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Federal Department of the Environment,
Transport, Energy and Communications DETEC

Federal Office for the Environment FOEN

Type approval of safety nets for protection against rockfall

Test Certificate No. S 09-3-ST

System description

• **System designation**		**Isostop 250 kJ ESS**
• **Address of manufacturer**		Isofer AG, Industriequartier, 8934 Knonau
• **System description**		
– Energy class		250 kJ
– Posts:	profile	HEA 180, HEA 200, HEA 220, HEA 240
	steel grade	S 355
	length a_l	2.2 m, 2.7m, 3.2 m
	interval a_s	m
– Support ropes:	type	DIN 3058
	diameter	16 mm
– Net:	type	Twisted cable net 8/10/300 mm
	diameter	8 mm, peripheral cable 10 mm
	mesh	300 x 300 mm

– System drawings

Description	No.	Date
General project drawings (10 pages)	-	22.04.2009
Technical documentation (28 pages)	-	22.04.2009
Dimensioning and checks (52 pages)	-	22.04.2009

Basic documentation

• **Field test (250 kJ ES)**		
WSL test report	Date 15 August 2008	Report no. 08-21
• **Statics**		
WSL test report	Date 30 July 2009	Report no. 09-3
• **Overall assessment**		
Overall assessment of the EKLS	Date 24 August 2009	Protocol no. 7

Field test – test results of 15 August 08

• **Preliminary test of outer part**

– Penetration of test body	yes ☐ / no ☒
– Additional observations	none

• **Preliminary energy test (50%)**	125 kJ
– Net height h_v	2.32 m
– Penetration of test body	yes ☐ / no ☒
– Braking time t_s	0.25 s
– Braking distance b_s	3.20 m
– Sum of the tensile forces in the upper cables	69 kN
– Sum of the tensile forces in the lower cables	75 kN
– Maximum of the tensile forces in a stay cable	28 kN
– List of damaged elements	
No damage to load-bearing structural components. Four of the four braking components were deformed and four were replaced for the main test as was the seam cable in the central area.	
– Assessment of repairs	
The scope of the repairs necessary after the test is assessed as minor. The time required to complete the repairs was 8.5 man hours.	
• **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	4.20 m
– *Minimum permissible residual braking height h_n*	*1.0 m*
– Measured residual braking height h_n	1.1 m
– Sum of the tensile forces in the upper cables	88 kN
– Sum of the tensile forces in the lower cables	85 kN
– Maximum of the tensile forces in a stay cable	51 kN
– List of damaged elements	
Four of the four braking components were deformed. The installed overload cables were extended by different lengths.	
• **Assessment of special criteria**	
– Comments on assembly and on the assembly instructions	
The system is very easy to assemble.	
– Comments on adaptability to the terrain	
Adaptability to the terrain is normal.	

– Comments on design complexity

The design is very simple. Damaged components are easy to replace.

– Comments on anticipated service life

The system components are supplied in accordance with the customer's requirements and specifications for the service life of the system. The expected service life of the standard version is assessed as adequate.

Statics – test results of 30 July 2009

• **Maximum forces at post head**			
– Transverse force V_y			51 kN
– Normal force N			10 kN
– Tangential force V_z			23 kN
• **Static dummy loads at post head**	Load case 1 (y axis)		
– Transverse force V_y			66 kN
– Normal force N			13 kN
– Tangential force V_z			8 kN
• **Static dummy loads at post head**	Load case 2 (z axis)		
– Transverse force V_y			43 kN
– Normal force N			8 kN
– Tangential force V_z			30 kN
• **Demonstrated post cross-sections**	Post with rock mounting		
– Net height	2.0 m	2.5 m	3.0 m
– Post length	2.23 m	2.73 m	3.23 m
– Profile	HEA 180	HEA 200	HEA 220
– Steel grade	S 355	S 355	S 355
• **Demonstrated post cross-sections**	Post sand back-filled		
– Net height	2.0 m	2.5 m	3.0 m
– Post length	3.63 m	4.33 m	5.03 m
– Profile	HEA 220	HEA 240	HEA 240
– Steel grade	S 355	S 355	S 355
• **Demonstrated post cross-sections**	Post with predetermined breaking point		
– Net height	2.0 m	2.5 m	3.0 m
– Post length	2.23 m	2.73 m	3.23 m
– Profile	HEA 200	HEA 220	HEA 240
– Steel grade	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. Environment in practice. Swiss Agency for the Environment, Forests and Landscape (SAEFL), Swiss Federal Research Institute WSL. Berne, 39 pages. Revised June 2006.

and

GERBER W., Anleitung zur Bemessung von Schutznetzen mit eingespannten Stützen, Umwelt Vollzug. Bundesamt für Umwelt, Eidg. Forschungsanstalt WSL, Bern, Entwurf Juni 2007 (Draft guideline in German on the dimensioning of protective nets with support posts, 2007)

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**
14.09.09	**Andreas Götz, Vice Director**	

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