PRECISION MEASUREMENTS, INC.	CALIBRATION PROCEDURE Force Gages	PMI-0019-390 REV. B Page 1 of 4
APPROVALS	**PRINT/SIGNATURE**	**ORIGINAL ISSUE**
PREPARED BY	**G. Zalace /**	**07/09/25**
METROLOGY MGR./SUPV.	**R. Ayala /**	**03/10/90**
TECHNICAL OPERATIONS	**R. Ayala /**	**03/10/90**
DOCUMENT CONTROL	**P. Kirsch /**	**03/10/90**

REVISION NO.	DESCRIPTION	DATE	PREPARED BY	APPROVED BY
A	Revised to include reference to ISO/ANSI standards and clarify procedural steps.	04/17/02	R. Bahrs	R. Ayala
B	Added requirement to consider Gravity Correction Factor with instructions on how to calculate and apply.	07/09/2025	G. Zalace	F. Loza

1.0 PURPOSE

1.1 To establish a comprehensive procedure for the calibration of Force Gages in accordance with ISO/IEC 17025, ANSI/NCSL Z540, and/or customer requirements.

2.0 SCOPE

2.1 This procedure includes basic instructions for the calibration and performance testing of Force Gages.

2.2 This procedure includes the testing of essential instrument parameters.

2.3 Tolerances are according to individual manufacturer specifications, or as designed by the applicable customer.
Note: Certain, specific procedural elements contained in this procedure may be omitted or altered according to individual customer designated requirements.

2.4 From this point forward the Test Instrument will be referred to as the "TI".

3.0 STANDARDS

3.1 The following listed standards are representative of those required to perform the calibration outlined in this procedure and which are available at Precision Measurements, Inc.

DESCRIPTION	MANUFACTURER	MODEL #
Load Cell	Morehouse	HADI
Weight Set	Rice Lake	1 lb to 558 lb
Weight Set	Troemner	1 mg to 100 g
Weight Set	Ohaus	1 mg to 100 g
Weight Set	Ohaus	100 g to 2 Kg
Weight Set	Fairbanks	5 Kg to 50 Kg

4.0 TEST CHARACTERISTICS

INSTRUMENT CHARACTERISTIC	PERFORMANCE SPECIFICATION
Linearity	Manufacturer or Customer Specification
Force	Manufacturer or Customer Specification

5.0 PRELIMINARY OPERATION

5.1 Check the TI for damage and basic operating performance. Any observed damage and/or performance malfunction(s) shall be recorded on the service documentation.
Note: Any damage degrading the performance of the instrument and/or malfunction(s) detected at any point in the process described in this procedure must be corrected prior to proceeding with the calibration process herein described.

5.2 Clean TI with either M-1 spray (all-purpose lubricant) or mild detergent. Ensure that the Pinion Rods are clean and dust free. Check for any damage. Any damages should be noted on the Certification Data Report.

5.3 Verify TI operation by applying force in the plus (+) and minus (-) directions. The TI should return to zero.

5.4 For using mass weights, determine if Gravity Correction Factors must be used by following steps in Appendix A.

6.0 PROCEDURE

6.1 Once this procedure is started, all Out of Tolerance conditions are to be recorded. Continue to the end prior to attempting any adjustment or repair.

6.2 For using mass weights, position the TI perpendicular to the floor.

6.3 For using the Morehouse HADI Load cell, setup the TI within the measurement system.

6.4 Set zero on the TI.

6.5 Apply load equal to 25%, 50%, 75%, and 100% of scale. This will determine the linearity of the TI. At each point also verify the reading is within the manufacturer or customer specification as applicable.

7.0 DOCUMENTATION

7.1 Record the calibration results including quantitative data, if required, in accordance with Precision Measurements, Inc.'s Operational Procedures and customer requirements, as applicable.

APPENDIX A – GRAVITY CORRECTION FACTOR (GCF)

1. Local gravity may introduce unacceptable errors in the calibration of force gages when using standard weights. When the % difference between the Local Gravity and the Standard Gravity is > 20% of the UUT accuracy, the GCF must be used to determine the actual force applied. If the % Difference is ≤ 20% of the UUT accuracy and the Test Uncertainty Ratio (TUR) is ≥ 4:1, the GCF does not need to be used. If the TUR is < 4:1, the GCF must be used regardless of the % Difference value.

2. Terminology:

   GCF = Local Gravity / Standard Gravity

   Force = Mass x (Local Gravity / Standard Gravity)

   Standard Gravity = 980.665 cm/sec^2

3. Find Local Gravity value for your location by accessing NOAA website at https://geodesy.noaa.gov/datasheets/index.shtml. Select NGS Map and enter address of your location at top left. Once your location is identified on map, zoom in or out as necessary to locate nearest geodetic survey marker to your location (black dot). Click on the selected marker and a popup menu will appear. Next to Datasheet, Select More Info. A new tab will appear in the browser. Find the line title MODELED GRAVITY. This value is the local gravity for that marker. It is presented in mgal. Divide the value by 1000 to get cm/sec^2.

   Determine if Local Gravity differs from Standard Gravity by more than 20 % by calculating the % Difference as follows:

   $$\% \text{ Difference} = \frac{(\text{Local Gravity} - \text{Standard Gravity})}{\text{Standard Gravity}} \times 100$$

   $$\text{Comparison} = \frac{\% \text{ Difference}}{\text{UUT Accuracy (\%)}} \times 100$$

   If the Comparison result is > 20%, the GCF must be calculated and applied to the mass values used to calibrate the UUT.

4. Calculate the GCF as follows:

   $$\text{GCF} = \frac{\text{Local Gravity}}{\text{Standard Gravity}}$$

5. Multiply the nominal applied mass value by the GCF to obtain the corrected applied mass value.

   Example: *Local gravity at your location is 979.100 cm/sec^2.*
   % Difference = (979.100 – 980.665) / 980.665 x 100 = 0.16%.
   OEM accuracy specification for UUT with range of 50 lbf is 0.2% of full scale.
   Comparison = (0.16% / 0.2%) x 100 = 79.8%
   Since the result is > 20%, the GCF must be calculated and applied.
   GCF = 979.100 / 980.665 = 0.998404
   When verifying the 10 lbf test point, the nominal applied mass of 10 lb is multiplied by the GCF. The corrected nominal applied mass value is now 10 x 0.998404 or 9.98 lbf. If the UUT accuracy is 0.2% FS or ± 0.1 lbf, the acceptable limits are now 9.98 ± 0.1 or 9.88 to 10.08.