

Federal Office for the Environment FOEN

## Type approval of safety nets for protection against rockfall

Test Certificate No. S 01-1

<ul> <li>System designation</li> <li>Address of designer</li> <li>GEOBRUGG Fatzer AG Schutzsysteme, Hofstrasse 55, 8590 Romanshorn</li> <li>System description         <ul> <li>Energy class</li> <li>3000 kJ</li> <li>Posts:</li> <li>profile</li> <li>HEB 200</li> <li>length a<sub>1</sub></li> <li>5.26 m</li> <li>interval a<sub>5</sub></li> <li>10 m</li> </ul> </li> <li>Support ropes: type</li> <li>DIN 3064</li> <li>diameter</li> <li>22 mm</li> <li>Net:</li> <li>type</li> <li>ROCCO 16-winding</li> <li>diameter 300 mm, wire diameter 3 mm</li> <li>mesh</li> <li>height h<sub>v</sub></li> <li>4.79 m</li> </ul> <li>System drawings</li> <li>Description</li> <li>No.</li> <li>Date</li> <li>Rockfall construction system RX-300</li> <li>GS-1027 d</li> <li>07.09.01</li>	System descrip	tion			
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DescriptionNo.DateRockfall construction system RX-300GS-1027 d07.09.01Post RX 200 HER 200CN 600220.04.01	- System drawings	S			
Rockfall construction system RX-300GS-1027 d07.09.01Post RX 200 HER 200CN 600220.04.01	Description			No.	Date
	Rockfall construction	system RX-3	600	GS-1027 d	07.09.01
Ground plate RX-300         Given bit Side         Given bit Side         Side <td>Ground plate RX-300</td> <td></td> <td></td> <td>GN-7001</td> <td>30.04.01</td>	Ground plate RX-300			GN-7001	30.04.01
Material specification RX-300 - 11.09.01	Material specification	RX-300	(	-	11.09.01
RX-300 guide for support ropes above / below with GN-1005.01 11.09.01 measurement boxes	RX-300 guide for sup	port ropes at	oove / below with	GN-1005.01	11.09.01
RX-300 guide for support ropes above / below without m.b 11.09.01	RX-300 guide for sup	port ropes at	oove / below without m.b.	-	11.09.01
Guy cables + retaining rope with measurement boxesGN-1005.0311.09.01Out addition retaining rope with measurement boxesON 4005.0414.00.01	Guy cables + retaining rope with measurement boxes			GN-1005.03	11.09.01
Guy cables + retaining rope with measurement boxes GN-1005-04 11.09.01 GS-8002 (force-path diagram for braking ring)	Guy caples + retaining rope with measurement boxes			GN-1005-04 -	11.09.01 -
GN-9017 (force-path diagram for braking ring)	GN-9017 (force-path diagram for braking ring)			-	-
GN-9055 (force-path diagram for braking ring)	-				
Basic documentation	Basic documen	tation			
Field test	• Field test				
WSL test report Date 16 April 2002 Poport po. 01.1	WSL test report		Data 16 April 2002	Poport po 01 1	
		Кероп	10.01-1		
Overall assessment     Date 16 April 2002     Report no. S 01-1       EKLS (FECAR)     EKLS (FECAR)	• Overall assessment Overall assessment of the EKLS (FECAR)		Date 16 April 2002	Report no. S 01-1	



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## **Test results**

Preliminary test of outer part	
<ul> <li>Penetration of test body</li> </ul>	yes 🗌 / no 🔀
<ul> <li>Additional observations</li> </ul>	none
<ul> <li>Preliminary energy test (50%)</li> </ul>	1500 kJ
<ul> <li>Penetration of test body</li> </ul>	yes 🗌 / no 🔀
<ul> <li>Braking time t<sub>s</sub></li> </ul>	0.32 s
<ul> <li>Braking distance b<sub>s</sub></li> </ul>	5.0 m
<ul> <li>Sum of the tensile forces in the 2 upper cables</li> </ul>	410 kN
<ul> <li>Sum of the tensile forces in the 2 lower cables</li> </ul>	400 kN
<ul> <li>Maximum of the tensile forces in a stay cable</li> </ul>	230 kN
<ul> <li>List of damaged elements</li> </ul>	

No damage to load-bearing parts of the structure. 35 out of 84 braking components were deformed and 21 were replaced for the main test.

- Assessment of repairs

The repairs necessary after the test were assessed as normal in view of the size of the whole system. These repairs took 75 man-hours.

Main energy test (100%)	3000 kJ
<ul> <li>Penetration of test body</li> </ul>	yes 🗌 / no 🖂
<ul> <li>Braking time t<sub>s</sub></li> </ul>	0.44 s
– Maximum permissible braking distance b <sub>s</sub>	12 m
<ul> <li>Measured braking distance b<sub>s</sub></li> </ul>	6.60 m
- Minimum permissible residual braking height $h_n$	2.5 m
<ul> <li>Measured residual braking height h<sub>n</sub></li> </ul>	2.65 m
<ul> <li>Sum of the tensile forces in the 2 upper cables</li> </ul>	520 kN
<ul> <li>Sum of the tensile forces in the 2 lower cables</li> </ul>	510 kN
<ul> <li>Maximum of the tensile forces in a stay cable</li> </ul>	330 kN

- List of damaged elements

No damage to load-bearing parts of the structure. 61 out of 84 braking components were deformed. Two of the 24 braking components (DIMO components) that are intended as breaking points were torn off the post heads.

## • Assessment of special criteria

- Comments on assembly and on the assembly instructions

Assembly is time-consuming, but in line with the size of the system.

- Comments on adaptability to the terrain
  - Adaptability to the terrain is somewhat restricted, but in line with the size of the system.



- Comments on design complexity

For the 3000 kJ energy class, the design is more complex than any existing system with lesser energy absoption capacity.

- Comments on anticipated life cycle

The manufacturer offers a choice of normal corrosion protection (galvanized according to DIN 2078) or special corrosion protection (zinc/aluminium coating). The expected service life of both is assessed as adequate.

## **Overall assessment**

19.05.2006

Test passed

**Test passed with reservations** 

Examined based on the following guidelines: GERBER, W. 2001: Guideline for the approval of rockfall protection kits. Environment in practice. Swiss Agency for the Environment, Forests and Landscape (SAEFL), Swiss Federal Research Institute WSL. Berne, 39 pages. Revised June 2006.

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

Date

Name, position

Signatures

Andreas Götz, Vice Director



Replaces the Certificate No. S 01-1 of 14 October 2002

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