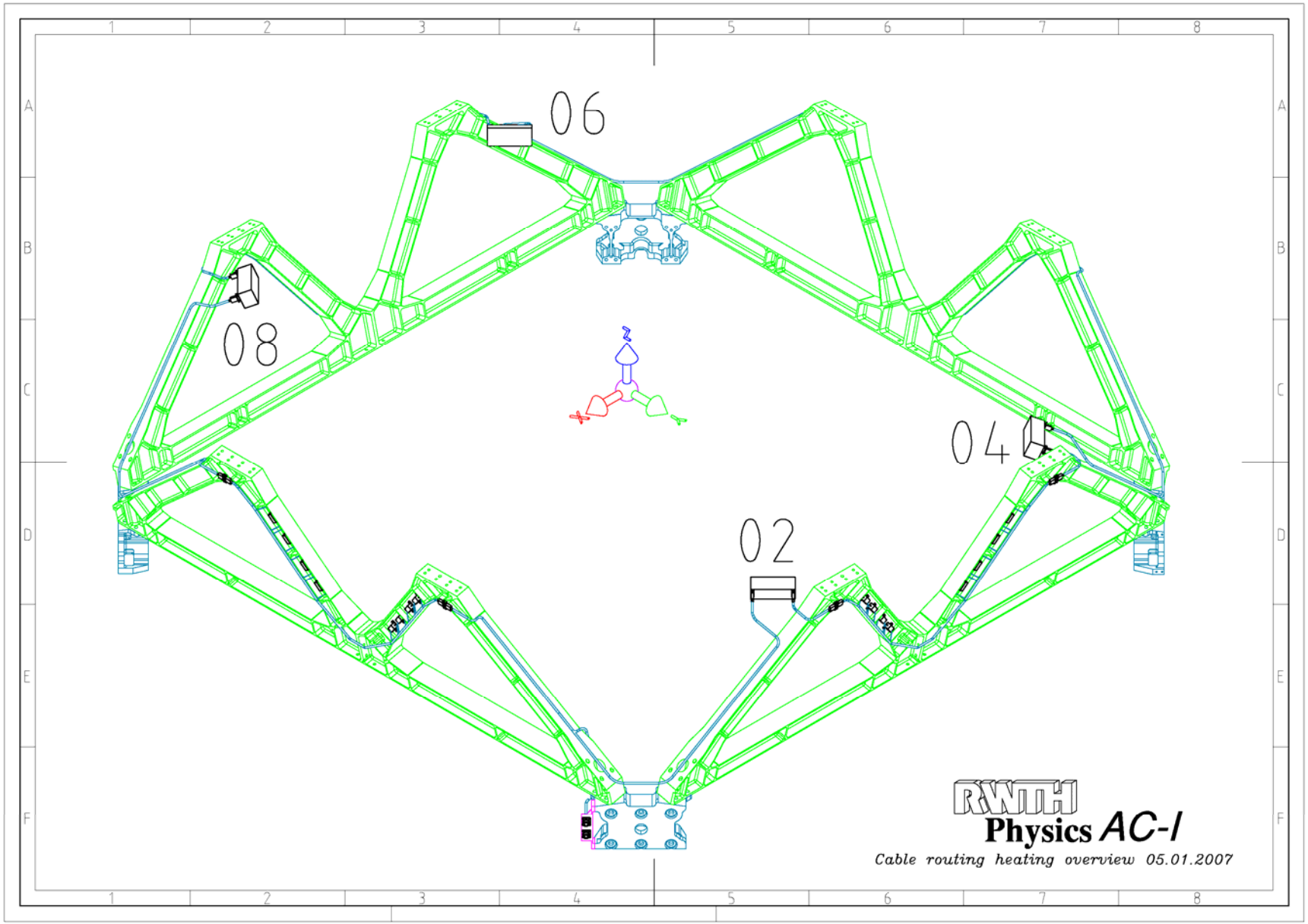
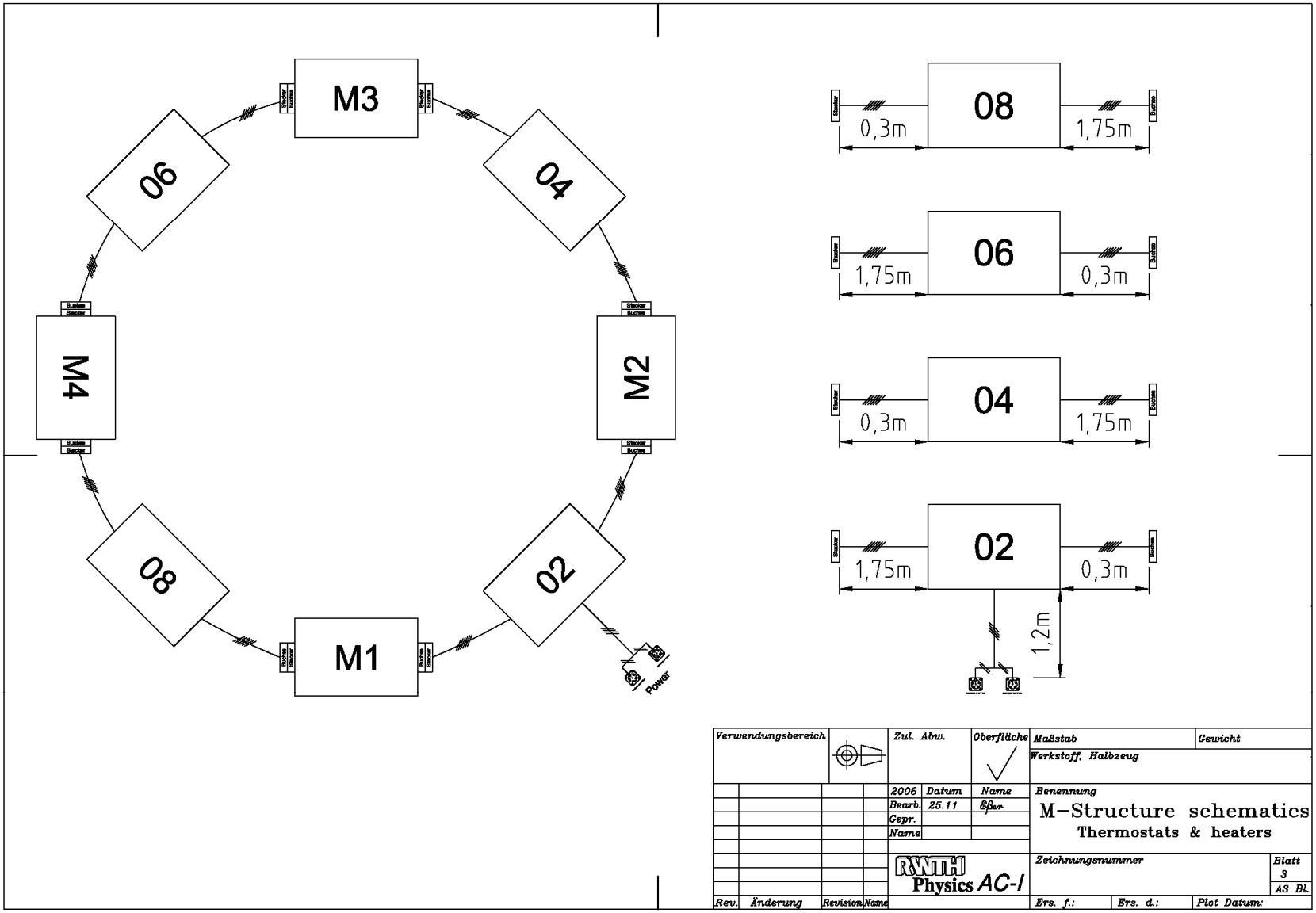
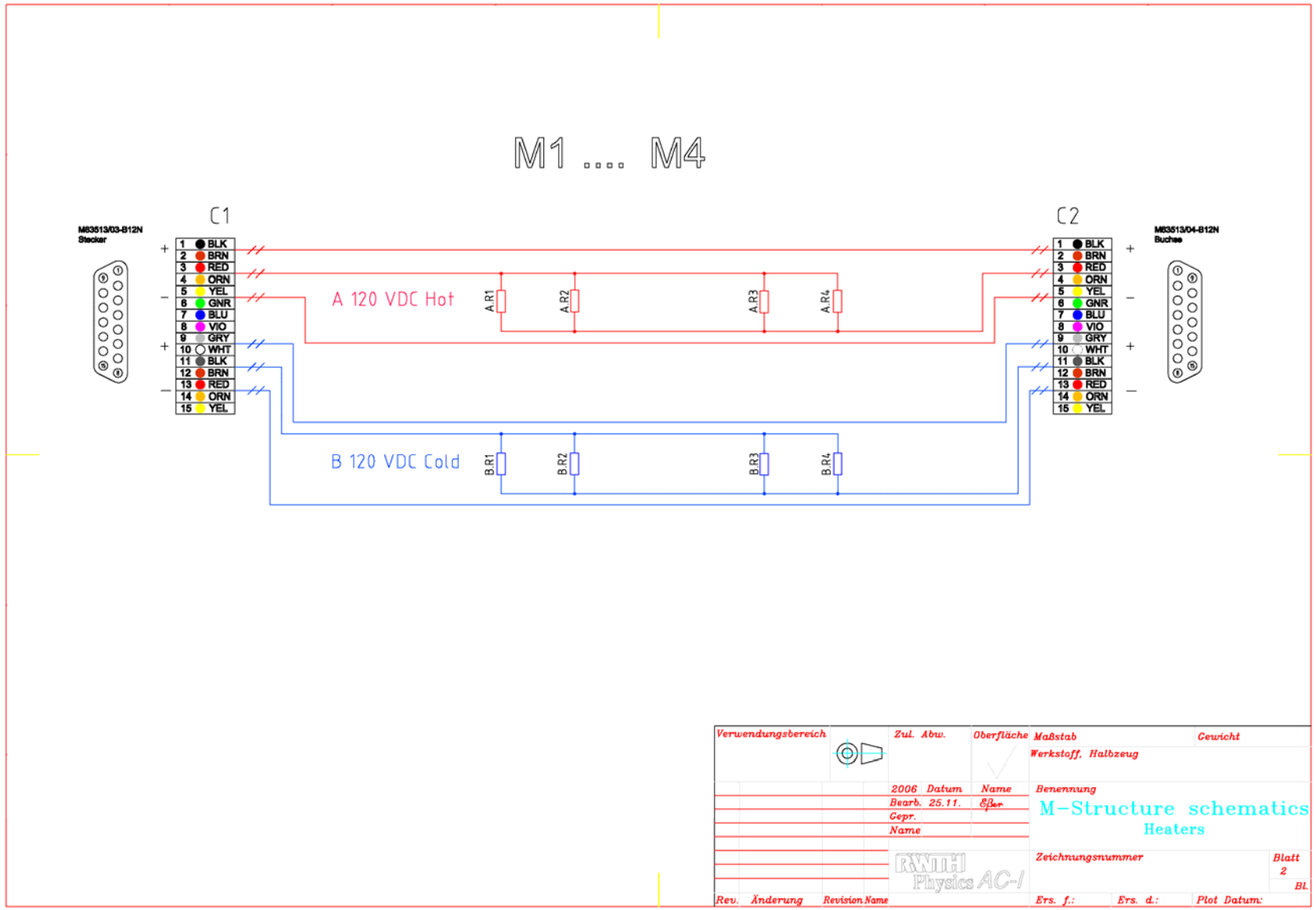
AMS-02: TRDTN7
Octagon M-Structure

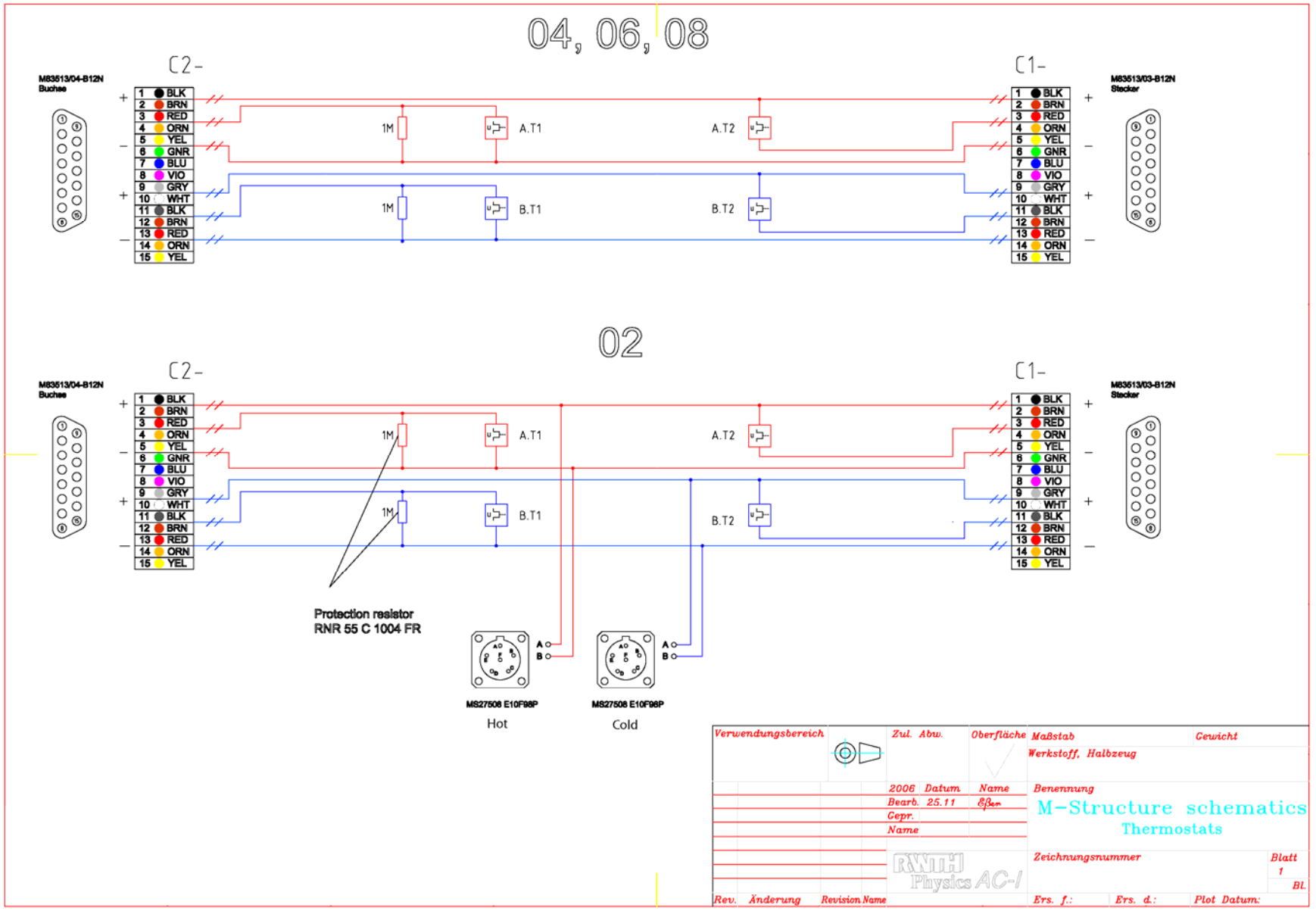
Author: Th. Kirn, Ch. Chung, K. Lübelsmeyer, A. Schultz v. Dratzig
I. Phys. Institute B, RWTH Aachen
Aachen, 13th January 2009

TRD M-Structure Heating

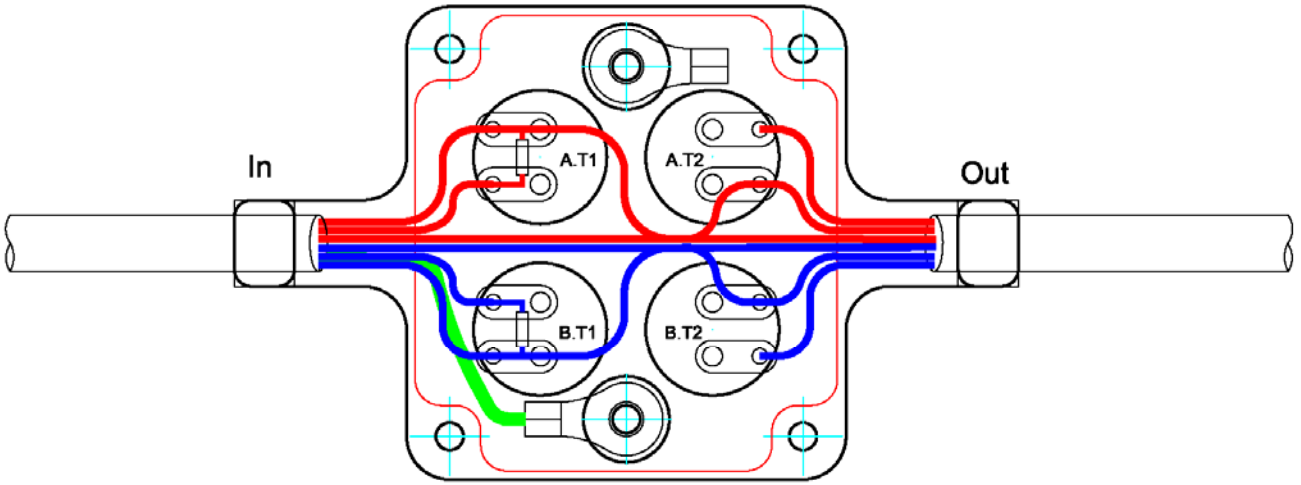

06
08
04
02
RWTH
Physics AC-I
Cable routing heating overview 05.01.2007


M3
04
M2
02
M1
08
M4
06
Power
08
0,3m
1,75m
06
1,75m
0,3m
04
0,3m
1,75m
02
1,75m
0,3m
1,2m
Verwendungsbereich
Zul. Abw.
Oberfläche
Maßstab
Gewicht
Werkstoff, Halbzeug
2006 Datum Name
Bearb. 25.11 Sßen
Gepr.
Name
Benennung
M-Structure schematics
Thermostats & heaters
RWTH Physics AC-I
Zeichnungsnummer
Blatt 3
A3 Bl.
Rev. Änderung Revision Name
Ers. f.:
Ers. d.:
Plot Datum:


M1 ... M4
C1
C2
M83513/03-B12N
Stecker
M83513/04-B12N
Buchse
1 BLK
2 BRN
3 RED
4 ORN
5 YEL
6 GNR
7 BLU
8 VIO
9 GRY
10 WHT
11 BLK
12 BRN
13 RED
14 ORN
15 YEL
A 120 VDC Hot
A.R1
A.R2
A.R3
A.R4
B 120 VDC Cold
B.R1
B.R2
B.R3
B.R4
Verwendungsbereich
Zul. Abw.
Oberfläche
Maßstab
Gewicht
Werkstoff, Halbzeug
2006 Datum
Name
Bearb. 25.11.
Eßer
Gepr.
Name
Benennung
M-Structure schematics
Heaters
RWTH Physics AC-I
Zeichnungsnummer
Blatt 2
Rev. Änderung
Revision Name
Ers. f.:
Ers. d.:
Plot Datum:


04, 06, 08
C2-
C1-
M83513/04-B12N
Buchse
M83513/03-B12N
Stecker
1 BLK
2 BRN
3 RED
4 ORN
5 YEL
6 GNR
7 BLU
8 VIO
9 GRY
10 WHT
11 BLK
12 BRN
13 RED
14 ORN
15 YEL
1M
A.T1
A.T2
B.T1
B.T2
02
Protection resistor
RNR 55 C 1004 FR
A
B
MS27508 E10F98P
Hot
MS27508 E10F96P
Cold
Verwendungsbereich
Zul. Abw.
Oberfläche
Maßstab
Gewicht
Werkstoff, Halbzeug
2006 Datum Name
Bearb. 25.11
Gepr.
Name
Benennung
M-Structure schematics
Thermostats
RWTH Physics AC-I
Zeichnungsnummer
Blatt 1
Rev. Änderung Revision Name
Ers. f.:
Ers. d.:
Plot Datum:

cabling of all boxes



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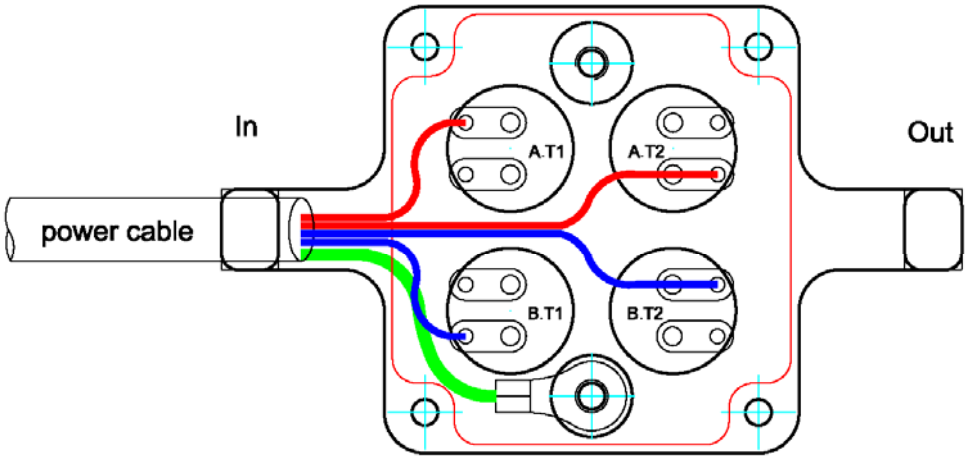
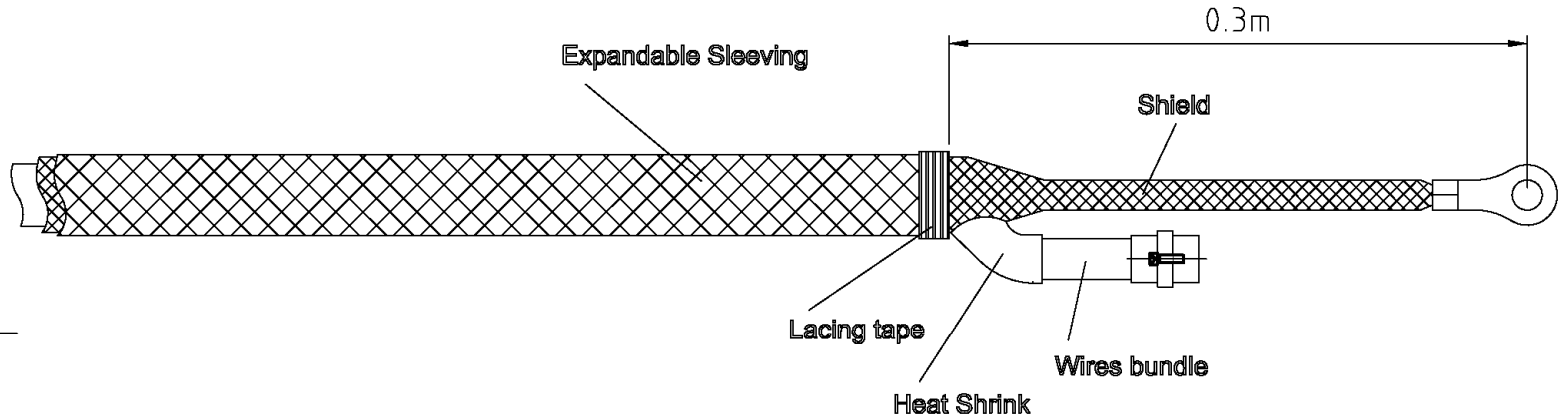
				Werkstoff, Halbzeug	
		2007 Datum	Name	Benennung	
		Bearb. 20.02	Eßer	Thermostatbox	
		Gepr.			
		Name		Zeichnungsnummer	Blatt 4
Rev. Änderung	Revision Name			Ers. f.: Ers. d.:	Plot Datum:

RWTH Physics AC-I

additional power cable box #2



Verwendungsbereich		Zul. Abw.	Oberfläche	Maßstab	Gewicht
				Werkstoff, Halbzeug	
		2007 Datum	Name	Benennung	
		Bearb. 20.02	Eßer	Thermostatbox	
		Gepr.			
		Name			
		RWTH Physics AC-I		Zeichnungsnummer	Blatt 4 BL
Rev. Änderung	Revision Name			Ers. f.:	Ers. d.: Plot Datum:



Shield	NCBRAID 1/8 1,5mm²
Expandable Sleeving	RXHT-1/4-0
Heat shrink	RW-175-1/4-X
Crimp terminal Ring	Tyco 322339, M6
Lancing Tape	Dacron MIL-T-43435B Type II Finish C
Wires bundle	M83613/04-B12N or M83613/03-B21N

Verwendungsbereich | Zul. Abw. | Oberfläche | Maßstab | Gewicht | Werkstoff, Halbzeug

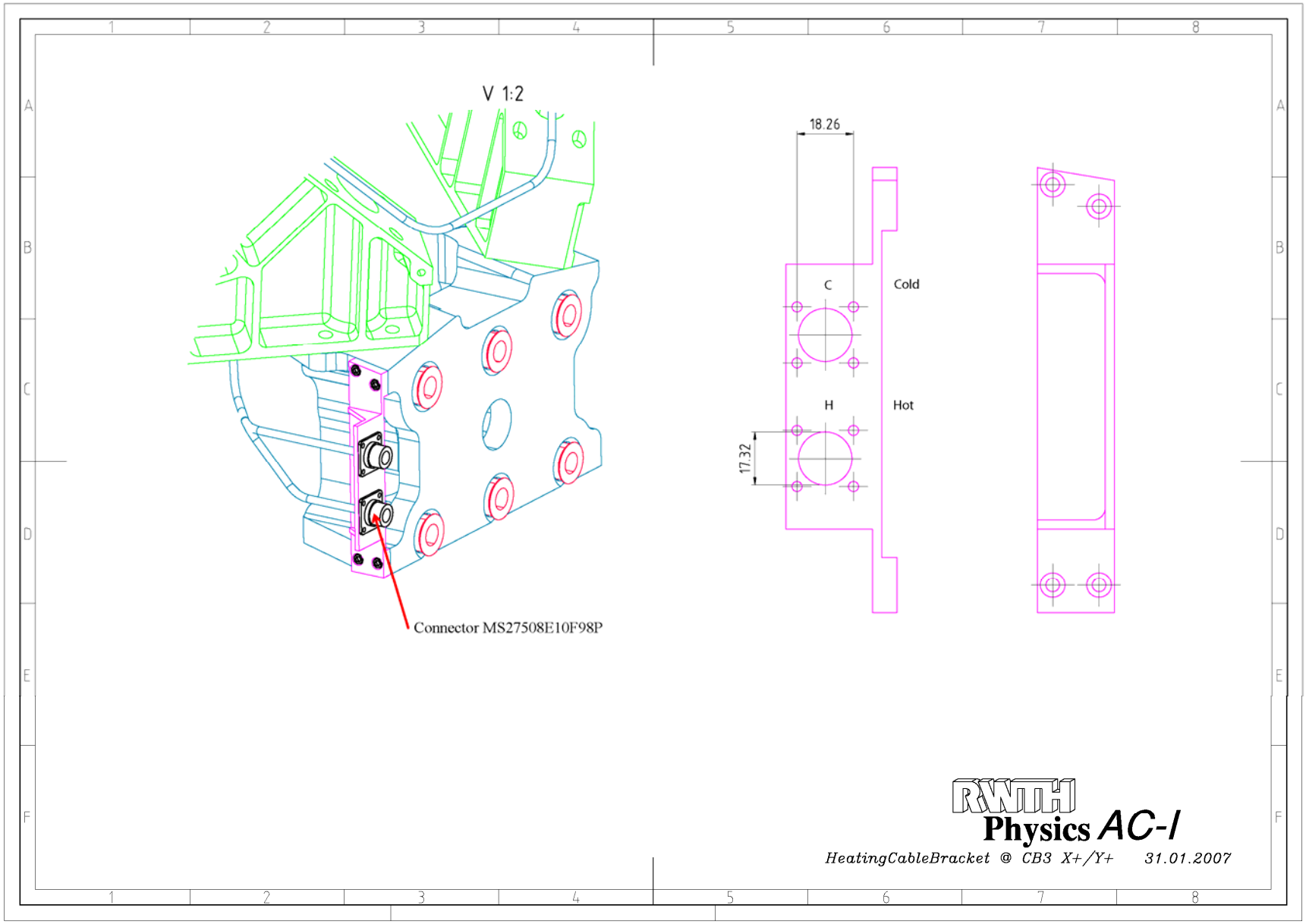
2007 Datum Name
Bearb. 12.02 Ößer
Gepr.
Name

Benennung: Heater cable

RWTH Physics AC-I

Zeichnungsnummer | Blatt 4 Bl.

Rev. Änderung Revision Name | Ers. f.: | Ers. d.: | Plot Datum:

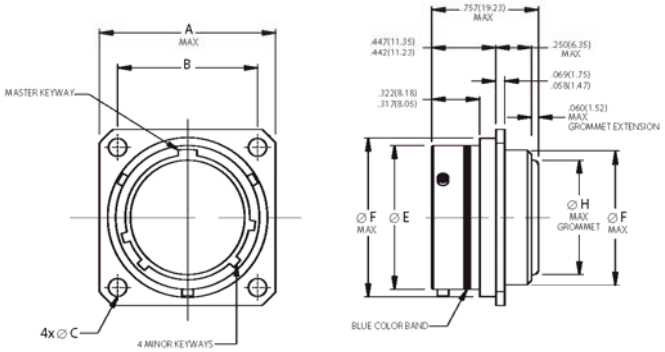

V 1:2
Connector MS27508E10F98P
18.26
C
Cold
H
Hot
17.32
RWTH
Physics AC-I
HeatingCableBracket @ CB3 X+/Y+ 31.01.2007

MS27508
Rear, Box Mounting Receptacle
AE208

conesys

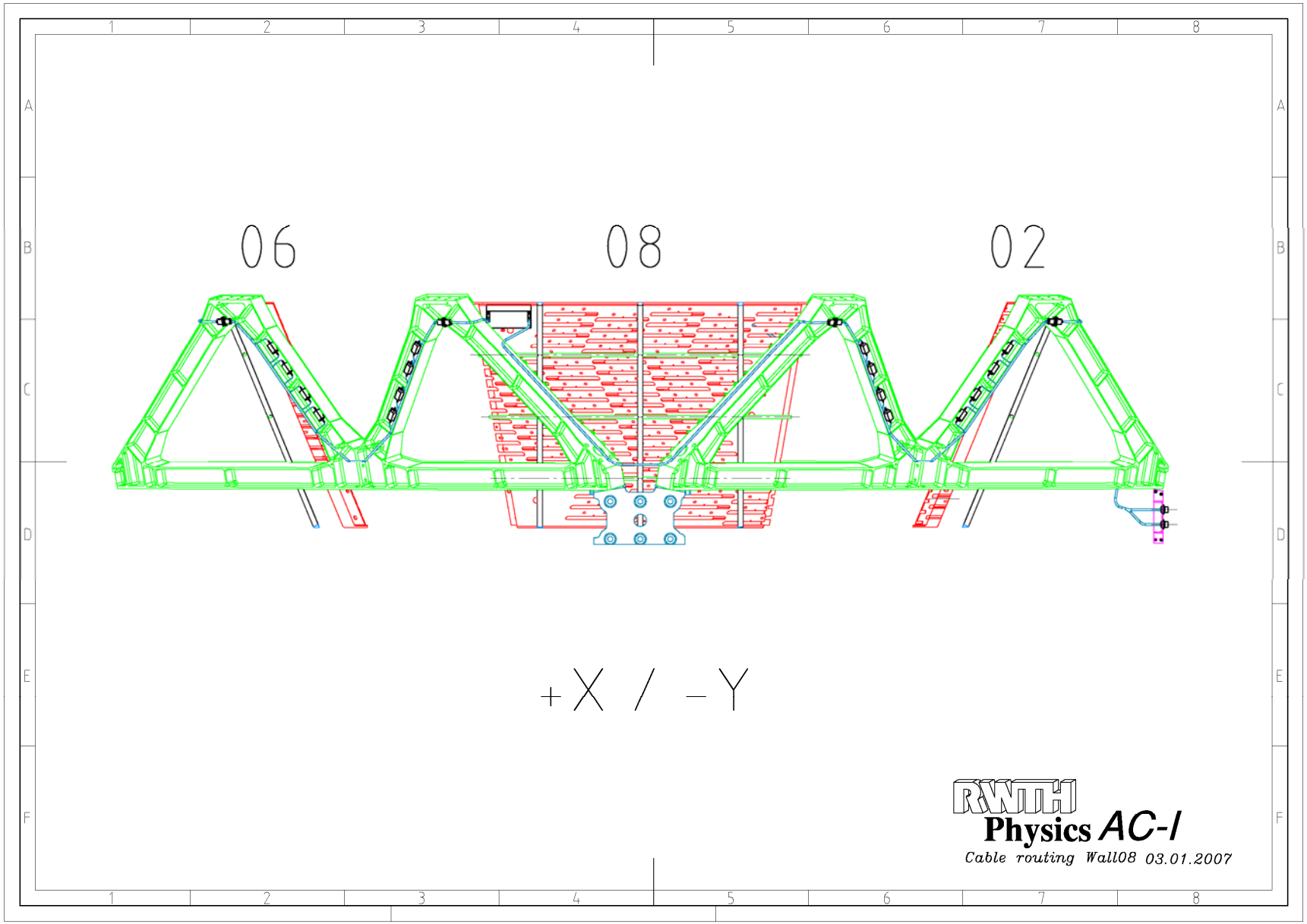
Bayonet Coupling, Crimp Removable, Rear Release, Low Profile/Light Weight

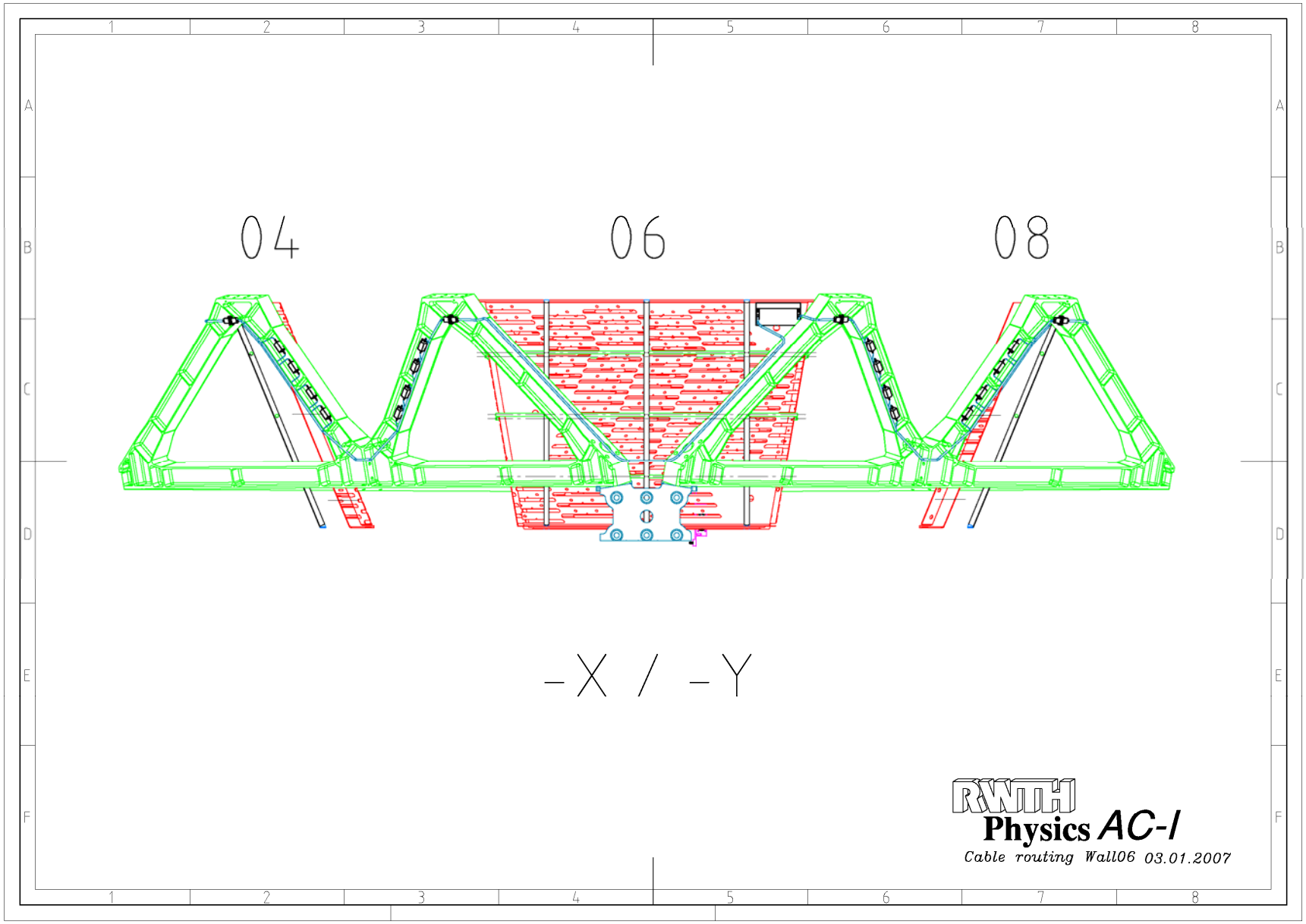
MIL-DTL-38999 S II

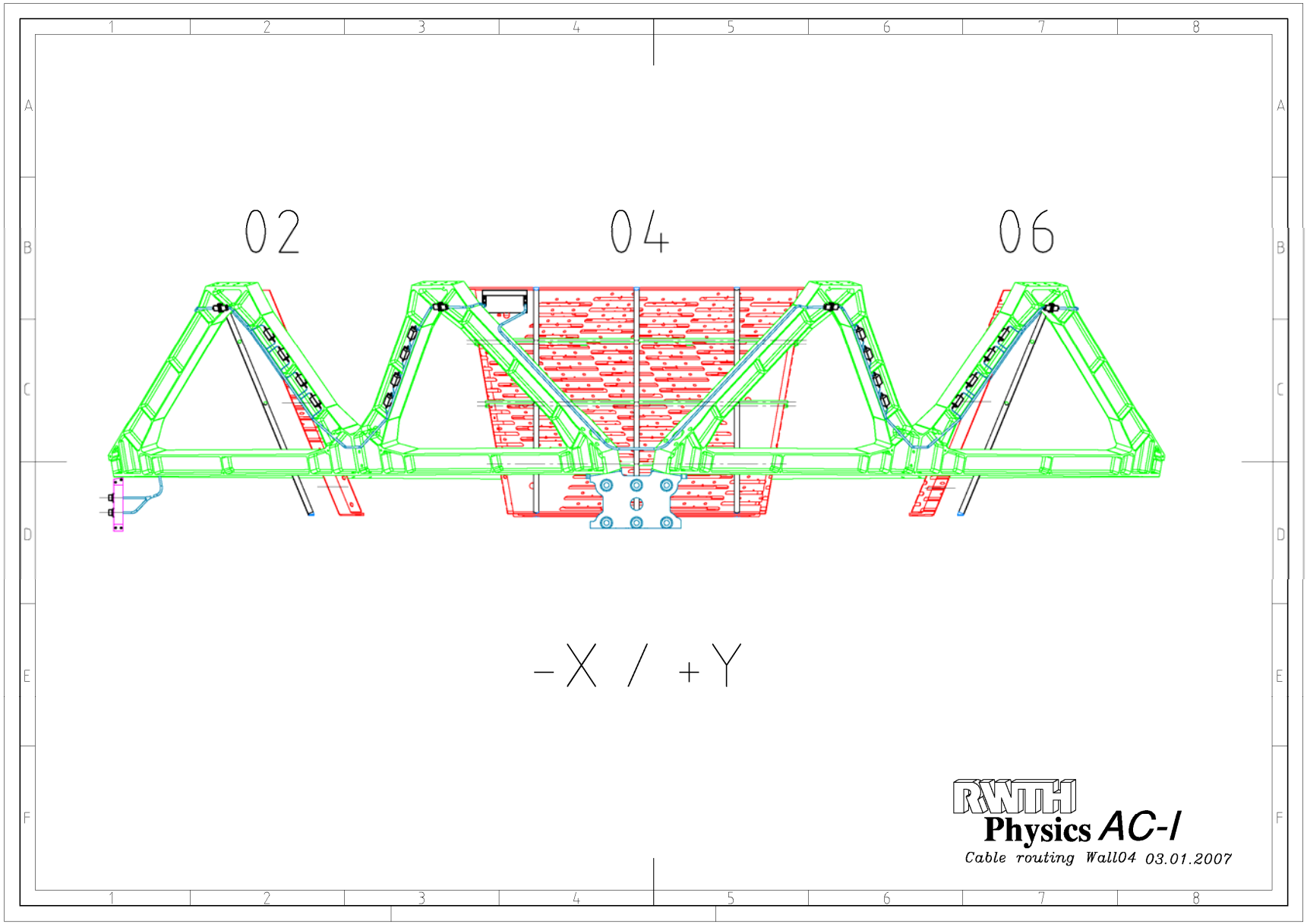


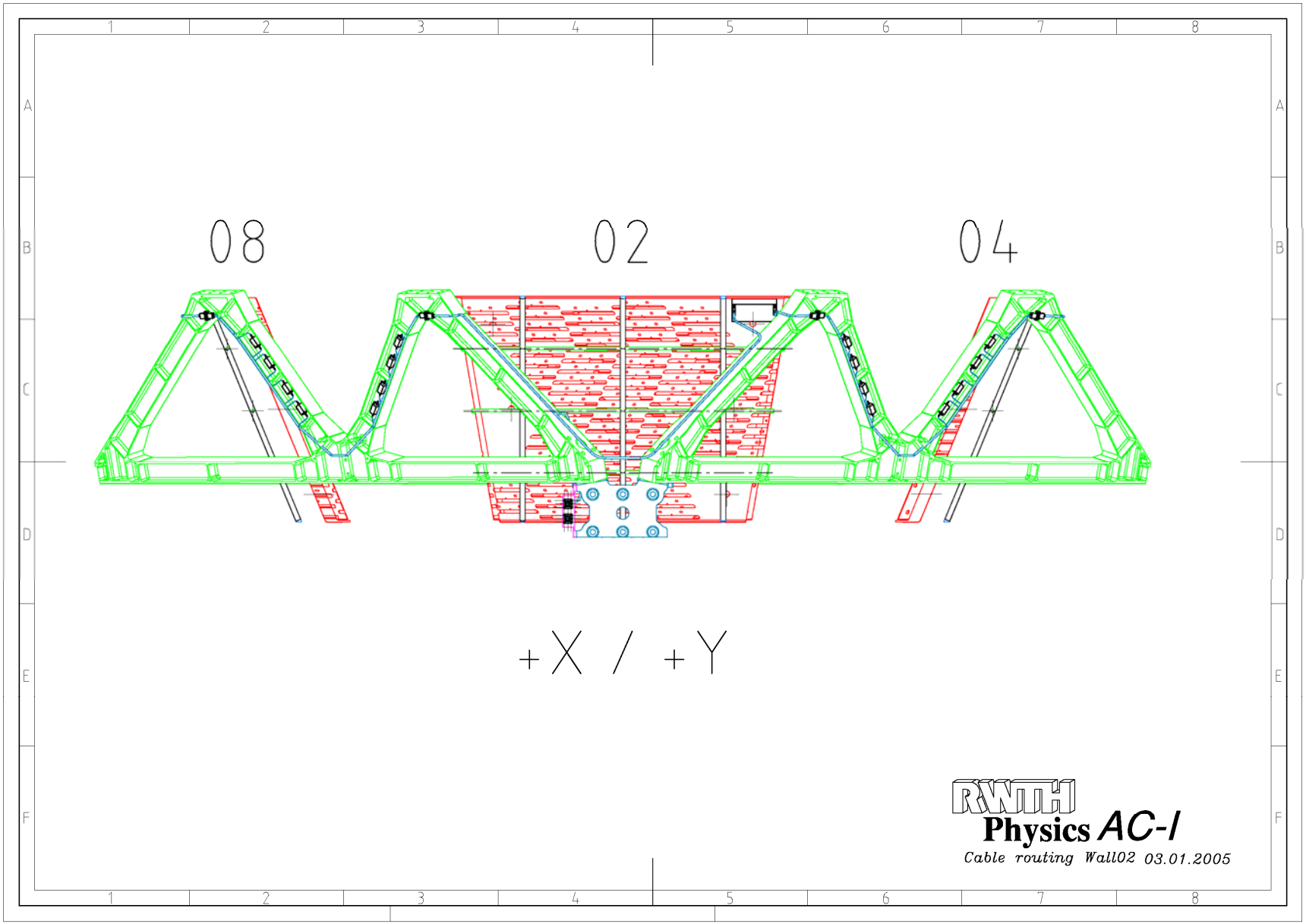
Note: See page 33 for panel thickness.

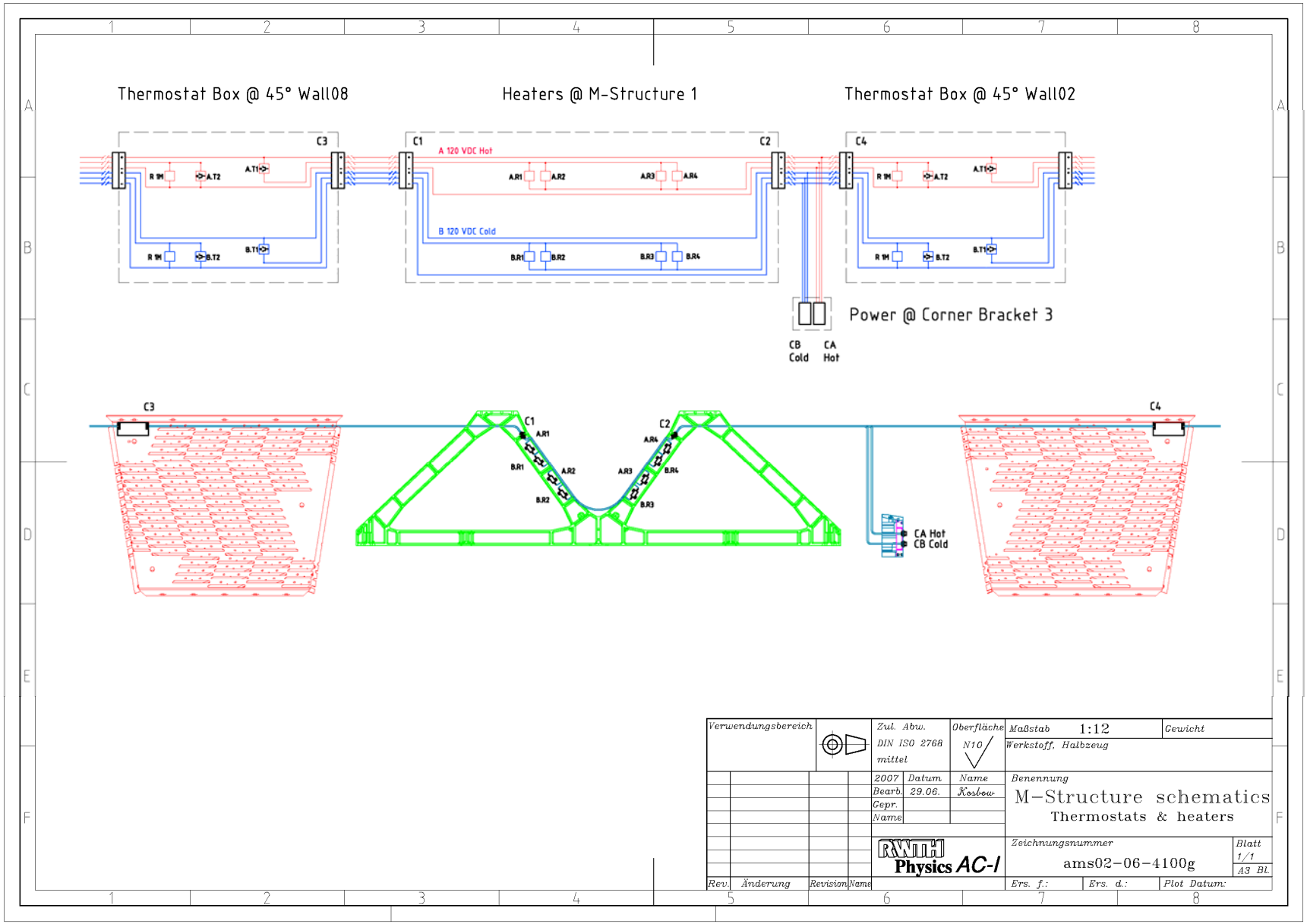
Shell Size	A Maximum inch	A Maximum mm	B (TP) inch	B (TP) mm	∅C +.010 -.005 inch	∅C +.25 -.13 mm	∅E ±.003 inch	∅E ±.08 mm	∅F Maximum inch	∅F Maximum mm	∅H Maximum inch	∅H Maximum mm
8	.828	21.03	.594	15.09	.120	3.05	.471	11.96	.547	13.89	.299	7.59
10	.954	24.23	.719	18.26	.120	3.05	.588	14.94	.672	17.07	.427	10.85
12	1.047	26.59	.812	20.62	.120	3.05	.748	19.00	.844	21.44	.541	13.74
14	1.141	28.98	.906	23.01	.120	3.05	.873	22.17	.969	24.61	.666	16.92
16	1.234	31.34	.969	24.61	.120	3.05	.998	25.35	1.094	27.79	.791	20.09
18	1.328	33.73	1.062	26.97	.120	3.05	1.123	28.52	1.219	30.96	.897	22.78
20	1.453	36.91	1.156	29.36	.120	3.05	1.248	31.70	1.344	34.14	1.022	25.96
22	1.578	40.08	1.250	31.75	.120	3.05	1.373	34.87	1.469	37.31	1.147	29.13
24	1.703	43.26	1.375	34.93	.147	3.73	1.498	38.05	1.594	40.49	1.272	32.31


06
08
02
+X / −Y
RWTH
Physics AC-I
Cable routing Wall08 03.01.2007


04
06
08
-X / -Y
RWTH
Physics AC-I
Cable routing Wall06 03.01.2007


02
04
06
-X / +Y
RWTH
Physics AC-I
Cable routing Wall04 03.01.2007


08
02
04
+X / +Y
RWTH
Physics AC-I
Cable routing Wall02 03.01.2005


Thermostat Box @ 45° Wall08
Heaters @ M-Structure 1
Thermostat Box @ 45° Wall02
C3
C1
C2
C4
A 120 VDC Hot
B 120 VDC Cold
A.R1
A.R2
A.R3
A.R4
B.R1
B.R2
B.R3
B.R4
A.T1
A.T2
B.T1
B.T2
R 1M
Power @ Corner Bracket 3
CB Cold
CA Hot
CA Hot
CB Cold
Verwendungsbereich
Zul. Abw.
DIN ISO 2768 mittel
Oberfläche
N10
Maßstab 1:12
Gewicht
Werkstoff, Halbzeug
2007 Datum
Name
Bearb. 29.06. Korbow
Gepr.
Name
Benennung
M-Structure schematics
Thermostats & heaters
RWTH Physics AC-I
Zeichnungsnummer
ams02-06-4100g
Blatt 1/1
A3 BL
Rev. Änderung
Revision Name
Ers. f.:
Ers. d.:
Plot Datum:

TRD M-Structure Heating
Space Qualification

TRD M-Structure Heating Thermostat Box #2

Space Qualification
TRD Heating Thermostat Box 02–
Vibration Test & Thermal Vacuum Test

St Schmitz, 11.11.2008

Thermostat Box 02 has been qualified via Vibration-Test (VT).

VT (30.05.2008): Thermostat Box 02

- Random vibration in 3-dimensions (x, y, z)
- Acceleration Level = 6.8gRMS

Control Channel - Profile Settings

	Status	Frequency [Hz]	G²/Hz	Slope (dB/okt)	-Alarm (dB)	+Alarm (dB)	-Abort (dB)	+Abort (dB)
1	On			3.0	12.0	12.0	24.0	24.0
2	On	80.0	0.0400000		12.0	12.0	24.0	24.0
3	On	500.0	0.0400000		12.0	12.0	24.0	24.0
4	On			-3.0	12.0	12.0	24.0	24.0

Vibration setup x-axis:

Fig. 1 Thermostat Box 02 mounted on Vibration-table in x-axis

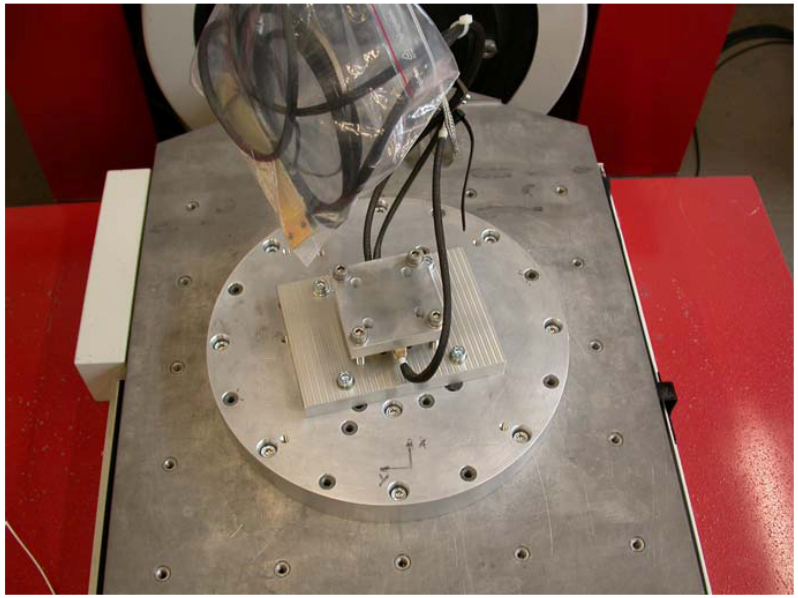
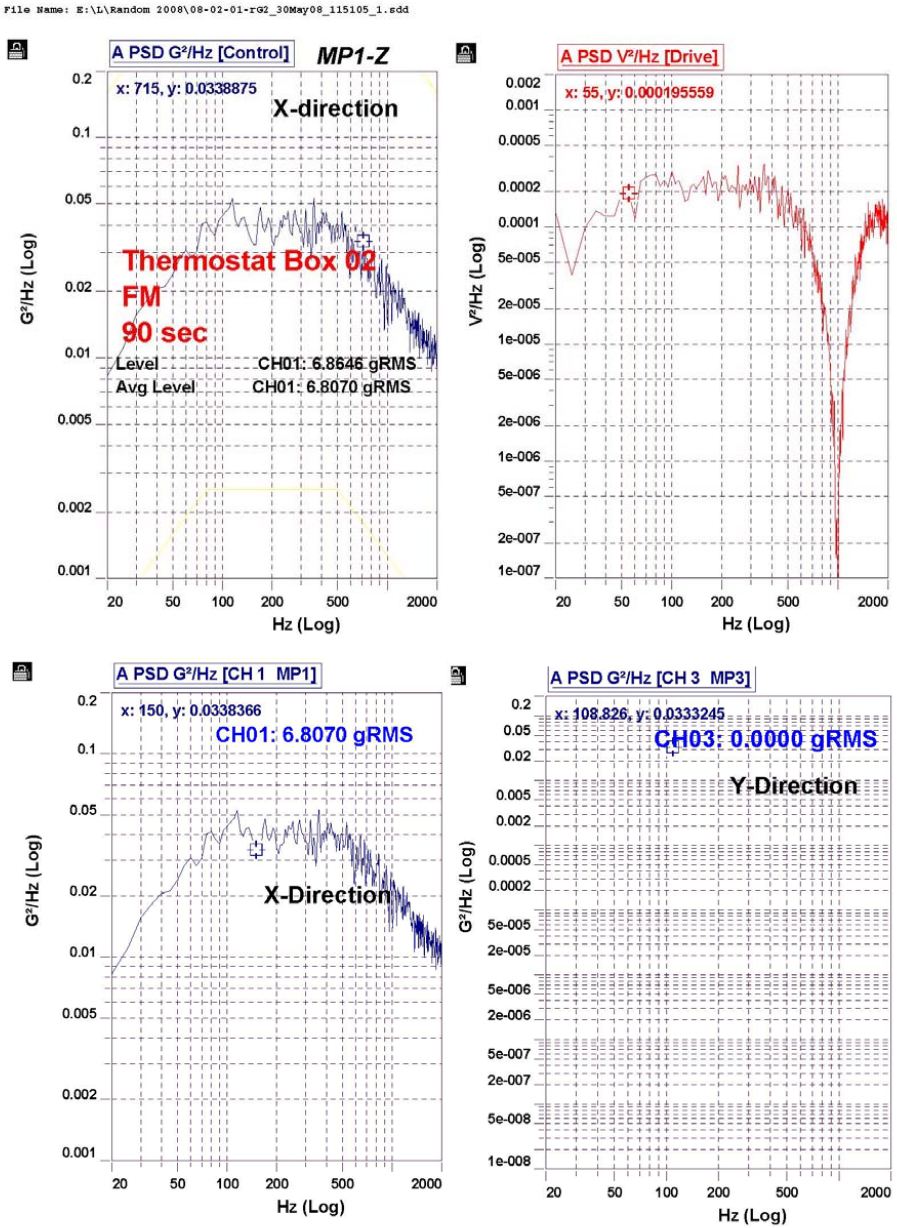


Fig. 2 Thermostat Box 02 mounted on Vibration-table in x-axis; top view


File Name: E:\L\Random 2008\08-02-01-rG2_30May08_115105_1.sdd
A PSD G²/Hz [Control]
MP1-Z
x: 715, y: 0.0338875
X-direction
Thermostat Box 02
FM
90 sec
Level CH01: 6.8646 gRMS
Avg Level CH01: 6.8070 gRMS
G²/Hz (Log)
Hz (Log)
A PSD V²/Hz [Drive]
x: 55, y: 0.000195559
V²/Hz (Log)
Hz (Log)
A PSD G²/Hz [CH 1 MP1]
x: 150, y: 0.0338366
CH01: 6.8070 gRMS
X-Direction
G²/Hz (Log)
Hz (Log)
A PSD G²/Hz [CH 3 MP3]
x: 108.826, y: 0.0333245
CH03: 0.0000 gRMS
Y-Direction
G²/Hz (Log)
Hz (Log)

Vibration setup y-axis:

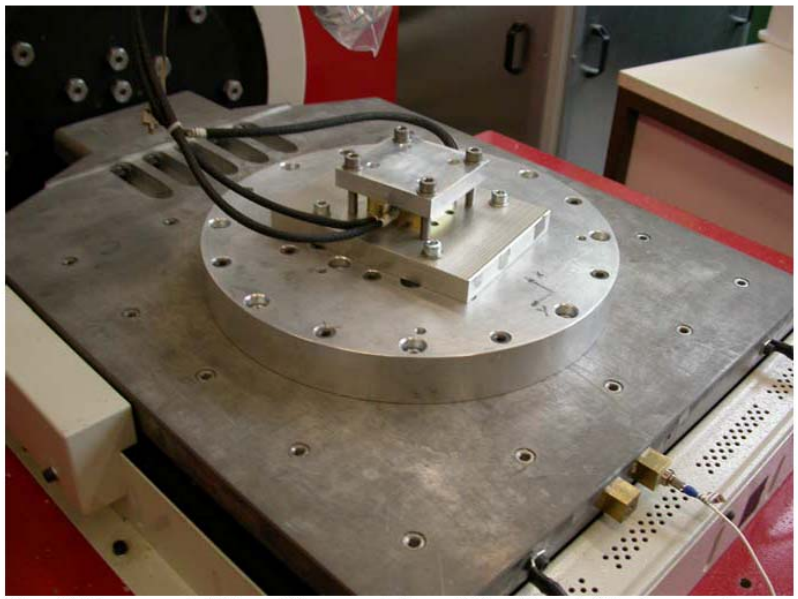
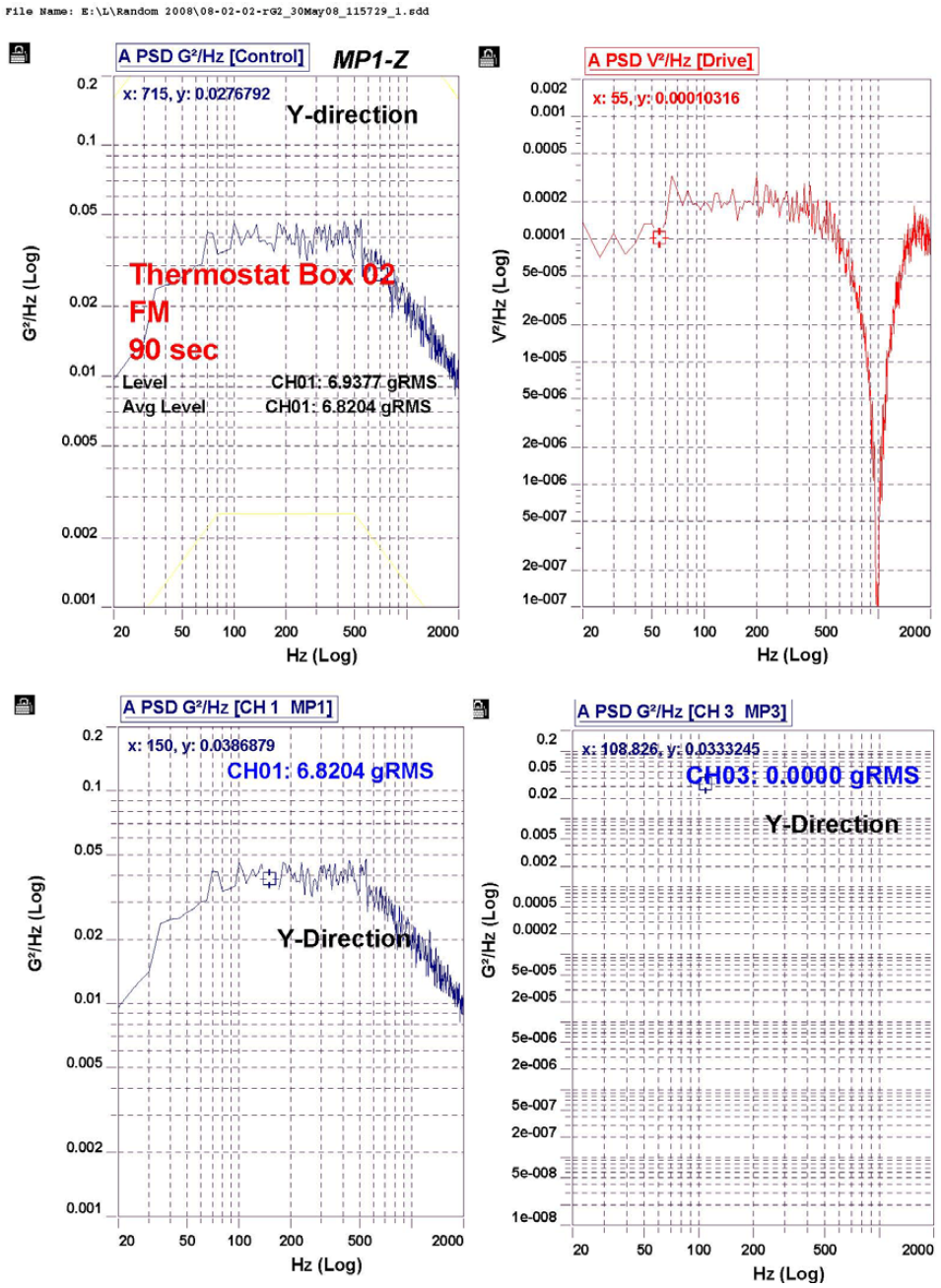


Fig. 3 Thermostat Box 02 mounted on Vibration-table in y-axis

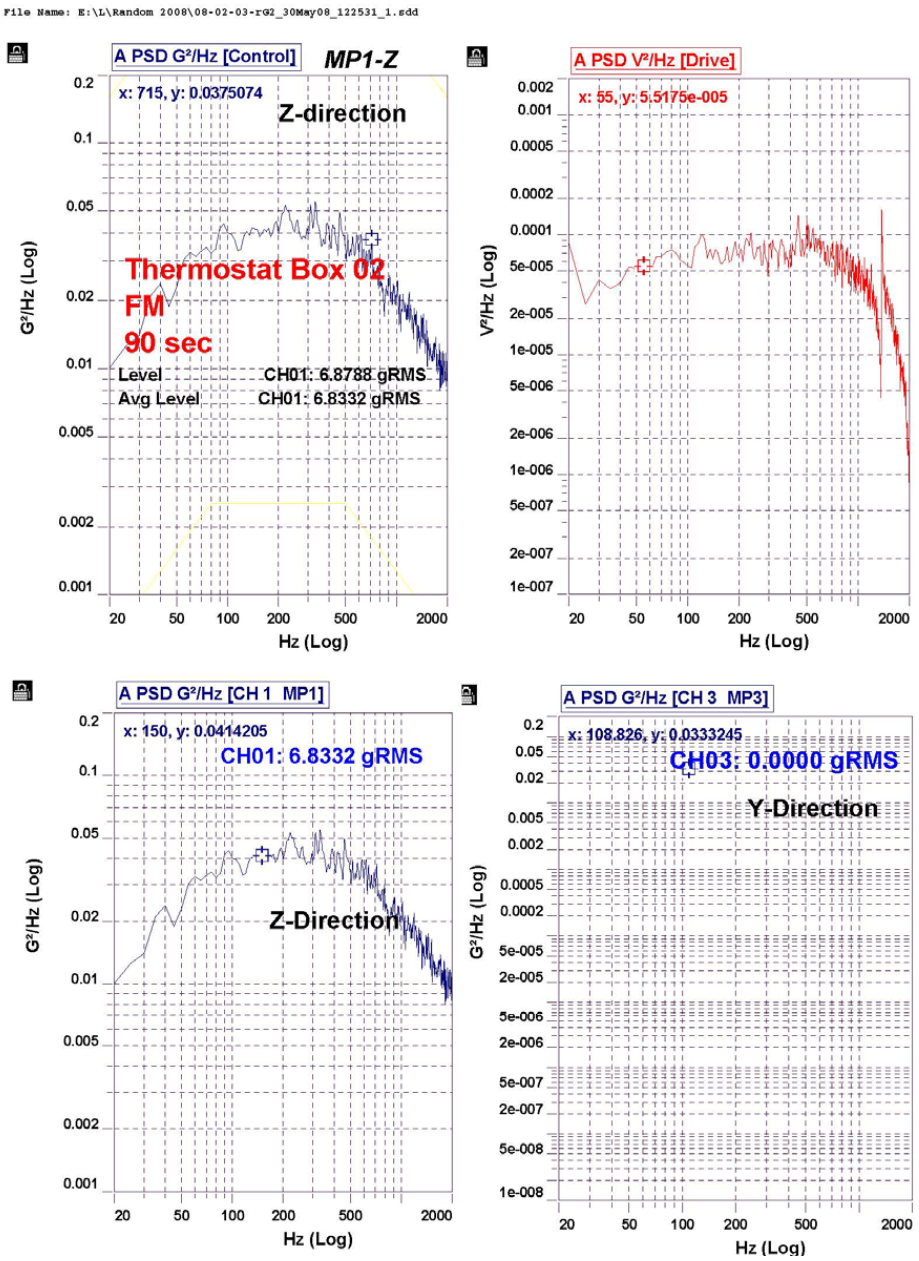
Fig. 4 Thermostat Box 02 mounted on Vibration-table in y-axis


File Name: E:\L\Random 2008\08-02-02-rG2_30May08_115729_1.sdd
A PSD G²/Hz [Control]
MP1-Z
x: 715, y: 0.0276792
Y-direction
Thermostat Box 02
FM
90 sec
Level CH01: 6.9377 gRMS
Avg Level CH01: 6.8204 gRMS
G²/Hz (Log)
Hz (Log)
A PSD V²/Hz [Drive]
x: 55, y: 0.00010316
V²/Hz (Log)
Hz (Log)
A PSD G²/Hz [CH 1 MP1]
x: 150, y: 0.0386879
CH01: 6.8204 gRMS
Y-Direction
G²/Hz (Log)
Hz (Log)
A PSD G²/Hz [CH 3 MP3]
x: 108.826, y: 0.0333245
CH03: 0.0000 gRMS
Y-Direction
G²/Hz (Log)
Hz (Log)

Vibration setup z-axis:

Fig. 5 Thermostat Box 02 mounted on Vibration-table in z-axis

Fig. 6 Thermostat Box 02 mounted on Vibration-table in z-axis


File Name: E:\L\Random 2008\08-02-03-rG2_30May08_122531_1.sdd
A PSD G²/Hz [Control]
MP1-Z
x: 715, y: 0.0375074
Z-direction
Thermostat Box 02
FM
90 sec
Level CH01: 6.8788 gRMS
Avg Level CH01: 6.8332 gRMS
G²/Hz (Log)
Hz (Log)
A PSD V²/Hz [Drive]
x: 55, y: 5.5175e-005
V²/Hz (Log)
Hz (Log)
A PSD G²/Hz [CH 1 MP1]
x: 150, y: 0.0414205
CH01: 6.8332 gRMS
Z-Direction
G²/Hz (Log)
Hz (Log)
A PSD G²/Hz [CH 3 MP3]
x: 108.826, y: 0.0333245
CH03: 0.0000 gRMS
Y-Direction
G²/Hz (Log)
Hz (Log)

Thermostat Box 02 has been qualified via one Thermal-Vacuum-Test (TVT).

TVT (04.06.2008): Thermostat Box 02

- Switching Points of the four Thermostats
- 5 cycles from -25°C to 45°C
- Voltage ~110V

TVT setup layout:

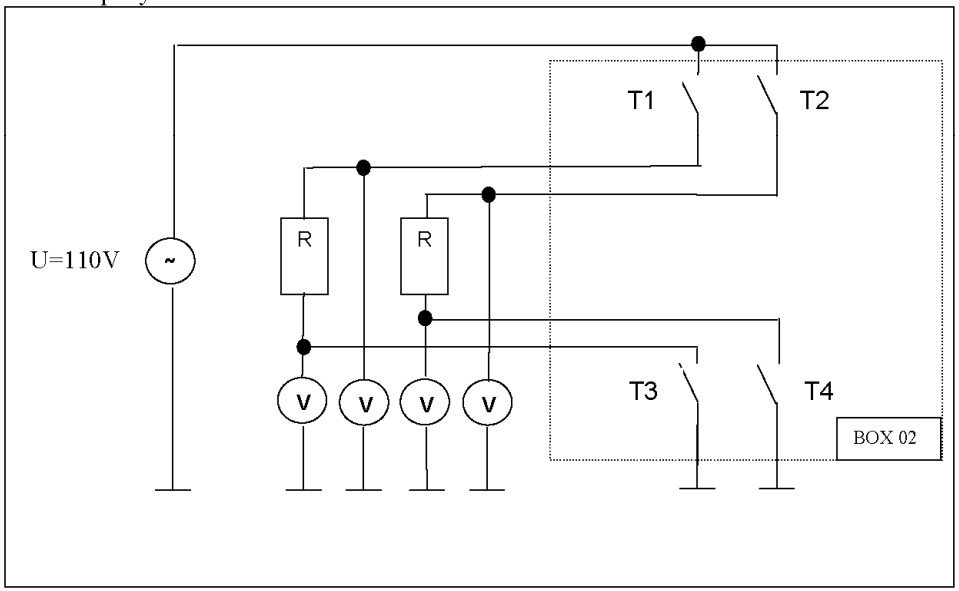


Fig. 7 TVT setup Thermostat Box 02 Power Supply, Thermostats, Voltmeter & Resistor

Voltage is measured with a Keithley Multimeter (Typ 2701) before and behind the resistor (R=3300Ω). Temperature Sensors T1 & T2 (PT1000) was mounted on the cover of Thermostat Box 02.

Thermostat switching points:

No. 00104:	On at T=11.54°C,	Off at T=18.84°C
No. 00120:	On at T=9.65°C,	Off at T=19.70°C
No. 00092:	On at T=11.80 °C,	Off at T=19.37°C
No. 00097:	On at T=10.00°C,	Off at T=18.19°C

Mean value of the five cycles.

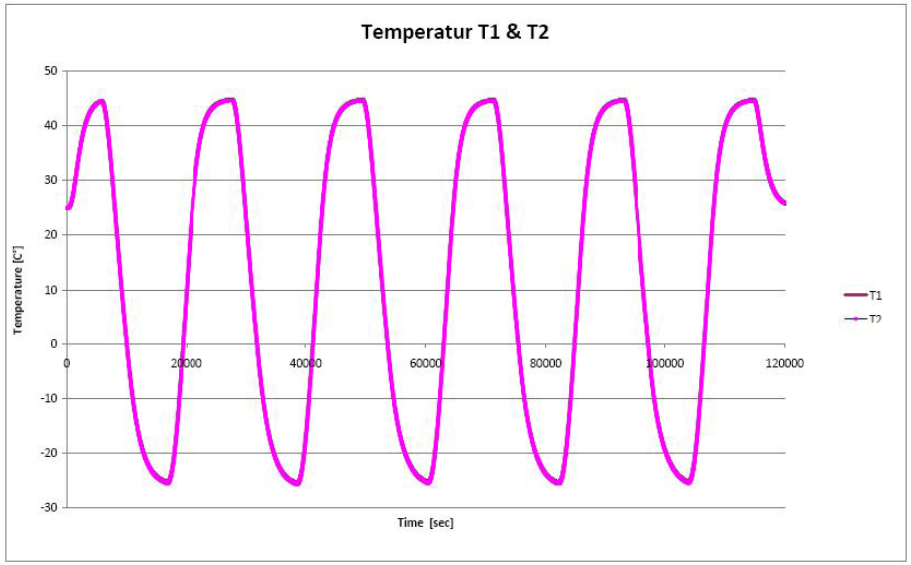


Fig. 8 Environment, Temperature sensor T1 & T2 on Thermostat Box 02

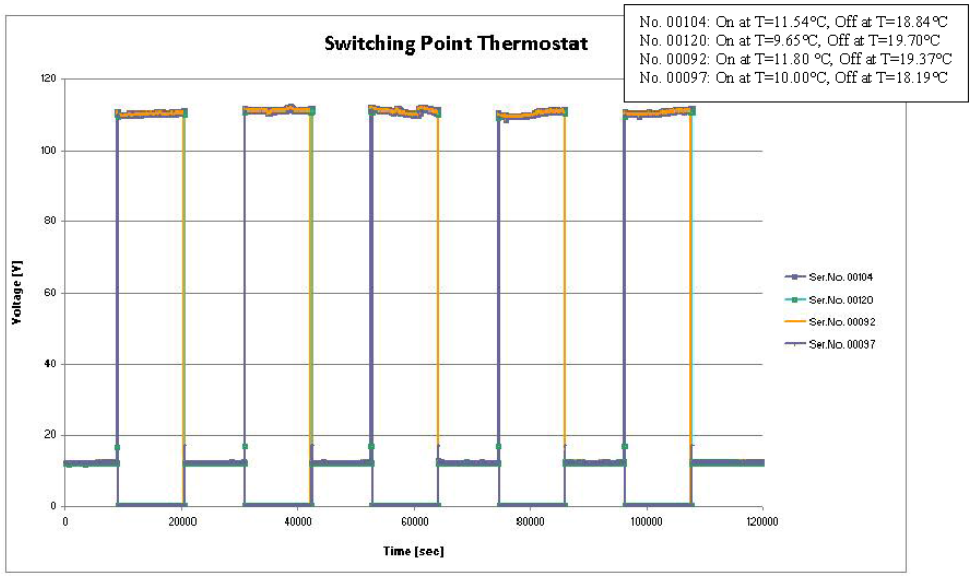


Fig. 9 Switching Points of the Thermostats

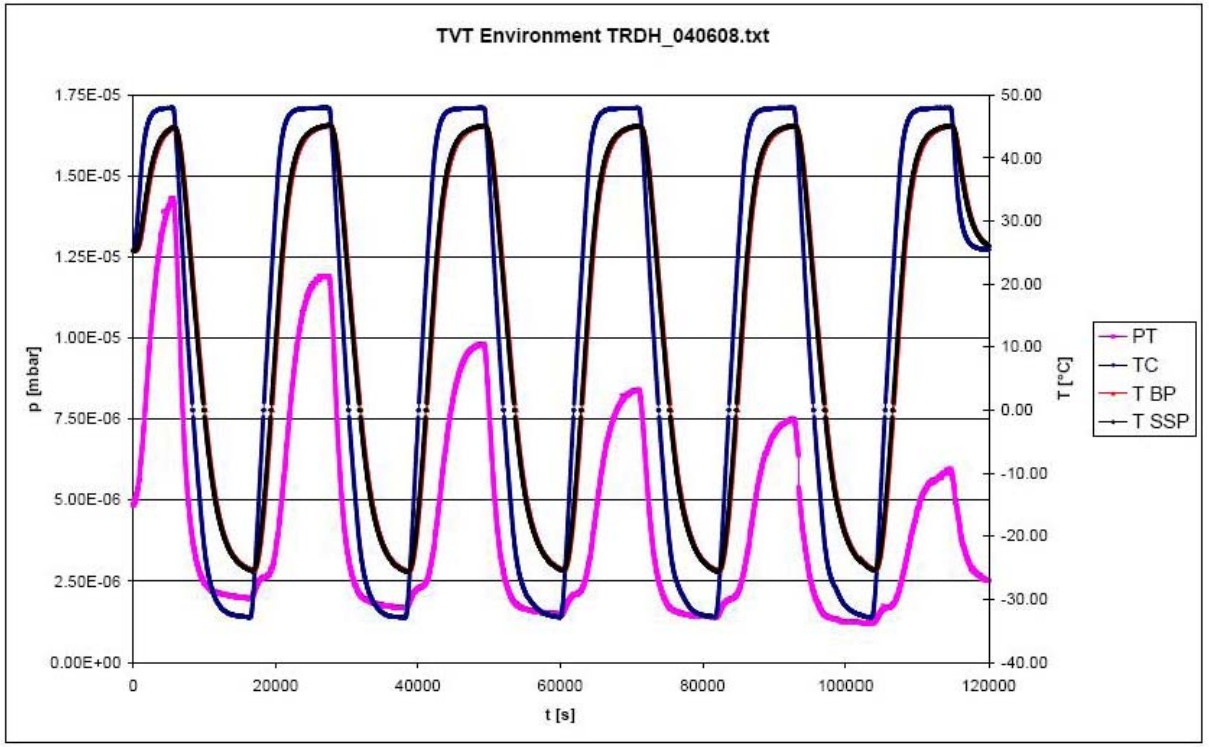


Fig. 10 TVT Environment

PT = pressure in tank
TC = temperature on copper plate
T BP = temperature on base plate of Box 02
T SSP = temperature on sandwich support plate (honeycomb)

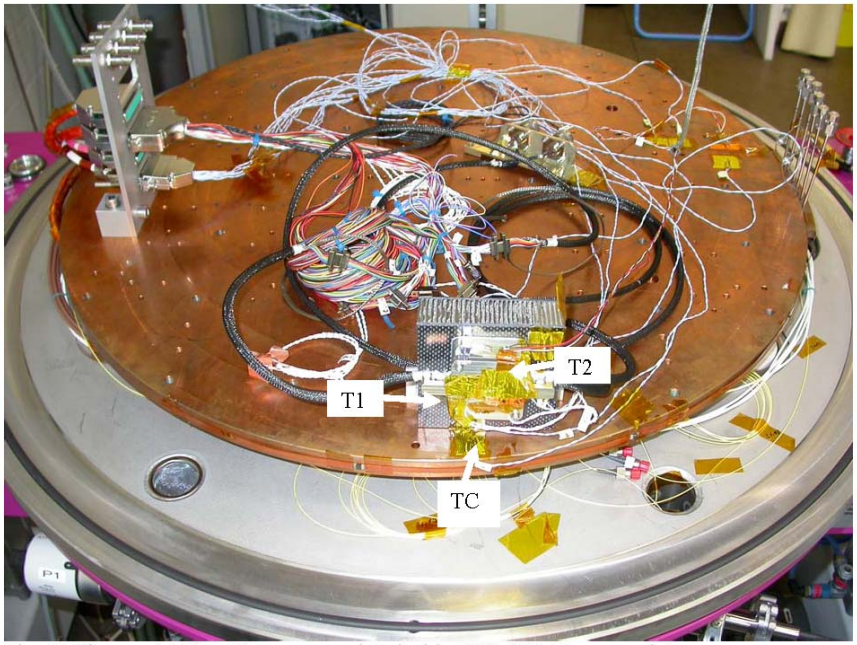


Fig. 11 Thermostat Box 02 on copper plate inside TVT, TC=T copper plate

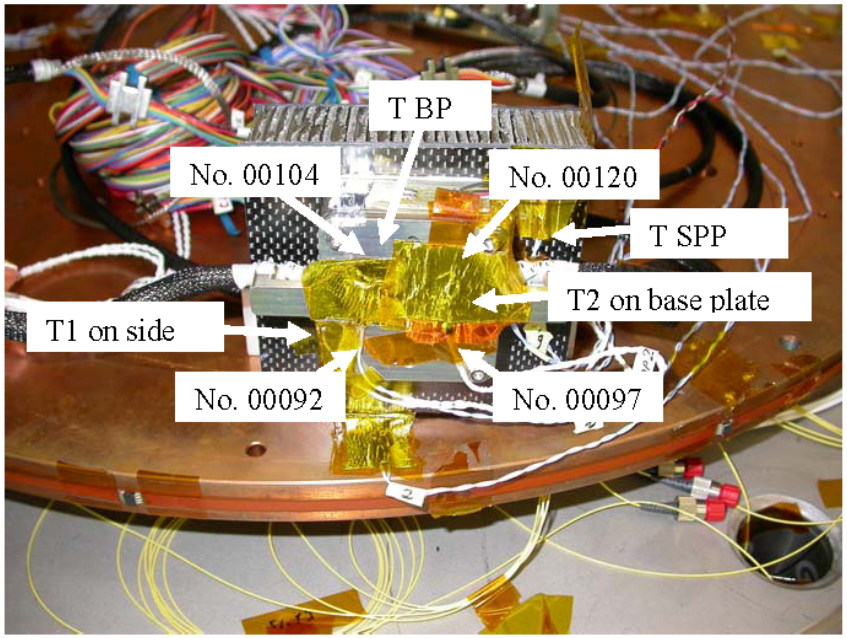


Fig. 12 Thermostat Box 02, Position of the Thermostats

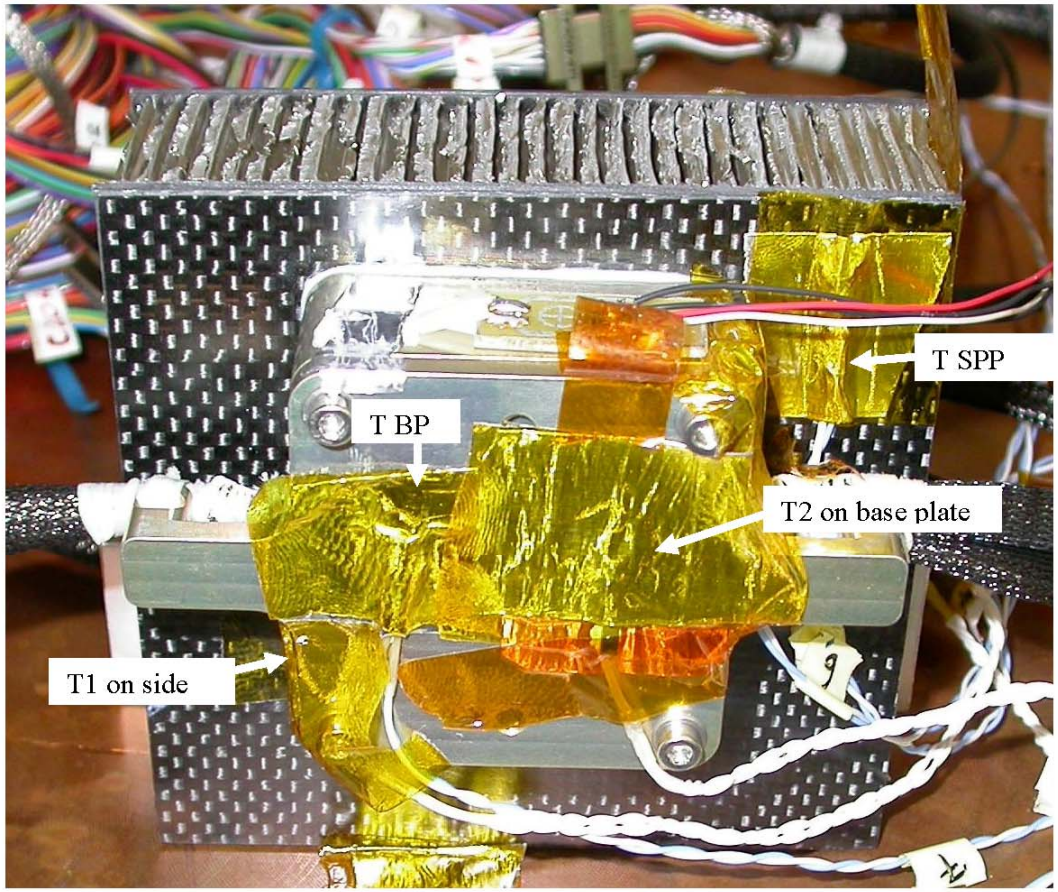


Fig. 13 Thermostat Box 02, detail sandwich support plate (honeycomb)

T1 = temperature on side of Box 02
T2 = temperature on base plate of Box 02
T BP = temperature on base plate of Box 02
T SSP = temperature on sandwich support plate (honeycomb)

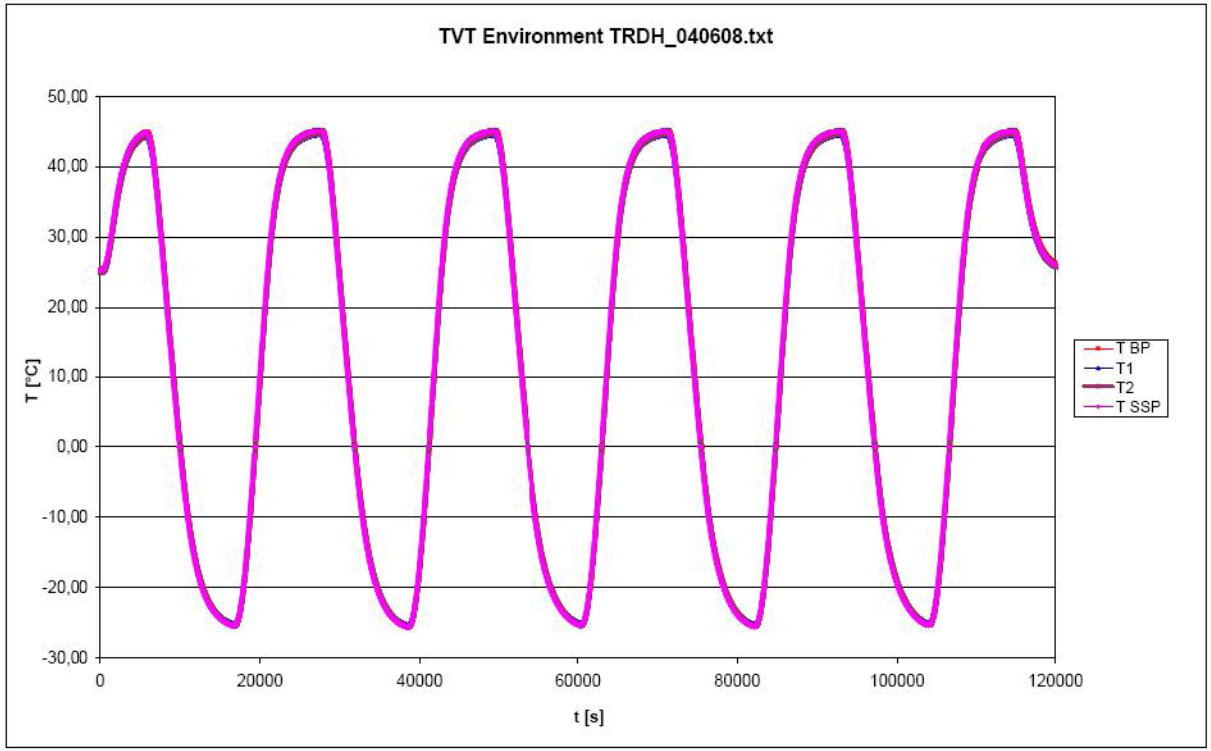


Fig. 14 Temperature sensor T BP, T SSP, T1 & T2

TRD M-Structure Heating Thermostat Box #4

Space Qualification
TRD Heating Thermostat Box 04
Vibration Test & Thermal Vacuum Test

St Schmitz, 04.07.2008

Thermostat Box 04 has been qualified via Vibration-Test (VT).

VT (03.07.2008): Thermostat Box 04

- Random vibration in 3-dimensions (x, y, z)
- Acceleration Level = 6.8gRMS

Control Channel - Profile Settings

	Status	Frequency [Hz]	G²/Hz	Slope (dB/okt)	-Alarm (dB)	+Alarm (dB)	-Abort (dB)	+Abort (dB)
1	On			3.0	12.0	12.0	24.0	24.0
2	On	80.0	0.0400000		12.0	12.0	24.0	24.0
3	On	500.0	0.0400000		12.0	12.0	24.0	24.0
4	On			-3.0	12.0	12.0	24.0	24.0

Vibration setup x-axis:

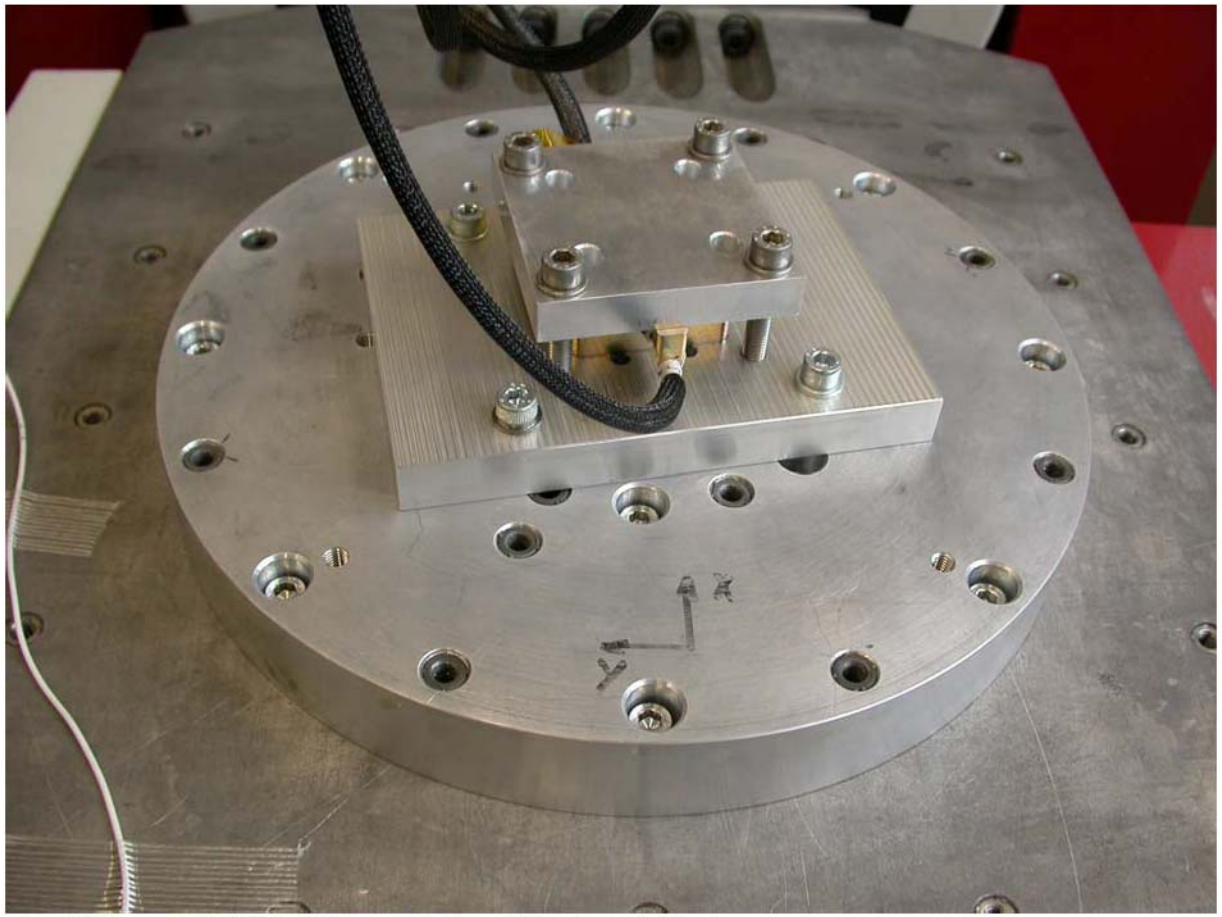
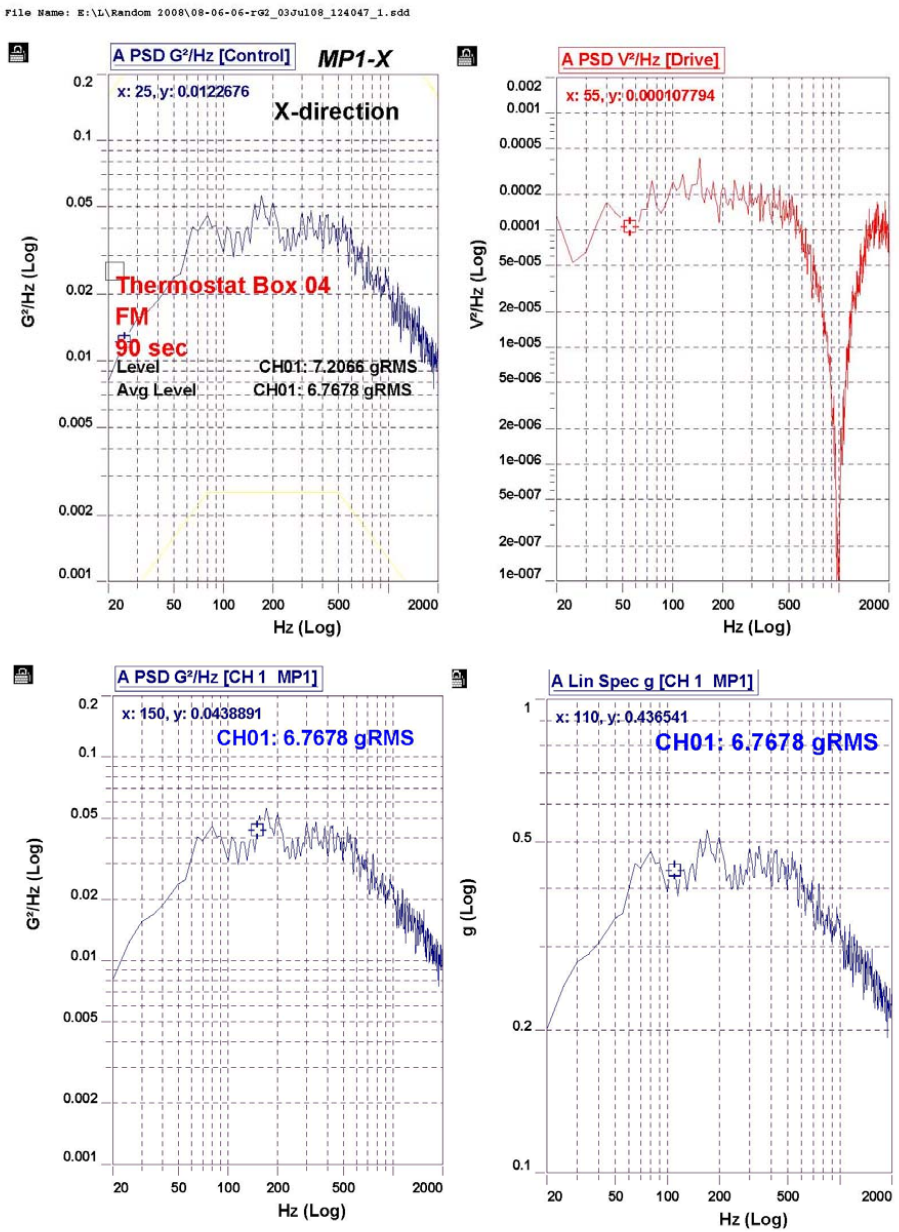


Fig. 1 Thermostat Box 04 mounted on Vibration-table in x-axis


File Name: E:\L\Random 2008\08-06-06-rG2_03Jul08_124047_1.sdd
A PSD G²/Hz [Control]
MP1-X
x: 25, y: 0.0122676
X-direction
Thermostat Box 04
FM
90 sec
Level CH01: 7.2066 gRMS
Avg Level CH01: 6.7678 gRMS
G²/Hz (Log)
Hz (Log)
A PSD V²/Hz [Drive]
x: 55, y: 0.000107794
V²/Hz (Log)
Hz (Log)
A PSD G²/Hz [CH 1 MP1]
x: 150, y: 0.0438891
CH01: 6.7678 gRMS
G²/Hz (Log)
Hz (Log)
A Lin Spec g [CH 1 MP1]
x: 110, y: 0.436541
CH01: 6.7678 gRMS
g (Log)
Hz (Log)

Vibration setup y-axis:

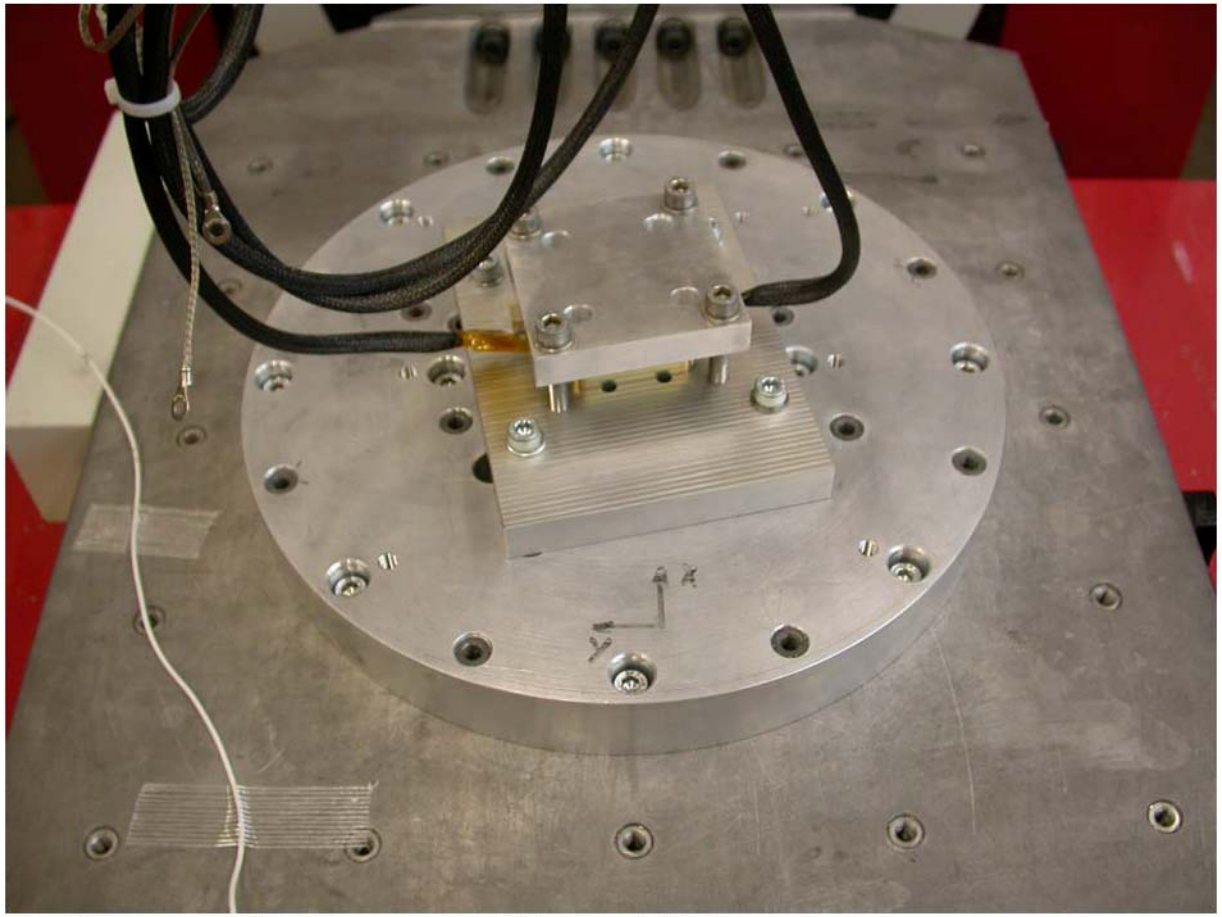
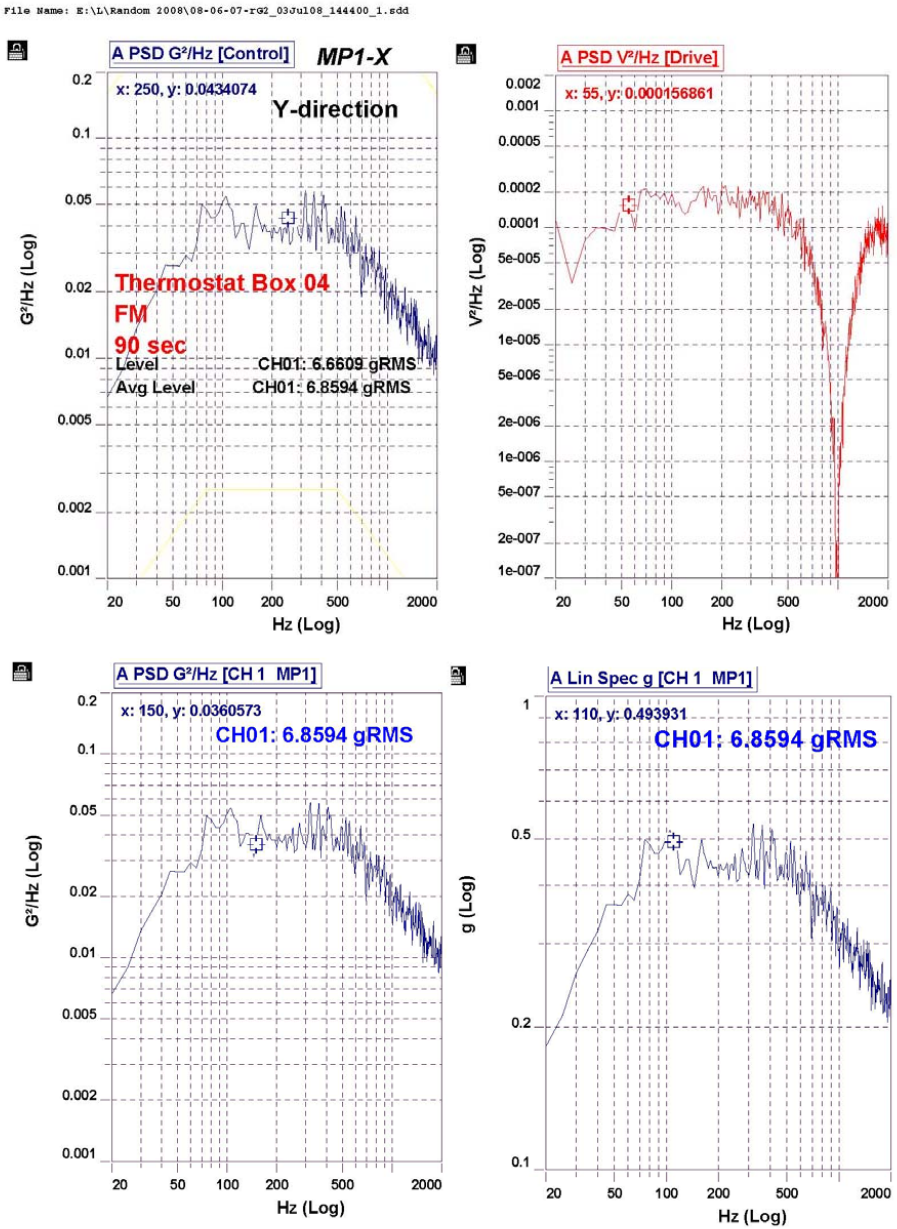


Fig. 2 Thermostat Box 04 mounted on Vibration-table in y-axis


File Name: E:\L\Random 2008\08-06-07-rG2_03Jul08_144400_1.sdd
A PSD G²/Hz [Control]
MP1-X
x: 250, y: 0.0434074
Y-direction
Thermostat Box 04
FM
90 sec
Level CH01: 6.6609 gRMS
Avg Level CH01: 6.8594 gRMS
G²/Hz (Log)
Hz (Log)
A PSD V²/Hz [Drive]
x: 55, y: 0.000156861
V²/Hz (Log)
Hz (Log)
A PSD G²/Hz [CH 1 MP1]
x: 150, y: 0.0360573
CH01: 6.8594 gRMS
G²/Hz (Log)
Hz (Log)
A Lin Spec g [CH 1 MP1]
x: 110, y: 0.493931
CH01: 6.8594 gRMS
g (Log)
Hz (Log)

Vibration setup z-axis:

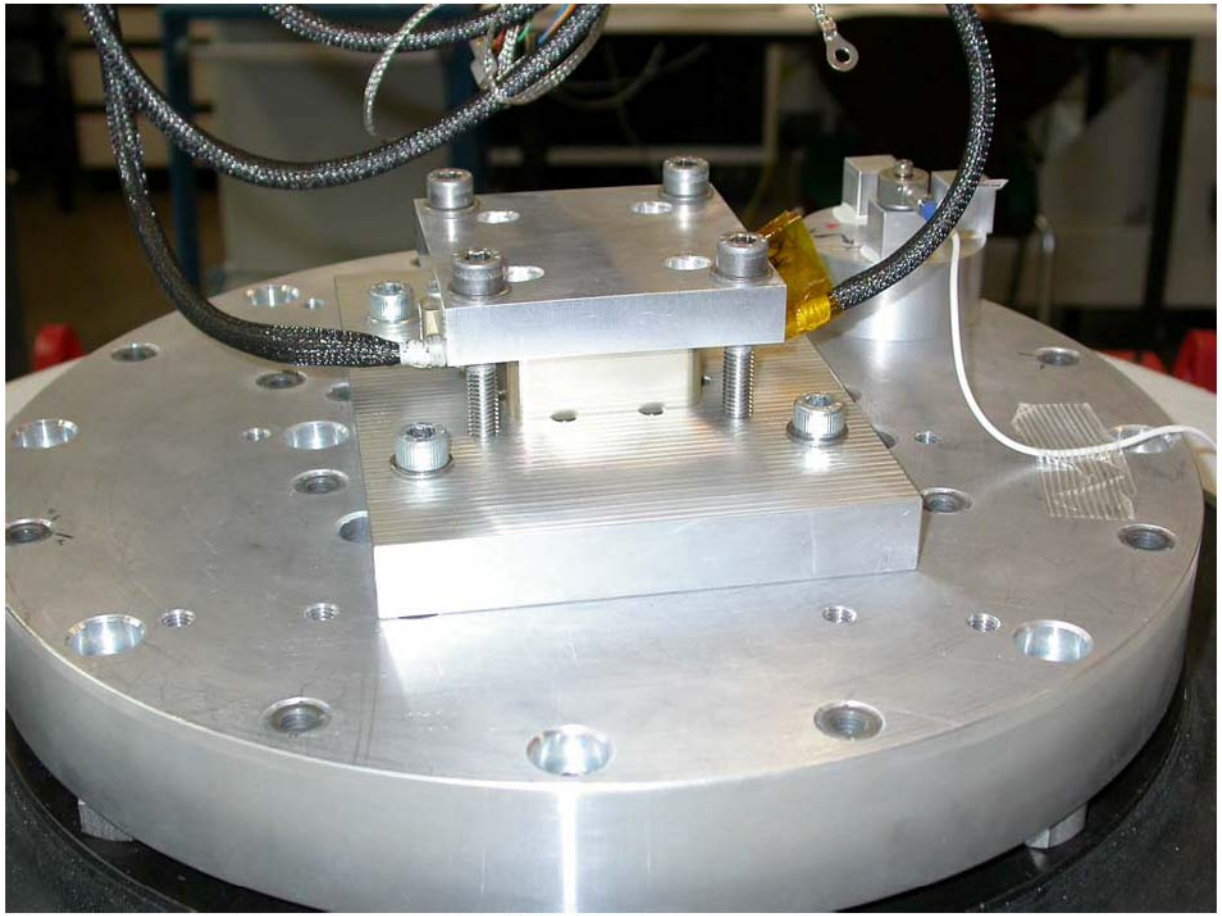
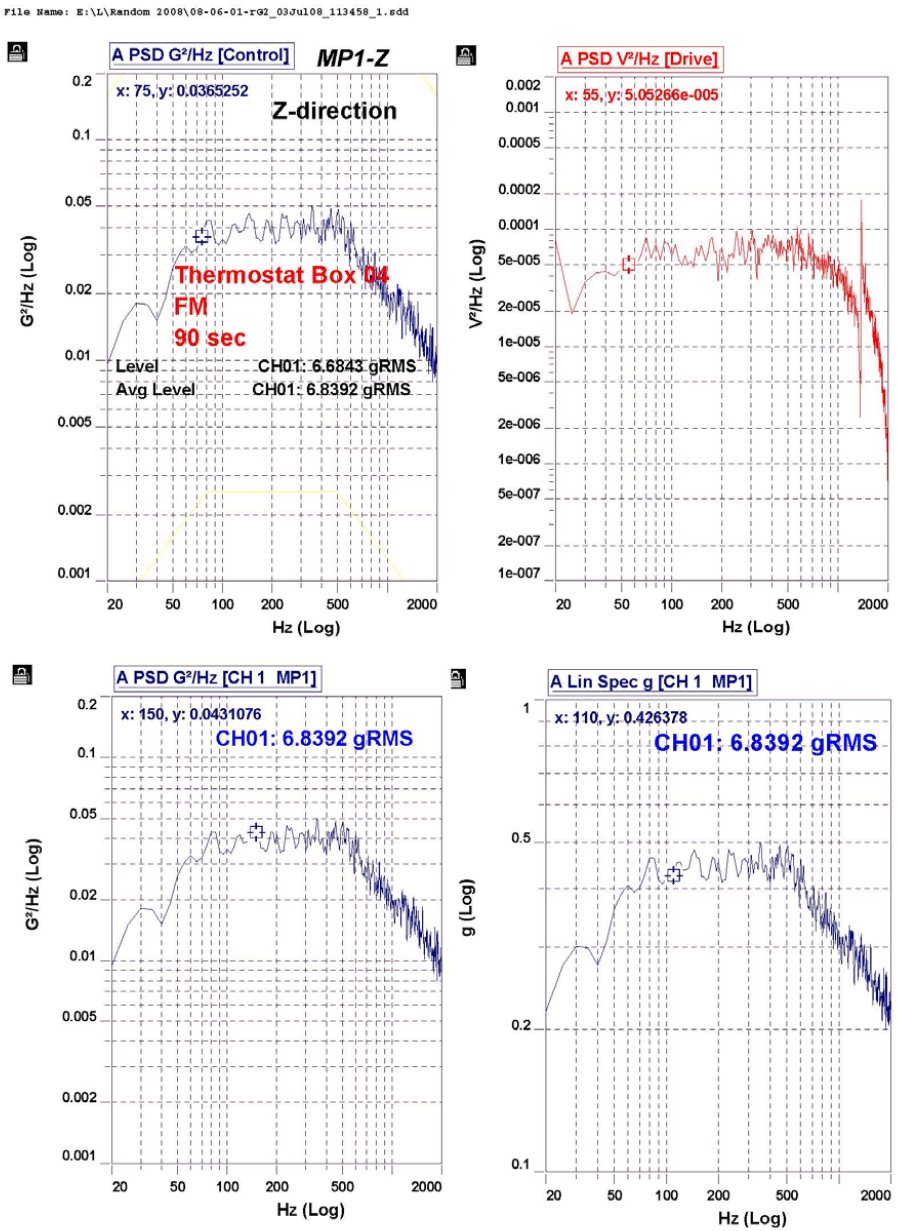


Fig. 3 Thermostat Box 04 mounted on Vibration-table in z-axis


File Name: E:\L\Random 2008\08-06-01-rG2_03Jul08_113458_1.sdd
A PSD G²/Hz [Control]
MP1-Z
x: 75, y: 0.0365252
Z-direction
Thermostat Box 04
FM
90 sec
Level CH01: 6.6843 gRMS
Avg Level CH01: 6.8392 gRMS
G²/Hz (Log)
Hz (Log)
A PSD V²/Hz [Drive]
x: 55, y: 5.05266e-005
V²/Hz (Log)
Hz (Log)
A PSD G²/Hz [CH 1 MP1]
x: 150, y: 0.0431076
CH01: 6.8392 gRMS
G²/Hz (Log)
Hz (Log)
A Lin Spec g [CH 1 MP1]
x: 110, y: 0.426378
CH01: 6.8392 gRMS
g (Log)
Hz (Log)

Thermostat Box 04 has been qualified via one Thermal-Vacuum-Test (TVT).

TVT (04.07.2008): Thermostat Box 04

- Switching Points of the four Thermostats
- 5 cycles from -25°C to 45°C
- Voltage ~110V

TVT setup layout:

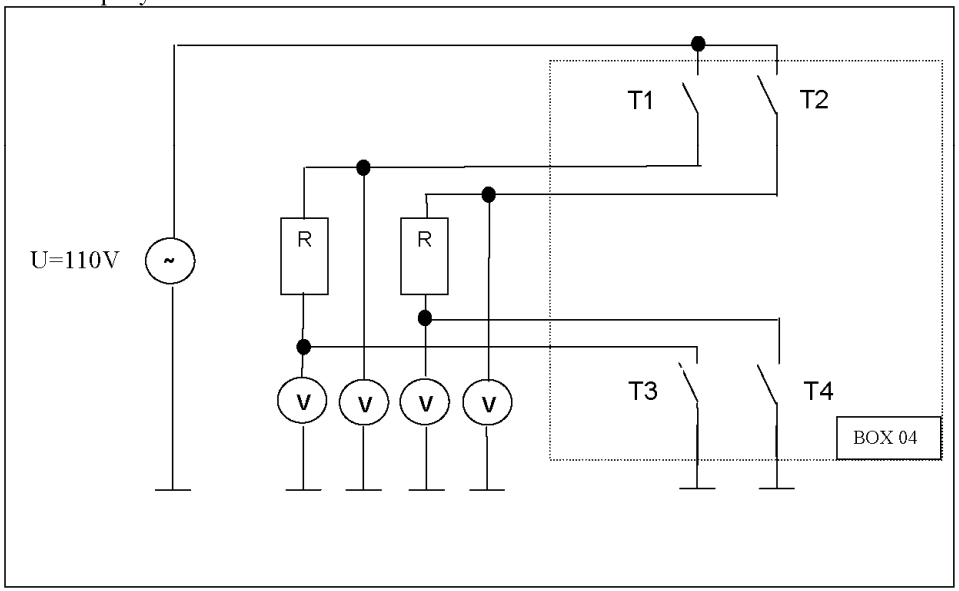


Fig. 4 TVT setup Thermostat Box 04 Power Supply, Thermostats, Voltmeter & Resistor

Voltage is measured with a Keithley Multimeter (Typ 2701) before and behind the resistor (R=3300Ω). Temperature Sensors T1 & T2 (PT1000) was mounted on the cover of Thermostat Box 04.

Thermostat switching points:

No. 00090:	On at T=10.22°C,	Off at T=17.99°C
No. 00086:	On at T=10.59°C,	Off at T=18.83°C
No. 00092:	On at T=10.06 °C,	Off at T=18.87°C
No. 00097:	On at T=9.71°C,	Off at T=17.86°C

Mean value of the five cycles.

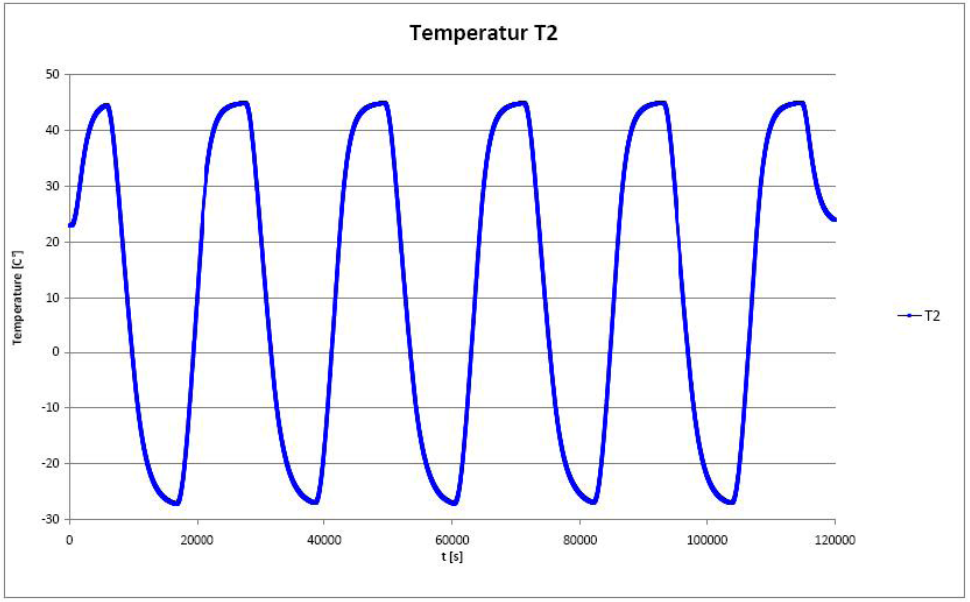


Fig. 5 Environment, Temperature sensor T2 on Thermostat Box 04

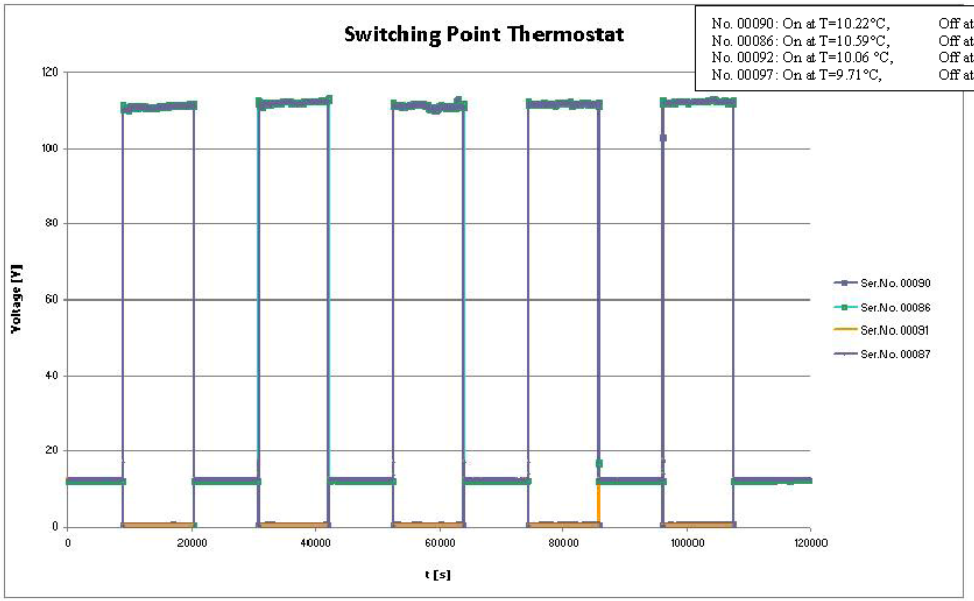


Fig. 6 Switching Points of the Thermostats

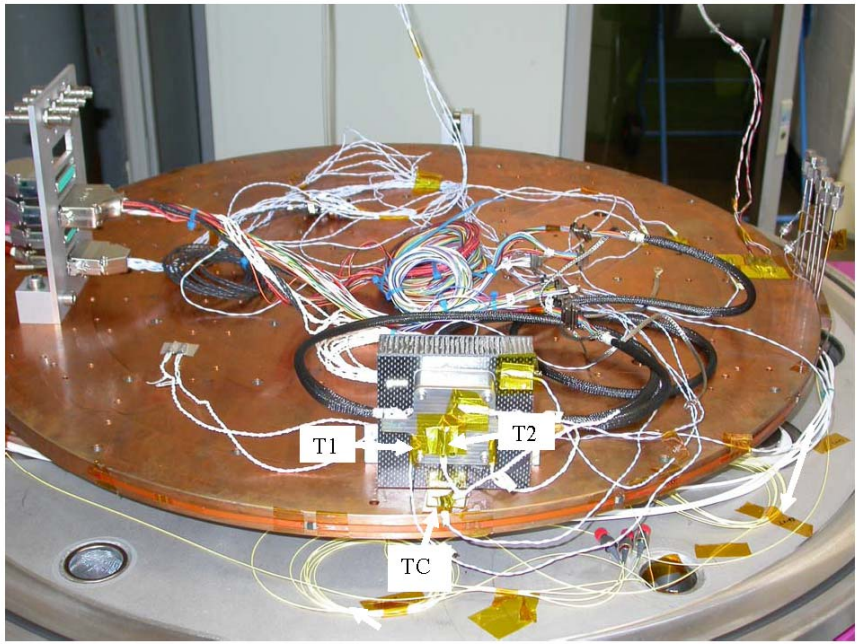


Fig. 8 Thermostat Box 04 on copper plate inside TVT, TC=T copper plate

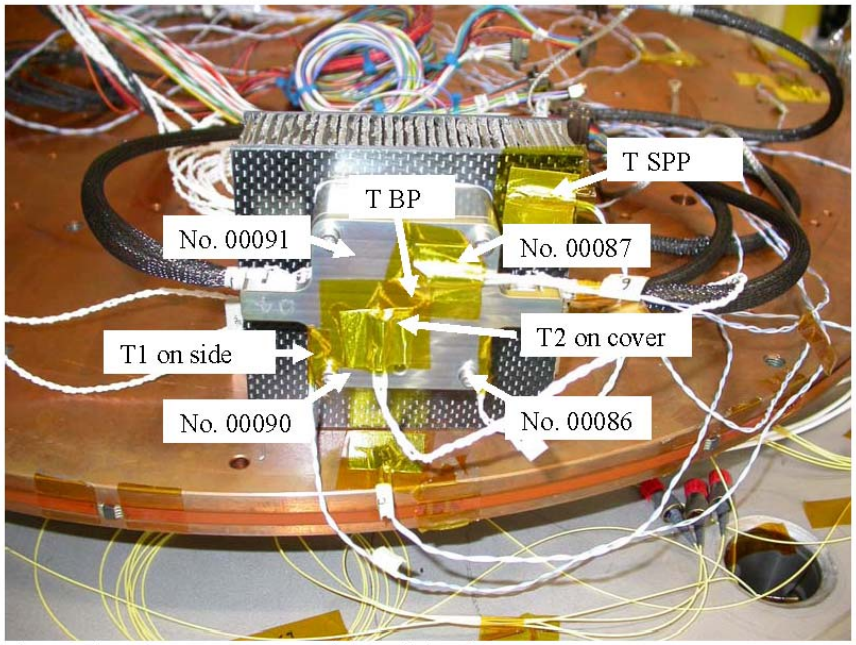


Fig. 9 Thermostat Box 04, Position of the Thermostats

TRD M-Structure Heating Thermostat Box #6

Space Qualification
TRD Heating Thermostat Box 06
Vibration Test & Thermal Vacuum Test

St Schmitz, 10.07.2008

Thermostat Box 06 has been qualified via Vibration-Test (VT).

VT (03.07.2008): Thermostat Box 06

- Random vibration in 3-dimensions (x, y, z)
- Acceleration Level = 6.8gRMS

Control Channel - Profile Settings

	Status	Frequency [Hz]	G²/Hz	Slope (dB/okt)	-Alarm (dB)	+Alarm (dB)	-Abort (dB)	+Abort (dB)
1	On			3.0	12.0	12.0	24.0	24.0
2	On	80.0	0.0400000		12.0	12.0	24.0	24.0
3	On	500.0	0.0400000		12.0	12.0	24.0	24.0
4	On			-3.0	12.0	12.0	24.0	24.0

Vibration setup x-axis:

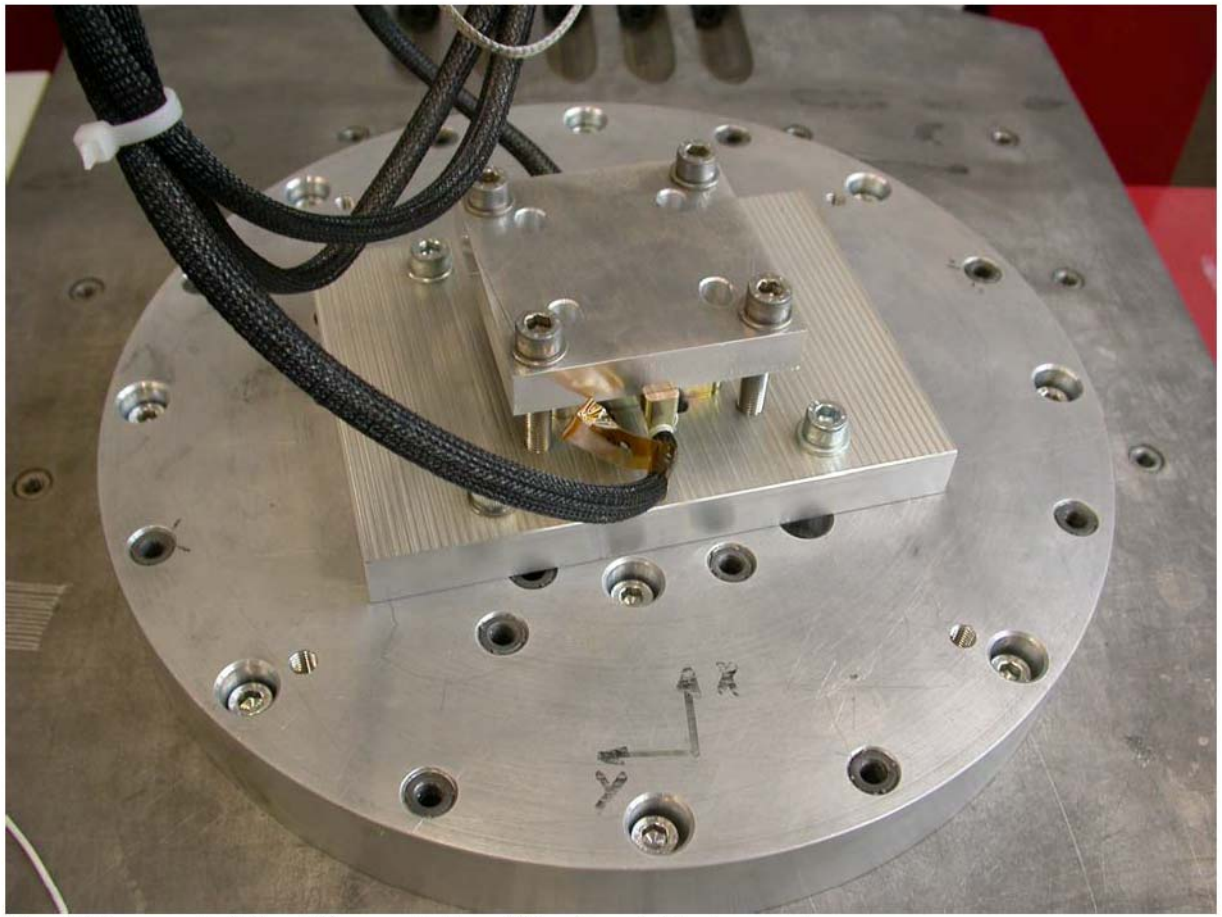
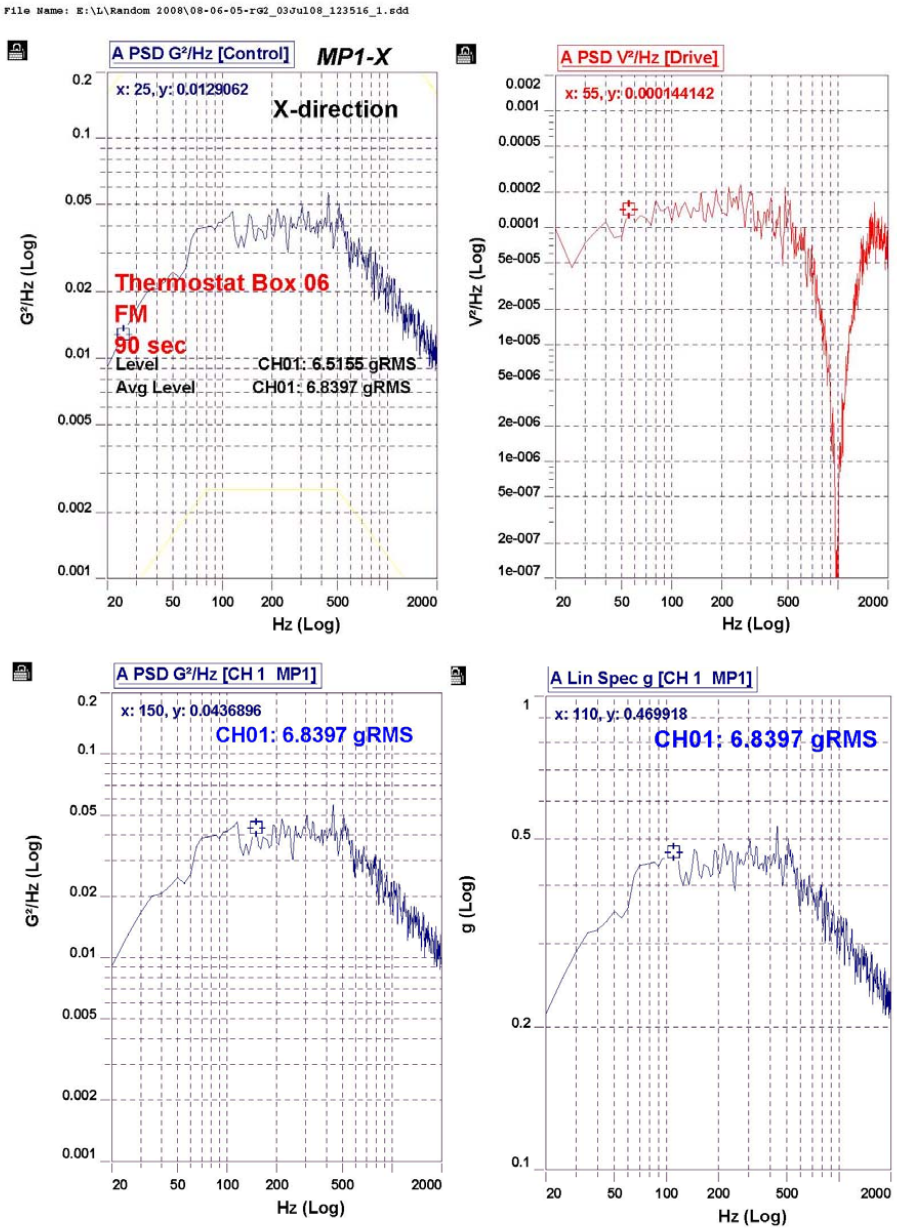


Fig. 1 Thermostat Box 06 mounted on Vibration-table in x-axis


File Name: E:\L\Random 2008\08-06-05-rG2_03Jul08_123516_1.sdd
A PSD G²/Hz [Control]
MP1-X
x: 25, y: 0.0129062
X-direction
Thermostat Box 06
FM
90 sec
Level
CH01: 6.5155 gRMS
Avg Level
CH01: 6.8397 gRMS
G²/Hz (Log)
Hz (Log)
A PSD V²/Hz [Drive]
x: 55, y: 0.000144142
V²/Hz (Log)
Hz (Log)
A PSD G²/Hz [CH 1 MP1]
x: 150, y: 0.0436896
CH01: 6.8397 gRMS
G²/Hz (Log)
Hz (Log)
A Lin Spec g [CH 1 MP1]
x: 110, y: 0.469918
CH01: 6.8397 gRMS
g (Log)
Hz (Log)

Vibration setup y-axis:

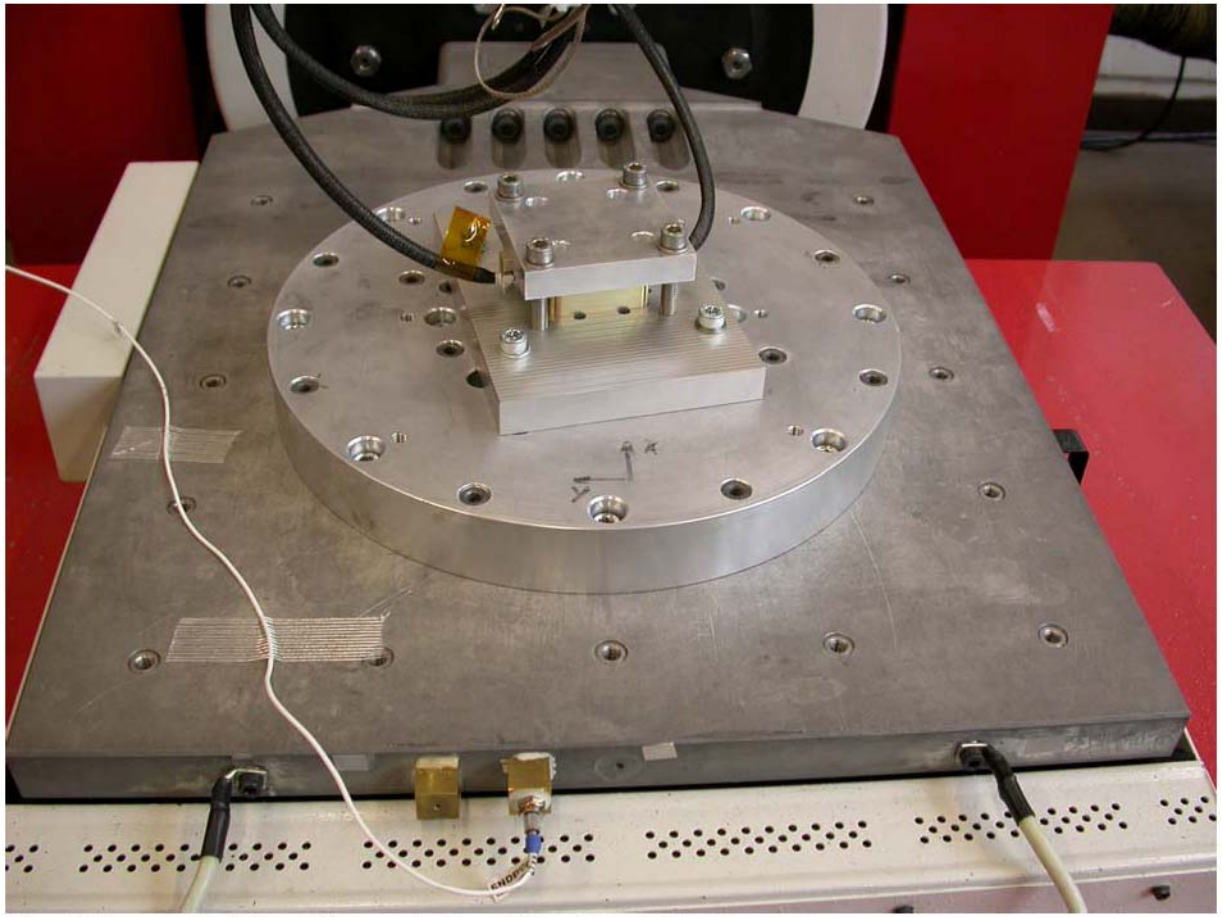
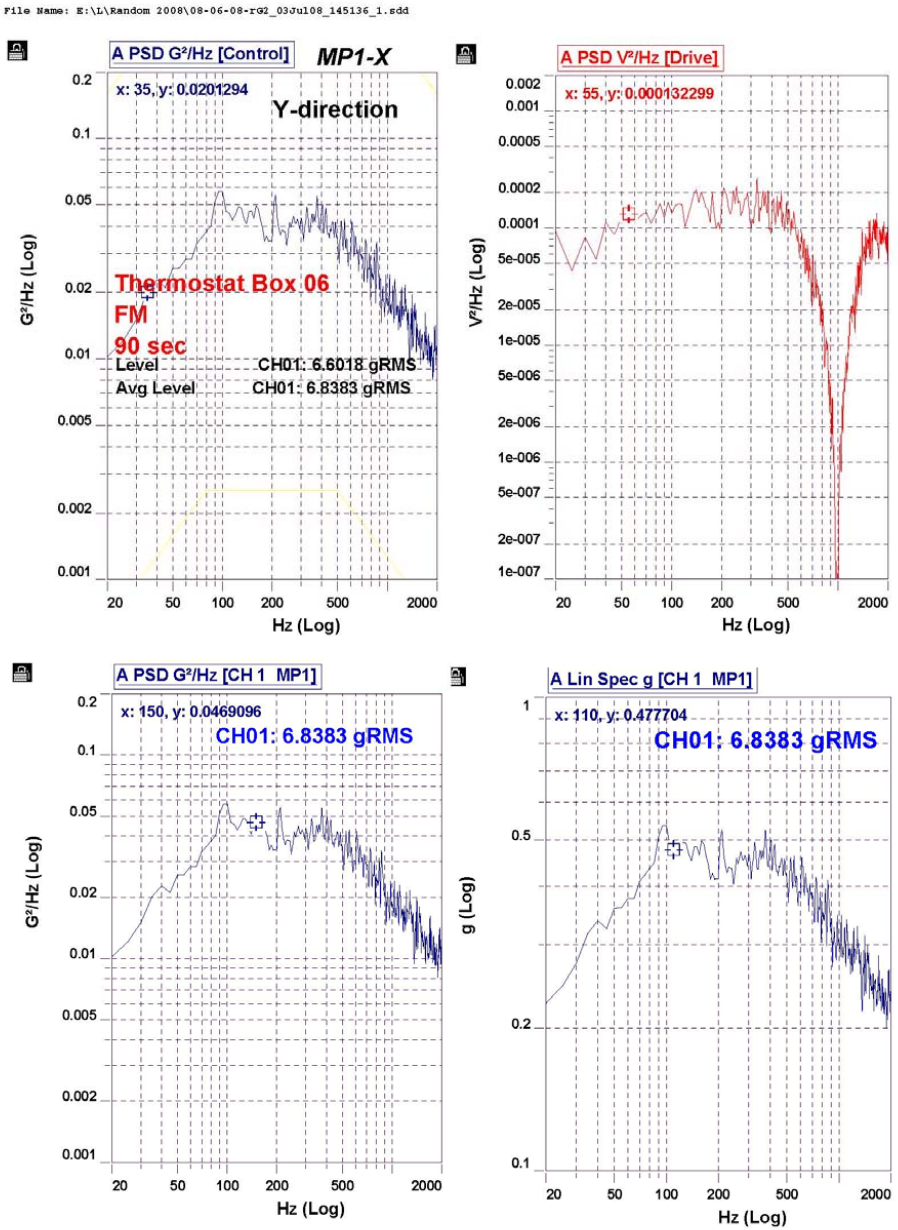


Fig. 2 Thermostat Box 06 mounted on Vibration-table in y-axis


File Name: E:\L\Random 2008\08-06-08-rG2_03Jul08_145136_1.sdd
A PSD G²/Hz [Control]
MP1-X
x: 35, y: 0.0201294
Y-direction
Thermostat Box 06
FM
90 sec
Level CH01: 6.6018 gRMS
Avg Level CH01: 6.8383 gRMS
G²/Hz (Log)
Hz (Log)
A PSD V²/Hz [Drive]
x: 55, y: 0.000132299
V²/Hz (Log)
Hz (Log)
A PSD G²/Hz [CH 1 MP1]
x: 150, y: 0.0469096
CH01: 6.8383 gRMS
G²/Hz (Log)
Hz (Log)
A Lin Spec g [CH 1 MP1]
x: 110, y: 0.477704
CH01: 6.8383 gRMS
g (Log)
Hz (Log)

Vibration setup z-axis:

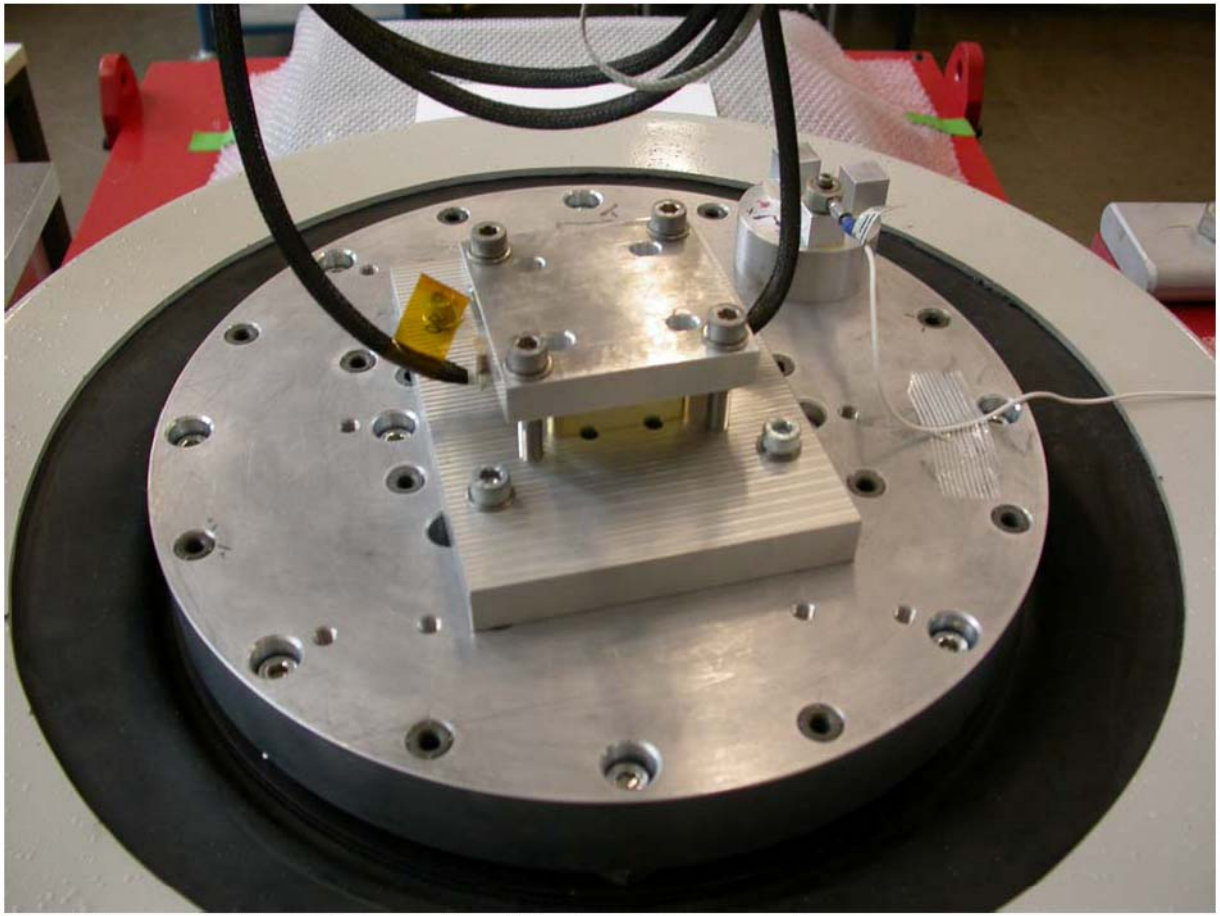
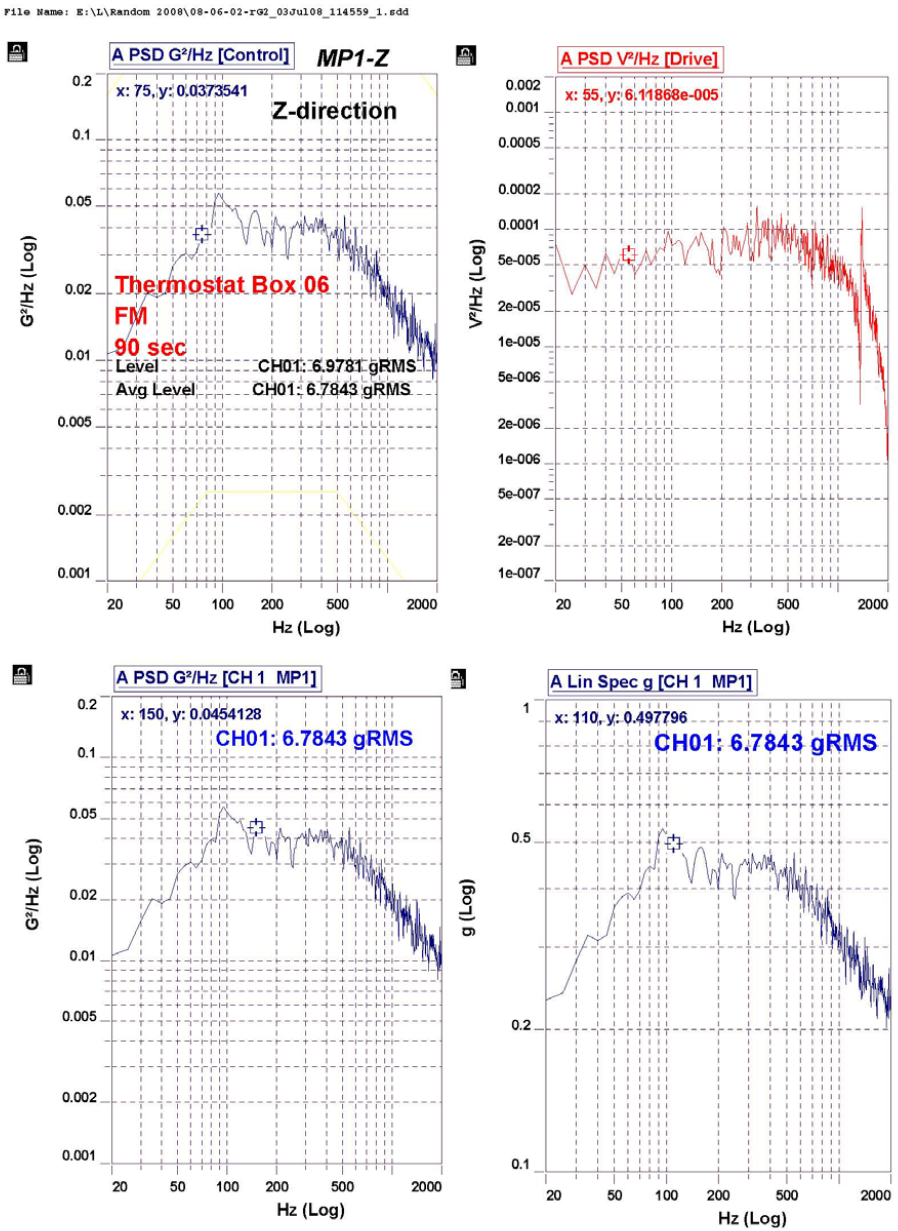


Fig. 3 Thermostat Box 06 mounted on Vibration-table in z-axis


File Name: E:\L\Random 2008\08-06-02-rG2_03Jul08_114559_1.sdd
A PSD G²/Hz [Control]
MP1-Z
x: 75, y: 0.0373541
Z-direction
Thermostat Box 06
FM
90 sec
Level CH01: 6.9781 gRMS
Avg Level CH01: 6.7843 gRMS
G²/Hz (Log)
Hz (Log)
A PSD V²/Hz [Drive]
x: 55, y: 6.11868e-005
V²/Hz (Log)
Hz (Log)
A PSD G²/Hz [CH 1 MP1]
x: 150, y: 0.0454128
CH01: 6.7843 gRMS
G²/Hz (Log)
Hz (Log)
A Lin Spec g [CH 1 MP1]
x: 110, y: 0.497796
CH01: 6.7843 gRMS
g (Log)
Hz (Log)

Thermostat Box 06 has been qualified via one Thermal-Vacuum-Test (TVT).

TVT (07.07.2008): Thermostat Box 06

- Switching Points of the four Thermostats
- 5 cycles from -25°C to 45°C
- Voltage ~110V

TVT setup layout:

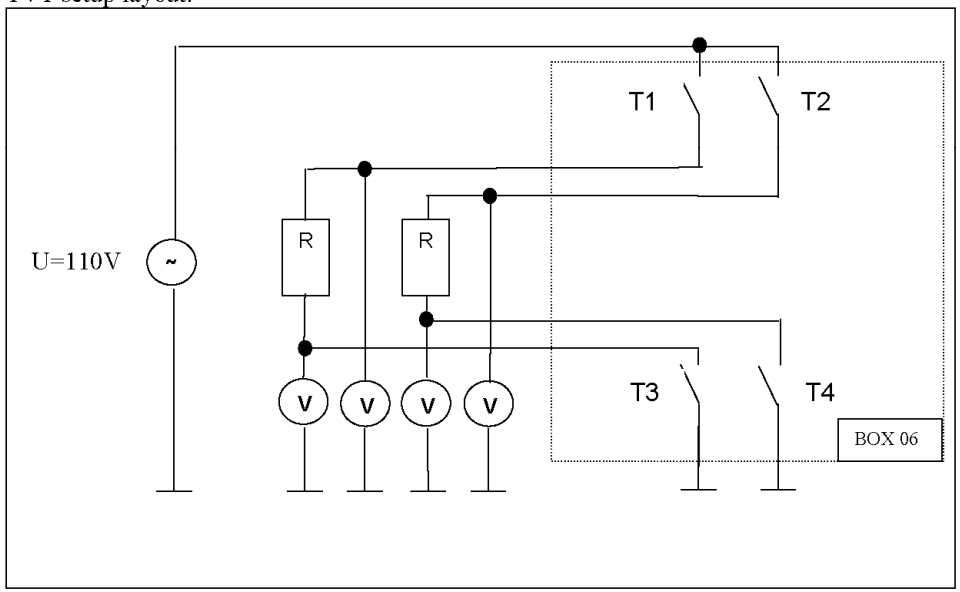


Fig. 4 TVT setup Thermostat Box 06 Power Supply, Thermostats, Voltmeter & Resistor

Voltage is measured with a Keithley Multimeter (Typ 2701) before and behind the resistor (R=3300Ω). Temperature Sensors T1 & T2 (PT1000) was mounted on the cover of Thermostat Box 06.

Thermostat switching points:

No. 00103:	On at T=9.27°C,	Off at T=19.07°C
No. 00108:	On at T=11.14°C,	Off at T=18.93°C
No. 00100:	On at T=10.48°C,	Off at T=18.25°C
No. 00107:	On at T=10.67°C,	Off at T=19.14°C

Mean value of the five cycles.

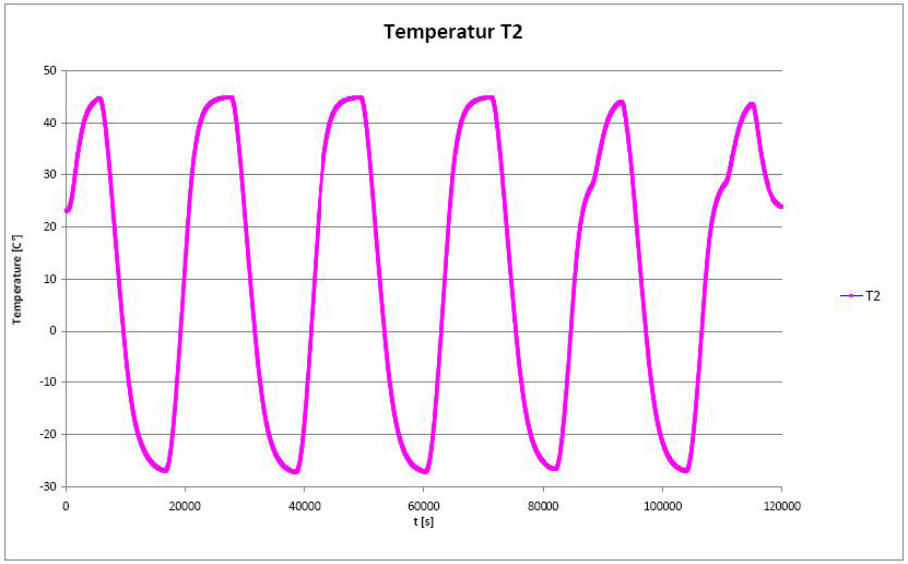


Fig. 5 Environment, Temperature sensor T2 on Thermostat Box 06

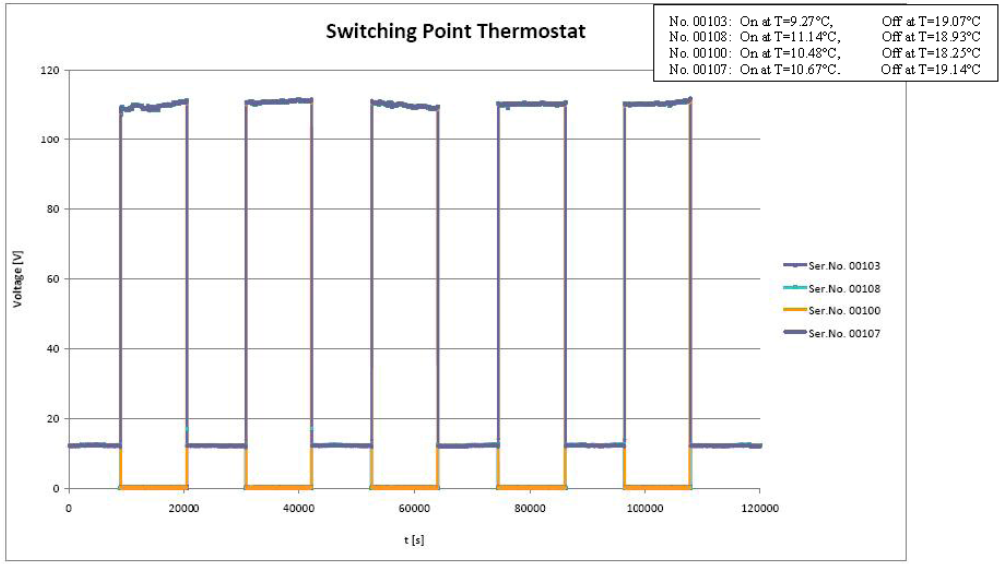


Fig. 6 Switching Points of the Thermostats

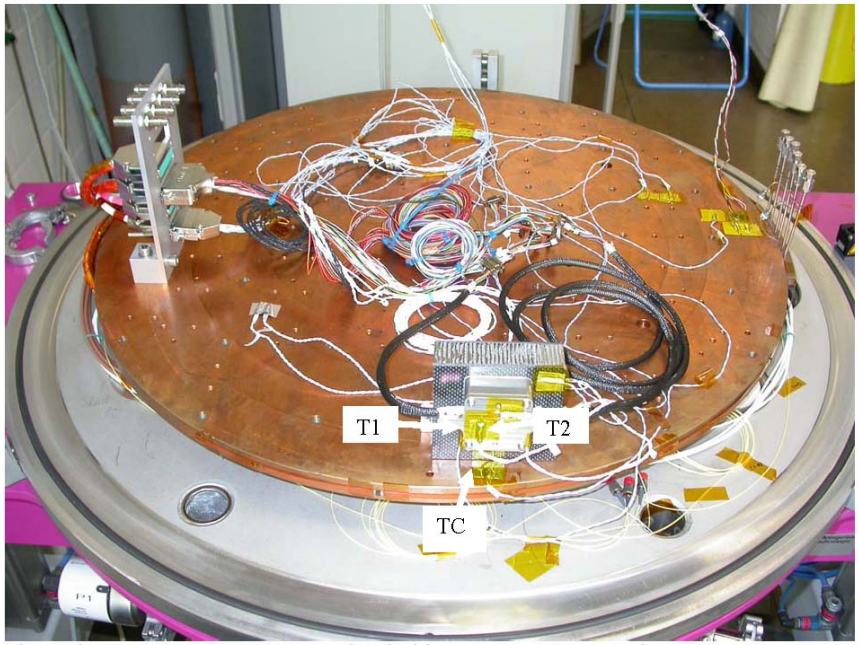


Fig. 7 Thermostat Box 06 on copper plate inside TVT, TC=T copper plate

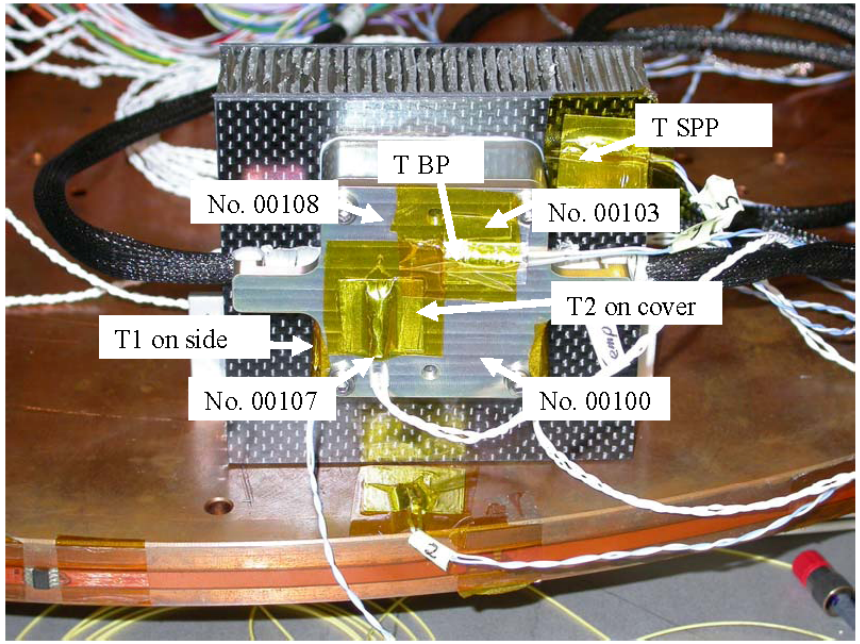


Fig. 8 Thermostat Box 06, Position of the Thermostats

TRD M-Structure Heating Thermostat Box #8

Space Qualification
TRD Heating Thermostat Box 08
Vibration Test & Thermal Vacuum Test

St Schmitz, 14.07.2008

Thermostat Box 08 has been qualified via Vibration-Test (VT).

VT (03.07.2008): Thermostat Box 08

- Random vibration in 3-dimensions (x, y, z)
- Acceleration Level = 6.8gRMS

Control Channel - Profile Settings

	Status	Frequency [Hz]	G²/Hz	Slope (dB/okt)	-Alarm (dB)	+Alarm (dB)	-Abort (dB)	+Abort (dB)
1	On			3.0	12.0	12.0	24.0	24.0
2	On	80.0	0.0400000		12.0	12.0	24.0	24.0
3	On	500.0	0.0400000		12.0	12.0	24.0	24.0
4	On			-3.0	12.0	12.0	24.0	24.0

Vibration setup x-axis:

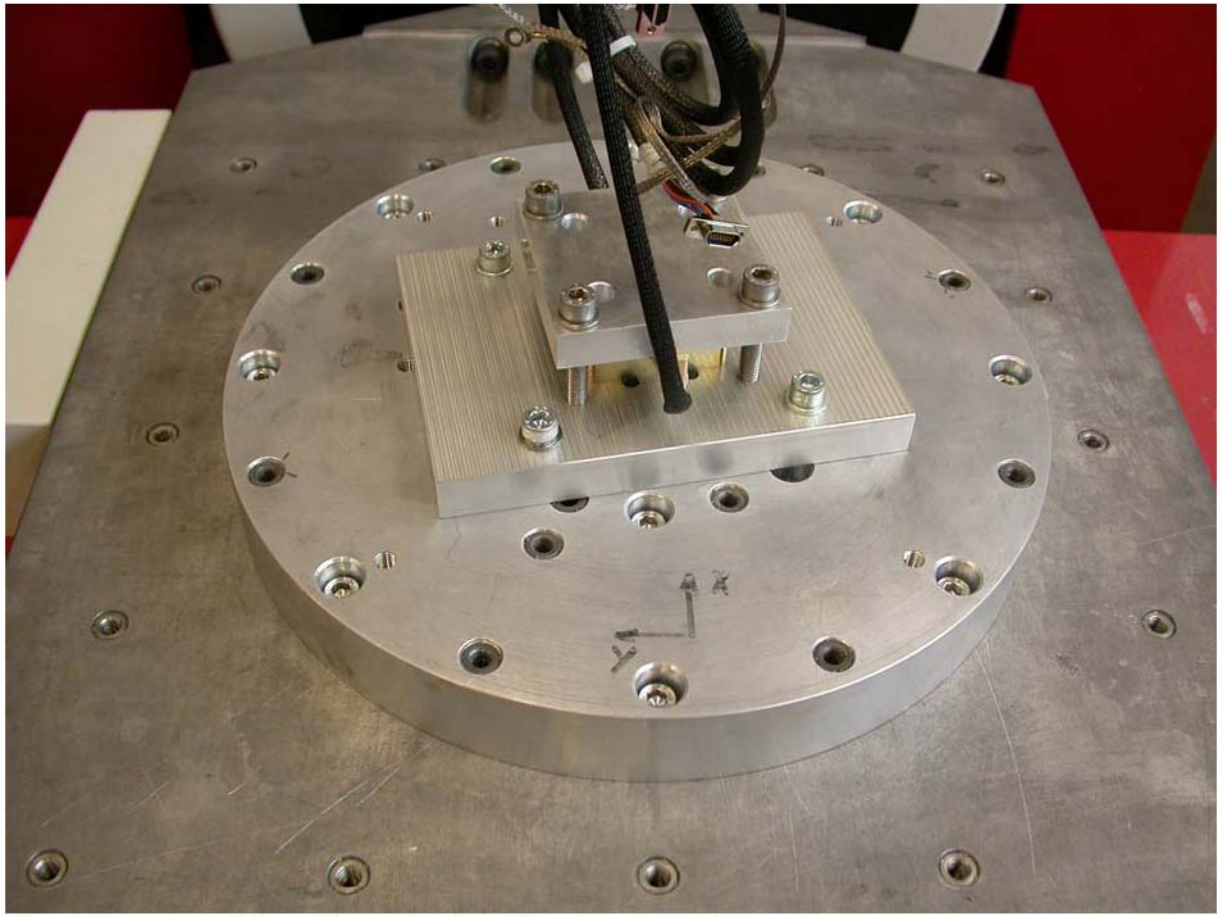
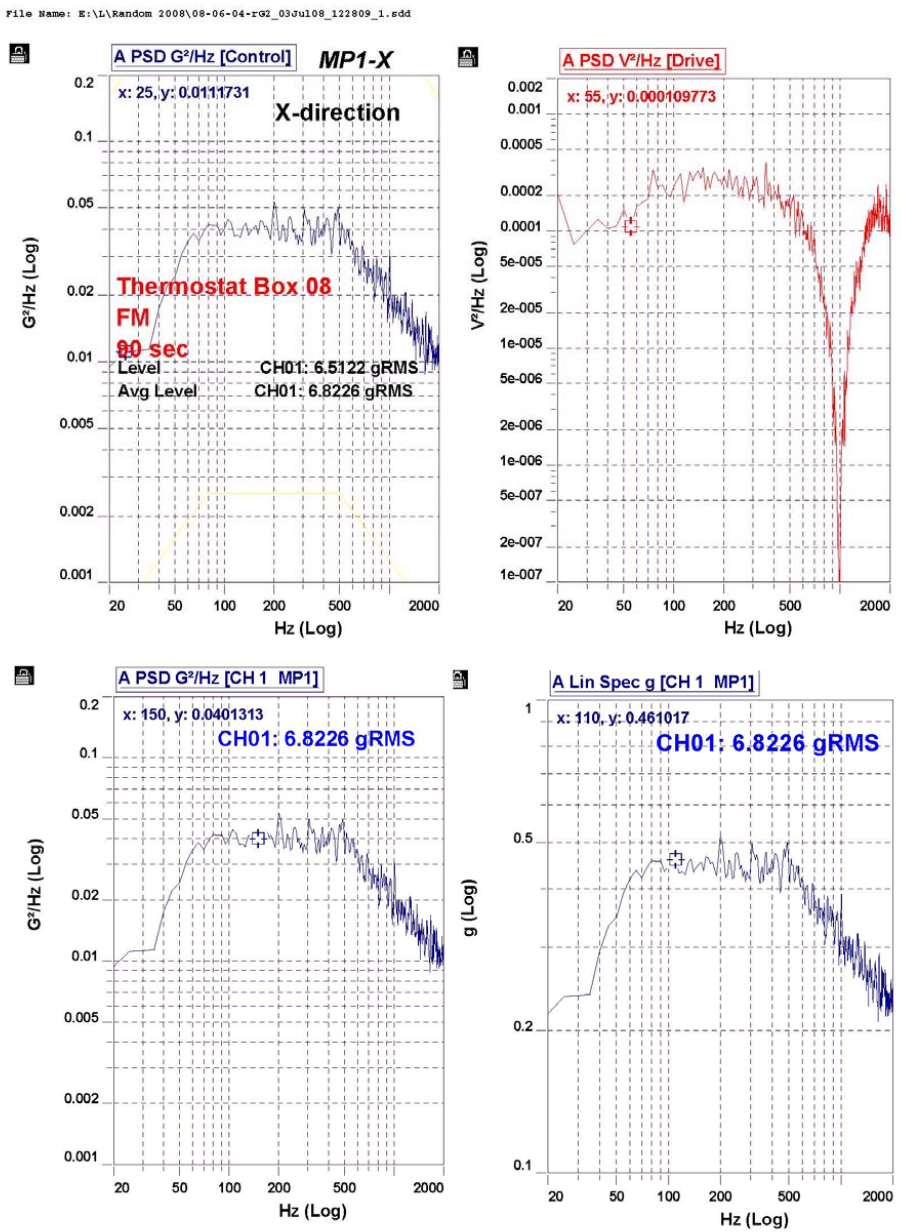


Fig. 1 Thermostat Box 08 mounted on Vibration-table in x-axis


File Name: E:\L\Random 2008\08-06-04-rG2_03Jul08_122809_1.sdd
A PSD G²/Hz [Control]
MP1-X
x: 25, y: 0.0111731
X-direction
Thermostat Box 08
FM
90 sec
Level
CH01: 6.5122 gRMS
Avg Level
CH01: 6.8226 gRMS
G²/Hz (Log)
Hz (Log)
A PSD V²/Hz [Drive]
x: 55, y: 0.000109773
V²/Hz (Log)
Hz (Log)
A PSD G²/Hz [CH 1 MP1]
x: 150, y: 0.0401313
CH01: 6.8226 gRMS
G²/Hz (Log)
Hz (Log)
A Lin Spec g [CH 1 MP1]
x: 110, y: 0.461017
CH01: 6.8226 gRMS
g (Log)
Hz (Log)

Vibration setup y-axis:

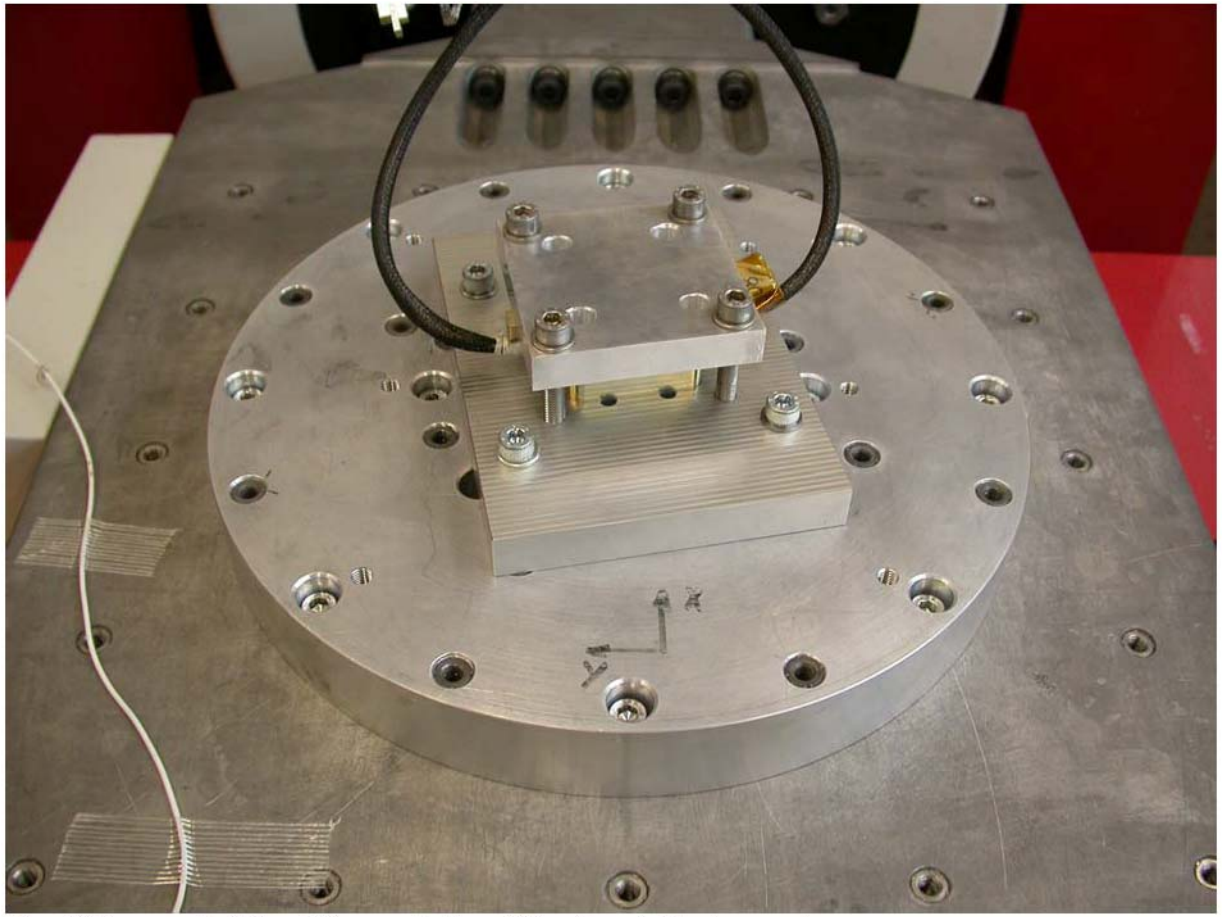
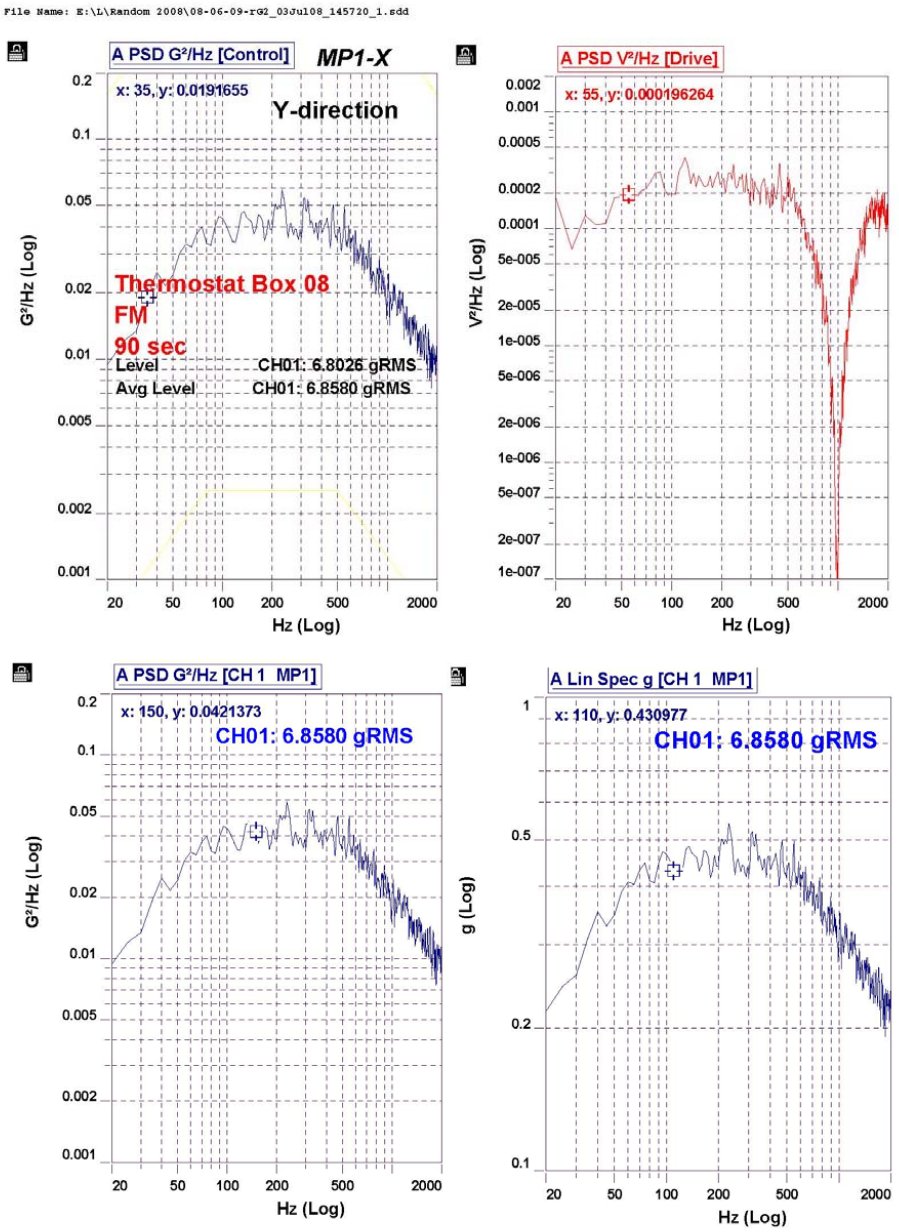


Fig. 2 Thermostat Box 08 mounted on Vibration-table in y-axis


File Name: E:\L\Random 2008\08-06-09-rG2_03Jul08_145720_1.sdd
A PSD G²/Hz [Control]
MP1-X
x: 35, y: 0.0191655
Y-direction
Thermostat Box 08
FM
90 sec
Level
CH01: 6.8026 gRMS
Avg Level
CH01: 6.8580 gRMS
G²/Hz (Log)
Hz (Log)
A PSD V²/Hz [Drive]
x: 55, y: 0.000196264
V²/Hz (Log)
Hz (Log)
A PSD G²/Hz [CH 1 MP1]
x: 150, y: 0.0421373
CH01: 6.8580 gRMS
G²/Hz (Log)
Hz (Log)
A Lin Spec g [CH 1 MP1]
x: 110, y: 0.430977
CH01: 6.8580 gRMS
g (Log)
Hz (Log)

Vibration setup z-axis:

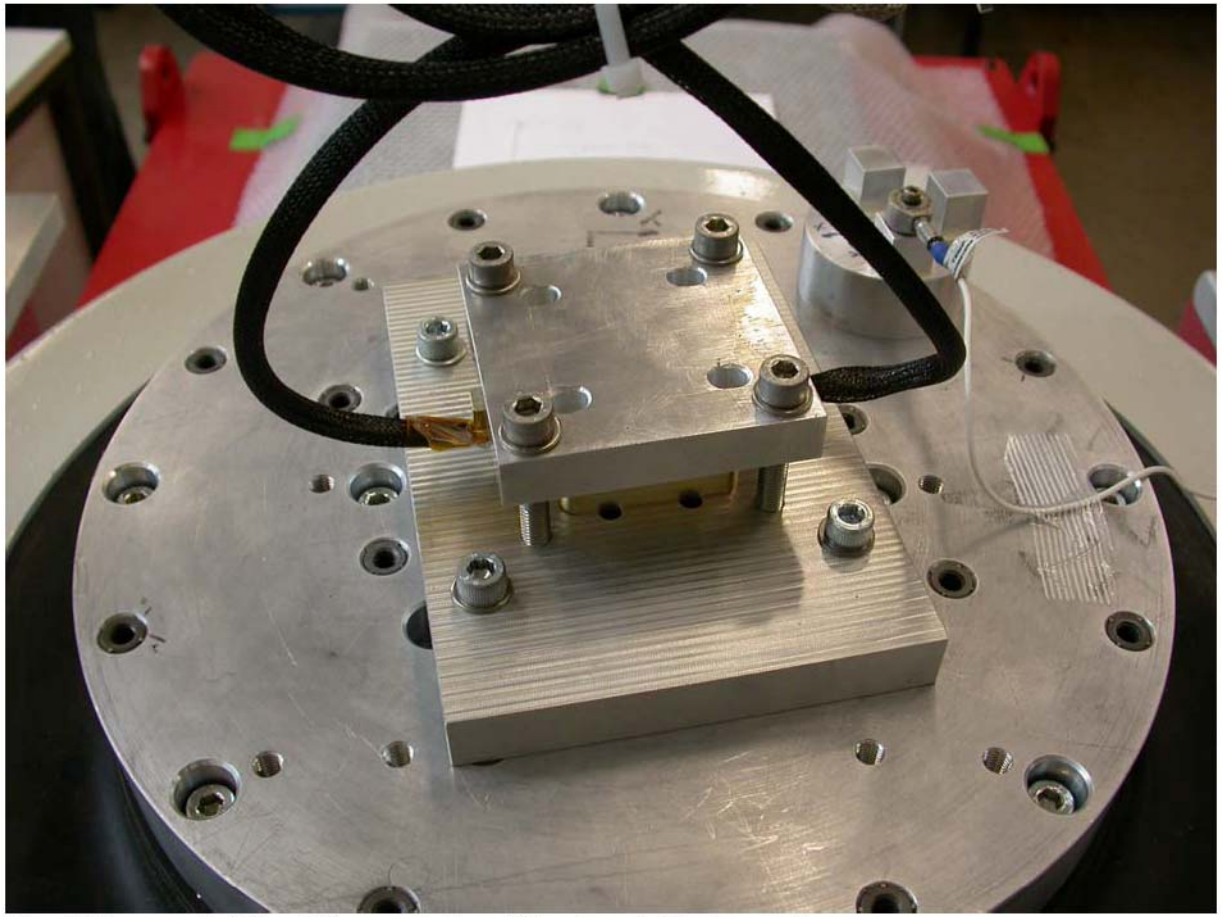
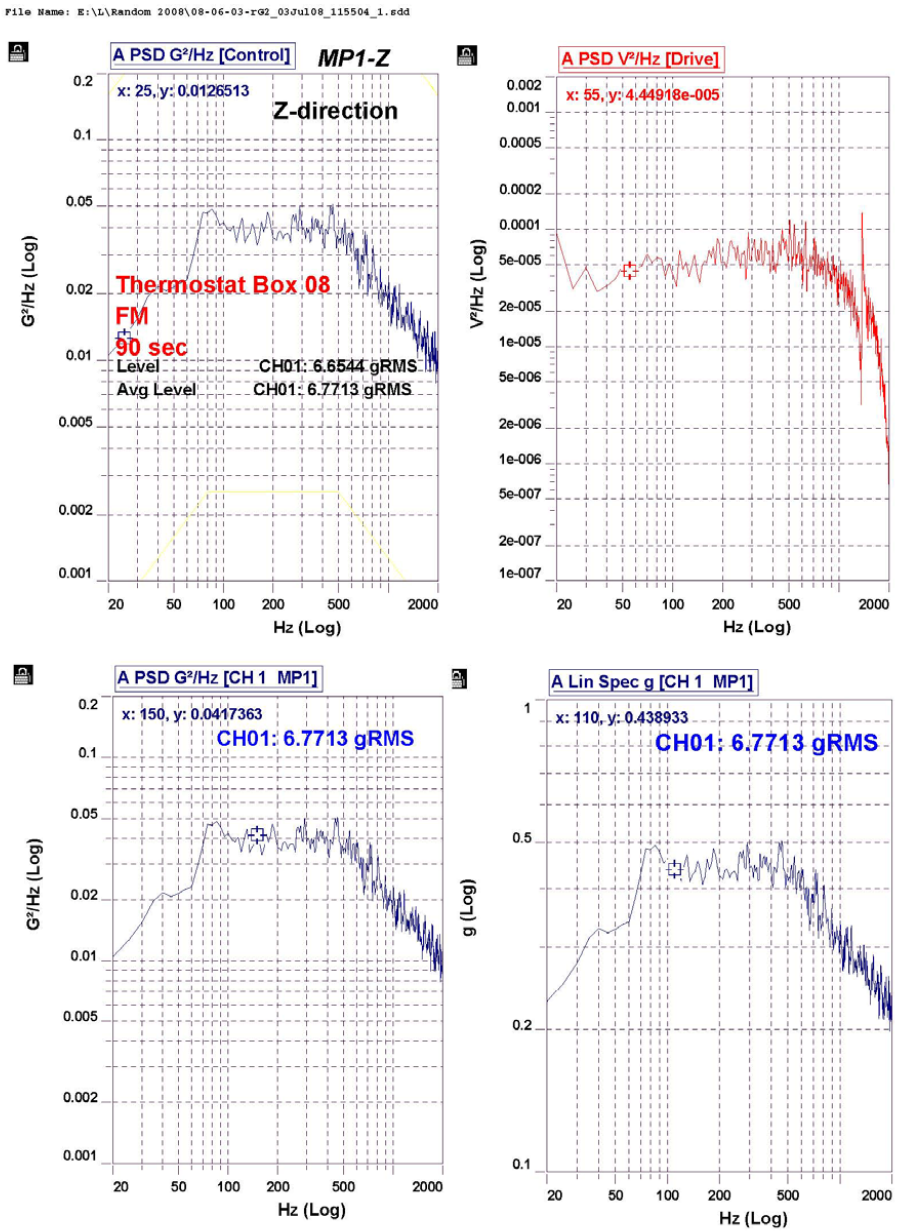


Fig. 3 Thermostat Box 08 mounted on Vibration-table in z-axis


File Name: E:\L\Random 2008\08-06-03-rG2_03Jul08_115504_1.sdd
A PSD G²/Hz [Control]
MP1-Z
x: 25, y: 0.0126513
Z-direction
Thermostat Box 08
FM
90 sec
Level CH01: 6.6544 gRMS
Avg Level CH01: 6.7713 gRMS
G²/Hz (Log)
Hz (Log)
A PSD V²/Hz [Drive]
x: 55, y: 4.44918e-005
V²/Hz (Log)
Hz (Log)
A PSD G²/Hz [CH 1 MP1]
x: 150, y: 0.0417363
CH01: 6.7713 gRMS
G²/Hz (Log)
Hz (Log)
A Lin Spec g [CH 1 MP1]
x: 110, y: 0.438933
CH01: 6.7713 gRMS
g (Log)
Hz (Log)

Thermostat Box 08 has been qualified via one Thermal-Vacuum-Test (TVT).

TVT (09.07.2008): Thermostat Box 08

- Switching Points of the four Thermostats
- 5 cycles from -25°C to 45°C
- Voltage ~110V

TVT setup layout:

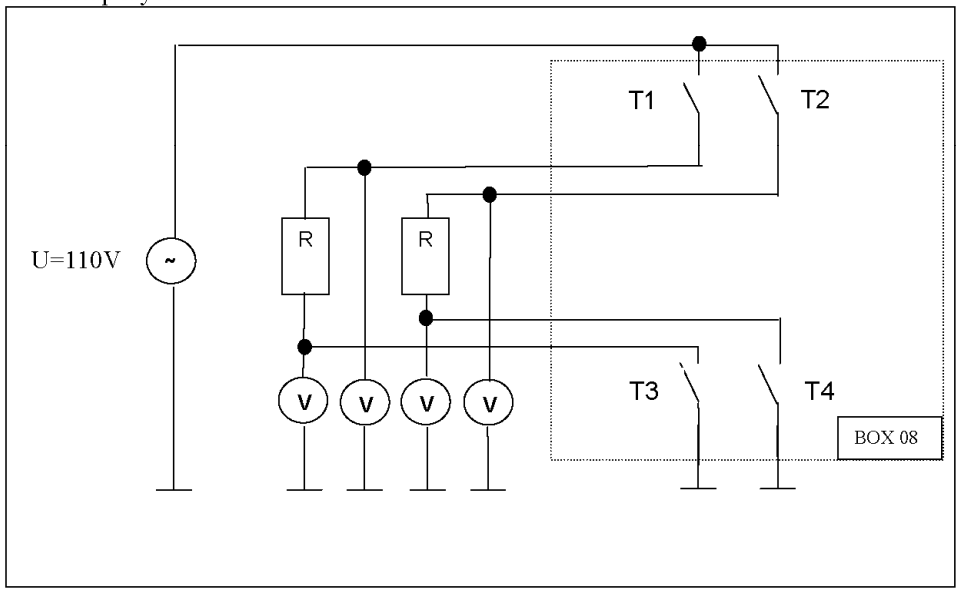


Fig. 4 TVT setup Thermostat Box 08 Power Supply, Thermostats, Voltmeter & Resistor

Voltage is measured with a Keithley Multimeter (Typ 2701) before and behind the resistor (R=3300Ω). Temperature Sensors T1 & T2 (PT1000) was mounted on the cover of Thermostat Box 08.

Thermostat switching points:

No. 00113:	On at T=10.78°C,	Off at T=18.46°C
No. 00119:	On at T=11.11°C,	Off at T=18.3°C
No. 00110:	On at T=11.6°C,	Off at T=18.07°C
No. 00115:	On at T=11.2°C,	Off at T=18.71°C

Mean value of the five cycles.

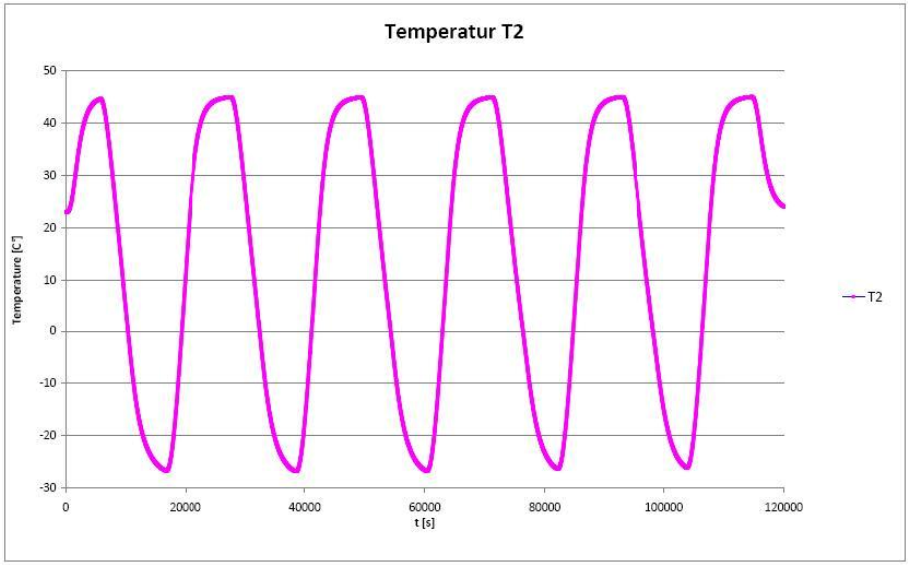


Fig. 5 Environment, Temperature sensor T2 on Thermostat Box 08

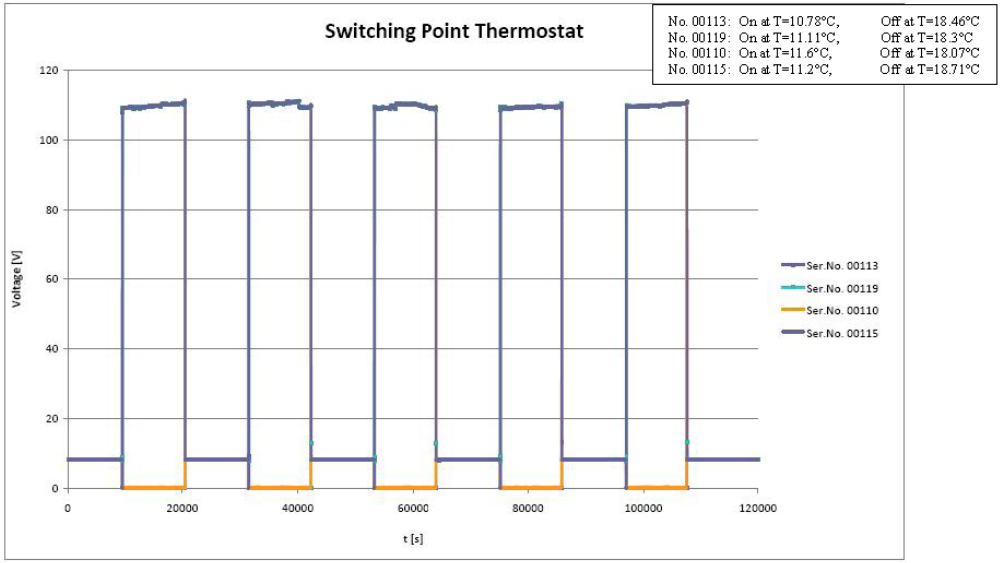


Fig. 6 Switching Points of the Thermostats

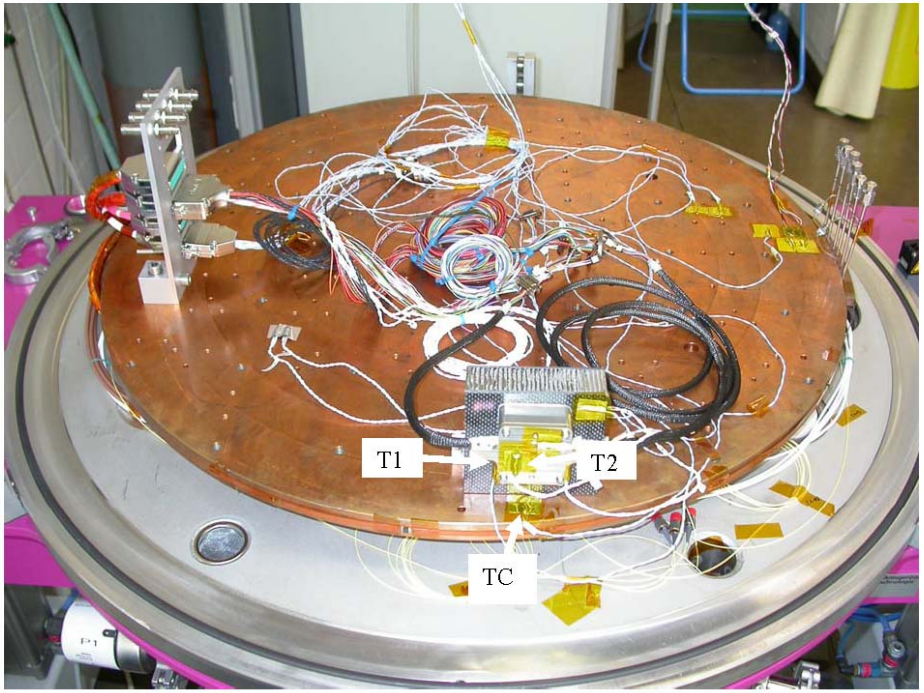


Fig. 7 Thermostat Box 08 on copper plate inside TVT, TC=T copper plate

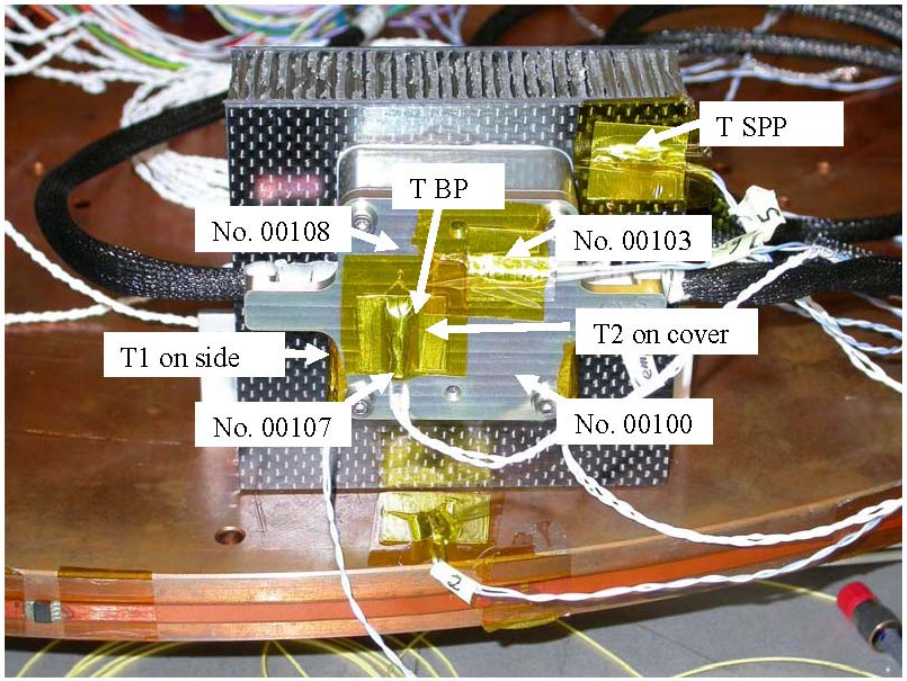


Fig. 8 Thermostat Box 08, Position of the Thermostats