

Report No. 080/01



Principal: Schroff GmbH
Langenalber Str. 96-100
D-75334 Straubenhardt

Inspection order: Mechanical charges, climate tests

Tested Item: Outdoor Cabinet 2000x700x700mm

Test item identification: Cabinet No.1 14990/037 (Vibration and Shocktest, loaded with 150kg)
Cabinet No.2 14990/037/10 (Seismic Test, 250kg)
Cabinet No.3 14990/037/20 (Temperature and climate tests, yellow-chromated frame)
Cabinet No.4 14990/037/30 (Temperature and climate tests, basic frame)

Location of inspection: TELUS - Testlabor für Umweltsimulation GmbH
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Accredited laboratory by
DAP Deutsches Akkreditierungssystem Prüfwesen

The accreditation is valid for the listed test methods
on the certificate



Date of receipt of tested item: 21th March 2002

Inspection periode: 21th March - 6th April 2002

Customer specification: IEC 61969-3 class 1

Test method: IEC 68-2-6, IEC-2-27; IEC 68-2-32; IEC 68-2-57;
IEC 68-2-1, IEC 68-2-2, B; IEC-68-2-14, Nb; IEC 68-2-56, Cb; IEC 68-2-30, Db

Conducted test: Vibration sinusoidal, half sinusoidal mech. shock, free fall, Seismic
Low temperature, dry heat, temperature changes, constant humidity, cyclic humidity

Participant: Mr. Reiser, Mr. Fischer (Company Schroff, temporarily)

Comments: Visual examinations were made between the different tests.
Result: No visible damage detectable

Editor

Date 9th April 2002

Signature

Rainer Riek

Editor

Date 9th April 2002

Signature

Rudolf Riek

Manager of the laboratory

Date 10th April 2002

Signature

Hartmut Krewel, Dipl. Ing. (FH)



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Enclosed:

Measurement notes (Vibration)
Measurement notes (Temperature / climate)

Enclosed 1 to 11
Enclosed 12 to 16

The test results refer exclusively to the mentioned examined objects. Reproduction in extracts only in accordance with the laboratory.



1 Test assembly and axial definition

1.1 Used test machines and test equipment

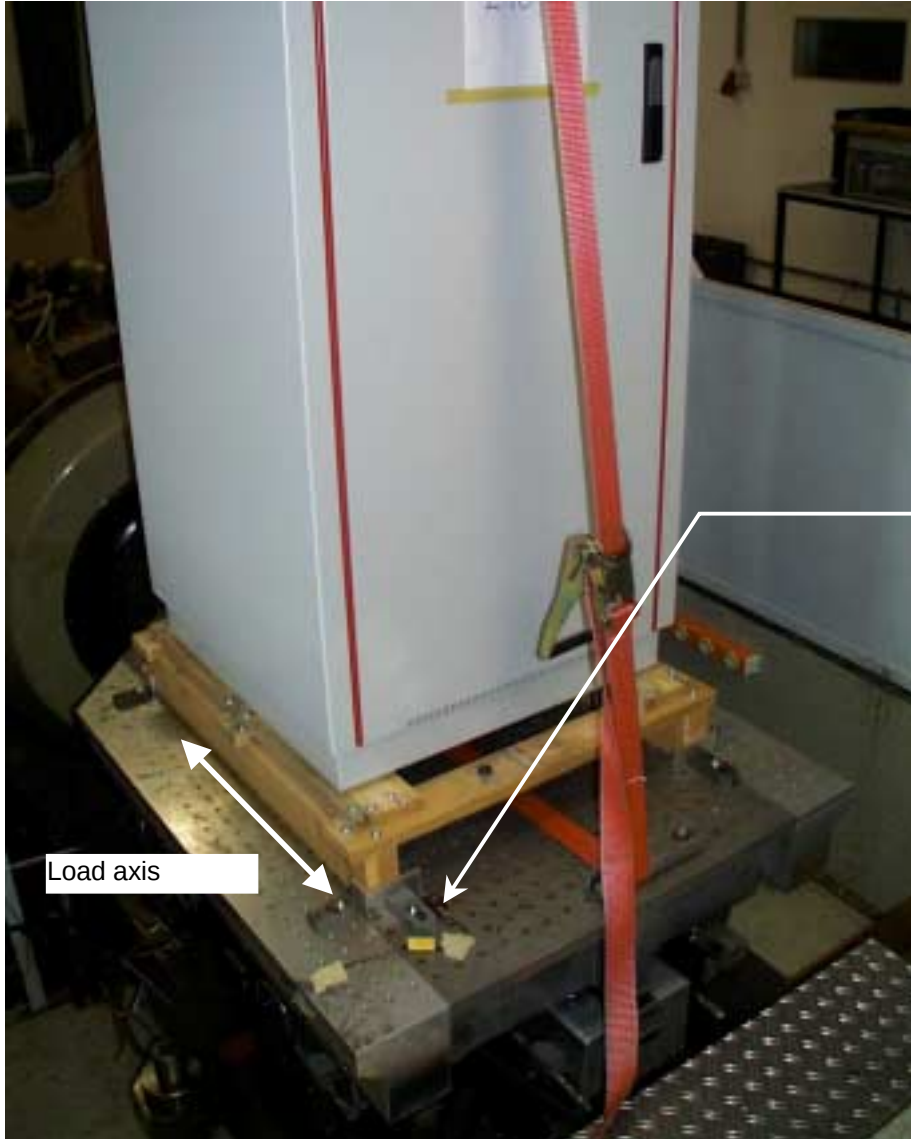
Description	Manufacturer/Type	Ser.No.:	Calibration valid until	Maintenance cycle
Vibrator	Derritron VP2500	11		
Charge amplifier 4 times Nexus	Brüel & Kjær 2692 0S4	2078868	Feb 03	12 Mon
Accelerometer	Endevco 2224C	14238	Feb 03	12 Mon
Vibration control system 1	Mahrenholtz & Partner	3415G16192	Oct 02	12 Mon
Navigable climate test chamber	Weiss 2x23,5/60 DU	4725	Nov 02	12 Mon
Data logging system	FLUKE 2400B	4310002	Jan 03	12 Mon

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1.2 Test assembly and axial definition

1.2.1 Test assembly Vibration sinusoidal , X axis

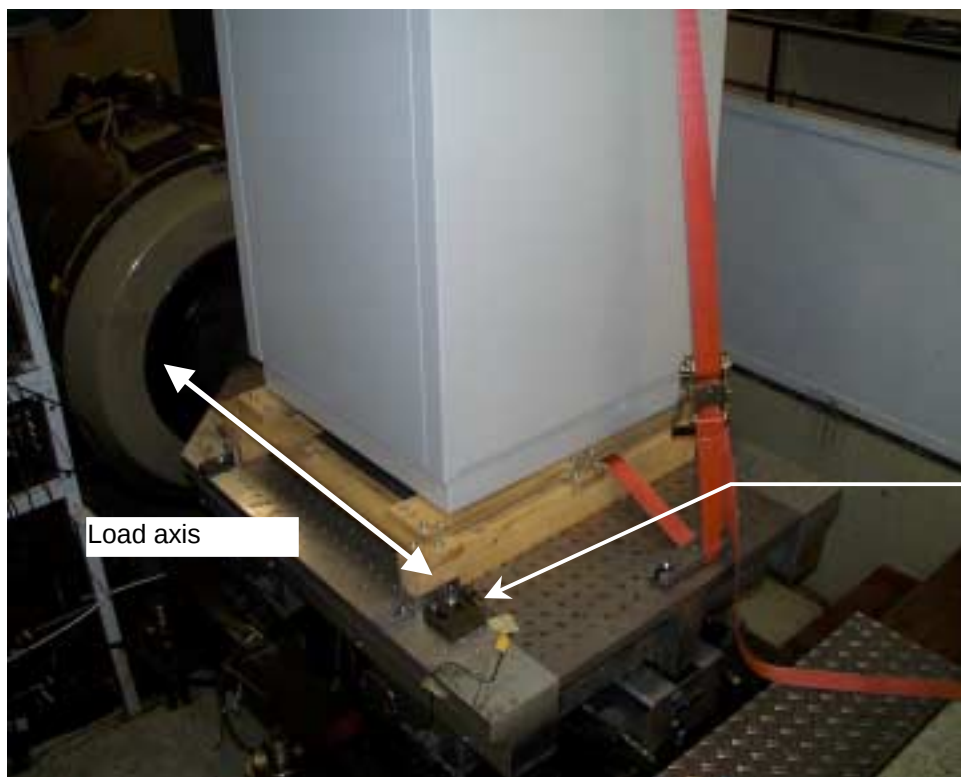


Picture 1

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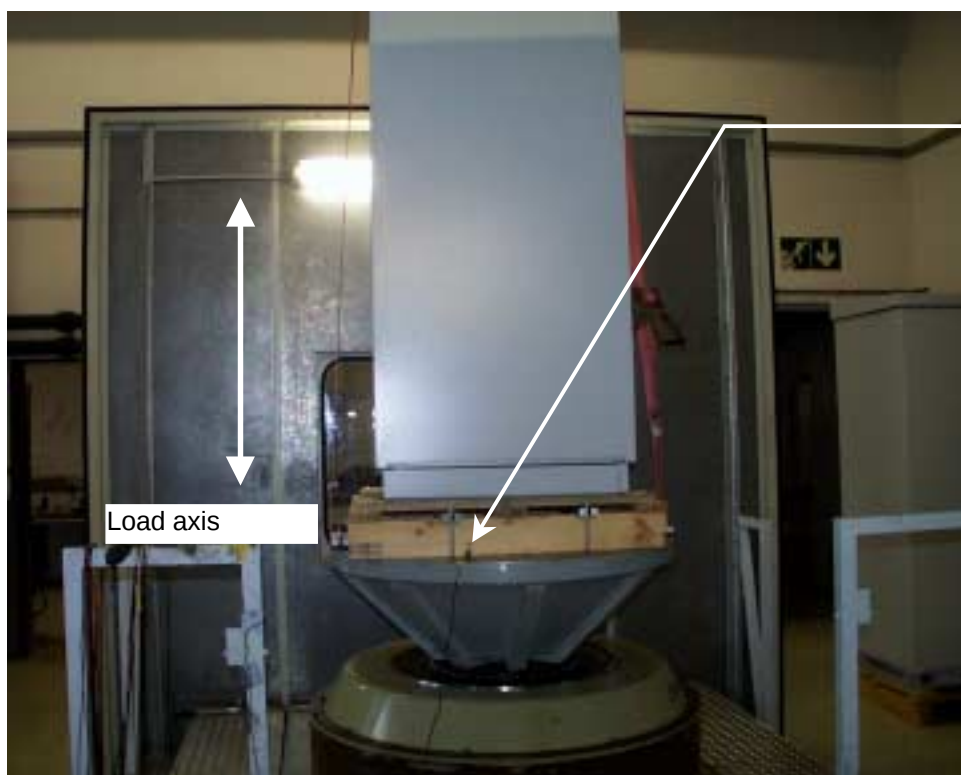
1.2.2 Test assembly Vibration sinusoidal , Y axis



Control sensor

Picture 2

1.2.3 Test assembly Vibration sinusoidal , Z axis



Control sensor

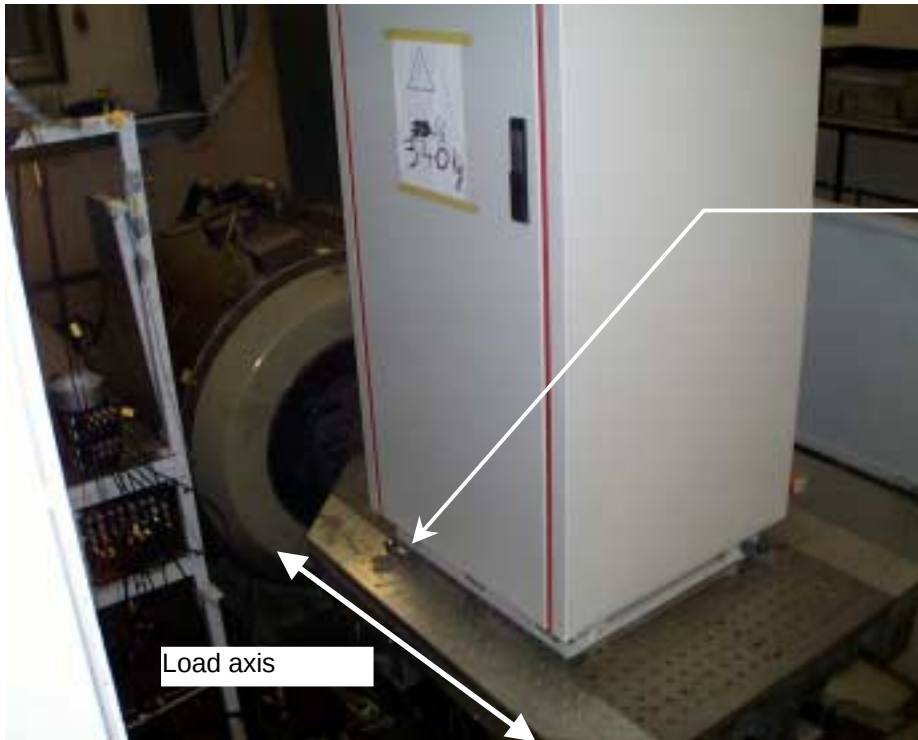
Picture 3

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1.2.4 Test assembly Seismic Test

The examined object was mounted on the shake table with 4 screws through the base plate. The simulation was effected in all 3 axis with the axis definition similar to the vibration test. (Picture 1-3)



Picture 4

1.2.5 Test assembly Free fall



Picture 5

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1.3 Internal mounting of the cabinets

1.3.1 Cabinet 1 (Shock and Vibration)



5 x 10kg mounted at top

100 kg mounted at bottom

Picture 6

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1.3.2 Cabinet 2 (Seismic Test)

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4 x 25kg mounted at top

60kg mounted on vertical
uprights

90kg mounted at bottom

Picture 7



1.4 Test assembly Temperature / Climate Test



Picture 8

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2 Description of the tests

2.1 Mechanical tests

2.1.1 Vibration - sinusoidal (IEC 68-2-6)

Frequency range:	5 – 500 Hz	
Constant amplitude:	10-8,5 Hz	3,5 mm
Constant acceleration amplitude:	10-200Hz	10 m/s ²
	200-500Hz	20 m/s ²
Level of deviation:	± 1,5 dB	
Duration of mechanical stress:	10 cycles (5..500..5Hz) per axis	
Mechanically loaded axes:	all 3 axes (x,y,z)	
Control strategy:	1 control recorder	
Environmental conditions:	room temperature 15..35°C	

2.1.2 Mechanical Shock (IEC 68-2-27)

Shock form:	half sinus
Maximum acceleration:	100 m/s ²
Duration of shock:	11 ms
Number of shocks:	3 impulses
Direction of impulse:	vertical

2.1.3 Seismic-Test (time response procedure to IEC 68-2-57)

Duration:	2 s	
Limit of acceleration:	5 m/s ²	
Lower frequency f_1 :	5 Hz * (Table 1)	
Higher frequency f_2 :	35 Hz (Table 2)	
Definition of frequency spectrum (Category 1):	to $2*f_1$	12 dB rising
	$2*f_1$ to $1/3*f_2$	5*5 m/s ² for 2% suppression
	from $1/3*f_2$ to $2/3*f_2$	dropping to 5 m/s ²
	from $2/3*f_2$ to f_2	5 m/s ²
Tested axes:	all 3 axes (x,y,z)	
Number of test cycles:	15 (30s total test) per axis	
*) lowest frequency of the swing test equipment		

2.1.4 Freefall (IEC 68-2-52 Ed)

Height of fall:	25 cm
Direction of fall:	vertical
Surface:	concrete
Number of falls:	1

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2.2 Temperature and climate tests

2.2.1 Constant cold (IEC 68-2-1, A)

Temperature : -45°C

Duration : 16 hours

2.2.2 Dry heat (IEC 68-2-2, B)

Temperature : +80°C

Duration : 16 hours

2.2.3 Temperature change (IEC 68-2-14, Nb)

Lowest temperature : -50°C, 3h

Highest temperature : +23°C, 3h

Speed of temperature change : 0,5k /min

Number of cycles : 3

2.2.4 Humid heat, constant (IEC 68-2-56, Cb)

Temperature : +30°C

Relative air humidity: 93 %

2.2.5 Humid air, cyclic (IEC 68-2-30, Db)

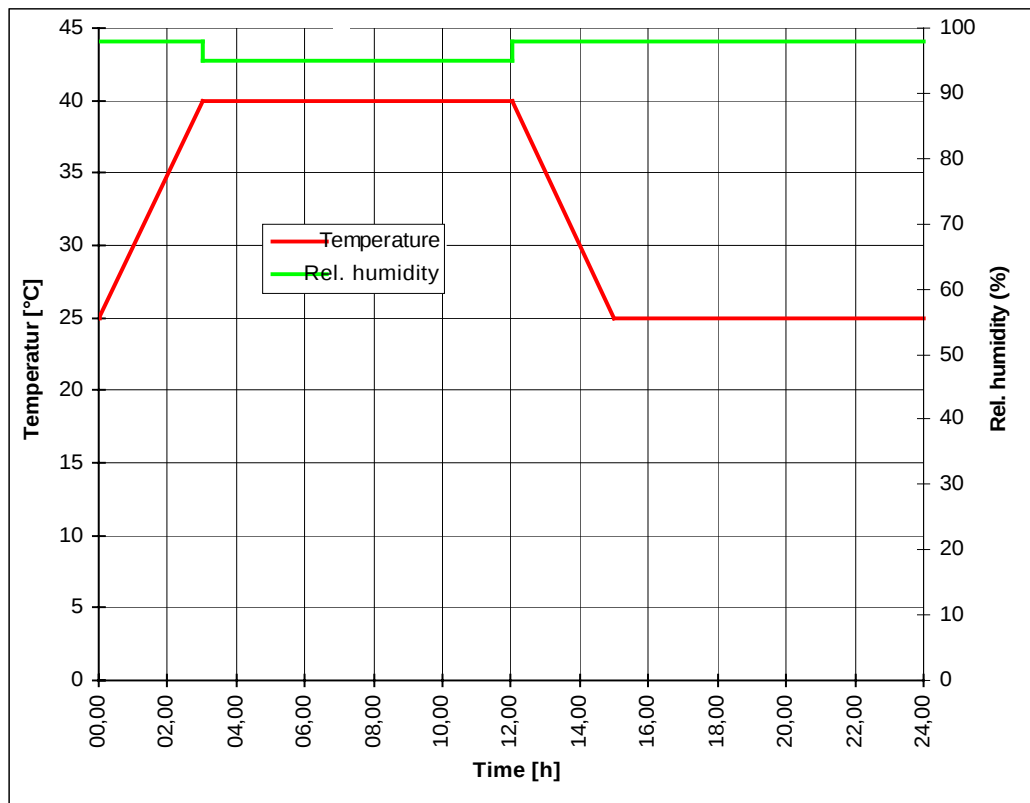


Diagram 1

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3 Test Procedure

Test	Ref.	Axis/Set-up	Type of Strain / Remarks	Time / Doc.
				21st March 2002
Schrank Nr. 1 14990/037				
# 1	2.1	X axis (Picture 1)	Vibration - sinusoidal, 10 cycles Acceleration procedure control channel	2:23:41 h Enclosure 1
Visual control inside and out <u>Result:</u> No damage detectable				
# 2	2.1	Y axis (Picture 2)	Vibration - sinusoidal, 10 cycles Acceleration procedure control channel	2:23:41 h Enclosure 2
Visual control inside and out <u>Result:</u> No damage detectable				
				22th March 2002
# 3	2.1	Z axis (Picture 3)	Vibration - sinusoidal, 10 cycles Acceleration procedure control channel	2:23:41 h Enclosure 3
Visual control inside and out <u>Result:</u> No damage detectable				
# 4	2.2	Z axis (Picture 3)	Mechanical Shock Acceleration procedure control channel + direction Acceleration procedure control channel + direction <u>Remark:</u> Due to extremely strong reaction of the tested item, the tolerances of the IEC 68-2-27 could not be adhered to.	2:23:41 h Enclosure 4 Enclosure 5
Visual control inside and out <u>Result:</u> No damage detectable				
# 5	2.4	vertical (Picture 5)	Free fall	1 fall
Visual control inside and out <u>Result:</u> No damage detectable				
Schrank Nr. 2 14990/038				
# 6	2.3	Z axis (Pictures 4+3)	Seismic test, duration of time Acceleration procedure control channel, time signal Acceleration procedure control channel, amplitude spectrum	15 shocks, 30 s in total Enclosure 6 Enclosure 7
Visual control inside and out <u>Result:</u> No damage detectable				
# 7	2.3	Y axis (Pictures 4+2)	Seismic test, duration of time Acceleration procedure control channel Acceleration procedure control channel, amplitude spectrum	15 shocks, 30 s in total Enclosure 8 Enclosure 9
Visual control inside and out <u>Result:</u> No damage detectable				
# 8	2.3	X axis Pictures 4+1)	Seismic test, duration of time Acceleration procedure control channel Acceleration procedure control channel, amplitude spectrum	15 shocks, 30 s in total Enclosure 10 Enclosure 11
Visual control inside and out <u>Result:</u> No damage detectable				

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Test Procedure (continuation)

Test	Ref.	Axis/Set-up	Type of Strain / Remarks	Time / Doc.
Cabinet No.3 14990/037/20 (frame yellow chromated) Cabinet No.4 14990/037/30 (basic frame)				
# 9	2.21	Picture 8	Constant cold - 45°C, 16h Temperature progressing Visual control inside and out <u>Result:</u> No damage detectable	22nd - 23rd March 2002 Enclosure 12
# 10	2.22	Picture 8	Dry heat +80°C, 16h Temperature progressing Visual control inside and out <u>Result:</u> No damage detectable	23rd March 2002 Enclosure 13
# 11	2.23	Picture 8	Temperature change -50°C / +23°C, 2 cycles Temperature progressing Visual control inside and out <u>Result:</u> No damage detectable	25th to 26th March 2002 Enclosure 14
# 12	2.24	Picture 8	Humid heat, constant Temperature progressing Remark : The relative humidity was controlled with the temperature of the water bath and was checked manually with a humidity psychrometer. Visual control inside and out <u>Result:</u> No damage detectable	26th to 30th March 2002 Enclosure 15
# 13	2.25	Picture 8	Humid heat, cyclic Temperature progressing Remark : The relative humidity was controlled with the temperature of the water bath and was checked manually with a humidity psychrometer. Visual control inside and out <u>Result:</u> No damage detectable	2nd to 6th April 2002 Enclosure 16

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