MINING METALLURGY MATERIALS
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MONTANUNIVERSITÄT
LEOBEN

Department MINERAL RESOURCES & PETROLEUM ENGINEERING
Chair of **Mining Engineering & Mineral Economics**
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Abstract of test report no. 0306

System TS-1500-ZD
Test V0606 / Eisenerz / 24.11.2006

General information

Energy class:	1.500kJ
Manufacturer:	Trumer Schutzbauten GmbH Maria Bühel Strasse 7 A-5110 Oberndorf bei Salzburg
System name:	TS-1500-ZD
Test report number:	0306
Report creation date:	05.12.2006

Specification of rock-fall protection kit TS-1500-ZD

The tested rock-fall protection kit TS-1500-ZD of TRUMER SCHUTZBAUTEN GMBH is a flexible rock-fall protection system for energy impacts up to 1500kJ. The rock-fall protection kit TS-1500-ZD is characterised by ground plates which are fixed to the underground by two anchors per plate. The posts are connected to the ground plates by tumbler bearings and they are held in position by uphill retaining cables at their top. The interception structure of the tested rock-fall protection kit comprises an OMEGA-net. An additional layer was not implemented at the test. The upper and lower longitudinal bearing ropes are arranged as single ropes and connected to the side foundations using energy dissipating devices. The system is supported by two integrated longitudinal ropes, which are connected to the side foundations using two energy dissipating devices per connection. The uphill retaining cables are also connected to their foundations by energy dissipating devices.

Main components of rock-fall protection kit TS-1500-ZD

Interception structure

PRIMARY NET

Type:	OMEGA/9,0mm/MW180
Number of net packages:	6
Dimensions of single net package:	3,35m x 5,00m
Connection to bearing ropes:	threaded
Connection to side posts:	rope 12 vz 6x19 DIN 3060 (DIN EN 12385-4) SE sZ 1.770 N/mm² (RBL: 106kN)
Connection between net packages:	by 7/16 inch shackles (22 per face)

The system was tested without additional layer.

Support structure

POSTS WITH WELDED TOPPLATE

Type:	I-Profil DIN 1025 – IPBl 200 – S235JRG2 (HE 200 A according to EURONORM 53-62)
Material:	S235JRG2
Surface conditioning:	raw
Length:	3.140mm

GROUNDPLATE

Material:	S235JRG2
Dimensions:	790mmx250mmx20mm
Dimensions of shims:	100mmx100mmx10mm
Drill diameter:	46mm
Surface conditioning:	raw

The posts are connected to the ground plates by tumbler bearings.

Connecting components

BEARING ROPES

Upper bearing rope:	rope 22 vz 6x36 DIN 3064 (DIN EN 12385-4) SE sZ 1.770 N/mm² (RBL: 390kN)
Lower bearing rope:	rope 22 vz 6x36 DIN 3064 (DIN EN 12385-4) SE sZ 1.770 N/mm² (RBL: 390kN)

SUPPORTING ROPES

Upper supporting rope:	rope 20 vz 6x19 DIN 3060 (DIN EN 12385-4) SE sZ 1.770 N/mm² (RBL: 293kN)
Lower supporting rope:	rope 20 vz 6x19 DIN 3060 (DIN EN 12385-4) SE sZ 1.770 N/mm² (RBL: 293kN)

RETAINING AND SIDE ROPES

Side cables:	rope 16 vz 6x19 DIN 3060 (DIN EN 12385-4) SE sZ 1.770 N/mm² (RBL: 188kN)
Uphill retaining ropes:	rope 22 vz 6x36 DIN 3064 (DIN EN 12385-4) SE sZ 1.770 N/mm² (RBL: 390kN)

Energy dissipating devices

ENERGY DISSIPATING DEVICES IN BEARING ROPES

Type:	AVT phx/FLA30x80/2,5W
Material:	St 37-2
Diameter:	250 mm
Position:	at he right and left foundations
Connection to rope:	1 inch shackle
Connection to anchor:	1 inch shackle
Number/Surface conditioning:	1 element per connection/raw

ENERGY DISSIPATING DEVICES IN SUPPORTING ROPES

Type:	AVT phx/FLA30x60/4,5W
Material:	St 37-2
Diameter:	200 mm
Position:	at he right and left foundations
Connection to rope:	7/8 inch shackle
Connection to anchor:	7/8 inch shackle
Number/Surface conditioning:	2 elements per connection/1 x raw, 1 x zinc coated

ENERGY DISSIPATING DEVICES IN UPHILL RETAINING CABLES

Type:	AVT phx/FLA25x60/1,5W
Material:	St 37-2
Diameter:	200 mm
Position:	at uphill anchors
Connection to rope:	7/8 inch shackle
Connection to anchor:	7/8 inch shackle
Number/Surface conditioning:	1 element per connection/raw

Summary of test results

The tested rock-fall protection kit TS-1500-ZD of TRUMER SCHUTZBAUTEN GMBH was hit by a block of reinforced concrete with a mass of 3.900kg and a velocity of 29,24m/s. The impact was placed in a height of 1,67m. The angle of block trajectory was determined with 30,87°. The impact energy was determined with 1.667kJ. The maximum horizontal system elongation was 6,18m. The block was stopped and caught by the rock-fall protection kit and did not touch the ground during the test until the system reached the maximum elongation. The whole impact energy was absorbed by the tested rock-fall protection kit. The energy impact did not cause visible damages of main components, but a few wires of the lower longitudinal bearing ropes were ruptured at the guiding devices of the inner post. In the place of impact the primary net was deformed irreversibly. The energy dissipating devices in the longitudinal bearing and supporting ropes were stretched, but still showed plenty of deformation capacity remaining after the test. The deformation capacities of energy dissipating devices in the uphill retaining cables of the middle functional module were almost exhausted. As a consequence of the impact the nominal height of the rock-fall protection kit was reduced from 3,036m to 1,950m, which means a residual height of the tested system of 63,90% of its nominal height.

Affirmation of test report no. 0306

The chair of Mining Engineering and Mineral Economics at the University of Leoben confirms that test report no. 0306 about the testing of rock-fall protection kit TS-1500-ZD is correct in respect of content and matter of fact.

The rock-fall protection kit TS-1500-ZD of Trumer Schutzbauten GmbH was tested according to the future "Guideline For European Technical Approval of Falling Rock Protection Kits" and **has passed the Maximum Energy Level (MEL) test.**

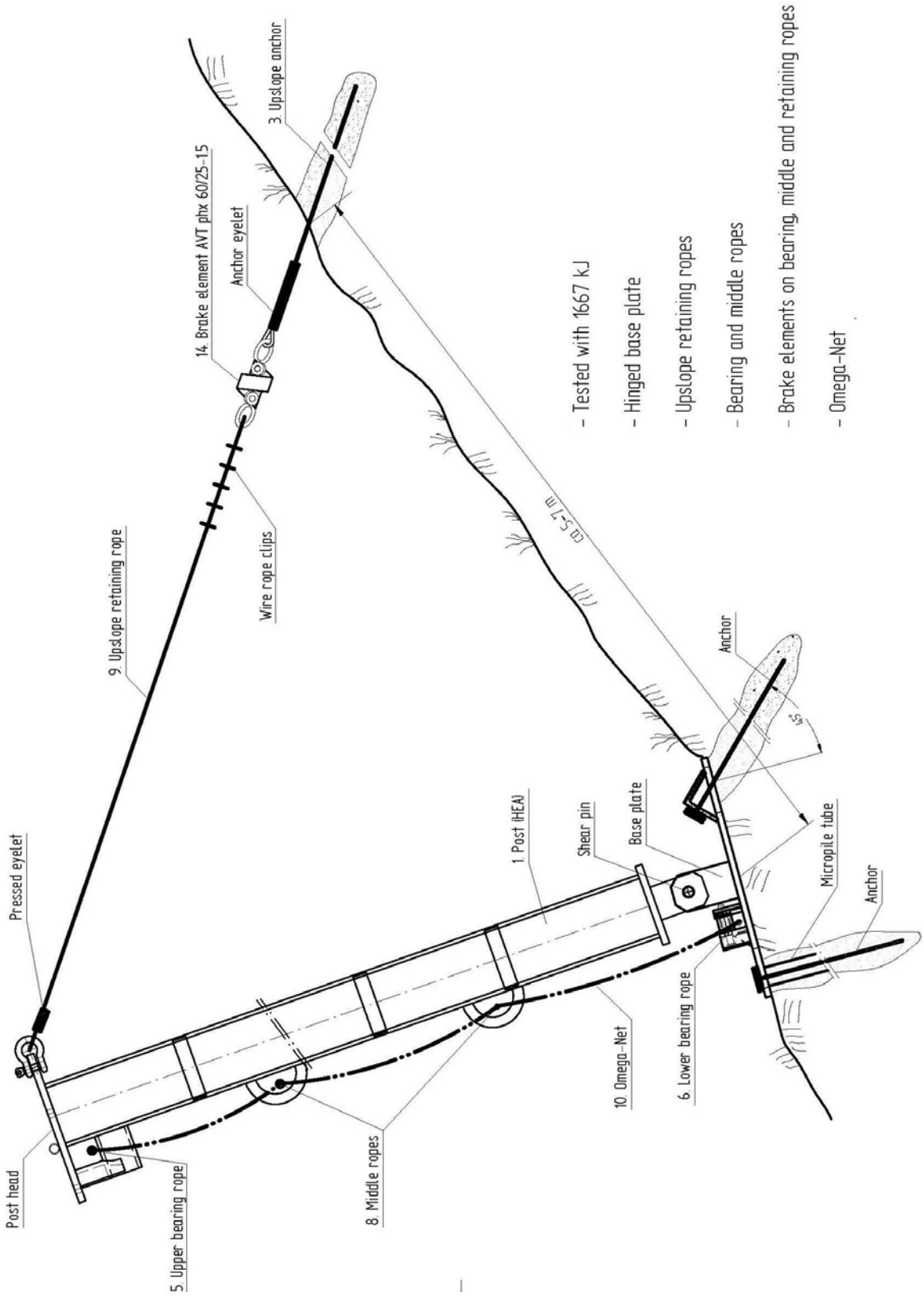
According to the test criterion "residual height" the system is classified as **System of Category A** (residual height > 50% nominal height).

Leoben, the 05/12/2006

(Dipl.-Ing. Christian Heiss)

(Ao.Univ.-Prof. Dipl.-Ing. Dr.mont. Peter Moser)

Rockfall Protection System TS-1500 · Lateral View



Rockfall Protection System TS-1500 · Plan View