Plán standardizace – Program rozvoje metrologie 2025

Číslo úkolu: VII/05/25

Zpráva pro závěrečnou oponenturu úkolu

Principy kalibrace a další aspekty kalibrace v oborech mechanický pohyb, vibrace a akustika

Příloha 2

Přehled příloh osvědčení o akreditaci zahraničních kalibračních laboratoří

OBSAH

1. A2LA (USA)

1.1. ELEMENT MATERIALS TECHNOLOGY HUNTSVILLE

III. Mechanical

Acceleration – Measuring Equipment	(0.5 to 1) Hz (> 1 to 5) Hz (5 to 9) Hz (10 to 99) Hz 100 Hz (> 100 to 920) Hz 920 Hz to 5 kHz (> 5 to 10) kHz	1.2 % 1.1 % 2.3 % 1.6 % 1.2 % 1.4 % 1.8 % 2.3 %	Standard low frequency accelerometer. Data acquisition card w/ low frequency long stroke shaker Standard accelerometer Data acquisition card w/ air bearing shaker TMS9155C
Acceleration (Shock) – Measuring Equipment	(20 to 10 000) g	2.0 %	TMS9155C

1.2. ELEMENT U.S. SPACE & DEFENSE

I. Mechanical

Parameter/Equipment	Frequency	CMC [2, 3] (±)	Comments
Acceleration Sensitivity	(5 to 9.99) Hz (10 to 99) Hz 100 Hz (101 to 920) Hz (921 to 5000) Hz (5001 to 10 000) Hz	1.6 % 1.0 % 0.90 % 1.0 % 1.7 % 2.5 %	Back to back comparison

[1] This laboratory is not normally available for commercial calibration service.

[2] Calibration and Measurement Capability Uncertainty (CMC) is the smallest uncertainty of measurement that a laboratory can achieve within its scope of accreditation when performing more or less routine calibrations of nearly ideal measurement standards of nearly ideal measuring equipment. CMCs represent expanded uncertainties expressed at approximately the 95 % level of confidence, usually using a coverage factor of $k = 2$. The actual measurement uncertainty of a specific calibration performed by the laboratory may be greater than the CMC due to the behavior of the customer's device and to influences from the circumstances of the specific calibration.

[3] In the statement of CMC, the value is defined as the percentage of reading.

2. ACCREDIA (Itálie)

2.1. L.C.E. s.r.l.

Area metrologica *Metrological area*: **Accelerazione**

Settore / *Calibration field*: (SAC-01) **Catena accelerometrica**

Strumento *Instrument*	Misurando *Measurand*	Campo di misura *Measurement range*		Condizioni *Additional parameters*		Incertezza *Uncertainty*	Metodo/Procedura *Method / Procedure*	Sede *Location*
Catene accelerometriche con trasduttori a singola e doppia faccia	Accelerazione (sensibilità in tensione o in carica)	9,81 m·s^{-2}		DC		1,2 %	Metodo interno. Taratura per confronto con accelerazione di gravità	A
		≥ 0,5 m·s^{-2}	≤ 300 m·s^{-2}	≥ 1 Hz	≤ 5 Hz	3,4 %	ISO 16063-21:2003 (1)	
				> 5 Hz	≤ 20 Hz	2,0 %		
				> 20 Hz	≤ 1 kHz	1,5 %		
				> 1 kHz	≤ 5 kHz	2,0 %		
				> 5 kHz	≤ 10 kHz	3,8 %		
	Velocità (sensibilità in tensione o in carica) (2)	≥ 0,005 m·s^{-1}	≤ 0,08 m·s^{-1}	≥ 1 Hz	≤ 5 Hz	3,4 %		
				> 5 Hz	≤ 20 Hz	2,0 %		
				> 20 Hz	≤ 1 kHz	1,5 %		
				> 1 kHz	≤ 5 kHz	2,0 %		
				> 5 kHz	≤ 10 kHz	3,8 %		
	Spostamento (sensibilità in tensione o in carica) (2)	≥ 1 µm	≤ 12 mm	≥ 1 Hz	≤ 5 Hz	3,4 %		
				> 5 Hz	≤ 20 Hz	2,0 %		
				> 20 Hz	≤ 1 kHz	1,5 %		
				> 1 kHz	≤ 5 kHz	2,0 %		
				> 5 kHz	≤ 10 kHz	3,8 %		

(Continua) Area metrologica "Misure acustiche"

Settore / *Calibration field*: (SAU-02) **Sensibilità assoluta alla pressione acustica**

Strumento *Instrument*			Misurando *Measurand*	Condizioni *Additional parameters*	Campo di misura *Measurement range*	Incertezza *Uncertainty*	Metodo/Procedura *Method / Procedure*	Sede *Location*
Microfoni	LS1 e LS2	(14)	Sensibilità alla pressione acustica	250 Hz	124 dB	0,09 dB	Metodo interno Taratura per confronto in accoppiatore	A
	LS2			da 31,5 Hz a 16 kHz	94 dB	da 0,11 dB a 0,22 dB	IEC 61094-5:2016; CEI EN 61094-5:2017	
	WS2				94 dB	da 0,11 dB a 0,22 dB		
	WS2	(15)	Sensibilità alla pressione acustica (corretta per campo libero)		94 dB	da 0,12 dB a 0,83 dB	Metodo interno. Taratura basata su IEC 61094-5:2016 e CEI EN 61094-5:2017	

Area metrologica *Metrological area*: **Misure acustiche**

Settore / *Calibration field*: (SAU-01) **Livello di pressione acustica**

Strumento *Instrument*		Misurando *Measurand*	Condizioni *Additional parameters*	Campo di misura *Measurement range*	Incertezza *Uncertainty*	Metodo/Procedura *Method / Procedure*	Sede *Location*
Pistonofoni		Livello di pressione acustica	da 160 Hz a 1,25 kHz	da 94 dB a 140 dB	0,10 dB	IEC EN 60942:2018 Annex B CEI EN 60942:2018 Annex B	A
		Frequenza	da 94 dB a 140 dB	da 160 Hz a 1,25 kHz	0,04 %		
Calibratori	(5)	Livello di pressione acustica	da 160 Hz a 1,25 kHz	da 90 dB a 125 dB	0,10 dB		
		Frequenza	da 94 dB a 140 dB	da 160 Hz a 1,25 kHz	0,04 %		
Calibratori multifrequenza		Livello di pressione acustica	da 31,5 Hz a 16 kHz	da 94 dB a 140 dB	da 0,10 dB a 0,49 dB		
		Ponderazione "inversa A" (6)	da 31,5 Hz a 16 kHz	94 dB	0,15 dB	Metodo interno. Taratura mediante rapporto di livello di pressione acustica	
		Correzioni pressione / campo libero microfoni (6)	da 31,5 Hz a 16 kHz	da 94 dB a 114 dB	0,12 dB		

(continua)

(Continua) Area metrologica "Accelerazione"

Settore / *Calibration field*		(SAC-02) **Calibratori/Generatori**						
Strumento *Instrument*	Misurando *Measurand*	Condizioni *Additional parameters*		Campo di misura *Measurement range*		Incertezza *Uncertainty*	Metodo/Procedura *Method / Procedure*	Sede *Location*
Calibratore vibrometrico	Accelerazione	≥ 15 Hz	≤ 20 Hz	≥ 0,5 m·s^{-2}	≤ 15 m·s^{-2}	1,6 %	Metodo interno. Taratura per confronto con accelerometro tarato secondo la ISO 16063-21:2003	A
		> 20 Hz	≤ 1 kHz			1,3 %		
	Frequenza	≥ 0,5 m·s^{-2}	≤ 15 m·s^{-2}	≥ 15 Hz	≤ 1 kHz	0,08 %		

(Continua) Area metrologica "Accelerazione" – Settore "Catena accelerometrica" (SAC-01)

Strumento *Instrument*	Misurando *Measurand*	Campo di misura *Measurement range*		Condizioni Additional parameters		Incertezza *Uncertainty*	Metodo/Procedura *Method / Procedure*	Sede *Location*
(continua)								
Analizzatori con trasduttore accoppiato	Accelerazione (sensibilità in tensione o in carica)	9,81 m·s^{-2}		DC		1,3 %	Metodo interno. Taratura per confronto con accelerazione di gravità	A
		≥ 0,5 m·s^{-2}	≤ 300 m·s^{-2}	≥ 1 Hz	≤ 5 Hz	3,5 %	ISO 16063-21:2003 (3)	
				> 5 Hz	≤ 20 Hz	2,2 %		
				> 20 Hz	≤ 1 kHz	1,7 %		
				> 1 kHz	≤ 5 kHz	2,1 %		
				> 5 kHz	≤ 10 kHz	3,9 %		
	Velocità (sensibilità in tensione o in carica) (4)	≥ 0,005 m·s^{-1}	≤ 0,08 m·s^{-1}	≥ 1 Hz	≤ 5 Hz	3,5 %		
				> 5 Hz	≤ 20 Hz	2,2 %		
				> 20 Hz	≤ 1 kHz	1,7 %		
				> 1 kHz	≤ 5 kHz	2,1 %		
				> 5 kHz	≤ 10 kHz	3,9 %		
	Spostamento (sensibilità in tensione o in carica) (4)	≥ 1 µm	≤ 12 mm	≥ 1 Hz	≤ 5 Hz	3,5 %		
				> 5 Hz	≤ 20 Hz	2,2 %		
				> 20 Hz	≤ 1 kHz	1,7 %		
				> 1 kHz	≤ 5 kHz	2,1 %		
				> 5 kHz	≤ 10 kHz	3,9 %		
Analizzatori con trasduttore mano braccio	Accelerazione	≥ 1 m·s^{-2}	≤ 100 m·s^{-2}	≥ 10 Hz	≤ 800 Hz	2,5 · 10^{-2}	ISO 8041-1:2017 §14	
Analizzatori con trasduttore corpo intero		≥ 0,1 m·s^{-2}	≤ 15 m·s^{-2}	≥ 2 Hz	≤ 80 Hz	2,5 · 10^{-2}		

(Continua) Area metrologica "Misure acustiche" – Settore "Livello di pressione acustica" (SAU-01)

Strumento *Instrument*		Misurando *Measurand*	Condizioni *Additional parameters*	Campo di misura *Measurement range*	Incertezza *Uncertainty*	Metodo/Procedura *Method / Procedure*	Sede *Location*
(continua)							
Pistonofoni	(7)	Livello di pressione acustica	da 160 Hz a 315 Hz	da 114 dB a 140 dB	0,10 dB	Metodo interno Taratura basata su IEC EN 60942:2003 Annex B CEI EN 60942:2004 Annex B	A
		Frequenza	da 114 dB a 140 dB	da 160 Hz a 315 Hz	0,04 %		
Calibratori		Livello di pressione acustica	da 160 Hz a 1,25 kHz	da 94 dB a 114 dB	0,10 dB		
		Frequenza	da 94 dB a 114 dB	da 160 Hz a 1,25 kHz	0,05 %		
Calibratori multifrequenza		Livello di pressione acustica	da 31,5 Hz a 16 kHz	da 94 dB a 114 dB	da 0,10 dB a 0,49 dB		
		Ponderazione "inversa A" (8)	da 31,5 Hz a 16 kHz	94 dB	0,15 dB	Metodo interno. Taratura mediante rapporto di livello di pressione acustica	
		Correzioni pressione / campo libero microfoni (8)	da 31,5 Hz a 16 kHz	da 94 dB a 114 dB	0,12 dB		

(continua)

[1] Con esclusione dello sfasamento. *(S výjimkou fázového posunu.)*
[2] I valori di campo di misura e di incertezza a fianco riportati sono determinati per calcolo a partire dai valori di accelerazione. *(Hodnoty měřicího rozsahu a nejistoty uvedené vedle jsou určeny výpočtem na základě hodnot zrychlení.)*
[3] Con esclusione dello sfasamento. *(S výjimkou fázového posunu.)*
[4] I valori di campo di misura e di incertezza a fianco riportati sono determinati per calcolo a partire dai valori di accelerazione. *(Hodnoty měřicího rozsahu a nejistoty uvedené vedle jsou určeny výpočtem na základě hodnot zrychlení.)*
[5] Conformi alle norme IEC EN 60942:2018 e CEI EN 60942:2018. *(V souladu s normami IEC EN 60942:2018 a CEI EN 60942:2018.)*

(Continua) Area metrologica "Misure acustiche" – Settore "Livello di pressione acustica" (SAU-01)

Strumento *Instrument*		Misurando *Measurand*	Condizioni *Additional parameters*	Campo di misura *Measurement range*	Incertezza *Uncertainty*	Metodo/Procedura *Method / Procedure*	Sede *Location*
(continua)							
Fonometri	(9)	Livello di pressione acustica	da 31,5 Hz a 16 kHz	da 20 dB a 155 dB	da 0,14 dB a 0,84 dB	Metodo interno. Taratura basata su Guida CEI 29-30:1997	A
	(10)		da 63 Hz a 16 kHz	da 20 dB a 150 dB	da 0,07 dB a 0,45 dB	Metodo interno. Taratura basata su IEC 61672-3:2006 e CEI EN 61672-3:2007	
	(11)		da 63 Hz a 16 kHz	da 20 dB a 150 dB	da 0,07 dB a 0,45 dB	IEC 61672-3:2013; CEI EN 61672-3:2014	
Filtri a bande di terzi di ottava	(12)		da 20 Hz a 20 kHz	da 20 dB a 150 dB	da 0,10 dB a 1,0 dB	Metodo interno. Taratura basata su IEC EN 61260:1995 e CEI EN 61260:1997	
Filtri a bande di ottava			da 31,5 Hz a 8 kHz	da 20 dB a 150 dB	da 0,10 dB a 1,0 dB		
Filtri a bande di terzi di ottava	(13)		da 20 Hz a 20 kHz	da 20 dB a 150 dB	da 0,19 dB a 0,50 dB	IEC 61260-3:2016; CEI EN 61260-3:2017	
Filtri a bande di ottava			da 31,5 Hz a 16 kHz	da 20 dB a 150 dB	da 0,19 dB a 0,50 dB		

[6] Verifica di specifiche per calibratori multifunzione non previste dalle norme IEC EN 60942:2018 e CEI EN 60942:2018. *(Ověření specifikací pro multifunkční kalibrátory, které nejsou stanoveny normami IEC EN 60942:2018 a CEI EN 60942:2018.*)

[7] Conformi alle norme IEC EN 60942:2003 e CEI EN 60942:2004. *(V souladu s normami IEC EN 60942:2003 a CEI EN 60942:2004.)*

[8] Verifica di specifiche per calibratori multifunzione non previste dalle norme IEC EN 60942:2003 e CEI EN 60942:2004. *(Ověření specifikací pro multifunkční kalibrátory, které nejsou stanoveny normami IEC EN 60942:2003 a CEI EN 60942:2004.)*

[9] Conformi alle norme EN 60651:2001, IEC 60804:2000 e CEI EN 60804:2001. *(V souladu s normami EN 60651:2001, IEC 60804:2000 a CEI EN 60804:2001.)*

[10] Conformi alle norme IEC 61672-1:2002 ed. 1 e CEI EN 61672-1:2003 ed. 1. *(V souladu s normami IEC 61672-1:2002 ed. 1 a CEI EN 61672-1:2003 ed. 1.)*

[11] Conformi alle norme IEC 61672-1:2013 ed. 2 e CEI EN 61672-1:2014 ed. 2. *(V souladu s normami IEC 61672-1:2013 ed. 2 a CEI EN 61672-1:2014 ed. 2.)*

[12] Conformi alle norme IEC 61260:1995 e CEI EN 61260:1997. *(V souladu s normami IEC 61260:1995 a CEI EN 61260:1997.)*

[13] Conformi alle norme IEC 61260-1:2014 e CEI EN 61260-1:2017. *(V souladu s normami IEC 61260-1:2014 a CEI EN 61260-1:2017.)*

[14] Conformi alle norme IEC 61094-1:2000 e CEI EN 61094-1:2001. *(V souladu s normami IEC 61094-1:2000 a CEI EN 61094-1:2001.)*

[15] Conformi alle norme IEC 61094-4:1995 e CEI EN 61094-4:1997. *(V souladu s normami IEC 61094-4:1995 a CEI EN 61094-4:1997.)*

2.2. Azienda USL TOSCANA SUD EST, U.F. Laboratorio di Sanità Pubblica

Area metrologica *Metrological area*	**Misure acustiche**

Settore / *Calibration field*	(SAU-01) **Livello di pressione acustica**

Strumento *Instrument*		Misurando *Measurand*	Condizioni *Additional parameters*	Campo di misura *Measurement range*	Incertezza *Uncertainty*	Metodo/Procedura *Method / Procedure*	Sede *Location*
Pistonofoni	(1)	Livello di pressione acustica	250 Hz	124 dB	0,1 dB	IEC EN 60942:2018 Annex B CEI EN 60942:2018 Annex B	A
		Frequenza	124 dB	250 Hz	0,01 %		
Calibratori		Livello di pressione acustica	250 Hz, 1 kHz	da 94 dB a 114 dB	0,13 dB		
		Frequenza	da 94 dB a 114 dB	250 Hz, 1 kHz	0,01 %		
Pistonofoni	(2)	Livello di pressione acustica	250 Hz	124 dB	0,1 dB	Metodo interno. Taratura basata su IEC EN 60942:2003 Annex B e CEI EN 60942:2004 Annex B	
		Frequenza	124 dB	250 Hz	0,02 %		
Calibratori		Livello di pressione acustica	250 Hz, 1 kHz	da 94 dB a 114 dB	0,13 dB		
		Frequenza	da 94 dB a 114 dB	250 Hz, 1 kHz	0,02 %		

(continua)

(Continua) Area metrologica "Misure acustiche" – Settore "Livello di pressione acustica" (SAU-01)

Strumento *Instrument*		Misurando *Measurand*	Condizioni *Additional parameters*	Campo di misura *Measurement range*	Incertezza *Uncertainty*	Metodo/Procedura *Method / Procedure*	Sede *Location*
(continua)							
Fonometri	(3)	Livello di pressione acustica	da 31,5 Hz a 16 kHz	da 25 dB a 140 dB	da 0,15 dB a 1,5 dB	Guida CEI 29-30:1997	A
	(4)	Livello di pressione acustica	da 31,5 Hz a 16 kHz	da 25 dB a 140 dB	da 0,15 dB a 1,52 dB	Metodo interno. Taratura basata su IEC 61672-3:2006 e CEI EN 61672-3:2007	
	(5)	Livello di pressione acustica	da 31,5 Hz a 16 kHz	da 25 dB a 140 dB	da 0,08 dB a 0,8 dB	IEC 61672-3:2013; CEI EN 61672-3:2014	
Filtri a bande di terzi di ottava	(6)	Livello di pressione acustica	da 20 Hz a 20 kHz	da 25 dB a 140 dB	da 0,2 dB a 0,5 dB	IEC 61260-1:2014 CEI EN 61260-1:2017	
Filtri a bande di ottava			da 31,5 Hz a 16 kHz	da 25 dB a 140 dB	da 0,2 dB a 0,5 dB		
Filtri a bande di terzi di ottava	(7)	Livello di pressione acustica	da 20 Hz a 20 kHz	da 25 dB a 140 dB	da 0,2 dB a 2,0 dB	Metodo interno. Taratura basata su IEC 61260:1995 e CEI EN 61260:1997	
Filtri a bande di ottava			da 31,5 Hz a 16 kHz	da 25 dB a 140 dB	da 0,2 dB a 2,0 dB		

Settore / *Calibration field*	(SAU-02) **Sensibilità assoluta alla pressione acustica**

Strumento *Instrument*		Misurando *Measurand*	Condizioni *Additional parameters*	Campo di misura *Measurement range*	Incertezza *Uncertainty*	Metodo/Procedura *Method / Procedure*	Sede *Location*
Microfoni a condensatore	Campioni da ½" (8)	Sensibilità alla pressione acustica	250 Hz	124 dB	0,12 dB	Metodo interno. Taratura per confronto in accoppiatore	A
			1 kHz		0,13 dB		
	Working Standard da ½" (9)	Risposta di frequenza in pressione	da 31,5 Hz a 16 kHz	94 dB	da 0,2 dB a 1,0 dB	Metodo interno. Verifica con calibratore multifrequenza	

[1] Conformi alle norme IEC EN 60942:2018 e CEI EN 60942:2018. *(V souladu s normami IEC EN 60942:2018 a IEC EN 60942:2018.)*
[2] Conformi alle norme IEC EN 60942:2003 e CEI EN 60942:2004. *(Vyhovuje IEC EN 60942:2003 a IEC EN 60942:2004.)*
[3] Conformi alle norme CEI EN 60651:2001 / IEC 60651:1979, CEI EN 60804:2001 / IEC 60804:2000. *(Vyhovuje IEC EN 60651:2001 / IEC 60651:1979, IEC EN 60804:2001 / IEC 60804:2000.)*
[4] Conformi alle norme IEC 61672-1:2002 ed. 1 e CEI EN 61672-1:2003 ed. 1. *(Vyhovuje IEC 61672-1:2002 ed. 1 a IEC EN 61672-1:2003 ed. 1.)*
[5] Conformi alle norme IEC 61672-1:2013 ed. 2 e CEI EN 61672-1:2014 ed. 2. *(Vyhovuje IEC 61672-1:2013 ed. 2 a IEC EN 61672-1:2014 ed. 2.)*
[6] Conformi alla norma IEC 61260-1:2014 e CEI EN 61260-1:2017. *(Vyhovuje normě IEC 61260-1:2014 a ČSN EN 61260-1:2017.)*
[7] Conformi alla norma CEI EN 61260:1997 / IEC EN 61260:1995. *(Vyhovuje normě IEC EN 61260:1997 / IEC EN 61260:1995.)*

2.3. TRESCAL s.r.l.

Area metrologica *Metrological area*: **Misure acustiche**

Settore / *Calibration field*: (SAU-01) **Livello di pressione acustica**

Strumento *Instrument*		Misurando *Measurand*	Condizioni *Additional parameters*	Campo di misura *Measurement range*	Incertezza *Uncertainty*	Metodo/Procedura *Method / Procedure*	Sede *Location*
Pistonofoni	(17)	Livello di pressione acustica	250 Hz	124 dB	0,10 dB	Metodo interno. Taratura basata su IEC EN 60942:2003 Annex B CEI EN 60942:2004 Annex B	A
		Frequenza	124 dB	250 Hz	0,012 %		
Calibratori		Livello di pressione acustica	250 Hz, 1 kHz	da 94 dB a 114 dB	0,10 dB		
		Frequenza	da 94 dB a 114 dB	250 Hz, 1 kHz	0,012 %		
Pistonofoni	(18)	Livello di pressione acustica	250 Hz	114 dB, 124 dB	0,10 dB	IEC 60942:2017 Annex B CEI EN IEC 60942:2018 Annex B	
		Frequenza	124 dB	250 Hz	0,012 %		
Calibratori		Livello di pressione acustica	250 Hz, 1 kHz	da 94 dB a 114 dB	0,10 dB		
		Frequenza	da 94 dB a 114 dB	250 Hz, 1 kHz	0,012 %		

(continua)

(Continua) Area metrologica "Misure acustiche" – Settore "Livello di pressione acustica" (SAU-01)

Strumento *Instrument*		Misurando *Measurand*	Condizioni *Additional parameters*	Campo di misura *Measurement range*	Incertezza *Uncertainty*	Metodo/Procedura *Method / Procedure*	Sede *Location*
(continua)							
Fonometri	(19)	Livello di pressione acustica	da 31,5 Hz a 16 kHz	da 25 dB a 140 dB	da 0,11 dB a 0,99 dB	Guida CEI 29-30:1997	A
	(20)		da 63 Hz a 16 kHz	da 25 dB a 140 dB	da 0,12 dB a 0,30 dB	Metodo interno. Taratura basata su IEC 61672-3:2006 e CEI EN 61672-3:2007	
	(21)		da 63 Hz a 16 kHz	da 25 dB a 140 dB	da 0,10 dB a 0,30 dB	IEC 61672-3:2013 CEI EN 61672-3:2014	

3. NATA (Austrálie)

3.1. Noise and Vibration Measurement Systems Pty Ltd, Sydney Calib. Lab.

Acoustical	Acoustic calibrators	Distortion;	Comparison with a	AS/IEC 60942 -	
	Vibration measuring systems	Acceleration sensitivity; Frequency response	Comparison measurement against reference transducer	By the methods of ISO 16063 part 21	
SERVICE	**PRODUCT**	**DETERMINANT**	**TECHNIQUE**	**PROCEDURE**	**LIMITATIONS**
Capability With Calibration and Measurement Capability of- Conditioning amplifiers 0.001 V/ms ^{2} Data acquisition systems / Analyser electrical tests 0.004 dB DC voltage 0.1 mV 1 % from 5 Hz to 10 Hz 0.8% at greater than 10 Hz to 2 kHz 1.2% at greater than 2 kHz to 7 kHz 2 % at greater than 7 kHz to 10 kHz					
Vibration metrology - Vibration standards and reference equipment	Vibration calibrators	Acceleration; Distortion; Frequency	Direct measurement by frequency analyser	By the methods of ISO 16063-21	
Capability with Calibration and Measurement Capability of - At a nominal frequency of 160 Hz Acceleration 0.8% Distortion 0.25% Frequency 0.01 Hz					
Vibration metrology - Vibration equipment	Accelerometers	Acceleration sensitivity	Comparison measurement against reference transducer	By the methods of ISO 16063 part 21	
Capability Level response from 0.1 m/s^2 for transducers with a sensitivity above 0.1 pC/m/s^2 and 0.4 mV/m/s^2 Up to 300 ms^{-2} for accelerometers up to 50 g at 160 Hz With Calibration and Measurement Capability of- 1 % from 5 Hz to 10 Hz 0.8% at greater than 10 Hz to 2 kHz 1.2% at greater than 2 kHz to 7 kHz 2 % at greater than 7 kHz to 10 kHz					

3.2. National Measurement Institute (NMI), Acoustics, Ultrasonics and Vibration Project, Lindfield

SERVICE	PRODUCT	DETERMINANT	TECHNIQUE	PROCEDURE	LIMITATIONS
Acoustical metrology - Acoustic standards and reference equipment	Acoustic calibrators - Single frequency	Distortion; Frequency; Short term fluctuations; Sound pressure level	Comparison with a reference standard; Direct measurement against reference signal; Direct measurement by electrical input; Direct measurement by frequency analyser	IEC60942	
Capability With Calibration and Measurement Capability of- 0.11 dB at nominal 1 kHz for sound pressure level 0.02 dB for short term level fluctuations 0.10 Hz for frequency 0.21% for total harmonic distortion and noise					
	Sound level meters	Sound pressure level	Direct measurement against a reference instrument; Direct measurement by electrical input; Direct	AS 1259.1 - 1990 Clauses 8.9, 8.10, 10.1,10.2.2, 10.2.3, 10.3.2, 10.3.3, 10.3.4, 10.4.2,	

SERVICE	PRODUCT	DETERMINANT	TECHNIQUE	PROCEDURE	LIMITATIONS
			measurement by reference sound source; Pressure field comparison measurement	10.4.3, 10.4.4, 10.4.5 AS 1259.2 - 1990 Clauses 9.1, 9.2.1, 9.2.2, 9.2.3, 9.3.1, 9.3.2, 9.3.3, 9.3.5 IEC 60651:2001, IEC 60804:2000, IEC 61672-3	
Capability With Calibration and Measurement Capability of- Acoustic tests using a multifunction acoustic calibrator 0.14 dB at 31.5 Hz 0.12 dB at 63 Hz 0.12 dB at 125 Hz to 500 Hz 0.11 dB at 1 kHz 0.13 dB at 2 kHz 0.14 dB at 4 kHz 0.15 dB at 8 kHz 0.21 dB at 12.5 kHz 0.37 dB at 16 kHz Electrical tests 0.18 dB for frequency & time weighting 0.20 dB for level linearity 0.16 dB for toneburst response, peak C sound level & overload indication 0.09 dB for self-generated noise & high-level stability					

3.3. ACU-VIB Electronics

SERVICE	PRODUCT	DETERMINANT	TECHNIQUE	PROCEDURE	LIMITATIONS
Acoustical metrology - Acoustic equipment	Band pass filters	Attenuation; Linearity	Direct measurement by electrical input	By the methods of AS/NZS 4476-1997, IEC 1260-1995 Clauses 5.3, 5.7, 5.8, 5.9; IEC 61260-3 and ACU-VIB procedure AVP06	

Capability

with Calibration and Measurement Capability of -
For direct measurement of attenuation, A, (electronic filter) via voltage output to voltage input -
0.1 dB -6 dB ≤A ≤ 40 dB
0.3 dB 40 dB < A ≤ 80 dB
0.11 dB for linearity
0.1 dB for mid-band relative attenuation
0.25 dB for lower limit of linearity range (noise)

For recording of displayed attenuation (measuring instrument) -

	Microphones	Frequency response; Pressure sensitivity	Direct measurement against a reference instrument	Calibration by electrostatic actuator by the method of ACU-VIB Procedure AVP01; Calibration by pressure response in a small volume coupler by the method of ACU-VIB Procedure AVP11; Calibration by measurement of the open circuit sensitivity by the method of ACU-VIB procedure AVP04	

Capability

with Calibration and Measurement Capability of -
Calibration by electrostatic actuator:
0.10 dB in the range 20 Hz to 20 kHz by electrostatic actuator

Calibration by small volume coupler:
0.12 dB at 31.5 Hz, 63 Hz, 4 kHz and at 8 kHz
0.11 dB at 125 Hz and up to and including 2 kHz
0.08 dB at 1 kHz as the reference frequency
0.19 dB at 12.5 kHz

	Dose meters for sound	Electrical response; Frequency response; Noise exposure/dose	Direct measurement by electrical input; Pressure field comparison measurement	AS/NZS 2399-1998 Clauses 6, 7, 8, 9, 10 and 11, IEC 61252 and ACU-VIB procedure AVP07; C weighted peak according to IEC 61672-3 Clause19; IEC 61672

Capability

Nominal octave frequencies from 63 Hz to 8 kHz;
with Calibration and Measurement Capability of -
0.03 Pa^2h at a dose of 8 Pa^2h (94 dBA 8h)
Acoustic tests in a small volume coupler at nominal octave frequencies
with Calibration and Measurement Capability of -
0.10 dB for frequencies from 63 Hz to below 125 Hz
0.09 dB for frequencies from 125 Hz to below 2 kHz
0.10 dB for frequencies from 2 kHz to below 4 kHz
0.11 dB for frequencies from 4 kHz to 8 kHz
0.09 dB at a reference frequency of 1 kHz

	Signal conditioning amplifiers	Attenuation; Frequency response; Linearity	Direct measurement by electrical input	By comparison with calibrated attenuator and voltmeter by ACU-VIB procedure AVP09

Capability

At nominal frequencies from 10 Hz to 20 kHz and; Gain from 40 dB to -80 dB
Calibration of transducer preamplifiers and signal conditioning amplifiers
for Gain, Attenuation and Frequency response
with Calibration and Measurement Capability of -
0.05 dB for Gain from 40 dB to -40 dB;
0.08 dB for Gain from -40 dB to -80 dB;
0.01 dB for frequency response at nominal frequencies from 10 Hz to 20 kHz

Acoustical metrology - Acoustic standards and reference equipment	Acoustic calibrators - Multi frequency; Acoustic calibrators - Single frequency	Distortion; Frequency; Sound pressure level	Comparison with a reference standard	By the methods of IEC 60942 and ACU-VIB procedure AVP02 and AVP03

Capability

At nominal octave frequencies between 31.5 Hz and 16 kHz
with Calibration and Measurement Capability at nominal octave frequencies of -
0.10 dB for sound level pressure at 31.5 Hz
0.09 dB for sound level pressure at 63 Hz
0.08 dB for sound level pressure at 125 Hz up to 2 kHz
0.07 dB for sound level pressure at reference frequency of 1 kHz
0.11 dB for sound level pressure at 4 kHz to below 8 k Hz
0.13 dB for sound level pressure at 8 kHz to below 12.5 kHz
0.18 dB for sound level pressure at 12.5 kHz to below 16 kHz
0.27 dB for sound level pressure at 16 kHz
0.05% for frequency
0.2% for total harmonic distortion and noise

	Sound level meters	Electrical response; Sound pressure level	Direct measurement by electrical input; Pressure field comparison measurement	AS 1259.1 - 1990 Clauses 8.9, 8.10, 10.2.2,10.2.3, 10.3.2, 10.3.3, 10.3.4, 10.4.1, 10.4.2, 10.4.3, 10.4.4 and 10.4.5; AS 1259.2 - 1990 Clauses 9.1, 9.2.1, 9.2.2, 9.2.3, 9.3.1, 9.3.2, 9.3.3, 9.3.4,9.3.5; ACU-VIB procedure AVP05; IEC 60651, IEC 60804; IEC 61672-3; ACU-VIB procedure AVP10;	

Capability

From 31.5 Hz to 16 kHz for acoustic tests
From 20 Hz to 20 kHz for electrical tests
with Calibration and Measurement Capability of -
Electrical tests
0.1 dB (AS 1259-1, IEC 60651, AS 1259-2, IEC 60804)
0.09 dB (IEC 61672-3)
Acoustic tests in a small volume coupler at nominal octave frequencies
0.11 dB for frequencies from 31.5 Hz to below 63 Hz
0.10 dB for frequencies from 63 Hz to below 125 Hz
0.09 dB for frequencies from 125 Hz to below 2 kHz
0.10 dB for frequencies from 2 kHz to below 4 kHz
0.11 dB for frequencies from 4 kHz to below 8 kHz
0.16 dB for frequencies from 8 kHz to below 12.5 kHz

Vibration metrology - Vibration equipment	Accelerometers; Velocity transducers	Acceleration sensitivity; Frequency response; Velocity sensitivity	Comparison measurement against reference transducer	ISO 16063-21; ACU VIB Procedures AVP08, AVP12, AVP14, AVP15, AVP19	Maximum force of up to 1000 N or Displacement limit of 158 mm peak to peak

Capability

In the acceleration range (or equivalent) 0.01 m/s2 up to 10 m/s2 below 10 Hz,
up to 50 m/s2 from 10 Hz,
up to 100 m/s2 from 40 Hz,
up to 500 m/s2 from 160 Hz,
Extended lower velocity range down to 0.1 mm/s from 0.5 Hz to below 16 Hz
For transducers of
Mass up to 5.0 kg at nominal frequencies from 0.5 Hz to 320 Hz;
Mass up to 500 grams for frequencies of 5kHz and below;
Mass up to 50 grams for frequencies of 10 kHz and below,
by comparison to the methods of ISO 16063-21
with calibration and measurement capability for sensitivity of

1.4% from 0.8 Hz to less than 1.6 Hz
0.6% from 1.6 Hz to less than 2500 Hz
1.0% from 2500 Hz to less than 5000 Hz
1.5% from 5000 Hz to less than 7000 Hz
2.3% from 7000Hz up to 10000 Hz

	systems; Vibration recording systems	Electrical response; Frequency response; Velocity sensitivity	against reference transducer; Direct measurement by electrical input	Procedure AVP12, AVP14, AVP15 and AVP19	1000 N or Displacement limit of 158 mm peak to peak

Capability

In the acceleration range (or equivalent) 0.01 m/s2 up to 10 m/s2 below 10 Hz,
up to 50 m/s2 from 10 Hz,
up to 100 m/s2 from 40 Hz,
up to 500 m/s2 from 160 Hz,
Extended lower velocity range down to 0.1 mm/s from 0.5 Hz to below 16 Hz
For transducers of
Mass up to 5.0 kg at nominal frequencies from 0.5 Hz to 320 Hz;
Mass up to 500 grams for frequencies of 5kHz and below;
Mass up to 50 grams for frequencies of 10 kHz and below,
by comparison to the methods of ISO 16063-21 or by methods of ISO 8041
with calibration and measurement capability for level response of
1.4% from 0.8 Hz to less than 1.6 Hz
0.6% from 1.6 Hz to less than 2500 Hz
1.0% from 2500 Hz to less than 5000 Hz
1.5% from 5000 Hz to less than 7000 Hz
2.3% from 7000Hz up to 10000 Hz
Electrical tests
0.1% display linearity
0.25% Vector addition (PPV)

Vibration metrology - Vibration standards and reference equipment	Vibration calibrators	Acceleration; Distortion; Frequency	Comparison measurement against reference transducer	ACU-VIB Procedure AVP13, ISO 16063-21, ISO 16063-44, ISO 8041

Capability

For frequencies between 7 Hz and 10 kHz at levels between 1 ms^{-2} and 100 ms^{-2}
with a Calibration and Measurement Capability for acceleration at nominal frequencies of
1.2% from 7 Hz to below 16 Hz
1% from 16 Hz to below 80 Hz
0.6% from 80 Hz to 2 kHz
1% from 2 kHz to 10 kHz
with a Calibration and Measurement Capability of -
0.02 Hz for frequency
0.2% for total harmonic distortion and noise