## SERVICE DATASHEET

# Vibration Testing

| | |
|---|---|
| **PROJECT TITLE** | - |
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# APPROVAL

| Issue | Date | Signatures | | |
|---|---|---|---|---|
| | | Author(s) | Reviewes by | Approved by |
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# CHANGE LOG

| Reference | Date | Issue | Revision |
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| PRO2020-RR-PQA-DS-102_01_00 | 10/01/2020 | 01_00 | 1 |

# CHANGE RECORD

| Issue: 01_00 | Revision: 1 | | |
|---|---|---|---|
| **Reason for change** | **Date** | **Page** | **Paragraph(s)** |
| N/A (initial release). | 10/01/2020 | All | All |

# TABLE OF CONTENTS

# 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.


1. Figure – 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 Strobe CAM System including**
- Contactless Vibration Testing

## 2.2 KEY FEATURES

✓ **The following test chambers are available**
- IMV i250/SA5M 40kN 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

**1. Table – 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<br>Sine Vibration<br>Random Vibration (ASD or PSD)<br>Shock / SRS Shock |
| **Chamber name or ID** | EK Vibration Test System<br>(S/N: 51000452) |
| **Test system type** | IMV i250/SA5M (EM2502) with K2 controller |
| **Frquency range** | 5…2500 Hz |
| **Armature resonance** | 1900 Hz |
| **Maximum peak force** | Sine: 40 kN<br>Random: 40 $kN_{rms}$<br>Shock: 80 kN |
| **Maximum acceleration** | Sine: 1140 $m/s_2$<br>Random: 80 $m/s_2$ rms<br>Shock: 2284 $m/s_2$ |
| **Maximum velocity** | Sine: 2.2 m/s<br>Shock: 2.2 m/s peak |
| **Maximum displacement** | Sine: 51 mm<br>Max travel: 68 mm |
| **Number of test axis** | 1* |
| **Armature diameter** | 440 mm |
| **Armature mass** | 35 kg |
| **Peak load** | 600 kb |
| **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 (±200g, 10mV/g±10%)<br>1 pc PCB Piezotronics TLD356A15 (±50g, 100mV/g±10%) |
| **monoaxial accelerometers** | 2 pcs PCB Piezotronics TLD352C03 (±200g, 10mV/g±10%)<br>2 pcs PCB Piezotronics TLD352C33 (±50g, 100mV/g±10%) |
| **Mechanical interfaces** | 25 pcs M10x40 fixing points on the armature<br>Witworth BSF 3/16''x32 or M6x0.75 on the accelerometers<br>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

**2. Table – 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** | 1Hz…4kHz |
| **Camera information** | 0.3…29MP |
| **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) |
| **Calcucated quabtities in 2D** | Velocities, accelerations* |
| **Analysis software(s)** | StrobeCAM, LIMTrack |

*Using scale calibration.

# 4 Accreditation and Audits

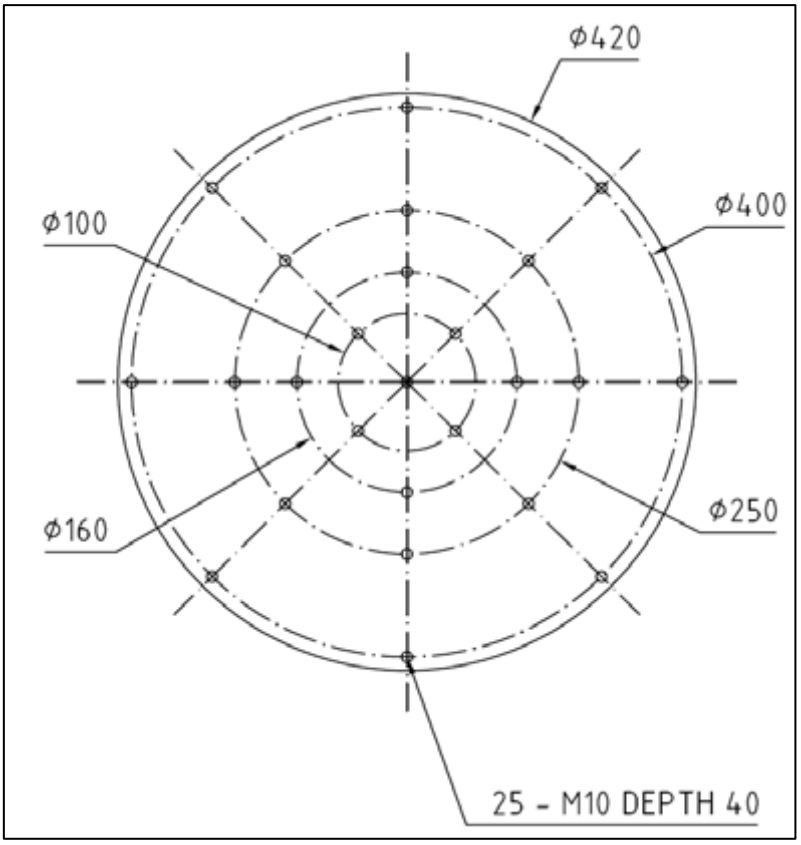
**3. Table – Accreditation and Audits**

| 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 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 |

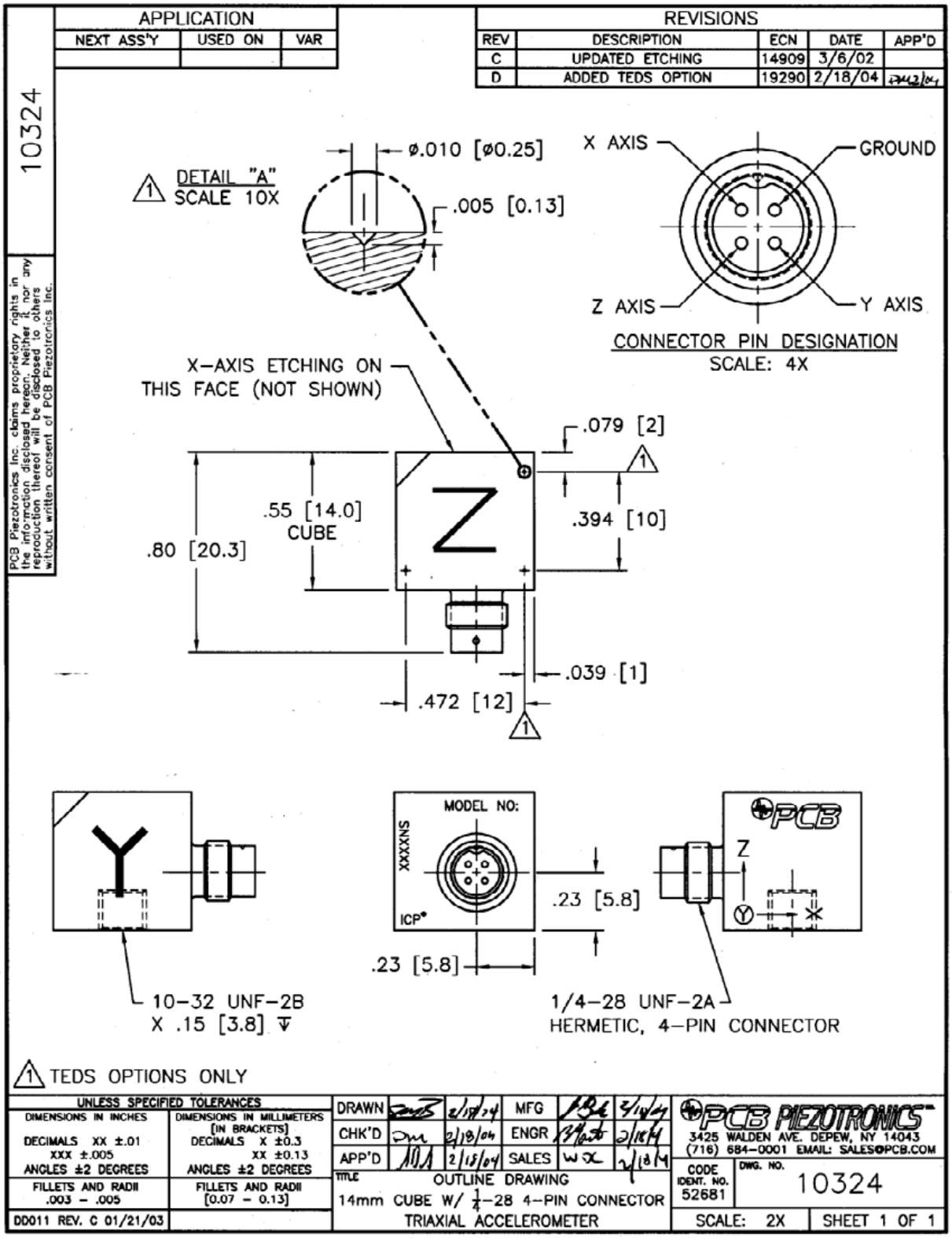
# 5 ANNEX A – Vibration Test System

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

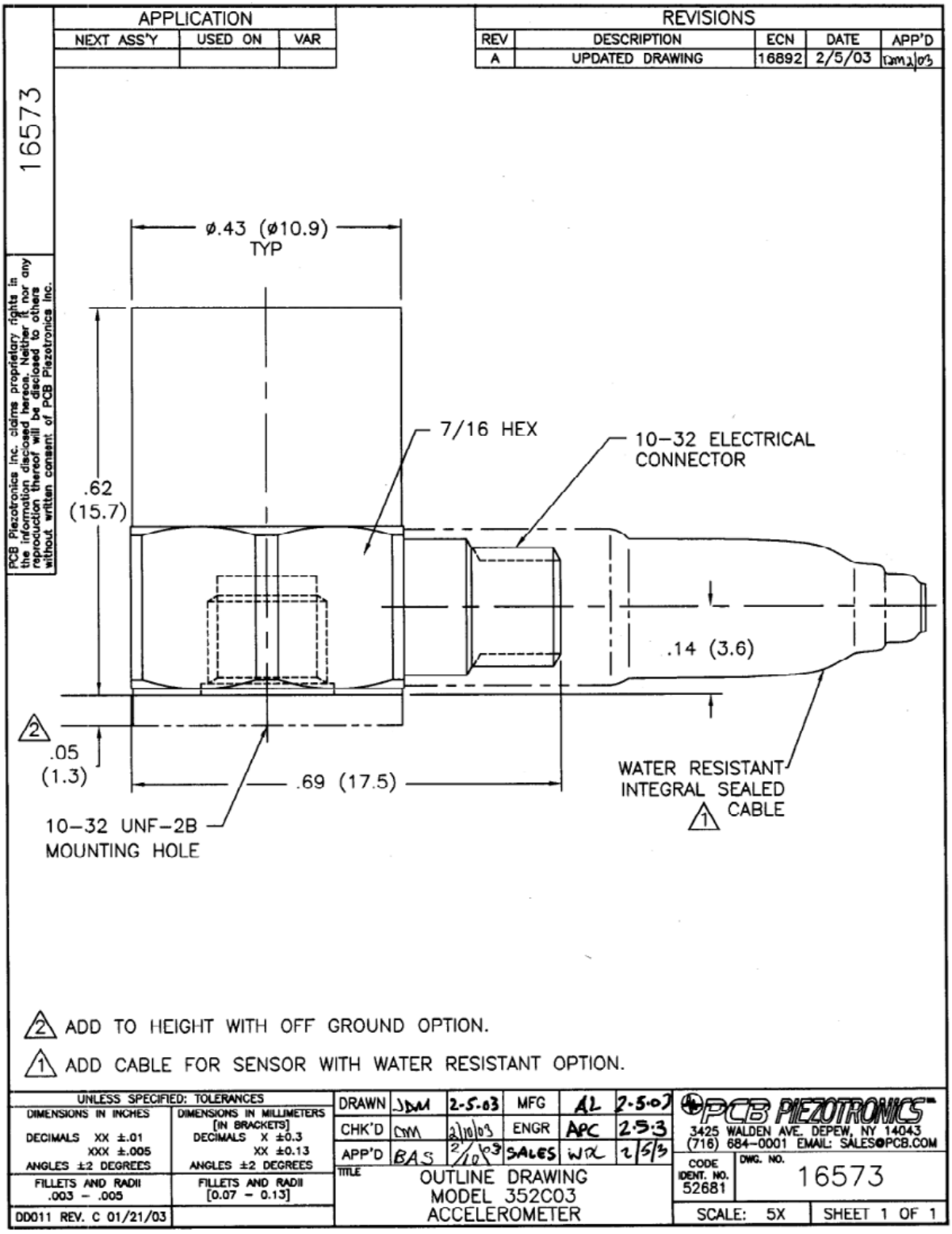
2. Figure – The picture of the Vibration Test System




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




4. Figure – 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)




5. Figure – 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 Strobe CAM Contactless Vibration Testing and Analysis System related additional information.


6. Figure – The camera of LIMESS Strobe CAM Contactless 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

**4. 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 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

**5. Table – Reference Documents**

| RD | Title | Reference | Version |
|---|---|---|---|
| **[RD 1]** | - | - | - |

## END OF DOCUMENT