



BEYOND THE STICKER AND THE CERT (ENSURING BETTER MEASUREMENTS & REDUCING RISK)

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HOUSEKEEPING

- **Session Length 60 minutes (including Q&A)**
- **Enter your questions in Chat**
- **Q&A at the end of the presentation**



Metrology 2017

Measurements for transport



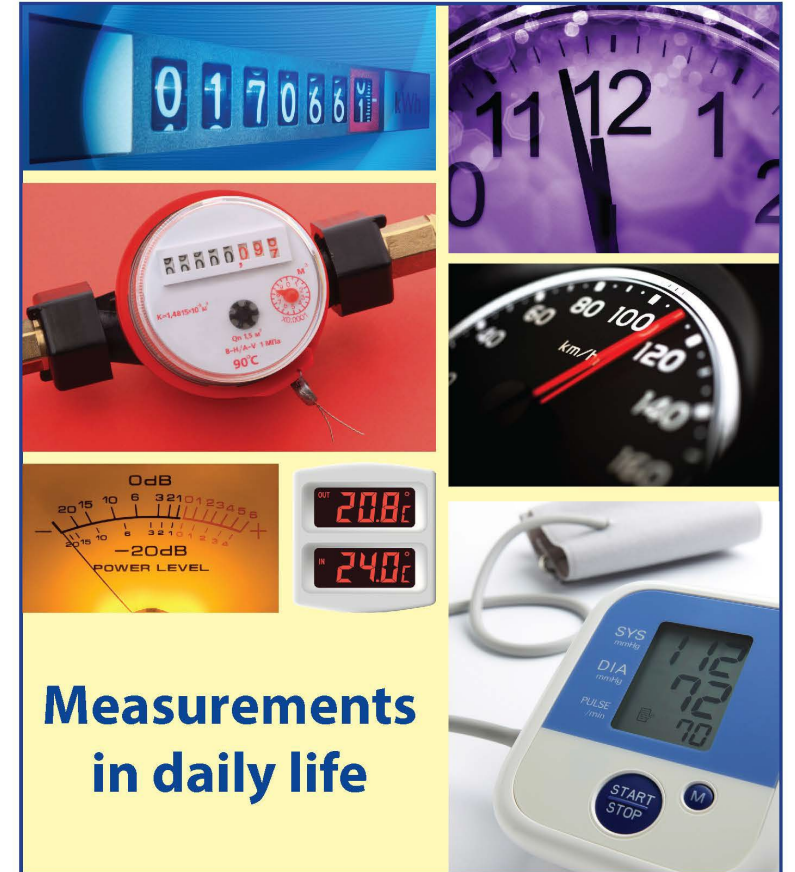
Bureau
International des
Poids et
Mesures



INM
Instituto Nacional de Metrología
de Colombia

World Metrology Day
20 May
www.worldmetrologyday.org

Metrology



Measurements in daily life



World Metrology Day
20 May
www.worldmetrologyday.org



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LEARNING OBJECTIVES



**CALIBRATION
WHAT & WHY**



**INTERPRET
CALIBRATION
CERTIFICATES**

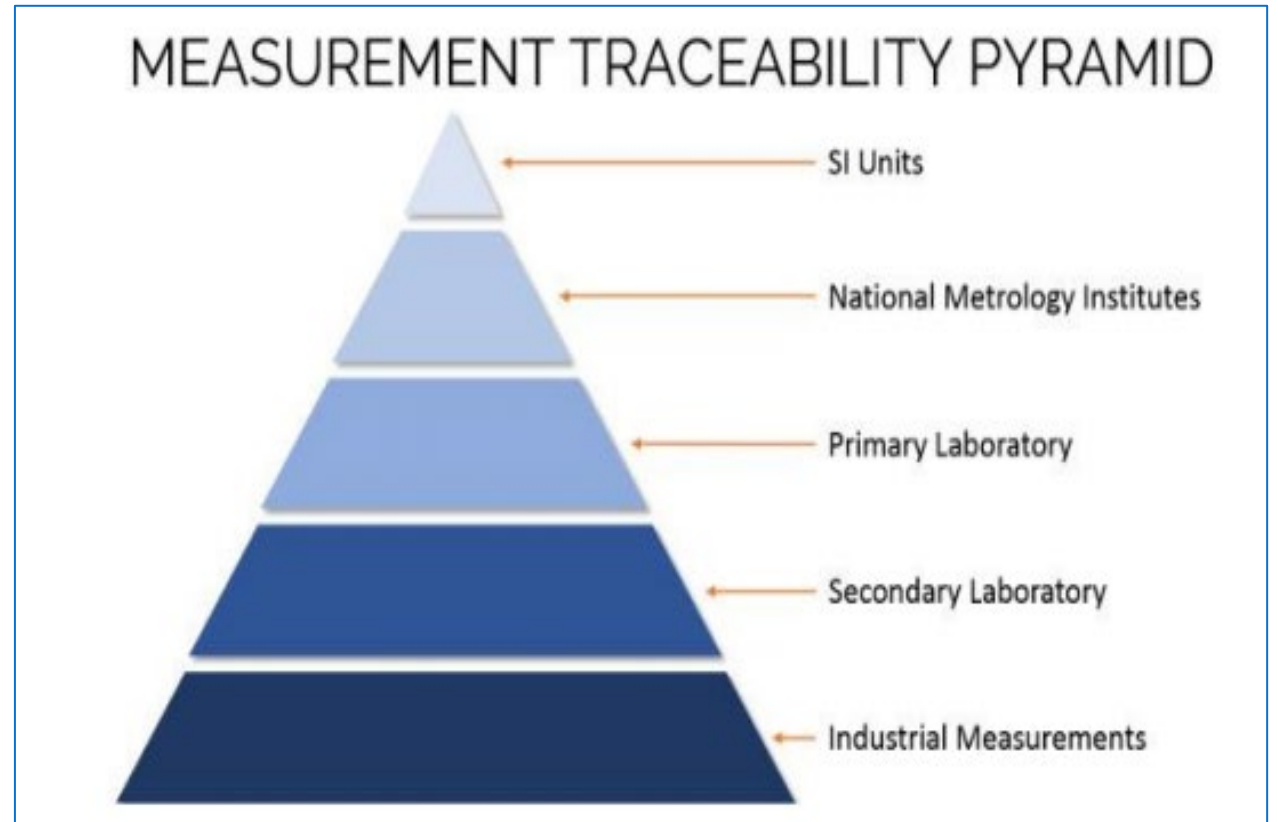


**ENSURE BETTER
MEASUREMENTS
AND
REDUCE RISK**

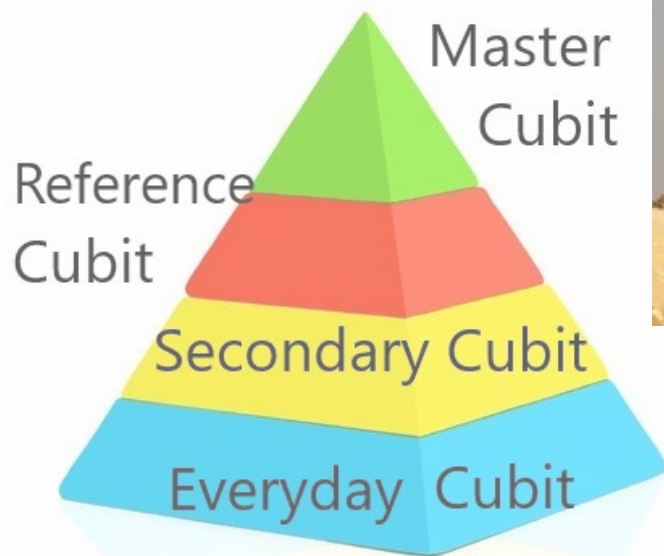
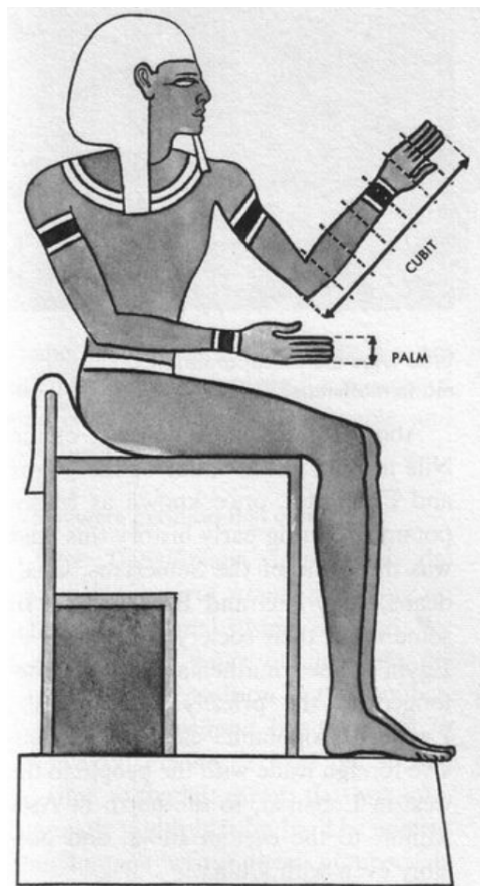
CALIBRATION = COMPARISON



CALIBRATION (METROLOGICAL) TRACEABILITY



CALIBRATION (METROLOGICAL) TRACEABILITY



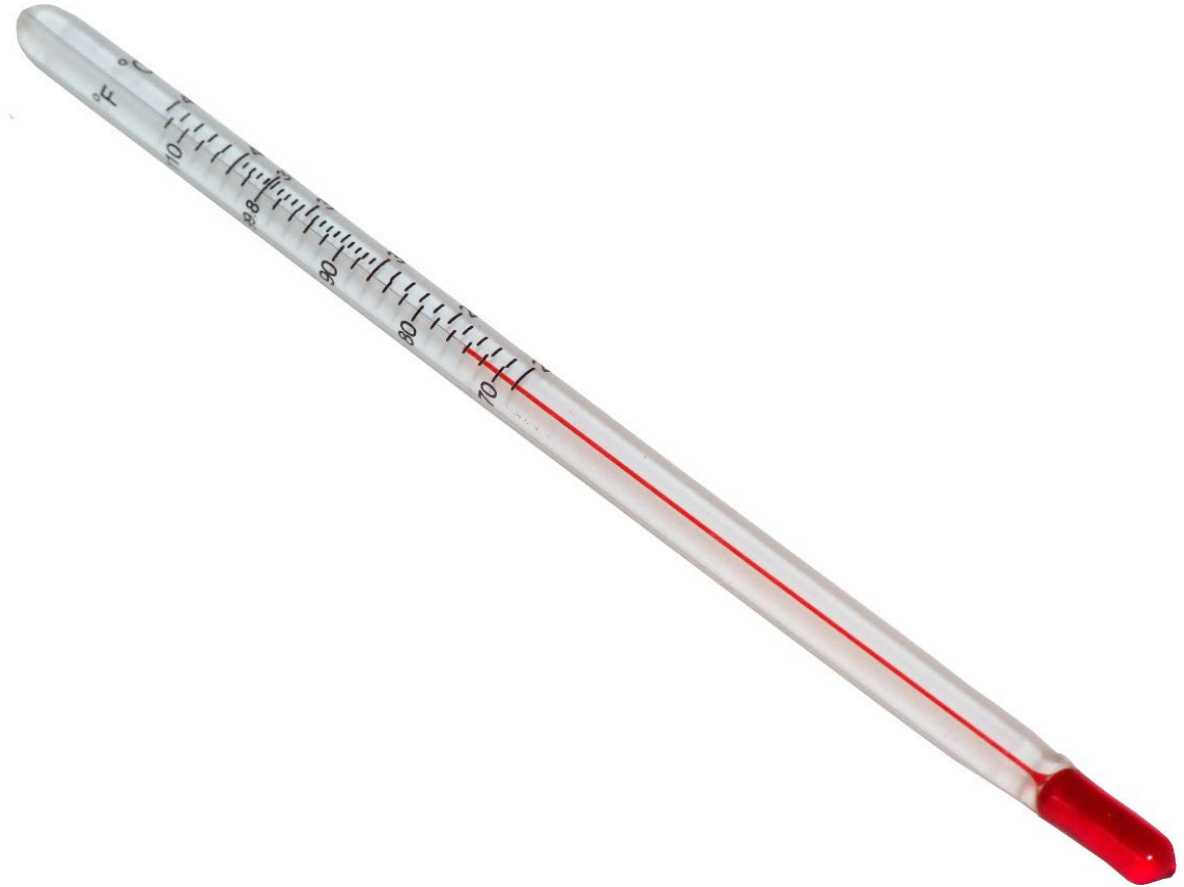
<0.05% Error

CALIBRATION MYTH

ADJUSTMENT



WHY NOT ADJUSTMENT?



WHY CALIBRATE?

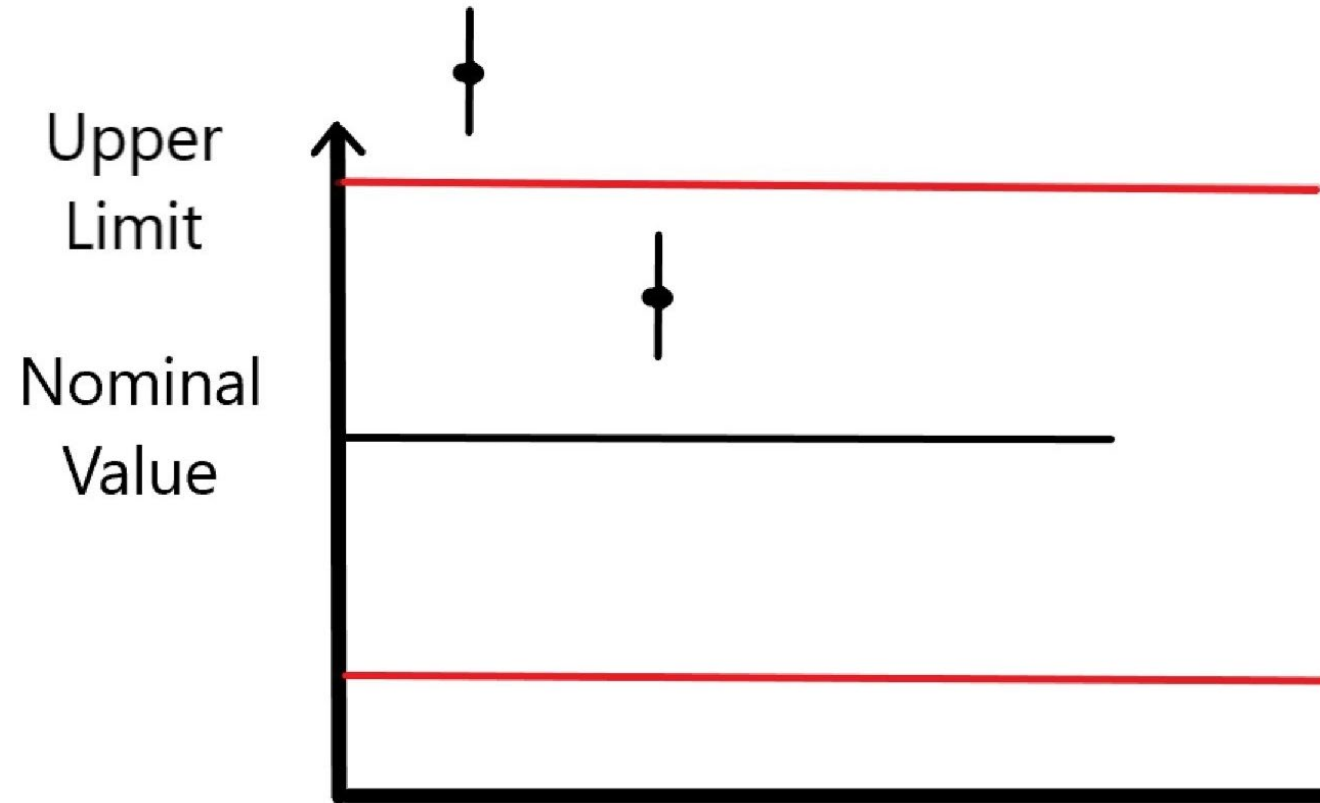


REDUCE RISK OF OUT-OF-TOLERANCE

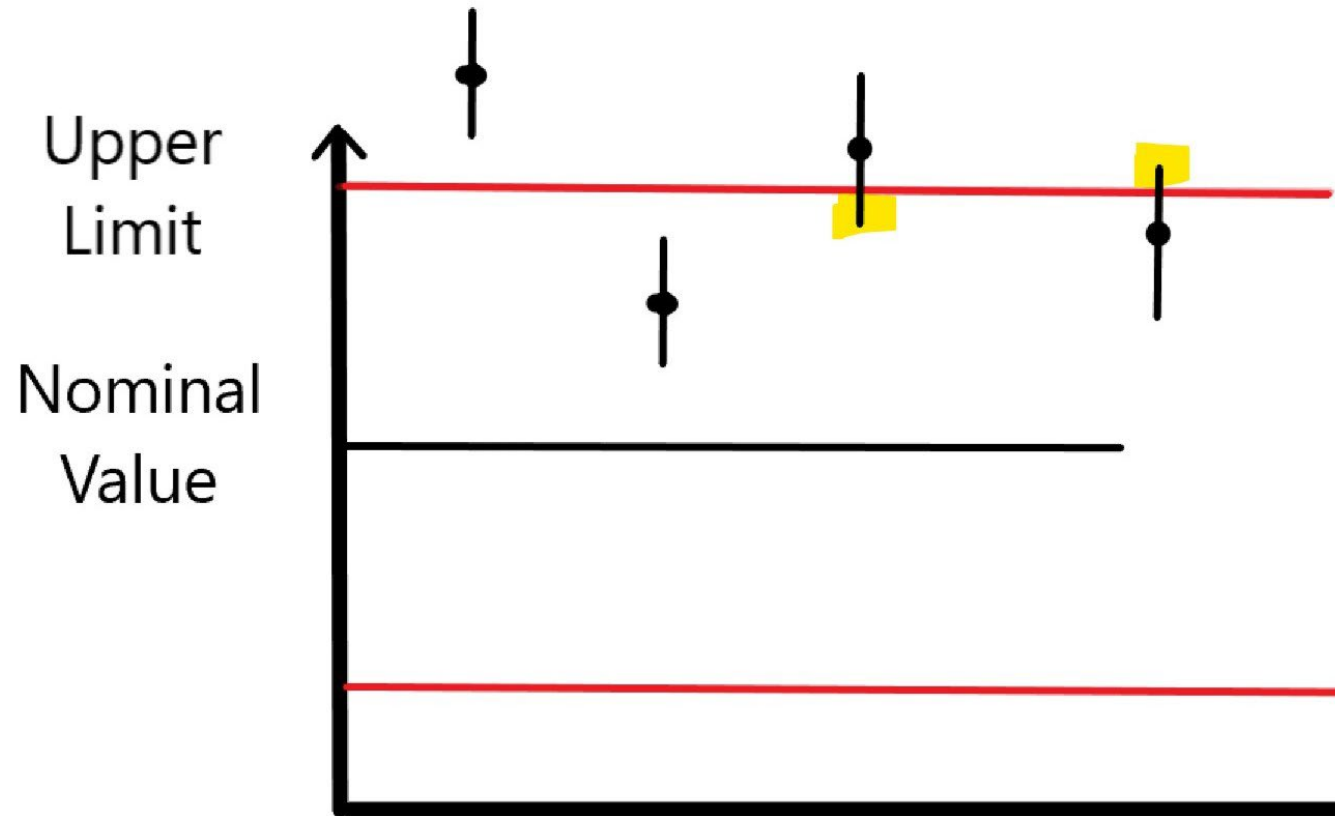
MEASUREMENT ERROR



UNDERSTANDING PASS / FAIL



UNDERSTANDING PASS / FAIL



OUT-OF-TOLERANCE IMPACTS



RECALIBRATE



**Instrument degrade or change
*with or without use***

WHAT IS ISO/IEC 17025?

ISO/IEC 17025:2017

General Requirements for the

Competence

of Testing & Calibration Laboratories

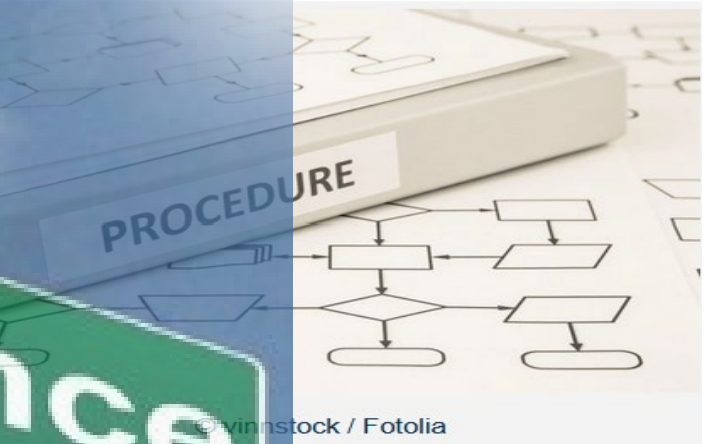
ISO 9001:2015 Quality Management Systems – Requirements

ACCREDITATION



17025:2017
ACCREDITED
LABORATORY

ISO/IEC 17025 ACCREDITATION



LEVELS OF CALIBRATION CERTIFICATES

- ***With Data and Uncertainties***
ISO/IEC 17025-accredited
- ***With Data***
- ***No Data (Inspection)***

ISO/IEC 17025 ACCREDITED CALIBRATION CERTIFICATE

XYZ Calibrations, Inc.



Certificate #0000.01

Certificate of Calibration

Certificate Number: **19435730**

ABC Company, Inc.
1111 MainStreet, Othertown, MN 59123 515-555-5555

Order Number: **15948**
Customer PO: **2021-R2D2**

Gauge Number: **A1-112**
Gauge Desc: **0 to 100 psi x 2 psi Dial Pressure Gage**
Manufacturer: **Pressure Good**
Model Number: **PG-100-2**
Serial Number: **8674309**

Date Received: **2021-09-08**
Calibration Date: **2021-09-13**
Cert. Issued Date: **2021-09-14**
Next Calibration: **2022-03-14**

As Found Condition: **In Tolerance**

Checked box indicate this calibration was performed at the customers facility.

Calibration was performed in accordance with XYZ Company Procedure AB333 and relevant sections of ASME B40.100 Standard. This calibration complies with the ANSI/NCSL Z540-1 and ISO/IEC 17025 Standards.

XYZ Company, Inc maintains measurement results are traceable to the International System of Units (SI) through National Institute of Standards and Technology (NIST), other authorized national metrology institute, consensus standards, or natural physical constants. Results shall not be reproduced, except in full, without the written approval of XYZ Company, Inc. Results relate only to the item(s) calibrated. Any number of factors may cause the calibration item to drift out of calibration before the recommended interval has expired.

The calibration measurement uncertainty, U_{max} , is expressed at approximately 95% level of confidence where $k = 2$. Statement of compliance made without consideration to the effect of uncertainty unless otherwise specified. In Tolerance stated when results are \leq specified tolerance limits, Out of Tolerance stated when results are $>$ specified tolerance limits.

Standards Used:	Cal. Date	Due Date	NIST Number
Pressure Tester ID# ABC1035	2020-11-28	2021-11-28	# A5A6H2ESAHH24
Temp/RH/Pressure ID# GG5678	2021-04-02	2021-10-02	# A8B6C7D5E3F0G9

Environmental Conditions during calibration: 23 °C, 33%RH, 99.2 kPa

CALIBRATION RESULTS:

As Found		Units = PSIG			
Ref Std	UUT	Difference: % of Span	Tolerance % of Span	In / Out Tolerance	U_{max}
0.02	0	-0.02	3	In	0.59
24.04	25	0.96	3	In	0.59
49.11	50	0.89	2	In	0.65
74.23	75	0.77	2	In	0.71
99.12	100	0.88	3	In	1.2
73.93	75	1.07	2	In	0.71
48.64	50	1.36	2	In	0.65
23.67	25	1.33	3	In	0.59
0.02	1	0.98	3	In	0.59

Comment: No Adjustments.

As Found = As Left

Performed and Authorized By: Toni Tiger, Calibration Technician

Title:

Certificate of Calibration

Certificate
Number:

Certificate Number: **19435730**

Cal Lab Name
& Address:

XYZ Calibrations, Inc.

123 Main Street, Anytown MN 56789
Telephone: 515-555-1234, Fax: 515-555-5678
www.xyzcalibrations.com

Customer Info:

ABC Company, Inc.
1111 Main Street, Othertown, MN 59123
515-555-5555

Where Calibrated:

Checked box indicate this calibration was performed at the customers facility.

Number of Pages or End of Report:

Page: 1 of 1

Item Being Calibrated:

Gauge Number: A1-112
Gauge Desc: 0 to 100 psi x 2 psi
Dial Pressure Gage
Manufacturer: Pressure Good
Model Number: PG-100-2
Serial Number: 8674309

Important Dates:

Date Received: 2021-09-08
Calibration Date: 2021-09-13
Cert. Issued Date: 2021-09-14
Next Calibration: 2022-03-14

Accreditation Symbol or Statement



ILAC Mutual Recognition Arrangement (MRA)



“Tested Once, Accepted Everywhere”

<https://ilac.org/ilac-mra-and-signatories/>

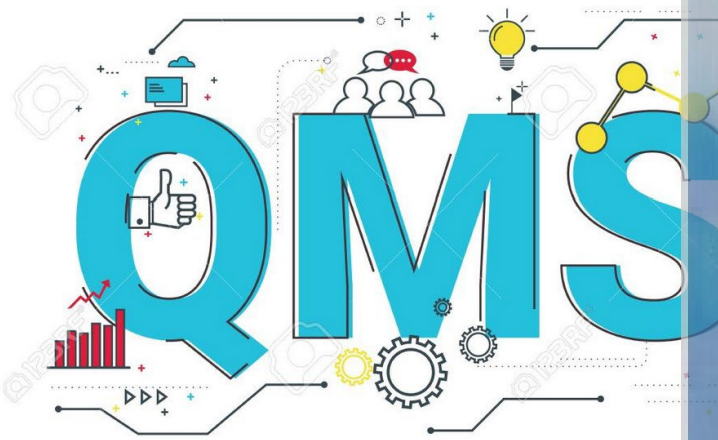
Accreditation Bodies



ACCREDITATION COFRAC N° 2-6637
Portée disponible sur www.cofrac.fr



ISO/IEC 17025 ACCREDITATION



Statement of Traceability:

XYZ Company, Inc maintains **measurement standards whose results are traceable to the International System of Units (SI)** through National Institute of Standards and Technology (NIST), other authorized national metrology institute, consensus standards, or natural physical constants.

Calibration Method:

Calibration was performed in accordance with XYZ Company Procedure AB333 and relevant sections of ASME B40.100 Standard.

Limits of Reproduction:

Results shall not be reproduced, except in full,
without the written approval of XYZ Company, Inc.

Results Apply To:

Results relate only
to the item(s) calibrated.

Reference Standards

Standards Used:

Pressure Tester ID# ABC1035

Cal. Date

2020-11-28

Due Date

2021-11-28

NIST Number

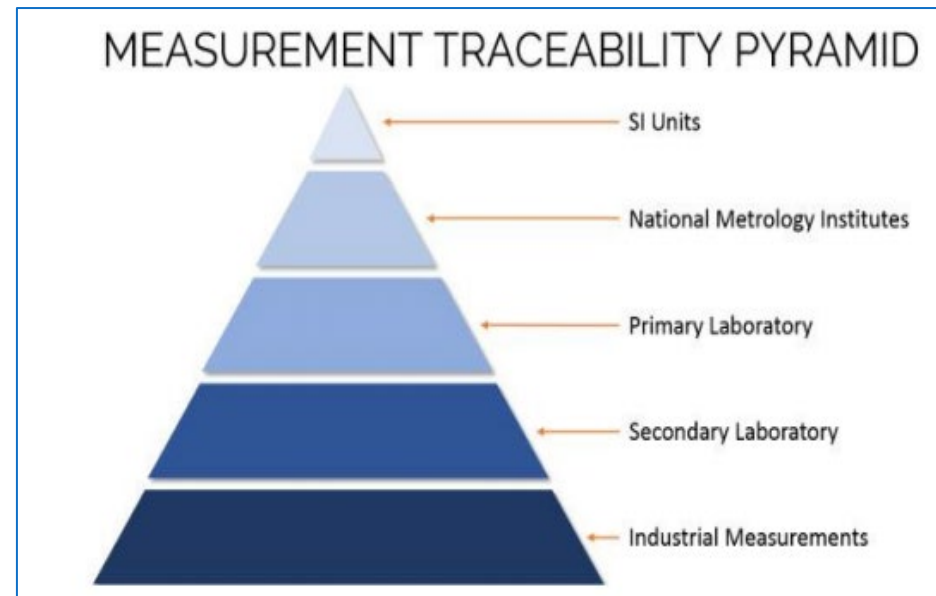
A5A6H2ESAHH24

Temp/RH/Pressure ID# GG5678

2021-04-02

2021-10-02

A8B6C7D5E3F0G9



Environmental Conditions

Environmental Conditions during calibration: 23 °C, 33%RH, 99.2 kPa



Units of Measurement

Span / Full Scale: 100

Units – PSIG



Tolerance Limits

(Span / Full Scale: 100 psig)

Tolerance:

up to 25 psig, 3% of span

25 to 75 psig, 2% of span

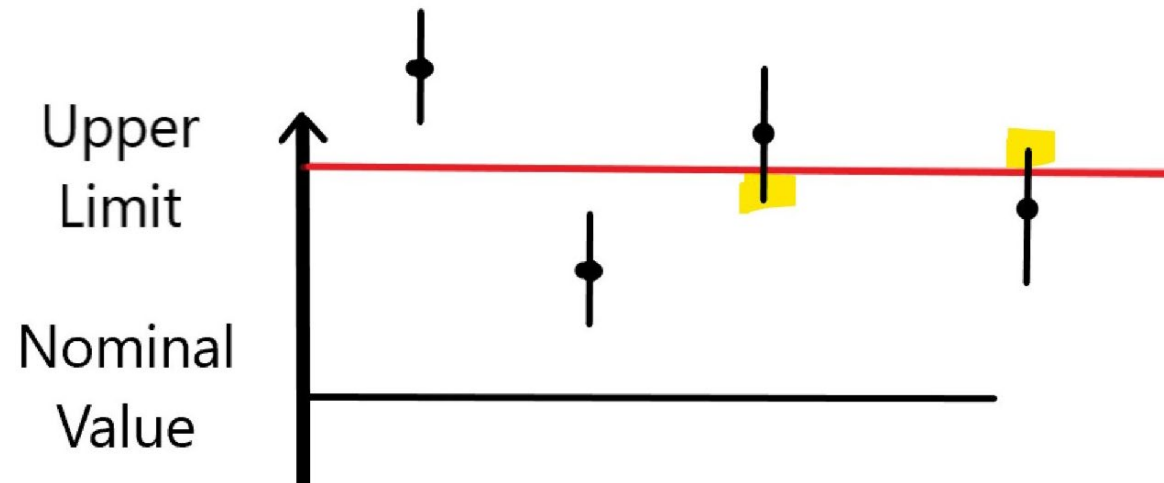
75 to 100 psig, 3% of span

Decision Rule:

Statements of compliance made **without** consideration to the effect of uncertainty.

In Tolerance stated when results are \leq specified tolerance limits,

Out of Tolerance stated when results are $>$ specified tolerance limits.



Calibration Data

As Found

Units = PSIG

Ref Std	UUT	Difference:	Tolerance	In / Out	U_{meas}
		% of Span	% of Span	Tolerance	
0.02	0	-0.02	3	In	0.59
24.04	25	0.96	3	In	0.59
49.11	50	0.89	2	In	0.65
74.23	75	0.77	2	In	0.71
99.12	100	0.88	3	In	1.2
73.93	75	1.07	2	In	0.71
48.64	50	1.36	2	In	0.65
23.67	25	1.33	3	In	0.59
0.02	1	0.98	3	In	0.59

Comment: No Adjustment Necessary.

As Found = As Left

Uncertainty of Measurement

The calibration measurement uncertainty, U_{meas} , is expressed at approximately **95% level of confidence where $k = 2$**

As Found		Units = PSIG			U_{meas}
Ref Std	UUT	Difference: % of Span	Tolerance % of Span	In / Out Tolerance	
0.02	0	-0.02	3	In	0.59
24.04	25	0.96	3	In	0.59
49.11	50	0.89	2	In	0.65
74.23	75	0.77	2	In	0.71
99.12	100	0.88	3	In	1.2
73.93	75	1.07	2	In	0.71
48.64	50	1.36	2	In	0.65
23.67	25	1.33	3	In	0.59
0.02	1	0.98	3	In	0.59

Comment: No Adjustment Necessary.

As Found = As Left

“K=2” & “95% CONFIDENCE”

k = standard deviation

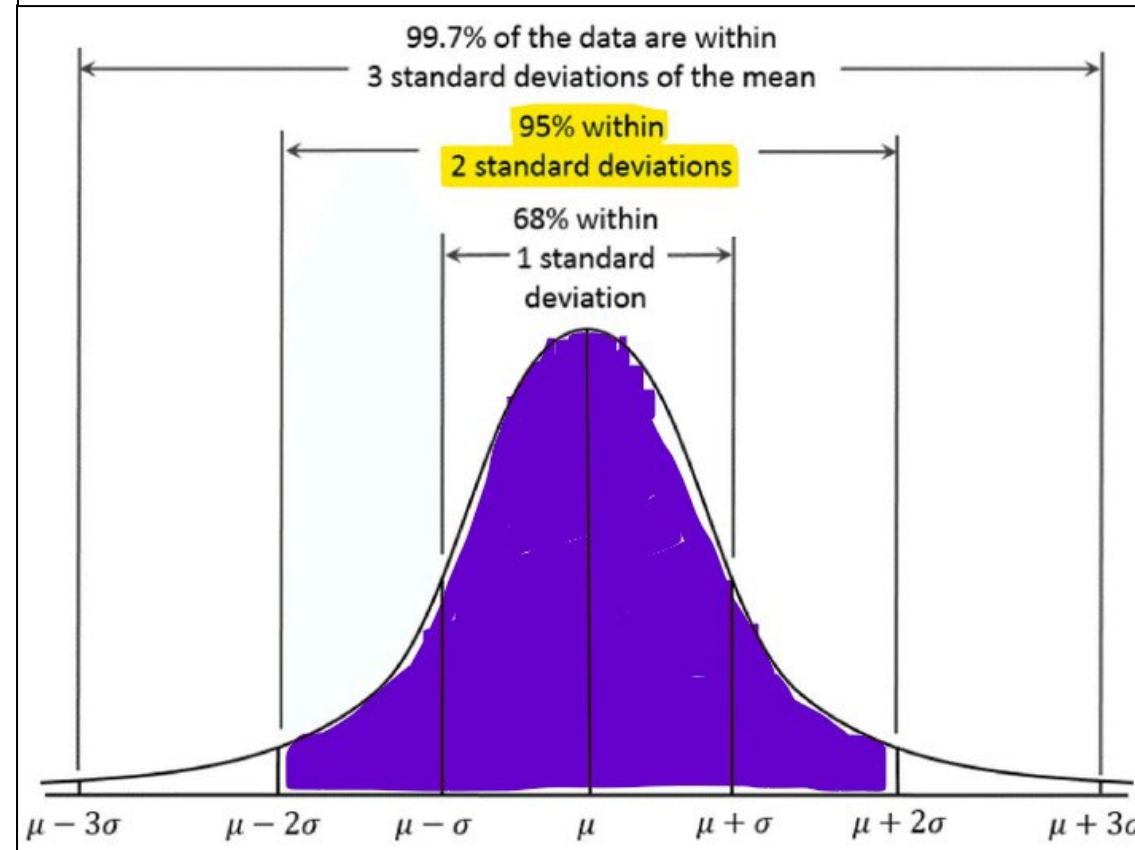
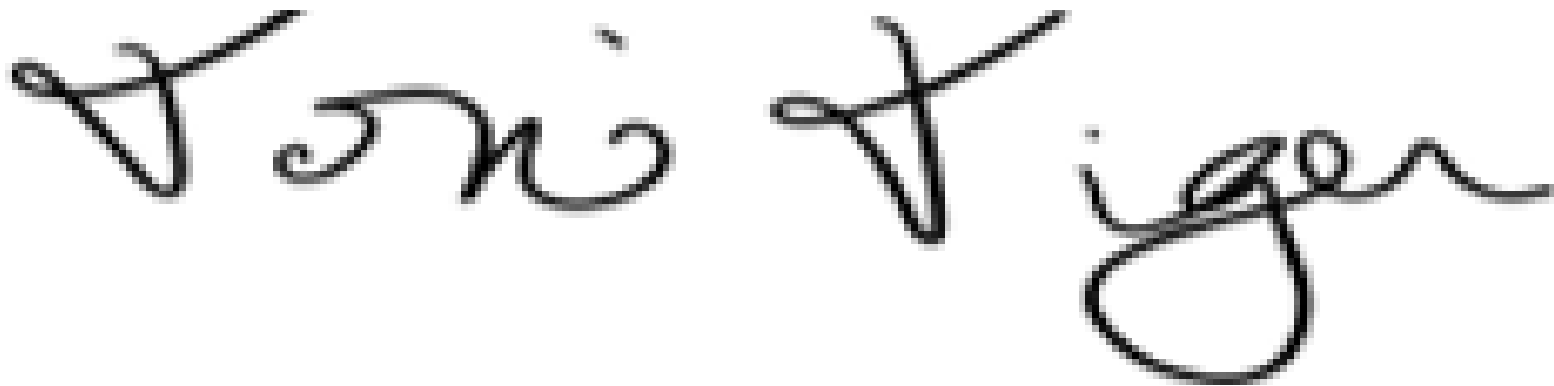


Image credit: [CC BY-SA](#)

Certificate Authorized By:

Performed and Authorized By:

A handwritten signature in black ink that reads "Toni Tiger". The signature is written in a cursive style with a large, looped 'T' at the beginning and a long, sweeping tail on the 'g'.

Toni Tiger, Calibration Technician

CALIBRATION CERTIFICATE WITH DATA

NOT Accredited

CALIBRATION CERTIFICATE WITH DATA

QUALITY CONTROL CERTIFICATE

The enclosed liquid handling instrument has been manufactured in a facility that employs a registered and certified quality management system.

This system ensures that the development and production of this product has been strictly controlled and that it meets the highest quality standards.

Each instrument passes stringent validation and Control Procedures in accordance with EN ISO 8655.

Model: VWR UHP VE1000
 Serial: 659060553
 European Article #: 613-1493
 North American cat.#: 89130-566
 Date: 2016-06-29
 Tested by: C19
 Status:

Volume (µl) : 100
 Accuracy (%) : 0.2327
 Precision (%) : 0.1530

Volume (µl) : 1000
 Accuracy (%) : 0.2862
 Precision (%) : 0.0667

Passed

Passed

Calibrated and tested using the gravimetric method with distilled water:

Condition of measurements:

Basis of adjustment: Ex; Reference temperature: 20°C; Relative air humidity: 50%; Barometric pressure: 101kPa

CALIBRATION CERTIFICATE

WITH DATA

PART 1

CALIBRATION REPORT

Report Number:	9231564010716
Date Issued:	Jan 07, 2019
Tape Serial Number:	9231564
Tape Size:	0.75 to 7 inch O.D.

About this Calibration

Temperature	68 °F ± 2 °F	
Relative Humidity	45 % ± 15 %RH	
Tension	5 lb	
Tape Tolerance	Within 0.001 inch	Within Mfg Tolerance
Uncertainty of Measurement	± 0.00025 inch	

Calibration Performed by: Johnny Mathis

WITH DATA - PART 2

Actual Findings and Procedure Numbers

Tape Reads	4.9000	Over 4.9000 inch	Procedure 1
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Calibration Equipment Used

Gage	Serial Number	Test Date	Due Date	NIST Traceable Report Number
4.9 inch	102098	Apr 08, 2018	Apr 08, 2019	101113-1

This tape has been checked at one or more points over a calibrated measuring standard.
Calibration performed in accordance with ISO/IEC 17025:2017

All standards are traceable to the National Institute of Standards and Technology (NIST)

**This calibration report shall not be reproduced, except in full
without the written approval of the issuing laboratory**

Results listed relate only to the item being calibrated.

A-Round Tuit Calibration Lab

12345 Circle Drive, Sphere City, OR 88589 USA

888-867-5309 www.bettermeasurements.com

Page 1 of 1

SIMPLE CERT: NO DATA

*Certificate of
Conformance & Accuracy*

This thermometer identified by Serial No. 3753
was verified by **direct comparison** to high precision temperature
calibration equipment whose accuracies are **traceable to the**
National Institute of Technology (NIST), formerly the National
Bureau of Standards (NBS) and/or Natural Physical Constants (Intrinsic
Standards): and was **found to be within Barnstead International**
specifications.

The standard Serial No. is **04924**

Certification Date DEC 08 2005



[Signature]

Michael P. Regan,
Director of Regulatory Affairs/Quality Assurance
Barnstead International
2555 Kerper Boulevard, Dubuque, IA 52001 U.S.A.
Phone: 800-453-7826 • Fax: 563-589-0516
Web: www.barnstead.com
calibration@barnstead.com

CC-100-1 • 3/04

SUMMARY OF CAL CERT LEVELS

Calibration Certificate Requirements	ISO 17025-accredited	Standard (Traceable)	Simple
Report Title	☑	☑	☑
Cal Lab Name & Address	☑	☑	☑
Description/Unique ID of Equipment Calibrated	☑	☑	☑
ID Who Authorized Report	☑	☑	☑
Calibration Date(s)	☑	☑	☑
Statement of Conformity (where relevant)	☑	☑	⊕
Decision Rule when Making Conformity Statement	☑	?	?
ID of Method Used	☑	☑	⊕
Reference Standards	⊕	☑	⊕
Report Unique ID	☑	☑	?
Clear Identification of Report End	☑	☑	?
Customer Name & Contact Info	☑	☑	?
Statement: How Measurements are Metrologically Traceable	☑	☑	?
Results, with Measurement Units	☑	⊕	?
Environmental Conditions	☑	⊕	?
Calibration Data	☑	⊕	?
As Found and, if adjusted, As Left Data	☑	⊕	?
Date of Receipt (where critical)	☑	?	?
Date of Report Issue	☑	?	?
Location Calibration Performed	☑	☑	?
Statement: Results Only Apply to Item Calibrated	☑	?	?
Deviations from method	☑	?	?
Clearly ID of Results From Subcontractor	☑	?	?
Measurement Uncertainty	☑	☑	?
Accreditation Logo/Statement	☑	no	no
Meets ISO/IEC 17025 requirements?	☑	?	no
Metrological Traceability ensured?	☑	?	?

LEGEND

- ☑ Included
- ⊕ Optional
- ? Unknown



I Read Cal Certs!

BEYOND THE CHECKLIST



$$\sigma = \sqrt{\frac{\sum_{i=1}^N (x_i - \mu)^2}{N - 1}}$$

CALIBRATION LABEL STICKER

CALIBRATION	
I.D. NO. _____	
BY _____	DATE _____
DUE _____	



OTHER THOUGHTS

Where to Calibrate?

Calibrate Before/After Moving?

Calibration Intervals?

RECAP LEARNING OBJECTIVES



**CALIBRATION
WHAT & WHY**



**INTERPRET
CALIBRATION
CERTIFICATES**



**ENSURE BETTER
MEASUREMENTS
AND
REDUCE RISK**

www.asq.org/membership

Questions?

Future Topics?



North Jersey
Section

The Global Voice of Quality™



Measurement
Quality Division
Excellence Through Quality™



BEYOND THE STICKER & THE CERT (ENSURING BETTER MEASUREMENTS & REDUCING RISK)

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