

SERVICE DATASHEET

Thermal-Vacuum Testing

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TABLE OF CONTENTS

1	Purpose and Scope	4
2	Application and Key Features	5
	2.1 APPLICATION	5
	2.2 KEY FEATURES.....	5
3	Specification	7
	3.1 T-VAC TEST CHAMBER	7
	3.2 CLIMATE TEST CHAMBER	8
	3.3 VACUUM BAKEOUT CHAMBER	9
4	Accreditation and Audits	10
5	ANNEX A – T-VAC Test Chamber	11
6	ANNEX B –Climate Test Chamber	13
7	ANNEX C – Vacuum Bakeout Chamber	14
8	List of Abbreviations	15
9	List of Figures	16
10	List of Tables	17
11	References	18
	11.1 APPLICABLE AND NORMATIVE DOCUMENTS.....	18
	11.2 REFERENCE DOCUMENTS.....	18

1 Purpose and Scope

The present document provides detailed technical information about the Thermal-Vacuum Testing services for ECSS-conform space equipment testing in the following cases:

- Thermal-Vacuum test;
- Thermal Ambient test (vacuum and non-vacuum);
- Thermal Cycling test (non-vacuum);
- Corona and Arc Discharge test (vacuum sweep);
- Multipaction test;
- Humidity test;
- Vacuum bakeout.

The definitions and glossary of terms from ECSS-S-ST-00-01C [AD 1] apply to this document.



1. Figure – Thermal-Vacuum Test Facility

2 Application and Key Features

2.1 APPLICATION

- ✓ **Thermal-Vacuum ECSS-conform tests including**
 - Thermal-Vacuum tests
 - Thermal Ambient test in vacuum conditions
- ✓ **Thermal ECSS-conform tests including**
 - Thermal Cycling test in non-vacuum conditions
 - Thermal Ambient test in non-vacuum conditions
- ✓ **Humidity ECSS-conform tests**
- ✓ **Other vacuum environment related specific ECSS-conform test including**
 - Corona and Arc Discharge test
 - Multipaction test
- ✓ **Space equipment vacuum bakeout**

2.2 KEY FEATURES

- ✓ **The following test chambers are available**
 - T-VAC test chamber (deep vacuum)
 - Climate test chamber (non-vacuum)
 - Bakeout chamber (vacuum)
- ✓ **Contamination control and spectroscopy**
 - TQCM contamination monitoring and control system
 - Mass spectrometry up to 200amu
- ✓ **Deep space vacuum test system**
 - Deep vacuum conditions down to 10-5Pa in the temperature range of [-65;+95]°C
 - Depressurisation with air or purified N2
- ✓ **Configurable test systems according to the user's need**
 - Controlled via graphical user interface
 - Fully autonomous test operation and remote access
 - Data collection via dedicated software (SpaceSim)

✓ **High level of safety assurance**

- The Facility is located at a closed, guarded site with limited number of access
- Every area is video controlled
- Any access to the Facility area is logged
- ESD-safe working environment with ESD-tester stations

✓ **Facility environmental parameters are logged (temperature, humidity)**

✓ **ECSS-conform space testing engineering support is available upon request**

3 Specification

3.1 T-VAC TEST CHAMBER

1. Table – T-VAC Test Chamber general specification

Parameters	Values
Applicable ECSS test as per ECSS-E-ST-10-03C [AD 2], ECSS-E-20-01A Rev.1 [AD 3]	Thermal-Vacuum Test Thermal Ambient (vacuum) Corona and Arc Discharge (vacuum sweep) Multipaction Test Vacuum bakeout with TQCM monitoring any mass spectrometry
Chamber name or ID	EK T-VAC Chamber
Chamber type	Custom made
Chamber dimensions (without TQCM)	78 cm [length]; 49 cm [cylindrical diameter];
Chamber dimensions (with TQCM)	62 cm [length]; 49 cm [cylindrical diameter];
Chamber volume	147.1L
Operational temperature range	-65...+95°C with ±1.0°C accuracy
Operational pressure range	10-5...105Pa with ±30% accuracy
Temperature monitoring and control	Up to 10 pcs of PT100 LakeShore sensors with ±0.5°C or ±0.1°C accuracy in the range of [-259; +600]°C Using thermal condition fixing plate
Contamination control	CrystalTek 66TR TQCM monitoring system Dynamic range: Solid film 50kHz + Non-Solid 10-20kHz Mass sensitivity: 1.96*10 ⁻⁹ g/cm2Hz (@15MHz)* TQCM sensor frequency accuracy: ±1Hz TQCM sensor temperature range: -59...+100°C Sensor FoV: 140°
Contamination spectrometry	INFICON Transpector MPH20P Residual Gas Analyzer Mass range: 1 to 200amu Resolution: <1 amu @10% peak height over the mass range** Sensitivity: 3.8*10 ⁻⁴ amps/mbar
Cold-trap	No
Depressurisation	Air or purified N ₂
Average heating velocity***	1.5°C/min (±0.5°C)
Average cooling velocity***	0.5°C/min (±0.3°C)
Data collection****	Using SpaceSim software up to 1Hz
Chamber mechanical interface	See ANNEX A
Chamber electrical interface	4 pcs of DB25 female/male connectors inside/outside 2 pcs of SM4036 by Fairview Microwave inside/outside (type N female to type N female bulkhead adapter)

* 1.73*10⁻⁹g/cm2Hz (@16MHz); 1.56*10⁻⁹g/cm2Hz (@16.8MHz)

** As per 1993 AVS Recommended Practice.

*** In case of empty chamber without internal additional

**** Measured pressures (in two points), used temperature sensor data set, TQCM system data set, measured mass spectrums.

3.2 CLIMATE TEST CHAMBER

2. Table– Climate Test Chamber general specification

Parameters	Values
Applicable ECSS test as per ECSS-E-ST-10-03C [AD 2]	Humidity Test Thermal Cycling Test (non-vacuum) Thermal Ambient (non-vacuum)
Chamber name or ID	EK Climate Chamber (S/N: 56766037170010)
Chamber type	Climats Excal 1421-HE
Chamber dimensions	55 cm [length]; 50 cm [depth]; 50 cm [height]
Chamber volume	137.5L
Chamber window size	35 cm x 38 cm
Operational temperature change	-65...+175°C with ±1.0°C accuracy
Operational humidity change	10...98%relH
Temperature control	Internal or external PT100 sensor with ±0.5°C accuracy
Humidity control	For temperatures +10...+90°C
Temperature regulation stability*	±0.1...±0.3°C
Work space homogeneity (as per IEC EN 60068-3-5)*	±0.5...±1.8°C
Humidity regulation stability	±1...±3%relH
Average heating velocity (as per IEC EN 60068-3-5)*	7.0°C/min (±0.5°C)
Average cooling velocity (as per IEC EN 60068-3-5)*	5.0°C/min (±0.5°C)
Admissible dissipation at +20°C	1.5 kW
Data collection period**	Using Spirale3 software up to 1Hz
Chamber mechanical interfaces	3 pcs stainless steel inner shelves (maximum load 12kg/shelf) For more details see ANNEX B
Chamber electrical interfaces	3 pcs access portholes (16 cmø left; 16 cmø right, 11 cmø right)

3.3 VACUUM BAKEOUT CHAMBER

3. Table – Vacuum Bakeout Chamber general specification

Parameters	Values
Applicable ECSS test as per ECSS-E-ST-10-03C [AD 2]	Vacuum Bakeout (no monitoring)
Chamber name or ID	EK Bakeout Chamber (S/N: 42278348)
Chamber type	Thermo Scientific VT6060M
Chamber dimensions	41.5 cm [length]; 34.5 cm [depth]; 37.1 cm [height]
Chamber volume	53L
Chamber window size	40 cm x 35 cm
Operational temperature change	(Ambient Temperature+15°C) +200°C with ±1°C accuracy
Lowest final pressure	10Pa
Depressurisation	Air or purified N2
Temperature control	Internal PT100 sensor with ±1.0°C accuracy
Work space homogeneity (as per DIN 128880 part 2)*	±4°C (@200°C)
Data collection period	No data collected
Chamber mechanical Interfaces	2 pcs stainless steel inner shelves (maximum load 12kg/shelf)
Chamber electrical interfaces	1 pc MicroD 9pin (MIL-DTL-83513) 1 pc BNC 50 Ohm (NBC50) 1 pc COAX 10pin (PLUG-MINI-1B-10) For more details see ANNEX C – Vacuum Bakeout Chamber

* In case of empty chamber in vacuum operation without internal additional heat sources.

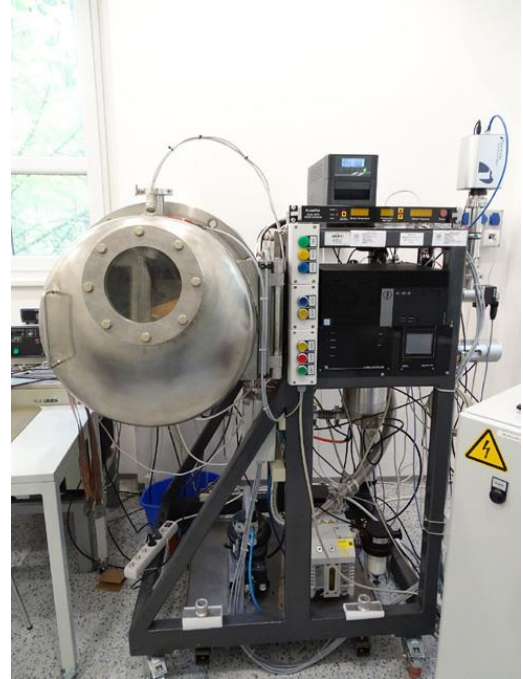
4 Accreditation and Audits

4. Table – Accreditation and Audits

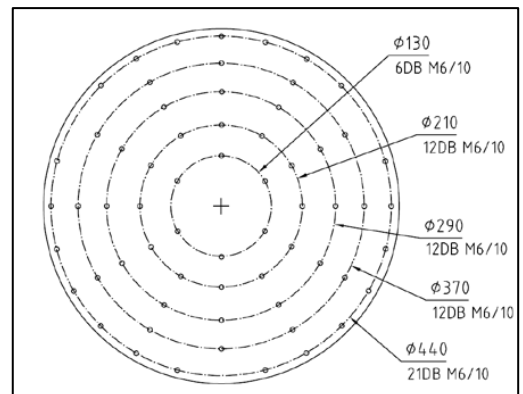
Code	Title	Type	Validity	Remarks
ISO 9001:2015	Quality management system	Accreditation planned	N/A	Accreditation is in progress
ISO 17025:2018	General requirements for the competence of testins and calibration laboratories	Accreditation planned	N/A	Accreditation is in progress
ECSS-Q-ST-20-07C [AD 2]	Quality and safety assurance for space test centres	Audit by ESA	N/A	Audit was performed in 2018

5 ANNEX A – T-VAC Test Chamber

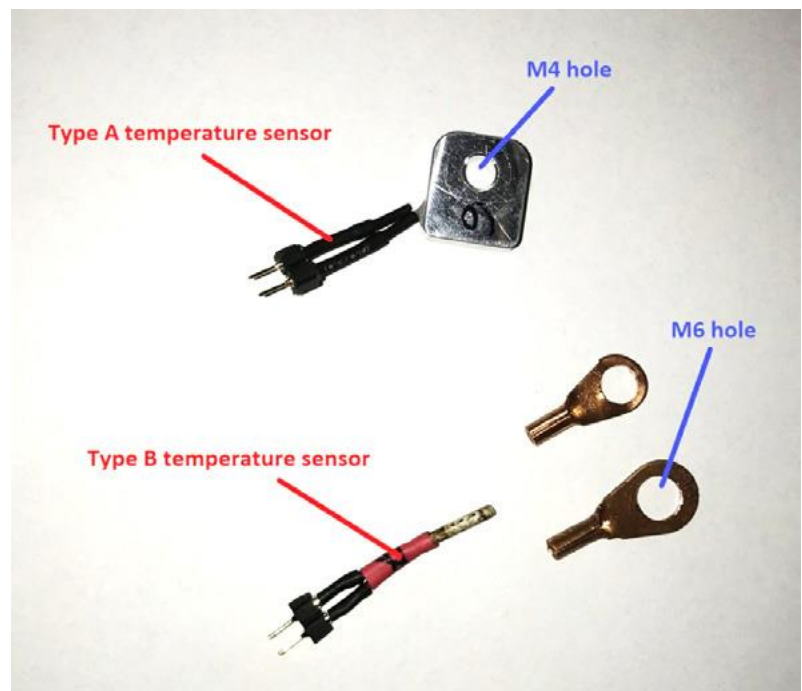
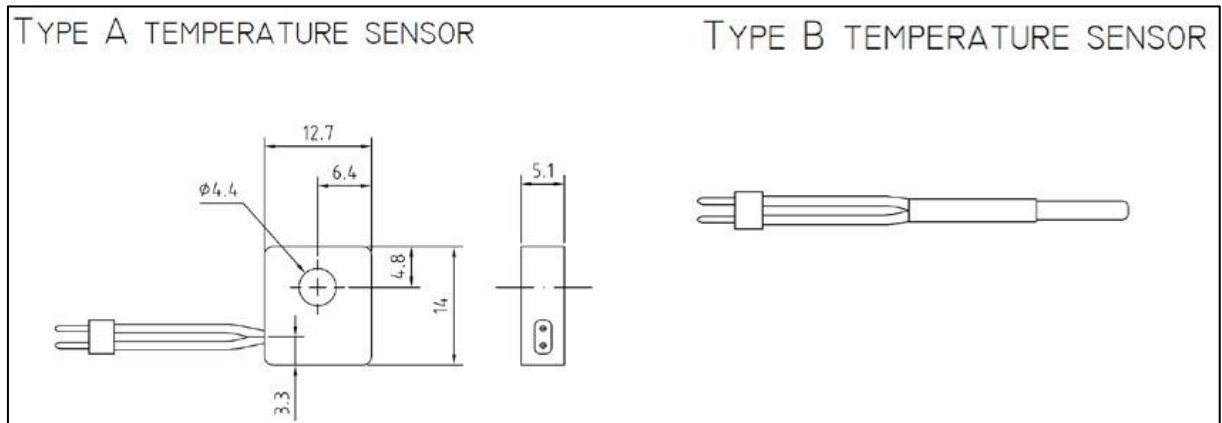
You find here the T-VAC Test Chamber related mechanical interface information for designing the mount of the test item and related temperature sensors.



2. Figure – The picture of the T-VAC Test Chamber



3. Figure – The thermal conduction chamber fixing plate is in the back of the chamber, the fixing points are placed with distance given on the picture above (M6/10 screws can be used for fixing)



4. Figure – There are six flat (type A) and four cylindrical sensors (type B), which can be used for T-VAC testing

5. Table – Available temperature sensors in the T-VAC chamber

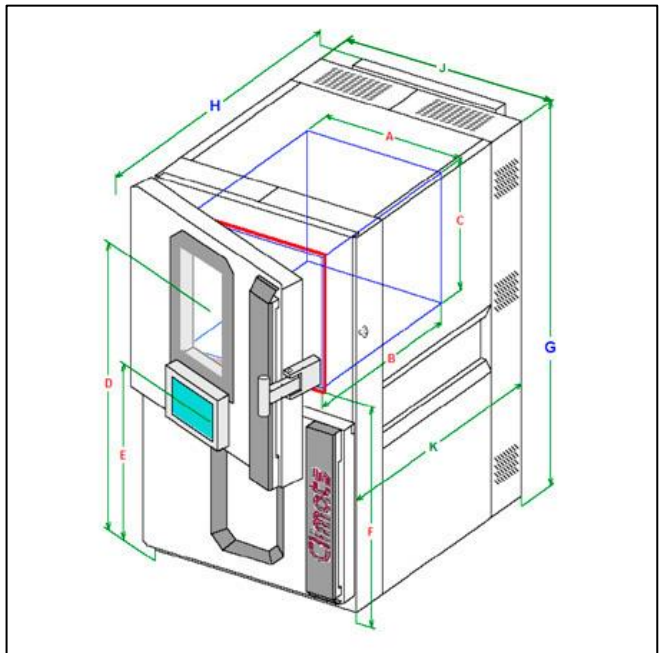
Sensor type	Sensor manufacturer ID	No. of sensors	Range	Accuracy
Type A	LakeShore PT-103-AM	5	[-259; 600] °C	±0.5°C
	LakeShore PT-103-AM-14H	1	[-259; 600] °C	±0.1°C
Type B	LakeShore PT-103	3	[-259; 600] °C	±0.5°C
	LakeShore PT-103-14H	1	[-259; 600] °C	±0.1°C

6 ANNEX B –Climate Test Chamber

You find here the Climate Test Chamber related mechanical interface information for designing the mount of the test item.



6. Figure– The picture of theclimate Test Chamber



5. Figure – The schematic view of the Climate chamber (A=55cm, B=50cm, C=50cm)

7 ANNEX C – Vacuum Bakeout Chamber

You find here the Vacuum Bakeout Chamber related mechanical and electrical interface information for designing the mount of the test item.



7. Figure– The picture of the Vacuum Bakeout Chamber



8. Figure - The picture of the Vacuum Bakeout Chamber electrical interfaces (outside)

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8 List of Abbreviations

AD	Applicable Documents
ECSS	European Cooperation for Space Standardization
RD	Reference Documents
TC	Telecommand
TM	Telemetry
TQCM	Thermoelectric Quartz Crystal Microbalances
T-VAC	Thermal-Vacuum

9 List of Figures

1. Figure – Thermal-Vacuum Test Facility	4
2. Figure – The picture of the T-VAC Test Chamber	11
3. Figure – The thermal conduction chamber fixing plate is in the back of the chamber, the fixing points are placed with distance given on the picture above (M6/10 screws can be used for fixing)	11
4. Figure – There are six flat (type A) and four cylindrical sensors (type B), wich can be use for T-VAC testing	12
6. Figure– The picture of the climate Test Chamber.....	13
5. Figure – The schematic view of the Climate chamber (A=55cm, B=50cm, C=50cm)	13
7. Figure– The picture of the Vacuum Bakeout Chamber	14
8. Figure - The picture of the Vacuum Bakeout Chamber electrical interfaces (outside).....	14

10 List of Tables

1. Table – T-VAC Test Chamber general specification	7
2. Table– Climate Test Chamber general specification	8
3. Table – Vacuum Bakeout Chamber general specification	9
4. Table – Accreditation and Audits	10
5. Table – Available temperature sensors in the T-VAC chamber	12
6. Table – Applicable and Normative Documents	18
7. Table – Reference Documents.....	18

11 References

11.1 APPLICABLE AND NORMATIVE DOCUMENTS

6. Table – Applicable and Normative Documents

AD	Title	Reference	Version
[AD 1]	ECSS system - Glossary of terms	ECSS-S-ST-00-01C	1 Oct 2012
[AD 2]	Space product assurance – Quality and safety assurance for space test centres	ECSS-Q-ST-20-07C	1 Oct 2014
[AD 3]	Space engineering - Multipaction design and test	ECSS-E-20-01A Rev.1	1 March 2013
[AD 4]	Space product assurance - Thermal vacuum outgassing test for the screening of space materials	ECSS-Q-ST-70-02C	15 Nov 2008
[AD 5]	Space product assurance - Quality and safety assurance for space test centres	ECSS-Q-ST-20-07C	1 Oct 2014

11.2 REFERENCE DOCUMENTS

7. Table – Reference Documents

RD	Title	Reference	Version
[RD 1]	-	-	-

END OF DOCUMENT