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Examination Procedure Outline for

Medium-Capacity Scales

It is recommended that this outline be followed for medium-capacity portable platform scales and warehouse scales, including self-contained and built-in types, with the following types of indicating elements: beams, dials, and electronic digital-indicators. Nonretroactive requirements are followed by the applicable date in parentheses.

SAFETY NOTES

When excerpting this Examination Procedure Outline for duplication, the "Safety Considerations" section and the "Glossary of Safety Key Phrases" should be duplicated and included with the outline.

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. The inspector should read and be familiar with the introductory section on safety found at the beginning of this publication. As a minimum, the following safety precautions should be noted and followed during the inspection. Definitions of each reminder are found in the "Glossary of Safety Key Phrases" at the back of this publication.

Safety policies and regulations vary among jurisdictions. It is essential that inspectors or servicepersons be aware of all safety regulations and policies in place at the inspection site and to practice their employer's safety policies. The safety reminders included in this EPO contain general guidelines useful in alerting inspectors and servicepersons to the importance of 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.

Electrical Hazards

First Aid Kit

Lifting

Location

Personal Protection Equipment
e.g., Safety Shoes, Hard Hat

Support – for Scale and Test Weights

Transportation of Equipment

also: **Wet/Slick Conditions**
Chemicals, Petroleum Products, and Hazardous Materials
Obstructions

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Inspection:

Safety First!!!

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.

	H-44 General Code and Scales Code References	Comments[1]
1. Zero-load balance as found.		
Digital zero indication	G-S.5.2.2.(d) (1/1/86)	ME only
Zero indication	S.1.1.	
Normal balance position	S.1.5.1.	B only
Adjustment of zero-load balance	S.2.1.1.	
Manual and semiautomatic zero-setting	S.2.1.2.	
Balance condition	UR.4.1.	
2. General considerations		
Selection of equipment	G-UR.1.1., UR.1.1.	
Installation		
In accordance with manufacturers instructions	G-UR.2.1.	
Indicating and recording elements	G-UR.2.2.	
Foundation, supports, and clearance	UR.2.1., UR.2.4.(1/1/73)	

Check to be sure the scale supports are adequate to support the scale <u>and</u> test weights equal to the capacity of the scale !

Accessibility for inspection, testing, and sealing	G-UR.2.3.	
Assistance in testing	G-UR.4.4.	
Position of equipment	G-UR.3.3.	
Customer indications	S.1.8.3.	
Level indicating means	S.2.4.	
Level condition	UR.4.2.	

[1] Key to abbreviations in Comments Column:
B = Beam Scales
D = Dial Scales
E = Electronic digital scales
U = Unmarked scales
M = Scales marked with an accuracy designation

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Inspection (cont.):

Use
- Facilitation of fraud ..... G-S.2.
- Method of operation ..... G-UR.3.1.
- Associated and nonassociated equipment ..... G-UR.3.2. — E only
- Special designs or marked for special applications ..... UR.3.5.

Environment
- Suitable for the environment in which it is used ..... G-UR.1.2.
- Protection from environmental factors ..... UR.2.3.

Maintenance requirements ..... G-UR.4.1.
- Scale modification ..... UR.4.3.

3. Marking ..... S.6.3.

a. Marking requirements - all devices
- Identification ..... G-S.1.
  - Name or ID of manufacturer ..... Retroactive
  - Model designation ..... Retroactive
  - Model prefix ..... (1/1/03)
  - Nonrepetitive serial number ..... (1/1/68)
  - Serial number prefix ..... (1/1/86) — M only
  - NTEP CC prefix and number ..... (1/1/03)
    (for devices that have an NTEP CC)
  - Remanufacturer information, as appropriate:
    - name and ID of remanufacturer ..... (1/1/02)
    - model number if different from original model number ... (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 and indicating elements in same housing or covered on the same CC (in addition to marking for all devices) ..... S.6.3.
- Accuracy class ..... (1/1/86) — M only
- 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 other than -10 ^{0}C to 40 ^{0}C (14 ^{0}F to 104 ^{0}F) ..... (1/1/86) — M only
- Scales designed for special purposes ..... (1/1/86) — M only

c. Marking requirements - indicating element not permanently attached or covered on separate CC (in addition to marking for all device) ..... S.6.3.
- Accuracy class ..... (1/1/86) — M only
- 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 other than -10 ^{0}C to 40 ^{0}C (14 ^{0}F to 104 ^{0}F) ..... (1/1/86) — M only
- Scales designed for special purposes ..... (1/1/86) — M only
- Maximum number of scale divisions (n_{max}) ..... (1/1/88)

Inspection (cont.):

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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 ..... (1/1/86) — M only
- Nominal capacity ..... Retroactive
- Temperature limits if other than -10 ^{0}C to 40 ^{0}C (14 ^{0}F to 104 ^{0}F) ..... (1/1/86) — M only
- Scales designed for special purposes ..... (1/1/86) — M only
- 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)

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) — E only

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 ..... (1/1/88)
- Temperature limits if other than -10 ^{0}C to 40 ^{0}C (14 ^{0}F to 104 ^{0}F) ..... (1/1/86)
- Maximum number of divisions ..... (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)

4. Design of weighing devices ..... S.5. — M only
   - Designation of accuracy class ..... (1/1/86)
   - Parameters of accuracy class ..... (1/1/86)
   - Multi-interval/multiple-range scale division value

5. Indicating and recording elements
   - Value of scale division ..... S.1.2. (1/1/86) — M only
   - Weight units ..... S.1.2.1.(1/1/89) — E only
   - Values of graduated intervals or increments ..... G-S.5.3.
   - Devices that indicate or record in more than one unit ..... G-S.5.3.1.
   - Prepackaging scales only ..... S.1.9.1.

   Tare
   - Value of tare division S.2.3. (1/1/83)
   - Tare mechanism S.2.3. (1/1/83)
   - Combined zero-tare ("0/T") key ..... S.2.1.6.

   Appropriateness of design
   - Indicating and recording elements ..... G-S.5.
   - Capacity indication, weight ranges, and unit weights ..... S.1.7.

Inspection (cont.):

Appropriateness of design (cont.)

Recommended minimum load	UR.3.1.	M only
Maximum Load	UR.3.2.	
Weighbeams	S.1.5. ex S.1.5.5.	B&D only
Poises	S.1.6.	B&D only
Dials and balance indicators with graduations having a specific value.		
Graduations	S.1.3.	B&D only
Indicators	S.1.4.3., S.1.4.2.	B&D only
Clearance	S.1.4.4.	B&D only
Parallax	S.1.4.5.	B&D only
Damping		
Damping means	S.2.5.	
Electronic elements	S.2.5.1. (b)	E only
Adjustable components	S.1.10.	
Provision for sealing	S.1.11. (a) (1/1/79)	
	S.1.11. (b) (1/1/90)	E only
	S.1.11. (c) (1/1/95), G.S.8.	E only
Security seal	G-UR.4.5.	

6. 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.	

Pretest Determinations:

1. Tolerances.

Acceptance/maintenance	G-T.1., G-T.2.	
Application	G-T.3.	
Principles	T.N.1.	M only
Tolerance values:		
Determine number of scale divisions $(n)^2$	$n = \frac{\text{Scale capacity}}{\text{Value of scale division}}$	
If scale is marked with an accuracy designation or for unmarked scales with 5000 or fewer scale divisions.		
Tolerance application – unmarked	T.1.1.	U only
Tolerance application - marked	T.N.2.1.	M only
Subsequent verification examinations	T.N.2.3.	M only
Multirange scales	T.N.2.4.	M only

Pretest Determinations (cont.):

Tolerance Values (cont.)		
Ratio tests	T.N.2.5.	MB only
Maintenance tolerance values	T.N.3.1./Table 6 (Class III)	
Acceptance tolerance values	T.N.3.2.	

[2] On a multiple range or multi-interval scale the number of divisions for each range independently shall not exceed the maximum specified for the accuracy class. The number of scale divisions, n, for each weighing range is determined by dividing the scale capacity for each range by the verification scale division, e, for each range (i.e., do not add "n" for the ranges together). On a scale system with multiple load receiving elements and multiple indications each element considered shall not independently exceed the maximum specified for the accuracy class. If the system has a summing indicator, the n_{max} for the summed element shall not exceed the maximum specified for the accuracy class. (Table 3 footnote added 1998).

Multiple indicating/recording elements	T.N.4.1.	M only
Single indicating/recording elements	T.N.4.2	M only
Single indicating element/multiple indications	T.N.4.3	M only
Shift or section test	T.N.4.4.	M only
Repeatability	T.N.5.	M only

2. Sensitivity.

Application	T.2.1.	UB only
General	T.2.2.	UB only
Sensitivity requirement, equilibrium change	T.3.1.	UB only
Sensitivity	T.N.6.	MB only

3. Discrimination.

Analog automatic indicating (includes balance indicators with graduations having specific values)	T.N.7.1.	MD only
Digital automatic indicating	T.N.7.2.	ME only

4. Minimum test weights and test loads ..... N.3.

Test Notes:

1. Error weights. Balance small error weights on the platform, the smallest weight being equal to the minimum tolerance value at maximum test load.

2. Check repeatability and agreement between indicatons throughout the test.

Repeatability of indications	G-S.5.4.
Digital indication and representation	G-S.5.2.2.

3. Recheck zero-load balance each time test load is removed.

Zero-load balance change	N.1.9.
Abnormal performance	G-UR.4.2.

4. If scale is equipped with a ticket printer or type-recording beam, print ticket at each test load. Check effectiveness of motion detection.

Digital indication and representation	G-S.5.2.2.	
Recorded representations	G-S.5.6.	
Money value, mathematical agreement	G-S.5.5.	
Motion detection	S.2.5.1.(b)	E only
Value of the indicated and recorded scale division	UR.1.3.(1/1/86)	M only

5. 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,

Test Notes (cont.):

adequate tests should be conducted to determine compliance; however, they must be conducted under controlled conditions.

Digital indicating elements	S.1.1.1.(1/1/93)	E only
Discrimination test	N.1.5.	MD/E only
Digital device	N.1.5.1.	ME only

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6. If the device is equipped with operational features such as programmable tare, multiple tare memory, weigh-in/weigh-out, or multiple weighing elements, check proper operation and appropriateness. E only
   - Maintenance of equipment ..... G-UR.4.1.
   - Abnormal performance ..... G-UR.4.2.
   - Multiple load-receiving elements ..... S.4.3.
   - Manual gross weight entry ..... S.1.12.(1/1/93), UR.3.9.

Test:

WEAR SAFETY SHOES !
USE PROPER LIFTING TECHNIQUES !

1. Sensitivity test at zero load ..... N.1.4. B only

2. Discrimination test at zero load, if applicable ..... N.1.5.(1/1/86) MD/E
   Digital Device ..... N.1.5.1. E only

3. Increasing-load test (with the load centered) ..... N.1.1.
   Initial verification – to capacity ..... N.3.
   Subsequent verification
   a. Small Scales - at minimum load (20d), 500d, 2000d, 4000d to capacity
   b. Larger scales – at minimum load (20d), 500d, 2000d, 4000d to capacity or, at tolerance intervals to table 4 values.
   c. Beam scales - at a minimum, test at half and full capacity on weighbeam. Scales not equipped with a full capacity beam should be ratio tested using standard weights on counterpoise hanger. At each test load, test scale counterpoise weights by substituting them for standard weights. If there is a noticeable change in indication, remove the counterpoise weight from service until it can be determined that it meets the requirements in the Weight Code of NIST Handbook 44. ..... N.1.7. B only

Test (cont.):

4. Shift test Use quarter-capacity test load centered successively over each main load support or half-capacity load centered successfully at the center of each quarter of the load-receiving element (can be conducted during increasing-load test) ..... N.1.3.8.

5. Sensitivity test at maximum test load ..... N.1.4. B only
   Discrimination test at maximum test load ..... N.1.5. MD&E only

(if applicable)

6. RFI/EMI tests (if a problem is suspected)
   Radio Frequency Interference (RFI)
   Electromagnetic Interference (EMI)
   - Testing with nonassociated equipment ..... G-N.2. — E only
   - Environment ..... G-UR.1.2.
   - Associated and nonassociated equipment ..... G-UR.3.2. — E only
   - Abnormal performance ..... G-UR.4.2. — E only
   - Presence of RFI verified ..... N.1.6.
     Tolerance
     - Unmarked scales ..... T.4. — U only
     - Marked Scales ..... T.N.9. — M only

7. Test for over-capacity indication. ..... S.1.7.

8. Decreasing-load test ..... N.1.2. — D&E only
   - Scales marked I, II, III, or IIII ..... N.1.2.1. — M only
     Tests shall be conducted with test 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 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.
   - All other scales ..... N.1.2.2.
     The test load shall be equal to one-half of the maximum load applied in the increasing-load test.

9. Recheck zero-load balance……N.1.9., G-UR.4.2.

10. Substitution or strain load test ..... Table 4.
    The scale shall be tested from zero to at least 12.5 percent of scale capacity using known test weights and then to at least 25 percent of scale capacity using either a substitution or strain load test that utilizes known test weights of at least 12.5 percent of scale capacity. Not more than three substitutions shall be used during substitution testing. Whenever practical, a strain load test should be conducted to the used capacity of the scale. Tolerance applies only to the known test load.

11. Recheck zero-load balance…… N.1.9., G-UR.4.2.

Test (cont.):

12. Conduct out-of-level test (portable scales without level-indicating means only) ..... S.2.4.

13. Test for proper design of automatic zero-setting mechanism, if scale is so equipped. ..... S.2.1.3.(c) (1/1/81) — E only

    Under normal operating conditions the maximum load that can be "rezeroed" when placed on or removed from the platform all at once, shall be 1.0 scale division.

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14.	Check proper design of tare auto-clear, if scale is so equipped.	S.2.3. (1/1/83)	E only
15.	If scale is equipped with a semi-automatic zero-setting mechanism, test effectiveness of motion detection	S.2.1.2.	E only
16.	Establish correct zero-load balance	N.1.9., G-UR.4.2.	
	After all equipment at a location has been tested, review results to determine compliance with equipment maintenance and use of adjustments	G-UR.4.1., G-UR.4.3.	