

Chapter 3. Inspection

“compliance with design, maintenance and user requirements”

Vehicle and Axle Load Scales

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Chapter 3 Objectives

1. Identify and describe the items of scale design, installation, and operation that must be checked during the inspection, including the following:
 - Zero-Load Balance as Found
 - Marking
 - Indicating and Recording Elements
 - Installation
 - Weighing and Load-Receiving Elements
 - Approaches
 - Maintenance, Use, and Environmental Factors
 - Assistance
2. Describe Handbook 44 requirements relating to these items that are applicable in field examinations.
3. Identify the criteria used to determine scale suitability.
4. Describe the purpose of the National Type Evaluation Program.
5. Identify **Not Built for Purpose Devices - Software Based**, and describe how they are to be marked.

Note: Before introducing the slide presentation for each chapter, it is recommended that the presenter read the course material for the chapter in its entirety and refer to the written material as needed while using the slide presentation to illustrate and explain the text.

NIST Handbook 44

- General Code
 - Application (G-A.1.) (G-A.2. conflicts with other codes)
 - Specifications (G-S.1.)
 - Notes (G-N.)
 - Tolerances – (G-T.1. & 2. acceptance, maintenance)
 - User Requirements (G-UR.4.1.)

Sections of the general code and device codes are arranged in a specific order as shown above. Describe how the sections are arranged and why.

NIST Handbook 44

- Device Codes
 - Application (A.1.) (mfg, sellers, users)
 - Specifications (S.1.) (mfg, technicians)
 - Tolerances (T.1.) (everyone)
 - Notes (N.1. Tests) (officials, technicians)
 - User Requirements (UR.1.) (everyone)

- Research the item using NCWM Reports

This is the section order of the device codes. Identify the various sections and the parties typically affected by those sections.

Background information for the various requirements is found by researching the NCWM Reports which are available on CD or DVD from NIST.

NIST Handbook 44

- Definitions
- Fundamental Considerations
 - Concept of acceptance and maintenance tolerances and the theory of tolerances.
 - Tolerances are “primarily accuracy criteria for use by the regulatory official.”
 - Not to bring equipment “merely within” tolerances when it is possible to adjust ‘closer’ to zero error.
- Test Apparatus, Inspection, other topics.

These are some more important sections of H-44. Identify the locations of these sections in the handbook.

National Type Evaluation Program

- Managed by the National Conference on Weights and Measures Inc.
- Conduct Type Evaluations of scales, liquid measuring devices, load cells, and other instruments.
- Certificate of Conformance (Certificate) are excellent tools for field inspectors.
 - Eliminates many of the difficult compliance questions (e.g., temperature).

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Explain the various steps of the NTEP program from start (manufacture submits device) to end (CC issued) Discuss the benefits of NTEP to your jurisdiction and explain how it benefits device manufacturers, device owners and users, and field inspection activities.

Explain the criteria for establishing when the modification of a vehicle scale would necessitate a CC.

G-A.6. Non-Retroactive Requirements

- Enforceable after the effective date for:
 - Devices manufactured within a state;
 - New and used devices brought into a state;
 - Non-commercial devices that the owner or user wants to switch to commercial use.
- They do not apply to devices in stock at dealers or to those in commercial use.
- *They are shown in italic text in the handbook and include a non-retroactive date (2004)*

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Read G-A.6. and explain the requirement. Explain why it is necessary to assign effective dates to nonretroactive requirements. Explain why nonretroactive requirements would be applied to a new indicator that has been installed on an older load receiving element.

G-A.5. Retroactive Requirements

- Apply to all equipment.
- Non-retroactive requirements are periodically reviewed by the NCWM Specifications and Tolerances Committee to see if they should be made retroactive.
- Giving notice well in advance helps eliminate most enforcement issues.

Read and explain G-A.5.

Marking Requirements



Marking Requirements

- What are the various marking requirements pertaining to the scale components being inspected?

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Identify the different scale components used in vehicle and axle-load scale applications that are required to be marked in accordance with S.6.3.

Marking Requirements



What are the effective dates of enforcement for the components being inspected?

G-A.5. Retroactive Requirements

GA.6. Nonretroactive Requirements

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Explain how retroactive and nonretroactive requirements are applied and the significance of officials determining the date that a device was placed into commercial service.

Vehicle Scale Marking Requirements Checklist

Requirement	Indicator	Weighing Element	Load Cell
Manufacture ID	All	All	All
Model Designation	All	All	All
Model Prefix	1/1/03	1/1/03	1/1/03
Serial Number	1/1/68	1/1/68	1/1/68
Serial Number Prefix	1/1/86	1/1/86	1/1/86
Serial Number Acceptable Abbreviations	1/1/01	1/1/01	1/1/01
Certificate of Conformance Number (CC)	1/1/03	1/1/03	1/1/03
Accuracy Class	1/1/86	1/1/88	1/1/88
Nominal Capacity	All	1/1/89	
Nominal Capacity and Value of d together	1/1/83		
Concentrated Load Capacity (CLC)	1/1/89	1/1/89	
Section Capacity ^[1] (Pre-1989 scales only)	All	All	
Maximum Number of Scale Divisions (n_{max})	1/1/88	1/1/88	1/1/88 ^[2]
Special Application	1/1/86	1/1/86	
Temperature Limits ³	1/1/86	1/1/86	1/1/86
Minimum Verification Scale Division (e_{min})		1/1/88	
Single (S) or Multiple (M)			1/1/88
Minimum Load Cell Verification Interval (v_{min})			Retro
Maximum Capacity			Retro
Minimum Dead Load			Retro
Safe Load Limit			Retro
Direction of Loading			1/1/88 ⁴

This is an example of the class handout entitled “Marking Requirements Checklist.” It is recommended that a checklist such as this one be used for the enforcement of marking requirements on vehicle and axle-load scales.

Location of Marking Information – Indicators and Load Cells G-S.1.

- Marking information must be permanent and readily observable without the necessity of the disassembly of a part requiring the use of any means separate from the device.

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Explain how a typical vehicle scale installation is comprised of multiple components and each component individually must comply with associated marking requirements. Then explain the bulleted item which applies to indicators.

Using electronic truck scale indicators as an example, explain why manufacturers purposely omit the required markings of capacity, division size and CLC. (It is because these indicators can usually be used with a variety of weighing elements having various dimensions, nominal capacities, and concentrated load capacities. Division size, nominal capacity, CLC is therefore usually marked by the installer and based on the load receiving element and/or the load cells used in the specific application). Because the various components used in vehicle scale applications can often be easily “swapped out” there is a need for officials to always be alert for the mismatching of components.



Explain why the nominal capacity and division size were not included as part of the information contained on the Fairbanks label that is shown in the lower portion of this photo. Who most likely installed this capacity label?* Identify and discuss the required marking information for vehicle and axle-load scale indicators as provided in Table S.6.3.a.

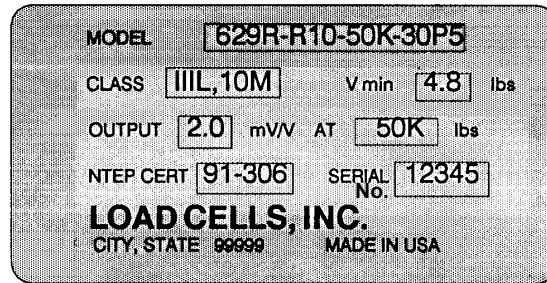
* Answer: a field service technician.



Explain these markings and identify those who likely installed them. (also a field service technician) Discuss the use of plastic tape with an adhesive backing to mark required information. Explore whether or not such marking should be considered permanent. Explain the difference between sectional capacity and CLC.



This is a photo of a manufacturer's identification plate.



Does not include direction of loading (not required if obvious), Temperature Limits, minimum dead or safe load limits

Drawing of load cell data plate showing marking information. Identify and explain the important information shown on the data plate. Review footnote (11), Table S.6.3.a. which allows required marking to be either on the load cell or an accompanying document. Using Table S.6.3.a., identify information required to be marked from this data plate and also any missing information.

Device or Family
Description

National Type Evaluation Program
Certificate of Conformance
for Weighing and Measuring Devices

Manufacturer
Information

For:
Load Cell
Beurling Beam
Model Family: 12345 Series (see below)
 n_{max} : Multiple Cells: 10 000
Capacity: 37 500 lb to 75 000

Submitted by:
Load Cell Company
123 Main Street
Anywhere, USA 12345
Tel: (111) 555-1212
Fax: (111) 555-1213
Contact:

Standard Features and Options

Model	Capacity (lb)	v_{max} (lb)	Minimum Dead Load (lb)
WBT-37.5 K	37 500	3.75	500
WBT-50.0 K	50 000	5.00	600
WBT-60.0 K	60 000	5.00	600
WBT-75.0 K	75 000	7.00	1000

Load Application Methods:

Radiused link applies load onto circular contoured knob on end of beam
Column member applies load to vertical threaded hole in end of beam

Features of
Specific Models

Temperature Range: -10 to 40 °C (14 to 104 °F)

Features and
Options

This device was evaluated under the National Type Evaluation Program (NTEP) and was found to comply with the applicable technical requirements of Handbook 44, "Specifications, Tolerances, and Other Technical Requirements for Weighing and Measuring Devices." Evaluation results and device characteristics necessary for inspection and use in commerce are on the following pages.

Chairman, NCWM, Inc.

Chairman, National Type Evaluation Program Committee

Note: The National Conference on Weights and Measures does not "approve", "recommend", or "endorse" any proprietary product or material, either as a or as single item or class or group. Results shall not be used in advertising or sales promotion to indicate explicit or implicit endorsement of the product or material by the NCWM.

Typical CC for a load cell. Arrows identify the location of specific information.

**Load Cell Company
Bending Beam Load Cell
Model: 12345 Series**

Application: The load cells may be used in Class III L scales for multiple cell applications consistent with the model designations, number of scale divisions, and parameters specified in this certificate. Load cells of a given accuracy class may be used in applications with lower accuracy class requirements provided the number of scale divisions, the v_{max} values, and temperature range are suitable for the application. The manufacturer may market the load cell with fewer divisions (n_{min}) and with larger v_{max} values than those listed on the certificate. However, the load cells must be marked with the appropriate n_{min} and v_{max} for which the load cell may be used.

Identification: A pressure sensitive identification badge containing the manufacturer's name, model designation, and serial number is located on the load cell. All other required information, if not marked on the load cell, must be on an accompanying document including the serial number of the load cell.

Test Conditions: This Certificate supersedes Certificate of Conformance Number 04-XXXXA2 and is issued without additional testing to include a vertical threaded hole in the end of the beam for load application. The CC holder applied technical information and performance data. This load application was also evaluated in a vehicle scale under NTEP-CC 04-YYYY. Previous test conditions are listed below as reference.

Certificate of Conformance Number 04-XXXXA2: This Certificate supersedes Certificate of Conformance Number 04-XXXXA1 and is issued without additional testing to include the Model 12345-60.0K, 60 000-lb capacity load cells.

Certificate of Conformance Number 04-XXXXA1: This addendum was issued to change the g_0 of the Model 12345-75.0K load cell from 7.50 lb to 7.00 lb. The certificate was previously changed to include the 50 600-lb capacity load cell in the 12345 Model Family. Testing of the two 37 500-lb load cells indicated below was performed in addition to the testing performed at the time that Certificate of Conformance Number 04-XXXXP was issued. Results of the additional testing indicate it is appropriate to include the 50 000-lb load cell in this certificate.

Certificate of Conformance Number 04-XXXX: This Certificate superseded Certificates of Conformance Numbers 04-XXXXP and 04-XXXXPA and was issued to upgrade the status of the certificates from provisional to full.

Certificate of Conformance Number 04-XXXXPA: This Certificate superseded Certificate of Conformance Number 04-XXXXP and was issued to include the Model 12345-50.0K, 50 000-lb capacity load cells. Two 37 500-lb capacity load cells were tested at NIST using dead weights as the reference standard. The data were analyzed for multiple load cell applications. The cells were tested over a temperature range of -10 °C to 40 °C. Three tests were run on each cell at each temperature. The temperature effect on zero was measured and a time dependence (creep) test was performed. The barometric pressure test was waived due to the insensitivity of the load cell design to changes in barometric pressure.

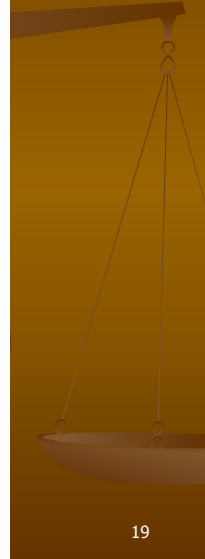
Certificate of Conformance Number 04-XXXXP: Two 37 500-lb capacity load cells were tested at the manufacturer's laboratory using dead weights as the reference standard. The data were analyzed for multiple load cell applications. The cells were tested over a temperature range of -10 °C to 40 °C. Three tests were run on each cell at each temperature. The temperature effect on zero was measured and a time dependence (creep) test was performed. The barometric pressure test was waived due to the insensitivity of the load cell design to changes in barometric pressure.

The results of the evaluations indicate the load cell complies with applicable requirements of NIST Handbook 44.

Type Evaluation Criteria Used: NIST Handbook 44, 2004 Edition

Tested By: NIST Force Group, NIST Office of Weights and Measures

Information Reviewed By: NTEP/Director



Additional information found on the CC.

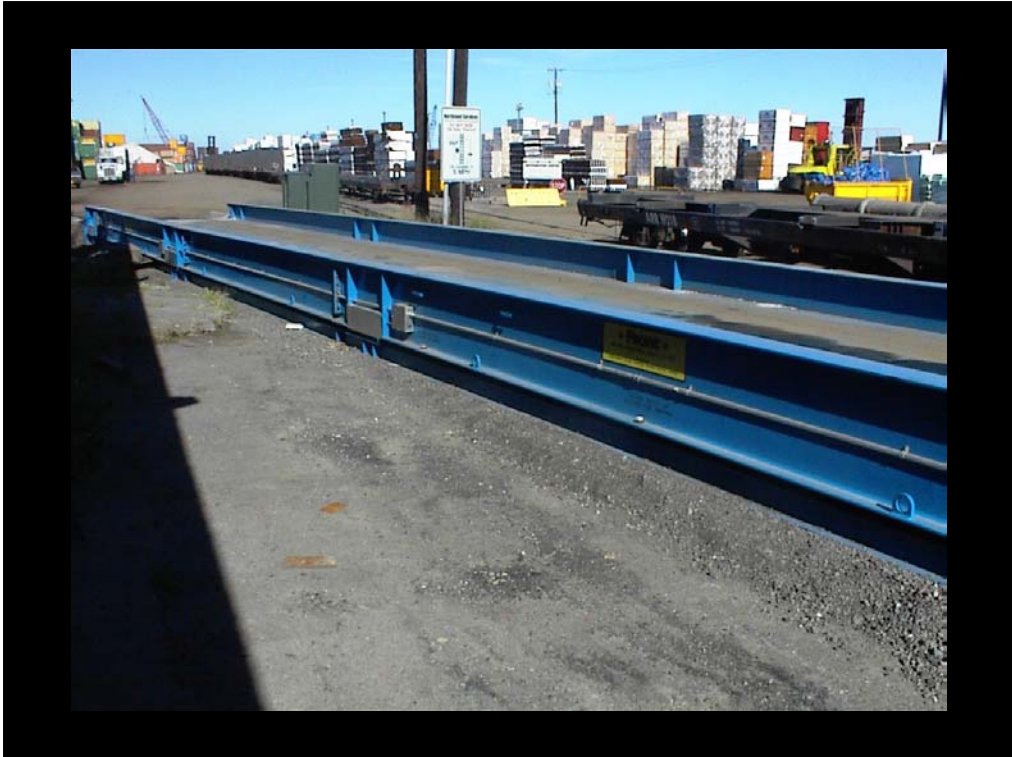
Location of Marking Information Load-receiving Element S.6.2

- Marking information may be located in an area that is accessible through the use of a tool provided:
 - **It is easily accessible and**
 - **Located on the weighbridge near the point where the signal leaves the weighing element or beneath the nearest access cover.**

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Identify and explain the locations on the load receiving element where the required marking information in G-S.1. of the General Code and S.6. of the Scales Code is permitted to be marked using the following as a guide.

1. The required marking information is permitted to be marked anywhere on the load-receiving element providing it is readily observable without the necessity of the disassembly of a part requiring the use of any means separate from the device, **or**
2. Such information can be located in an area that is accessible only through the use of a tool; provided that the information is easily accessible, i.e., on the weighbridge near the point where the signal leaves the weighing element or beneath the nearest access cover.



Explain where to look on this load-receiving element for required marking information.

Reference: S.6.2.



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Small hand tools are sometimes needed to access required identification information that is permitted to be marked on a junction box beneath an access cover on the weighbridge (load-receiving element). Before removing access covers, always look for required identification information on the exterior of the load receiving element or an exposed junction box first. Many scale service agencies prefer to mount the data plate in one of these locations rather than under an access cover. Explain where to look on this load-receiving element for required marking information.

Reference: S.6.2.

S.6.3. - Markings Requirements Built for Purpose Devices

- A Built for Purpose Device: any main device or element which was manufactured with the intent that it be used as, or part of, a weighing or measuring device or system.
- Example: personal computers that serve as the digital indicator are Not Built for Purpose Devices.

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Use handout entitled “2003 NCWM Changes to HB44” to define and describe “built for purpose” and “not built for purpose, software-based” devices.

Not Built for Purpose Devices – Software Based

- The “scale indicator” functions are provided by a software package that takes the place of a digital indicator.
- A serial number on the PC isn’t very helpful as it is the software that must conform to NIST Handbook 44.

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Explain the bulleted items.

Reference: Handout entitled “2003 NCWM Changes to HB44.”

Not Built for Purpose Devices – Software Based

- Instead, the PC must display the version of software used in the PC so officials can identify the manufacturer of the software that handles the weighing functions.
- NTEP evaluates the software for compliance with the handbook and the official verifies that the correct version in use with the scale.

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This is a new nonretroactive requirement which adds a new paragraph G-S.1.1. and renumbers the existing G-S.1.1 requirement to G-S.1.2. The new G-S.1.1. requirement will specify the required information that must be marked on a not built-for-purpose, software-based device.

Reference: Handout entitled “2003 NCWM Changes to HB44.”

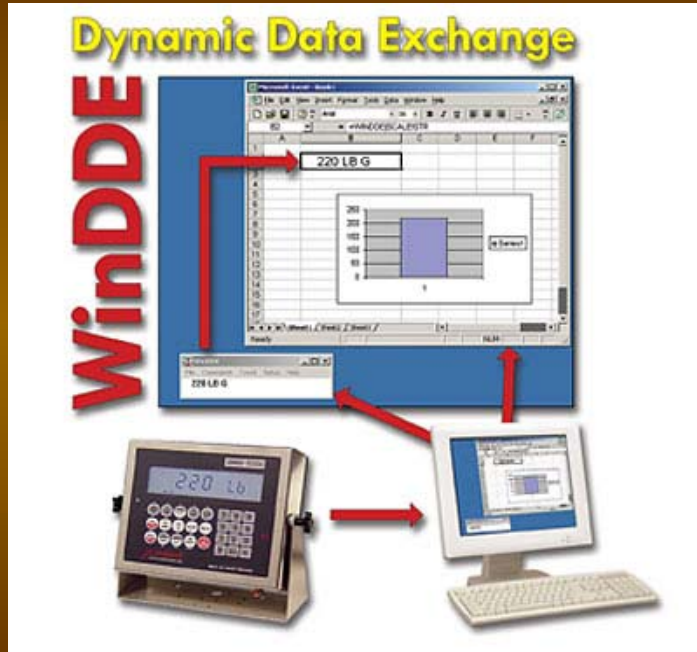


Photo shows how a personal computer can take the place of a scale indicator or be used in conjunction with the scale indicator. Explain how it is the software that allows the computer to function as a weight indicator.

Scale Suitability

- **UR.1. Selection Requirements.** - Equipment shall be suitable for the service in which it is used with respect to elements of its design, including but not limited to, its capacity, number of scale divisions, value of the scale division or verification scale division, minimum capacity, and computing capability.
- Footnote: Purchasers and users of ...vehicle scales should be aware of possible additional requirements for their design and installation.

Read UR.1. and explain how the elements of a scale's design affect suitability.

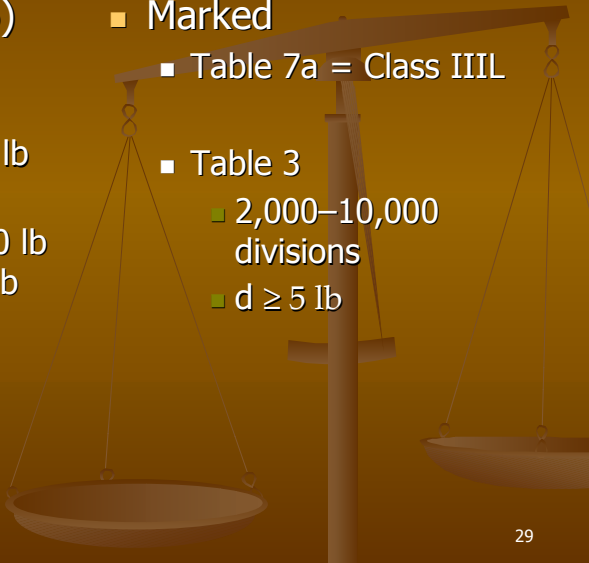
Scale Suitability Criteria

- Capacity
- What do they do with the scale?
 - Buying/Selling
 - Axle Loads
- How much do the trucks weigh and what are their axle loads? Is the CLC or Section Capacity appropriate for the trucks?
- How many trucks do they weigh?
- How long and wide are the trucks?
- Direct Sale?
 - customer indication
- Value of Scale Division (10 lb, 20 lb, 50 lb) =
What is the money value of the error?

Discuss each bulleted item explaining how it relates to the suitability of a scale. Explain how the division size of a scale and the minimum applicable tolerance affect the amount of inherent error in a scale.

Scale Suitability Criteria

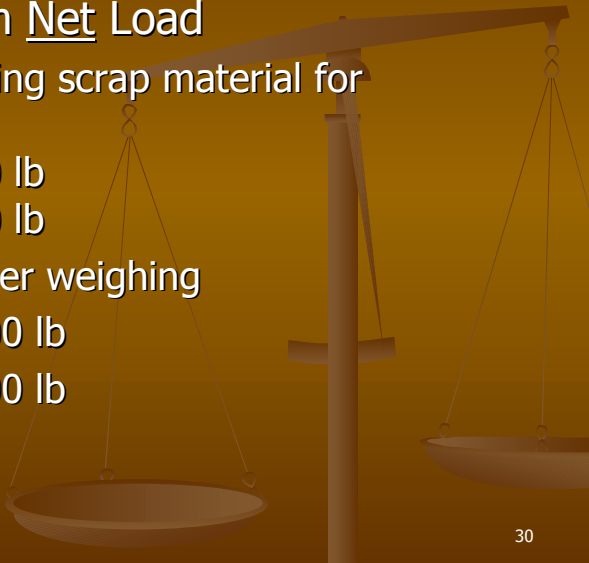
- Unmarked (Pre 86)
 - Table 7b –
 - Up to 200,000 lbs
Maximum d is 20 lb
 - More than 200,000 lb
Maximum d is 50 lb
- Marked
 - Table 7a = Class III L
 - Table 3
 - 2,000–10,000 divisions
 - $d \geq 5$ lb



Refer to table 7a and 7b, Scales Code, for marked and unmarked scales. Explain the selection requirements contained in these tables.

Scale Suitability Criteria

- UR.3.7 Minimum Net Load
 - a. 10 d for weighing scrap material for recycling.
 - $10 \times 20 = 200 \text{ lb}$
 - $10 \times 50 = 500 \text{ lb}$
 - b. 50 d for all other weighing
 - $50 \times 20 = 1000 \text{ lb}$
 - $50 \times 50 = 2500 \text{ lb}$



Read and explain the purpose of UR.3.7. Define the term “scrap material for recycling.” Explain how the minimum load weighed affects the percentage of error in a weight determination:

G-UR.2.1. Installation.

- A device shall be installed in accordance with the manufacturer's instructions, including any instructions marked on the device. A device installed in a fixed location shall be installed so that neither its operation nor its performance will be adversely affected by any characteristic of the foundation, supports, or any other detail of the installation.

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Read and explain the requirement. Explain the need for officials to familiarize themselves with proper installation procedures for devices they are responsible for inspecting.

Installation

- **G-UR.2.3. Accessibility for Inspection, Testing, and Sealing Purposes.** - A device shall be located, or such facilities for normal access thereto shall be provided, to permit:
 - a. inspecting and testing the device;
 - b. inspecting and applying security seals to the device; and
 - c. access for test equipment.
- Otherwise, the owner or operator must provide labor and materials as required.

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Read and explain the requirement. Provide some actual field examples that will help to provide an understanding of when to apply this requirement.

S.1.1. Zero Indication

With no load on the load receiving element:

- (a) Indicating or recording elements must indicate or print zero.
- (b) An automatic indicating scale or balance indicator shall indicate an out of balance condition on both sides of zero.

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Read and explain the requirement.

Zero Load Balance – As Found

- UR.4.1. Balance Condition – maintained so it indicates or records zero when there is nothing on the load receiving element.
 - For truck scales the biggest causes are shock loading, debris, friction/binding, rain or dirt buildup.
- Document your findings and ask the operator to reset zero to both correct the problem and to determine if the individual knows how to operate the controls.

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Read and explain this requirement. Discuss how the accuracy of a scale is affected when a scale weighing operation is not started at a zero load balance condition. Discuss some of the causes that can change the zero balance condition of a scale.

G-UR.2.2. Installation of Indicating and Recording Element

- A device shall be so installed that there is no obstruction between a primary indicating or recording element and the weighing or measuring element; otherwise there shall be convenient and permanently installed means for direct communication, oral or visual, between an individual located at a primary indicating or recording element and an individual located at the weighing or measuring element. [See also G-UR.3.3.]

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Read and explain the requirement. Be certain to define the term “primary indicating or recording element” in your explanation. (See HB 44 definition) Provide examples showing the different methods used in truck scale installations to provide the necessary direct communication.

Environmental Factors

- **UR.2.3. Protection From Environmental Factors.** - The indicating elements, the lever system or load cells, and the load-receiving element of a permanently installed scale, and the indicating elements of a scale not intended to be permanently installed, shall be adequately protected from environmental factors such as wind, weather, and RFI that may adversely affect the operation or performance of the device.

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Read and explain the requirement. Discuss how truck scales are affected by environmental factors and provide possible remedies to offset such negative influences.



Photograph of exposed levers and load cell. Explain how this scale might react on a windy or rainy day and what could be done to improve the installation.

UR.2.4. Foundation, Supports, and Clearance.

- The foundation and supports of any scale installed in a fixed location shall be such as to provide strength, rigidity, and permanence of all components, and clearance shall be provided around all live parts to the extent that no contacts may result when the load-receiving element is empty, nor throughout the weighing range of the scale. *On vehicle and livestock scales, the clearance between the load-receiving elements and the coping at the bottom edge of the platform shall be greater than at the top edge of the platform. [1973]*

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Read and explain the retroactive portion of the requirement. Discuss the possible affects on a vehicle scale when adequate clearance is not maintained around all live parts. Read and explain the nonretroactive portion of the requirement. Provide and discuss actual examples of violations observed on different types of vehicle scale installations, i.e. snow/ice buildup around load cells, steelyard rod rubbing hole in floor of scale house, scale deck binding against pit wall, etc.



Clearance problem – low profile electronic scale.



Same scale different view.

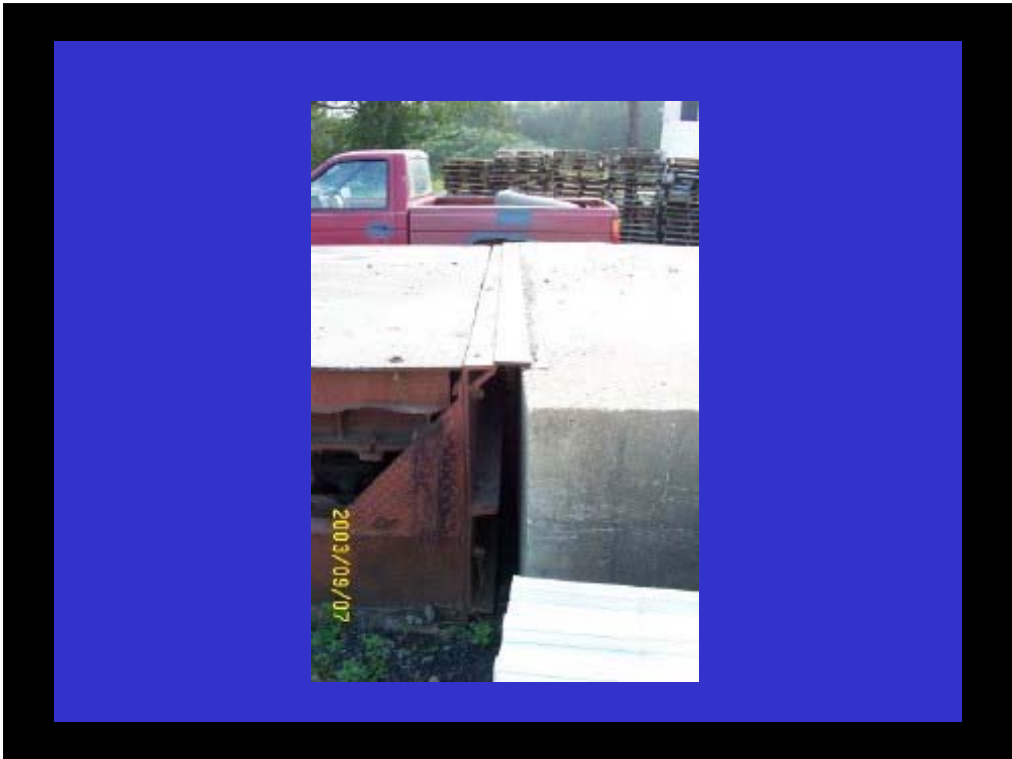


Photo shows a frequently used length of either “T” webbing or steel being used to cover the area between the concrete approach and the end of the scale. Explain the purpose of this cover. Explain how such covers should be installed in accordance with the manufacture’s instructions. Provide examples of some problems associated with improper installation.

UR.2.5. Access to Weighing Elements.

- Adequate provision shall be made for ready access to the pit of a vehicle, livestock, animal, axle-load, or railway track scale for the purpose of inspection and maintenance. Any of these scales without a pit shall be installed with adequate means for inspection and maintenance of the weighing elements.

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Read and explain the requirement. Discuss the importance of conducting a pit inspection. Describe what it is officials should be looking for when they inspect a pit.

Approaches – Vehicle Scales

UR.2.6.1. Vehicle Scales. - *On the entrance and exit ends of a vehicle scale installed in any one location for a period of 6 months or more, there shall be a straight approach as follows:*

(a) the width at least the width of the platform,

(b) the length at least one-half the length of the platform but not required to be more than 12 m (40 ft), and

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Read and explain the entire requirement as shown on this slide and the next. Read and explain each section of the requirement, (a)-(c), individually. Discuss the importance of the requirement and the adverse affects trucks can have on vehicle scales with improper approaches. Explain the affects that combination tractor/trailers have on a scale when they are pulled onto or removed from the platform from grade. Explain the jarring affect that large trucks have on a scale when they quickly stop on the load-receiving element.

- *(c) not less than 3 m (10 ft) of any approach adjacent to the platform shall be constructed of concrete or similar durable material to ensure that this portion remains smooth and level and in the same plane as the platform. However, grating of sufficient strength to withstand all loads equal to the concentrated load capacity of the scale may be installed in this portion. Any slope in the remaining portion of the approach shall ensure (1) ease of vehicle access, (2) ease for testing purposes, and (3) drainage away from the scale. (1976)*

UR.2.6.2. Axle-Load Scales. - At each end of an axle-load scale there shall be a straight paved approach in the same plane as the platform. The approaches shall be the same width as the platform and of sufficient length to insure the level positioning of vehicles during weight determinations.

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Read and explain this requirement. Explain why this requirement is different than that of a vehicle scale. Explain why it is important for the entire vehicle to be level when determining the weights of axles on a vehicle.



Explain how the approaches shown here conform to U.R.2.6.1. Note straight approaches on either end of scale conforming to width and length requirements. Also notice how the area that is adjacent to the platform is smooth, level, and appears to be in the same plane as the platform.



Explain how the approaches shown here appear to conform to U.R.2.6.1. Note straight approaches on either end of scale conforming to width and length requirements. Also notice how the area that is adjacent to the platform shown in the photo is smooth, level, and appears to be in the same plane as the platform. Discuss how this area adjacent to the platform, as well as any remaining portion of the approach must be constructed. Include in your discussion, the materials to be used, the dimensions of the different portions, and the amount of permissible slope, if any.



Photo of truck scale approaches. Review the individual approach requirements while making comparisons to this photo. Note the incorrect slope in the portion of the approach that is adjacent to the load-receiving element. Explain how this slope would be deemed unacceptable if this scale were installed in any one location for a period of 6 months or more.

Reference: UR.2.6.1



Review the individual approach requirements of UR.2.6.1. while making comparisons to this photo. Note straight approaches on either end of scale. Also notice the actual construction of the approach. The photo shows the entire approach to be constructed of concrete with the first 10 or more feet of area that is adjacent to the platform being smooth, level, and in the same plane as the platform. Notice the slope in the remaining portion. Does this portion ensure ease of vehicle access, ease for testing purposes, and drainage away from the scale? Explain.



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Review the individual approach requirements while making comparisons to this photo. Does the slope in this approach ensure ease for testing purposes?

Maintenance

- G-UR.4.1. – Maintenance of Equipment – “proper operating condition” throughout its service life.
- G-UR.4.2. – Abnormal Performance – “brought to the attention of competent service personnel”
- G-UR.4.3. – Use of Adjustments – “as close as practical to zero value.

Read and explain each requirement. Provide some specific examples showing when and how each requirement could be applied.

Modifications

- **UR.4.3. Scale Modification.** - The dimensions (e.g., length, width, thickness, etc.) of the load receiving element of a scale shall not be changed beyond the manufacturer's specifications, nor shall the capacity of a scale be increased beyond its design capacity by replacing or modifying the original primary indicating or recording element with one of a higher capacity, except when the modification has been approved by a competent engineering authority, preferably that of ... the manufacturer of the scale, and by the official.

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Read and explain this requirement. Identify some modifications to vehicle or axle-load scales that you have observed and discuss your actions.

Use - Loading

- UR.3.2. Maximum Load. - A scale shall not be used to weigh a load of more than the nominal capacity of the scale.
- UR.3.2.1. Maximum Loading for Vehicle Scales.
 - A vehicle scale shall not be used to weigh loads exceeding the maximum load capacity of its span as specified in Table UR.3.2.1.

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Read UR.3.2. and explain why a scale should not be used above its nominal capacity. Read UR.3.2.1. and explain the purpose of the requirement and its association with the federal bridge formula.

Explain how maximum loading is determined from table UR.3.2.1. Use several truck axle configurations to teach the application of this table.

UR.3.3. Single-Draft Vehicle Weighing.

- A vehicle or a coupled vehicle combination shall be commercially weighed on a vehicle scale only as a single draft. That is, the total weight of such a vehicle or combination shall not be determined by adding together the results obtained by separately and not simultaneously weighing each end of such vehicle or individual elements of such coupled combination.

Read and explain only the portion of the requirement shown on this slide. The remaining portion is shown on the next slide. Be certain to explain the differences in the the terms “single draft” and “multi-draft” or “split weighing.”

UR.3.3. Single-Draft Vehicle Weighing.

However:

- the elements may be uncoupled (tractor, semitrailer, trailer), and be weighed individually.
- the weights obtained while all individual elements are resting simultaneously on more than one scale platform may be added together.

Note: this paragraph does not apply to highway law-enforcement scales and scales used for the collection of statistical data.

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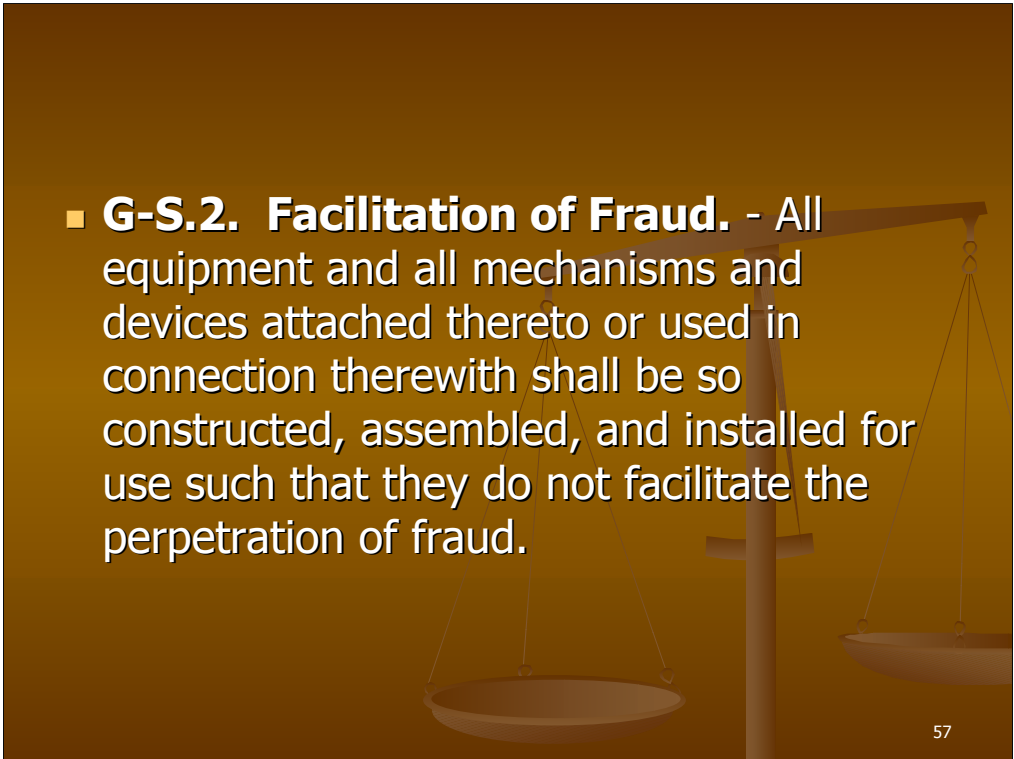
Read and explain the final portion of the requirement as shown. Discuss the importance of requiring an entire vehicle be positioned on the load-receiving element during commercial weight determinations. In addition, discuss how combination vehicle elements can be uncoupled and weighed individually and the results summed to provide an accurate weight determination. Explain how the weighing results determined by split weighing will differ from those obtained by weighing and adding together the results of uncoupled vehicle elements that are weighed individually and positioned entirely on the load-receiving element.

Assistance

- **G-UR.4.4. Assistance in Testing Operations.** - if the design, construction, or location of any device is such as to require a testing procedure involving special equipment or accessories or an abnormal amount of labor, such equipment, accessories, and labor shall be supplied by the owner or operator of the device as required by the weights and measures official.

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Read and explain the requirement. Provide examples of when this requirement should be applied.

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- **G-S.2. Facilitation of Fraud.** - All equipment and all mechanisms and devices attached thereto or used in connection therewith shall be so constructed, assembled, and installed for use such that they do not facilitate the perpetration of fraud.

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Read and explain the requirement. Provide a reminder of the need to investigate the use and operation of each device as part of the inspection routine. Give examples of how a device might be constructed, assembled, and installed in a manner to facilitate the perpetration of fraud.