Pipeline Condition Assessment Model

Engineering reference and spreadsheet User Guide

Combined reference document for model version 17.81
13 October 2026

Executive summary

The Pipeline Condition Assessment Model provides a structured way to assess water mains and decide where further investigation, operational changes or renewal planning deserve attention. The model developers combined asset records, measured conditions where available, operating pressure and failure history into a spreadsheet that produces a remaining planning-life range, a condition rating, and a comparison of pressure scenarios.

This paper explains the engineering decisions behind that approach and how utilities, public authorities and development partners can use the results. It supports technical discussion and program appraisal, including briefings on diplomatic and funding organizations. Sections 1–7 explain the engineering basis. Sections 8–14 provide the user guide, input reference, and troubleshooting instructions.

The approach recognizes that age alone cannot describe the condition of a buried pipe. Remaining wall, pressure demand, material behavior, joints, and recorded failures provide additional evidence. The model brings these considerations together while keeping the assessment method appropriate to the information available.

Development and attribution

Developed by Stuart Hamilton, Raid Al-Zraikat, Naem Saleh and Danial Warq.
A MESC III product, implemented by Engicon.

The following contributors provided input, advice, and support during the initial testing: Bambos Charalambous, Ignacio M. Peña, Igor Dundović, Jamie Patterson, Mike Wrigglesworth, Layla Al-Zraikat and Joe Dalton. These credits acknowledge recorded contributions and do not imply individual certification of this paper.

Technical basis: spreadsheet v17.81. Status: Working Version

1 Engineering Purpose and Scope

Water main investment requires a judgement about both asset conditions and the consequences of losing service. An old pipe may retain useful structural reserve, while a younger pipe may have serious local deterioration or a damaging operating history. A consistent assessment makes those differences visible and helps engineers explain why one section needs attention before another.

The US Environmental Protection Agency's review of water main condition curves describes approaches to representing deterioration, break frequency, and serviceability. It identifies mechanisms that differ between materials, including corrosion, graphitization, and joint defects [2]. This supports considering more than installation age when screening assets.

AWWA's asset-management policy supports decisions over the full asset life, linking operation, maintenance and renewal to service requirements and acceptable risk [3]. The model contributes condition evidence and pressure comparisons to that broader process. Network performance, affordability, and the final choice of intervention require additional assessment.

What has been developed

The workbook provides three routes: direct-wall thickness measurement, measured acoustic velocity and an assessment based on asset records and engineering assumptions. It applies the selected route to supported materials and reference sizes, incorporates operating and failure history inputs, and presents results on a dashboard with two explanatory graphs. Correctly converted metric and imperial inputs describe equivalent physical assets [1].

The protected calculation structure and user guide support repeatable use. Retaining the assessment date, asset identity, evidence sources, and reasons for engineering judgement allows another reviewer to understand and reproduce a result.

What the output means

Remaining planning life is an estimate within the model's chosen deterioration and intervention assumptions. It helps compare priorities and plan further work. It is not a certified safe operating period or a predicted date of bursting. Local defects, exceptional transients, ground movement, or construction damage may govern failure outside the mechanisms represented.

This paper documents the method and its calculation verification. It does not report a surveyed network dataset, independently observed service life results or measured program benefits. Future claims about reduced bursts, water savings or avoided expenditure should be supported by a separately documented deployment study.

2 Engineering Decisions Behind the Methods

Direct evidence of remaining wall

For supported metallic pipes, the direct method compares the governing measured wall with a planning threshold. The threshold is the greatest of a material specific fraction of reference wall,

an absolute minimum, and a pressure-based wall requirement. Both deterioration and pressure demand can therefore influence the assessment [1].

Internal circumferential stress increases with water pressure. Failure risk and estimated service life are assessed based on the remaining pipe wall thickness. This physical relationship supports checking pressure demand against remaining wall. The simplified calculation does not provide a complete structural assessment of external loads, crack geometry, brittle fracture, or defective joints.

The deterioration rate is estimated based on the pipe material, soil conditions, and average wall loss inferred from the reference wall thickness. This retains a background deterioration allowance when the inferred rate is low. The original wall may differ from its nominal reference, and average historical loss may not represent future corrosion, so both estimates require judgement.

Measurements must represent the section being assessed. A reading establishes condition at its location; inspection coverage, local pitting and the measurement technique determine how far it can be extended. Critical sections may need a more detailed survey before a section-wide conclusion is justified.

Acoustic evidence of equivalent condition

For ductile iron, grey cast iron and carbon steel, the acoustic route interprets measured wave speed against a supported healthy reference and estimates equivalent wall condition [1]. Within the model's assumptions, greater wall flexibility reduces wave speed. This is an indirect indicator whose reliability depends on the reference and measurement conditions.

Equivalent wall condition is not a measured minimum pit depth. Air, changes in material or geometry, and uncertain reference conditions can affect interpretation and measured velocity. The workbook applies validity limits. Practical deployment should also compare acoustic findings with representative direct inspections before relying on them for major investment decisions.

Assessment without measured condition

The Engineering Best Practice Assessment route uses age, material, operating conditions, and entered condition factors. It supports initial screening where inspection evidence is incomplete and helps identify where better evidence has most value. Non-metallic materials use a separate age and pressure-rating route because metallic wall-loss assumptions do not adequately describe their behavior [1].

3 Assumptions and their Engineering Basis

The model combines established physical principles with numerical assumptions used for screening. Established principles support which influences to consider; they do not establish every coefficient in the workbook. This distinction matters when transferring the model between utilities or countries.

Decision	Engineering reason	Application
Material-specific assessment	Materials have different deterioration and failure mechanisms.	Verify material and class; review defaults using local evidence.
Pressure and surge	Internal pressure creates structural demand.	Use measured conditions and investigate significant transients.
Joints and environment	Installation and surroundings can govern performance beyond the pipe barrel.	Support category selections with records or inspection.
Failure history	Repeated bursts can reveal damage or loading absent from other inputs.	Use consistent lengths, periods, and event definitions.
Consequence affects priority	Equal condition can produce different service impacts.	Set intervention priority without changing physical life.

Planning horizons

Nominal lives are starting horizons, not established expiry dates for individual pipes. For example, v17.81 assigns 75 years to several metallic groups, 80 to PVC and 100 to HDPE [1]. The Water Research Foundation's PVC project uses testing and field performance evidence to study long-term prediction [4]; it does not establish the model's 80-year default as universal.

Uncertainty and calibration

Displayed ranges use assumed allowances of ±15% for direct-wall, ±20% for acoustic and ±30% for record-based assessment, subject to upper limits [1]. They are planning spreads, not statistically established confidence intervals. Multiplying several adverse condition factors can compound conservatism where those factors are correlated. Local calibration should examine this interaction as well as individual defaults.

4 Interpreting Life Reserve and Graphs

Why life and color can differ

Life expresses an estimated planning horizon after factors and caps. Direct-wall structural reserve expresses the usable wall margin remaining above the model's threshold, relative to the margin between reference and critical wall. The percentage is limited to 0–100%; it is not a probability of survival or a certified load capacity [1].

Two different wall measurements can give the same displayed life when a horizon limit or rounding controls the result. Their reserve can still cross a color threshold. A color change with unchanged years can therefore identify a margin that the life figure alone does not show.

Indicator	Thresholds in v17.81	Interpretation
Lower life estimate	Red ≤5 years; amber >5 to 10; green >10.	The model's planning urgency bands.
Direct-wall reserve	Red ≤25%; amber >25% to 50%; green >50%.	Can make the overall color more urgent.
Minimum service pressure	The scenario below the entered minimum is red.	Improved modelled life cannot justify inadequate service.

Using the pressure graphs

The first graph shows central remaining life as operating pressure varies. The second derives a relative index from 0 to 100 from that same life result. An index of 80 does not mean an 80% chance of failure. Both graphs represent one calculation; they are not independent evidence. Flat sections may reflect life limits or exhausted reserve [1].

The curves identify pressure scenarios worth investigating. Surge and the other asset inputs stay fixed along the curve. The proposed change still needs hydraulic and transient review, including service at critical locations. The workbook does not simulate network flows, customer supply, or the full transient response.

Interpreting burst history

Burst counts are normalized by assessed length and history period. The rate affects retained life and, at or above the 50 m, reference pressure, pressure sensitivity. Missing history is not evidence of zero failures. Short records and small sections can give volatile rates; review the underlying events and possible common external causes before relying on the classification [1].

5 Using Results to Plan Action

Start with a defined section of broadly consistent material, class, size, and operating conditions. Record location, length, installation year, assessment date, and data sources. Assess materially different sections separately. Select a method that matches the evidence and identify assumptions explicitly.

Review results with field observations, failure records, and the consequences of losing service. Where uncertainty could affect the recommended course of action, obtain additional evidence before deciding. Preserve the assessment and explain any engineering decision that differs from its initial indication.

Risk-Based Pipeline Assessment and Inspection

Pipeline condition assessment should follow a proportionate, risk-based approach, taking account of both the likelihood and consequences of failure, irrespective of pipe diameter. Consideration should be given to material, age, operating conditions, failure history, environmental factors, and the criticality of the asset.

The level of assessment should reflect the available evidence and the decisions being considered. Initial assessments may be undertaken at pipeline or network-section level, with more detailed investigations of individual pipe sections being justified by identified risks, uncertainty, or operational importance.

The selection of inspection methods should be based on their suitability, reliability, practicality, and cost-effectiveness. Where additional condition information is needed, appropriate technologies may be considered to support decisions regarding continued operation, monitoring, targeted repair, rehabilitation, or replacement.

Specialist inspection technologies should not be regarded as an automatic requirement. Their application should be supported by a clear technical and economic justification demonstrating that the additional information is likely to improve asset management decisions and provide value to the utility.

Application	Model contribution	Evidence needed for action
Inspection targeting	Identify poor indicators, conflicting evidence, and high-consequence sections.	Representative coverage and a technique suited to the suspected defect.
Pressure management	Compare present and feasible alternative operating pressures.	Pressure logging, hydraulic assessment and transient review.
Renewal planning	Develop priorities for rehabilitation or replacement appraisal.	Feasibility, costs, service disruption, and alternatives.
Monitoring	Establish a baseline for reassessment.	New failures, operating changes, and repeated condition evidence.

Illustrative application

Consider two sections with equal modelled remaining life. One supplies a critical facility without an alternative supply; the other has network redundancy. The first may justify earlier inspection and contingency planning because its failure consequences are greater. That priority does not imply faster physical deterioration.

If reducing pressure improves modelled life but breaches minimum service-pressure, the graph does not support adopting that scenario. The engineer should investigate a feasible pressure range, surge control, or physical intervention. These examples illustrate use of the method; they are not reported field outcomes.

Building an investment program

The model contributes a consistent condition assessment to a wider business case. It does not calculate the complete costs and benefits or automatically select investments. Combine its

findings with service requirements, intervention feasibility, and affordability. Reassess after significant failures, new inspections, or material operating changes.

6 Application for Authorities and Development Partners

For public authorities, embassies and development partners, the model can support scrutiny of why water main investigations or investments are proposed. A common assessment structure makes measured evidence and assumptions visible and helps reviewers ask whether an intervention addresses the identified problem.

A program submission should include the assessed sections, evidence quality, condition, consequence, and the proposed action with its basis. It should identify conclusions sensitive to uncertain inputs. Costs, expected service benefits, and delivery responsibilities require supporting analysis alongside the model.

A documented pilot using the model

It is recommended that a pilot survey be undertaken across representative pipe materials, ages, and pressure regimes. It should include known or suspected sound sections as well as areas with known problems.

Results from pipelines confirmed to be in good condition should be used as a benchmark in comparison with other network sections surveyed. All outputs should be reviewed, validated, and discussed to ensure they are consistent before comparisons are made or future investment decisions are taken.

Compare model indications with direct condition evidence and subsequent operating records. Investigate disagreements and change defaults only with a documented engineering basis. Retain the version used for each assessment. Where enough data exists, check revised assumptions against sections that were not used to set them.

Responsibility and operating limits

The utility retains responsibility for records and operational decisions. The reviewing engineer confirms that the method suits the asset and proposed use. Program sponsors can use the evidence to appraise scope and monitor delivery while retaining clear engineering accountability.

Maintaining a useful reference

Keep the paper, workbook, and user guide together with the assessment register. Record material changes to assumptions, repeat the affected checks and explain their effect on previous priorities. This creates an evidence trail for technical review and later program evaluation.

7 Verification and Reference Sources

What the checks establish

The v17.81 record reports passing results for 956 selectable methods, material, class, and diameter cases and 450 adverse condition interactions. Expanded graph checks covered 924 points across 84 scenarios. Additional tests addressed failure rate boundaries, invalid inputs, and equivalent units.

These checks support agreement between the implemented rules, dashboard, and graphs in the tested cases. They are not field trials or a count of validated assets. Not every possible numerical input has been assessed.

Evidence supporting the decisions

Reference 1 documents the implemented model and its test evidence. References 2 to 4 support the engineering and asset management context. They do not validate the workbook's exact coefficients or constitute endorsement by the organizations named.

Nominal lives, critical wall limits, loss rates, the 25-year measured evidence horizon, burst bands, pressure response factors and uncertainty allowances remain model specific choices. The workbook's parameter registers and user guide provides detailed implementation references.

References

[1] Hamilton, S., Al-Zraikat, R., Saleh, N. and Warq, D. Pipeline Condition Assessment Model, v17.81. MESC III product, implemented by Engicon. Workbook, user guide and associated calculation and graph verification records, September 2026. Internal project evidence.

[2] Thomson, J., Flamberg, S. and Condit, W. 2013. Primer on Condition Curves for Water Mains. US EPA, EPA/600/R-13/080.

[3] American Water Works Association. Policy Statement on Asset Management. Revised 13 October 2025.

[4] The Water Research Foundation. Long-Term Performance Prediction for PVC Pipes. Project 2879, completed 2005. Public project summary.

External sources accessed 11 September 2026. Reference 4 is the public summary; the full subscriber report was not reviewed.

Document control

Pipeline_Condition_Assessment_Model_v17.81_.xlsx. Combines the engineering report with consolidated operating instructions for the spreadsheet. Version status: Working Version (13 October 2026). Previously circulated for evaluation; no calculation errors, operational failures or technical corrections have been reported to date. The calculation methodology remains unchanged. This status does not constitute independent certification or field validation.

8 User Guide and Quick Start

This user guide accompanies the protected v17.81 workbook. Sections 1–7 provide the engineering reference; sections 8–14 explain operation. Use this consolidated guide for current instructions. Version-labelled notes in the workbook record earlier changes and may describe superseded behavior.

Before starting

Keep an unchanged master workbook and save an assessment copy for each asset or section. Replace the supplied example data. Open the file in Microsoft Excel and enable editing if it opens in Protected View and you recognize the source.

Only Dashboard, Failure Curve and user guide should be visible. Dashboard is the entry and results page. Failure Curve contains pressure comparisons and explanatory text. The workbook user guide includes supporting detail and version history. Hidden calculation sheets continue to operate.

Complete an assessment in this order

1. On Dashboard, select units in B2 before entering measurements. Enter the survey date, section length, and asset location in B3:B5.

2. Select the assessment method in B6. Enter installation year in B7, then select material, category/class, and diameter in B8:B10, in that order.

3. Enter the measurement required by the selected method: acoustic velocity in B11 or direct-wall thickness in B12. The record-based method does not use either measurement.

4. Complete operating pressure, what-if pressure and the condition and operating fields in B13:B21. If no pressure scenario is intended, set B14 equal to B13.

5. Review burst history in B22:B24, enter minimum service-pressure in B26 and select the supply regime in B27. Record evidence and assumptions in the comments area D2:G2.

6. Read the condition finding, what-if result, planning priority, and all advisory messages. Confirm that the displayed controlling evidence matches your selected method.

7. Review the Failure Curve page. Save the assessment with its evidence and record the resulting engineering action. Preview the selected sheets before printing or exporting them.

Editable and protected areas

Only Dashboard B2:B24, B26:B27 and D2:G2 are open for entry. B25 is a calculated failure rate display and must remain locked. Other outputs and formulas are protected, and formula contents are hidden.

Row heights can be adjusted on every worksheet.

9 Asset and Measurement Inputs

Use dropdowns where provided. After changing method, material or units, reselect the dependent material, class, and diameter as appropriate. Do not assume the value left from the previous assessment remains valid.

Cell	Field	What to enter or check
B2	Units	Choose metric or imperial before entering data. Changing this selector does not convert existing numbers.
B3	Survey date	Actual condition survey date. Age is survey year minus installation year, not today's year.
B4	Length surveyed	Positive length for the assessed section: kilometres in metric, miles in Imperial. Burst counts must cover this same section.
B5	Location	A traceable road, zone, or asset identifier. Replace the example location.
B6	Assessment method	Select direct-wall Thickness / NDT, Measured Acoustic Velocity or Engineering Best Practice Assessment.
B7	Installation year	A year from 1800 to the survey year. Use the best supported record and note uncertainty.
B8	Pipe material	Choose a material offered for the selected method. Unsupported measured routes cannot be used.
B9	Category or class	Select the verified class or a deliberate Unknown option. Class influences reference data where available.
B10	Internal diameter	Choose a supported reference diameter. Imperial labels include the exact metric reference in brackets.
B11	Acoustic velocity	Only active for Measured Acoustic Velocity. Enter measured wave speed in m/ms in both unit systems.
B12	Direct-wall thickness	Only active for direct wall / NDT. Enter governing measured remaining wall in mm or decimal inches.

Measurement essentials

Acoustic velocity is wave speed, not water flow velocity. For example, 1.28 m/ms equals 1,280 m/s; enter 1.28, not 1,280. A valid value below the reference value may indicate reduced equivalent stiffness and a deterioration in wall condition. It is not automatically an invalid reading.

For direct wall, use the governing measured remaining wall, including the lowest relevant pitting point established by the survey. No further generic pitting deduction is applied. Record inspection

coverage and limitations, including graphitization where relevant. Values retained in an inactive measurement box do not control life.

10 Operating Condition and Failure Inputs

Cell	Field	What to enter or check
B13	Current pressure	Representative normal operating pressure in metres of head or psi.
B14	What if pressure	Proposed operating pressure in the same units. Set equal to B13 for a baseline comparison.
B15	Soil aggressiveness	Select the evidenced category or deliberately choose Unknown - Average / Unknown - Worst Case.
B16	Consequence	1 = low; 5 = critical. Changes action and priority, not physical remaining life.
B17	Surge / transient head	Additional pressure above normal operating pressure, in metres of head or psi. Do not enter total peak pressure here.
B18	Structural condition	Use Auto unless an evidenced manual grade is justified. Measured methods use their own evidence logic.
B19	Pressure rating	Rated pressure in metres of head or psi. A valid positive rating is required for the non-metallic route; verify the record.
B20	Cycling severity	Select Low, Moderate, High, Severe or an Unknown option. Describes repeated loading, separately from surge magnitude.
B21	Installation / joint condition	Select Good, Average, Poor or an Unknown option using records or inspection.
B22	Burst history mode	Normally Auto from failure rate. Manual Nil / Minimal / Average / Severe is an engineering override; document why.
B23	Recorded bursts/ failures	Non-negative whole count over the section and period. Leave missing records blank rather than claim verified zero failures.
B24	History period	Years covered by reliable records. Use a positive period to calculate a rate, including a verified zero-burst rate.
B25	Calculated failure rate	Read only. Change B4, B23 or B24 to correct source data. It does not calculate pipe age.
B26	Minimum required service-pressure	Utility service requirement in metres of head or psi. Current and what-if pressures are checked against it.
B27	Supply regime	Continuous or intermittent. Intermittent supply forces at least Moderate cycling and adds a metallic planning allowance.

Cell	Field	What to enter or check
D2:G2	Comments	Record evidence sources, uncertainty, survey coverage, and reasons for manual choices.

11 Choosing a Method and Changing Units

Method	Supported material scope	Evidence required
Direct-wall Thickness / NDT	Ductile iron, grey cast iron, carbon steel, copper, galvanized iron and unknown metallic.	Positive governing measured wall, verified identity and representative inspection coverage.
Measured Acoustic Velocity	Ductile iron, grey cast iron, and carbon steel only.	Positive measured velocity and a supported healthy reference; suitable measurement conditions.
Engineering Best Practice Assessment	All listed metallic and non-metallic groups, including plastics, GRP, AC, concrete, and PCCP.	Asset records and operating/condition evidence; verified pressure rating for non-metallic assessment.

Select the method explicitly. Entering a wall reading while the acoustic method is selected does not activate direct-wall assessment. A manual structural grade does not substitute for the measurement required by a measured method. If the pipe is outside a supported measured route, use an appropriate supported method or seek a specialist assessment.

Convert populated inputs when changing units

The selector changes interpretation and labels, not the numbers already entered. Reselect diameter and convert length, wall thickness, current and what-if pressures, surge, pressure rating, and minimum service-pressure. Dates, installation year, burst count, history years and category selections do not need unit conversion. Acoustic velocity remains in m/ms.

Quantity	Conversion used for this workbook
Length	1 mile = 1.609344 km
Wall thickness	1 inch = 25.4 mm; enter decimal inches, not a feet-and-inches expression.
Pressure	1 psi = 0.7043373869 metres of head
Diameter label	An approximately 6 in label with 150 mm in brackets uses the exact 150 mm reference.

For an equivalent comparison, use the same reference pipe and avoid unnecessary rounding. Six inches converted literally is 152.4 mm; the model's approximately 6 in (150 mm) dropdown label represents its 150 mm reference. Do not assume that the label identifies a separate, thicker pipe.

Unknown data

Unknown - Average and Unknown - Worst Case apply different assumptions. Choose deliberately and explain the choice. Do not invent measurements to obtain a result. If required evidence is missing, use the supported record-based route where appropriate and state its limitations.

12 Results and the Graph Page

Read the complete findings

The main condition box reports the current life range, condition, and action. The what if box reports the pressure scenario and central life change. Read the planning priority and advisory text as well as the color. Confirm the controlling condition evidence before relying on the result.

The lower life bound governs the life color: red at 5 years or less, amber above 5 through 10, green above 10. Direct-wall reserve can impose a worse color. Pressure below the entered minimum service requirement also makes the relevant result red, even when its separately stated structural condition is green or amber.

Consequence and failure evidence influence planning priority and the recommended response. The displayed confidence or basis describes the evidence route; it is not a statistical confidence level. Direct wall is local evidence unless coverage supports a wider conclusion, while acoustic condition represents an equivalent section average.

Information below row 28

The lower Dashboard rows provide useful review information. Rows 28-34 identify the method, life ranges, pressure effect, and failure classification. Rows 35-40 contain wall diagnostics, retained condition, priority, and action. Rows 41-49 show planning-life and condition factors. Rows 50-61 describe acoustic references and evidence; rows 62-70 provide direct-wall diagnostics when that method is active.

These are calculated outputs, not additional entry boxes. They help explain unexpected results. Pressure-required wall is a calculated requirement, not a measurement. A closest velocity-reference suggestion does not establish the actual material or authorize changing pipe identity to fit a reading.

Read the first graph before the index

On Failure Curve, the horizontal axis is operating pressure in the selected units. Graph 1 shows central remaining planning life in years; the Dashboard shows a range around that estimate. The accompanying table uses the lower-bound color rules and applicable reserve and service-pressure overrides.

Graph 2 is a relative index from 0 to 100 derived from the same life estimate. Higher values indicate greater relative modelled vulnerability. A value of 80 does not mean 80% failure probability. Zero does not mean failure is impossible; 100 does not mean immediate failure is certain.

The graph pressure grid covers the equivalent of 10 -110 metres of head. Other inputs, including surge, remain fixed. Use B14 for a scenario outside that range. Invalid required inputs clear the plotted series; resolve the input warning rather than interpret an empty graph as a healthy result.

13 Worked Checks and Troubleshooting

A simple failure history example

For a 10 km section with 1 recorded burst over 5 years, the metric rate is 100 × 1 ÷ (10 × 5) = 2 bursts per 100 km per year. Auto classifies this as Minimal. Correctly converting the length to miles changes the displayed unit and rate number but preserves the internal classification. This arithmetic example does not predict a pipe's remaining life.

Enter zero bursts only when records confirm that no failures occurred and provide the corresponding history period and section length. Missing count or period is insufficient history, not a verified Nil classification. Negative or non-numeric periods and invalid counts must be corrected. Changing B25 is neither necessary nor permitted.

Checking a pressure comparison

Set B14 equal to B13 while both meet B26. The current and what if life ranges and structural colors should agree, with zero central life change. Then enter the proposed pressure in B14 and review both the structural result and the service-pressure message. This is a useful check when preparing an assessment.

What you see	What to check or do
Life does not change after a measurement edit	Check B6 and the controlling-evidence message. The field may be inactive, or a life cap or rounding may control the display.
Same life but a different color	Read direct-wall reserve and the minimum service-pressure warning. These can override the life band.
Changing class still gives zero EBP life	Age may have exhausted the nominal horizon. Class alone does not justify positive life beyond it.
Life changes after switching units	Reselect diameter and convert all unit-dependent inputs, including surge, rating, and service minimum.
Invalid acoustic reading	Check m/ms, material, class, diameter, and measurement conditions. Do not force a value into the accepted range.
Input or graph does not update	Check required fields, dropdown choices, and Excel Automatic calculation. Recalculate; if it is still inconsistent, retain the file for review.

What you see	What to check or do
Missing dropdown or formula error	Select the intended input cell and confirm the correct workbook version. If unresolved, stop using the affected result and report the cell and inputs.

14 Saving, Printing, and Maintaining Assessments

Keep the assessment reproducible

Save an assessment copy with an asset identifier, survey date, and workbook version in its filename. Retain the input records and inspection evidence alongside it. Keep the baseline before exploring a scenario; the workbook's what-if field compares pressures rather than maintaining a historical record of all previous assessments.

Record the selected method, input units, measurement coverage, pressure evidence, burst-record period, and any manual override. Save the current and what-if findings with the service-pressure check and the engineering decision. The comment field is a useful short record; lengthy evidence should be kept in the associated assessment file.

Print or export useful pages

Use Excel Print Preview to check Dashboard and Failure Curve before printing or exporting to PDF. Verify the asset identity, survey date, length, and units on the graph page. Check that both graphs and the explanatory notes are included and readable. Choose the intended sheets or print area rather than assuming the entire workbook will produce a concise report.

If words are clipped, increase the affected row height. Row-height formatting is permitted on all worksheets while protection remains active. Excel's AutoFit feature may not reliably adjust the height of rows containing merged cells. Increase the row heights manually where necessary. Check the preview again. Reducing font size is not necessary to preserve the protected calculations.

Protection and controlled changes

B25 and all calculated outputs are locked, with formula contents hidden. Only the three user-facing tabs are visible. Protection reduces accidental edits; it does not validate the engineering assumptions or replace review of the result.

If an error persists, keep the affected file and record the version, Excel version, method, material, class, diameter, and inputs that reproduce it. Identify the cell or message and the expected behavior. Refer proposed calculation changes to the model owner for review and coordinated updates to the workbook, user guide, and this document.

Report the error to the lead developer: shamilton@hydrotec.ltd.uk

Before relying on an assessment

Confirm that the section identity and evidence match the data entered, and that units and dependent selections are correct.

Resolve invalid input messages and review warnings, reserve, confidence, and minimum service pressure.

Check that the graphs correspond to the selected assessment and that the proposed action accounts for consequence and uncertainty.

Document the responsible engineering review and the next inspection, operational or planning action. Reassess when new failures or evidence materially change the position.