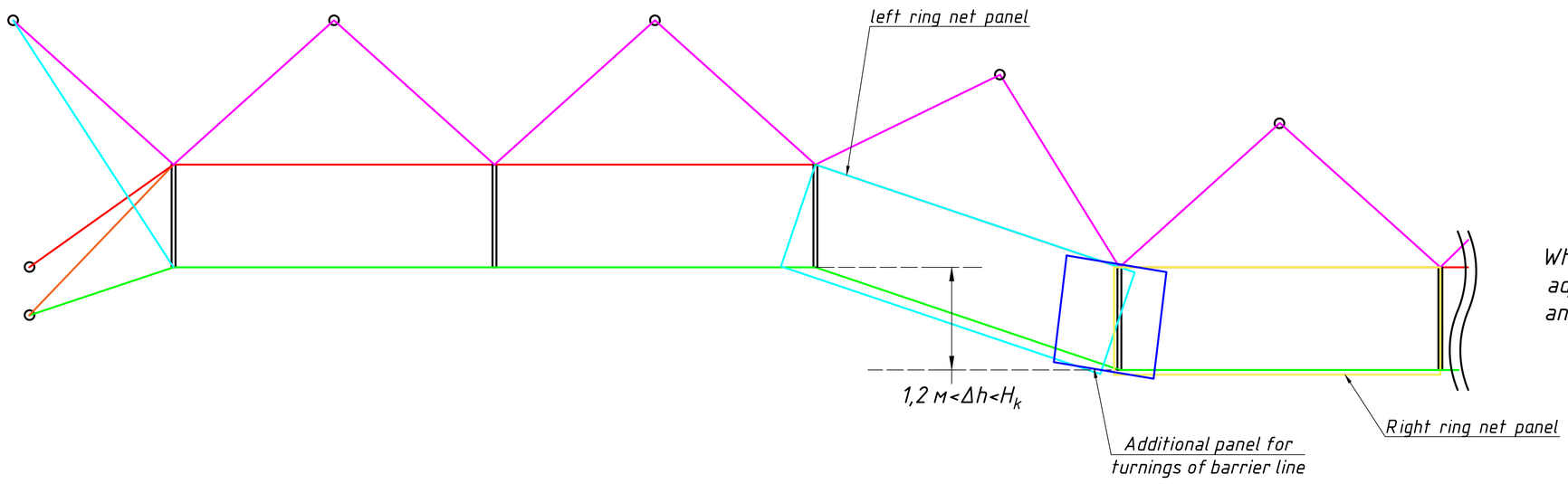
When the barrier line is turned outward by an angle of 35 ° –50 °, an additional top retain rope (blue) is installed on the rotary post, the top (red) and bottom (green) support ropes are cutted, and lateral ropes (orange) installed. The swivel post becomes edge simultaneously for two lines to the right and left of it. The ring net remains unified. When turn > 50 °, the barrier line breaks completely with ring net and in this case, one line is installed above (height) the other.

Turn of the barrier line inward (upslope) at an angle 30°– 45°



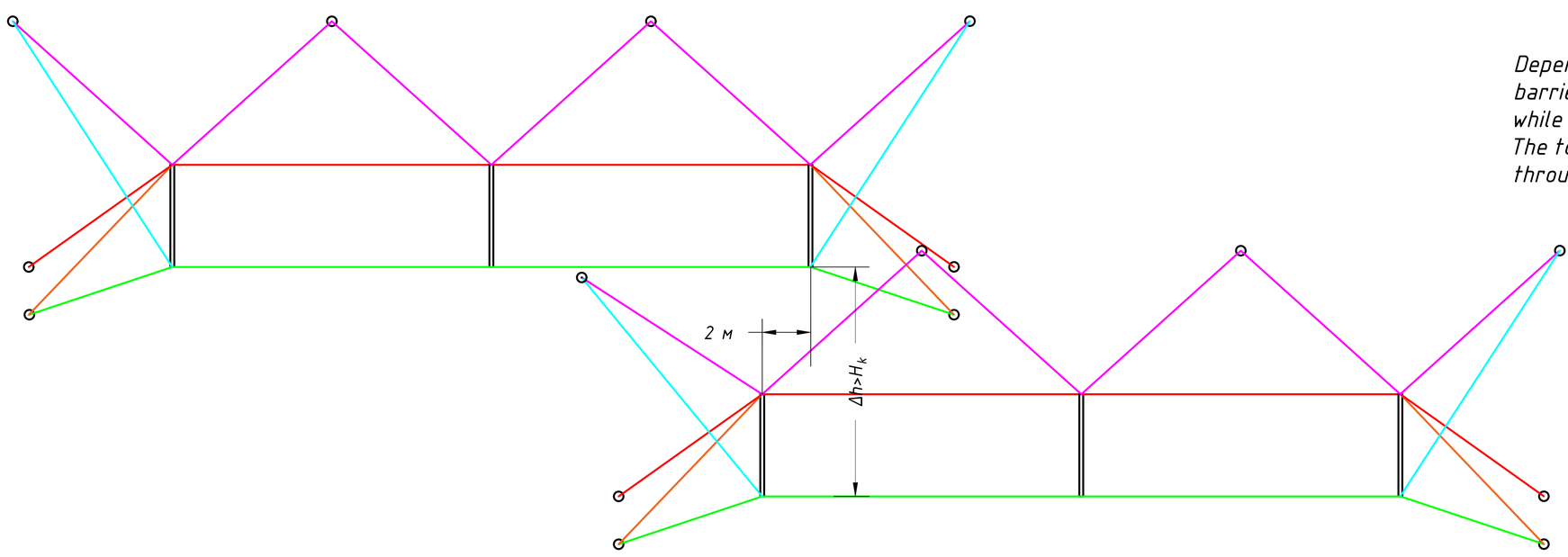
When the barrier line is turned inward at an angle of 30 ° to 45 °, the support ropes are cutted and attached to the anchors. When turn more than 45 °, the barrier line is completely cutted with ring nets and in this case, one line installed above (height) the other.

Height difference within one section 1,2 m<Δh<H_k



When the relief is bent and the installation points of adjacent post are offset by an amount of 1,2m<Δh<H_k an additional ring net panel is required.

Height difference within one section Δh>H_k

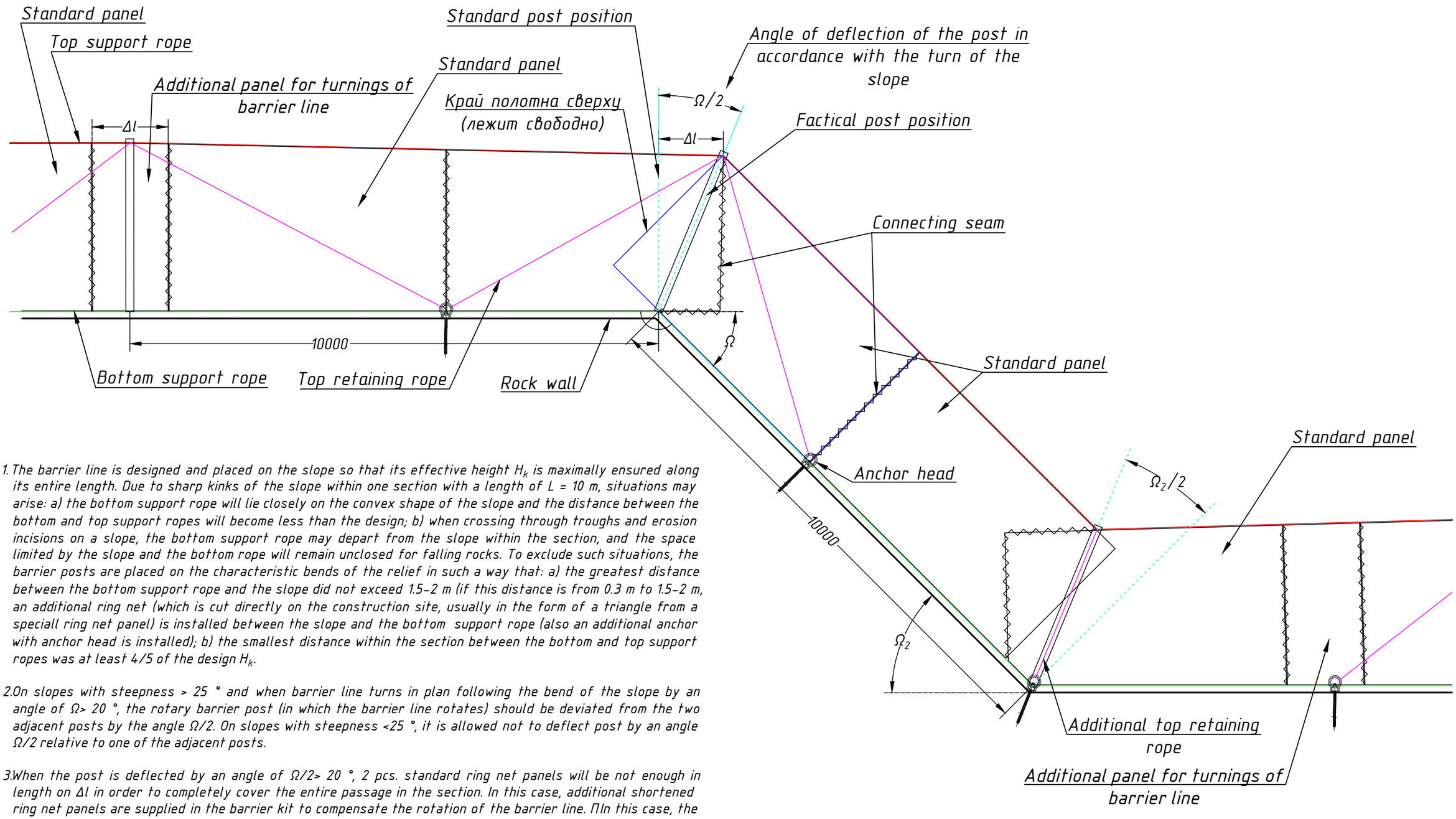


Depending on the conditions of the relief, the line of the barrier can break off at one height and begin at another, while the overlap between the lines should be at least 2 m. The top retain ropes of the lower line should not pass through the ring net panels of the upper line.

Изм.	Кол. уч.	Лист	№ док.	Подп.	Дата	Rockfall protection barrier GB-1000A, H_k=3,5 m			
						Changing the barrier line in direction and height	Стадия	Лист	Листов
								7	
							LLC "Geo-Barrier"		

Format A0

Top view of the rockfall barrier line on a sheer wall



1. The barrier line is designed and placed on the slope so that its effective height H_k is maximally ensured along its entire length. Due to sharp kinks of the slope within one section with a length of L = 10 m, situations may arise: a) the bottom support rope will lie closely on the convex shape of the slope and the distance between the bottom and top support ropes will become less than the design; b) when crossing through troughs and erosion incisions on a slope, the bottom support rope may depart from the slope within the section, and the space limited by the slope and the bottom rope will remain unclosed for falling rocks. To exclude such situations, the barrier posts are placed on the characteristic bends of the relief in such a way that: a) the greatest distance between the bottom support rope and the slope did not exceed 1.5–2 m (if this distance is from 0.3 m to 1.5–2 m, an additional ring net (which is cut directly on the construction site, usually in the form of a triangle from a speciall ring net panel) is installed between the slope and the bottom support rope (also an additional anchor with anchor head is installed); b) the smallest distance within the section between the bottom and top support ropes was at least 4/5 of the design H_k.

2. On slopes with steepness > 25 ° and when barrier line turns in plan following the bend of the slope by an angle of Ω> 20 °, the rotary barrier post (in which the barrier line rotates) should be deviated from the two adjacent posts by the angle Ω/2. On slopes with steepness <25 °, it is allowed not to deflect post by an angle Ω/2 relative to one of the adjacent posts.

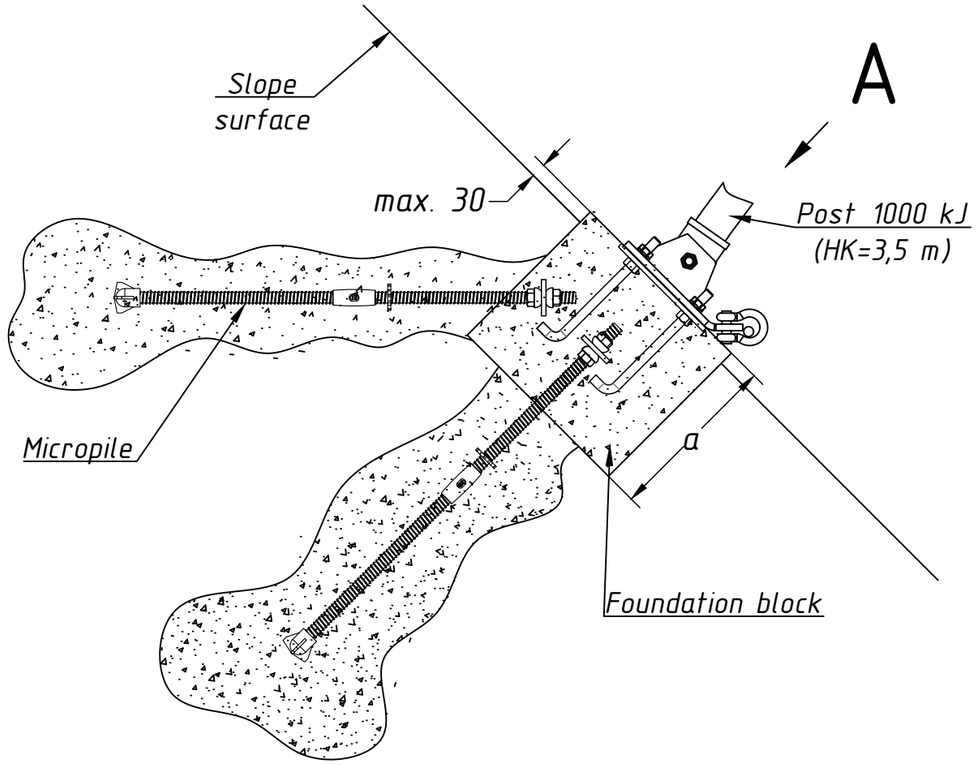
3. When the post is deflected by an angle of Ω/2> 20 °, 2 pcs. standard ring net panels will be not enough in length on Δl in order to completely cover the entire passage in the section. In this case, additional shortened ring net panels are supplied in the barrier kit to compensate the rotation of the barrier line. ПIn this case, the standard ring net panels are stretched from the top of the swivel post to adjacent posts, where then the missing length is compensated by additional short ring net panel. In most cases, when barrier line is turning, the stock of the length of standard ring net panels is enough to stretch them in the section without using an additional shortened panel.

4. In the area of the swivel post, the ring net panels connects with shackles with an overlap. Necessary to satisfy the condition: 2 shackles on each ring in the seam. The seam should be made along the edge of the lower ring net panel.

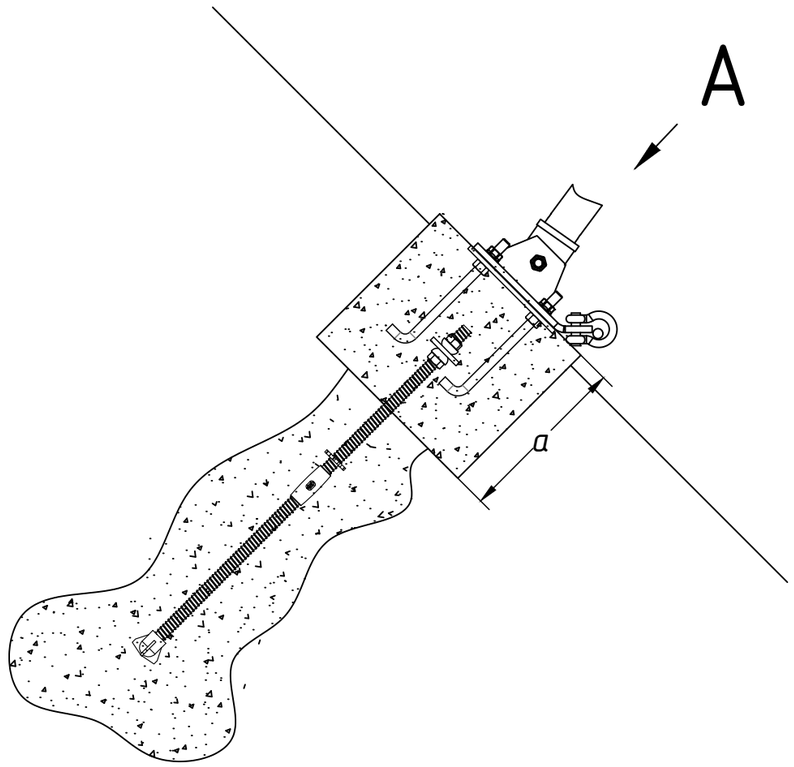
Изм.	Кол. уч.	Лист	№ док.	Подп.	Дата	Rockfall protection barrier GB-1000A, H_k=3,5 m			
						Deviation of the angle of the posts at the corners of the wall. Panels stitching	Стадия	Лист	Листов
								8	
							LLC "Geo-Barrier"		

Format A3

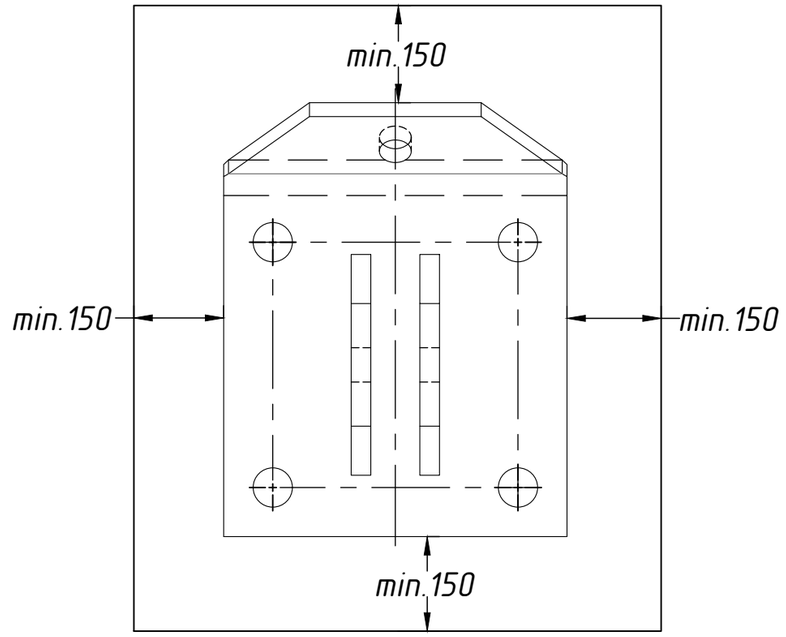
Type 1: installation of post in dispersed ground



Type 2: installation of posts on rocky ground

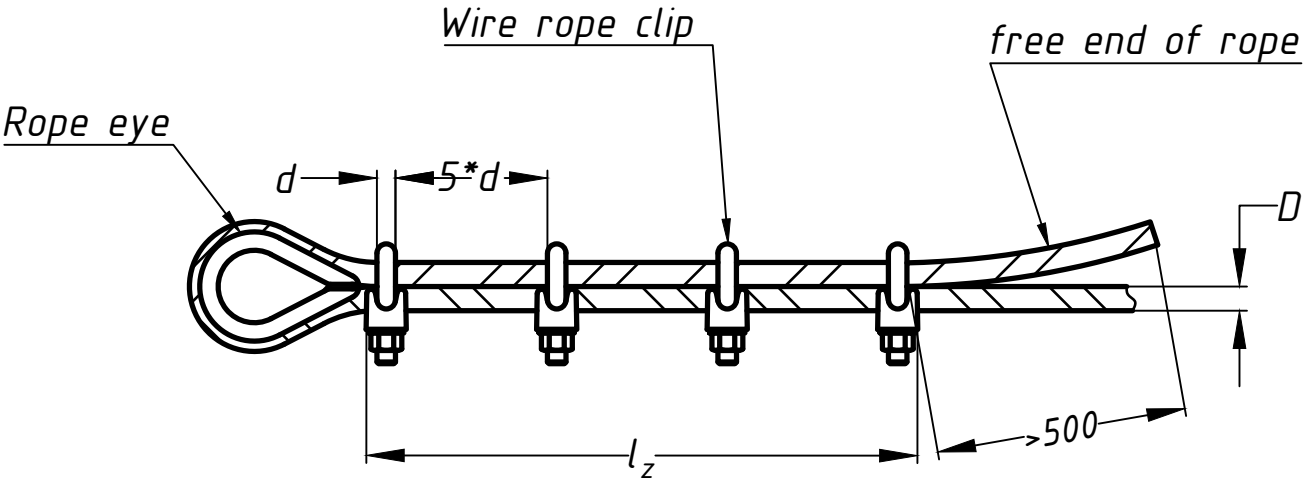


A
Post base plate
(top view)



1. The type of foundation under the barrier post is selected based on the type of the soil, its physical and mechanical properties, the steepness of the slope, the size of the barrier and loads.
2. The height of the foundation is selected when designing ground anchors based on the length of the foundation bolts, the type of foundation, the size of the barrier.
3. Working drawings of the concrete foundation with the reinforcement scheme are made as a separate sheet at the design stage.
4. To install barrier posts it is possible to use both injection and rod ground anchors.
5. Without a concrete foundation, posts may only be installed on rocky, un-weathered, monolithic ground with high compressive strength.

Изм.	Кол. уч.	Лист	№ док	Подп.	Дата	Rockfall protection barrier GB-1000A, H_k=3,5 m		
						Types of post foundations	Стадия	Лист 9 / Листов
								LLC "Geo-Barrier"



The rope clamp is used with the rope indicated in the table.
The number of clamps per termination and the tightening torque of the nuts should be selected according to this table. Application of the thimble according to the requirements of the manufacturer.

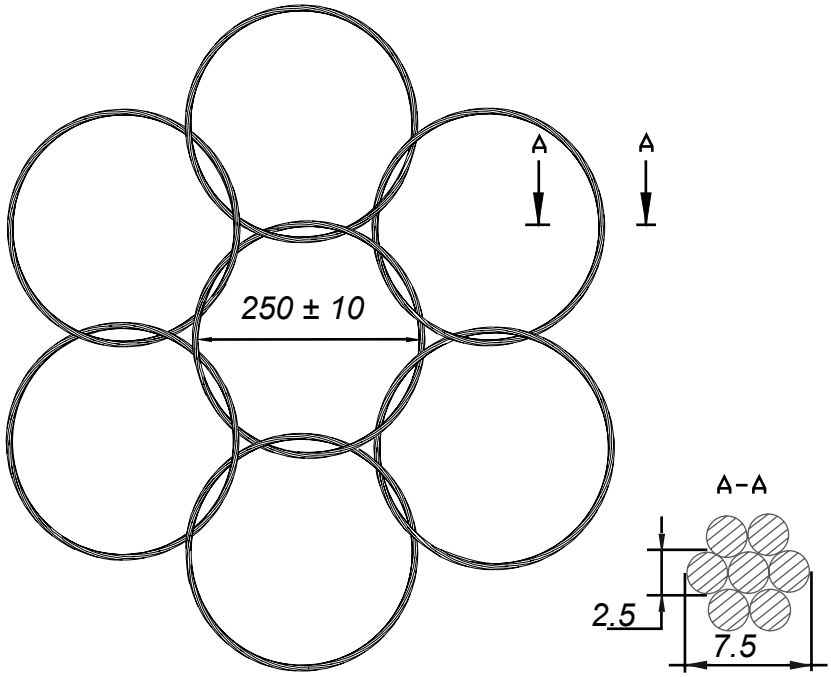
Wire rope diameter D, mm	Wire rope clip DIN 1142	Number of climps per termination, pcs.	d, mm	Nut tightening torque, H*m	Termination length l_z, мм
8,0–10,5	10	5	8	6,6	160
11,0–13,5	13	5	12	24,3	240
14,0–16,5	16	6	14	36	350
17,0–19,5	19	6	14	50	350
20,0–22,5	22	8	16	79	560
23,0–26,5	26	8	20	108	700
27,0–31,0	30	9	20	156	800

Изм.	Кол. уч.	Лист	№ док	Подп.	Дата	Rockfall protection barrier GB-1000A, H_k=3,5 m		
						Table of applicability of wire rope climps for terminating rope ends	Стадия	Лист 10 / Листов 1
								LLC "Geo-Barrier"

Format A4

Geobarrier
Nature under lock

TECHNICAL SHEET
RING NET-2,5.25.7/6



TECHNICAL CHARACTERISTICS:

Geometry:

Type of ring binding	7 loops
Inner ring diameter	250 mm
Type of net binding	6 contacts
Weight of one ring	0,225 kg

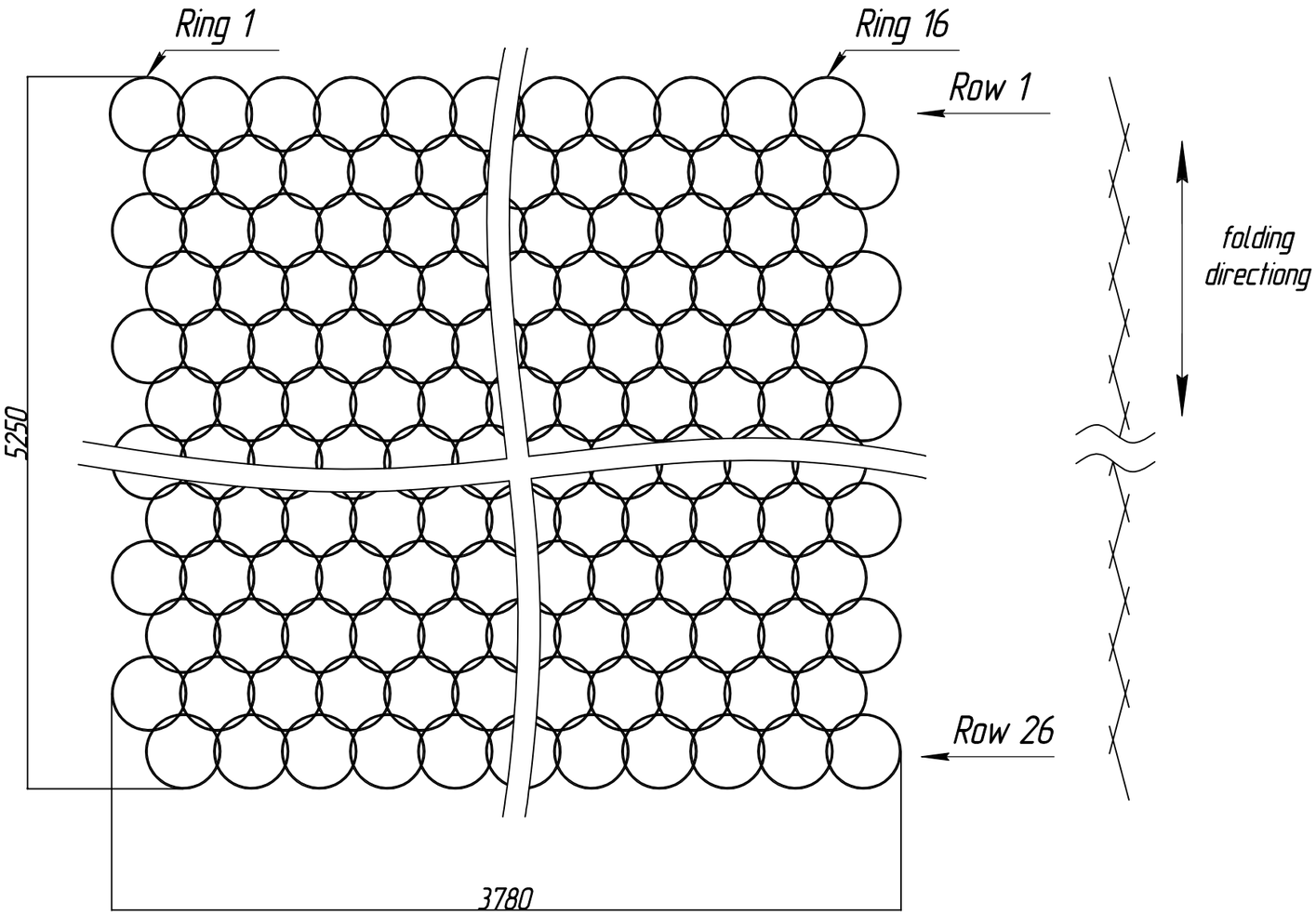
Steel wire:

Wire diameter	Ø 2.5 mm
Tensile strenght	≥1570 N/mm^2
Corrosion protection	Zn
Coating density	≥255 g/m^2

Strength characteristics:

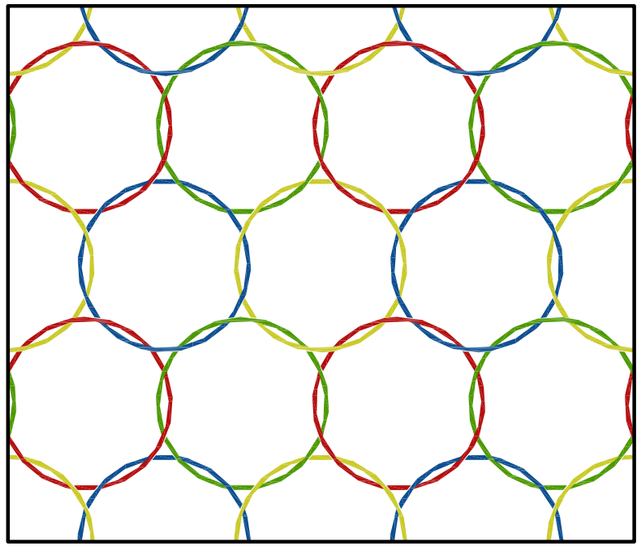
Tensile strenght of net	300 kN/m
Breaking load of the ring	75 kN

Ring net-2.5.25.7/6

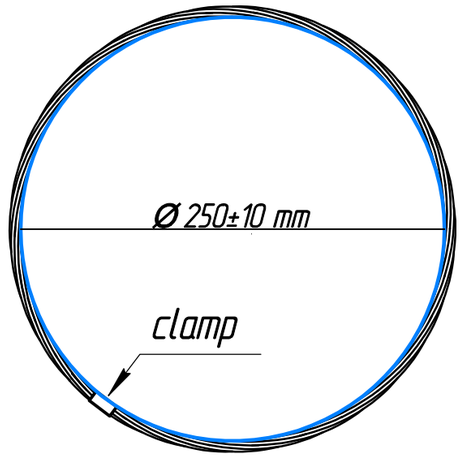


folding directiong

6 contacts between rings



Ring



Ring net dimensions	
Length L, mm	3780
Height H, mm	5250
Area of net, sq.meter	19,85
Rings in row, pcs.	16
Number of rows, pcs.	26
Number of rings, pcs.	416

Ring net parameters	
Wire diameter, mm	2,5
Internal ring diameter, mm	250
Number of loops	7
Contacts between rings	6

Package size: 2,14x0,66x0,2 m

Ring net 2,5.25.7/6

Ring net

Weight

93,6

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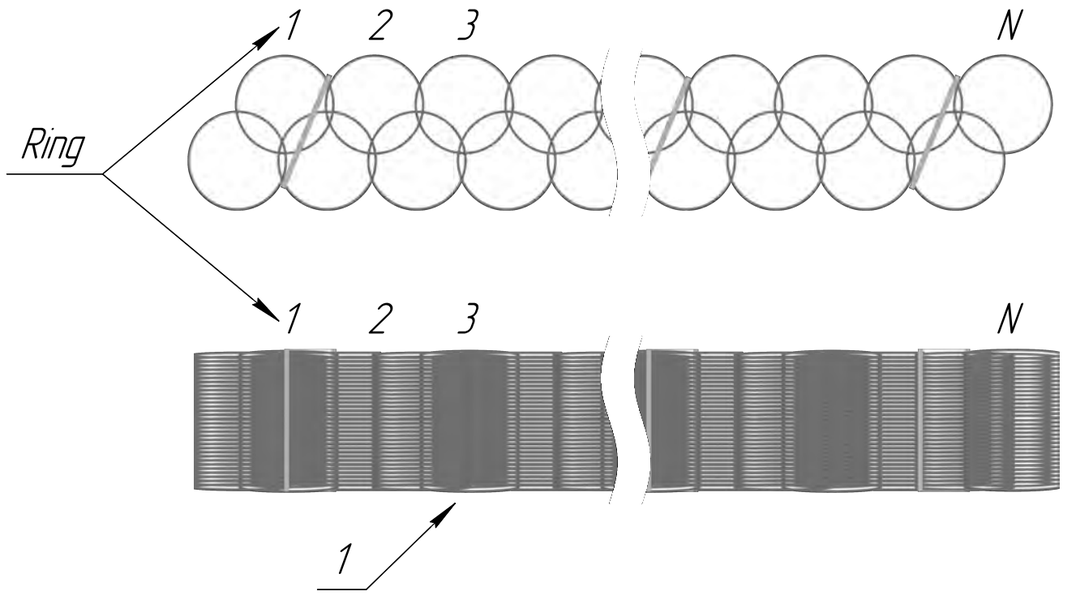
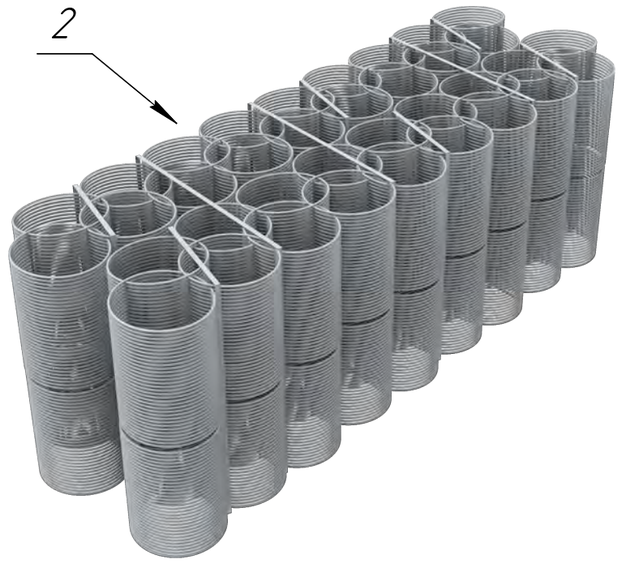
www.geobarrier.ru

Packed ring net panel

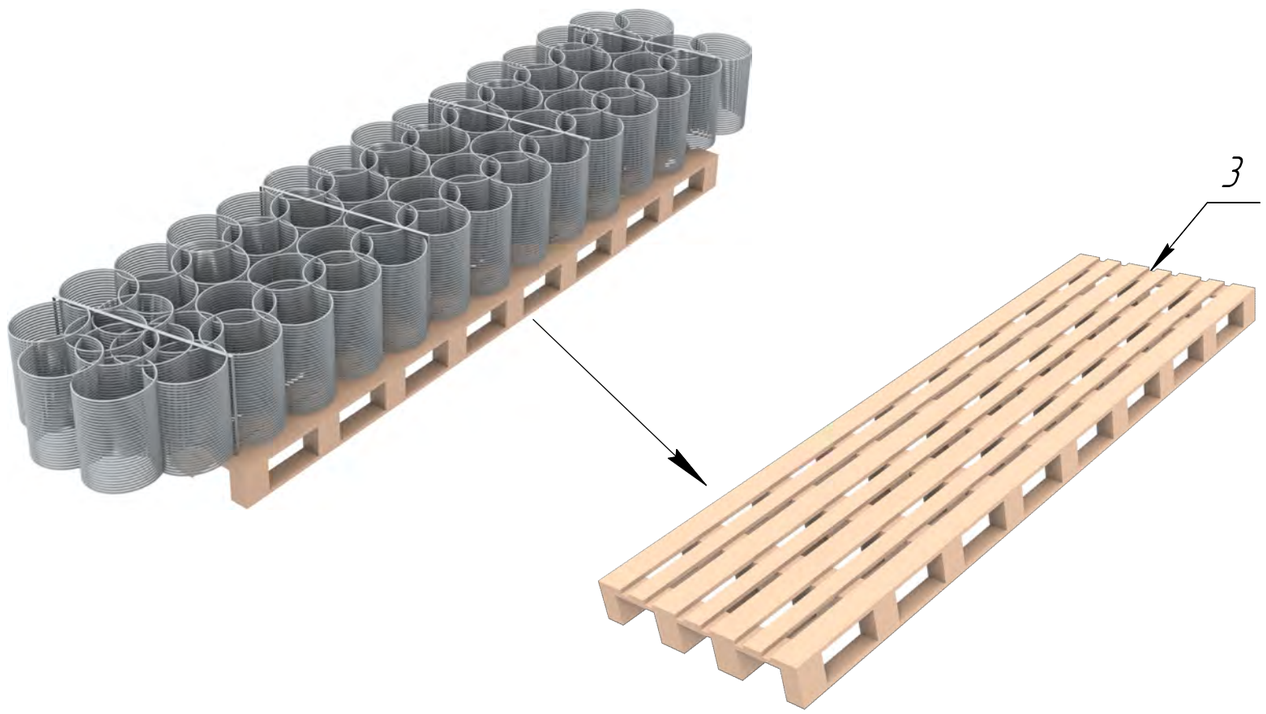


Individually packed ring net panels

Package of 4 ring net panels



Ring net panel packed on pallet



1. Ring net panel TU-1275-001-75212412-04
2. Steel strapping band 0,5x20 GOST 3560-73
3. Pallet (size according to customer's request)

Transportation and packaging scheme	
Geo-Barrier Nature under lock	
Technical department	www.geobarrier.ru info@geobarrier.ru
06.12.2019	

Geo-Barrier
Nature under lock

Energy absorber with deformable element DT-10

internal standard: CTO 022-75212412-2017

SPECIFICATIONS:

Energy absorption ability - up to 300 kJ

Activation force - 10 tf

Working stroke:
3 m - DT-10/3000

Energy carrier:
square 12 GOST 2591-88
St3ps GOST 380-94

Weight:
29,3 kg

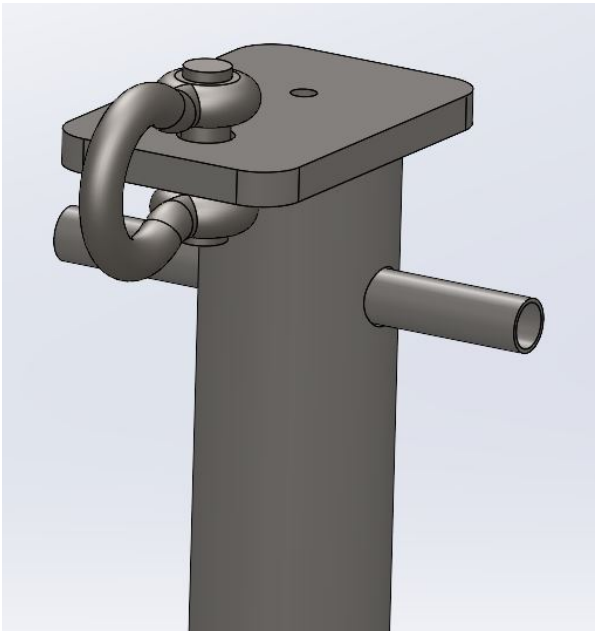
Product sheeting: hot dip galvanizing

Geo-Barrier
Nature under lock

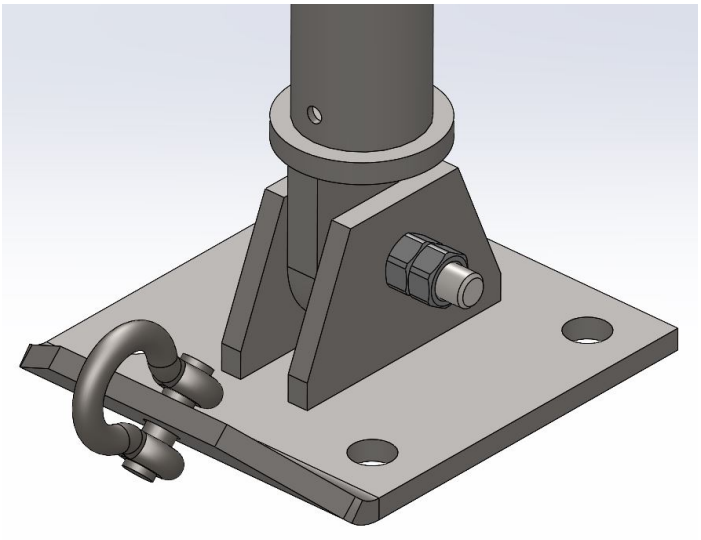
Hinged post ГБ-1200.35.000 Нк=3,5 m

internal standard: ТУ 5264-012-75212412-17

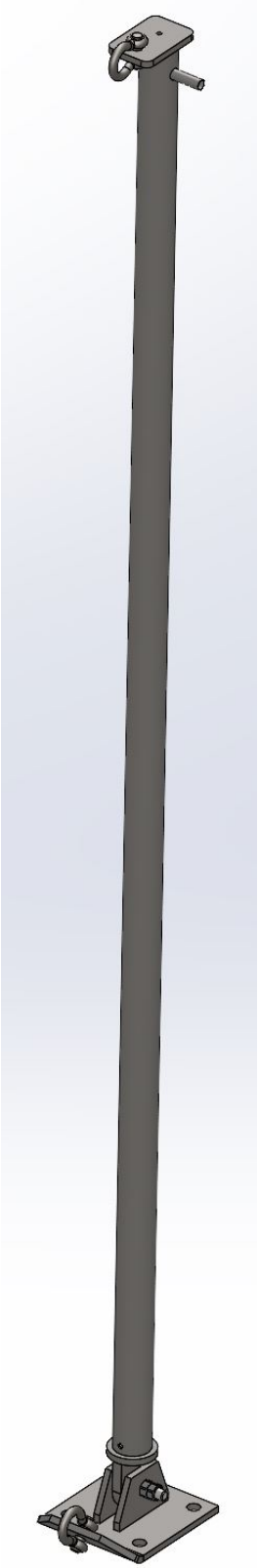
Top of the post



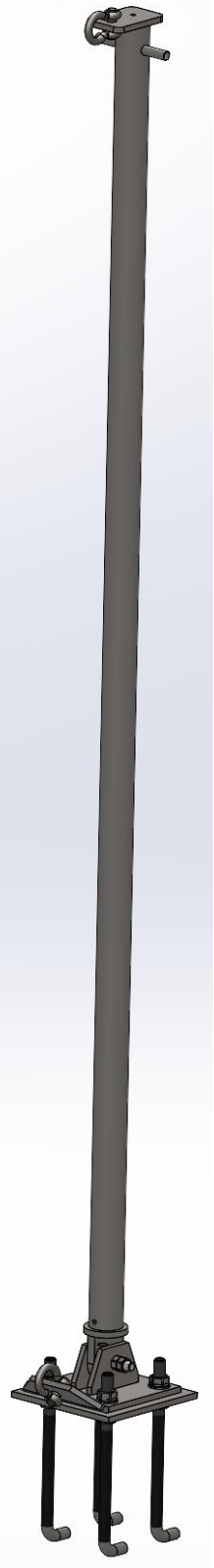
Base of the post



General view



General view assembled with mortgage and foundation bolts



SPECIFICATIONS:

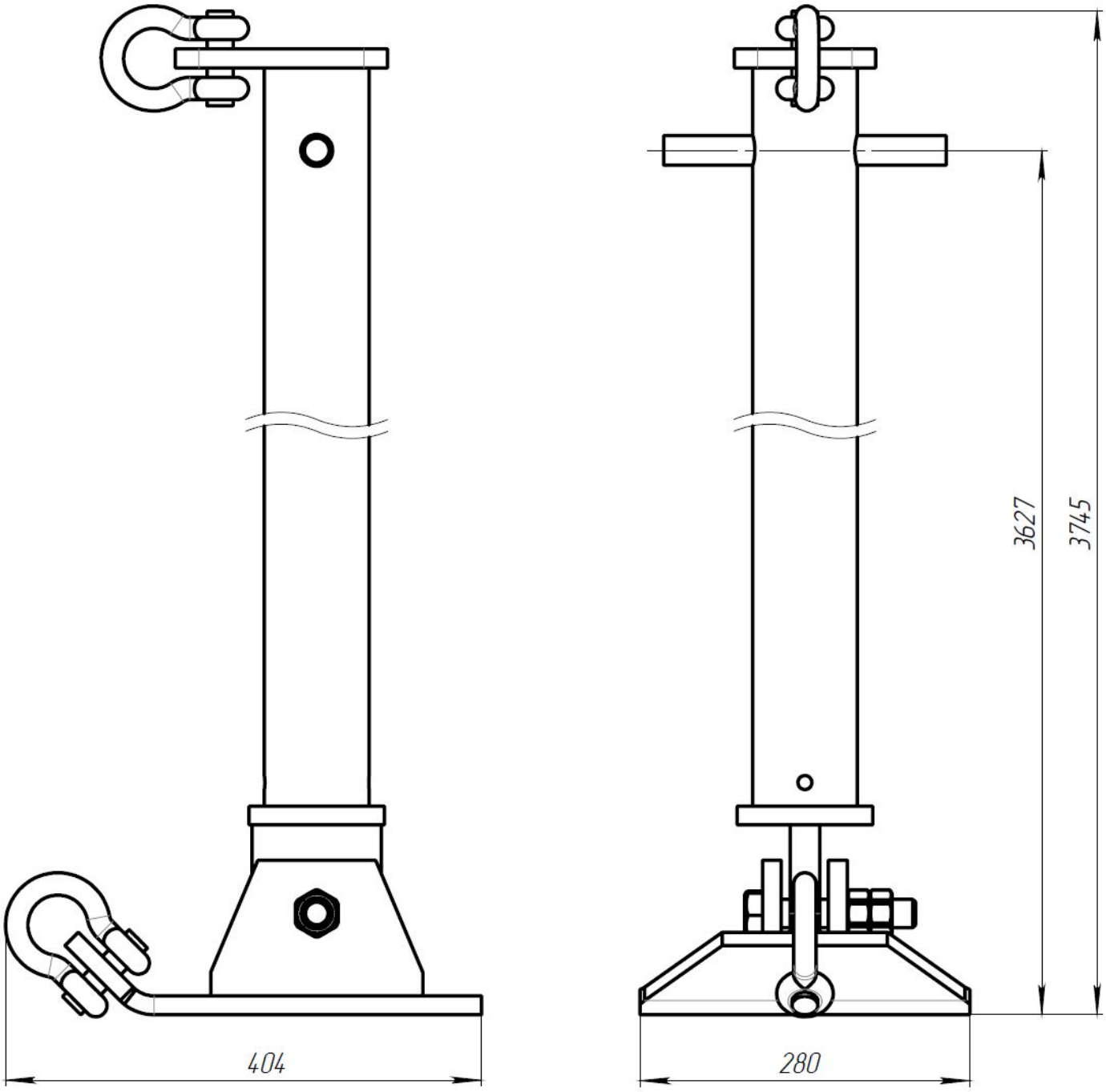
Working height: H_k = 3,5 m
Weight: 92,36 kg
Coating: hot dip galvanizing
Construction type: seamless steel pipe
Steel grade: 09Г2С

Geo-Barrier
Nature under lock

Hinged post ГБ-1200.35.000 Нк=3,5 m

internal standard: ТУ 5264-012-75212412-17

General view

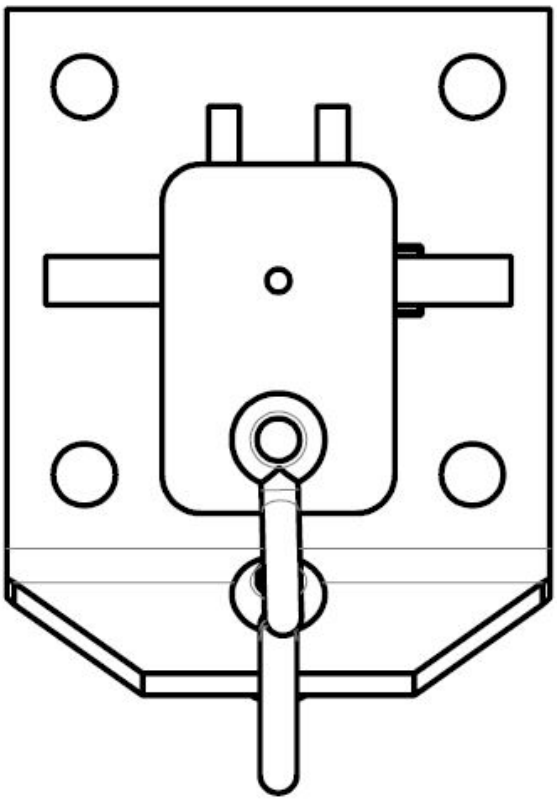


Geo-Barrier
Nature under lock

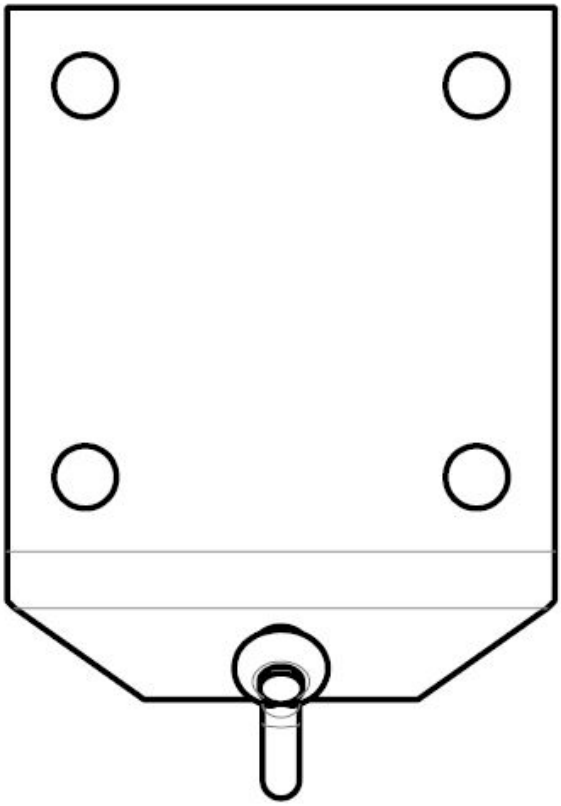
Hinged post ГБ-1200.35.000 Нк=3,5 m

internal standard: ТУ 5264-012-75212412-17

View from above



Bottom view



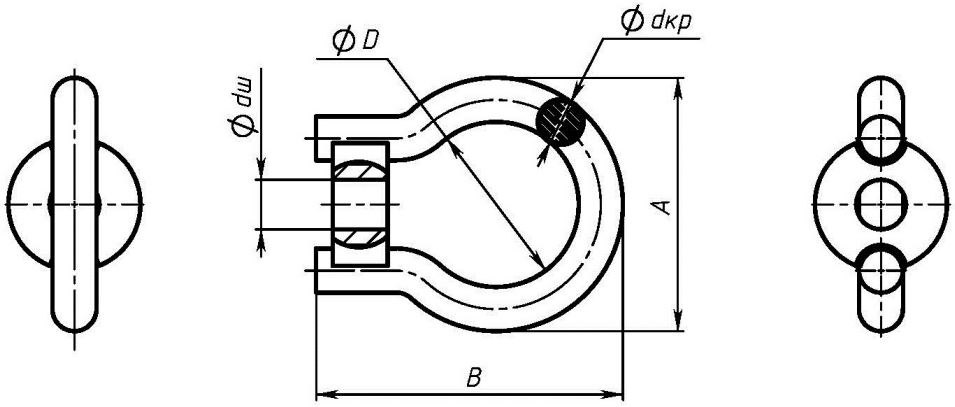
Geo-Barrier
Nature under lock

Anchor head, ТУ 1270-008-75212412-16

AH-III-40
AH-III-52
AH-III-72

SPECIFICATIONS:

	Mechanical parameters	
Designation	Working load, kN	Breaking load, kN
AO-III-40	680	930
AO-III-52	1080	1450
AO-III-72	1600	2090



Designation	$d_ш$[mm]	A [mm]	B [mm]	D [mm]	$d_{кр}$[mm]	weight [kg]
AH-III-40	45	200	250	140	30	7
AH-III-52	60	240	310	160	40	13
AH-III-72	80	300	390	200	50	26