

WEIGHING INSTRUMENTS

COMPLIANCE REQUIREMENTS AND GUIDELINES



Compliance Requirements and Guidelines

Weighing scales, weighing instruments, weighing balances... different resources use different terminology. This white paper article will be mainly using the term “weighing instrument”.

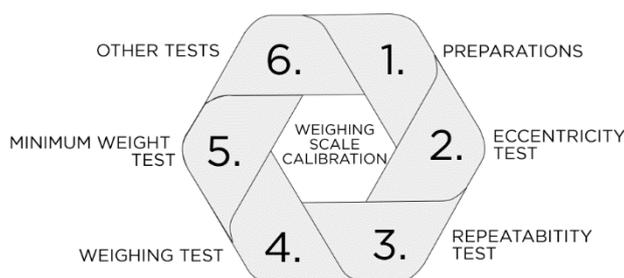
As with any measurement instruments, weighing instruments should also be calibrated regularly to assure that they are measuring correctly and accurately. A proper metrologically traceable calibration is the only way to know how accurately weighing instruments are measuring.

Many weighing instruments are used for legal measurements or measurements used as basis for monetary transfer and these are part of a legal or statutory verification program based on local legislation. New Zealand is a member of OIML – Organisation Internationale de Métrologie Légale (International Organization of Legal Metrology) and the current Weights and Measures Act 1987 and Weights and Measures Regulations 1999 are based on an assortment of OIML recommendations.

This article offers the guidelines for:

- Trade-approved weighing instrument requirements
- Calibration checks on trade-approved or non-trade weighing instrument

CALIBRATING WEIGHING SCALES & INSTRUMENTS



1. Preparations before calibration

Before starting the calibration of the weighing instrument, we should clarify a few things and get prepared. We should find out the technical characteristics of the weighing instrument (max weight value), the accuracy requirement class (max error allowed) and what to do if the calibration fails (adjustment).

Typically, the whole measurement range is calibrated, and the calibration is performed

in the location where the instrument is being used. We need to ensure there is enough weights for the calibration procedure available.

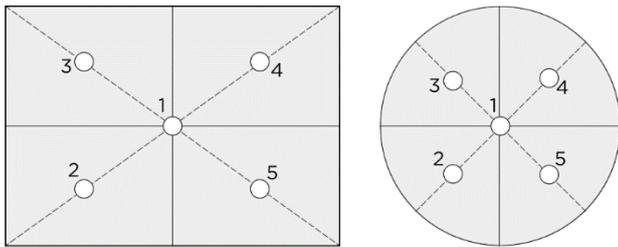
Perform the Inspection Check-list:

- Indicator – Ensure the integrity of Indicator;
- Under Pan – Check under the platter for abnormalities, material accumulation, foreign objects and debris;
- Level Bubble – Instrument should be at a horizontal level, especially for small accurate weighing instruments.
- Levellers;
- Loadcell – Inspect loadcell integrity, corrosion and appropriated mounting.
- Rating Plate;
- Dash Pot;
- Levelling Feet - Ensure all the levelling foot are fitted;
- Stable platform;
- Stamping Plug;
- Corrosion;
- Water Damage – Inspect for water intrusion on indicator, summing boxes and other components;
- Mains Lead;
- Legends;
- Environment: Ensure there is no disturbance on the scale;

2. Eccentricity test

In normal use of a weighing instrument the load is not always placed perfectly on the centre of the load receptor. Sometimes the results of a weighing instrument can vary slightly depending on different locations the load is placed in the load receptor. In order to test how much effect, the location of the load has, the eccentricity test is performed.

In the eccentricity test, the reference load is placed in a few different specified locations on the load receptor. First, the load is placed in the centre of the load receptor (the load’s centre of gravity) and the result is observed. Next, the load is placed in four different sectors of the load receptor, as illustrated in the picture below:



The test load used in an eccentricity test should be at nearest of one third ($1/3$) of the max load of the weighing instrument. The test should preferably be done using just one test load, if possible.

The aim of the eccentricity test is to find out the difference caused by the location of the load, it is not necessary to have an accurate calibrated load. It is naturally important to use the same load throughout the test.

3. Repeatability test

Like any instrument, weighing instruments may also suffer from repeatability issues. This means that when the same load is measured several times, the result is not always exactly the same. To find out the repeatability of the instrument, a repeatability test is done.

The repeatability test is performed by repeatedly placing the same load on the same location on load receptor (to avoid any eccentricity error) multiple times. Test should be done in identical and constant conditions and with identical handling.

The load used should be close to the maximum load of the instrument. Often a repeatability test is done with one load only, but it can be done also with several different load values separately.

The load does not necessarily need to be a calibrated load, as the aim is to find out the repeatability. If possible, the load used should be a single load (not several small loads).

A repeatability test is normally done by repeating the measurement at least 5 times in row. For instruments with a high range (over 100 kg), it should be done at least 3 times.

In the repeatability test, the instrument is first zeroed, then the load is placed on load receptor and indication is recorded once it is stabilized. Then the load is removed, and zero indication is checked and zeroed if

necessary. Then the load is placed again, and so on.

4. Weighing test

The purpose of the weighing test is to test the accuracy (calibrate) of the weighing instrument throughout its whole range in several steps, with increasing and decreasing weight.

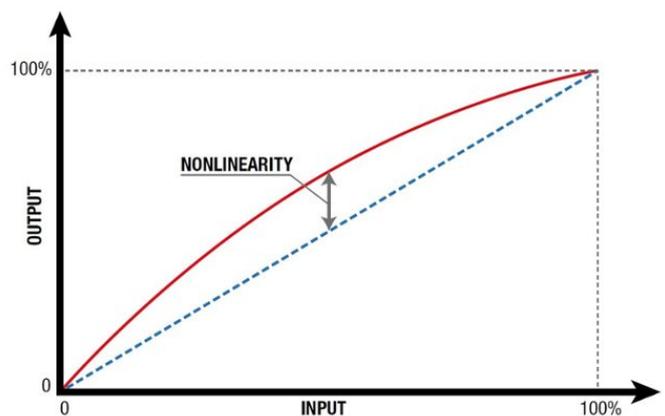
The most common practice is the following: start with zeroing the instrument without any load. Set the loads of the first test point, wait for stabilization, and record the indication. Continue increasing the loads through all the increasing test points. Once the maximum load is recorded, remove the loads and ensure the zero is indicated.

Generally, the test points are selected so that they are equally distributed throughout the range. More test points can be used for the typical range of usage of the instrument.

Linearity

In a weighing test, using multiple points through the measurement range of the instrument helps to reveal any issues with linearity. Linearity issues means that the instrument does not equally measure accurately throughout the range. Even if the zero and full span are correct, there may be errors in the middle of the range, which is referred to, as linearity errors, or unlinearity (or nonlinearity).

Below picture is a general illustration of unlinearity. Even if instrument's zero and full range is adjusted correctly, could be error in the midrange due to unlinearity of the instrument:



5. Minimum weight test

Minimum weight test is a test that is not always required to be done. For trade-approved equipment this is mandatory. The purpose of the minimum weight test is to find the smallest load that can be measured while still achieving reliable measurement results and fulfilling the accuracy requirements. When the measured value gets smaller, typically the relative error of the reading becomes higher. The weighing instrument should not be used to measure any loads smaller than the minimum load.

6. Other tests

There are also some other tests specified in the standards, but these are typically not done during a normal calibration although they can be done as a type of approval test or in the initial verification.

Example of these tests are:

- Tare test
- Variation of indication over time
- Test of magnetic interaction
- Printed dockets vs. indicated weight

TRADE-APPROVED WEIGHING INSTRUMENTS

The New Zealand Weights and Measures Act 1987 and the Weights and Measures Regulation 1999, any trade-approved scale requires:

Certificate of approval number: This is in relation to a weight, measure, weighing or measuring instrument. This refers to the number given to the certificate of approval issued under regulation 5 for that type of weight, measure, or weighing or measuring instrument.

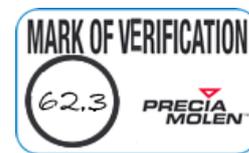
Platforms, weighbridges and built machines are required the base approval and indicator approval. The approval typically states maximum capacity, division size, load receptor model (loadcell), physical dimension, calibration plug sealing type, conditions and variants for the same approval.

The instrument must display the metrological information to the user or public. PRECIA MOLEN have a Scale Badge, in the following waterproof label format:



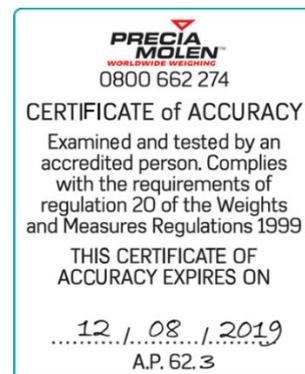
Label1. PRECIA MOLEN scale badge. AKA: Scale legends, Rating Plate, Measure Label

Mark of Verification: This refers to a mark of verification prescribed by regulation 14. The mark of verification is used by the Accredited Person (AP) who tested the instrument. PRECIA MOLEN label is printed on metalized foil and tamper proof mechanism.



Label2. PRECIA MOLEN Mark of Verification.

Certificate of Accuracy: The Act requires the Certificate of Accuracy to be on tamper proof labels, not less than 40 X 50m in size, with the expiry date for the Certificate specified.



Label3. PRECIA MOLEN Certificate of Accuracy.

Certificates of Accuracy issued are valid for a year, if any component is replaced or the seals are tampered, the scale needs to be re-certified.

PRECIA MOLEN also issues the site a Summary of Certificate of Accuracy in "paper form". This document is outside of the scope of the Weights and Measure Act 1999 and the main purpose is for audit trail and compliance proof requirements in general.

Summary of Certificate of Accuracy Issued

Customer: SAMPLE CO LTD.
Location: 123 Queen St, Auckland 1010

Certificates Issued
Precia Molen New Zealand Ltd. Certify that the equipment described below was issued a Certificate of Accuracy on the 06/04/2018.

ALL CERTIFICATES OF ACCURACY
EXPIRE ON
06 April 2019

Serial Number	Description	Capacity
4586131	Precia Molen i35 (Weighbridge)	60000kg X 20kg
584631F5	Precia Molen i20 (Bench Scale)	30kg X 0.01kg
584631F6	Precia Molen i20 (Bench Scale)	30kg X 0.01kg
584631F7	Precia Molen i20 (Bench Scale)	30kg X 0.01kg
39587521	Rinstrum R320 (Platform Scale)	2000kg X 1kg
3958857	Rinstrum R320 (Platform Scale)	2000kg X 1kg
39587521	Rinstrum X320 (Overhead Track Scale)	3000kg X 1kg
35427585	Rinstrum X320 (Overhead Track Scale)	3000kg X 1kg
5455SF4556752	Ishida IWB (Portable Scale)	6/15kg X 0.002/0.005kg
JDW458455785D	Ishida IWB (Portable Scale)	6/15kg X 0.002/0.005kg
54889DF9	Precia Molen i40 (Checkweigher)	30kg X 0.01kg
54889DF8	Precia Molen i40 (Checkweigher)	30kg X 0.01kg
85763GF1	Precia Molen i5 (Crane Scale)	2000kg X 1kg
FNLKEE50554521	Gedge 8000 (Platform Scale)	1500kg X 0.5kg
7909305	Rinstrum R320 (Platform Scale)	60kg X 0.02kg
545220	Rinstrum R320 (Platform Scale)	150kg X 0.05kg
894320	Rinstrum R320 (Platform Scale)	60kg X 0.02kg

Marco de Oliveira
 06.04.2018

Christine Hammond
 Compliance Manager

PRECIA MOLEN NEW ZEALAND LTD
 62 Commerce St, Hamilton, New Zealand
 T 0800 662 274
 preciamolen.co.nz

In addition to the label on the instrument a Calibration Report is issued, with the plant details, check list, before and after indications. This complies with the OIML (International Organization of Legal Metrology) recommendations.

Calibration Report

Sample can be found below:

Calibration Test Report

Customer: Sample Model: Precia Molen i20
Site Address: 62 Commerce St, Frankton Serial#: 123456
Contract Number: 0 Capacity: 30 kg X 0.05kg
Job Number: 1010 Cust ID: Internal

Inspection: Key: P=Pass, F=Fail, N/A=Not Applicable

Indicator	<input checked="" type="checkbox"/> Rating Plate	<input checked="" type="checkbox"/> Corrosion	<input checked="" type="checkbox"/> Next calibration due	26-Apr-19
Under Pan	<input checked="" type="checkbox"/> Dash pot	<input checked="" type="checkbox"/> Water Damage	<input checked="" type="checkbox"/> Trade Application	Yes
Level Bubble	<input checked="" type="checkbox"/> Levelling Feet	<input checked="" type="checkbox"/> Mains Lead	<input checked="" type="checkbox"/> TSS Due	26-Apr-19
Levers	<input checked="" type="checkbox"/> Stable Platform	<input checked="" type="checkbox"/> Legends		
LoadCell	<input checked="" type="checkbox"/> Stamping Plug	<input checked="" type="checkbox"/> Environment		

Test Sequence

Zero Setting: Repeatability: Corner tested at: 10

Linearity: <input checked="" type="checkbox"/>	Tare: <input checked="" type="checkbox"/>	Corner1	10.00	Corner2	10.00
Printer: <input checked="" type="checkbox"/>		Corner4	10.00	Corner3	10.00

Span/Linearity Check

Applied load	Indication as found	Indication after Cal
1	0	0.00
2	5	5.00
3	10	10.00
4	20	20.00
5	30	30.00
6	0	0.00
7	---	---
8	---	---
9	---	---
10	---	---

Note: We hereby certify that scale data above are accurate and are actual results of test undertaken. We further certify that on the date that this test was done, scale performance is within normal conditions. All test weights used are traceable to the New Zealand national standards and are certified by the Trading Standards Service of the Ministry of Consumer Affairs as required by the current weights and measures act. Certificate number: A2234, A2742, A2787. Test carried out in accordance with Weighpac V1.5.

Comments:

Technician: Marco de Oliveira Calibration Date: 26-Apr-18

Precia Molen New Zealand Ltd
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TRADE-APPROVED OR NON-TRADE WEIGHING INSTRUMENTS

Standard Calibration checks

Standard calibrations apply to any non-trade scale and is good practice to perform a calibration check on trade-approved scales before the next certification due.

This not only ensure the scale is accurate, but also the hardware pass the scale checklist, such as: free from obstruction/cleanness, free from water, levelling feet and other aspects that may require service or repairs.

The intervals are agreed between customer and PRECIA MOLEN, but a minimum of six-month interval is recommended.

PRECIA MOLEN waterproof calibration label, contains the Serial Number, engineer, date and next due:

0800 662 274
 Serial# 123456
 Calibrated by Marco
 Date 12/08/2018
 Next Due FEB 2019

RELATED REFERENCES

- OIML R76-1 - Non-automatic weighing instruments Part 1: Metrological and technical requirements - Tests
- OIML R 111 - OIML R111: Weights of classes E1, E2, F1, F2, M1, M1-2, M2, M2-3 and M3
- New Zealand Weights and Measures Act 1987.
- New Zealand Weights and Measures Regulation 1999.
- Precia Molen Quality Management System Manual.
- JCGM 200:2008 - International vocabulary of metrology – Basic and general concepts and associated terms