An Instrument Out of Calibration Should Not Be Bookable

Most calibration systems tell you an instrument is overdue. Fewer stop anyone using it, and almost none answer the question that matters: which results since the last calibration are now suspect?

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IN BRIEF

An instrument that is overdue for calibration or was found out of tolerance should not be bookable until it is cleared, and the system should say why. When a calibration finds the instrument out of tolerance as found, every result produced since the previous calibration is in question, and the lab needs that list from the record, not from memory.

Key takeaways

- A due date that does not stop use is a reminder. A lock in the booking calendar that does stop use is a control.
- As-found is the reading that matters for the past. As-left only says the instrument has been fine since the technician left.
- An out-of-tolerance as-found result puts every result since the last passing calibration in question, not the last few weeks.
- A shared instrument going offline takes the instruments that depend on it with it, and their own dates will still look fine.
- The booking calendar and the calibration record should be one system on one record, or one of them is lying right now.

Every accredited laboratory has a calibration schedule, and every schedule has a column that turns red when a date passes. Most labs believe that column is a control. It is a reminder. A red cell stops nobody from picking up the instrument on Monday morning, running twenty samples on it and signing the results, and by the time somebody reads the schedule the results have gone to the customer.

This article is about the gap between knowing an instrument is overdue and preventing its use, and about the harder question that follows a calibration which fails: what has that instrument produced since it was last known to be right? It covers why a due date is not a control, what the two readings on a calibration certificate mean, how to find the suspect results, what happens when a shared instrument goes offline, and whether the calibration record and the booking calendar should be the same system.

Why is "overdue" a warning and not a control?

Because a warning requires somebody to read it, and a control does not. A calibration schedule, whether it is a spreadsheet, a wall chart or a module in the quality system, records when each instrument is next due and shows which dates have passed. The information is correct. What it lacks is any connection to the moment of use. The analyst booking the balance for Tuesday does not look at the schedule; they look at the booking calendar, and the calendar does not know the balance is overdue.

The gap is structural, not a matter of diligence. The schedule is owned by the quality function and reviewed monthly. The calendar is used by the bench and consulted hourly. Two systems, two rhythms, and the instrument sits between them. In a small lab with one quality manager who also runs the bench, the gap is bridged by one person's memory. In any lab larger than that, it is bridged by luck.

A control closes the gap at the point of use. An instrument whose calibration has lapsed, whose service is overdue or which has been flagged after a failed check should not appear as available in the calendar the lab already uses. Anyone who tries to book it should see that it is locked and why, and the lock should lift only when a person with the authority to clear it does so, with their name on the clearance. That is the difference between an accreditation assessor finding a red cell on a schedule and finding a result signed on a locked

instrument. The first is a system working. The second is a nonconformance.

What does as-found versus as-left tell you?

A calibration certificate carries two sets of readings for each test point, and most people read the wrong one. *As-left* is the instrument's reading after any adjustment, and it is the number that says the instrument is fine from now on. *As-found* is the reading before adjustment, and it is the number that says what the instrument was doing for the months before the technician arrived.

For the future, as-left matters. For the past, only as-found does. An instrument found within tolerance and adjusted slightly closer to nominal has been right all along; every result it produced stands. An instrument found outside tolerance and adjusted back has been wrong for an unknown period ending today; every result it produced since the last time it was known to be right is now in question. The as-left reading is identical in both cases. The consequences are not.

> NOTE
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> A calibration record that stores only pass or fail, or only the as-left reading, has thrown away the fact the lab most needs. Ask whether your system records the as-found reading for every test point, compares it to the tolerance, and raises a distinct flag when any point was out of tolerance as found. If it does not, an out-of-tolerance history is invisible the moment the certificate is filed.

The comparison should be arithmetic the system does, not a judgement the technician writes in a comment box. Each test point has a nominal value and a tolerance. Each as-found reading is inside or outside it. An instrument with any point outside is out of tolerance as found, and that verdict should be recorded on the instrument, dated, and visible to anyone who looks at the instrument's history, regardless of what the as-left readings say.

Which results are suspect when an instrument fails as found?

All of them since the last calibration at which the instrument was found within tolerance. The window is often wider than people expect: an annual calibration that fails means twelve months of results, not the few weeks since someone noticed a drift. The lab's obligation is to assess the impact of the out-of-tolerance condition on those results, and the first step of that assessment is knowing which results they are.

This is where most systems fail, because they do not connect the instrument to the results it produced. The calibration record lives in the quality system. The results live in the LIMS or the notebook. The connection between them is a field in which the analyst typed the instrument's identifier, if they did. The list of suspect results is then a search of that field across a year of records, and its confidence is the confidence in a year of typing.

The list should come from the record, not from memory or from a search of free text. Every result should carry a link to the instrument that produced it, as a real reference rather than a typed name, so that the question "what did this instrument produce between these two dates" is a query with a complete answer. Then the impact assessment begins from a list rather than an estimate, affected customers can be identified, and the assessor who asks how the lab knew the scope can be shown the record.

WHAT A FAILED AS-FOUND CALIBRATION SETS IN MOTION

Day 0

The calibration finds one test point outside tolerance as found. The instrument is adjusted and passes as left.

Day 0, same afternoon

The instrument is flagged and locked against booking. The flag names the failed point and the date of the last passing calibration.

Day 1

The system lists every result the instrument produced since that last passing calibration, by sample, method and customer.

Days 1 to 5

The quality unit assesses impact per result, decides what is re-tested, notifies affected customers, and records the conclusion.

On closure

A named person clears the lock. The instrument reappears in the calendar. The whole sequence is on its record.

What happens downstream when a shared instrument goes offline?

Instruments depend on each other more than schedules admit. A gas chromatograph depends on a gas generator. A microbiology suite depends on an incubator and an autoclave. A tensile test rig depends on the environmental chamber it sits in and the reference load cell it is checked against. When the upstream item is locked, the downstream items are unusable, but their own calibration dates are fine and their own calendar entries look available.

So an analyst books the chromatograph, arrives, and finds no carrier gas. Or worse, does not find out, because the generator's fault is intermittent and the run completes with a result nobody knows to doubt. The schedule shows one instrument down. The lab has three.

A system that knows the dependencies can show them. When the upstream instrument is flagged, the downstream instruments that rely on it should appear as unusable too, with the reason pointing back at the

upstream item. The propagation should follow the chain as far as it goes, because a reference standard at the top of a hierarchy can take a dozen instruments with it. The alternative is the quality manager holding the dependency map in their head and walking the lab telling people what not to use, which works until the quality manager is on leave.

Should the calibration record and the booking calendar be the same system?

Yes, or one of them will lie. Everything above depends on the moment of booking knowing the state of calibration, and two systems maintained by two functions on two rhythms cannot guarantee that. A synchronisation between them is a third system with its own failure modes, and when it fails, the calendar shows an instrument available that the quality record shows locked, and nobody can tell which is right.

When the calibration record, the service schedule and the booking calendar are one record on the instrument, the lock is not a synchronisation. It is a property of the instrument that the calendar reads. The schedule can be driven by the calendar as well as the date, so an instrument approaching its service interval by usage count is flagged before the date arrives, which matters for anything whose wear depends on how much it is used rather than how long it has sat. And the history of every booking, every calibration, every lock and every clearance sits in one place, attributed and dated, which is what the assessor asks to see.

The practical test is simple. Name one instrument in your lab that is overdue today, and find out whether anyone booked it this week. If answering that takes two systems and a conversation, the calendar and the calibration record are not the same system, and one of them is wrong about something right now. The accreditation standard asks the lab to ensure equipment is fit for use before it is used. A due date on a schedule does not ensure anything. A lock in the calendar does.

What instrument management carries in this work

LabLynx builds instrument and asset management with scheduling for laboratories whose accreditation depends on proving equipment was fit for use, alongside inventory management for the reference materials and consumables those instruments consume, and instrument integration so the result carries a real link to

the instrument that produced it.

> **How LabLynx handles this**
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> The LabLynx instrument and asset management solution holds the calibration record with as-found and as-left readings per test point, the service schedule by date and by usage, the dependency between instruments, and the booking calendar, as one record per instrument, so a lapsed, overdue or flagged instrument is blocked from booking in the same calendar the lab already uses and a failed as-found result lists what it produced. LabLynx One, the platform this site describes elsewhere, is where that capability is being brought back as a standard part of the product; it is not on the platform's current module list today, and we will tell you that plainly rather than demo it as if it were.

Frequently asked questions

What is as-found and as-left in calibration?

As-found is the instrument's reading at each test point before any adjustment, and it describes how the instrument had been performing since its previous calibration. As-left is the reading after adjustment, and it describes how the instrument will perform from now on. An instrument can pass as-left and still have failed as-found, which means results produced before the calibration are in question.

What should happen when an instrument is found out of tolerance?

It should be flagged and locked against use until cleared, and the lab should identify every result it produced since the last calibration at which it was found within tolerance. Each result needs an impact assessment: whether the error could have changed the reported value. Affected customers are notified, re-tests decided, and a named person clears the lock when the investigation closes.

Can a LIMS block bookings on overdue instruments?

It can when the calibration record and the booking calendar are the same system, so the calendar reads the instrument's calibration state at booking time. A lapsed, overdue or flagged instrument does not appear as available, and the person sees why. Two systems joined by a synchronisation can attempt this, but when it fails the calendar shows available what the quality record shows locked.

How often should lab instruments be calibrated?

At an interval the laboratory sets from the manufacturer's recommendation, the instrument's history of drift, how much it is used and how critical its measurements are, then reviews as evidence accumulates. Accreditation standards require a programme with defined intervals rather than prescribing a frequency. An instrument that repeatedly passes as-found can justify a longer interval; one that fails as-found should have its interval shortened.

What is calibration management software?

Software that holds each instrument's calibration schedule, certificates and readings, its service history and the flags raised against it. The useful kind goes further: it records as-found and as-left readings per test point and compares them to tolerance, blocks booking of lapsed or flagged instruments, shows which downstream instruments an offline item takes down, and links each result to the instrument that produced it.

Sources and references

1. ISO/IEC 17025:2017 General requirements for the competence of testing and calibration laboratories, clause 6.4 Equipment

   International Organization for Standardization

2. 21 CFR 211.68 Automatic, mechanical, and electronic equipment

   Electronic Code of Federal Regulations

3. ISO 10012:2003 Measurement management systems

International Organization for Standardization

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Brandon Holland is LabLynx's Marketing & Operations Digital Solutions Architect. He builds and runs the digital systems behind the company's public surface, from the website and content architecture to the tooling that keeps product information accurate everywhere it appears. He writes about laboratory informatics from the systems side: how lab records get structured, searched, and kept defensible as a lab scales.

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