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Federal Department of the Environment,
Transport, Energy and Communication (DETEC)

Federal Office for the Environment (FOEN)

Type approval of safety nets for protection against rockfall

Test Certificate No. S 07-01-ST

System description

• **System designation**		**AXI-025**
• **Adresse of manufacturer**		GEOBRUGG Fatzer AG Schutzsysteme, Hofstrasse 55, 8590 Romanshorn
• **System description**		
– Energy class		250 kJ
– Posts:	profile	HEB 160
	quality of steel	S 355
	length a_l	2.48 m
	interval a_s	10 m
– Support ropes:	type	EN 12385-4
	diameter	18 mm
– Net:	type	ROCCO ring net (7 windings)
	diameter	Ring diameter 350 mm, wire diameter 3mm
	mesh	-

– System drawings

Description	No.	Date
System handbook AXI-025	138-N-FO/EKLS 02	04.01.2007
Statics	138-N-FO/EKLS 02	28.12.2006
Drawings	138-N-FO/EKLS 02	28.12.2006

Basic documentation

• **Field test**		
WSL test report	Date 31 August 2005	Report no. 05-12
• **Statics**		
WSL statics test report	Date 8 June 2007	Report no. 07-01
• **Overall assessment**		
Overall assessment of the EKLS (FECAR)	Date 27 June 2007	Protocol no. 35

Test results

• **Preliminary test of outer part**	
– Penetration of test body	yes ☐ / no ☒
– Additional observations	none

• **Preliminary energy test (50%)**	125 kJ
– Height of net h_v	2.32m
– Penetration of test body	yes ☐ / no ☒
– Braking time t_s	0.20 s
– Braking distance b_s	3.25 m
– Sum of the tensile forces in the 2 upper ropes	112 kN
– Sum of the tensile forces in the 1 lower rope	81 kN
– Maximum tensile force in one stay rope	35 kN
– List of damaged elements	
No damage to the installation as a whole. 6 of the 8 braking elements were deformed.	
– Assessment of repairs	
The middle part of the net was replaced and the upper and lower ropes were re-tensioned. The work took 8 person-hours.	
The repairs necessary after the test are considered to be slight.	
• **Main energy test (100%)**	250 kJ
– Penetration of test body	yes ☐ / no ☒
– Braking time t_s	0.27 s
– *Maximum permissible braking distance b_s*	*5.0 m*
– Measured braking distance b_s	4.05 m
– *Minimum permissible residual braking height h_n*	*1.0 m*
– Measured residual braking height h_n	1.35 m
– Sum of the tensile forces in the 2 upper ropes	145 kN
– Sum of the tensile forces in the 1 lower rope	94 kN
– Maximum tensile forces in one stay rope	51 kN
– List of damaged elements	
The load-bearing structure suffered only very slight, visible damage. One flange of the T profile welded onto the ground plate was slightly bent as a result of leverage by the shackle. One strand of the lower support rope tore at the foot of the post and came out of the rope.	
6 of the 8 braking elements were deformed.	
• **Assessment of special criteria**	
– Comments on assembly and on the assembly instructions	
The assembly presents no particular difficulties.	
– Comments on adaptability to the terrain	
The adaptability to the terrain is normal	

– Comments on design complexity

The construction is simple. Damaged elements can easily be replaced.

– Comments on anticipated service life

Anchor bolts and posts are not galvanised as standard. The manufacturer recommends galvanisation in particular for ground plates. The brake rings consist of galvanised steel tubes and aluminium press sleeves.

The anticipated service life is ascertained to be adequate.

Statics – results of tests on 8 June 2007

- **Maximum forces at head of post**
  - – force at right angles V_y 51 kN
  - – normal force N 13 kN
  - – tangential force V_z 17 kN
- **Static equivalent load at head of post**
  - – force at right angles V_y 66 kN
  - – normal force N 17 kN
  - – tangential force V_z 22 kN
- **Proven cross-sections of posts**

– height of net	2.0 m	2.5 m	3.0 m
– length of post	2.48 m	2.98 m	3.48 m
– profile	HEB 160	HEB 160	HEB 180
– quality of steel	S 355	S 355	S 355

Overall assessment

☒ **Test passed** ☐ **Test passed with reservations**

Tested according to the following guidelines: GERBER, W. 2001: Guideline for the approval of rockfall protection kits. Federal Offfice for the Environment (FOEN) and Swiss Federal Research Institute for Forest, Snow and Landscape (WSL). Bern, 39 pages, revised June 2006

and

GERBER W., Guidance on the measurement of protection nets with fitted posts, environmental execution. Federal Office for the Environment, Swiss Federal Institute for Research WSL, Bern, draft June 2007

RESERVATION: Should deficiencies arise following certification of the safety net, the FOEN may revoke product release and delete it from the type approval list.

Date	**Name, position**	**Signatures**
17.09.07	**Andreas Götz, Vizedirektor**	

Federal Office for the Environment (FOEN)
Risk Prevention Division
3003 BERN
http:// www.umwelt-schweiz.ch/typenpruefung