EPO No. 12E

Examination Procedure Outline for

Livestock and Animal Scales Equipped with Electronic Digital Indicators

It is recommended that this outline be followed for livestock and animal scales equipped with electronic digital indicators. Requirements that apply only to scales marked with an accuracy class are indicated with an asterisk. 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.

Clothing

Electrical Hazards

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

First Aid Kit

Lifting

Location

also: **Wet/Slick Conditions**
Overhead Hazards, Obstructions

Safety Cones/Warning Signs

Support – for Scale and Test Weights

Transportation of Equipment

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Inspection:

Safety First!!!

Check the inspection site carefully for safety hazards and take appropriate precautions.

Use caution in moving in wet, slippery areas.

Use personal protection equipment appropriate for the inspection site.

Position safety cones and warning signs if necessary.

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

1. Zero-load balance as found. If the device is not in balance, the user should be made aware of paragraph UR.4.1. and a warning issued if necessary. If a ring scale and a tare has been taken for a ring man, check accuracy of the tare taken ..... S.1.1., S.2.1.1., S.2.1.2. UR.4.1.,G-S.5.2.2.(d) (1/1/86)*

2. General Considerations
   - Selection ..... G.S.3., G-UR.1.1, UR.1.
   - Installation G-UR.2.,
     - Supports for portable scale ..... UR.2.1.
     - Protection from environment ..... UR.2.3.
     - Foundation, supports, and clearance ..... UR.2.4.
     - Access to weighing elements ..... UR.2.5.
     - Stock racks ..... UR.2.7.

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 ..... G-UR.4.4.
   - Position, customer readability ..... G-UR.3.3.
   - Maintenance, use, and environmental factors.
     - Facilitation of fraud ..... G-S.2.
     - Environment ..... G-UR.1.2.
     - Operation ..... G-UR.3.1.
     - Maintenance ..... G-UR.4.

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Maintenance, use, and environmental factors (cont.).
- Maximum load ..... UR.3.2.
- Minimum load for livestock ..... UR.3.8.
- Manual gross weight entries ..... UR.3.9, S.1.12.
- Scale modification ..... UR.4.3.

3. Marking ..... S.6.3., S.6.2.

Nominal capacity ..... S.6.1. (1/1/86) (livestock only)

Nominal capacity must satisfy the relationship of:
nominal capacity ≤ CLC x (N - 0.5), where N = the number of sections in the scale.

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)
- 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)
- 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)
- 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 device) 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 other than -10 ^{0}C to 40 ^{0}C (14 ^{0}F to 104 ^{0}F) ..... (1/1/86)
- Scales designed for special purposes ..... (1/1/86)
- Maximum number of scale divisions (n_{max}) ..... (1/1/88)

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Inspection (cont.):

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)
Nominal capacity ..... Retroactive
Nominal capacity on load receiving element ..... (1/1/89) (livestock only)
Concentrated Load Capacity (CLC) on the load-receiving element (for scales manufactured prior to 1989, the Section Capacity may be used as the CLC; except that, the CLC marking must be added at the time of modification to any scale not previously marked) ..... (1/1/89) (livestock only)
Temperature limits if other than -10 ^{0}C to 40 ^{0}C (14 ^{0}F to 104 ^{0}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)

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 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. Determination of Load Cell Suitability (applicable to load cells with an NTEP Certificate of Conformance):
   a. The number of scale divisions (n) of the scale is less than or equal to the n_{max} of the indicator or the load cells, whichever is less; e.g., if the indicator has an n_{max} of 10,000 and the load cells have an n_{max} of 5,000, then the scale may use up to 5,000 divisions.
   b. The load cell is approved for the required accuracy class. **Note:** A Class III load cell may be used in a Class III L application; however the opposite is not true.
   c. The load cell is rated Single (S) or Multiple (M) use as appropriate to the application. **Note:** A load cell rated for single use may be used in a single or multiple load cell application; however, a load cell rated for multiple use cannot be used in a single load cell application.

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Inspection (cont.):

Determination of Load Cell Suitability (cont.)

d. The load cell complies with the requirements for temperature effect on zero-load balance..... S.5.4., T.N.8.1
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Note: Testing to determine the effect of temperature on zero-load balance cannot be performed in the field; however, for purposes of field inspection, a load cell is considered to comply with T.N.8.1.3. if the v_{min} value marked on the load cell is less than or equal to the v_{min} value as calculated below based upon the d and N for the scale; if it is not, the scale does not comply with T.N.8.1.3.

Full electronic scale with more than one load cell: The verification scale division v_{min}, for the load cells must be less than or equal to the scale division, d, divided by the square root of the number of load cells, N, used in the scale:

$$v_{min} \leq \frac{d}{\sqrt{N}}$$

Note: Maximum values of v_{min} for commonly encountered multiple load cell scales are listed in the Appendix to EPO 12-E.

For scales with mechanical lever systems:

$$v_{min} \leq \frac{d}{\sqrt{N} \times \text{scale multiple}}$$

5. Indicating and recording elements.
   - Value of scale division S.1.2. (1/1/86)
   - Weight units S.1.2.1. (1/1/89)
   - Designation of accuracy class ..... S.5.*
   - Value of graduated interval ..... G-S.5.3.
   - Marked devices ..... UR.1.1.(a)
   - Unmarked devices ..... UR.1.1.(b)(animal only)
   - Recorded scale division ..... UR.1.3.
   - Tare division value, if equipped with a keyboard[1] ..... S.2.3.(1/1/83)
   - Tare mechanism ..... S.2.3.(1/1/83)
   - Appropriateness ..... G-UR.1.1.
     - Indicating and recording elements ..... G.S.5.
     - Parameters for accuracy class ..... S.5.2.(1/1/86)*
     - Selection ..... UR.1.
     - Recommended minimum load ..... UR.3.1.*

[1] Generally, tare is not considered appropriate on these scales. If the device is located in an auction market and is a ring scale, a tare capability may be considered appropriate.

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Inspection (cont.):

Indicating and recording elements (cont.)	
Maximum load	UR.3.2.
Damping means	S.2.5., S.2.5.1.
Adjustable components	S.1.10.
Provision for sealing	S.1.11, G-S.8.(1/1/90), G-UR.4.5.
Manual gross weight entries	S.1.12.(1/1/93), UR.3.9.(livestock)

6. Design of weighing elements ..... S.4.

Pretest Determinations:

1. Tolerances.

Acceptance/maintenance	G-T.1., G-T.2.
Application	G-T.3., G-T.4., T.N.2.1., T.N.2.3., T.N.2.4.
Tolerance values:	Scale Capacity
Determine number of scale divisions (n)	n = Value of scale division
If scale is marked with an accuracy designation.	
Maintenance tolerance	T.N.3.1./Table 6 (Class III L–livestock scales, Class III – animal scales)
Acceptance tolerance	T.N.3.2.
Agreement of indications	T.N.4.1
Shift or section test	T.N.4.4.
Repeatability	T.N.5.
Unmarked scales	
Livestock scales	T.1.1.
Maintenance tolerance	T.N.3.1./Table 6 (Class III L)
Acceptance tolerance	T.N.3.2.
Agreement of indications	T.N.4.1.
Shift or section test	T.N.4.4.
Repeatability	T.N.5.
Animal scales with 5000 or less scale divisions	T.1.1.
Maintenance tolerance	T.N.3.1./Table 6 (Class III)
Acceptance tolerance	T.N.3.2.
Agreement of indications	T.N.4.1.
Repeatability	T.N.5.
Discrimination	T.N.7.2.

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Pretest Determinations (cont.):

2. Determine "used capacity."
   For calculation in metric units:
   Multiply area of platform in square meters (length x width = area) by: 540 kilograms for cattle, 340 kilograms for calves and hogs, and 240 kilograms for sheep.

   For calculation in inch pound units:
   Multiply area of platform in square feet (length x width = area) by: 110 pounds for cattle, 70 pounds for calves and hogs, and 50 pounds for sheep.

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

Carefully inspect electrical supply lines for test equipment for wear or damage; correct potentially hazardous conditions before use; protect lines from damage during use.

Test Notes:

Wear appropriate personal protection equipment such as safety shoes to prevent possible injury from falling weights and slipping on slick surfaces and a hard hat to prevent injury from overhead hazards.

1. Check repeatability of, and agreement between, indications throughout test. ..... G-S.5.2.2.(a), T.N.5.

2. Recheck zero-load balance each time test load is removed. ..... N.1.9., G-UR.4.2.

3. If the scale is equipped with a printer, print a ticket at each test load..... G-S.5.6., UR.1.3.(1/1/86)*
   Check effectiveness of motion detection
   Animal Scales > 2000 kg (5000 lb) capacity in service
   prior to January 1, 1981 and all livestock scales ..... S.2.5.1.(a)
   All other animal scales ..... S.2.5.1.(b)

4. If, during the conduct of the test, the performance of the device is questionable with respect to the zone of uncertainty and the width of zero, tests may be conducted to determine compliance..... N.1.5.(1/1/86)*,N.1.5.1., S.1.1.1.

5. If the device is equipped with operational features such as manual weight entries or a scoreboard indication of average weight, unit price, total prices, etc.; check proper operation and appropriateness..... G-UR.4.1., G-UR.4.2.

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Test:

WEAR SAFETY SHOES !
USE PROPER LIFTING TECHNIQUES !

1. Discrimination test at zero-load, if deemed necessary and if environmental conditions can be controlled.....N.1.5.(1/1/86)*, N.1.5.1.*

2. Increasing-load test.
   Depending on test weights available, test as close to tolerance breakpoints as possible .....N.1.1.

3. Shift test. Can be conducted during increasing-load test.
   Livestock scale with more than two sections.....N.1.3.4.
   For Livestock scales with more than two sections, conduct at least one shift test with a minimum test load of 12.5 percent of scale capacity anywhere on the load-receiving element using the prescribed test patterns and maximum test loads specified below

   Prescribe test pattern: An area of 1.2 meters (4 feet) in length and 3.0 meters (10 feet) in width or the width of the scale platform, whichever is less, shall be loaded to no more than half of the concentrated load capacity before loading the other side.

   For test patterns less than 1.2 meters (4 feet) in length, determine the maximum loading by the formula [(wheel base of test cart or length of test load divided by 48 in) x 0.9 x CLC].

   For test patterns that exceeds 1.2 meter (4 feet), the maximum test load applied shall not exceed CLC x the largest r factor in table UR.3.2.1.

   For weighing elements installed prior to January 1, 1989, the rated section capacity may be substituted for concentrated load capacity to determine maximum loading.

   Multiple pattern loading: To test to the nominal capacity, multiple patterns may be simultaneously loaded in a manner consistent with the method of use.

   Other designs: Special design scales and those that are wider than 3.7 meters (12 feet) shall be tested in a manner consistent with the method of use, but following the principles described above.

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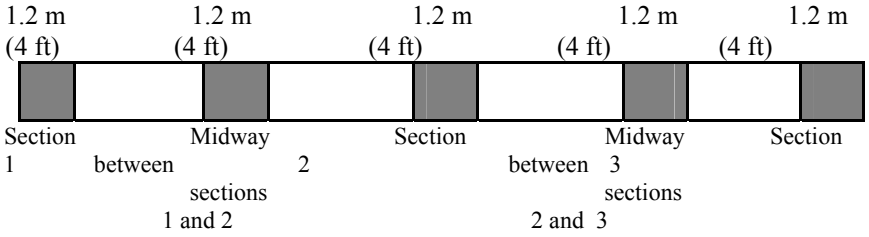
Test (cont.):



Test load: The maximum test load applied to the prescribed test pattern shall not exceed the concentrated load capacity (or for scales manufactured prior to January 1, 1989, the rated section capacity).

Note: When testing scales manufactured prior to January 1, 1989, caution should be exercised when loading test weights equivalent to the rated section capacity onto areas between sections.

Note: When loading the first section to be tested, it is recommended that observations be made at each increment of test weight application.

Note: When loading the scale for testing one side of the test pattern shall be loaded to no more than half of the concentrated load capacity or test load before loading the other side.

Two-section livestock scales and animal scales ..... N.1.3.8.

4. RFI/EMI test (if a problem is suspected) ..... G-N.2, G-UR.3.2., G-UR.4.2,G-UR.1.2., N.1.6., T.4., T.N.9.*

   Radio Frequency Interference (RFI)
   Electromagnetic Interference (EMI)

5. Discrimination test at maximum test load, if deemed necessary and if environmental conditions can be controlled ..... N.1.5.(1/1/86)*, N.1.5.1.

6. Over capacity test (if practical) ..... S.1.7.

7. Decreasing-load test ..... N.1.2.
   Marked animal scales only ..... N.1.2.1.*
   Livestock scales and unmarked animal scales ..... N.1.2.2.

8. Remove all test weights and determine any zero-load balance change ..... N.1.9., G-UR.4.2.

9. Test for proper design of automatic zero-setting mechanism, if device is so equipped
   Livestock scales ..... S.2.1.3.(a)(1/1/81)
   Animal scales ..... S.2.1.3.(c)(1/1/81)

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Test (cont.):

10. If device is equipped with a semi-automatic zero-setting mechanism (push button), test effectiveness of motion detection
    Scales > 2000 kg (5000 lb) capacity in service prior to January 1, 1981 ..... S.2.1.2.(a)
    All other livestock and animal scales ..... S.2.1.2.(b)

11. Establish correct zero-load balance.

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Maximum Values of v_{min}
Multiple Load Cell Scales
(Table values are in pounds.)

Load Cells	Scale Division 1 lb	2 lb	5 lb	10 lb	20 lb	50 lb	100 lb
2	0.71	1.41	3.54	7.07	14.1	35	70
4	0.50	1.00	2.50	5.00	10.0	25	50
6	0.41	0.82	2.04	4.08	8.2	20.4	41
8	0.35	0.71	1.77	3.54	7.1	17.7	35
10	0.32	0.63	1.58	3.16	6.3	15.8	32
12	0.29	0.58	1.44	2.89	5.8	14.4	29
14	0.27	0.53	1.34	2.67	5.4	13.4	27

Full electronic scales

Example: For a livestock scale with two sections (four load cells) and a displayed scale division of 5 lb, the maximum value permitted for each load cell is 2.5 lb. The calculation is shown below. If the value marked on the load cell is less than or equal to the value computed for the v_{min}, then the load cell is considered to comply with T.N.8.1.3.

$$v_{min} \leq \frac{d}{\sqrt{N}} = \frac{5\text{ lb}}{\sqrt{4}} = \frac{5\text{ lb}}{2} = 2.5\text{ lb}$$

Electromechanical Scales

Example: Calculate the multiple of the lever system from the ratios marked on the levers. Suppose the multiple for a livestock scale is 400:1 and that the scale has a scale division of 5 lb. Then the maximum value for the v_{min} of the load cell is 0.0125 lb. The calculation is shown below. If the load cell is marked with a v_{min} less than or equal to the calculated value, then the load cell is considered to comply with T.N.8.1.3.

$$v_{min} \leq \frac{d}{\text{scale multiple}} = \frac{5\text{ lb}}{4} = 0.0125\text{ lb}$$