

## Pumps, Valves & Liquid Handling

### Pipette Service & Calibration A Guide to Accurate and Reproducible Results

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Pipettes are often the foundation of many laboratory processes and experiments, but for many researchers, pipettes require little thought to operate. Because of the simplicity of pipettes, many users overlook the need for maintenance. Like all precision tools, pipettes require regular calibration and maintenance to ensure accurate performance. A leading pipette manufacturer and distributor has accumulated data suggesting that a significant amount of pipettes are not serviced regularly and those that are serviced regularly experience high as found failures due to substandard service providers.

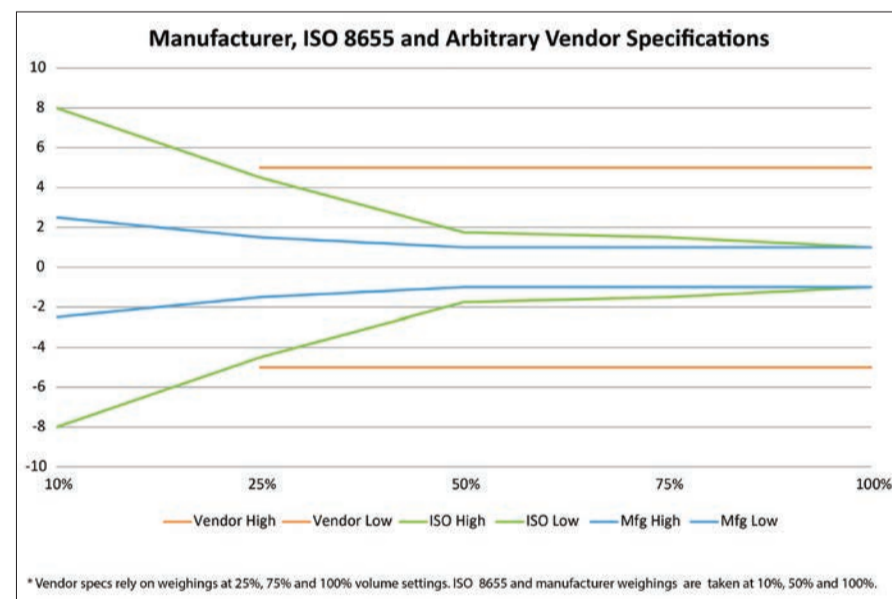
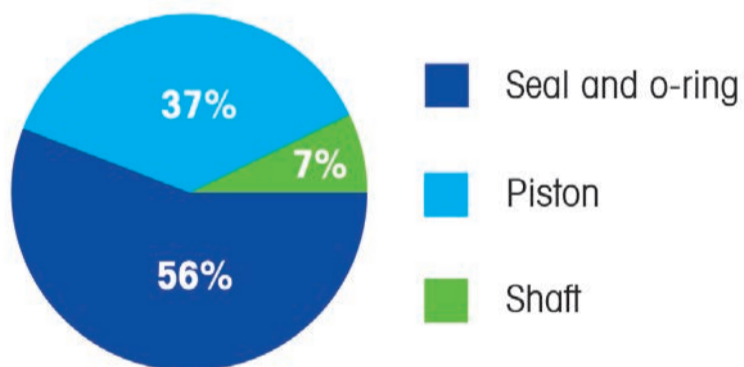


#### What's Hidden Beneath the Surface?

Only a small fraction of pipette failures are evident to end users. It is estimated that 95% of pipette failures can be attributed to one or more components of the pipette's sealing system – compromising the seal, O-ring, shaft and piston. These failures are most commonly caused by tiny cracks in the seal or a buildup of contamination inside the pipette, which can best be detected by a trained technician. A comprehensive preventive maintenance program will proactively replace seals using manufacturer approved parts, re-grease O-rings and pistons and check the shaft for damage, ensuring that the pipette can perform to its designed specifications.

Some service providers define their own pipette specifications, which can only perform to the accuracy they have specified. These specifications are commonly used by onsite service providers due to the challenges of meeting manufacturer or even ISO 8655 specifications in uncontrolled environments. Depending on the pipette and the volume setting, the difference in standards can translate to a likely gap in tolerance of 3% to 5%.

#### Sealing System Failures



#### It Works, But is it Accurate?

Application use may vary, but one factor linking all labs – therefore the most important reason for everyone to regularly calibrate their pipettes – is the need to produce accurate and reproducible data. It all comes down to the accuracy of those tiny amounts of liquid transferred from one vessel to another. In this respect, it is the small, hidden faults that can have the most impact on your results.

A  $\pm 5\%$  variance in performance may be acceptable for one experiment and unacceptable for another. For example, when establishing a standard curve or amplified serial dilution, this inaccuracy could make a fundamental difference to your data or go unnoticed and lead to incorrect results. Inaccurate results can lead to published data being challenged or, at the very least, require that the experiment be repeated multiple times.

#### Equipment also Affects Accuracy

The most common factory-approved method for determining pipette performance uses gravimetric analysis. The weight of water in micro-grams is converted to volume in micro-litres.

Pipettes come in various types and volumes and having the right equipment is essential for accurate calibration. Small volume pipettes like a 2 $\mu$ L or 10  $\mu$ L require a 7-digit balance, while the commonly used 200 $\mu$ L pipette on the other hand will require a 5-digit balance for calibration. And, multichannel pipettes should be calibrated with a multichannel balance, capable of calibrating all channels individually yet simultaneously. Pipette accuracy can be compromised when pipettes are calibrated with improper equipment.

#### Calibration Standard Defines Accuracy Level

The calibration standard used by the service provider will likely be the single most important factor affecting the accuracy of your pipettes. Because calibration standards often vary from one service provider to the next, it is wise to know the differences before selecting a service provider.

Pipettes that are calibrated to manufacturer specifications perform within optimal range as defined by the manufacturer. ISO 8655 is an international standard that governs pipette calibration. Pipettes calibrated under ISO 8655 standards – regardless of brand – may be greater than the manufacturer specified performance. When calibrating a pipette to the manufacturer specifications or ISO 8655 standards, environmental conditions must be taken into account.

#### Standard Balance Sensitivity

Nominal pipette volume	Sensitivity (g)	Display
2 $\mu$ l, 10 $\mu$ l	10 <sup>-7</sup>	0.0000 mg
20 $\mu$ l, 25 $\mu$ l, 50 $\mu$ l	10 <sup>-6</sup>	0.000 mg
100 $\mu$ l, 200 $\mu$ l, 250 $\mu$ l, 300 $\mu$ l	10 <sup>-5</sup>	0.00 mg
1ml, 2ml, 2.5ml, 5ml, 10mL	10 <sup>-4</sup>	0.0 mg

Note: These guidelines are based on the Procedure for Evaluating Accuracy and Precision of Rainin Pipettes.

## Pipette Service Saves Time and Money

Recent data from two of the nation's largest pharmaceutical companies have estimated the cost of each individual pipette failure to be at least \$11,000 per incident. Such costs can easily reach millions of dollars for FDA regulated products, which can also be subject to mandatory recalls.

Unfortunately, the costs and hassles associated with pipette failures are not limited to those facing government regulations. Whether you're working with precious samples or expensive reagents, organising a protocol can take weeks to setup and starting over multiple times is undesirable. Even for those who are just trying to publish a paper, repeating an experiment multiple times can be costly and time consuming. The only way to minimise the waste of valuable resources is to ensure that your pipettes are calibrated and serviced regularly.

## Selecting a Pipette Service Provider

Your service provider can have a big impact on the success of your experiments, so knowing what to look for, and what questions to ask, will save you time, money, and minimise your liability.

Five points to consider before selecting a service provider:

**1. Audit the service provider** – Everyone dreads an audit, but not as much as a bad service provider. Once onsite, you can ask to see the inventory of parts, balances, training records, maintenance records and service databases. You can also demand an audit from an accredited onsite service provider – a physical lab is required in order to obtain accreditation.

**2. Compare measurement uncertainties** – Measurement uncertainties establish the performance you can expect from the service provider. You can download a free copy directly from the accrediting bodies. Use it to compare scope and performance of other service providers. Another important factor to keep in mind is that the accreditation level of some service providers is limited to 2µL or even 5µL. Such an accreditation should in theory bar the service provider from servicing pipettes from 2µL to 25µL.

**3. Manufacturer parts** – Unfortunately, many pipette parts currently on the market have been re-engineered. These parts are developed and manufactured by third parties without proper specs. Such parts will alter the performance of your pipette and ultimately jeopardise your data. Ask the service provider to show proof of purchase for all parts, directly from manufacturers.

**4. Quality standards** – Ask how the service provider ensures quality service. Is the company ISO 9001 accredited? What protocols are in place for technician training and certification? Does the company have a disaster recovery plan? What safety measures do they have in place to prevent technicians from creating fictitious calibrations analysis?

**5. Know what you are paying for** – It's fair to say that 'you get what you pay for', so be sure to ask what is not included in the price quoted. Many providers offer low upfront costs, and then charge extra for parts, labour and shipping, which can double the price.

Finally, consider these three red flags before making your decision.

- Lack of an ISO 17025 accreditation
- No warranty or a warranty that is less than 6 months
- Extraordinary claims such as no as found failures

## Frequency of Service Should Match Your Needs

Most pipette manufacturers recommend service and calibration at least once per year. If your application depends on rare samples, costly procedures or subjected to routine audits to comply with regulatory guidelines, it is recommended to service your pipettes more frequently. Your Metrology or Quality departments should provide frequency guidelines for pipette service and calibration given your specific application. But if not, ask yourself: how many weeks or months of data would you be willing to risk?



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## Miniature Inert Solenoid Valve Protects Sensitive Fluids

Rapid and precise dispensing of aggressive and sensitive fluids is a critical requirement in many OEM applications and miniature component specialists **Lee Products** have an outstanding reputation for developing solenoid valves which excel in these situations. Their LFY2 Chemically Inert Solenoid Valve is a good example of this as a recent addition to their field-proven Y-Valve range.

This 3-way inert, zero-dead volume solenoid valve features an innovative 'Y' internal flow design that reduces the internal volume to a total of just 12 microlitres. This design also provides a clean, flushable flow path which reduces, or eliminates carry over between fluids and helps to protect fragile samples. In addition the valve's balanced actuation virtually eliminates pumping effects, which is common to diaphragm valves.

The electrical interface of the valve provides secondary connector retention and is compatible with standard AMP® connectors. Available in 12 and 24 VDC operating voltages and with either 062 MINISTAC or standard ¼ - 28 flat bottom fluid connections the LFY2 requires a small footprint of just 77mm L x 26mm W. The valve has a response time of less than 30 ms and is designed for long and reliable operation of over 5 million cycles. Custom configurations, including wetted materials and porting configurations are available to suit specific OEM applications.

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