2015 NIST EPO No. 9

Examination Procedure Outline for

Part 1 – Monorail Scales – Electronic Digital Indicators

Part 1 – Monorail Scales – Electronic Digital Indicators 1
Part 2 – Monorail Scales and Meat Beams – Mechanical 11

It is recommended that this outline be followed as minimum criteria for examining monorail scales equipped with electronic digital indicators used to weigh statically or dynamically. See EPO 9, Part 2 for Mechanical Meatbeam and Monorail Scales.

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 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 or servicepersons be aware of all safety regulations and policies in place 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 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.

Prior to beginning any inspection, the inspector should read and be familiar with the 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:

Clothing

Personal Protection Equipment
e.g., Safety Shoes

Electrical Hazards

Support – for scales, test weights, and load-receiving elements (e.g., meat hooks or test platform)

First Aid Kit

Transportation of Equipment

Hardhat – for protection from overhead (e.g., hanging meat hooks)

Eye Protection - for protection from hanging meat hooks

Lifting

Also: Overhead Hazard, Materials or Obstructions

H-44 General Code and Scale 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. ..... S.1.1., S.1.1.1., S.2.1.1., S.2.1.2., S.2.1.4., UR.4.1., G-S.5.2.2(d)*

   If the device is not in balance, the user should be made aware of paragraph UR.4.1., and warning issued if necessary. If device is set for tare, check accuracy of the tare being taken.

2. Indicating and recording elements.

   Scale division, value (d) and number (n). ..... S.1.2.*, S.1.2.1. (1/1/89), S.1.2.2., S.5.*, G-UR.1.1., UR.1., UR.1.1.(b), G-S.5.3., UR 1.3.1.(b), UR.3.10.

   Tare division value..... S.2.3. (1/1/83), S.2.3.1.
   Tare mechanism. ..... S.2.3.
   Appropriateness. ..... G-S.5., S.1.7., S.5.2.*,UR.1.1. (a)*, UR.3.1.*

   Recording elements, General ..... G-S.5.6.
   Customer readability, if applicable. ..... G-UR.3.3.
   Damping means. ..... S.2.5.1.
   Adjustable components. ..... S.1.10.
   Provision for sealing. S.1.11. (1/1/90), G-UR.4.5., G-S.8. G-S.8.1. (1/1/2010)

   Manual Weight Entries. ..... S.1.12. (1/1/93), UR.3.9. S.6.3., S.6.2.

H-44 General Code and Scale Code References

Inspection (cont.):

3. Marking. ..... G-S.1.
   a. Marking requirements - all devices
      - Identification. ..... Retroactive
      - Name or ID of manufacturer. ..... Retroactive
      - Model identifier ..... (1/1/03)
      - Model identifier prefix. ..... (1/1/68)
      - Nonrepetitive serial number. ..... (1/1/86)
      - Serial number prefix. ..... (1/1/03)
      - NTEP CC prefix and number (for devices that have an NTEP CC). ..... (1/1/04)
      - Software version or revision identifier. ..... G-S.1.2.
      - Devices or main elements remanufactured after January 1, 2002. ..... G-S.1.
        - name and ID of remanufacturer or distributor ..... (1/1/02)
        - model number if different from original model number. ..... (1/1/02)

   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 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 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 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 for 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
      - Temperature limits if narrower than and within -10 °C to 40 °C (14 °F to 104 °F). ..... (1/1/86)
      - Scales designed for special application. ..... (1/1/86)
      - Maximum number of scale divisions (nmax). ..... (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)

	H-44 General Code and Scale Code References

Inspection (cont.):

G-S.1. (cont.)

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. ..... (1/1/86)
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)
"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)

f. Marking requirements – current software version or revision identifier for not built-for-purpose, software- based devices. ..... G-S.1.(d) (1/1/2004), G-S.1.(d)(1)(2), (1/1/07), G-S.1.1.(1/1/2004)

4. Design of balance, tare, level, damping, and arresting mechanisms. ..... S.2.1., S.2.3., S.2.5.1.

5. Design of weighing elements. ..... S.4.

6. Installation :

Static monorail scales. ..... UR.2.3., UR.2.4., G-UR.2.

Dynamic monorail scale considerations: ..... N.1.3.5.1., UR.2.3., UR.2.4., G-UR.2.

- Space to avoid contact between carcasses,
- Higher resolution checkweigh scales, and
- Carcasses used multiple times.

H-44 General Code and Scale Code References

Inspection (cont.):

SAFETY REMINDER

- **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.**
- **Be sure that a first aid kit is available and that the kit is appropriate for the type of inspection activity.**
- **Check to be sure the scale supports are adequate to support the scale, test weights equal to the capacity of the scale, and test platforms or chains to suspend test weights**

7. Maintenance, use, and environmental factors (cleanliness, obstructions, modifications, etc.).....G-S.2., G-UR.1.2., G-UR.3.1., G-UR.3.2., G-UR.4., UR.4.3.

8. Assistance.....G-UR.4.4.

9. Provisions for testing and accessibility.....UR.2.9., G-UR.2.3.

10. 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; for example, if the indicator has an n_{max} of 10 000 and the load cells have an n_{max} of 5000, then the scale may use up to 5000 divisions.

    b. The load cell is approved for the required accuracy class. Note: A Class II load cell may be used in a Class III 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 uses cannot be used in a single load cell application.

    d. The load cell complies with the requirements for V_{min} and temperature effect on zero-load balance. .....S.5.4., T.N.8.1.3.

H-44 General Code and Scale Code References

Inspection (cont.):

For scales with mechanical lever systems:

$$v_{\min} \leq \frac{d^*}{\sqrt{N} \times (scale\ multiple)}$$

$$v_{\min} \leq \frac{d^*}{\sqrt{N}} = \frac{1\,lb}{\sqrt{2}} = \frac{1\,lb}{1.414} = 0.71\,lb$$

*When the value of the scale division, d, is different from the verification scale division, e, for the scale, the value of e must be used in the formulae above.

Pretest Determinations:

1. Tolerances.
   - Acceptance/Maintenance.....G-T.1., G-T.2.
   - Application.....T.N.2.1., T.N.2.3., T.N.2.4.
   - Tolerance values:
     - Scales marked with an accuracy class. .....T.N.3.1., T.N.3.2., Table 6 (Class III),
     - Scales not marked.....T.N.3.8., T.N.4.1., T.N.4.4., T.N.4.5., T.N.5.
     - Discrimination. .....T.N.7.2.

2. Select trolleys, trees, chains, or other auxiliary gear necessary to suspend test weights on rail or meat hook. If two or more trolley-and-tree combinations are used; they should be uniform in weight (within plus or minus two ounces).

SAFETY REMINDER!!!

- **Wear appropriate personal protection equipment such as hard hats and eye protection to prevent injury from overhead meat hooks, hanging carcasses, falling weights, and slipping on slick surfaces.**
- **Wear safety shoes to prevent possible injury from falling weights and slipping on slick surfaces.**

H-44 General Code and Scale Code References

Pretest Determinations (cont.):

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

Test Notes:

1. Suspend auxiliary gear (trolleys, trees, chains) from live rail.

2. Balance in auxiliary gear.

3. Check repeatability and agreement between indications and between indications and recorded representations throughout test. .....T.N.4.1., T.N.5., G-S.5.2.2.(a)

4. 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.

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

6. If the scale is equipped with a printer, print a ticket at each test load; check effectiveness of motion detection. .....G S.5.6., S.2.5.1., UR.1.3. (1/1/86)

7. 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, adequate tests should be conducted to determine compliance. .....N.1.5., N.1.5.1., S.1.1.1.

8. If the device is equipped with operational features such as automatic zero-setting mechanism, programmable tare,*manual weight entries, or two scales with one printer, check proper operation and appropriateness.

*Note: See UR.3.9. The use of manual gross weight entries, are not allowed on monorail scales.

	H-44 General Code and Scale Code References

Test:

Static Test:

SAFETY REMINDER!!!

- **Wear safety shoes!**
- **Use proper lifting techniques!**

3. 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)

4. Over capacity test, if deemed necessary. ..... S.1.7., S.2.1.5., S.2.1.5.(b) (1/1/2009)

5. Decreasing load test. Test at one half of maximum test load. ..... N.1.2.

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

7. Test for proper design of automatic zero-setting mechanism, if device is so equipped. S.2.1.3.1.(c), S.2.1.3.2.8.

8. If device is equipped with a semi-automatic zero-setting mechanism (push button), test effectiveness of motion detection..... S.2.1.2.(b)

9. Establish correct zero load balance.

Dynamic Test ..... N.1.3.5.1.

On a dynamic test with 20 or more test drafts, 10 % of the individual test drafts may be two times the basic tolerances, if the error on the total of all test load drafts does not exceed 0.2 %.

1. Conduct dynamic test with livestock carcasses

2. Test no less than 20 test loads using carcasses or portions of carcasses of the type normally weighed (two additional test loads may be included in the test run in the event that one or two of the test load are rendered unusable).

3. Position the test carcasses far enough ahead of the scale so the swaying motion settles to duplicate the normal sway of a continuously running plant chain.

H-44 General Code and Scale Code References

Dynamic Test (cont.).....N.1.3.5.1.

4. If the plant conveyor chain does not space or prevent the carcasses from touching one another, the dynamic test should not be conducted until this condition is corrected.

5. Individually weigh (statistically) the carcasses on the same scale being tested or another monorail scale in close proximity with the same or smaller divisions.

    a. The scale selected for weighing the carcasses must be tested statically with test weights.

6. If the scale being tested is used for weighing freshly slaughtered animals, a static weighment of the carcasses must be taken as quickly as possible before or following the Dynamic weighment to avoid loss due to shrinkage.

~~6~~7. If multiple dynamic tests are conducted using the same carcasses, obtain static weights before and after multiple dynamic tests.

8. If the carcass changes weight between static tests, the amount of weight change should be taken into account, or the carcass should be discarded for tolerance purposes.

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Examination Procedure Outline for

Part 2 – Monorail Scales and Meat Beams – Mechanical

It is recommended that this outline be followed for monorail scales equipped with equipped with weigh-beams or mechanical dials. 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 – See EPO 9, Part 1

	H-44 General Code and Scale 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..... S.1.1., S.2.1.1., S.2.1.2., UR.4.1

   If the device is not in balance, the user should be made aware of paragraph UR.4.1., and warning issued if necessary. If device is set for tare, check accuracy of the tare being taken.

2. Indicating and recording elements.

   Scale division, value (d) and number (n)..... S.1.2.*, G-UR.1.1., UR.1., UR.1.1.(b), G-S.5.3.

   Tare division value. ..... S.2.3. (1/1/83), S.2.3.1.
   Tare mechanism. ..... S.2.3.
   Weighbeams. ..... S.1.5. except S.1.5.5.
   Poises..... S.1.6.
   Dials and balance indicators. ..... S.1.3., S.1.4., S.2.2.
   Appropriateness..... G-S.5., S.1.7.,
   Damping means..... UR.1.1.(a),* UR.3.1.,*
   Customer readability. S.5.,*UR.3.2.,
   Adjustable appropriateness. ..... S.2.5.

	H-44 General and Scale References	Code Code

Inspection (cont.):

3.	Marking.	S.6.3., S.6.2.
	a. Marking requirements - all devices	
	Identification.	G-S.1.
	Name or ID of manufacturer	Retroactive
	Model identifier	Retroactive
	Model identifier prefix.	(1/1/03)
	Nonrepetitive serial number.	(1/1/68)
	Serial number prefix.	(1/1/86)
	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 and ID of remanufacturer or distributor	(1/1/02)
	Model number if different from original model number.	(1/1/02)
	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)
	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)
	Scales designed for special purposes.	(1/1/86)
	Maximum number of scale divisions (n_{max}).	(1/1/88)
	d. Marking requirements for 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
	Scales designed for special application.	(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)
4.	Installation.	UR.2.3., UR.2.4., G-UR.2.
5.	Design of balance, tare, level, damping, and arresting mechanisms.	S.2.1., S.2.3., S.2.5.1.
6.	Design of weighing elements.	S.4.

	H-44 General Code and Scale Code References

Inspection (cont.):

7. Maintenance, use, and environmental factors (cleanliness, obstructions, modifications, etc.). ..... G-S.2., G-UR.1.2., G-UR.3.1., G-UR.4., UR.4.3.

SAFETY REMINDER!!!

- **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.**
- **Be sure that a first aid kit is available and that the kit is appropriate for the type of inspection activity.**
- **Check to be sure the scale supports are adequate to support the scale, test weights equal to the capacity of the scale, and test platforms or chains used to suspend test weights.**

8. Assistance. ..... G-UR.4.4.

9. Provisions for testing and accessibility. ..... UR.2.9., G-UR.2.3.

Pretest Determinations:

1. Tolerances.
   Acceptance/Maintenance. ..... G-T.1., G-T.2.

   Application. ..... T.N.2.1., T.N.2.3., T.N.2.4.

   Tolerance values:
   Scales marked with an accuracy class. ..... T.N.3.1., T.N.3.2., Table 6 (Class III), T.N.4., T.N.5.
   Scales not marked. ..... T.1.1., T.N.3.1., Table 6 (Class III), T.N.3.2. T.N.4.1., T.N.4.2., T.N.5.

   Discrimination. ..... T.N.7.1.*

	H-44 General Code and Scale Code References

Pretest Determinations (cont.):

2. Select trolleys, trees, chains, or other auxiliary gear necessary to suspend test weights on rail or meat hook. If two or more trolley-and-tree combinations are used; they should be uniform in weight ± 52 grams (± 2 ounces).

SAFETY REMINDER!!!

- **Wear appropriate personal protection equipment such as hard hats and eye protection to prevent injury from overhead meat hooks, hanging carcasses, falling weights, and slipping on slick surfaces.**
- **Wear safety shoes to prevent possible injury from falling weights and slipping on slick surfaces.**

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

Test Notes:

1. Suspend auxiliary gear (trolleys, trees, chains) from live rail.
2. If beam scale, place small error weights on or suspend from the live rail or hook. The value of the smallest weight should be equal to the minimum tolerance value and the total of all the weights should be equal to the tolerance at maximum test load.
3. Balance in auxiliary gear and test weights.
4. Check repeatability and agreement between indications and between indications and recorded representations throughout test. ..... T.N.4.1., T.N.5., G-S.5.2.2.(a)
5. Check zero-load balance each time test load is removed. N.1.9., G-UR.4.2
6. If scale is equipped with a type-recording beam or printer, print a ticket at each test load.. ..... G S.5.6., UR.1.3.(1/1/86)

Static Test:

SAFETY REMINDER!!!

- **Wear safety shoes!**
- **Use proper lifting techniques!**

	H-44 General Code and Scale Code References

Static Test (cont.):

1.	Sensitivity teat at zero[load (weighbeams only).....	N.1.4.
	Discrimination test at zero only (dial indicators only).....	N.1.5.
2.	Increasing load test.	N.1.1.
	a. Beam scales. Test at not less than three points or notches on weigh-beam. Scales not equipped with a full capacity beam should be ratio tested using standard weights on counterpoise hanger.	
	When ratio testing, test poise and beam by substituting poise position with the removal of standard weights from counterpoise hanger.	N.1.7.
	b. Dial scales. Test at not less than three points on reading face, including all possible quarters of capacity. Test all unit weights possible. If equipped with tare bars, test at one half and full capacity of each bar.	
3.	Shift test. Use test load equal to the largest load that can be anticipated to be weighed at the installation, but never less than one-half capacity. Apply load successively on the right end, the left end, and the center of the live rail. This can be conducted during the increasing load test.	N.1.3.5.
4.	Beams and balance indicators only, test for SR at the maximum test load.	N.1.4.
	Dials only. Conduct the discrimination test at maximum test load.	N.1.5.
5.	Dials only. Conduct the decreasing-load test at one-half of the maximum test load (at no less than one-half of the dial face capacity.	*N.1.2.1., N.1.2.2.
6.	Beams only. Conduct a counterpoise weight accuracy test (see *HB 44 Section 2.23. Weights* paragraph T.1. and appropriate Table 1. Maintenance Tolerance for Avoirdupois Weights or Table 1. Maintenance Tolerance for Metric Weights).	HB 44 Section 2.23 paragraph T.1.
7.	Remove all test weights and determine any zero-balance change.	N.1.9., G-UR.4.2.

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