

2015 NIST EPO No. 1

Examination Procedure Outline for Retail Computing Scales

It is recommended that this outline be followed as minimum criteria for examining electronic digital indicating and mechanical analog-indicating retail computing scales and prepackaging scales. Requirements that apply only to scales marked with an accuracy class are indicated with an asterisk (*). Non-retroactive requirements are followed by the applicable date in parentheses.

SAFETY NOTES

When excerpting this Examination Procedure Outline for duplication, the NIST EPO Safety Annex (Safety Considerations and Glossary of Safety Key Phrases) should be duplicated and included with this outline.

Safety policies and regulations vary among jurisdictions. It is essential that inspectors and servicepersons be aware of all safety regulations and policies in effect at the inspection site and practice their employer's safety policies. The safety reminders included in this EPO contain general guidelines useful in alerting inspectors and servicepersons of the importance in taking adequate precautions to avoid personal injury. These guidelines can only be effective in improving safety when coupled with training in hazard recognition and control.

Prior to beginning any inspection, the inspector should read and be familiar with the NIST EPO Safety Annex - "Safety Considerations and Glossary of Safety Key Phrases." The terms and key phrases in each safety reminder of this outline are found in the glossary of the EPO Safety Annex. The inspector is reminded of the importance of evaluating potential safety hazards prior to an inspection and taking adequate precautions to avoid personal injury or damage to the device. As a minimum, the following safety precautions should be noted and followed during the inspection:

Electrical Hazards

First Aid Kit

Lifting

Location

also:

Wet and Slick Conditions

Chemicals. Petroleum Products and

Hazardous Materials

Obstructions

Personal Protection Equipment
e.g., Safety Shoes

Support – for Scale and Test weights

Transportation of Equipment

**H-44 General Code
and Scales Code
References**

Inspection:

SAFETY REMINDER!!!

- Check the inspection site carefully for safety hazards and take appropriate precautions.
- Learn the nature of hazardous products used at or near the inspection site.
- Use personal protection equipment appropriate for the inspection site.
- Be sure that a first aid kit is available and that the kit is appropriate for the type of inspection activity

- | | |
|--|---|
| 1. Zero-load balance as found. For prepackaging scale, check to determine if tare is being taken. | S.1.1., UR.4.1., S.2.1.1., S.2.1.2., G-S.5.2.2.(d) (1/1/86) |
| 2. General Considerations. | |
| Selection..... | G-UR.1. |
| Installation..... | G-UR.2.1., G-UR.2.2., UR.2.2. |
| InstallationG-UR.2.1.,G-UR.2.2., UR.2.2. | UR.2.2. |
| Supports and clearance..... | UR.2.1., UR.2.4. |

SAFTEY REMINDER!!!

- Check to be sure the scale supports are adequate to support the scale and test weights equal to the capacity of the scale!

- | | |
|--|---|
| Accessibility for inspection, testing, and sealing. | G-UR.2.3. |
| Testing devices at a central location..... | G-UR.4.6. |
| Assistance..... | G-UR.4.4. |
| Position, customer readability. | G-UR.3.3., S.1.8.3. |
| Level indicating means and condition..... | S.2.4., UR.4.2. |
| Maintenance, use, and environmental factors cleanliness, obstructions, modifications, etc.)..... | G-S.2., G-UR.1.2., G-UR.3.1., G-UR.3.2., UR.3.5., G-UR.4., UR.2.3., UR.4.3. |
| 3. Marking..... | S.6.3., S.5.1.* (1/1/86), S.6.2, G-S.1.1. (1/1/04), G-S.5.2.4. |
| a. Marking requirements – all devices | |
| - Identification..... | G-S.1. |
| Name, initials, or trademark of manufacturer or distributor | Retroactive |
| Model identifier | Retroactive |
| Model identifier prefix..... | (1/1/03) |
| acceptable abbreviations for “model” and “number | G-S.1. (cont.) |

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Inspection (cont.):

Nonrepetitive serial number	(1/1/03)
Serial number prefix	(1/1/68)
acceptable abbreviations for “serial” and “number”	(1/1/86)
Current software version or revision identifier (for not-built-for-purpose software based devices)	(1/1/01) (1/1/04)
Software version or identifier preface (for not-built-for-purpose software based devices)	(1/1/07)
Acceptable abbreviations for version, revision, and number	(1/1/07)
NTEP CC prefix and number (for devices that have an NTEP CC)	(1/1/03)
Devices or main elements remanufactured after January 1, 2002.....	G-S.1.2.
Name, initials, or trademark of last remanufacturer or distributor, model designation if different from original model designation....	(1/1/02)
Lettering.....	G-S.7.
Operational controls, indications, and features	G-S.6. (1/1/77)
Visibility of identification.....	G-UR.2.1.1.
Interchange or reversal of parts.....	G-S.4.
 b. Marking requirements – weighing, load-receiving, and indicating element in same housing or covered on the same CC (in addition to marking for all devices)	 S.6.3.
Accuracy class	(1/1/86)
Nominal capacity	Retroactive
Value of scale division with nominal capacity, if not apparent	(1/1/83)
Value of "e" (if different from "d")	(1/1/86)
Temperature limits if narrower than and within – 10 °C to 40 °C (14 °F to 104 °F)	(1/1/86)
Scales designed for special purposes	(1/1/86)
 c. Marking requirements - indicating element not permanently attached or covered on separate CC (in addition to marking for all devices)	 S.6.3.
Accuracy class	(1/1/86)
Nominal capacity	Retroactive
Value of scale division with nominal capacity, if not apparent	(1/1/83)
Value of "e" (if different from "d")	(1/1/86)
Temperature limits if narrower than and within – 10 °C to 40 °C (14 °F to 104 °F)	(1/1/86)
Scales designed for special purposes	(1/1/86)
Maximum number of scale divisions (n_{max})	(1/1/88)
 d. Marking requirements - weighing and load-receiving element not permanently attached or covered on separate CC (in addition to marking for all devices).	 S.6.3.
Accuracy class	(1/1/88)
Nominal capacity.....	Retroactive
Temperature limits if narrower than and within – 10 °C to 40 °C (14 °F to 104 °F)	(1/1/86)
Scales designed for special purposes	(1/1/86)
Maximum number of scale divisions (n_{max}).....	(1/1/88)
Minimum verification scale division for which device complies with the requirements (e_{min} or d).....	(1/1/88)

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Inspection (cont.):

- e. Marking requirements - load cell with Certificate of Conformance (in addition to marking for all devices) S.6.3., S.5.4. (1/1/94)

Note: Requires information on a data plate attached to the load cell or in an accompanying document. If a document is provided, the serial number shall appear on the load cell and in the document. (1/1/88)

- Manufacturer’s name or trademark, model designation, model prefix, and serial number and prefix shall also be marked on both the load cell and in any accompanying documents (1/1/91)
- Accuracy class (1/1/86)
- Temperature limits if narrower than and within – 10 °C to 40 °C (14 °F to 104 °F) (1/1/86)
- Maximum number of divisions (1/1/88)..... (1/1/88)
- “S” or “M” for single or multiple cell applications (1/1/88)
- Direction of loading, if not obvious..... (1/1/88)
- Minimum dead load, maximum capacity, safe load limit, and load cell verification interval (V_{min}) (1/1/88)
- V_{min} stated in mass units (1/1/01)

4. Indicating and recording elements.

- Value of scale division S.1.2.* (1/1/86), S.1.2.1. (1/1/89), S.1.2.2.1.*, S.1.2.2.2.*, S.5.3., UR.1.1.(b), G-S.5.3., G-S.5.3.1., UR.1.3. (1/1/86)
- Customer Indications. S.1.8.4.
- Prepackaging scales only S.1.9.1.
- Value of tare division. S.2.3. (1/1/83)
- Tare mechanism. S.2.3.
- Combined zero-tare (“0/T”) key. S.2.1.6.
- Appropriateness of design..... G-S.3., G-S.5., S.1.3., S.1.4., S.1.8.1., S.1.8.2., (1/1/86), S.1.8.3. (1/1/01), S.1.9.2. S.5.2.,* S.5.4. (1/1/94)
- Recorded representations, General..... G-S.5.6.
- Prepackaging scales only. UR.1.,UR.1.1., UR.3.1.*
- Suitability for use. UR.3.2.,G-UR.1.1. S.2.5.
- Damping means..... S.1.10.
- Adjustable components. S.1.11.(a) (1/1/79)
- Provisions for sealing S.1.11.(b) (1/1/90), S.1.11.(c) (1/1/95), G-S.8. (1/1/90), S.1.8.4.1. (1/1/01), G-UR.4.5.

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Inspection (cont.):

5. Weighing elements	
Antifriction means.....	S.4.1.
Adjustable components.....	S.4.2.
Multiple load-receiving elements.....	S.4.3.
Drainage, if wet commodities are weighed.....	S.3.2., UR.3.6.
Scoop counterbalances.....	S.3.3.

Pretest Determinations:

Tolerances.	
1. Acceptance/maintenance.....	G-T.1., G-T.2.
2. Application.....	G-T.3.
3. Tolerance values:	

Determine number of scale divisions (n)

$$n = \frac{\text{Scale capacity}}{\text{Value of the scale division}}$$

If scale is marked with an accuracy designation.....	T.N.2.1., T.N.2.3., T.N.2.4., T.N.3.1., Table 6 (Class III), T.N.3.2., T.N.4.4., T.N.5.
If scale is unmarked and n equals 5000 or less.....	T.1.1., T.N.2.1., T.N.2.3., T.N.2.4., T.N.3.1./Table 6 (Class III), T.N.3.2., T.N.4.3., T.N.5.
Operating temperature unmarked scales.....	T.N.8.1.4. (1/1/81)
Unmarked postal & parcel post scales.....	T.1.2.
Discrimination.....	T.N.7.1, T.N.7.2., N.1.5. (1/1/86), N.1.5.1.
Accuracy of Field Standards.....	N.2.
Minimum Test Weights and Test Loads.....	N.3., Table 4.

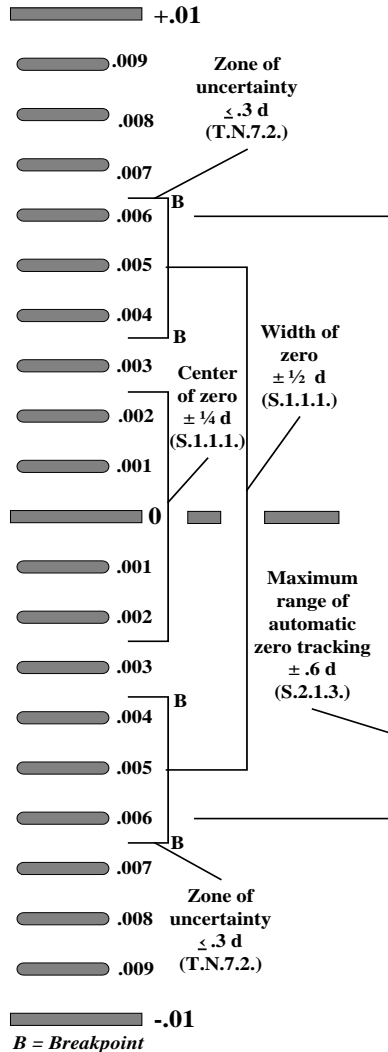
Test Notes:

1. Check repeatability of, and agreement between indications throughout test. G-S.5.2.2.(a) (b),
T.N.4.3., T.N.5.,
G-S.5.4.
2. Recheck zero load balance each time test load is removed..... N.1.9., G-UR.4.2.
3. If scale is equipped with a printer, print ticket or label at each test load. Verify;
the effectiveness of motion detection. S.2.5.1.(b)
that price calculations based on weight are rounded to the nearest cent. G-S.5.5.
that any recorded representations for weight, unit price, and total sale agree with
their associated corresponding values that are displayed; and G-S.5.2.2., G-S.5.6.,
S.2.5.1.(b), S.1.8.2.
that the value of the scale division as recorded on the recorded representation is
the same as the division value indicated. UR.1.3. (1/1/86)

Also verify that any options for obtaining a recorded representation are
appropriate. The customer may be given the option of not receiving the recorded
representation. If the system is equipped with the capability, the customer may
also be given the option of receiving the recorded representation electronically in
lieu of or in addition to a hard copy. G-S.5.6.
4. **Electronic scales only** - If, during the conduct of the test, the performance of the
device is questionable with respect to the zone of uncertainty or the width of zero
(see test procedure below), adequate tests should be conducted to determine
compliance. N.1.5. (1/1/86),
N.1.5.1.,S.1.1.1.(a),
S.1.1.1.(b) (1/1/93)
5. **Electronic scales only** - If the device is equipped with operational features such
as programmable tare and/or unit prices, multiplier keys, sales accumulation,
manual weight entries, price retention, two scales with one printer, etc., check
proper operation and appropriateness. G-UR.4.1., G-UR.4.2.,
S.4.3., S.1.12. (1/1/93
and 1/1/05), UR.3.9.

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Test Notes (cont.):



This example of Automatic Zero-Tracking and the Width of Zero test is based on a scale division of 0.01 lb. The principles used in this example can also be used to test scales with other division sizes, including scales indicating in metric units.

Automatic Zero-Tracking test:

<u>Test action</u>	<u>Required Indication</u>
a. Zero scale	0.00 lb
b. Apply 0.007 lb	+ 0.01 lb
(Repeat three times. Three failures will result in scale rejection.)	
c. Zero scale	0.00 lb
d. Apply 0.007 lb	+ 0.01 lb
e. Zero Scale	0.00 lb
f. Remove 0.007 lb	- 0.01 lb or a below zero indication

(Repeat three times. Three successive failures will result in scale rejection. If scale passes go to the next test)

Width of Zero test:

<u>Test action</u>	<u>Required Indication</u>
a. Zero scale	0.00 lb
b. Apply 0.007 lb	+ 0.01 lb
c. Zero scale	0.00 lb
d. Remove 0.007 lb	- 0.01 lb or a below zero indication.
e. Apply 0.015 lb	+ 0.01 lb stable

(Three successive failures will result in rejection.)

Note: The Width of Zero test is predecessor to the test for discrimination and may be performed on scales manufactured prior to 1986. For scales manufactured on or after 1/1/86, the test for discrimination applies.

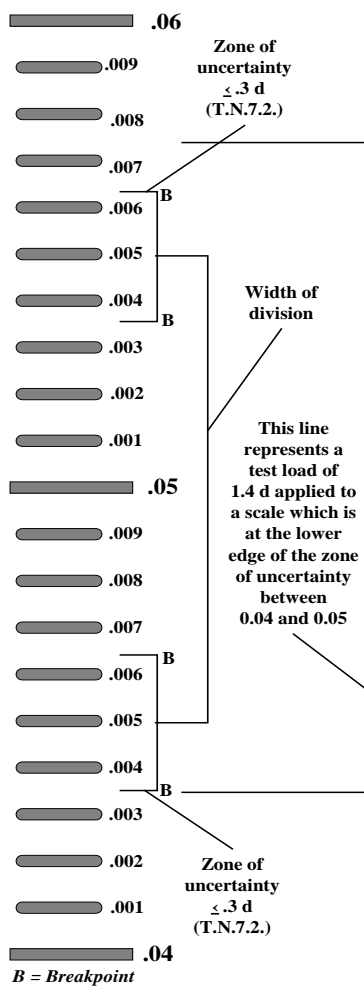
Important: Apply or remove the test weights all at once in both tests. Use forceps if necessary.

Test for Electronic Scales:

1. Test for discrimination at or near zero load (if environmental conditions permit)..... N.1.5. (1/1/86), N.1.5.1.

SAFTEY REMINDER!!!

- **WEAR SAFETY SHOES!**
- **USE PROPER LIFTING TECHNIQUES!**



This example of a discrimination test at or near zero load is based on a scale division of 0.01 lb. The principles used in this example can also be used to test scales with other division sizes, including scales indicating in metric units.

- a. With the device at zero, place decimal weights on scale equal to 1d.
- b. Zero the scale and place a test load equal to 5d on the load receiving element.
- c. Remove the decimal weights in 0.1d increments until the indication flickers between 0.04 lb and 0.05 lb. If the indication does not flicker but indicates a steady 0.04 lb, add 0.1d. If the scale indicates 0.05 lb, it is at the breakpoint in the zone of uncertainty. (Remove the 0.1d if it was used to verify the breakpoint.)
- d. Add a test load equal to 1.4d to the scale (0.014 lb)
- e. The indication should read a steady 0.06 lb.
- f. If the scale passes this test at a load near zero, the test should be performed near the maximum test load.

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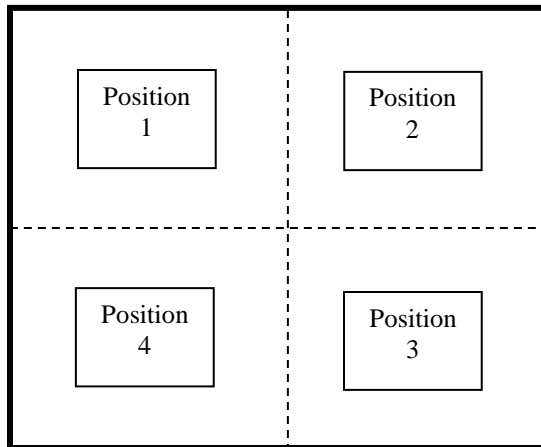
Test for Electronic Scales (cont.):

- 2. Increasing-load test¹ (with the load approximately centered) at the following minimum test loads (20d):
For scales indicating in metric units:
 - 100 g; then at each 500 g to 2.5 kg; at 500 g to 2.5 kg intervals thereafter to an amount equal to the shift-test load (i.e., a test-weight load equal to at least 30 % of scale capacity, but not to exceed 35 % of scale capacity).
 - Include test points equal to 500d, 2000d, and 4000d..... N.1.1.
For other scales:
 - 0.50 lb; then at each pound to 5 lb; at 1 lb, 2 lb, or 5 lb intervals thereafter to an amount equal to the shift-test load, (i.e., a test-weight load equal to at least 30 % of scale capacity, but not to exceed 35 % of scale capacity).
 - Include test points equal to 500d, 2000d, and 4000d..... N.1.1.

- 3. Shift test: use test weights equal to no less than 30 % of scale capacity, but not to exceed 35 % of scale capacity..... N.1.3.7.(a)



Test weight position



Shift Test Positions - Electronic Scales

- 4. Continue increasing - load test:
For scales indicating in metric units - at 2.5 kg intervals to capacity.
For other scales - at 5 lb intervals to capacity.

¹ For scales that are not marked with an accuracy classification and have less than 1000 scale divisions, use the following procedure: begin test at 20d; then test at 0.50 lb and at each pound thereafter to capacity, including test loads at 1/4, 1/2, and 3/4 capacity.

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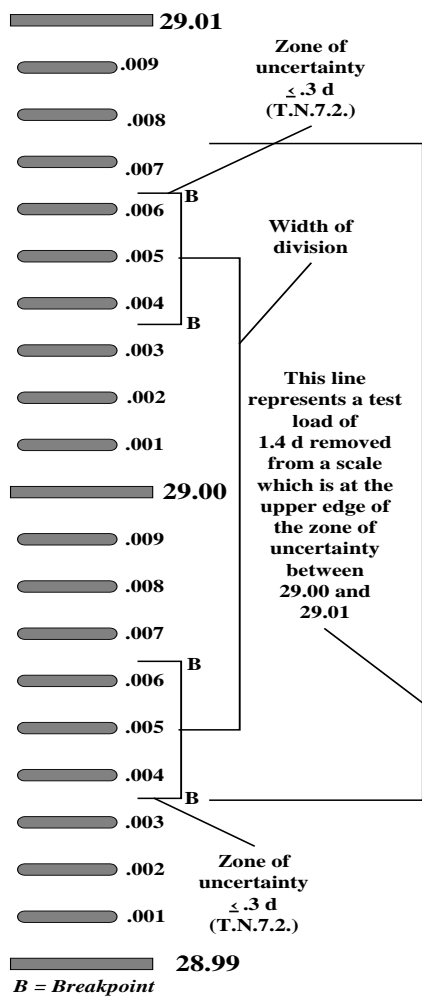
Test for Electronic Scales (cont.):

- 5. Radio Frequency Interference (RFI)/Electromagnetic Interference (EMI)
 Conduct test at or near capacity when RFI/EMI transmission sources are present
 or if a problem is suspected. G-UR.1.2., G-N.2.,
 G-UR.3.2., G-UR.4.2.,
 N.1.6., T.4., T.N.9.*

- 6. Test for over-capacity indication..... S.1.7.(a) retroactive,
 S.1.7.(b)(1/1/93)

- 7. Test for discrimination at or near capacity (if environmental conditions permit). N.1.5. (1/1/86), N.1.5.1.

 A test load equivalent to 1.4d shall cause a change in the indicated or recorded
 value of at least 2.0d..... T.N.7.2.



This example of a discrimination test near capacity is based on a scale division of 0.01 lb at a test load of 29.00 lb. The principles used in this example can also be used to test scales with other division sizes and capacities, including scales indicating in metric units.

- a. With the scale at zero, add decimal weights equal to 1.4d and zero the device.
- b. Add test weights to make the scale indicate a weight value near capacity (e.g., 29.00 lb).
- c. With the scale stable, add decimal weights in 0.1d increments until the indication flickers between 29.00 lb and 29.01 lb. If the indication shows a steady 29.01 lb, remove 0.1d. If the scale indicates 29.00 lb it is at the breakpoint in the zone of uncertainty. (Replace the 0.1d if it was used to verify the breakpoint.)
- d. Remove the 1.4d test load (0.014 lb).
- e. The scale should indicate a steady 28.99 lb.
- f. If the test passes near the maximum capacity, the test should be performed near zero.

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Test for Electronic Scales (cont.):

- 8. Decreasing-load test - for scales marked with an accuracy class and having 1000 or more scale divisions (d), test with loads equal to the maximum test load at each tolerance value. For example, on a Class III scale, at test loads equal to 4000d, 2000d, and 500d; for all other scales, the test load shall be equal to one-half of the maximum load applied in the increasing-load test. N.1.2., N.1.2.1., or N.1.2.2.
- 9. Recheck zero-load balance..... N.1.9., G-UR.4.2.
- 10. Test for proper design of automatic zero-tracking mechanism, if the scale is so equipped..... S.2.1.3.1.(a), S.2.1.3.2.(b)
 Under normal operating conditions the maximum load that can be “rezeroed” when placed on or removed from the platform all at once, shall be 0.6 scale division for scales manufactured between January 1, 1981 and January 1, 2007, and 0.5 scale division for scales manufactured after January 1, 2007.
- 11. Check proper design of tare auto-clear, if scale is so equipped. S.2.3. (1/1/83)
- 12. If scale is equipped with a semi-automatic zero-tracking mechanism, test effectiveness of motion detection. S.2.1.2.(b)
- 13. Establish correct zero-load balance..... N.1.9., G-UR.4.2.

Test for Mechanical Scales:

SAFETY REMINDER!!!

- **WEAR SAFETY SHOES!**
- **USE PROPER LIFTING TECHNIQUES!**

- 1. Increasing-load test (include test loads of 500d, 2000d, and 4000d as part of this test -all test loads approximately centered).. N.1.1.
 - For scales that indicate in metric units: test loads of 30 g, 100 g, 200 g, and 500 g
 - For other scales: test loads of 1 oz, 3 oz, 7 oz, and 15 oz or 0.05 lb, 0.15 lb, 0.45 lb, and 0.95 lb

Then check:

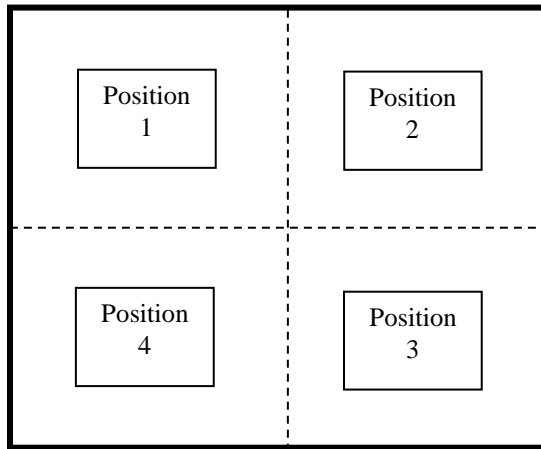
- For scales that indicate in metric units - at each 500 g to one quarter capacity
- For other scales at each pound to one-quarter capacity.

Test for Mechanical Scales (cont.):

- 2. Shift test - use test weights equal to no less than 30 % of scale capacity, but not to exceed 35 % of scale capacity..... N.1.3.7.(a)



Test weight
position



Shift Test Positions - Mechanical Scales

- 3. Continue increasing-load test at one-half, three-quarters, and nominal capacity N.1.1.
- 4. Test for discrimination (if environmental conditions permit)..... N.1.5. (1/1/86)
 - A test load equivalent to 1.4d shall cause a change in the indicated or recorded value of at least 1.0d. T.N.7.1.*
- 5. Decreasing-load test. N.1.2.
 - For scales marked with an accuracy class and having 1000 or more scale divisions, test with loads to equal the maximum test load at each tolerance value. For example, on a Class III scale, at test loads equal to 4000d, 2000d, and 500d; for scales with n less than 1000, the test load shall be equal to one-half of the maximum load applied in the increasing-load test. N.1.2.1.
 - All other scales, test with one-half of the maximum load applied in the increasing-load test. N.1.2.2.
- 6. Recheck zero-load balance..... N.1.9., G-UR.4.2.
- 7. Money-value test. Check chart or drum at several points. G-S.5.1.

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Test for Mechanical Scales (cont.):

8. The money value computation (analog indications) does not exceed: S.1.8.1., S.1.8.2.

Maximum Money Value Interval	Price / Kilogram	Price/Pound
\$0.01	\$0.55 or less	\$0.25 or less
\$0.02	\$0.56 to \$2.75	\$0.26 to \$1.25
\$0.05	\$2.76 to \$7.50	\$1.26 to \$3.40
\$0.10	greater than \$7.50	greater than \$3.40

9. Money value computation (analog quantity indications/digital money values)..... S.1.8.3.

SAFETY REMINDER!!!
– **Secure all test equipment when transporting it to next location.**

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