DAEIL SYSTEMS

ACTIVE VIBRATION ISOLATION SYSTEM INSTALLATION REPORT

Delivered by Sungkuk Kim

Work Completed, June 27, 2019

Contents

1. Measurement Details

- **Measurement Date**

  June 24, 2019

- **Measurement Devices**

  1. LAN-XI Data Acquisition Hardware
     - Brüel & Kjær 3050-A-040 (Serial Number: 3050-111438)
  2. Data Analysis Software
     - Brüel & Kjær PULSE LAB SHOP 14
  3. Sensors
     - PCB Accelerometer
     - Model: 393B05 (Serial Number: 48995, 40626)

- **Measurement Location**

  1st Floor

- **Measurement Setup**

  Bandwidth: 0 – 100 Hz

  Lines: 400

  Window: Hanning

  Averaging: Fast Fourier Transform Spectrum Averaging

  Amplitude Units: m/s2

  Spectral Unit: RMS

2. Equipment Information

DAEIL SYSTEMS

- **Manufacturer**

  FEI

- **Model**

  HELIOS G4 UC DualBeam System FIB S/TEM

- **Floor Vibration Specification**

	Vertical	Left to right	Front to back
Helios G4 UX with or without enclosure, no HWL; 0.6nm; Stub, 0 Tilt	F	G	G
Helios G4 UX with or without enclosure, with HWL; 0.6nm; Stub, 0 Tilt	E	F	F
Helios G4 CX with or without enclosure, no HWL; 0.7 nm (STEM) / 0.8 nm (no STEM); Stub, 0 Tilt	F	G	G
Helios G4 CX with or without enclosure, with HWL; 0.7 nm (STEM) / 0.8 nm (no STEM); Stub, 0 Tilt	E	F	F
Helios G4 FX/HX with or without enclosure, no HWL; 0.6nm; Shuttle,0 Tilt	F	G	G
Helios G4 FX/HX with or without enclosure, with HWL; 0.6nm;Shuttle,0 Tilt	E	F	F

3. Vibration Isolation System Information

Model: DVIA-MB3000

Platform Dimensions		1140 x 910 x 224 mm
Load Capacity		1500 - 3500 kg
Actuator		Electromagnetic Actuator
Maximum Actuator Force		Vertical: 40N, Horizontal: 20 N
Degrees of Freedom		6 degrees
Active Isolation Range		0.5 - 100 Hz
Vibration Isolation at 2 Hz		≥90%
Vibration Isolation at 10 Hz		≥99%
Input Voltage (V)		AC100 - 240V / 50 - 60 Hz / 1A
Power Consumption (W)		Maximum 110W, <50 W in normal operation
Operating Range	Temperature (°C)	5 - 50 °C
	Humidity (%)	20 - 90%
Required Air Pressure		≥ 0.5 MPa

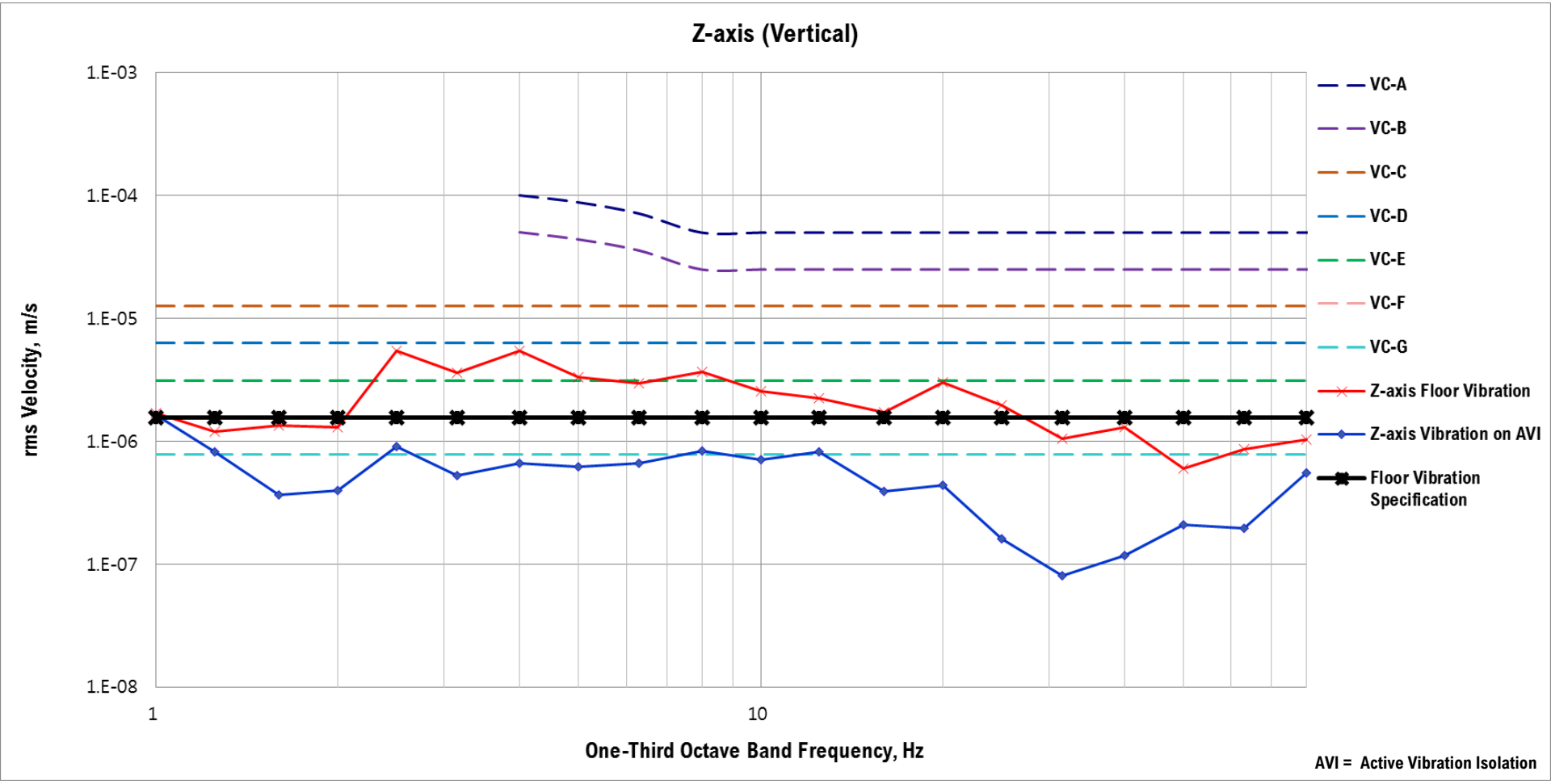
4. Installation Photos

5. Summary

DAEIL SYSTEMS

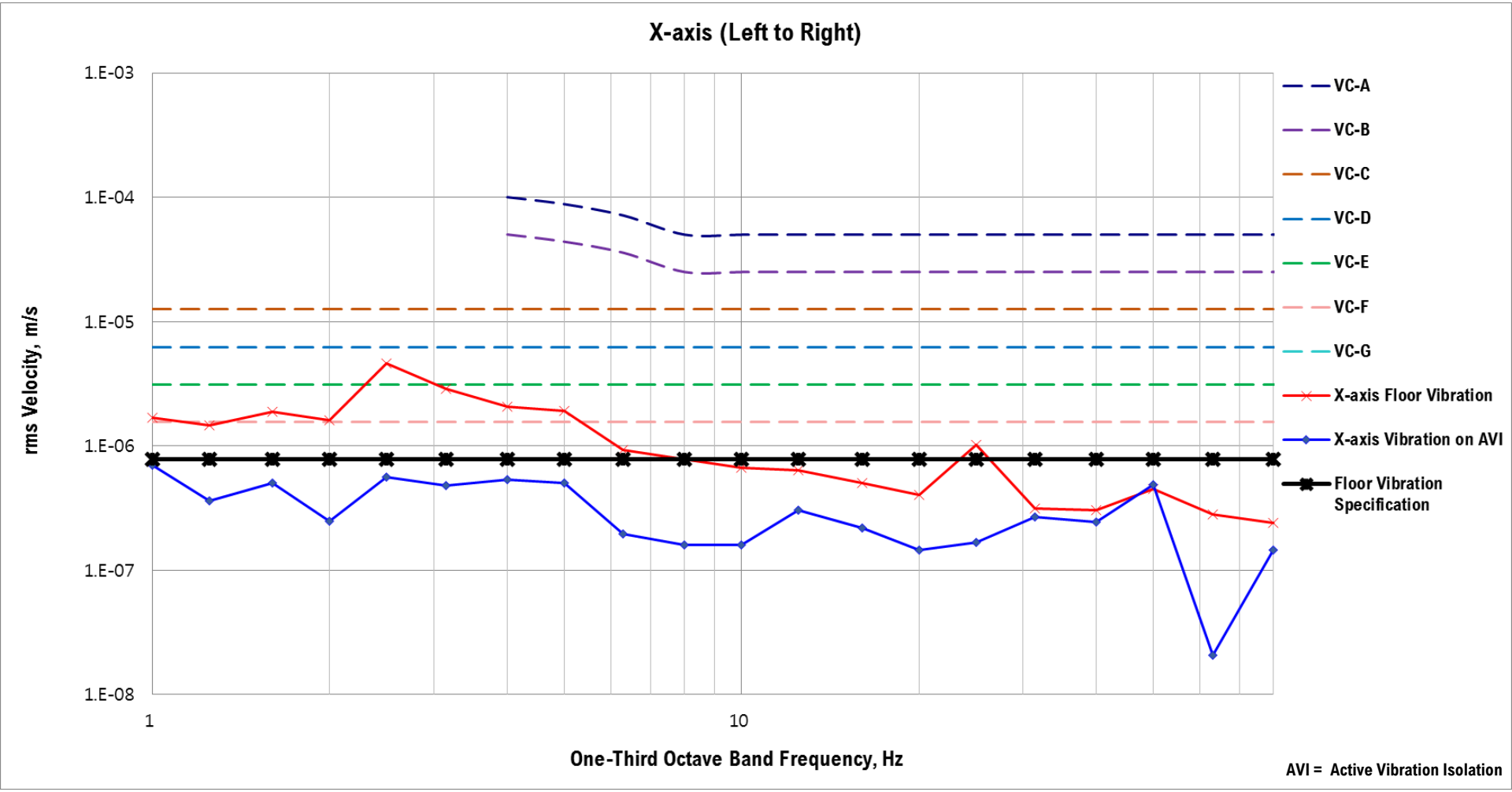
Floor Vibration Specification			
Frequency Range	1 - 80 Hz		
Floor Vibration Specification	VC-F	VC-G	VC-G
Measurement Direction	Z-axis (Vertical)	X-axis (Left to Right)	Y-axis (Front to Back)
Floor Vibration	Fail	Fail	Fail
Vibration On Active Vibration Isolation System	Pass	Pass	Pass

6. Results – Z-axis (Vertical)



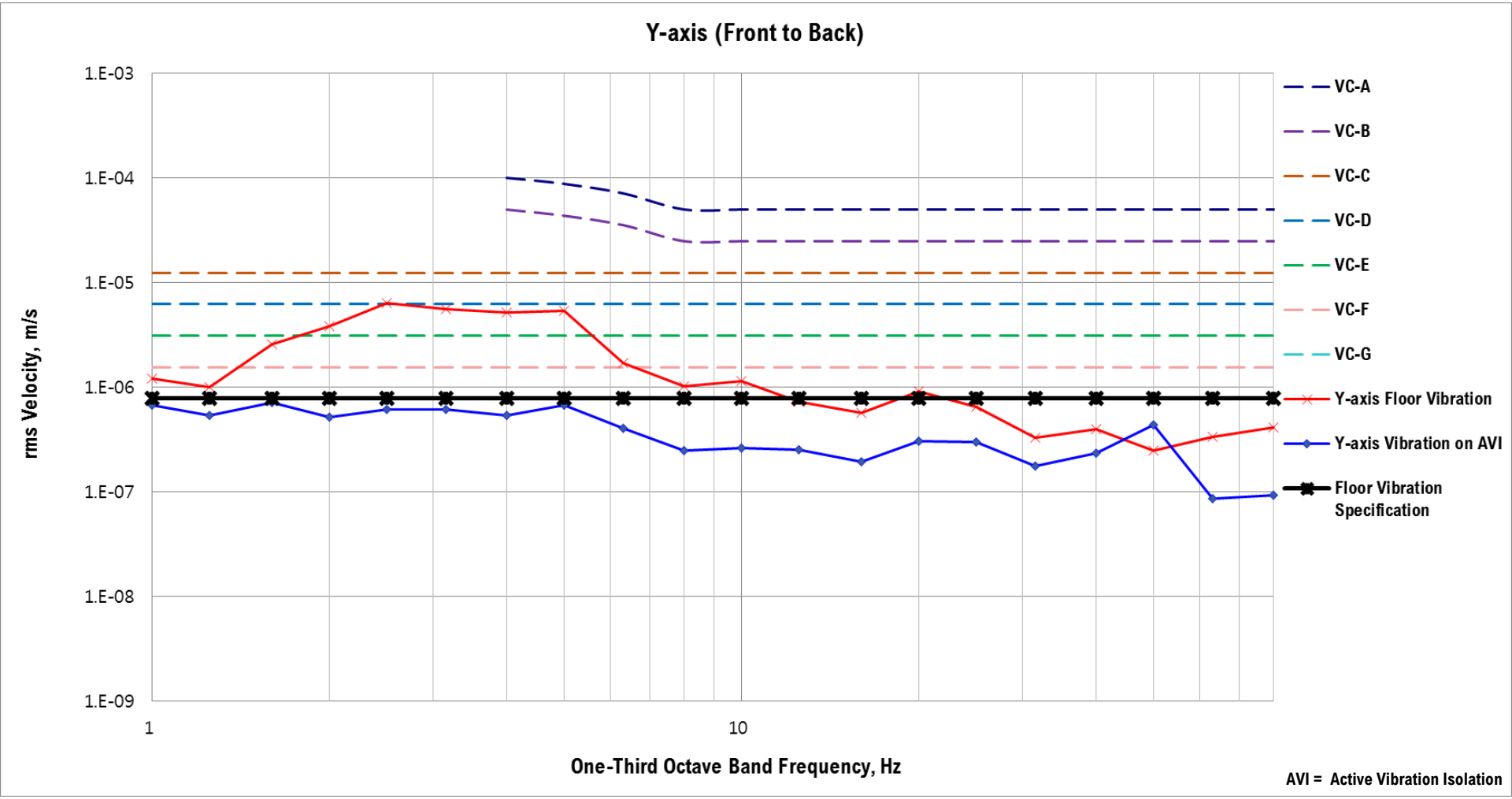
The measured vertical floor vibration did not meet the vibration specification VC-F.
The active vibration isolation system reduced the vertical floor vibration from VC-D to VC-F.

6. Results – X-axis (Left to Right)



The measured X-axis floor vibration did not meet the floor vibration specification VC-D.
The active vibration isolation system reduced the X-axis floor vibration from VC-D to VC-G.

6. Results – Y-axis (Front to Back)



The measured Y-axis floor vibration did not meet the floor vibration specification VC-G.
The active vibration isolation system reduced the Y-axis floor vibration from VC-D to VC-G.

DAEIL SYSTEMS

Generic Vibration Criteria

Criterion Curve	Description	Amplitude[1] μm/s (in/s)	Detail Size[2] μm
Workshop (ISO)	Distinctly perceptible vibration. Appropriate to workshops and non–sensitive areas.	800 (32,000)	N/A
Office (ISO)	Perceptible vibration. Appropriate to offices and non–sensitive areas.	400 (16,000)	N/A
Residential Area (ISO)	Barely perceptible vibration. Appropriate to sleep areas in most instances. Usually adequate for computer equipment, hospital recovery rooms, semiconductor probe test equipment, and microscopes less than 40x.	200 (8,000)	75
Operating Theatre (ISO)	Vibration not perceptible. Suitable in most instances for surgical suites, microscopes to 100x and for other equipment of low sensitivity.	100 (4,000)	25
VC–A	Adequate in most instances for optical microscopes to 400x, microbalances, optical balances, proximity and projection aligners, etc.	50 (2,000)	8
VC–B	Appropriate for inspection and lithography equipment (including steppers) to 3μm line widths.	25 (1,000)	3
VC–C	Appropriate standard for optical microscopes to 1000x, lithography and inspection equipment (including moderately sensitive electron microscopes) to 1μm detail size, TFT–LCD stepper/scanner processes.	12.5 (500)	1 – 3
VC–D	Suitable in most instances for demanding equipment, including many electron microscopes (SEMs and TEMs) and E–Beam systems.	6.25 (250)	0.1 – 0.3
VC–E	A challenging criterion to achieve. Assumed to be adequate for the most demanding of sensitive systems including long path, laser–based, small target systems, E–Beam lithography systems working at nanometer scales, and other systems requiring extraordinary dynamic stability.	3.12 (125)	<0.1
VC–F	Appropriate for extremely quite research spaces; generally difficult to achieve in most instances, especially cleanrooms. Not recommended for use as a design criterion, only for evaluation.	1.56 (62.5)	N/A
VC–G	Appropriate for extremely quite research spaces; generally difficult to achieve in most instances, especially cleanrooms. Not recommended for use as a design criterion, only for evaluation.	0.78 (31.3)	N/A

1. As measured in one–third octave bands of frequency over the frequency 8 to 80 Hz (VC–A and VC–B) or 1 to 80 Hz (VC–C through VC–G).
2. The detail size refers to line width in the case of microelectronics fabrication, the particle (cell) size in the case of medical and pharmaceutical research, etc. It is not relevant to imaging associated with probe technologies, AFMs, and nanotechnology.

The information given in this table is for guidance only. In most instances, it is recommended that the advice of someone knowledgeable about applications and vibration requirements of the equipment and processes be sought.