SERVICE DATASHEET

Vibration Testing

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CHANGE RECORD

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1 Purpose and Scope

The present document provides detailed technical information about the Vibration Testing service by REMRED Technologies Ltd. used for ECSS-conform space equipment testing and analysis the following cases:

- Resonance Search
- Sine Vibration test
- Random Vibration test
- Shock /SRS Shock test
- Contactless Vibration Testing using Stroboscope System;
- Vibration Analysis using Stroboscope System

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

Figure 1 – Vibration Test Facility

2 Application and Key Features

2.1 APPLICATION

✓ **Vibration ECSS-conform test including**
- Resonance Search
- Sine Vibration test
- Random Vibration test
- Shock / SRS Shock test

✓ **Vibration testing and analysis using StrobeCAM System including**
- Contactless Vibration Testing

2.2 KEY FEATURES

✓ **The following vibration test systems are available**
- IMV i250/SA5M 40 kN vibration test system
- LIMESS StrobeCAM v4 vibration testing and analysis system

✓ **StobeCAM contactless vibration testing and analysis**
- Vibration testing and analysis without accelerometers
- Visualisation, recording and documentation of object motion
- Measurement of resonance curve (frequency response)
- Measurement of displacement, velocity and acceleration
- Contactless component testing

✓ **Configurable test systems according to the user's need**
- Controlled via graphical user interface
- Programmed test operation and remote access
- Data collection and analysis via dedicated software (K2 Software, LimTrack)

✓ **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

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

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

✓ **Mechanical workshop is available upon request**

3 Specification

3.1 VIBRATION TEST SYSTEM

Table 1 – Vibration Test System general specification

Parameters	Values
Applicable ECSS test as per ECSS-E-ST-10-03C [AD 2], ECSS-E-HB-32 -25A [AD 3], ECSS-E-HB-32 -26A [AD 4]	Resonance Search Sine Vibration Random Vibration (ASD or PSD) Shock / SRS Shock
Test system name or ID	EK Vibration Test System (S/N: 51000452)
Test system type	IMV i250/SA5M (EM2502) with K2 controller
Frequency range	5…2500 Hz
Armature resonance	1900 Hz
Maximum peak force	Sine: 40 kN Random: 40 kN_{rms} Shock: 80 kN
Maximum acceleration	Sine: 1142 m/s^2 Random: 800 $m/s^2{}_{rms}$ Shock: 2000 m/s^2
Maximum velocity	Sine: 2.2 m/s Shock: 2.2 m/s peak
Maximum displacement	Sine: 51 mm p-p Max travel: 68 mm p-p
Number of test axis	1*
Armature diameter	440 mm
Armature mass	35 kg
Peak load	600 kg
Allowable eccentric moment	1550 Nm
Cooling system type	Air cooling
Crane support capacity	3 t
Built in protections	Phase-sequence, high temperature, cooling dropout, surge current
Triaxial accelerometers	1 pc PCB Piezotronics TLD356A02 (±500 g, 10 mV/g±10%) 1 pc PCB Piezotronics TLD356A15 (±50 g, 100 mV/g±10%)
Monoaxial accelerometers	2 pcs PCB Piezotronics TLD352C03 (±500 g, 10 mV/g±10%) 2 pcs PCB Piezotronics TLD352C33 (±50 g, 100 mV/g±10%)
Mechanical interfaces	25 pcs M10x40 fixing points on the armature Witworth BSF 3/16''x32 or M6x0.75 on the accelerometers For more details see ANNEX A – Vibration Test System

*Dedicated adapters are needed for 3-axial testing.

3.2 STROBECAM VIBRATION TESTING AND ANALYSIS SYSTEM

Table 2 – StobeCAM Vibration Testing and Analysis System general specification

Parameters	Values
Applicable ECSS test as per ECSS-E-ST-10-03C [AD 2], ECSS-E-HB-32-25A [AD 3] ECSS-E-HB-32-26A [AD 4]	Contactless Vibration Testing and Analysis (Mode shape tests, PCB level tests, Resonance curve tests)
Test system name or ID	EK StrobeCam Vibration Testing and Analysis System (S/N: 503400933)
Test system type	LIMESS StrobeCAM v4
Input frequency range	1 Hz…4 kHz
Camera information	0.3…29 MP
Field of view	from millimeter to meter
Visualisation in 3D	Slow-motion visualisation of fast events
Contactless measurements in 2D	of 2D coordinaten and 2D displacements in mm at unlimited number of points (subpixel accurate tracking)
Calculated quantities in 2D	Velocities, accelerations*
Analysis software(s)	StrobeCAM, LIMTrack

*Using scale calibration.

4 Accreditation and Audits

Table 3 – Accreditation and Audits

Code	Title	Type	Validity	Remarks
ISO 9001:2015	Quality management system	Accredited	2025	Audit was performed in 2022
ISO 17025:2018	General requirements for the competence of testing 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 – Vibration Test System

You find here the Vibration Test System related mechanical interface information for designing the mount of the test item and related accelerometers.

Figure 2 – The picture of the Vibration Test System

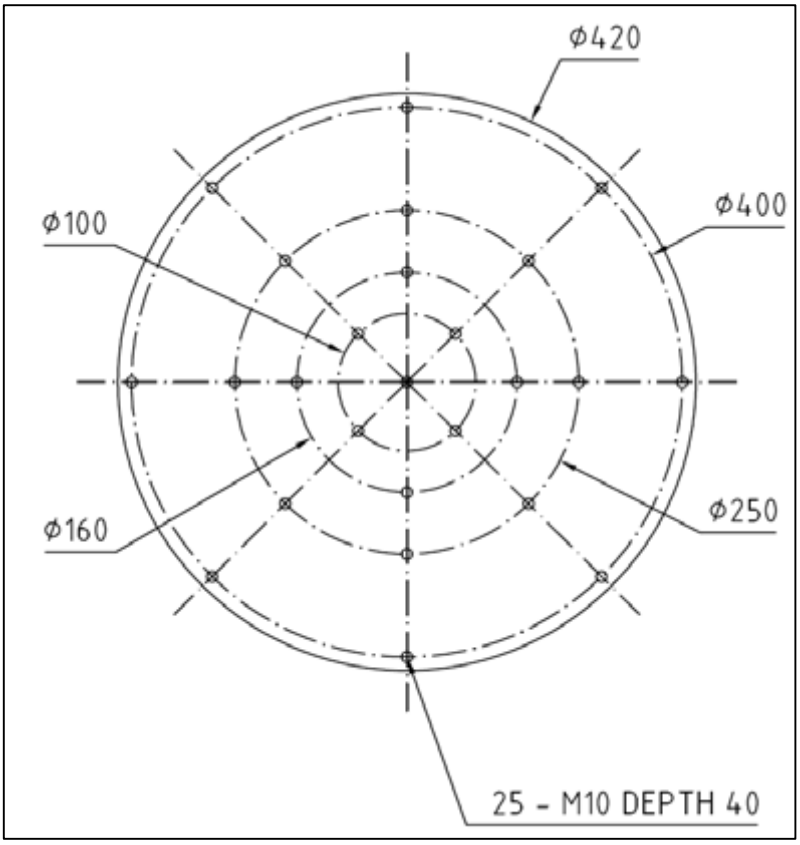

Figure 3 – The shaker adapter, the fixing points are placed with distance given on the picture above (M10/40 screws can be used for fixing)

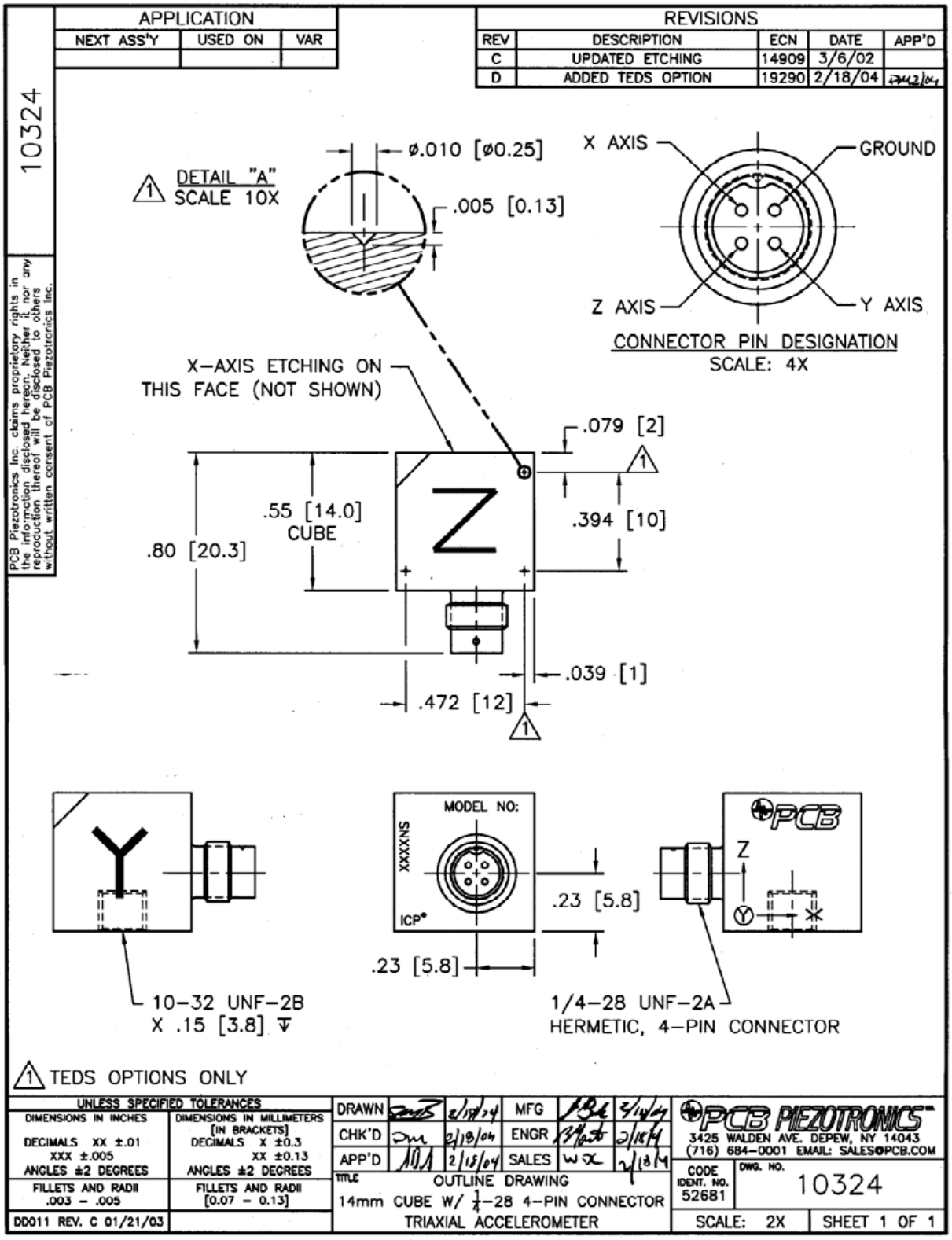

Figure 4 – Mechanical drawings of triaxial accelerometers and related interfaces (Witworth BSF 3/16''x32 or M6x0.75 course shall be provided on the tested item for fixture if needed)

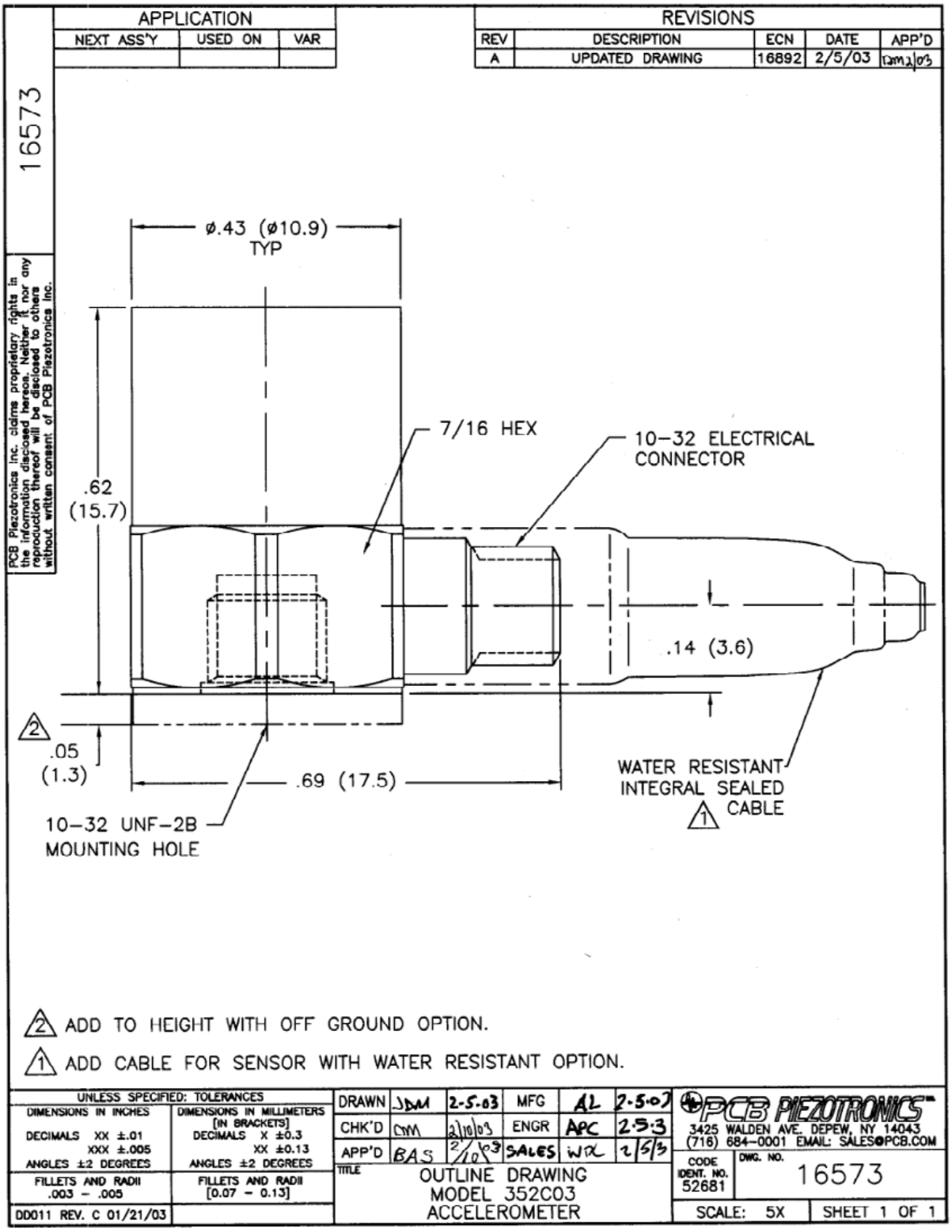

Figure 5 – Mechanical drawings of monoaxial accelerometers and related interfaces (Witworth BSF 3/16''x32 or M6x0.75 course shall be provided on the tested item for fixture if needed)

6 ANNEX B –StrobeCAM Vibration Testing and Analysis System

You find here the StrobeCAM Contactless Vibration Testing and Analysis System related additional information.

Figure 6 – The camera of LIMESS StrobeCAM Vibration Testing and Analysis System

7 List of Abbreviations

AD	Applicable Documents
ASD	Amplitude Spectral Density
ECSS	European Cooperation for Space Standardization
PSD	Power Spectral Density
RD	Reference Documents
SRS	Shok Response Spectra
TC	Telecommand
TM	Telemetry

8 List of Figures

9 List of Tables

10 References

10.1 APPLICABLE AND NORMATIVE DOCUMENTS

Table 4 – 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 ngineering - Testing	ECSS-E-ST-10-03C	1 June 2012
[AD 3]	Space engineering – Mechanical shock design and verification handbook	ECSS-E-HB-32-25A	14 July 2015
[AD 4]	Spacecraft mechanical loads analysis handbook	ECSS-E-HB-32-26A	19 Feb 2013
[AD 5]	Space product assurance – Quality and safety assurance for space test centres	ECSS-S-ST-20-07C	1 Oct 2014

10.2 REFERENCE DOCUMENTS

Table 5 – Reference Documents

RD	Title	Reference	Version
[RD 1]	-	-	-

END OF DOCUMENT