



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
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Manager of the laboratory
Date 10th April 2002
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The test results refer exclusively to the mentioned examined objects. Reproduction in extracts only in accordance with the laboratory.

Enclosed:

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

Enclosed 1 to 11
Enclosed 12 to 16



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	Bruel & Kjaer 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



Control sensor

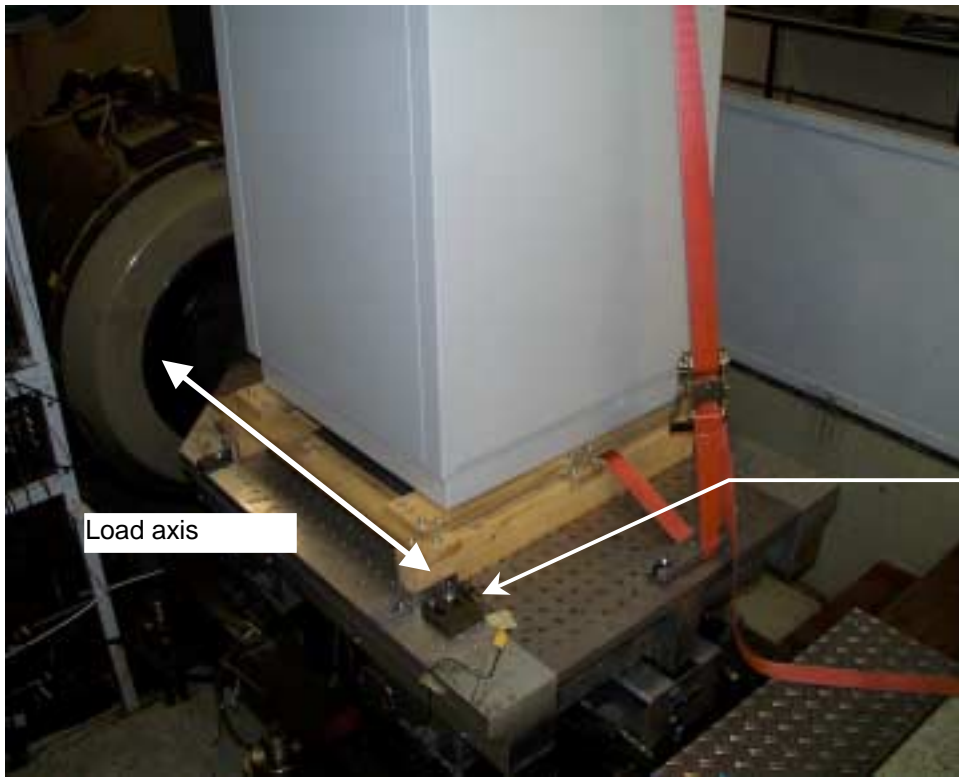
Load axis

Picture 1

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1.2.2 Test assembly Vibration sinusoidal , Y axis

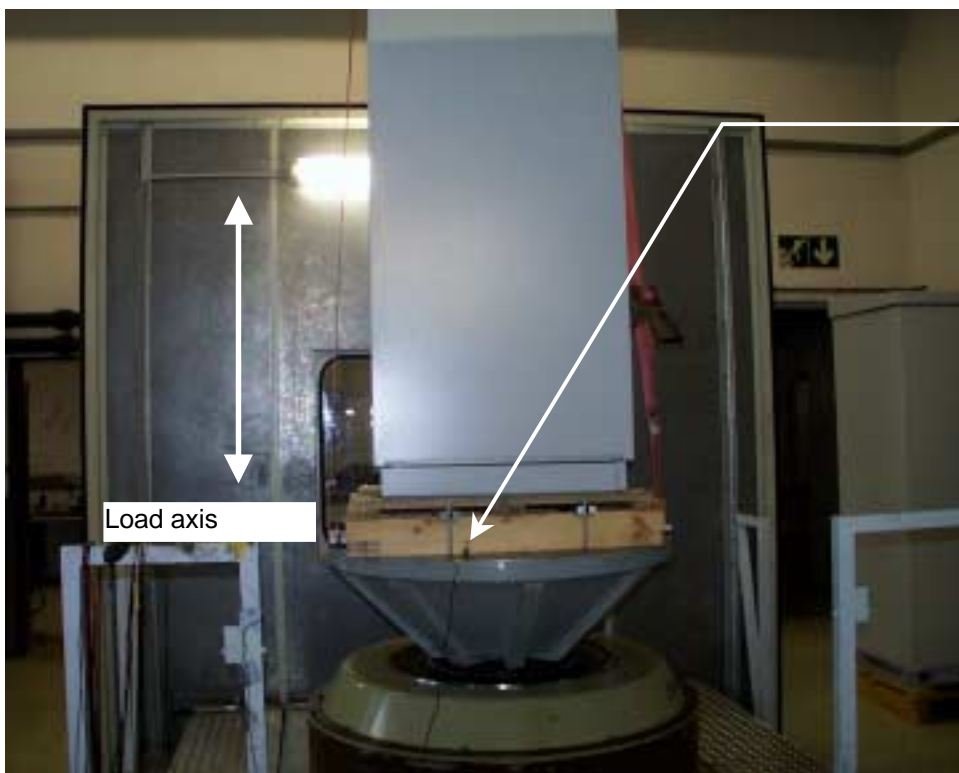


Control sensor

Load axis

Picture 2

1.2.3 Test assembly Vibration sinusoidal , Z axis



Control sensor

Load axis

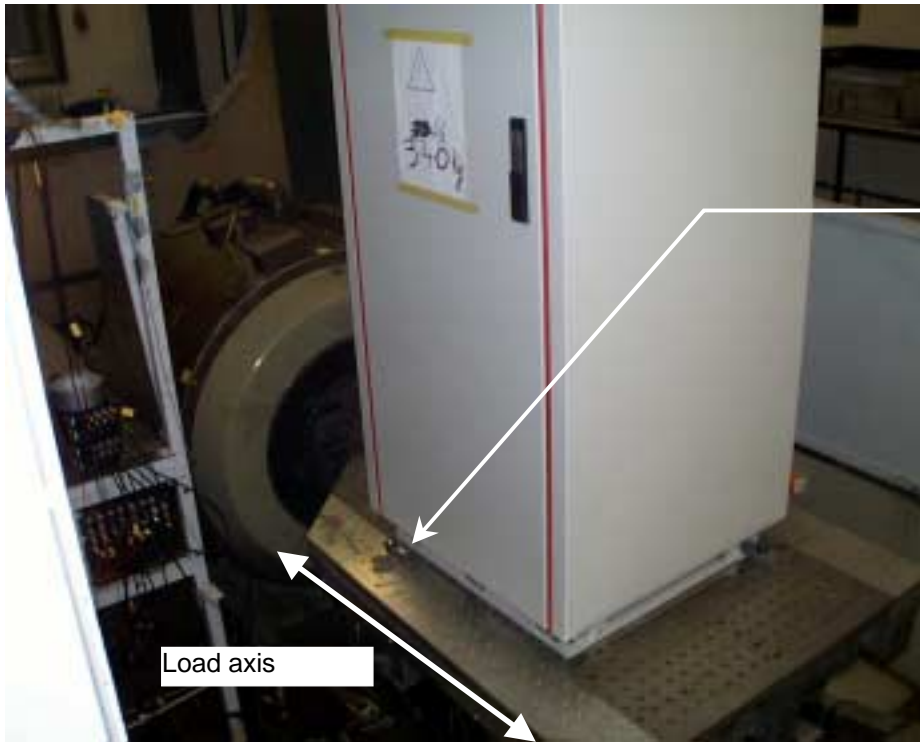
Picture 3

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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)



Control sensor

Load axis

Picture 4

1.2.5 Test assembly Free fall



25 cm

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

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Picture 8



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)

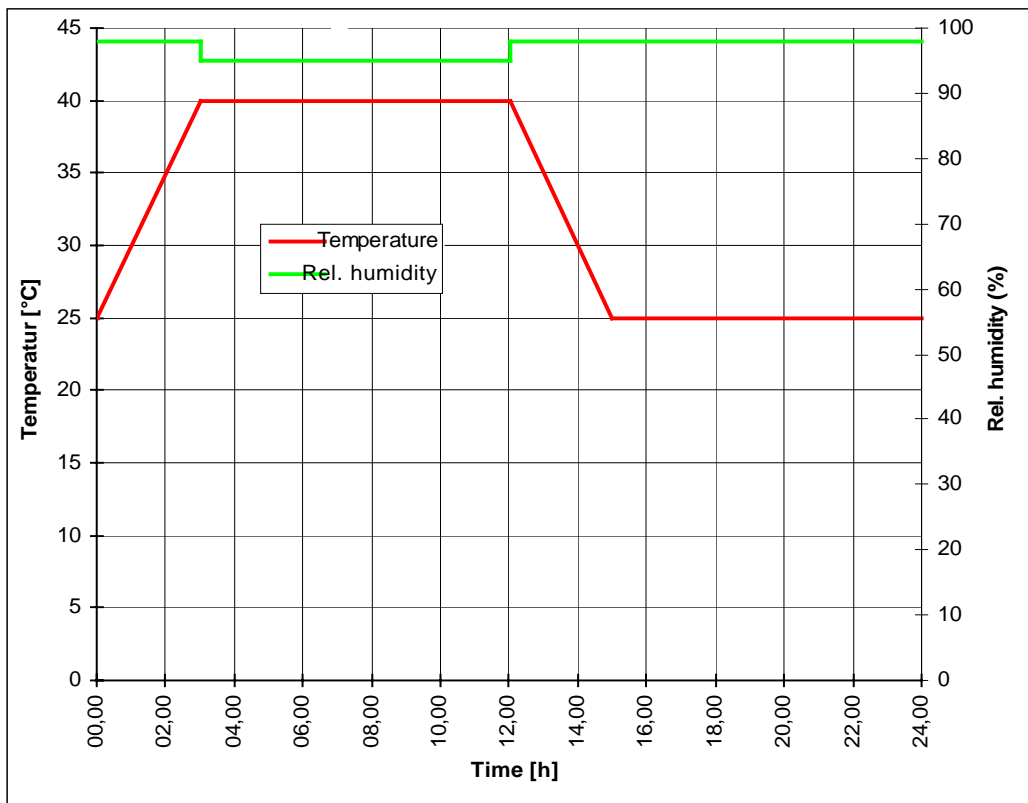


Diagram 1

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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: No damage detectable</u>
# 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: No damage detectable</u>
				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: No damage detectable</u>
# 4	2.2	Z axis (Picture 3)	Mechanical Shock Acceleration procedure control channel + direction Acceleration procedure control channel + direction <u>Remark: Due to extremely strong reaction of the tested item, the tolerances of the IEC 68-2-27 could not be adhered to.</u>	2:23:41 h Enclosure 4 Enclosure 5
				Visual control inside and out <u>Result: No damage detectable</u>
# 5	2.4	vertical (Picture 5)	Free fall	1 fall
				Visual control inside and out <u>Result: No damage detectable</u>
				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: No damage detectable</u>
# 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: No damage detectable</u>
# 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: No damage detectable</u>

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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: No damage detectable</u>	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: No damage detectable</u>	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: No damage detectable</u>	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: No damage detectable</u>	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: No damage detectable</u>	2nd to 6th April 2002 Enclosure 16

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