ISO/IEC 17020:2026 profile · Clause 7.5, control of data and information

Spreadsheet Validation Dossier

ASME B31.3 straight-pipe wall thickness under internal pressure · Sample A

Sample. This document illustrates the NormXL 7.0 Dossier. It was computed from the NormXL sample workbook `B31.3_Wall_Thickness_Sample.xlsx`, and every value in it can be checked by hand. It was not produced by a released NormXL engine.

File	`B31.3_Wall_Thickness_Sample.xlsx`
File size	`11,819 bytes`
SHA-256	`28a815ee b5a86f43 6546c770 2ea8702f f1fc66cb 77d15a42 d511af50 8ac260d1`
Generated (UTC)	`2026-11-03 13:35:56 UTC`
Compliance profile	ISO/IEC 17020:2026 · inspection bodies · Clause 7.5
Dossier reference	`NXL-SAMPLE-A-28A815EE` · revision 0 (sample)
Last saved by	Microsoft Excel `AppVersion 16.0300` · modified `2026-11-02 15:56:51 UTC`

Overall status Not released: 3 red flags, 2 more findings

41	41/41	30	4
formula cells · 8 unique formulas	recalculated independently · Δ 0	tests with wrong or extreme inputs · 11 failed	constants with no source · 15 formulas

Contents

Pages 1–3 are the summary for the inspector and the assessor: status, findings, what to do now and a short glossary. **Pages 4–24** are the supporting evidence for your validation file.

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NormXL produces evidence; your organisation approves it.

Check the seal yourself: `certutil -hashfile B31.3_Wall_Thickness_Sample.xlsx SHA256` (Windows) · `shasum -a 256 B31.3_Wall_Thickness_Sample.xlsx` (macOS) · `sha256sum B31.3_Wall_Thickness_Sample.xlsx` (Linux). The result must equal the SHA-256 above. Appendix B lists three values to check with a calculator.

Executive summary

What we found in the workbook named on the cover, in plain words. Every row points to the page where the evidence is printed. What to do next is on page 3.

Not released: 3 red flags, 2 more findings

The formulas calculate what they say: all 41 of 41 formula cells give the same result when recalculated independently (Δ 0). The workbook is not released because of what happens around the arithmetic: a decision that flips at its limit, formulas anyone can overtype, an input that accepts any value and four constants without a source.

41	24	19/30	0
formula cells, all on sheet Calc	cells that decide (ACTION, ACCEPT) · 1 flips at its limit	tests with wrong or extreme inputs passed	macros or links to other files

Findings

ID	Class	What we found · where · detail	Evidence (pages 4–24)	How to fix it
RF-1	Red flag	**A wall loss of exactly 0.10 mm does not trigger ACTION** *Technical term: binary rounding at the limit (IEEE 754 precision drift)* `Calc!F33` (rule in `F30:F41`) CML-04: 4.72 → 4.62 mm is a wall loss of exactly 0.10 mm on paper. Excel stores 0.09999999999999645 and returns NO ACTION at the 0.10 mm action threshold. Of five boundary pairs exactly 0.10 mm apart, four return NO ACTION (§5).	§4 OQ-019 · §5 ST-06, 09, 10, 12 · §6	Declare the rounding rule and apply it in the formula, e.g. `=IF(ROUND(C33-D33,2)>=0.1,"ACTION","NO ACTION")`.
RF-2	Red flag	**Formulas can be overtyped and the quality factor accepts any value** *Technical term: unlocked formula cells; uncontrolled input* Sheet `Calc` · `Inputs!C9` Sheet Calc is not protected: all 41 formula cells are formatted Locked, but the setting has no effect, so any formula can be overtyped. Inputs!C9 (quality factor E) has no data validation and accepts 10, −1, 0, text or a blank (§5 ST-26 to ST-30). Inputs is protected without a password, and its validation rules allow a cleared cell (ST-22).	§5 ST-22, 26–30 · §6.2	Protect Calc under your password procedure; add validation to C9 with blanks refused; check inputs with ISNUMBER before the decision cells.
RF-3	Red flag	**Four constants have no recorded source** *Technical term: buried hard-coded constants* `G14` · `H22` · `H23` · `F30:F41` 0.4 (Y coefficient) in G14, 1.5 (corrosion allowance) in H22, 0.875 (mill under-tolerance) in H23 and 0.1 (action threshold) in F30:F41: 4 values with no source, in 15 formulas. When the material, the temperature or the procedure changes, these values do not.	§3.9 Constant Ledger	Move each value to a labelled input cell with its source (code edition, table, procedure) and reference it.
FF-4	Further finding	**The printed minimum wall differs from the value used in the decision** *Technical term: display ≠ decision* `Calc!H22` · `Calc!G35` H22 prints the minimum wall as 4.5 mm (format 0.0) and stores 4.5053571428571431. G35 compares the stored value, so CML-06's 4.50 mm reading is rejected while the sheet shows 4.5 against 4.5. The decision is correct; the printed record does not support it.	§5 ST-01 · §6.1	Print t_m at the resolution of the readings (0.01 mm, rounded up) and state the comparison rule on the sheet.
FF-5	Further finding	**A text entry ('N/A') is accepted as a reading** *Technical term: text accepted as a reading* `Calc!G36` · `H45` · `H46` "N/A" for CML-07 returns ACCEPT in G36, because Excel ranks any text above any number. MIN(D30:D41) skips it, H45 does not count it, and its wall-loss and interval-action cells show #VALUE!.	§4 OQ-034 · §5 ST-13	Return a distinct result for a non-numeric reading, e.g. `=IF(NOT(ISNUMBER(D36)),"NO READING",…)`.

Red flags are validation gaps an assessor would raise as findings. Further findings are results that are correct or visible on screen but leave the record or the input path open. The decision on every finding stays with your organisation and, at assessment, with your assessor.

What to do now

Five steps, in order. This sample is **Not released**, so step 1 applies.

1. **Fix the red flags.** Read the findings on page 2 and correct the 3 red flags in your workbook; each row says how. Fix the 2 further findings at the same time if you can.
2. **Re-validate the corrected workbook.** Any change gives the file a new SHA-256 fingerprint, so it gets a new Dossier. This Dossier then describes the old version only.
3. **Review, sign and file.** The responsible person (Technical Manager, Quality Manager) reviews the findings and signs the release block in §7 on page 22: print and sign, or sign electronically under your document control. File the signed Dossier (PDF) with your validation records. Use the DOCX version if you need your own document number.
4. **At assessment.** Show the assessor the cover, this summary and Appendix B on page 24 (the Quick-Verify card: under five minutes with a calculator). Pages 4–24 are the supporting evidence on file.
5. **Re-validate whenever the workbook changes.** §7.2 on page 22 lists the triggers: a new fingerprint, a changed formula or constant, a new code edition or procedure.

Glossary

SHA-256 fingerprint
A 64-character code calculated from the exact bytes of the file. Any change, even opening and saving it again, gives a different code, so it shows which version was validated.

Δ (difference)
The independently recalculated value minus the value Excel stored. Δ 0 means the two agree to the last digit.

IQ · OQ
Installation qualification records what the file is and contains (§3). Operational qualification shows that every formula calculates correctly (§4).

Binary rounding (IEEE 754)
Excel stores numbers in binary, so 0.10 can be held as 0.09999999999999645. At an acceptance limit that tiny difference can flip a decision.

Red flag · further finding
A red flag is a gap an assessor would raise as a finding and must be fixed before release. A further finding is correct or visible on screen, but leaves the record or the input open to error.

Dual-engine recalculation
Every formula is calculated twice, once by Excel (the value stored in the file) and once independently from the formula text, and the results are compared cell by cell.

Limitations

1. This is a sample. The independent values were computed by a reference recalculation that stands in for the NormXL 7.0 engine; they are printed so that anyone can repeat them by hand.
2. The tests with wrong or extreme inputs (§5) are evaluated under Excel's rules, not executed in Excel. Three of them (CML-04, CML-06, CML-07) are confirmed by Excel's own stored values in the file.
3. Data validation is assessed for typed entry. A paste, or clearing a cell, bypasses it in any workbook.
4. The intended use in §1 is taken from the workbook's own labels. The workbook itself states: "Illustrative values … Not for engineering use."
5. No statistical functions are used, so the statistical benchmark (NIST StRD) does not apply.

Document control

Dossier reference	`NXL-SAMPLE-A-28A815EE`
Revision	0 · sample
Generated (UTC)	`2026-11-03 13:35:56 UTC`
Profile	ISO/IEC 17020:2026 · Clause 7.5 (Appendix A)
File	`B31.3_Wall_Thickness_Sample.xlsx`
SHA-256	`28a815ee b5a86f43 6546c770 2ea8702f f1fc66cb 77d15a42 d511af50 8ac260d1`
Pages	24, each with the file's SHA-256 in its header

Review and approval

To be completed under your own document-control procedure; the release decision itself is signed in §7. NormXL does not sign, and no accreditation body has reviewed this document.

Prepared by	Reviewed by · Technical Manager	Approved by · Quality Manager
Name	Name	Name
Role	Role	Role
Signature	Signature	Signature
Date	Date	Date

NormXL produces evidence; your organisation approves it.

§1 User requirements & scope

In plain words: what the spreadsheet is for and what it must do

What the spreadsheet is for, what it decides, and the criteria it is tested against.

1.1 Intended use

The workbook calculates the pressure design thickness of a straight pipe under internal pressure with the ASME B31.3 equation `t = P·D / [2(S·E·W + P·Y)]`, adds a corrosion allowance to obtain the minimum required wall t_m, and derives the ordered nominal wall for a 12.5 % mill under-tolerance. For twelve condition monitoring locations (CML-01 to CML-12) on line `P-101 · NPS 6 seamless` it then computes the wall loss since the previous ultrasonic reading, raises an interval action when the loss reaches 0.10 mm, and accepts or rejects each current reading against t_m.

Derived from the workbook's own labels (Inputs!A1:C3, Calc!A14:A46, Calc!B29:G29). The reviewer confirms or corrects this statement; only your organisation can write the intended use.

1.2 Intended-use answers recorded for this Dossier

What does the spreadsheet decide?	Accept or reject a wall-thickness reading against t_m; whether a CML needs an interval action.
Who enters data?	Inspection engineer: design data on sheet Inputs, UT readings on sheet Calc.
Reporting resolution of readings	0.01 mm (all numeric readings in the file are typed to two decimals).
Declared rounding rule	**None declared.** Open item for the reviewer (§1.5).
Reviewer · approver	Technical Manager · Quality Manager (signature blocks on pages 3 and 22).

Sample answers, derived from the workbook. In your own Dossier you give them yourself.

1.3 Inputs

Cell	Quantity	Symbol	Unit	Value in file	Entry control (data validation)	Lock state
`Inputs!C5`	Design pressure	*P*	MPa	5	decimal 0 to 50 · stop · blanks allowed	unlocked
`Inputs!C6`	Outside diameter	*D*	mm	168.3	decimal 10 to 2000 · stop · blanks allowed	unlocked
`Inputs!C7`	Allowable stress	*S*	MPa	138	decimal 1 to 500 · stop · blanks allowed	unlocked
`Inputs!C8`	Weld joint strength reduction factor	*W*	—	1	decimal 0 to 1 · stop · blanks allowed	unlocked
`Inputs!C9`	Quality factor	*E*	—	1	none	unlocked
`Calc!C30:C41`	Previous UT reading per CML	—	mm	12 values	none	locked, sheet unprotected
`Calc!D30:D41`	Current UT reading per CML	—	mm	11 values + "N/A"	none	locked, sheet unprotected

1.3 Inputs (continued): UT readings as found in the file

CML	Row	Previous C (mm)	Current D (mm)
CML-01	30	6.1	6.05
CML-02	31	5.8	5.74
CML-03	32	5.21	5.2
CML-04	33	4.72	4.62
CML-05	34	4.95	4.88
CML-06	35	4.61	4.5

CML	Row	Previous C (mm)	Current D (mm)
CML-07	36	5.4	"N/A" (text)
CML-08	37	6.02	5.99
CML-09	38	5.55	5.47
CML-10	39	5.1	5.02
CML-11	40	4.98	4.93
CML-12	41	6.2	6.18

§1 User requirements & scope (continued)

In plain words: what the spreadsheet is for and what it must do

1.4 Outputs and decision cells

Cell	Output	Unit	Number format	Role
Calc!G14	Pressure design thickness t	mm	0.00	calculated
Calc!H22	Minimum required wall t_m = t + c	mm	0.0	acceptance limit
Calc!H23	Ordered nominal wall, 12.5 % mill under-tolerance	mm	0.00	calculated
Calc!E30:E41	Wall loss per CML	mm	0.00	calculated
Calc!F30:F41	Interval action per CML: ACTION / NO ACTION	—	General	**decision**
Calc!G30:G41	Decision per CML: ACCEPT / REJECT	—	General	**decision**
Calc!H45	CMLs below t_m (count of REJECT)	—	General	summary
Calc!H46	Minimum current reading	mm	0.00	summary

1.5 Declared rounding rule

No rounding rule is declared in the workbook, and no formula rounds: there is no ROUND, ROUNDUP, ROUNDDOWN, MROUND or TRUNC in any decision path. Every comparison therefore uses the full binary64 value, while the number formats round only what is printed (G14 to 0.00, H22 to 0.0, E30:E41 to 0.00). “Precision as displayed” is off. The reviewer should declare, and the workbook should implement, one rule for each decision, for example: wall loss rounded to 0.01 mm before comparison with 0.10 mm; current reading compared with t_m rounded up to 0.01 mm.

1.6 Requirements and acceptance criteria

ID	Requirement	Acceptance criterion
URS-01	G14 implements t = P·D / [2(S·E·W + P·Y)] with Y = 0.4.	Independent recalculation agrees, Δ = 0.
URS-02	H22 adds the corrosion allowance c = 1.5 mm to t.	Δ = 0.
URS-03	H23 divides t_m by 0.875 (12.5 % mill under-tolerance).	Δ = 0.
URS-04	E30:E41 give previous minus current reading.	Δ = 0 for every CML.
URS-05	F30:F41 return ACTION when the wall loss, as recorded to 0.01 mm, is 0.10 mm or more.	Equals the paper decision at every boundary vector.
URS-06	G30:G41 return ACCEPT when the current reading is at least t_m, otherwise REJECT.	Equals the paper decision; a non-numeric reading never returns ACCEPT.
URS-07	H45 counts rejected CMLs; H46 returns the lowest current reading.	Δ = 0; every CML without a valid reading is visible.
URS-08	Inputs accept only plausible values; text and blanks are refused.	Every out-of-range, text or blank vector is stopped at entry.
URS-09	Formula cells cannot be overwritten without a recorded change.	Calculation sheet protected; formula cells locked.
URS-10	Every constant in a formula is documented with its source.	Constant Ledger complete, no undocumented literal.
URS-11	The printed values support the decision that was made.	Display and decision agree at every comparison.
URS-12	The validated version can be identified at any time.	SHA-256 recorded; re-hash reproduces it.

1.7 Scope of this validation

- The file whose SHA-256 is printed in every page header: B31.3_Wall_Thickness_Sample.xlsx, 11,819 bytes.
- Both worksheets, Inputs and Calc; all 41 formula cells; all input cells, number formats, cell locks, sheet and workbook protection, data validation and calculation settings.
- Not in scope: the engineering choice of S, E, W, Y and the corrosion allowance, the inspection procedure that sets the 0.10 mm action threshold, and the report that quotes the results.

§2 Risk assessment & traceability

In plain words: which results matter most, and which test covers each requirement

Every output classified by its effect on the inspection result; assurance scaled to the risk.

2.1 Classification

Software category	GAMP® 5 Category 4 (configured): Excel as installed is Category 3; this template's formulas, limits and decisions are configuration. No VBA, so nothing moves it towards Category 5.
Impact of the workbook	Direct. The accept/reject and interval decisions determine whether a pressure-piping location is fit for continued service and when it is re-inspected.
Overall risk class	High · full assurance: independent recalculation of every cell, boundary and negative vectors at every decision, display and protection audit.

2.2 Output risk register

Cell	Output	Effect on the result	Severity	Likelihood an error goes unnoticed	Risk class	Assurance applied
G14	t	Indirect: feeds t_m	High	Low (single formula, recalculated)	Medium	OQ, constant ledger
H22	t_m	Direct: acceptance limit for 12 CMLs	High	Medium (printed to 0.0)	High	OQ, §6 display audit
H23	nominal	Informational (ordering)	Low	Low	Low	OQ
E30:E41	wall loss	Indirect: printed beside F	Medium	Medium (residue hidden by 0.00)	Medium	OQ, §6
F30:F41	interval action	Direct: inspection interval	High	High (flips at the limit)	High	OQ, boundary vectors, §6
G30:G41	accept / reject	Direct: fitness for service	High	Medium (text, display)	High	OQ, boundary and negative vectors, §6
H45	count	Direct: summary read first	High	High (ignores errors and text)	High	OQ, negative vectors
H46	minimum	Indirect: summary	Medium	High (skips text)	Medium	OQ, negative vectors

2.3 Method

Severity is the consequence of a wrong value reaching the inspection record (High: a decision on fitness for service or on the inspection interval; Medium: a value that feeds such a decision; Low: informational). Likelihood rates how easily a wrong value would go unnoticed by a careful user, given the number format, the cell protection and the input controls found in §3 and §6. Risk class is the higher of the two where severity is High, and the lower otherwise. The method is a conventional severity-and-detectability screen; your own risk procedure takes precedence.

2.4 Hazards specific to this workbook

- A decision taken on a binary residue rather than on the documented threshold (F30:F41).
- A formula overtyped with a number in an unprotected sheet, invisible on screen (all of Calc).
- A design factor outside its physical range accepted without warning (Inputs!C9).
- A code coefficient or allowance changed in the code edition or procedure but not in the formula (0.4, 1.5, 0.875, 0.1).
- A text entry such as "N/A" treated as a passing reading, and summaries that do not reveal it (G36, H45, H46).

§2 Traceability matrix

In plain words: which results matter most, and which test covers each requirement

Each requirement traced to the cells that implement it, the tests that cover it and the result.

Requirement	Implemented in	OQ (§4)	Stress vectors and audits (§5, §6, §3)	Result	Finding
URS-01	G14	OQ-001	—	PASS	–
URS-02	H22	OQ-002	—	PASS	–
URS-03	H23	OQ-003	—	PASS	–
URS-04	E30:E41	OQ-004 to OQ-015	—	PASS	–
URS-05	F30:F41	OQ-016 to OQ-027	ST-06 to ST-12 · §6.1	FAIL	RF-1
URS-06	G30:G41	OQ-028 to OQ-039	ST-01 to ST-05 · ST-13 to ST-16	FAIL	FF-5
URS-07	H45, H46	OQ-040, OQ-041	ST-13 · ST-22 · ST-29	FAIL	FF-5, RF-2
URS-08	Inputs!C5:C9	–	ST-18 to ST-30	FAIL	RF-2
URS-09	Calc (41 cells)	–	§6.2 lock map	FAIL	RF-2
URS-10	15 formulas	–	§3.9 Constant Ledger	FAIL	RF-3
URS-11	24 decision cells	–	§6.1 · ST-01	Observation	FF-4
URS-12	whole file	–	§3.1 · Appendix B	PASS	–

A requirement passes only when every test traced to it passes. Agreement in §4 shows that the arithmetic is reproduced; it does not by itself satisfy URS-05 to URS-11, which are tested at the limits and with bad inputs.

Coverage

Formula cells covered by OQ	41 of 41 (100 %)
Decision cells with boundary vectors	F33 and G35 as representatives of the two decision rules, which are identical in R1C1 form across all 12 rows (§3.6)
Input cells with negative vectors	Inputs!C5, C7, C8, C9 · Calc!C33, D33, D35, D36
Requirements without a test	none

§3 Installation qualification & formula inventory

In plain words: what the file contains

What exactly was validated: the file, the application that saved it, and its settings.

3.1 File identity

File name	`B31.3_Wall_Thickness_Sample.xlsx`
SHA-256 of the exact bytes	`28a815ee b5a86f43 6546c770 2ea8702f f1fc66cb 77d15a42 d511af50 8ac260d1`
Size	`11,819 bytes`
Format	Office Open XML workbook (.xlsx), ZIP package of 12 parts; no macro project
Application that last saved it	Microsoft Excel · `AppVersion 16.0300` · `fileVersion appName=xl lastEdited=7 lowestEdited=7 rupBuild=29127`
Calculation engine identifier	`calcId 191029`
Created · modified (document properties)	`2026-11-02T15:56:51Z` · `2026-11-02T15:56:51Z`
Author fields	creator and lastModifiedBy recorded (initials)
Document security flag	`DocSecurity 0` (no read-only recommendation, no encryption)
Save-location metadata	present: `x15ac:absPath` in xl/workbook.xml records the folder of the last save (not reproduced here)

3.2 Calculation settings (calcPr)

Calculation mode	automatic (attribute not set; default)
Precision as displayed	off (fullPrecision not set; default true)
Iterative calculation	off (not set)
Full calculation on load	not set
Volatile functions	none
Array or dynamic-array formulas	none

3.3 Content not present

VBA project	none (.xlsx; no vbaProject.bin)
External links	none
Defined names	none
Data connections · pivots	none
Comments · drawings · charts	none
Conditional formatting	none
Hidden sheets · rows · columns	none
Workbook structure protection	not set

Package parts

Part	Bytes
`[Content_Types].xml`	1,432
`_rels/.rels`	588
`xl/workbook.xml`	1,833
`xl/_rels/workbook.xml.rels`	972
`xl/worksheets/sheet1.xml`	2,889
`xl/worksheets/sheet2.xml`	6,603
`xl/theme/theme1.xml`	8,419
`xl/styles.xml`	1,990
`xl/sharedStrings.xml`	1,355
`xl/calcChain.xml`	908
`docProps/core.xml`	601
`docProps/app.xml`	807

§3 Installation qualification (continued)

In plain words: what the file contains

3.4 Worksheets

Sheet	Visibility	Used range	Protection	Formula cells	Numeric constant cells	Validation rules
Inputs	visible	A1:C9	protected · objects, scenarios · no password	0	5	4
Calc	visible	A1:H46	not protected	41	23	0

3.5 Unique formulas

Formulas are grouped by their relative (R1C1) form: cells in one group compute the same thing on different rows. 41 formula cells reduce to 8 unique formulas.

ID	Formula as written (first cell of the group)	Cells	Count	Functions	Format
U1	=Inputs!C5*Inputs!C6/(2*(Inputs!C7*Inputs!C9*Inputs!C8+Inputs!C5*0.4))	G14	1	—	0.00
U2	=G14+1.5	H22	1	—	0.0
U3	=H22/0.875	H23	1	—	0.00
U4	=C30-D30	E30:E41	12	—	0.00
U5	=IF(C30-D30>=0.1,"ACTION","NO ACTION")	F30:F41	12	IF	General
U6	=IF(D30>=$H$22,"ACCEPT","REJECT")	G30:G41	12	IF	General
U7	=COUNTIF(G30:G41,"REJECT")	H45	1	COUNTIF	General
U8	=MIN(D30:D41)	H46	1	MIN	0.00

3.6 R1C1 form of the repeated formulas

Group	R1C1 form
U4	=R[0]C[-2]-R[0]C[-1]
U5	=IF(R[0]C[-3]-R[0]C[-2]>=0.1,"ACTION","NO ACTION")
U6	=IF(R[0]C[-3]>=R22C8,"ACCEPT","REJECT")

Each repeated group is identical in R1C1 form on every row, so no cell in a range has been replaced by a typed value or a different formula. That is the overtype check for this version; it says nothing about future edits, which only protection (§6.2) and the SHA-256 (§7) can address.

3.7 Function library

Functions used	IF (36 cells) · COUNTIF (1) · MIN (1)
Operators	+ - * / >=
Statistical functions	none: no NIST StRD benchmark applies to this workbook
Cells not independently recalculated	none

§3.8 Formula inventory: all 41 formula cells

In plain words: what the file contains

Sheet Calc. Values as stored by Excel (17 significant digits) and as printed under each cell's number format.

OQ ID	Cell	Formula as written	Format	Locked	Stored by Excel	Shown
OQ-001	G14	=Inputs!C5*Inputs!C6/(2*(Inputs!C7*Inputs!C9*Inputs!C8+Inputs!C5*0.4))	0.00	yes	3.0053571428571431	3.01
OQ-002	H22	=G14+1.5	0.0	yes	4.5053571428571431	4.5
OQ-003	H23	=H22/0.875	0.00	yes	5.1489795918367349	5.15
OQ-004	E30	=C30-D30	0.00	yes	0.049999999999999822	0.05
OQ-005	E31	=C31-D31	0.00	yes	0.059999999999999609	0.06
OQ-006	E32	=C32-D32	0.00	yes	0.0099999999999997868	0.01
OQ-007	E33	=C33-D33	0.00	yes	0.099999999999999645	0.10
OQ-008	E34	=C34-D34	0.00	yes	0.070000000000000284	0.07
OQ-009	E35	=C35-D35	0.00	yes	0.11000000000000032	0.11
OQ-010	E36	=C36-D36	0.00	yes	#VALUE!	#VALUE!
OQ-011	E37	=C37-D37	0.00	yes	0.029999999999999361	0.03
OQ-012	E38	=C38-D38	0.00	yes	0.080000000000000071	0.08
OQ-013	E39	=C39-D39	0.00	yes	0.080000000000000071	0.08
OQ-014	E40	=C40-D40	0.00	yes	0.050000000000000711	0.05
OQ-015	E41	=C41-D41	0.00	yes	0.020000000000000462	0.02
OQ-016	F30	=IF(C30-D30>=0.1,"ACTION","NO ACTION")	General	yes	NO ACTION	NO ACTION
OQ-017	F31	=IF(C31-D31>=0.1,"ACTION","NO ACTION")	General	yes	NO ACTION	NO ACTION
OQ-018	F32	=IF(C32-D32>=0.1,"ACTION","NO ACTION")	General	yes	NO ACTION	NO ACTION
OQ-019	F33	=IF(C33-D33>=0.1,"ACTION","NO ACTION")	General	yes	NO ACTION	NO ACTION
OQ-020	F34	=IF(C34-D34>=0.1,"ACTION","NO ACTION")	General	yes	NO ACTION	NO ACTION
OQ-021	F35	=IF(C35-D35>=0.1,"ACTION","NO ACTION")	General	yes	ACTION	ACTION
OQ-022	F36	=IF(C36-D36>=0.1,"ACTION","NO ACTION")	General	yes	#VALUE!	#VALUE!
OQ-023	F37	=IF(C37-D37>=0.1,"ACTION","NO ACTION")	General	yes	NO ACTION	NO ACTION
OQ-024	F38	=IF(C38-D38>=0.1,"ACTION","NO ACTION")	General	yes	NO ACTION	NO ACTION
OQ-025	F39	=IF(C39-D39>=0.1,"ACTION","NO ACTION")	General	yes	NO ACTION	NO ACTION
OQ-026	F40	=IF(C40-D40>=0.1,"ACTION","NO ACTION")	General	yes	NO ACTION	NO ACTION
OQ-027	F41	=IF(C41-D41>=0.1,"ACTION","NO ACTION")	General	yes	NO ACTION	NO ACTION
OQ-028	G30	=IF(D30>=$H$22,"ACCEPT","REJECT")	General	yes	ACCEPT	ACCEPT
OQ-029	G31	=IF(D31>=$H$22,"ACCEPT","REJECT")	General	yes	ACCEPT	ACCEPT
OQ-030	G32	=IF(D32>=$H$22,"ACCEPT","REJECT")	General	yes	ACCEPT	ACCEPT
OQ-031	G33	=IF(D33>=$H$22,"ACCEPT","REJECT")	General	yes	ACCEPT	ACCEPT
OQ-032	G34	=IF(D34>=$H$22,"ACCEPT","REJECT")	General	yes	ACCEPT	ACCEPT
OQ-033	G35	=IF(D35>=$H$22,"ACCEPT","REJECT")	General	yes	REJECT	REJECT
OQ-034	G36	=IF(D36>=$H$22,"ACCEPT","REJECT")	General	yes	ACCEPT	ACCEPT
OQ-035	G37	=IF(D37>=$H$22,"ACCEPT","REJECT")	General	yes	ACCEPT	ACCEPT
OQ-036	G38	=IF(D38>=$H$22,"ACCEPT","REJECT")	General	yes	ACCEPT	ACCEPT
OQ-037	G39	=IF(D39>=$H$22,"ACCEPT","REJECT")	General	yes	ACCEPT	ACCEPT
OQ-038	G40	=IF(D40>=$H$22,"ACCEPT","REJECT")	General	yes	ACCEPT	ACCEPT
OQ-039	G41	=IF(D41>=$H$22,"ACCEPT","REJECT")	General	yes	ACCEPT	ACCEPT
OQ-040	H45	=COUNTIF(G30:G41,"REJECT")	General	yes	1	1
OQ-041	H46	=MIN(D30:D41)	0.00	yes	4.5	4.50

"Locked: yes" is Excel's default cell format. It has no effect while the sheet is unprotected, which is the case for Calc (§6.2). No formula cell is hidden.

§3.9 Constant Ledger

In plain words: what the file contains

Every number typed inside a formula, with its cell, occurrences and an empty source column for your reviewer.

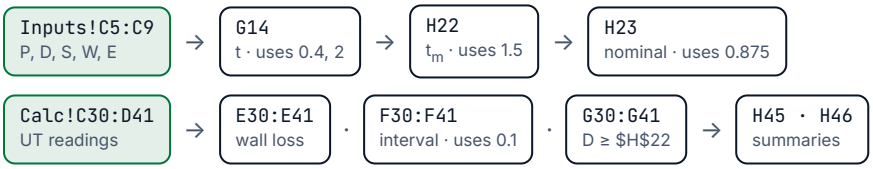
Value	Meaning (from labels and the equation)	Cells	Occurrences	Documented in the workbook	Source (reviewer)
0.4	Y coefficient (B31.3 Table 304.1.1; depends on material and temperature)	Calc!G14	1	no	source: _____
1.5	Corrosion allowance c, mm	Calc!H22	1	no	source: _____
0.875	Mill under-tolerance factor (label in A23 says “12.5 %”)	Calc!H23	1	label only	source: _____
0.1	Interval action threshold, mm	Calc!F30:F41	12	no	source: _____
2	Coefficient of the B31.3 equation itself	Calc!G14	1	the code’s own	not a finding

Four values without a source, in 15 formulas (1 + 1 + 1 + 12). NormXL does not guess where a constant comes from; it makes sure none of them can hide. Not every literal is wrong: the 2 in the B31.3 equation is the code’s own coefficient. Each undocumented literal is a design decision without a label, a source or an owner.

Text constants in formulas

Text	Where	Occurrences	Dependency
"ACTION" · "NO ACTION"	F30:F41	12 + 12	outputs of the interval rule
"ACCEPT" · "REJECT"	G30:G41	12 + 12	outputs of the decision rule
"REJECT"	H45	1	must match the G-column text exactly, or H45 silently counts nothing

Calculation chain



F30:F41 recompute C−D themselves instead of referring to column E, so the printed wall loss and the value that decides are two separate calculations that happen to agree.

§4 Operational qualification: dual-engine test matrix

In plain words: every formula recalculated and compared with Excel

Every formula cell recalculated independently and compared with the value Excel stored.

4.1 Method and acceptance criterion

Engine A	values stored in the file by Microsoft Excel (AppVersion 16.0300) when it was last saved
Independent value	every formula re-parsed from the file and evaluated in IEEE 754 binary64; in this sample by a reference recalculation standing in for the NormXL 7.0 engine
Paper value	the same formula in exact rational arithmetic on the values as typed; repeating decimals end in …

Δ	independent value − Excel value, in binary64
Acceptance	numbers: Δ = 0; text and errors: identical
Result	41 of 41 cells agree · largest |Δ| = 0

Method. Engine A is the set of values Excel stored in the file when it was last saved. The independent values were obtained by re-parsing every formula from the file and evaluating it twice: in IEEE 754 binary64 (the number format Excel uses) and in exact rational arithmetic on the values as typed (the arithmetic an engineer does on paper). Decision cells are also evaluated under a model of Excel's comparison convention (both operands rounded to 15 significant digits), which reproduces all 20 pairs of the reference set recorded in Microsoft Excel 16.0 (§4.8).

4.2 Design calculation: Calc!G14, H22, H23

Test	Cell	Inputs (as typed)	Formula as written	Excel (stored)	NormXL (independent)	Δ	Paper value (exact)	Result
OQ-001	G14	P 5 · D 168.3 · S 138 · E 1 · W 1	=Inputs!C5*Inputs!C6/(2*(Inputs!C7*Inputs!C9*Inputs!C8+Inputs!C5*0.4))	3.0053571428571431	3.0053571428571431	0	3.0053571428571428…	PASS
OQ-002	H22	G14 3.0053571428571431	=G14+1.5	4.5053571428571431	4.5053571428571431	0	4.5053571428571428…	PASS
OQ-003	H23	H22 4.5053571428571431	=H22/0.875	5.1489795918367349	5.1489795918367349	0	5.1489795918367346…	PASS

OQ-001 by hand

t = P·D / [2(S·E·W + P·Y)] = 5 × 168.3 / [2 × (138 × 1 × 1 + 5 × 0.4)] = 841.5 / [2 × 140] = 841.5 / 280 = 3.0053571428571428…

binary64 nearest to 841.5 / 280 = 3.0053571428571431 = the value Excel stored · Δ 0

t_m = 3.0053571428571431 + 1.5 = 4.5053571428571431 (shown 4.5) · nominal = 4.5053571428571431 / 0.875 = 5.1489795918367349 (shown 5.15)

The formula multiplies S, E and W in the order C7*C9*C8. Multiplication order does not change the result here (E = W = 1); it is recorded because a reviewer comparing the formula with the code equation will look for it.

§4 Operational qualification (continued)

In plain words: every formula recalculated and compared with Excel

4.3 Wall loss: Calc!E30:E41 = previous − current

Test	Cell	Inputs (as typed)	Formula as written	Excel (stored)	NormXL (independent)	Δ	Paper value (exact)	Result
OQ-004	E30	C30 6.1 · D30 6.05	=C30-D30	0.049999999999999822	0.049999999999999822	0	0.05	PASS
OQ-005	E31	C31 5.8 · D31 5.74	=C31-D31	0.059999999999999609	0.059999999999999609	0	0.06	PASS
OQ-006	E32	C32 5.21 · D32 5.2	=C32-D32	0.0099999999999997868	0.0099999999999997868	0	0.01	PASS
OQ-007	E33	C33 4.72 · D33 4.62	=C33-D33	0.099999999999999645	0.099999999999999645	0	0.1	PASS
OQ-008	E34	C34 4.95 · D34 4.88	=C34-D34	0.070000000000000284	0.070000000000000284	0	0.07	PASS
OQ-009	E35	C35 4.61 · D35 4.5	=C35-D35	0.11000000000000032	0.11000000000000032	0	0.11	PASS
OQ-010	E36	C36 5.4 · D36 N/A	=C36-D36	#VALUE!	#VALUE!	same	#VALUE!	PASS
OQ-011	E37	C37 6.02 · D37 5.99	=C37-D37	0.029999999999999361	0.029999999999999361	0	0.03	PASS
OQ-012	E38	C38 5.55 · D38 5.47	=C38-D38	0.080000000000000071	0.080000000000000071	0	0.08	PASS
OQ-013	E39	C39 5.1 · D39 5.02	=C39-D39	0.080000000000000071	0.080000000000000071	0	0.08	PASS
OQ-014	E40	C40 4.98 · D40 4.93	=C40-D40	0.050000000000000711	0.050000000000000711	0	0.05	PASS
OQ-015	E41	C41 6.2 · D41 6.18	=C41-D41	0.020000000000000462	0.020000000000000462	0	0.02	PASS

Every stored wall loss differs from its paper value in the last digits (for example 0.099999999999999645 for 0.10). The number format 0.00 hides the difference. Both engines agree, so this is not a calculation error; it becomes one only where a decision compares it with a limit (OQ-019, §6).

OQ-010: “N/A” in D36 makes E36 return #VALUE! in Excel and in the independent evaluation alike. The error is visible on the sheet; what the decision cell in the same row does with the text is OQ-034.

§4 Operational qualification (continued)

In plain words: every formula recalculated and compared with Excel

4.4 Interval action: Calc!F30:F41

Test	Cell	Inputs (as typed)	Formula as written	Excel (stored)	NormXL (independent)	Δ	Paper decision	Agreement
OQ-016	F30	C30 6.1 · D30 6.05	=IF(C30-D30>=0.1,"ACTION","NO ACTION")	NO ACTION	NO ACTION	same	NO ACTION	PASS
OQ-017	F31	C31 5.8 · D31 5.74	=IF(C31-D31>=0.1,"ACTION","NO ACTION")	NO ACTION	NO ACTION	same	NO ACTION	PASS
OQ-018	F32	C32 5.21 · D32 5.2	=IF(C32-D32>=0.1,"ACTION","NO ACTION")	NO ACTION	NO ACTION	same	NO ACTION	PASS
OQ-019	F33	C33 4.72 · D33 4.62	=IF(C33-D33>=0.1,"ACTION","NO ACTION")	NO ACTION	NO ACTION	same	ACTION	PASS
OQ-020	F34	C34 4.95 · D34 4.88	=IF(C34-D34>=0.1,"ACTION","NO ACTION")	NO ACTION	NO ACTION	same	NO ACTION	PASS
OQ-021	F35	C35 4.61 · D35 4.5	=IF(C35-D35>=0.1,"ACTION","NO ACTION")	ACTION	ACTION	same	ACTION	PASS
OQ-022	F36	C36 5.4 · D36 N/A	=IF(C36-D36>=0.1,"ACTION","NO ACTION")	#VALUE!	#VALUE!	same	#VALUE!	PASS
OQ-023	F37	C37 6.02 · D37 5.99	=IF(C37-D37>=0.1,"ACTION","NO ACTION")	NO ACTION	NO ACTION	same	NO ACTION	PASS
OQ-024	F38	C38 5.55 · D38 5.47	=IF(C38-D38>=0.1,"ACTION","NO ACTION")	NO ACTION	NO ACTION	same	NO ACTION	PASS
OQ-025	F39	C39 5.1 · D39 5.02	=IF(C39-D39>=0.1,"ACTION","NO ACTION")	NO ACTION	NO ACTION	same	NO ACTION	PASS
OQ-026	F40	C40 4.98 · D40 4.93	=IF(C40-D40>=0.1,"ACTION","NO ACTION")	NO ACTION	NO ACTION	same	NO ACTION	PASS
OQ-027	F41	C41 6.2 · D41 6.18	=IF(C41-D41>=0.1,"ACTION","NO ACTION")	NO ACTION	NO ACTION	same	NO ACTION	PASS

⚠ **Agreement is not correctness.** OQ-019 (F33, CML-04) agrees in both engines and is still the wrong decision: 4.72 − 4.62 = 0.10 mm on paper, which meets the 0.10 mm threshold, but the stored difference is 0.09999999999999645 and both engines return NO ACTION. This is red flag RF-1, tested further in §5 (ST-06 to ST-12).

§4 Operational qualification (continued)

In plain words: every formula recalculated and compared with Excel

4.5 Accept / reject decision: Calc!G30:G41 = IF(D ≥ $H$22, ...)

Test	Cell	Inputs (as typed)	Formula as written	Excel (stored)	NormXL (independent)	Δ	Paper decision	Agreement
OQ-028	G30	D30 6.05 · H22 4.505357142 8571431	=IF(D30>=$H$22,"ACCEPT","REJECT")	ACCEPT	ACCEPT	same	ACCEPT	PASS
OQ-029	G31	D31 5.74 · H22 4.505357142 8571431	=IF(D31>=$H$22,"ACCEPT","REJECT")	ACCEPT	ACCEPT	same	ACCEPT	PASS
OQ-030	G32	D32 5.2 · H22 4.505357142 8571431	=IF(D32>=$H$22,"ACCEPT","REJECT")	ACCEPT	ACCEPT	same	ACCEPT	PASS
OQ-031	G33	D33 4.62 · H22 4.505357142 8571431	=IF(D33>=$H$22,"ACCEPT","REJECT")	ACCEPT	ACCEPT	same	ACCEPT	PASS
OQ-032	G34	D34 4.88 · H22 4.505357142 8571431	=IF(D34>=$H$22,"ACCEPT","REJECT")	ACCEPT	ACCEPT	same	ACCEPT	PASS
OQ-033	G35	D35 4.5 · H22 4.505357142 8571431	=IF(D35>=$H$22,"ACCEPT","REJECT")	REJECT	REJECT	same	REJECT	PASS
OQ-034	G36	D36 N/A · H22 4.505357142 8571431	=IF(D36>=$H$22,"ACCEPT","REJECT")	ACCEPT	ACCEPT	same	ACCEPT	PASS
OQ-035	G37	D37 5.99 · H22 4.505357142 8571431	=IF(D37>=$H$22,"ACCEPT","REJECT")	ACCEPT	ACCEPT	same	ACCEPT	PASS
OQ-036	G38	D38 5.47 · H22 4.505357142 8571431	=IF(D38>=$H$22,"ACCEPT","REJECT")	ACCEPT	ACCEPT	same	ACCEPT	PASS
OQ-037	G39	D39 5.02 · H22 4.505357142 8571431	=IF(D39>=$H$22,"ACCEPT","REJECT")	ACCEPT	ACCEPT	same	ACCEPT	PASS
OQ-038	G40	D40 4.93 · H22 4.505357142 8571431	=IF(D40>=$H$22,"ACCEPT","REJECT")	ACCEPT	ACCEPT	same	ACCEPT	PASS
OQ-039	G41	D41 6.18 · H22 4.505357142 8571431	=IF(D41>=$H$22,"ACCEPT","REJECT")	ACCEPT	ACCEPT	same	ACCEPT	PASS

⚠ OQ-034 (G36, CML-07): the reading is the text “N/A”. Excel ranks any text above any number, so “N/A” ≥ 4.5053571428571431 is TRUE and the cell returns ACCEPT. Both engines agree, because both follow Excel’s rules. The requirement (URS-06) is that a non-numeric reading never returns ACCEPT: further finding FF-5.

ⓘ OQ-033 (G35, CML-06): 4.50 < 4.5053571428571431, so REJECT is the correct decision. The sheet prints t_m as 4.5, so the printed record shows 4.5 against 4.5: further finding FF-4 (§6.1).

§4 Operational qualification (continued)

In plain words: every formula recalculated and compared with Excel

4.6 Summaries: Calc!H45, H46

Test	Cell	Inputs (as typed)	Formula as written	Excel (stored)	NormXL (independent)	Δ	Paper value (exact)	Result
OQ-040	H45	G30:G41	=COUNTIF(G30:G41,"REJECT")	1	1	0	1	PASS
OQ-041	H46	D30:D41	=MIN(D30:D41)	4.5	4.5	0	4.5	PASS

4.7 Agreement by formula group

Group	Cells	n	Agree	max |Δ|	Result
U1	G14	1	1	0	PASS
U2	H22	1	1	0	PASS
U3	H23	1	1	0	PASS
U4	E30:E41	12	12	0	PASS
U5	F30:F41	12	12	n/a (text)	PASS
U6	G30:G41	12	12	n/a (text)	PASS
U7	H45	1	1	0	PASS
U8	H46	1	1	0	PASS

Notes on the summaries

H46 = 4.5 because MIN skips the text in D36; H45 = 1 counts CML-06 only. Both match Excel. Whether they meet URS-07 is tested in §5 (ST-13, ST-22, ST-29).

4.8 Excel comparison convention: reference check

=IF(a−b>=0.1,"ACTION","NO ACTION") for 20 pairs exactly 0.1 apart, as recorded in Microsoft Excel 16.0 (default settings, 2 November 2026). The comparison model used in §4 and §5 (both operands rounded to 15 significant digits) reproduces 20 of 20 logged results; strict IEEE 754 reproduces 19 of 20. The highlighted row is the one where they differ.

a − b	stored difference	strict	model	Excel 16.0
10.2-10.1	0.09999999999999645	NO ACTION	NO ACTION	NO ACTION
3.3-3.2	0.09999999999999645	NO ACTION	NO ACTION	NO ACTION
25.4-25.3	0.09999999999997868	NO ACTION	NO ACTION	NO ACTION
37.6-37.5	0.10000000000000142	ACTION	ACTION	ACTION
12.7-12.6	0.09999999999999645	NO ACTION	NO ACTION	NO ACTION
5.3-5.2	0.09999999999999645	NO ACTION	NO ACTION	NO ACTION
100.3-100.2	0.09999999999994316	NO ACTION	NO ACTION	NO ACTION
0.3-0.2	0.09999999999999978	NO ACTION	ACTION	ACTION
1.3-1.2	0.10000000000000009	ACTION	ACTION	ACTION
2.3-2.2	0.09999999999999645	NO ACTION	NO ACTION	NO ACTION

a − b	stored difference	strict	model	Excel 16.0
8.2-8.1	0.09999999999999645	NO ACTION	NO ACTION	NO ACTION
4.6-4.5	0.09999999999999645	NO ACTION	NO ACTION	NO ACTION
6.4-6.3	0.10000000000000053	ACTION	ACTION	ACTION
9.7-9.6	0.09999999999999645	NO ACTION	NO ACTION	NO ACTION
15.2-15.1	0.09999999999999645	NO ACTION	NO ACTION	NO ACTION
0.2-0.1	0.10000000000000001	ACTION	ACTION	ACTION
20.4-20.3	0.09999999999997868	NO ACTION	NO ACTION	NO ACTION
7.9-7.8	0.10000000000000053	ACTION	ACTION	ACTION
11.5-11.4	0.09999999999999645	NO ACTION	NO ACTION	NO ACTION
9.5-9.4	0.09999999999999645	NO ACTION	NO ACTION	NO ACTION

§4 Decision cells under three evaluations

In plain words: every formula recalculated and compared with Excel

Both operands to 17 significant digits; the decision in strict IEEE 754, under Excel's convention and on paper.

Test	Cell	Left operand (stored)	Limit	Excel stored	Strict IEEE 754	Excel convention	Paper	Status
OQ-016	F30	0.049999999999999822	>= 0.10000000000000001	NO ACTION	NO ACTION	NO ACTION	NO ACTION	consistent
OQ-017	F31	0.059999999999999609	>= 0.10000000000000001	NO ACTION	NO ACTION	NO ACTION	NO ACTION	consistent
OQ-018	F32	0.0099999999999997868	>= 0.10000000000000001	NO ACTION	NO ACTION	NO ACTION	NO ACTION	consistent
OQ-019	F33	0.099999999999999645	>= 0.10000000000000001	NO ACTION	NO ACTION	NO ACTION	ACTION	RF-1
OQ-020	F34	0.070000000000000284	>= 0.10000000000000001	NO ACTION	NO ACTION	NO ACTION	NO ACTION	consistent
OQ-021	F35	0.11000000000000032	>= 0.10000000000000001	ACTION	ACTION	ACTION	ACTION	consistent
OQ-022	F36	#VALUE!	>= 0.10000000000000001	#VALUE!	#VALUE!	#VALUE!	#VALUE!	error shown
OQ-023	F37	0.029999999999999361	>= 0.10000000000000001	NO ACTION	NO ACTION	NO ACTION	NO ACTION	consistent
OQ-024	F38	0.080000000000000071	>= 0.10000000000000001	NO ACTION	NO ACTION	NO ACTION	NO ACTION	consistent
OQ-025	F39	0.080000000000000071	>= 0.10000000000000001	NO ACTION	NO ACTION	NO ACTION	NO ACTION	consistent
OQ-026	F40	0.050000000000000711	>= 0.10000000000000001	NO ACTION	NO ACTION	NO ACTION	NO ACTION	consistent
OQ-027	F41	0.020000000000000462	>= 0.10000000000000001	NO ACTION	NO ACTION	NO ACTION	NO ACTION	consistent
OQ-028	G30	6.0499999999999998	>= 4.5053571428571431	ACCEPT	ACCEPT	ACCEPT	ACCEPT	consistent
OQ-029	G31	5.7400000000000002	>= 4.5053571428571431	ACCEPT	ACCEPT	ACCEPT	ACCEPT	consistent
OQ-030	G32	5.2000000000000002	>= 4.5053571428571431	ACCEPT	ACCEPT	ACCEPT	ACCEPT	consistent
OQ-031	G33	4.6200000000000001	>= 4.5053571428571431	ACCEPT	ACCEPT	ACCEPT	ACCEPT	consistent
OQ-032	G34	4.8799999999999999	>= 4.5053571428571431	ACCEPT	ACCEPT	ACCEPT	ACCEPT	consistent
OQ-033	G35	4.5	>= 4.5053571428571431	REJECT	REJECT	REJECT	REJECT	consistent
OQ-034	G36	N/A	>= 4.5053571428571431	ACCEPT	ACCEPT	ACCEPT	ACCEPT	FF-5
OQ-035	G37	5.9900000000000002	>= 4.5053571428571431	ACCEPT	ACCEPT	ACCEPT	ACCEPT	consistent
OQ-036	G38	5.4699999999999998	>= 4.5053571428571431	ACCEPT	ACCEPT	ACCEPT	ACCEPT	consistent
OQ-037	G39	5.0199999999999996	>= 4.5053571428571431	ACCEPT	ACCEPT	ACCEPT	ACCEPT	consistent
OQ-038	G40	4.9299999999999997	>= 4.5053571428571431	ACCEPT	ACCEPT	ACCEPT	ACCEPT	consistent
OQ-039	G41	6.1799999999999997	>= 4.5053571428571431	ACCEPT	ACCEPT	ACCEPT	ACCEPT	consistent

Two engines that agree have reproduced the arithmetic. That does not make the decision right at the limit: F33 is reproduced faithfully by every binary evaluation and still differs from the paper decision. G36 agrees everywhere because the text rule is Excel's own; it fails the requirement, not the arithmetic.

§5 Negative & boundary stress-test log

In plain words: what happens with wrong or extreme inputs

Every injected vector with its expected and actual result.

Boundary vectors sit at each acceptance limit and one step either side, at the 0.01 mm reporting resolution and at 0.001 mm. Negative vectors inject text, blanks, zeros, negatives and out-of-range values. “Entry check” applies the workbook’s own data-validation rule to a typed entry; “Actual” is the formula response under Excel’s rules (comparison model of §4.8). Expected results come from the requirements in §1.6.

ID	Vector	Injected	Entry check	Expected	Actual (Excel rules)	Result	Finding
ST-01	CML-06 reading at the printed t_m Correct decision; the sheet prints 4.5 against 4.5 (see §6).	D35 = 4.5	accepted (no data validation)	G35 REJECT	G35 REJECT Excel stored	PASS	FF-4
ST-02	one 0.001 mm step below t_m	D35 = 4.505	accepted (no data validation)	G35 REJECT	G35 REJECT	PASS	—
ST-03	one 0.001 mm step above t_m	D35 = 4.506	accepted (no data validation)	G35 ACCEPT	G35 ACCEPT	PASS	—
ST-04	reading equal to stored t_m	D35 = 4.505357142857143 1	accepted (no data validation)	G35 ACCEPT	G35 ACCEPT	PASS	—
ST-05	one 0.01 mm step above (reporting resolution)	D35 = 4.51	accepted (no data validation)	G35 ACCEPT	G35 ACCEPT	PASS	—
ST-06	wall loss 4.72 − 4.62 = 0.10 mm on paper As saved in the workbook (CML-04).	C33 = 4.72 D33 = 4.62	accepted (no data validation)	F33 ACTION	F33 NO ACTION Excel stored	FAIL	RF-1
ST-07	wall loss 4.73 − 4.62 = 0.11 mm on paper	C33 = 4.73 D33 = 4.62	accepted (no data validation)	F33 ACTION	F33 ACTION	PASS	—
ST-08	wall loss 4.71 − 4.62 = 0.09 mm on paper	C33 = 4.71 D33 = 4.62	accepted (no data validation)	F33 NO ACTION	F33 NO ACTION	PASS	—
ST-09	wall loss 4.60 − 4.50 = 0.10 mm on paper	C33 = 4.6 D33 = 4.5	accepted (no data validation)	F33 ACTION	F33 NO ACTION	FAIL	RF-1
ST-10	wall loss 5.30 − 5.20 = 0.10 mm on paper	C33 = 5.3 D33 = 5.2	accepted (no data validation)	F33 ACTION	F33 NO ACTION	FAIL	RF-1
ST-11	wall loss 6.40 − 6.30 = 0.10 mm on paper Here the residue falls the other way.	C33 = 6.4 D33 = 6.3	accepted (no data validation)	F33 ACTION	F33 ACTION	PASS	—
ST-12	wall loss 6.10 − 6.00 = 0.10 mm on paper	C33 = 6.1 D33 = 6	accepted (no data validation)	F33 ACTION	F33 NO ACTION	FAIL	RF-1
ST-13	"N/A" typed as the current reading (CML-07) Text ranks above any number; H45 does not count it and H46 skips it.	D36 = "N/A"	accepted (no data validation)	G36 REJECT	G36 ACCEPT · H45 1 · H46 4.5 Excel stored	FAIL	FF-5

§5 Stress-test log (continued)

In plain words: what happens with wrong or extreme inputs

ID	Vector	Injected	Entry check	Expected	Actual (Excel rules)	Result	Finding
ST-14	current reading left blank (CML-04) A blank compares as 0: conservative outcome.	D33 = (blank)	accepted (no data validation)	G33 REJECT	G33 REJECT	PASS	—
ST-15	current reading 0 (CML-04)	D33 = 0	accepted (no data validation)	G33 REJECT	G33 REJECT	PASS	—
ST-16	sign error: −4.62 (CML-04)	D33 = -4.62	accepted (no data validation)	G33 REJECT	G33 REJECT	PASS	—
ST-17	"N/A" as the previous reading (CML-04) The error is visible on the sheet.	C33 = "N/A"	accepted (no data validation)	E33 #VALUE! · F33 #VALUE!	E33 #VALUE! · F33 #VALUE!	PASS	—
ST-18	text "N/A" typed into P	Inputs!C5 = "N/A"	rejected on entry (not a number)	refused at entry	refused at entry	PASS	—
ST-19	P = −5 typed	Inputs!C5 = -5	rejected on entry (outside 0 to 50)	refused at entry	refused at entry	PASS	—
ST-20	P = 50.01 typed (upper limit + 0.01)	Inputs!C5 = 50.01	rejected on entry (outside 0 to 50)	refused at entry	refused at entry	PASS	—
ST-21	P = 50 (upper limit)	Inputs!C5 = 50	accepted	G14 26.629746835443037…	G14 26.629746835443036	PASS	—
ST-22	P cleared (blank) Validation allows blanks: t = 0, t_m = 1.5 mm and every numeric reading is accepted.	Inputs!C5 = (blank)	accepted (blank allowed)	refused at entry	accepted · H22 1.5 · H45 0	FAIL	RF-2
ST-23	S = 0 typed (below 1)	Inputs!C7 = 0	rejected on entry (outside 1 to 500)	refused at entry	refused at entry	PASS	—
ST-24	W = 1.01 typed (above 1)	Inputs!C8 = 1.01	rejected on entry (outside 0 to 1)	refused at entry	refused at entry	PASS	—
ST-25	E = 0.85 (valid value)	Inputs!C9 = 0.85	accepted (no data validation)	G14 3.526823134953897 7…	G14 3.526823134953897 7	PASS	—
ST-26	E = 10 typed Accepted: t_m falls to 1.8 mm and CML-06 becomes ACCEPT.	Inputs!C9 = 10	accepted (no data validation)	refused at entry	accepted · H22 1.804450072358900 1 · G35 ACCEPT	FAIL	RF-2
ST-27	E = −1 typed Accepted: t_m is negative and every numeric reading is accepted.	Inputs!C9 = -1	accepted (no data validation)	refused at entry	accepted · H22 -1.59375 · H45 0	FAIL	RF-2
ST-28	E = 0 typed Accepted: t = D/(2·Y), a conservative but meaningless result.	Inputs!C9 = 0	accepted (no data validation)	refused at entry	accepted · H22 211.875	FAIL	RF-2
ST-29	text "N/A" typed into E Accepted: every decision cell shows #VALUE! while H45 reports 0 CMLs below t_m.	Inputs!C9 = "N/A"	accepted (no data validation)	refused at entry	accepted · G14 #VALUE! · H45 0	FAIL	RF-2
ST-30	E cleared (blank) Accepted: E counts as 0.	Inputs!C9 = (blank)	accepted (no data validation)	refused at entry	accepted · H22 211.875	FAIL	RF-2

Summary

Vectors run	30
Passed	19
Failed	11 · RF-1 4 · RF-2 6 · FF-5 1
Confirmed by Excel's stored values	ST-01, ST-06, ST-13 (CML-06, CML-04, CML-07 as saved)

What the failures mean

- Four of five wall-loss pairs exactly 0.10 mm apart return NO ACTION; one (6.40 − 6.30) returns ACTION. The binary residue, not the documented threshold, decides.
- Inputs!C9 accepts any value: E = 10 or −1 makes every numeric reading ACCEPT; text makes every decision #VALUE! while H45 still reports 0 CMLs below t_m.
- A cleared design pressure is allowed by the validation rule and gives t_m = 1.5 mm.

§6 IEEE 754 precision & tamper-resistance audit

In plain words: what is shown versus what is decided; protection

Display versus decision at every comparison against a limit.

6.1 Display versus decision

Cell	Left operand stored	Shown	Limit stored	Shown	Decision	Decision on shown values	Assessment
F30	0.049999999999999822	0.05	0.10000000000000001	0.1	NO ACTION	NO ACTION	display supports decision
F31	0.059999999999999609	0.06	0.10000000000000001	0.1	NO ACTION	NO ACTION	display supports decision
F32	0.0099999999999997868	0.01	0.10000000000000001	0.1	NO ACTION	NO ACTION	display supports decision
F33	0.099999999999999645	0.10	0.10000000000000001	0.1	NO ACTION	ACTION	RF-1: record says ACTION
F34	0.070000000000000284	0.07	0.10000000000000001	0.1	NO ACTION	NO ACTION	display supports decision
F35	0.11000000000000032	0.11	0.10000000000000001	0.1	ACTION	ACTION	display supports decision
F36	#VALUE!	#VALUE!	0.10000000000000001	0.1	#VALUE!	n/a (text or error operand)	text or error operand
F37	0.029999999999999361	0.03	0.10000000000000001	0.1	NO ACTION	NO ACTION	display supports decision
F38	0.080000000000000071	0.08	0.10000000000000001	0.1	NO ACTION	NO ACTION	display supports decision
F39	0.080000000000000071	0.08	0.10000000000000001	0.1	NO ACTION	NO ACTION	display supports decision
F40	0.050000000000000711	0.05	0.10000000000000001	0.1	NO ACTION	NO ACTION	display supports decision
F41	0.020000000000000462	0.02	0.10000000000000001	0.1	NO ACTION	NO ACTION	display supports decision
G30	6.0499999999999998	6.05	4.5053571428571431	4.5	ACCEPT	ACCEPT	display supports decision
G31	5.7400000000000002	5.74	4.5053571428571431	4.5	ACCEPT	ACCEPT	display supports decision
G32	5.2000000000000002	5.20	4.5053571428571431	4.5	ACCEPT	ACCEPT	display supports decision
G33	4.6200000000000001	4.62	4.5053571428571431	4.5	ACCEPT	ACCEPT	display supports decision
G34	4.8799999999999999	4.88	4.5053571428571431	4.5	ACCEPT	ACCEPT	display supports decision
G35	4.5	4.50	4.5053571428571431	4.5	REJECT	ACCEPT	FF-4: shows 4.5 vs 4.5
G36	N/A	N/A	4.5053571428571431	4.5	ACCEPT	n/a (text or error operand)	text or error operand
G37	5.9900000000000002	5.99	4.5053571428571431	4.5	ACCEPT	ACCEPT	display supports decision
G38	5.4699999999999998	5.47	4.5053571428571431	4.5	ACCEPT	ACCEPT	display supports decision
G39	5.0199999999999996	5.02	4.5053571428571431	4.5	ACCEPT	ACCEPT	display supports decision
G40	4.9299999999999997	4.93	4.5053571428571431	4.5	ACCEPT	ACCEPT	display supports decision
G41	6.1799999999999997	6.18	4.5053571428571431	4.5	ACCEPT	ACCEPT	display supports decision

"Shown" is what Excel prints under the cell's number format (wall loss in column E at 0.00, readings at 0.00, t_m in H22 at 0.0); the limit 0.1 is a literal. A row is flagged when the decision depends on digits beyond the printed precision. Rounding functions in decision paths: none. Precision as displayed: off.

§6 Tamper-resistance audit (continued)

In plain words: what is shown versus what is decided; protection

6.2 Protection and lock map

Workbook structure	**not protected**: sheets can be added, renamed, hidden or deleted
Sheet Inputs	protected (sheet, objects, scenarios) · **no password**: Review › Unprotect Sheet removes it in one click · input cells C5:C9 unlocked by design; all other cells locked
Sheet Calc	**not protected**: all 41 formula cells and all 24 reading cells are formatted Locked, which has no effect
Hidden formulas	none (no cell has the Hidden protection attribute)

Calc · 41 formula cells · Locked format, no effect: sheet not protected

G14 H22 H23 E30 E31 E32 E33 E34 E35 E36 E37 E38
E39 E40 E41 F30 F31 F32 F33 F34 F35 F36 F37 F38
F39 F40 F41 G30 G31 G32 G33 G34 G35 G36 G37 G38
G39 G40 G41 H45 H46

Inputs · 5 input cells · unlocked by design, sheet protected without a password

C5 C6 C7 C8 C9

editable · dashed amber outline: no data validation (Inputs!C9)

6.3 Data validation

Cell	Symbol	Type	Range	Error style	Error message	Blanks allowed
Inputs!C5	*P*	decimal	0 to 50	stop	yes	yes
Inputs!C6	*D*	decimal	10 to 2000	stop	yes	yes
Inputs!C7	*S*	decimal	1 to 500	stop	yes	yes
Inputs!C8	*W*	decimal	0 to 1	stop	yes	yes
Inputs!C9	*E*	none	—	—	—	—

Readings in Calc!C30:D41 carry no validation. A rule set to “stop” blocks a typed entry only: a paste or a cleared cell bypasses it.

6.4 Tamper evidence

Sheet protection guards against accidents; it is not tamper evidence. The tamper evidence for this record is the SHA-256 of the exact bytes, printed in every page header: any change to the file, including opening and re-saving it with no edit, changes the fingerprint. Keep the validated master read-only in a controlled location and let users work on copies.

§7 QA release & version control

In plain words: who approves, and when to re-validate

Release decision, conditions for release, re-validation triggers and the version log.

Not released: 3 red flags, 2 more findings

Status proposed by this Dossier. The release decision belongs to the approver below.

7.1 Conditions for release

	Correction	Closes
CA-1	Declare the rounding rule; implement it in F30:F41 (and in G30:G41 if your rule rounds t_m).	RF-1
CA-2	Protect Calc; validate Inputs!C9; refuse blanks; check readings with ISNUMBER.	RF-2
CA-3	Move 0.4, 1.5, 0.875 and 0.1 to labelled, sourced input cells.	RF-3
CA-4	Print t_m at the decision resolution; state the rule on the sheet.	FF-4
CA-5	Return a distinct result for a non-numeric reading; make H45 count it.	FF-5
CA-6	Re-run the full Dossier on the corrected file and record its new SHA-256.	—

7.2 Re-validation triggers

- Any change of the file's SHA-256, including a re-save without edits.
- Any change to a formula, a constant, a number format on a decision path, a lock or a validation rule.
- A change of code edition, material, design temperature or allowance that affects S, E, W, Y or c.
- A change to the inspection procedure (action threshold, reading resolution, rounding rule).
- A change of intended use, line or number of CMLs.
- A new major version of the spreadsheet application used in production.
- Any finding from use, audit or assessment that concerns this workbook.

7.3 Version log

Version	SHA-256	File date (UTC)	Change	Dossier	Status
1	28a815ee…8ac260d1	2026-11-02 15:56:51	baseline as received	NXL-SAMPLE-A-28A815EE	Not released

7.4 Approval

Release decision: ☐ Released ☐ Released with observations ☐ Not released

Reviewed by · Technical Manager

Name

Role

Signature

Date

Approved by · Quality Manager

Name

Role

Signature

Date

NormXL produces evidence; your organisation approves it.

App. A Clause cross-reference: ISO/IEC 17020:2026

In plain words: where each requirement of the standard is answered

Where this Dossier holds the evidence for each requirement of the 2026 edition that concerns calculation tools.

Clause	Requirement in summary (paraphrased)	Evidence in this Dossier	Status for this file
7.5	Systems that handle inspection data are validated for their intended use before use.	§1 URS · §4 OQ · §5 stress log	Not yet: RF-1, FF-5
7.5	They are re-validated before changes are implemented.	§7.2 triggers · §7.3 version log · SHA-256	Defined
7.5	They are protected against unauthorised access, tampering and loss.	§6.2 lock map · §6.4 tamper evidence	Not yet: RF-2
7.5	They are monitored, with failures recorded.	§5 log · §7.3 version log	Your procedure
7.5	Inspection data stays intact from the reading in the field to the conclusion on the report.	§6.1 display versus decision · §3.9 Constant Ledger	Not yet: RF-3, FF-4
6.2.9	Equipment-level requirement on software (continues, revised, the 2012 edition's 6.2.13).	§3 installation qualification	Recorded
4.2	Confidentiality of client information.	Local-processing statement below	Recorded
—	Where a report states conformity, the basis of that statement, including any decision rule, is clear. Check the clause in your copy of the standard.	§1.5 rounding rule · §6.1	Open: no rule

Transition from the 2012 edition

The 2012 edition dealt with computers in Clause 6.2.13, inside the equipment requirements. The 2026 edition keeps an equipment-level requirement on software (6.2.9) and adds Clause 7.5, *Control of data and information*, as a standalone clause. A gap analysis against the 2026 edition can reference this Dossier's reference and SHA-256 in the rows that cover software validation and the control of data and information.

Local processing (Clause 4.2)

The analysis behind this sample read the workbook on a local computer. NormXL is designed so that 0 KB of a workbook leaves the user's browser; no external provider receives its contents.

Paraphrased. Read the clauses in your copy of ISO/IEC 17020:2026 and your accreditation body's transition guidance. The ISO/IEC 17025:2017 and ISO 13485:2016 profiles replace this appendix and the clause references; the structure of the Dossier is the same. NormXL is independent and is not affiliated with, endorsed by or approved by any accreditation body.

App. B Assessor Quick-Verify card

In plain words: check three values with a calculator and confirm the file

Three values to check with a calculator, and one command to confirm the file. No NormXL software needed.

1 `Calc!G14` · **pressure design thickness** `t`

```
t = P·D / [2(S·E·W + P·Y)]
  = 5 × 168.3 / [2 × (138 × 1.00 × 1.00 + 5 × 0.4)]
  = 841.5 / [2 × 140] = 841.5 / 280 = 3.005357… mm
```

Excel stores `3.0053571428571431` and shows 3.01. Agrees

2 `Calc!F33` · **interval action for CML-04** · `=IF(C33-D33>=0.1,"ACTION","NO ACTION")`

`wall loss = 4.72 - 4.62 = 0.10 mm → 0.10 ≥ 0.10 → ACTION`

Excel stores the difference as `0.09999999999999645` and returns `NO ACTION`. Test failed: RF-1

3 `Calc!G35` · **decision for CML-06** · `=IF(D35>=$H$22,"ACCEPT","REJECT")`

t_m = 3.005357… + 1.5 = 4.505357… mm · reading 4.50 < 4.505357… → REJECT

Excel returns `REJECT` (correct), while H22 prints t_m as 4.5: the sheet shows 4.5 against 4.5. Observation: FF-4

Confirm the file with one command

Windows (Command Prompt)	`certutil -hashfile B31.3_Wall_Thickness_Sample.xlsx SHA256`
Windows (PowerShell)	`Get-FileHash .\B31.3_Wall_Thickness_Sample.xlsx -Algorithm SHA256`
macOS	`shasum -a 256 B31.3_Wall_Thickness_Sample.xlsx`
Linux	`sha256sum B31.3_Wall_Thickness_Sample.xlsx`

Expected result (upper or lower case, with or without spaces):

```
28a815ee b5a86f43 6546c770 2ea8702f f1fc66cb 77d15a42 d511af50 8ac260d1
```

Reproduce vector 2 in your own Excel

In a blank worksheet type `4.72` in A1, `4.62` in B1 and `=IF(A1-B1>=0.1,"ACTION","NO ACTION")` in C1. C1 returns NO ACTION. Type `=A1-B1` in D1 and widen its number format: Excel shows 0.0999999999999996, at most 15 significant digits of the stored 0.099999999999999645.

If the result differs, the file in front of you is not the file this Dossier describes: it may have been edited, or simply opened and saved again. Either way it needs re-validation (§7.2).

NormXL produces evidence; your organisation approves it.