

Software validation record

fixture_budget.xlsx

Document number	HVR-4AA198E4
Revision	1
Laboratory	Sample Laboratory (constructed demonstration file)
Measurement function	Pressure, mass, temperature and a calibration curve
File examined	fixture_budget.xlsx
File hash (SHA-256)	4aa198e4473fa73a8ae8126014a029f524277bcb782a858c3975995a98b581cf
Software type	Spreadsheet, 5 worksheets, 4 carrying formulas. No macros. Self-contained.
Date of record	2026-07-31
Prepared by	Félix Desrochers, Desrochers Validation
Status	For review and signature by the laboratory's technical manager

This record presents evidence about what the identified workbook computes and where it departs from published requirements. It is not a statement that the laboratory's measurement results are correct, and it is not an approval or certification of any kind. No accreditation body approves validation providers. The signature that gives this record standing is the laboratory's own.

REVISION HISTORY

Rev	Description	Date
1	Initial issue.	2026-07-28

Later revisions are issued by Desrochers Validation against the same document number when the workbook changes or a finding is resolved. A revision of the workbook itself gets a new document number, because the number is derived from the file.

CONTENTS

#	Section	Page
1	Summary and required actions	3
2	What was examined	5
3	Requirements specification	6
4	Test cases and results	10
5	Boundary and negative tests	10
6	Findings	11
7	Coverage against NIST GLP 15	13
8	Change control record	15
9	Statement of limitations	16
10	Review and approval	16
A	Appendix A: every NIST GLP 15 check	18
B	Appendix B: full test case listing	24
C	Appendix C: formula inventory	27

1. Summary and required actions

This workbook has findings that need attention. The detail behind every number below is in the sections that follow; this page is the whole record in short.

Worksheets examined	5
Uncertainty budgets found	3
Calibration regressions found	1
Formula cells reviewed	84 in 29 distinct shapes
Findings	4
Items for review	4
Notes	3
Test cases	45 run, 40 pass, 4 fail , 1 for review
Boundary cases	12 run, 7 showed unguarded behaviour (section 5)
Worksheets tested arithmetically	4 of 4 carrying formulas (section 9)
NIST GLP 15 checks	23 of 47 answered here, 3 gathered for your judgment, 11 for the laboratory

Findings at a glance

Finding	Where	Against
[B1] Type A contribution appears to omit the $1/\sqrt{n}$ divisor	Pressure 0 to 100 kPa	GUM 4.2
[B5] Combined uncertainty is a linear sum, not root-sum-square	Pressure 0 to 100 kPa	GUM 5.1.2
[C1] Reported uncertainty carries more than two significant figures	Pressure 0 to 100 kPa	ILAC-P14 5.3
[C4] Coverage factor stated but coverage probability is not	Pressure 0 to 100 kPa	ILAC-P14 5.2

What the laboratory needs to do

	Action	Why
1	Correct or justify: [B1] Type A contribution appears to omit the $1/\sqrt{n}$ divisor on Pressure 0 to 100 kPa	Departs from GUM 4.2.
2	Correct or justify: [B5] Combined uncertainty is a linear sum, not root-sum-square on Pressure 0 to 100 kPa	Departs from GUM 5.1.2.

	Action	Why
3	Correct or justify: [C1] Reported uncertainty carries more than two significant figures on Pressure 0 to 100 kPa	Departs from ILAC-P14 5.3.
4	Correct or justify: [C4] Coverage factor stated but coverage probability is not on Pressure 0 to 100 kPa	Departs from ILAC-P14 5.2.
5	Resolve: 4 test cases disagree with an independent calculation (PRES.T3, PRES.T4, PRES.T5, CALI.LR2)	Either the workbook or the requirement in section 3 is wrong.
6	Complete: 11 NIST form items only you can answer (items B1, B4, C1, E3, E4, E5 and others)	Appendix A. The record is not finished until these are filled in.
7	Confirm: The requirements in section 3 match what the workbook was built to do	They were reverse-derived from the file. If they are wrong, every test below them measures the wrong thing.
8	Review: [A-drift] No contributor found for: drift	Judgment belongs to you.
9	Review: [A7] No customer-device contribution beyond resolution is identifiable	Judgment belongs to you.
10	Review: [B2] Rectangular divisor: confirm half-width against full-width	Judgment belongs to you.
11	Review: [D6] Hardcoded value inside a formula column	Judgment belongs to you.

2. What was examined

Field	Value
File	fixture_budget.xlsx
SHA-256	4aa198e4473fa73a8ae8126014a029f524277bcb782a858c3975995a98b581cf
Size	10,660 bytes
Last modified	2026-07-31
Worksheets	5
Formula cells	84
Unique formula patterns	29

The hash identifies the exact file examined. Any later edit changes it, which is what makes this record traceable to a specific version. A full sheet-by-sheet formula inventory is in Appendix C.

- **Pressure 0 to 100 kPa:** 17 rows by 9 columns, visible, unprotected, 6 formula shapes, 1 volatile.
- **Mass 1 mg to 200 g:** 19 rows by 9 columns, visible, protected, 8 formula shapes.
- **Temperature -40 to 150 C:** 18 rows by 9 columns, visible, unprotected, 8 formula shapes.
- **Calibration Curve:** 18 rows by 6 columns, visible, unprotected, 7 formula shapes.
- **Document Control:** 11 rows by 2 columns, visible, unprotected, 0 formula shapes.

What was tested, worksheet by worksheet

Worksheet	Formula cells	Calculation recognised	Test cases	Boundary cases
Pressure 0 to 100 kPa	17	uncertainty budget	13	4
Mass 1 mg to 200 g	21	uncertainty budget	15	4
Temperature -40 to 150 C	18	uncertainty budget	13	4
Calibration Curve	28	linear calibration regression	4 (2 compared)	0
Document Control	0	none	0	0

Every worksheet above was inspected for workbook properties and ordinary cell-formula integrity and hygiene checks in section 6, whatever the last three columns say, and every detected formula appears in the inventory in Appendix C. Array and data-table formulas are inventoried and named as unsupported rather than silently treated as literals. Test cases are a different thing: each one compares a value derived independently from the requirements in section 3 against what the workbook itself computes, and that can only be done where the calculation matches an archetype we have implemented. Today those are uncertainty budgets laid out as a table of

contributors, the calibration-laboratory convention of one row per contribution with a value, a distribution divisor and a sensitivity coefficient, row-wise mass uncertainty calculations, uncertainty from repeated CRM analyses, ordinary linear calibration curves, and coordinate-alignment regressions. A budget built by a different convention, such as the Kragten spreadsheet method common in analytical chemistry, is inspected for hygiene like any other sheet but is not recomputed. **A worksheet showing no test cases is not a worksheet that passed.** It is one whose arithmetic this record does not speak to, and section 9 lists them.

3. Requirements specification

No requirements specification accompanied this workbook, which is the usual case. The requirements below are **reverse-derived from the file itself** and the published method named with each test. They are what section 4 tests against. **Read them first.** If a requirement is wrong, the tests below it are testing the wrong thing, and that is the one error this method cannot catch on its own.

Uncertainty budgets

These requirements apply to all 3 budget sheets listed below.

#	The workbook is required to
R1	Accept a set of uncertainty contributions, each with a value, a distribution divisor and a sensitivity coefficient.
R2	Compute each contribution's standard uncertainty as value divided by divisor (GUM 4.3).
R3	Scale each by its sensitivity coefficient (GUM 5.1.2).
R4	Combine them as the root sum of squares, $u_c = \sqrt{\sum (c_i u_i)^2}$ (GUM 5.1.2).
R5	Multiply by the stated coverage factor to give the expanded uncertainty U (GUM 6.2.1).
R6	Report U to at most two significant figures (ILAC-P14 5.3).
R7	State the coverage factor and the coverage probability (ILAC-P14 5.2).

Pressure 0 to 100 kPa : 5 contributors, header at row 5, coverage factor 2.

Row	Contributor	Value	Divisor	Sensitivity
6	Repeatability	0.042	1	1
7	UUT Resolution	0.1	1.73205	1
8	Reference Standard (cert)	0.055	2	1
9	Temperature effect	0.03	1.73205	1.15
10	Reference drift	0.02	1.73205	1

The same block as it sits in the workbook, formulas showing. Compare it against your own file: if this is not the table you meant, everything below it is testing the wrong block.

	A	B	C	D	E	F	G	H	I
3	Instrument: Ref std DPI-610, S/N 4471								
4									
5	Contributor	Value	Units	Distribution	Divisor	Std Uncert	Sensitivity	Contribution	DoF
6	Repeatability	0.042	kPa	Normal	1	=B6/E6	1	=F6*G6	9
7	UUT Resolution	0.1	kPa	Rectangular	=SQRT(3)	=B7/E7	1	=F7*G7	1000000000
8	Reference Standard (cert)	0.055	kPa	Normal (k=2)	2	0.0275	1	=F8*G8	1000000000
9	Temperature effect	0.03	kPa	Rectangular	=SQRT(3)	=B9/E9	1.15	=F9*G9	1000000000
10	Reference drift	0.02	kPa	Rectangular	=SQRT(3)	=B10/E10	1	=F10*G10	1000000000
11									
12	Combined standard uncertainty u_c							=SUM(H6:H10)	
13	Coverage factor							2	
14	Expanded uncertainty U							=H12*H13	
15	Reported U (kPa)							=ROUND(H14,4)	

Mass 1 mg to 200 g : 6 contributors, header at row 5, coverage factor 2.

Row	Contributor	Value	Divisor	Sensitivity
6	Repeatability of the mean	0.00018	3.16228	1
7	Balance resolution	0.0001	3.4641	1
8	Reference standard (cert)	0.00025	2	1
9	Reference standard drift	9e-05	1.73205	1
10	Air buoyancy and environment	0.00012	1.73205	1
11	Customer device readability	5e-05	3.4641	1

The same block as it sits in the workbook, formulas showing. Compare it against your own file: if this is not the table you meant, everything below it is testing the wrong block.

	A	B	C	D	E	F	G	H	I
3	Instrument: Ref std OIML E2 set, S/N 20114								
4									
5	Contributor	Value	Units	Distribution	Divisor	Std Uncert	Sensitivity	Contribution	DoF
6	Repeatability of the mean	0.00018	g	Normal, 1s	=SQRT(10)	=B6/E6	1	=F6*G6	9
7	Balance resolution	0.0001	g	Rectangular half-width	=2*SQRT(3)	=B7/E7	1	=F7*G7	1000000000
8	Reference standard (cert)	0.00025	g	Normal (k=2)	2	=B8/E8	1	=F8*G8	1000000000
9	Reference standard drift	9e-05	g	Rectangular	=SQRT(3)	=B9/E9	1	=F9*G9	1000000000
10	Air buoyancy and environment	0.00012	g	Rectangular	=SQRT(3)	=B10/E10	1	=F10*G10	1000000000
11	Customer device readability	5e-05	g	Rectangular half-width	=2*SQRT(3)	=B11/E11	1	=F11*G11	1000000000
12									
13	Combined standard uncertainty u_c							=SQRT(SUMSQ(H6:H11))	
14	Coverage factor k							2	
15	Coverage probability							95%	

	A	B	C	D	E	F	G	H	I
16	Expanded uncertainty U							=H13*H14	
17	Reported U (g)							=ROUND(H16,5)	

Temperature -40 to 150 C : 5 contributors, header at row 5, coverage factor 2.

Row	Contributor	Value	Divisor	Sensitivity
6	Repeatability of the mean	0.021	2.44949	1
7	Indicator resolution	0.01	3.4641	1
8	Reference standard (cert)	0.03	2	1
9	Bath uniformity and environment	0.018	1.73205	1
10	Customer device readability	0.05	3.4641	1

The same block as it sits in the workbook, formulas showing. Compare it against your own file: if this is not the table you meant, everything below it is testing the wrong block.

	A	B	C	D	E	F	G	H	I
3	Instrument: Ref std PRT 5628, S/N 9912								
4									
5	Contributor	Value	Units	Distribution	Divisor	Std Uncert	Sensitivity	Contribution	DoF
6	Repeatability of the mean	0.021	C	Normal, 1s	=SQRT(6)	=B6/E6	1	=F6*G6	5
7	Indicator resolution	0.01	C	Rectangular half-width	=2*SQRT(3)	=B7/E7	1	=F7*G7	1000000000
8	Reference standard (cert)	0.03	C	Normal (k=2)	2	=B8/E8	1	=F8*G8	1000000000
9	Bath uniformity and environment	0.018	C	Rectangular	=SQRT(3)	=B9/E9	1	=F9*G9	1000000000
10	Customer device readability	0.05	C	Rectangular half-width	=2*SQRT(3)	=B10/E10	1	=F10*G10	1000000000
11									
12	Combined standard uncertainty u_c							=SQRT(SUMSQ(H6:H10))	
13	Coverage factor k							2	
14	Coverage probability							95%	
15	Expanded uncertainty U							=H12*H13	
16	Reported U (C)							=ROUND(H15,2)	

Linear calibration regression

Calibration Curve : 6 calibration points, header at row 5.

#	The workbook is required to
LR1	Fit a straight line to the reference and measured pairs by ordinary least squares.
LR2	Compute the slope as $\frac{\sum (x - \bar{x})(y - \bar{y})}{\sum (x - \bar{x})^2}$.
LR3	Compute the intercept as mean(y) minus slope times mean(x). Omitting the second term is the common error.

#	The workbook is required to
LR4	Report the goodness of fit and the residual scatter.
LR5	Retain at least three points, preferably five.
LR6	Apply the fit only within the calibrated range.

Traceability

Whether every requirement above is actually tested, and where a requirement is not arithmetic, what covers it instead. **A requirement with no test case is not a requirement that passed.**

Uncertainty budgets

#	Test cases	Result
R1	none	Structural, not arithmetic. What was found on each sheet is listed above.
R2	16	all pass
R3	16	all pass
R4	3	1 fail
R5	3	1 fail
R6	3	1 fail
R7	none	Not arithmetic. Checked as C4, reported in section 6 where it applies.

Linear calibration regression

#	Test cases	Result
LR1	2	1 fail
LR2	1	all pass
LR3	1	1 fail
LR4	none	Not verified. No value for this was found in the workbook to compare against. If it is present and the extraction missed it, say so and it will be read by hand.
LR5	1	all pass
LR6	1	1 for review

4. Test cases and results

Expected values are computed from the requirements in section 3 and the workbook's inputs.

They are never taken from the formulas being tested, because a result derived from the formula under test only demonstrates that the formula equals itself. Actual values come from evaluating the workbook's current formula chain. A saved Excel result is used only to corroborate a formula result; it never substitutes for a formula this record cannot evaluate.

45 cases: 40 pass, 4 fail, 1 for review. Every case is listed in Appendix B. Failures are set out here.

Case	What was tested	Expected	Actual
PRES.T3	Combined standard uncertainty at H12	0.0798979	0.158701
PRES.T4	Expanded uncertainty at H14	0.159796	0.317401
PRES.T5	Reported uncertainty carries one or two significant figures	1 or 2	4
CALI.LR2	intercept at B16	0.301905	50.3083

- **PRES.T3.** GUM 5.1.2: $u_c = \sqrt{\sum (c_i u_i)^2}$, computed here from the input columns alone. Actual evaluated from the workbook's formulas.
- **PRES.T4.** GUM 6.2.1: $U = k u_c$ with $k = 2$. Actual evaluated from the workbook's formulas.
- **PRES.T5.** ILAC-P14 5.3. Counted from the reported value itself.
- **CALI.LR2.** Least squares intercept, $\bar{y} - \bar{b}\bar{x}$, computed here from the 6 calibration points alone. Actual evaluated from the workbook's formulas.

5. Boundary and negative tests

Each case substitutes one input and re-evaluates the workbook's own chain through to the combined uncertainty. These are executed against the file, not described in the abstract. A failure is not necessarily a defect: most budgets are built for valid input and do not guard against a zero divisor. It records what happens if one is ever entered.

Case	Input substituted	Expected	Actual	Result
PRES.BND.1	'UUT Resolution' value set to zero	a combined uncertainty below the 0.158701 baseline, no error	0.100966	pass
PRES.BND.2	'UUT Resolution' value made negative	unchanged at 0.158701: an uncertainty is not signed	0.0432306	FAIL
PRES.BND.3	'UUT Resolution' divisor set to zero	a guarded result rather than an error propagated into u_c	#DIV/o!	FAIL
PRES.BND.4	'UUT Resolution' value replaced with text	a guarded result rather than an error propagated into u_c	#VALUE! (text in a numeric field)	FAIL

Case	Input substituted	Expected	Actual	Result
MASS.BND.1	'Reference standard (cert)' value set to zero	a combined uncertainty below the 0.00016555 baseline, no error	0.000108543	pass
MASS.BND.2	'Reference standard (cert)' value made negative	unchanged at 0.00016555: an uncertainty is not signed	0.00016555	pass
MASS.BND.3	'Reference standard (cert)' divisor set to zero	a guarded result rather than an error propagated into u_c	#DIV/o!	FAIL
MASS.BND.4	'Reference standard (cert)' value replaced with text	a guarded result rather than an error propagated into u_c	#VALUE! (text in a numeric field)	FAIL
TEMP.BND.1	'Reference standard (cert)' value set to zero	a combined uncertainty below the 0.0249633 baseline, no error	0.0199541	pass
TEMP.BND.2	'Reference standard (cert)' value made negative	unchanged at 0.0249633: an uncertainty is not signed	0.0249633	pass
TEMP.BND.3	'Reference standard (cert)' divisor set to zero	a guarded result rather than an error propagated into u_c	#DIV/o!	FAIL
TEMP.BND.4	'Reference standard (cert)' value replaced with text	a guarded result rather than an error propagated into u_c	#VALUE! (text in a numeric field)	FAIL

6. Findings

4 findings · 4 items for review · 3 notes

Finding: departs from an explicit requirement in the GUM or ILAC-P14. *Review:* requires a judgment call that belongs to the laboratory. *Note:* hygiene, recorded but not a compliance matter.

Each entry is one distinct check. Where a check applies on several sheets it is reported once, with every location listed.

Findings

1. [B1] Type A contribution appears to omit the $1/\sqrt{n}$ divisor

The GUM evaluates Type A standard uncertainty as the experimental standard deviation of the MEAN, $s/\sqrt{n}$. No $\sqrt{n}$ term appears on this row. If the Value column already holds the standard deviation of the mean this is correct. Confirm which it holds, because the two differ by a factor of $\sqrt{n}$ and the budget does not say.

- row 'Repeatability'

Source: GUM 4.2 · *Cells:* Pressure 0 to 100 kPa!F6, Pressure 0 to 100 kPa!E6

2. [B5] Combined uncertainty is a linear sum, not root-sum-square

The GUM law of propagation combines contributions as $u_c = \sqrt{\sum((c_i \cdot u_i)^2)}$. Adding them instead, whether with SUM() or with a chain of plus signs, materially overstates the combined standard uncertainty.

Source: GUM 5.1.2 · Cells: Pressure 0 to 100 kPa!H12

3. [C1] Reported uncertainty carries more than two significant figures

ILAC-P14 5.3: 'The numerical value of the expanded uncertainty shall be given to, at most, two significant figures.'

- H15 displays with 4 significant figures

Source: ILAC-P14 5.3 · Cells: Pressure 0 to 100 kPa!H15

4. [C4] Coverage factor stated but coverage probability is not

ILAC-P14 5.2: 'The coverage factor and the coverage probability shall be stated on the calibration certificate.' A k value alone does not satisfy this; the ~95% coverage probability must appear.

Source: ILAC-P14 5.2

Reviews

5. [A-drift] No contributor found for: drift

No labelled row matches this contributor. It may be genuinely not applicable to this measurement (that is a judgment call for the lab), but its absence should be justified in the budget.

Source: ILAC-P14 5.4

6. [A7] No customer-device contribution beyond resolution is identifiable

ILAC-P14 5.4 requires contributions reasonably attributable to the customer's device, and that components evaluated for the best existing device be replaced with those of the customer's device. The only device-related row found is 'UUT Resolution', which is a resolution term. Confirm whether any component still carries best-existing-device assumptions inherited from the CMC evaluation.

Seen 3 times across 3 sheets: Pressure 0 to 100 kPa, Mass 1 mg to 200 g, Temperature -40 to 150 C.

Source: ILAC-P14 5.4

7. [B2] Rectangular divisor: confirm half-width against full-width

GUM 4.3.7 gives $u = a/\sqrt{3}$ where a is the HALF-width of the interval. Where the tabulated value is a full span (e.g. a resolution figure), the divisor should be $2\sqrt{3}$. Confirm which convention the Value column uses.

Seen 6 times across 3 sheets: Pressure 0 to 100 kPa, Mass 1 mg to 200 g, Temperature -40 to 150 C.

Source: GUM 4.3.7 · Cells: Pressure 0 to 100 kPa!E7, Pressure 0 to 100 kPa!E9, Pressure 0 to 100 kPa!E10, Mass 1 mg to 200 g!E9, Mass 1 mg to 200 g!E10, Temperature -40 to 150 C!E9

8. [D6] Hardcoded value inside a formula column

A hand-entered value in an otherwise uniform formula column is invisible on inspection and will not update when inputs change. Confirm each is intentional: a coverage factor legitimately is a constant, an overwritten calculation is not.

- F8 holds 0.0275 in column F, which has 4 formula cells (row: 'Reference Standard (cert)')

Source: hygiene · Cells: Pressure 0 to 100 kPa!F8

Notes

9. [D2-LIMIT] Error-value check could not be performed

This workbook carries no cached calculation results, so evaluated error values (#REF!, #DIV/0! and similar) cannot be detected statically. Open and save the file in Excel, then re-run, or treat this check as not performed. It is recorded as a limitation rather than reported as a pass.

Seen 5 times across 5 sheets: Pressure 0 to 100 kPa , Mass 1 mg to 200 g , Temperature -40 to 150 C , Calibration Curve , Document Control .

Source: limitation

10. [D3] Sheet is not protected

Calculation cells are editable. Cell protection is commonly expected so that formulas cannot be overwritten in normal use.

Seen 4 times across 4 sheets: Pressure 0 to 100 kPa , Temperature -40 to 150 C , Calibration Curve , Document Control .

Source: hygiene

11. [D4] Volatile function present

Volatile functions recalculate on every open, so the workbook cannot reproduce a historical result identically. For a record retained as evidence, prefer a static value.

Source: hygiene · Cells: Pressure 0 to 100 kPa!B2

7. Coverage against NIST GLP 15

The NIST Office of Weights and Measures publishes a Software Verification and Validation form to be completed for each software file used in a laboratory (GLP 15, 2019, Appendix A, free at <https://doi.org/10.6028/NIST.IR.8250>). **Every check on that form is reported in Appendix A**, so nothing is quietly skipped.

Outcome	Count
Answered in this record	23 of 47

Outcome	Count
...of which pass	7
...of which fail	8
...of which need review	8
Evidence gathered, for your judgment	3
Only the laboratory can answer	11
Do not apply to this file	5
Need information not supplied	5

Checks marked for the laboratory are not failures. They are questions about backups, passwords and which procedure was chosen, which no examination of a file can answer. They are left blank deliberately, for signature.

Checks that failed

Check	What it asks	Evidence
A4	Data-entry fields are labeled and color coded (avoiding red and green)	20 of 20 input fields carry a row label; 13 carry a fill colour. Every data-entry field must be identifiable; partial colour coding leaves unmarked entry fields.
A10	Unused fields/cells are locked	4 worksheets of 5 not protected, so the locked attribute has no effect there: Pressure 0 to 100 kPa, Temperature -40 to 150 C, Calibration Curve, Document Control. The one remaining sheet is protected and its cells are locked.
C2	Repeated calculations appropriately reference the correct cells	1 hand-entered value sits inside an otherwise uniform column, so a repeated calculation does not reference the cells its neighbours do. See the findings section.
C3	Calculations, tested with reference data, show appropriate accuracy	4 of 43 test cases disagree with an independent calculation, including PRES.T3, PRES.T4, PRES.T5, CALI.LR2. Expected results were derived from the GUM and the budget's own input columns, and by ordinary least squares from the calibration points, independently of the formulas under test, which is what this check asks for. A further 2 cases in section 4 state a fact about the file rather than comparing anything, for example the degrees of freedom the fit has or the range it covers, and are not counted here.
C4	Rounding is done at the appropriate locations in the file	Reported uncertainty carries more than two significant figures. ILAC-P14 5.3 governs the expanded uncertainty as it is reported. See the findings section.

Check	What it asks	Evidence
D2	Fields are categorized as Number and not General when appropriate	33 of 153 numeric or formula cells are formatted General rather than Number, for example Pressure 0 to 100 kPa!B6, Pressure 0 to 100 kPa!E6, Pressure 0 to 100 kPa!G6, Pressure 0 to 100 kPa!I6, Pressure 0 to 100 kPa!B7. General lets Excel choose the displayed precision, so what is on screen may not be what is stored.
I1	Hand calculations agree with the spreadsheet, or differ insignificantly	The same evidence as C3.
J1	Equation and calculation cells are protected against inadvertent editing	4 worksheets unprotected, so equation cells can be overwritten: Pressure 0 to 100 kPa, Temperature -40 to 150 C, Calibration Curve, Document Control.

Checks marked for review. 11 checks could not be settled from the file alone and need a judgement the laboratory has to make: A1, A3, A6, A8, A11, B3, D3, E8, G1, G2, J2. These are not failures and they are not passes. Each one is set out with its evidence in appendix A.

8. Change control record

What the file itself can testify to, followed by what only the laboratory can supply.

Item	Observed
File hash at examination	4aa198e4473fa73a8ae8126014a029f524277bcb782a858c3975995a98b581cf
Last modified	2026-07-31
Sheet protection	1 protected, 4 unprotected
Hand-entered values inside formula columns	7
Volatile functions	1
References outside the workbook	0

A workbook with unprotected calculation cells and hand-entered values inside formula columns cannot demonstrate that it has not been altered since it was last reviewed. That is what this section exists to record.

To be completed by the laboratory	
Version or revision identifier	_____
Who authorised the current version	_____
What changed since the last version	_____

To be completed by the laboratory	
Date last re-verified	_____

9. Statement of limitations

What this record does **not** establish:

- **Completeness is checked against a standard contributor set, not against your measurement.** We test whether the budget accounts for the contributors ILAC-P14 5.4 expects to see, which are repeatability, resolution, reference standard, drift and environment, and we report which are absent. Whether an absent contributor is genuinely not applicable to your measurement is metrology judgment and stays with you. We show the gaps. We do not decide which of them matter.
- **It does not confirm the input values are correct.** Testing addresses the arithmetic and its compliance with stated requirements, not the physical validity of the input values or their traceability.
- **It does not assess conformity of released results.** No opinion is offered on data previously issued using this workbook.
- **It is not an accreditation, certification, or approval,** and does not predict the outcome of any assessment.
- **The requirements in section 3 are reverse-derived.** They were read out of the file, not supplied by the laboratory. If they misstate the intent, the tests in section 4 are measuring against the wrong specification. Reviewing section 3 is the one step that cannot be delegated to us.
- **1 requirement in section 3 could not be tested:** LR4 . The workbook holds no value to compare against, so nothing was verified either way. The traceability table in section 3 shows this requirement by requirement.
- **Error-value check could not be performed.** This workbook carries no cached calculation results, so evaluated error values (#REF!, #DIV/o! and similar) cannot be detected statically. Open and save the file in Excel, then re-run, or treat this check as not performed. It is recorded as a limitation rather than reported as a pass.

Checks were performed against JCGM 100:2008 (GUM) and ILAC-P14:09/2020. Clause numbering for ILAC-P14 follows the 2020 edition, which superseded the 2013 edition on 28 September 2020 and renumbered the requirements cited here from section 6 to section 5.

10. Review and approval

By signing, the laboratory accepts this record, document **HVR-4AA198E4**, as evidence for the workbook identified on the cover, and confirms that the requirements in section 3 describe what that workbook is intended to do.

Responsibilities

Desrochers Validation	Examined the workbook identified on the cover. Derived the requirements in section 3 from the file and from the published standards it implements. Computed every expected value in sections 4 and 5 independently of the workbook's own formulas. Reported findings, coverage and limitations.
Desrochers Validation does not	Decide what belongs in the laboratory's uncertainty budget, approve the workbook for use, or certify anything. No accreditation body approves validation providers, and nothing in this record is a signature on the laboratory's behalf.
The laboratory	Confirms that section 3 states what the workbook is intended to do. Answers the NIST GLP 15 checks marked <i>laboratory</i> in Appendix A, which concern backups, passwords and procedure and cannot be answered from a file. Decides what to do about each finding. Signs below.

Prepared by	Desrochers Validation (not an approval)
Reviewed by	_____
Title	_____
Signature	_____
Date	_____

Approved for use by	_____
Title	_____
Signature	_____
Date	_____

Findings accepted / actioned	_____
Next re-verification due	_____

Appendix A: every NIST GLP 15 check

All 47 checks, including the ones this record cannot answer. A checklist with the awkward rows removed is worth nothing.

A. Software Inspection

Check	Assessment	Result	Evidence and observations
A1	Spreadsheet is clear and makes sense	review	5 worksheets, 84 formula cells in 29 distinct shapes. Legibility is a judgment for the reviewer.
A2	There are instructions for use	pass	One cell directs the operator at this workbook, for example Document Control!B10: "Enter values only in the shaded Value and Divisor columns. Every other cell is ..."
A3	Instructions and data input appear on the visible portion of the first worksheet	review	First worksheet 'Pressure 0 to 100 kPa' has content in the first 30 rows but no wording that directs the operator to enter data there.
A4	Data-entry fields are labeled and color coded (avoiding red and green)	FAIL	20 of 20 input fields carry a row label; 13 carry a fill colour. Every data-entry field must be identifiable; partial colour coding leaves unmarked entry fields.
A5	The Standard Operating Procedure used is clearly specified	pass	The procedure is identified at Calibration Curve!A3: "Method per SOP 29; least squares fit".
A6	The number of digits to be rounded to is specified	review	3 rounding formulas present, but no cell states how many digits to round to. This item asks for the number of digits, and a sentence containing the word "rounding" does not give one.
A7	The user is warned whenever data-entry fields are left blank	pass	2 formulas test for an empty data-entry field and display a message, for example Mass 1 mg to 200 g!B19: "Incomplete: enter every contributor value".
A8	Data-entry fields are blank when opened, so old data is not reused	review	20 of 20 input fields hold values in the file as supplied, for example Pressure 0 to 100 kPa!B6, Pressure 0 to 100 kPa!E6, Pressure 0 to 100 kPa!B7, Pressure 0 to 100 kPa!B8. For an uncertainty budget that is expected. Confirm the values belong to this instrument and were not carried over from another.
A9	The software opens at the right location within the file	pass	Opens on 'Pressure 0 to 100 kPa' at A1, within five rows of the first identified input at row 6.

Check	Assessment	Result	Evidence and observations
A10	Unused fields/cells are locked	FAIL	4 worksheets of 5 not protected, so the locked attribute has no effect there: Pressure 0 to 100 kPa, Temperature -40 to 150 C, Calibration Curve, Document Control. The one remaining sheet is protected and its cells are locked.
A11	Rows/columns the operator need not see are hidden	review	Nothing is hidden. Whether working columns should be hidden from the operator is a design judgment for the laboratory.
A12	Unused sheets are removed	pass	No empty worksheets. All 5 carry content.
A13	Worksheets are named appropriately	pass	All 5 worksheets carry meaningful names.

B. Mathematical Specification

Check	Assessment	Result	Evidence and observations
B1	The correct SOP is used	<i>laboratory</i>	For the laboratory to complete. This cannot be established from the file.
B2	The formulae and methods chosen from that SOP are specified	pass	Documentation worksheet present: Document Control. GLP 15 section B recommends exactly this.
B3	Sources and references for formulae are specified	review	3 cells state where a formula or method came from, for example Calibration Curve!A3: "Method per SOP 29; least squares fit". This establishes provenance for the cited material, not that a source is specified for every formula in the workbook. Confirm the remaining formulae against their sources.
B4	The SOP, its methods and formulae are appropriate to the level of precision	<i>laboratory</i>	For the laboratory to complete. This cannot be established from the file.

C. Code Review

Check	Assessment	Result	Evidence and observations
C1	The formulae in the fields exactly match the procedure	<i>laboratory</i>	For the laboratory to complete. This cannot be established from the file.

Check	Assessment	Result	Evidence and observations
C2	Repeated calculations appropriately reference the correct cells	FAIL	1 hand-entered value sits inside an otherwise uniform column, so a repeated calculation does not reference the cells its neighbours do. See the findings section.
C3	Calculations, tested with reference data, show appropriate accuracy	FAIL	4 of 43 test cases disagree with an independent calculation, including PRES.T3, PRES.T4, PRES.T5, CALI.LR2. Expected results were derived from the GUM and the budget's own input columns, and by ordinary least squares from the calibration points, independently of the formulas under test, which is what this check asks for. A further 2 cases in section 4 state a fact about the file rather than comparing anything, for example the degrees of freedom the fit has or the range it covers, and are not counted here.
C4	Rounding is done at the appropriate locations in the file	FAIL	Reported uncertainty carries more than two significant figures. ILAC-P14 5.3 governs the expanded uncertainty as it is reported. See the findings section.

D. Numerical Stability

Check	Assessment	Result	Evidence and observations
D1	Calculations are stable with large numbers and small differences	not assessed	The available boundary cases substitute ordinary budget inputs. They do not exercise calculations with large numbers or small differences, so numerical stability was not assessed.
D2	Fields are categorized as Number and not General when appropriate	FAIL	33 of 153 numeric or formula cells are formatted General rather than Number, for example Pressure 0 to 100 kPa!B6, Pressure 0 to 100 kPa!E6, Pressure 0 to 100 kPa!G6, Pressure 0 to 100 kPa!I6, Pressure 0 to 100 kPa!B7. General lets Excel choose the displayed precision, so what is on screen may not be what is stored.
D3	Number cells are locked to an appropriate number of decimal places	review	67 of 153 numeric cells fix their decimal places; the rest do not. Confirm the unconstrained ones do not feed a reported value.

E. Component Testing

Check	Assessment	Result	Evidence and observations
E1	Conditional logic cells handle negative values properly	not assessed	3 conditional logic cells found. The budget boundary cases do not target and verify each conditional branch, so this behaviour was not assessed.

Check	Assessment	Result	Evidence and observations
E2	Conditional logic cells withstand a boundary value test	not assessed	3 conditional logic cells found. The budget boundary cases do not target and verify each conditional branch, so this behaviour was not assessed.
E3	Each macro used is functional	<i>laboratory</i>	For the laboratory to complete. This cannot be established from the file.
E4	Each command/button is functional	<i>laboratory</i>	For the laboratory to complete. This cannot be established from the file.
E5	Combinations of interdependent macros are functional	<i>laboratory</i>	For the laboratory to complete. This cannot be established from the file.
E6	Plotted graphs are accurate	not applicable	The workbook contains no charts.
E7	Plotted graphs and their axes are properly labeled	not applicable	The workbook contains no charts.
E8	Worksheets/reports print properly, if needed to	review	3 of 5 worksheets define a print area or page setup. Confirm the remaining sheets print properly: Pressure 0 to 100 kPa, Document Control.
E9	Conditional (color and non-color) formatting is functional	not applicable	No conditional formatting is used in this workbook.

F. Numerical Reference Results

Check	Assessment	Result	Evidence and observations
F1	Look-up tables and lists match the latest calibration report	<i>laboratory</i>	For the laboratory to complete. This cannot be established from the file.
F2	Uncertainties match the latest Scope	not assessed	No accredited scope was supplied. Provide the laboratory's CMC for this measurement and this check compares the workbook's expanded uncertainty against it.
F3	Values that reference another workbook are dated	not applicable	No cell references another workbook.
F4	Behaviour is as intended when a master list's date is updated	not applicable	No look-up formulas and no references to another workbook.

G. Embedded Data Evaluation

Check	Assessment	Result	Evidence and observations
G1	Embedded data (conversion factors, reference values) is correct	review	Embedded divisors and constants read from the file: Pressure 0 to 100 kPa!E6 = 1 (Repeatability); Pressure 0 to 100 kPa!E8 = 2 (Reference Standard (cert)); Mass 1 mg to 200 g!E8 = 2 (Reference standard (cert)); Temperature -40 to 150 C!E8 = 2 (Reference standard (cert)). Each should match the distribution named on its row.
G2	The evaluation of the embedded data is dated and documented	review	24 embedded numeric constants, for example Pressure 0 to 100 kPa!B6 = 0.042, Pressure 0 to 100 kPa!B7 = 0.1, Pressure 0 to 100 kPa!B8 = 0.055. The workbook carries dating text at Mass 1 mg to 200 g!A2: "Date: 2026-07-01 (static, no volatile function)". That is a date in the file and not a record that these constants were evaluated: this item asks when each embedded value was last checked against its source, and a revision date, a calibration date and the date a conversion factor was verified are three different facts. Which of them this date is, and which constant it belongs to, cannot be read out of the workbook, so it has to come from the laboratory.

H. Back-to-Back Testing

Check	Assessment	Result	Evidence and observations
H1	Newer and older spreadsheets agree down to intermediate calculations, dated	not assessed	No previous version was supplied. Provide last year's workbook and this check compares them down to intermediate calculations.

I. Analysis Without Computer Assistance

Check	Assessment	Result	Evidence and observations
I1	Hand calculations agree with the spreadsheet, or differ insignificantly	FAIL	4 of 43 test cases disagree with an independent calculation, including PRES.T3, PRES.T4, PRES.T5, CALI.LR2. Expected results were derived from the GUM and the budget's own input columns, and by ordinary least squares from the calibration points, independently of the formulas under test, which is what this check asks for. A further 2 cases in section 4 state a fact about the file rather than comparing anything, for example the degrees of freedom the fit has or the range it covers, and are not counted here.

J. Security

Check	Assessment	Result	Evidence and observations
J1	Equation and calculation cells are protected against inadvertent editing	FAIL	4 worksheets unprotected, so equation cells can be overwritten: Pressure 0 to 100 kPa, Temperature -40 to 150 C, Calibration Curve, Document Control.

Check	Assessment	Result	Evidence and observations
J2	Cells are locked in place and cannot be moved or dragged	review	Protection is on, but locked cells remain selectable on 1 sheet: Mass 1 mg to 200 g. Confirm that is intended.
J3	Confidentiality of passwords is appropriate	<i>laboratory</i>	For the laboratory to complete. This cannot be established from the file.
J4	Files are backed up automatically	<i>laboratory</i>	For the laboratory to complete. This cannot be established from the file.
J5	Additional back-up is available at alternate facilities	<i>laboratory</i>	For the laboratory to complete. This cannot be established from the file.
J6	Files on network drives cannot be accidentally deleted	<i>laboratory</i>	For the laboratory to complete. This cannot be established from the file.

Appendix B: full test case listing

Case	What was tested	Expected	Actual	Result
PRES.T1.6	Standard uncertainty for 'Repeatability': value / divisor	0.042	0.042	pass
PRES.T2.6	Contribution for 'Repeatability': standard uncertainty x sensitivity	0.042	0.042	pass
PRES.T1.7	Standard uncertainty for 'UUT Resolution': value / divisor	0.057735	0.057735	pass
PRES.T2.7	Contribution for 'UUT Resolution': standard uncertainty x sensitivity	0.057735	0.057735	pass
PRES.T1.8	Standard uncertainty for 'Reference Standard (cert)': value / divisor	0.0275	0.0275	pass
PRES.T2.8	Contribution for 'Reference Standard (cert)': standard uncertainty x sensitivity	0.0275	0.0275	pass
PRES.T1.9	Standard uncertainty for 'Temperature effect': value / divisor	0.0173205	0.0173205	pass
PRES.T2.9	Contribution for 'Temperature effect': standard uncertainty x sensitivity	0.0199186	0.0199186	pass
PRES.T1.10	Standard uncertainty for 'Reference drift': value / divisor	0.011547	0.011547	pass
PRES.T2.10	Contribution for 'Reference drift': standard uncertainty x sensitivity	0.011547	0.011547	pass
PRES.T3	Combined standard uncertainty at H12	0.0798979	0.158701	FAIL
PRES.T4	Expanded uncertainty at H14	0.159796	0.317401	FAIL
PRES.T5	Reported uncertainty carries one or two significant figures	1 or 2	4	FAIL
MASS.T1.6	Standard uncertainty for 'Repeatability of the mean': value / divisor	5.6921e-05	5.6921e-05	pass
MASS.T2.6	Contribution for 'Repeatability of the mean': standard uncertainty x sensitivity	5.6921e-05	5.6921e-05	pass
MASS.T1.7	Standard uncertainty for 'Balance resolution': value / divisor	2.88675e-05	2.88675e-05	pass
MASS.T2.7	Contribution for 'Balance resolution': standard uncertainty x sensitivity	2.88675e-05	2.88675e-05	pass
MASS.T1.8	Standard uncertainty for 'Reference standard (cert)': value / divisor	0.000125	0.000125	pass

Case	What was tested	Expected	Actual	Result
MASS.T2.8	Contribution for 'Reference standard (cert)': standard uncertainty x sensitivity	0.000125	0.000125	pass
MASS.T1.9	Standard uncertainty for 'Reference standard drift': value / divisor	5.19615e-05	5.19615e-05	pass
MASS.T2.9	Contribution for 'Reference standard drift': standard uncertainty x sensitivity	5.19615e-05	5.19615e-05	pass
MASS.T1.10	Standard uncertainty for 'Air buoyancy and environment': value / divisor	6.9282e-05	6.9282e-05	pass
MASS.T2.10	Contribution for 'Air buoyancy and environment': standard uncertainty x sensitivity	6.9282e-05	6.9282e-05	pass
MASS.T1.11	Standard uncertainty for 'Customer device readability': value / divisor	1.44338e-05	1.44338e-05	pass
MASS.T2.11	Contribution for 'Customer device readability': standard uncertainty x sensitivity	1.44338e-05	1.44338e-05	pass
MASS.T3	Combined standard uncertainty at H13	0.00016555	0.00016555	pass
MASS.T4	Expanded uncertainty at H16	0.000331099	0.000331099	pass
MASS.T5	Reported uncertainty carries one or two significant figures	1 or 2	2	pass
TEMP.T1.6	Standard uncertainty for 'Repeatability of the mean': value / divisor	0.00857321	0.00857321	pass
TEMP.T2.6	Contribution for 'Repeatability of the mean': standard uncertainty x sensitivity	0.00857321	0.00857321	pass
TEMP.T1.7	Standard uncertainty for 'Indicator resolution': value / divisor	0.00288675	0.00288675	pass
TEMP.T2.7	Contribution for 'Indicator resolution': standard uncertainty x sensitivity	0.00288675	0.00288675	pass
TEMP.T1.8	Standard uncertainty for 'Reference standard (cert)': value / divisor	0.015	0.015	pass
TEMP.T2.8	Contribution for 'Reference standard (cert)': standard uncertainty x sensitivity	0.015	0.015	pass
TEMP.T1.9	Standard uncertainty for 'Bath uniformity and environment': value / divisor	0.0103923	0.0103923	pass
TEMP.T2.9	Contribution for 'Bath uniformity and environment': standard uncertainty x sensitivity	0.0103923	0.0103923	pass

Case	What was tested	Expected	Actual	Result
TEMP.T1.10	Standard uncertainty for 'Customer device readability': value / divisor	0.0144338	0.0144338	pass
TEMP.T2.10	Contribution for 'Customer device readability': standard uncertainty x sensitivity	0.0144338	0.0144338	pass
TEMP.T3	Combined standard uncertainty at H12	0.0249633	0.0249633	pass
TEMP.T4	Expanded uncertainty at H15	0.0499266	0.0499266	pass
TEMP.T5	Reported uncertainty carries one or two significant figures	1 or 2	1	pass
CALI.LR1	slope at B15	1.00013	1.00013	pass
CALI.LR2	intercept at B16	0.301905	50.3083	FAIL
CALI.LR5	Degrees of freedom available for the fit	4	4	pass
CALI.LR6	Calibrated range covered by the fit	0 to 100	0 to 100	review

The basis for each case, meaning the clause and the inputs it was derived from, is recorded in the machine-readable results file issued with this record.

Appendix C: formula inventory

Formula shapes are shown with cell references normalised, so a column of identical formulas appears once. This is how the whole workbook is reviewed rather than sampled.

Pressure 0 to 100 kPa

Formula shape	Cells	Example locations
=#*#	6	H6, H7, H8, H9
=#/#	5	F6, F7, F9, F10
=SQRT(3)	3	E7, E9, E10
=TODAY()	1	B2
=SUM(##)	1	H12
=ROUND(##,4)	1	H15

Mass 1 mg to 200 g

Formula shape	Cells	Example locations
=#*#	7	H6, H7, H8, H9
=#/#	6	F6, F7, F8, F9
=2*SQRT(3)	2	E7, E11
=SQRT(3)	2	E9, E10
=SQRT(10)	1	E6
=SQRT(SUMSQ(##))	1	H13
=ROUND(##,5)	1	H17
=IF(COUNTA(##)<6,"Incomplete: enter every contributor value","Complete")	1	B19

Temperature -40 to 150 C

Formula shape	Cells	Example locations
=#*#	6	H6, H7, H8, H9
=#/#	5	F6, F7, F8, F9
=2*SQRT(3)	2	E7, E10

Formula shape	Cells	Example locations
=SQRT(6)	1	E6
=SQRT(3)	1	E9
=SQRT(SUMSQ(##))	1	H12
=ROUND(#,2)	1	H16
=IF(COUNTA(##)<5,"Incomplete: enter every contributor value","Complete")	1	B18

Calibration Curve

Formula shape	Cells	Example locations
=#-AVERAGE(##)	12	C6, D6, C7, D7
=#*#	6	E6, E7, E8, E9
=#^2	6	F6, F7, F8, F9
=COUNT(##)	1	B14
=SUM(##)/SUM(##)	1	B15
=AVERAGE(##)	1	B16
=IF(COUNT(##)<3,"Incomplete: at least three points are needed","Complete")	1	B18

Prepared by Desrochers Validation. This record is for review and signature by the laboratory's technical manager.