

Rockfall protection system

Overview



General:

TRUMER rockfall catchment fences were developed to protect infrastructure, utilities, buildings and lives from falling debris. Typical catchment fences are installed in run-out or deposition zones, close to the elements at risk that they protect. For this purpose TRUMER offers a wide range of tested systems that differ in the maximum energy level and the approved heights. Fixed rotations systems, as well as systems with retaining ropes are available. All systems are tested in accordance with either ETAG 27 or Austrian WLV guideline.

ETAG 27

ETAG 27 is the guideline from the European Organisation for Technical Approvals entitled "Guideline for European Technical Approval of Falling Rock Protection Kits", was published in 2008 and is the basis for the CE marking.

WLV

The WLV guideline from the Austrian Service of Torrent and Avalanche Control, the national authority responsible for natural hazard prevention and mitigation, entitled "WLV-Richtlinie für den Eignungsnachweis von Steinschlagschutznetzen" was published in 2005.

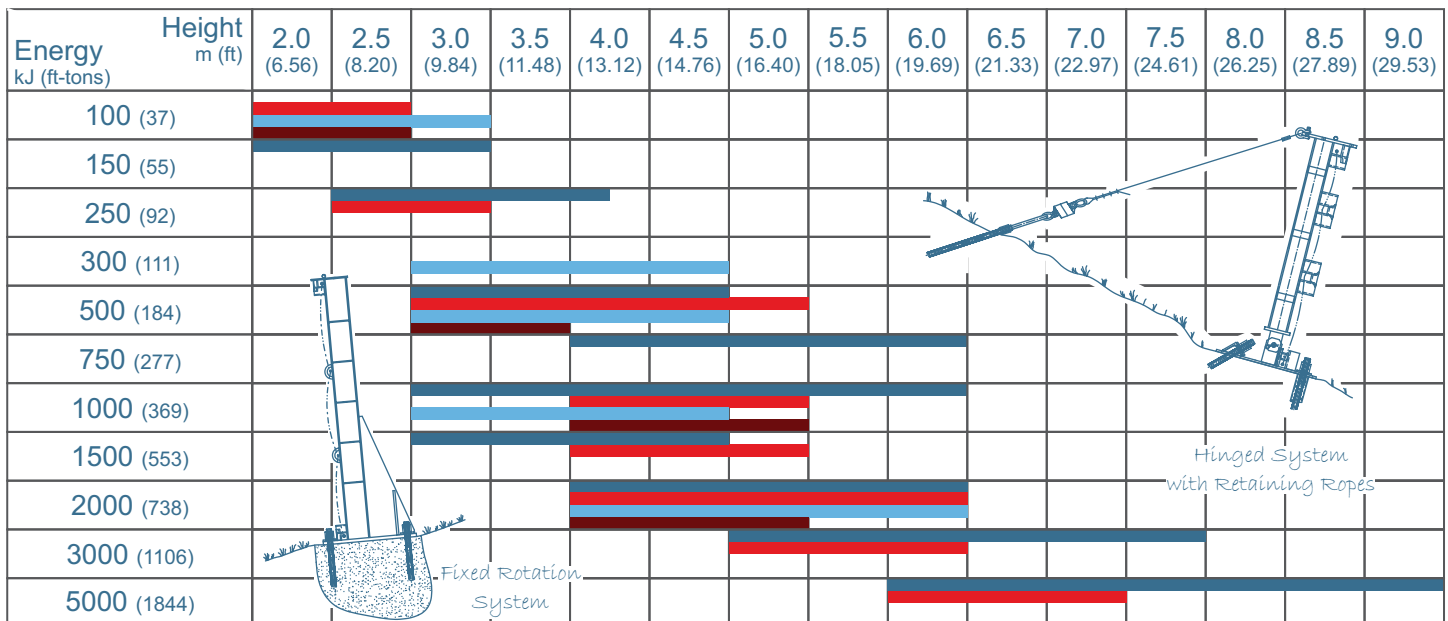
Hinged post-base plate

This type of system has an independent post and base plate that are connected with a steel pin to form a hinge, allowing the post to rotate in a direction perpendicular to the fence line. The system requires retaining ropes from the post head which are anchored uphill.

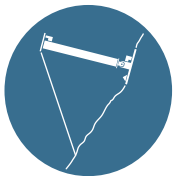
Fixed rotation

A fixed rotation system has a post with an integrated base plate. The connection between post and base plate is rigid and welded. The system is free standing and do not require retaining ropes at the head of the post.

Energy / Height Matrix



Hinged System (Acc. to WLV) 
 Hinged System (ETAG 27 Certified) 
 Fixed Rotation System (Acc. to WLV) 
 Fixed Rotation System (ETAG 27 Certified) 



HINGED SYSTEM - Acc. to WLV

Model	TS-150-ZD	TS-250-ZD	TS-500-ZD	TS-750-ZD	TS-1000-ZD 04	TS-1000-ZD 07	TS-1500-ZD	TS-2000-ZD	TS-3000-ZD	TS-5000-ZD					
Style	Hinged System														
Energy Class	0	1	2	3							4	5	6	8	
MEL [kJ]	150	250	500	750	1000							1500	2000	3000	5000
SEL [kJ]	N/A										1660				
Approved Height [m]	2.0 - 3.0	2.5 - 3.75	3.0 - 4.5	4.0 - 6.0	4.0 - 6.0							3.0 - 4.5	4.0 - 6.0	5.0 - 7.5	6.0 - 9.0
Verification	Full Scale Tested														
Certification	Tested by Montanuniversität Leoben according to WLV Guideline														
Report Number	0204	0108	0307	0202	0104	0607	0306	0206	0207	0308					
Test Height [m]	2.0	2.5	3.0	4.0	4.0							3.0	4.0	5.0	6.0
Max. Elongation [m]	2.64	4.44	5.98	5.76	6.29	5.50	6.18	7.57	7.93	9.95					
Residual Height Cat.	A (≥ 50 %)														
Net Type	HPN 50/50/4.6	Omega-Net 6.0/135	Omega-Net 7.5/135	Omega-Net 9.0/185							Omega-Net 10.5/180				
Corrosion Protection	ZnAl, Cl. A	Zn or ZnAl, Class A													
Connection	Rope	Shackled (Panel to Panel), Threaded (Bearing Rope)													
Tested Post Type	HEA 100	HEA 120	HEA 140	HEA 160	HEA 180	HEA 200	HEA 220	HEA 240	HEA 260	HEA 280					
Connection	Tongue and Pin (Post with Base Plate)														
No. of Anchors ⁽¹⁾	2														
Bearing [mm] / Pcs. ⁽²⁾	16 / 2	20 / 2	24 / 2	20 / 2							22 / 2	24 / 2	24 / 4		
Middle [mm] / Pcs. ⁽²⁾	N/A		16 / 2									18 / 2	20 / 2	22 / 4	24 / 4
Retaining [mm] / Pcs. ⁽¹⁾	12 / 2	16 / 2	18 / 2	16 / 2							22 / 2	24 / 2	24 / 4		
Bearing / Pcs. ⁽³⁾	AVT phx / 2														
Middle / Pcs. ⁽³⁾	AVT phx / 2														
Retaining / Pcs. ⁽³⁾	AVT phx / 1														
Lateral Anchor [kN]	112	216	231	246	149	170	236	249	245	307					
Retaining Anchor [kN]	49	74	187	277	134	202	262	279	293	299					
Base Plate [kN] ⁽⁴⁾	42	97	123	232	149	149	201	221	270	343					

⁽¹⁾ Quantity per post

⁽²⁾ Quantity per fence segment

⁽³⁾ Quantity per rope

⁽⁴⁾ Slope parallel force at Base Plate



HINGED SYSTEM - ETAG 27 Certified

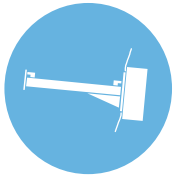
Model	TSC-100-ZD	TSC-250-ZD	TSC-500-ZD	TSC-500-ZD H4	TSC-1000-ZD	TSC-1500-ZD	TSV-2000-ZD H4	TSC-2000-ZD	TSC-3000-ZD	TS-5000-ZD		
Style	Hinged System											
Energy Class	0	1	2	3	4	5	6	8				
MEL [kJ]	100	250	500	1000	1500	2000	3000	5000				
SEL [kJ]	N/A	85	170	330	500	660	1000	1660				
Approved Height [m]	2.0 - 2.5	2.5 - 3.0	3.0 - 3.5	4.0 - 5.0							5.0 - 6.0	6.0 - 7.0
Verification	Full Scale Tested											
Certification	ETAG 27 Certified											
ETA Number	ETA-12/0156	ETA-12/0204	ETA-12/0117	ETA-12/0116	ETA-11/0226	ETA-11/0225	ETA-14/0357	ETA-11/0228	ETA-11/0227	ETA-10/0202		
Test Height [m]	2.0	2.5	3.0	4.0							5.0	6.0
Max. Elongation [m]	3.03	3.86	4.59	5.02	4.87	5.78	5.83	7.19	7.22	8.62		
Residual Height Cat.	A (≥ 50 %)											
Net Type	Omega-Net 6.0/135	Omega-Net 7.5/135	Omega-Net 9.0/185								Omega-Net 10.5/180	
Corrosion Protection	Zn or ZnAl, Class A											
Connection	Shackled (Panel to Panel), Threaded (Bearing Rope)											
Tested Post Type	HEA 100	HEA 120	HEA 140	HEA 180	HEA 200	HEA 220	HEA 300	HEA 400				
Connection	Tongue and Pin (Post with Base Plate)											
No. of Anchors ⁽¹⁾	2											
Bearing [mm] / Pcs. ⁽²⁾	16 / 2	20 / 2		22 / 2		24 / 2		24 / 2		24 / 4		
Middle [mm] / Pcs. ⁽²⁾		-	18 / 2	20 / 2	20 / 2	20 / 3	20 / 2	24 / 4				
Retaining [mm] / Pcs. ⁽¹⁾	12 / 2	16 / 2		22 / 2		24 / 2		24 / 2		24 / 4		
Bearing / Pcs. ⁽³⁾		AVT phx / 2		AVT phx / 4		GDV II / 2		AVT phx / 2		AVT phx / 2		
Middle / Pcs. ⁽³⁾		-	AVT phx / 2	AVT phx / 4	AVT phx / 4	GDV II / 2	AVT phx / 4	AVT phx / 4	AVT phx / 4	AVT phx / 4		
Retaining / Pcs. ⁽³⁾		-	AVT phx / 1	AVT phx / 1	AVT phx / 1	-	AVT phx / 1	AVT phx / 1	AVT phx / 1	AVT phx / 1		
Lateral Anchor [kN]	110	186	228	183	194	252	302	236	229	307		
Retaining Anchor [kN]	37	88	104	171	181	293	322	369	296	299		
Base Plate [kN] ⁽⁴⁾	57	98	116	88	198	251	216,5	222	302	343		

⁽¹⁾ Quantity per post

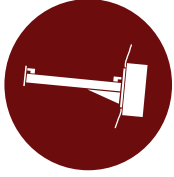
⁽²⁾ Quantity per fence segment

⁽³⁾ Quantity per rope

⁽⁴⁾ Slope parallel force at Base Plate



FIXED ROTATION SYSTEM - Acc. to WLV



FIXED ROTATION SYSTEM - ETAG 27 Certified

Model	TS-100-oA	TS-300-oA	TS-500-oA	TS-1000-oA	TS-2000-oA
Style	Fixed Rotation System				
Energy Class	0	1	2	3	5
MEL [kJ]	100	300	500	1000	2000
SEL [kJ]	N/A				
Approved Height [m]	2.0 - 3.0		3.0 - 4.5		4.0 - 6.0
Verification	Full Scale Tested				
Certification	Tested by Montanuniversität Leoben according to WLV Guideline				
Report/ETA Number	0103	0603	0203	0407	0208
Test Height [m]	2.0		3.0		4.0
Max. Elongation [m]	2.22		4.42		6.03
Residual Height Cat.	A (≥ 50 %)				
Net Type	HPN 50/50/4.6	Omega-Net 6.0/135	Omega-Net 7.5/135	Omega-Net 9.0/185	Omega-Net 9.0/185
Corrosion Protection	ZnAl, Cl. A				
Connection	Rope	Shackled (Panel to Panel), Threaded (Bearing Rope)			
Tested Post Type	HEA 140	HEB 160	HEB 200	HEB 240	HEB 280
Connection	Fixed (Post with Base Plate)				
No. of Anchors ⁽¹⁾	3				
Bearing [mm] / Pcs. ⁽²⁾	16 / 2		20 / 2		24 / 2
Middle [mm] / Pcs. ⁽²⁾	N/A		16 / 2		24 / 2
Bearing / Pcs. ⁽³⁾	N/A		AVT phx / 2		
Middle / Pcs. ⁽³⁾	N/A		AVT phx / 2		
Lateral Anchor [kN]	201	96	113	231	324
Base plate [kN] ^{(4)/(5)}	186 ⁽⁴⁾	170 ⁽⁴⁾	205 ⁽⁴⁾	378 ⁽⁴⁾	505 ⁽⁴⁾
Bending Moment at foot of post [kNm] ⁽⁶⁾	198	249	289	671	773

- ⁽¹⁾ Quantity per post
- ⁽²⁾ Quantity per fence segment
- ⁽³⁾ Quantity per rope
- ⁽⁴⁾ Slope parallel force at base plate
- ⁽⁵⁾ Tension force per tension anchor at base plate
- ⁽⁶⁾ Bending moment for tested height

Model	TSV-500-oA	TSV-1000-oA	TSV-2000-oA
Style	Fixed Rotation System		
Energy Class	2	3	5
MEL [kJ]	500	1000	2000
SEL [kJ]	170	330	660
Approved Height [m]	3.0 - 3.5		
Verification	Full Scale Tested		
Certification	ETAG 27 Certified		
Report/ETA Number	ETA-14/0272	ETA-13/0690	ETA-14/0358
Test Height [m]	3.0		4.0
Max. Elongation [m]	4.68		4.93
Residual Height Cat.	A (≥ 50 %)		
Net Type	Omega-Net 6.0/135	Omega-Net 7.5/135	Omega-Net 9.0/185
Corrosion Protection	Zn or ZnAl, Class A		
Connection	Shackled (Panel to Panel), Threaded (Bearing Rope)		
Tested Post Type	HEB 180	HEA 240	HEA 260
Connection	Fixed (Post with Base Plate)		
No. of Anchors ⁽¹⁾	3		
Bearing [mm] / Pcs. ⁽²⁾	18 / 2		20 / 2
Middle [mm] / Pcs. ⁽²⁾	18 / 1		18 / 2
Bearing / Pcs. ⁽³⁾	GDV II / 1		GDV I / 1
Middle / Pcs. ⁽³⁾	GDV II / 2		GDV I / 1
Lateral Anchor [kN]	116	149	206
Base plate [kN] ^{(4)/(5)}	110 ⁽⁴⁾	187 ⁽⁴⁾ / 273 ⁽⁶⁾	307 ⁽⁴⁾ / 532 ⁽⁵⁾
Bending Moment at foot of post [kNm] ⁽⁶⁾	104	281	614