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SERVICE DATASHEET

Thermal-Vacuum Test Facility

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APPROVAL

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1 **Purpose and Scope**

The present document provides detailed technical information about the Thermal-Vacuum Test Facility operated by REMRED Space Technologies Ltd. used for ECSSconform 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.



Figure 1 – Thermal-Vacuum Test Facility

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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 tests 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)
- \checkmark ECSS-conform space testing engineering support is available upon request

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3 Specification

3.1 T-VAC TEST CHAMBER

Table 1 – T-VAC Test Chamber general specification

Parameters	Values
Applicable ECSS tests 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 and mass spectrometry
Chamber name or ID	EK T-VAC Chamber
Chamber type	Custom made
Chamber dimensions (without TQCM)	78 cm [length]; 49 cm [cilindrical diameter]
Chamber dimensions (with TQCM)	62 cm [length]; 49 cm [cilindrical diameter]
Chamber volume	147.1L
Operational temperature range	-65+95°C with ±1.0°C accuracy
Operational pressure range	10-5105Pa 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 conduction fixing plate
Contamination control	CrystalTek 66TR TQCM monitoring system Dynamic range: Solid film 50kHz + Non-Solid 10-20kHz Mass sensitivity: 1.96*10-9g/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*10-4amps/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 interfaces	See ANNEX A
Chamber electrical interfaces	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.

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3.2 CLIMATE TEST CHAMBER

Parameters	Values
Applicable ECSS tests 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 range	-65+175°C with ±1.0°C accuracy
Operational humidity range	1098%reIH
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 homogenity (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 shelfs (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)

Table 2 – Climate Test Chamber general specification

* In case of empty chamber without internal additional heat sources. ** Meaured temperatures and humidity values.

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3.3 VACUUM BAKEOUT CHAMBER

Parameters	Values
Applicable ECSS tests as per ECSS-Q-ST-70-02C [AD 4]	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 range	(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 homogenity (as per DIN 12880 part 2)*	±4°C (@200°C)
Data collection period	No data collected
Chamber mechanical interfaces	2 pcs stainless steel inner shelfs (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

Table 3 – Vacuum Beakout Chamber general specification

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

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4 Accreditation and Audits

Code	Title	Туре	Validity	Remarks
ISO 9001:2015	Quality management systems	Accrediation planned	N/A	Accreditation is in progress
ISO 17025:2018	General requirements for the competence of testing and calibration laboratories	Accrediation planned	N/A	Accreditation is in progress
ECSS-Q-ST-20-07C [AD 5]	Quality and safety assurance for space test centres	Audit by ESA	N/A	Audit was performed in 2018

Table 4 – Accreditation and Audits

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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.

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

Figure 3 – 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)



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

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

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

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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.



Figure 5 – The picture of the Climate Test Chamber

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Figure 6 – The schematic view of the Climate chamber (A=55cm, B=50cm, C=50cm)

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7 ANNEXC-Vacuum Bakeout Chamber

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



Figure 7 – The picture of the Vacuum Bakeout Chamber

Figure 8 – 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
тс	Telecommand
ТМ	Telemetry
ТQСМ	Thermoelectric Quartz Crystal Microbalances
T-VAC	Thermal-Vacuum

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11 References

11.1 APPLICABLE AND NORMATIVE DOCUMENTSS

AD	Title	Reference	Version
[AD 1]	ECSS system - Glossary of terms	ECSS-S-ST-00-01C	1 Oct 2012
[AD 2]	Space engineering - Testing	ECSS-E-ST-10-03C	1 June 2012
[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

Table 6 – Applicable and Normative Documents

11.2 REFERENCE DOCUMENTS

Table 7 – Reference Documents

RD	Title	Reference	Version
[RD 1]	-	-	-

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