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**S.6.1. Nominal Capacity; Vehicle and Axle-Load Scales.** – For all vehicle and axle-load scales, the marked nominal capacity shall not exceed the concentrated load capacity (CLC) times the quantity of the number of sections in the scale minus 0.5.

As a formula, this is stated as: 
$$\text{nominal capacity} \leq \text{CLC} \times (N - 0.5)$$
 where  $N$  = the number of sections in the scale.

(See N.1.3.3. Vehicle Scales, Axle-Load Scales, and Livestock Scales and T.N.3.1. Maintenance Tolerance Values)

[Nonretroactive as of January 1, 1989]

**Note:** When the device is used in a combination railway track and vehicle weighing application, the above formula shall apply only to the vehicle scale application.

(Added 1988) (Amended 1999 and 2002)

**S.6.2. Location of Marking Information.** – Scales that are not permanently attached to an indicating element, and for which the load-receiving element is the only part of the weighing/load-receiving element visible after installation, may have the marking information required in G-S.1. of the General Code and S.6. of the Scales Code located in an area that is accessible only through the use of a tool; provided that the information is easily accessible (e.g., the information may appear on the junction box under an access plate). The identification information for these scales shall be located on the weighbridge (load-receiving element) near the point where the signal leaves the weighing element or beneath the nearest access cover.

(Added 1989)

**S.6.3. Scales, Main Elements, and Components of Scales or Weighing Systems.** – Scales, main elements of scales when not contained in a single enclosure for the entire scale, load cells for which Certificates of Conformance (CC) have been issued under the National Type Evaluation Program, and other equipment necessary to a weighing system, but having no metrological effect on the weighing system, shall be marked as specified in Table S.6.3.a. Marking Requirements and explained in the accompanying notes in Table S.6.3.b. Notes for Table S.6.3.a.

(Added 1990)

**S.6.4. Railway Track Scales.** – A railway track scale shall be marked with the maximum capacity of each section of the load-receiving element of the scale. Such marking shall be accurately and conspicuously presented on, or adjacent to, the identification or nomenclature plate that is attached to the indicating element of the scale. *The nominal capacity of a scale with more than two sections shall not exceed twice its rated section capacity. The nominal capacity of a two-section scale shall not exceed its rated section capacity.\**

[\*Nonretroactive as of January 1, 2002]

(Amended 1988, 2001, and 2002)

**S.6.5. Livestock Scales.** – A livestock scale manufactured prior to January 1, 1989, or after January 1, 2003, shall be marked with the maximum capacity of each section of the load-receiving element of the scale. Livestock scales manufactured between January 1, 1989, and January 1, 2003, shall be marked with either the Concentrated Load Capacity (CLC) or the Section Capacity. Such marking shall be accurately and conspicuously presented on, or adjacent to the identification or nomenclature plate that is attached to the indicating element of the scale. *The nominal capacity of a scale with more than two sections shall not exceed twice its rated section capacity. The nominal capacity of a two-section scale shall not exceed its rated section capacity.\**

[\*Nonretroactive as of January 1, 2003]

(Added 2002)

See also Note 14 in Table S.6.3.b. Notes for Table S.6.3.a.

**S.6.6. Counting Feature, Minimum Individual Piece Weight and Minimum Sample Piece Count.** – A Class I or Class II prescription scale with an operational counting feature shall be marked with the minimum individual piece weight and minimum number of pieces used in the sample to establish an individual piece weight.

(Added 2003)

<b>Table S.6.3.a. Marking Requirements</b>					
<b>To Be Marked With ↓</b>	<b>Weighing Equipment</b>				
	<b>Weighing, Load-Receiving, and Indicating Element in Same Housing or Covered on the Same CC<sup>1</sup></b>	<b>Indicating Element not Permanently Attached to Weighing and Load-Receiving Element or Covered by a Separate CC</b>	<b>Weighing and Load-Receiving Element Not Permanently Attached to Indicating Element or Covered by a Separate CC</b>	<b>Load Cell with CC (11)</b>	<b>Other Equipment or Device (10)</b>
Manufacturer's ID (1)	x	x	x	x	x
Model Designation and Prefix (1)	x	x	x	x	x
Serial Number and Prefix (2)	x	x	x	x	x (16)
Certificate of Conformance Number (CC) (23)	x	x	x	x	x (23)
Accuracy Class (17)	x	x (8)	x (19)	x	
Nominal Capacity (3)(18)(20)	x	x	x		
Value of Scale Division, "d" (3)	x	x			
Value of "e" (4)	x	x			
Temperature Limits (5)	x	x	x	x	
Concentrated Load Capacity (CLC) (12)(20)(22)		x	x (9)		
Special Application (13)	x	x	x		
Maximum Number of Scale Divisions ( $n_{max}$ ) (6)		x (8)	x (19)	x	
Minimum Verification Scale Division ( $e_{min}$ )			x (19)		
"S" or "M" (7)				x	
Direction of Loading (15)				x	
Minimum Dead Load				x	
Maximum Capacity				x	
Safe Load Limit				x	
Load Cell Verification Interval ( $v_{min}$ ) (21)				x	
Section Capacity and Prefix (14)(20)(22)(24)		x	x		

**Table S.6.3.a.  
Marking Requirements**

**Note:** For applicable notes, see Table S.6.3.b.

<sup>1</sup> Weighing/load-receiving elements and indicators which are in the same housing or which are permanently attached will generally appear on the same CC. If not in the same housing, elements shall be hard-wired together or sealed with a physical seal or an electronic link. This requirement does not apply to peripheral equipment that has no input or effect on device calibrations or configurations.

(Added 2001)

(Added 1990) (Amended 1992, 1999, 2000, 2001, 2002, and 2004)

**Table S.6.3.b.  
Notes for Table S.6.3.a. Marking Requirements**

1. Manufacturer's identification and model designation and *model designation prefix*.\*  
[\*Nonretroactive as of January 1, 2003]  
(See also G-S.1.) [*Prefix lettering may be initial capitals, all capitals or all lower case*]  
(Amended 2000)
2. *Serial number* [*Nonretroactive as of January 1, 1968*] and *prefix* [*Nonretroactive as of January 1, 1986*]. (See also G-S.1.)
3. The device shall be marked with the nominal capacity. *The nominal capacity shall be shown together with the value of the scale division (e.g., 15 x 0.005 kg, 30 x 0.01 lb, or capacity = 15 kg, d = 0.005 kg) in a clear and conspicuous manner and be readily apparent when viewing the reading face of the scale indicator unless already apparent by the design of the device. Each scale division value or weight unit shall be marked on multiple range or multi-interval scales.* [*Nonretroactive as of January 1, 1983*]  
(Amended 2005)
4. *Required only if different from "d."*  
[*Nonretroactive as of January 1, 1986*]
5. *Required only on Class III, III L, and IIII devices if the temperature range on the NTEP CC is narrower than and within -10 °C to 40 °C (14 °F to 104 °F).* [*Nonretroactive as of January 1, 1986*]  
(Amended 1999)
6. *This value may be stated on load cells in units of 1000; e.g., n: 10 is 10 000 divisions.* [*Nonretroactive as of January 1, 1988*]
7. *Denotes compliance for single or multiple load cell applications. It is acceptable to use a load cell with the "S" or Single Cell designation in multiple load cell applications as long as all other parameters meet applicable requirements. A load cell with the "M" or Multiple Cell designation can be used only in multiple load cell applications.* [*Nonretroactive as of January 1, 1988*]  
(Amended 1999)
8. *An indicating element not permanently attached to a weighing element shall be clearly and permanently marked with the accuracy Class of I, II, III, III L, or IIII, as appropriate, and the maximum number of scale divisions,  $n_{max}$ , for which the indicator complies with the applicable requirement. Indicating elements that qualify for use in both Class III and III L applications may be marked III/III L and shall be marked with the maximum number of scale divisions for which the device complies with the applicable requirements for each accuracy class.* [*Nonretroactive as of January 1, 1988*]

**Table S.6.3.b.**  
**Notes for Table S.6.3.a. Marking Requirements**

9. *For vehicle and axle-load scales only. The CLC shall be added to the load-receiving element of any such scale not previously marked at the time of modification. [Nonretroactive as of January 1, 1989] (Amended 2002)*
10. Necessary to the weighing system but having no metrological effect, e.g., auxiliary remote display, keyboard, etc.
11. *The markings may be either on the load cell or in an accompanying document; except that, if an accompanying document is provided, the serial number shall appear both on the load cell and in the document. [Nonretroactive as of January 1, 1988] The manufacturer's name or trademark, the model designation, and identifying symbols for the model and serial numbers as required by paragraph G-S.1. shall also be marked both on the load cell and in any accompanying document. [Nonretroactive as of January 1, 1991]*
12. Required on the indicating element and the load-receiving element of vehicle and axle-load scales. *Such marking shall be identified as "concentrated load capacity" or by the abbreviation "CLC."\**  
*[\*Nonretroactive as of January 1, 1989]*  
(Amended 2002)
13. *A scale designed for a special application rather than general use shall be conspicuously marked with suitable words, visible to the operator and to the customer, restricting its use to that application, e.g., scale, prepack scale, weight classifier, etc.\* When a scale is installed with an operational counting feature, the scale shall be marked on both the operator and customer sides with the statement "The counting feature is not legal for trade," except when a Class I or Class II prescription scale complies with all Handbook 44 requirements applicable to counting features. [Nonretroactive as of 1986]*  
(Amended 1994 and 2003)
14. Required on *livestock\** and railway track scales. When marked on vehicle and axle-load scales manufactured before January 1, 1989, it may be used as the CLC. For livestock scales manufactured between January 1, 1989, and January 1, 2003, required markings may be either CLC or section capacity.  
*[\*Nonretroactive as of January 1, 2003]*  
(Amended 2002)
15. *Required if the direction of loading the load cell is not obvious. [Nonretroactive as of January 1, 1988]*
16. *Serial number [Nonretroactive as of January 1, 1968] and prefix [Nonretroactive as of January 1, 1986]. (See also G-S.1.) Modules without "intelligence" on a modular system (e.g., printer, keyboard module, cash drawer, and secondary display in a point-of-sale system) are not required to have serial numbers.*
17. *The accuracy class of a device shall be marked on the device with the appropriate designation as I, II, III, III L, or IIII. [Nonretroactive as of January 1, 1986]*
18. The nominal capacity shall be conspicuously marked as follows:
  - (a) on any scale equipped with unit weights or weight ranges;
  - (b) on any scale with which counterpoise or equal-arm weights are intended to be used;
  - (c) on any automatic-indicating or recording scale so constructed that the capacity of the indicating or recording element, or elements, is not immediately apparent;
  - (d) on any scale with a nominal capacity less than the sum of the reading elements; and
  - (e) *on the load-receiving element (weighbridge) of vehicle, axle-load, and livestock scales.\**  
*[\*Nonretroactive as of January 1, 1989]*  
(Amended 1992)



**Table S.6.3.b.**  
**Notes for Table S.6.3.a. Marking Requirements**

19. *[Nonretroactive as of January, 1, 1988]*  
(Amended 1992)
20. *Combination vehicle/railway track scales must be marked with both the nominal capacity and CLC for vehicle weighing and the nominal capacity and section capacity for railway weighing. All other requirements relating to these markings will apply.*  
*[Nonretroactive as of January 1, 2000]*  
(Added 1999)
21. *The value of the load cell verification interval ( $v_{min}$ ) must be stated in mass units. In addition to this information, a device may be marked with supplemental representations of  $v_{min}$ .*  
*[Nonretroactive as of January 1, 2001]*  
(Added 1999)
22. *Combination vehicle/livestock scales must be marked with both the CLC for vehicle weighing and the section capacity for livestock weighing. All other requirements relative to these markings will apply.*  
*[Nonretroactive as of January 1, 2003]*  
(Added 2002) (Amended 2003)
- Note: The marked section capacity for livestock weighing may be less than the marked CLC for vehicle weighing.*  
(Amended 2003)
23. *Required only if a CC has been issued for the device or equipment. [Nonretroactive as of January 1, 2003]*  
(G-S.1. Identification (e) Added 2001)
24. *The section capacity shall be prefaced by the words “Section Capacity” or an abbreviation of that term. Abbreviations shall be “Sec Cap” or “Sec C.” All capital letters and periods may be used.*  
*[Nonretroactive as of January 1, 2005]*  
(Added 2004)

## N. Notes

### N.1. Test Procedures.

**N.1.1. Increasing-Load Test.** – The increasing-load test shall be conducted on all scales with the test loads approximately centered on the load-receiving element of the scale, except on a scale having a nominal capacity greater than the total available known test load. When the total test load is less than the nominal capacity, the test load is used to greatest advantage by concentrating it, within prescribed load limits, over the main load supports of the scale.

**N.1.2. Decreasing-Load Test (Automatic Indicating Scales).** – The decreasing-load test shall be conducted with the test load approximately centered on the load-receiving element of the scale.

**N.1.2.1. Scales Marked I, II, III, or IIII.** – Except for portable wheel load weighers, decreasing-load tests shall be conducted on scales marked I, II, III or IIII and with  $n$  equal to or greater than 1000 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 4000 d, 2000 d, and 500 d; 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. (See Table 6)  
(Amended 1998)

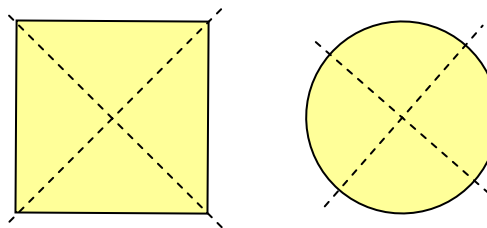
**N.1.2.2. All Other Scales.** – On all other scales, except for portable wheel load weighers, the decreasing-load test shall be conducted with a test load equal to one-half of the maximum load applied in the increasing-load test.

(Amended 1998)

**N.1.3. Shift Test.**

**N.1.3.1. Dairy-Product Test Scales.** – A shift test shall be conducted with a test load of 18 g successively positioned at all points on which a weight might reasonably be placed in the course of normal use of the scale.

**N.1.3.2. Equal-Arm Scales.** – A shift test shall be conducted with a half-capacity test load centered successively at four points positioned equidistance between the center and the front, left, back, and right edges of each pan as shown in the diagrams below. An equal test load shall be centered on the other pan.



**N.1.3.3. Vehicle Scales, Axle-Load Scales, and Livestock Scales.**

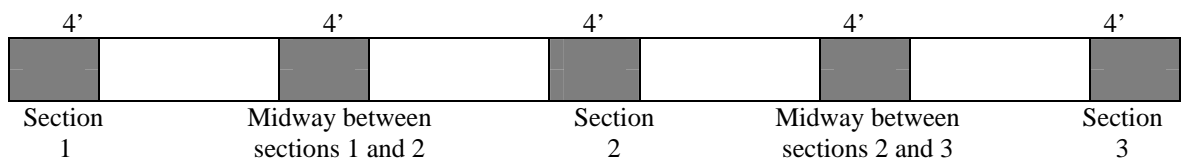
**N.1.3.3.1. Vehicle Scales, Axle-Load Scales, and Combination Vehicle/Livestock Scales.**

- (a) **Minimum Shift Test.** At least one shift test shall be conducted with a minimum test load of 12.5 % of scale capacity, which may be performed anywhere on the load-receiving element using the prescribed test patterns and maximum test loads specified below. (Combination Vehicle/Livestock Scales shall also be tested consistent with N.1.3.3.2. Prescribed Test Pattern and Test Loads for Livestock Scales with More Than Two Sections and Combination Vehicle/Livestock Scales.)

(Amended 1991, 2000, and 2003)

- (b) **Prescribed Test Pattern and Loading for Vehicle Scales, Axle-Load Scales, and Combination Vehicle/Livestock Scales.** – The normal prescribed test pattern shall be an area of 1.2 m (4 ft) in length and 3.0 m (10 ft) in width or the width of the scale platform, whichever is less. Multiple test patterns may be utilized when loaded in accordance with paragraph (c), (d), or (e) as applicable. An example of a possible test pattern is shown in the diagram below.

(Amended 1997, 2001, and 2003)



- (c) **Loading Precautions for Vehicle Scales, Axle-Load Scales, and Combination Vehicle/Livestock Scales.** – 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. The area covered by the test load may be less than 1.2 m (4 ft) x 3.0 m (10 ft) or the width of the scale platform, whichever is less; for test patterns less than 1.2 m

(4 ft) in length the maximum loading shall meet the formula: [(wheel base of test cart or length of test load divided by 48 in) x 0.9 x CLC]. The maximum test load applied to each test pattern shall not exceed the concentrated load capacity of the scale. When the test pattern exceeds 1.2 m (4 ft), the maximum test load applied shall not exceed the concentrated load capacity times the largest “r” factor in Table UR.3.2.1. Span Maximum Load for the length of the area covered by the test load. For load-receiving elements installed prior to January 1, 1989, the rated section capacity may be substituted for concentrated load capacity to determine maximum loading. An example of a possible test pattern is shown above.

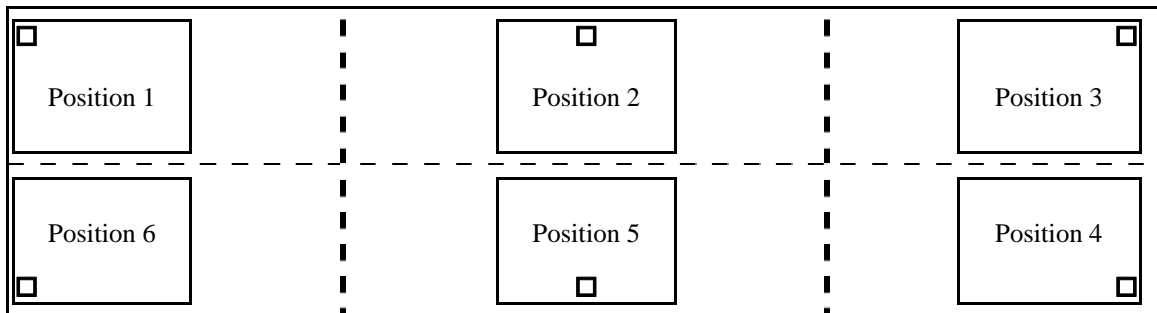
(Amended 1997 and 2003)

- (d) **Multiple Pattern Loading.** – To test to the nominal capacity, multiple patterns may be simultaneously loaded in a manner consistent with the method of use.
- (e) **Other Designs.** – Special design scales and those that are wider than 3.7 m (12 ft) shall be tested in a manner consistent with the method of use but following the principles described above.

(Amended 1988, 1991, 1997, 2000, 2001, and 2003)

(Amended 2003)

**N.1.3.3.2. Prescribed Test Pattern and Test Loads for Livestock Scales with More Than Two Sections and Combination Vehicle/Livestock Scales.** A minimum test load of 5000 kg (10 000 lb) or one-half of the rated section capacity, whichever is less, shall be placed, as nearly as possible, successively over each main load support as shown in the diagram below. For livestock scales manufactured between January 1, 1989, and January 1, 2003, the required loading shall be no greater than one-half CLC. (Two-section livestock scales shall be tested consistent with N.1.3.7. All Other Scales Except Crane Scales, Hanging Scales, Hopper Scales, Wheel-Load Weighers, and Portable Axle-Load Weighers.)



□ = Load Bearing Point

(Added 2003)

**N.1.3.3.3. Prescribed Test Patterns and Test Loads for Two-Section Livestock Scales.** – A shift test shall be conducted using the following prescribed test loads and test patterns, provided the shift test load does not exceed one-half the rated section capacity or one-half the rated concentrated load capacity whichever is applicable, using either:

- (a) A one-half nominal capacity test load centered as nearly as possible, successively at the center of each quarter of the load-receiving element as shown in N.1.3.7. All Other Scales Except Crane Scales, Hanging Scales, Hopper Scales, Wheel-Load Weighers, and Portable Axle-Load Weighers Figure 1; or

- (b) A one-quarter nominal capacity test load centered as nearly as possible, successively over each main load support as shown in N.1.3.7. All Other Scales Except Crane Scales, Hanging Scales, Hopper Scales, Wheel-Load Weighers, and Portable Axle-Load Weighers Figure 2.

(Added 2007)

**N.1.3.4. Railway Track Scales Weighing Individual Cars in Single Drafts.** – A shift test shall be conducted with at least two different test loads, if available, distributed over, to the right and left of, each pair of main levers or other weighing elements supporting each section of the scale.

**N.1.3.5. Monorail Scales, Static Test.** – A shift test shall be conducted with a test load equal to the largest load that can be anticipated to be weighed in a given installation, but never less than one-half scale capacity. The load shall be placed successively on the right end, the left end, and the center of the live rail.

(Added 1985)

**N.1.3.5.1. Dynamic Monorail Weighing Systems.** – Dynamic tests with livestock carcasses or portions of carcasses shall be conducted during normal plant production. No less than 20 test loads using carcasses or portions of carcasses of the type normally weighed shall be used in the dynamic test. If the plant conveyor chain does not space or prevent the carcasses or portions of carcasses from touching one another, dynamic tests shall not be conducted until this condition has been corrected.

All carcasses or portions of carcasses shall be individually weighed statically on either the same scale being tested dynamically or another monorail scale with the same or smaller divisions and in close proximity. (The scale selected for static weighing of the carcasses or portions of carcasses shall first be tested statically with certified test weights that have been properly protected from the harsh environment of the packing plant to ensure they maintain accuracy.)

If the scale being tested is used for weighing freshly slaughtered animals (often referred to as a “hot scale”), care must be taken to get a static weight as quickly as possible before or following the dynamic weighing to avoid loss due to shrink. If multiple dynamic tests are conducted using the same carcasses or portions of carcasses, static weights shall be obtained before and after multiple dynamic tests. If the carcass or portion of a carcass changes weight between static tests, the amount of weight change shall be taken into account, or the carcass or portion of a carcass shall be disregarded for tolerance purposes.

**Note:** For a dynamic monorail test, the reference scale shall comply with the principles in the Fundamental Considerations paragraph 3.2. Tolerances for Standards.

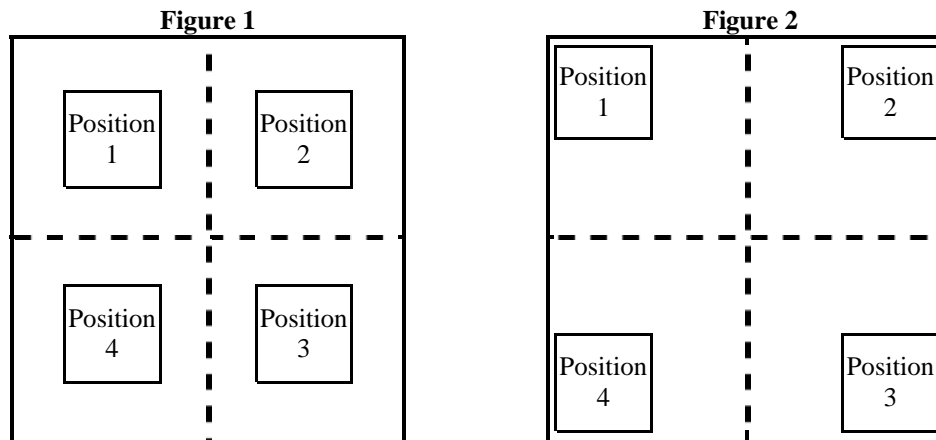
(Added 1996) (Amended 1999 and 2007)

**N.1.3.6. Vehicle On-Board Weighing Systems.** – The shift test for a vehicle on-board weighing system shall be conducted in a manner consistent with its normal use. For systems that weigh as part of the lifting cycle, the center of gravity of the load may be shifted in the vertical direction as well as from side to side. In other cases, the center of gravity may be moved to the extremes of the load-receiving element using loads of a magnitude that reflect normal use (i.e., the load for the shift test may exceed one-half scale capacity), and may, in some cases, be equal to the capacity of the scale. The shift test may be conducted when the weighing system is out of level to the extent that the weighing system remains operational.

(Added 1992)

**N.1.3.7. All Other Scales Except Crane Scales, Hanging Scales, Hopper Scales, Wheel-Load Weighers, and Portable Axle-Load Weighers.** – A shift test shall be conducted using the following prescribed test loads and test patterns. A single field standard weight used as the prescribed test load shall be applied centrally in the prescribed test pattern. When multiple field standard weights are used as the prescribed test load, the load shall be applied in a consistent pattern in the shift test positions throughout the test and applied in a manner that does not concentrate the load in a test pattern that is less than when that same load is a single field standard weight on the load-receiving element.

- (a) For scales with a nominal capacity of 500 kg (1000 lb) or less, a shift test shall be conducted using a one-third nominal capacity test load (defined as test weights in amounts of at least 30 % of scale capacity, but not to exceed 35 % of scale capacity) centered as nearly as possible at the center of each quadrant of the load-receiving element using the prescribed test pattern as shown in Figure 1.
- (b) For scales with a nominal capacity greater than 500 kg (1000 lb), a shift test may be conducted by either using a one-third nominal capacity test load (defined as test weights in amounts of at least 30 % of scale capacity, but not to exceed 35 % of scale capacity) centered as nearly as possible at the center of each quadrant of the load-receiving element using the prescribed test pattern as shown in Figure 1, or by using a one-quarter nominal capacity test load centered as nearly as possible, successively, over each corner of the load-receiving element using the prescribed test pattern as shown in Figure 2.



(Added 2003)

(Amended 1987, 2003, and 2007)

**N.1.4. Sensitivity Test.** – A sensitivity test shall be conducted on nonautomatic-indicating (weighbeam) scales only, with the weighing device in equilibrium at zero-load and at maximum test load. The test shall be conducted by increasing or decreasing the test load in an amount equal to the applicable value specified in T.2. Sensitivity Requirement (SR) or T.N.6. Sensitivity.

**N.1.5. Discrimination Test.** – *A discrimination test shall be conducted on all automatic indicating scales with the weighing device in equilibrium at or near zero load and at or near maximum test load, and under controlled conditions in which environmental factors are reduced to the extent that they will not affect the results obtained. For scales equipped with an Automatic Zero-Tracking Mechanism (AZT), the discrimination test may be conducted at a range outside of the AZT range.*

[Nonretroactive as of January 1, 1986]

(Added 1985) (Amended 2004)

**N.1.5.1. Digital Device.** – On a digital device, this test is conducted from just below the lower edge of the zone of uncertainty for increasing load tests, or from just above the upper edge of the zone of uncertainty for decreasing-load tests.

**N.1.6. RFI Susceptibility Tests, Field Evaluation.** – An RFI test shall be conducted at a given installation when the presence of RFI has been verified and characterized if those conditions are considered “usual and customary.”

(Added 1986)

**N.1.7. Ratio Test.** – A ratio test shall be conducted on all scales employing counterpoise weights and on nonautomatic-indicating equal-arm scales.

**N.1.8. Material Tests.** – A material test shall be conducted on all customer-operated bulk weighing systems for recycled materials using bulk material for which the device is used. Insert into the device, in a normal manner, several accurately pre-weighed samples (free of foreign material) in varying amounts approximating average drafts.

**N.1.9. Zero-Load Balance Change.** – A zero-load balance change test shall be conducted on all scales after the removal of any test load. The zero-load balance should not change by more than the minimum tolerance applicable. (Also see G-UR.4.2.)

**N.1.10. Counting Feature Test.** – A test of the counting function shall be conducted on all Class I and Class II prescription scales having an active counting feature used in “legal for trade” applications. The test should verify that the scale will not accept a sample with less than either the minimum sample piece count or the minimum sample weight of 30 e. Counting feature accuracy should be verified at a minimum of two test loads. Verification of the count calculations shall be based upon the weight indication of the test load.

**Note:**

(1) The minimum sample weight is equal to the marked minimum individual piece weight times the marked minimum sample piece count.

(2) Test load as used in this section refers to actual calibration test weights selected from an appropriate test weight class.

(Added 2003)

**N.1.11. Substitution Test.** – In the substitution test procedure, material or objects are substituted for known test weights, or a combination of known test weights and previously quantified material or objects, using the scale under test as a comparator. Additional test weights or other known test loads may be added to the known test load to evaluate higher weight ranges on the scale.

(Added 2003)

**N.1.12. Strain-Load Test.** – In the strain-load test procedure, an unknown quantity of material or objects are used to establish a reference load or tare to which test weights or substitution test loads are added.

(Added 2003)

**N.2. Verification (Testing) Standards.** – Field standard weights used in verifying weighing devices shall comply with requirements of NIST Handbook 105-Series standards (or other suitable and designated standards) or the tolerances expressed in Fundamental Considerations, paragraph 3.2. (i.e., one-third of the smallest tolerance applied).

(Amended 1986)

**N.3. Minimum Test Weights and Test Loads.** – The minimum test weights and test loads for in-service tests (except railway track scales) are shown in Table 4. (See Footnote 2 in Table 4. Minimum Test Weights and Test Loads.)

(Added 1984) (Amended 1988)

**N.3.1. Minimum Test-Weight Load and Recommended Strain-Load Test for Railway Track Scales.**

(Amended 1990)

**N.3.1.1. Approval.** – The test-weight load shall be not less than 35 000 kg (80 000 lb). A strain-load test conducted up to the used capacity of the weighing system is recommended.

(Added 1990)

**N.3.1.2. Interim Approval.** – A test-weight load of not less than 13 500 kg (30 000 lb) and a strain-load test up to at least 25 % of scale capacity may be used to return a scale into service following repairs.

(Added 1990)

**Note:** The length of time the scale may be used following an interim test is at the discretion of the official with statutory authority.

(Added 1990)

**N.3.1.3. Enforcement Action for Inaccuracy.** – To take enforcement action on a scale that is found to be inaccurate, a minimum test load of 13 500 kg (30 000 lb) must be used.

(Added 1990)

<b>Table 4. Minimum Test Weights and Test Loads<sup>1</sup></b>			
<b>Device Capacity</b>	<b>Minimums (in terms of device capacity)</b>		<b>(where practicable)</b>
	<b>Test Weights (greater of)</b>	<b>Test Loads<sup>2</sup></b>	
0 to 150 kg (0 to 300 lb)	100 %		
151 to 1 500 kg (301 to 3 000 lb)	25 % or 150 kg (300 lb)	75 %	Test weights to dial face capacity, 1 000 d, or test load to used capacity, if greater than minimums specified.
1 501 to 20 000 kg (3 001 to 40 000 lb)	12.5 % or 500 kg (1 000 lb)	50 %	
20 001 kg+ (40 001 lb+)	12.5 % or 5 000 kg (10 000 lb)	25 % <sup>3</sup>	During initial verification, a scale should be tested to capacity.

<sup>1</sup> If the amount of test weight in Table 4 combined with the load on the scale would result in an unsafe condition, then the appropriate load will be determined by the official with statutory authority.

<sup>2</sup> The term “test load” means the sum of the combination of field standard test weights and any other applied load used in the conduct of a test using substitution test methods. Not more than three substitutions shall be used during substitution testing, after which the tolerances for strain load tests shall be applied to each set of test loads.

<sup>3</sup> The scale shall be tested from zero to at least 12.5 % of scale capacity using known test weights, and then to at least 25 % of scale capacity using either a substitution or strain load test that utilizes known test weights of at least 12.5 % of scale capacity. Whenever practical, a strain load test should be conducted to the used capacity of the scale. When a strain load test is conducted, the tolerances apply only to the test weights or substitution test loads.

(Amended 1988, 1989, 1994, and 2003)

**Note:** GIPSA requires devices subject to their inspection to be tested to at least “used capacity,” which is calculated based on the platform area of the scale and a weight factor assigned to the species of animal weighed on the scale. “Used capacity” is calculated using the formula:

Used Scale Capacity = Scale Platform Area x Species Weight Factor

Where species weight factor = 540 kg/m<sup>2</sup> (110 lb/ft<sup>2</sup>) for cattle, 340 kg/m<sup>2</sup> (70 lb/ft<sup>2</sup>) for calves and hogs, and 240 kg/m<sup>2</sup> (50 lb/ft<sup>2</sup>) for sheep and lambs

**N.3.2. Field Standard Weight Carts.** – Field Standard Weight Carts that comply with the tolerances expressed in Fundamental Considerations, paragraph 3.2. (i.e., one-third of the smallest tolerance applied) may be included as part of the minimum required test load (see Table 4) for shift tests and other test procedures.

(Added 2004)

#### **N.4. Coupled-in-Motion Railroad Weighing Systems<sup>3</sup>.**

**N.4.1. Weighing Systems Used to Weigh Trains of Less Than Ten Cars.** – These weighing systems shall be tested using a consecutive-car test train consisting of the number of cars weighed in the normal operation run over the weighing system a minimum of five times in each mode of operation following the final calibration.

(Added 1990) (Amended 1992)

**N.4.2. Weighing Systems Placed in Service Prior to January 1, 1991, and Used to Weigh Trains of Ten or More Cars.** – The minimum test train shall be a consecutive-car test train of no less than ten cars run over the scale a minimum of five times in each mode of operation following final calibration.

(Added 1990) (Amended 1992)

**N.4.3. Weighing Systems Placed in Service on or After January 1, 1991, and Used to Weigh Trains of Ten or More Cars.**

- (a) These weighing systems shall be tested using a consecutive-car test train of no less than ten cars run over the scale a minimum of five times in each mode of operation following final calibration; or
- (b) if the official with statutory authority determines it necessary, the As-Used Test Procedures outlined in N.4.3.1. shall be used.

(Added 1990) (Amended 1992)

**N.4.3.1. As-Used Test Procedures** – A weighing system shall be tested in a manner that represents the normal method of operation and length(s) of trains normally weighed. The weighing systems may be tested using either:

- (a) a consecutive-car test train of a length typical of train(s) normally weighed; or
- (b) a distributed-car test train of a length typical of train(s) normally weighed.

However, a consecutive-car test train of a shorter length may be used provided that initial verification test results for the shorter consecutive-car test train agree with the test results for the distributed-car or full-length consecutive-car test train as specified in N.4.3.1.1. Initial Verification.

The official with statutory authority shall be responsible for determining the minimum test train length to be used on subsequent tests.

(Added 1990) (Amended 1992)

**N.4.3.1.1. Initial Verification.** – Initial verification tests should be performed on any new weighing system and whenever either the track structure or the operating procedure changes. If a consecutive-car test train of length shorter than trains normally weighed is to be used for subsequent verification, the shorter consecutive-car test train results shall be compared either to a distributed-car or to a consecutive-car test train of length(s) typical of train(s) normally weighed.

The difference between the total train weight of the train(s) representing the normal method of operation and the weight of the shorter consecutive-car test train shall not exceed 0.15 %. If the difference in test results exceeds 0.15 %, the length of the shorter consecutive-car test train shall be increased until agreement within 0.15 % is achieved. Any adjustments to the weighing system based

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<sup>3</sup> A test weight car that is representative of one of the types of cars typically weighed on the scale under test may be used wherever reference weight cars are specified.

(Added 1991)



upon the use of a shorter consecutive-car test train shall be offset to correct the bias that was observed between the full-length train test and the shorter consecutive-car test train.

(Added 1990) (Amended 1992 and 1993)

**N.4.3.1.2. Subsequent Verification.** – The test train may consist of either a consecutive-car test train with a length not less than that used in initial verification, or a distributed-car test train representing the number of cars used in the normal operation.

(Added 1990)

**N.4.3.1.3. Distributed-Car Test Trains.**

- (a) The length of the train shall be typical of trains that are normally weighed.
- (b) The reference weight cars shall be split into three groups, each group consisting of ten cars or 10 % of the train length, whichever is less.  
(Amended 1991)
- (c) The test groups shall be placed near the front, around the middle, and near the end of the train.
- (d) Following the final adjustment, the distributed-car test train shall be run over the scale at least three times or shall produce 50 weight values, whichever is greater.
- (e) The weighing system shall be tested in each mode of operation.

(Added 1990) (Amended 1992)

**N.4.3.1.4. Consecutive-Car Test Trains.**

- (a) A consecutive-car test train shall consist of at least ten cars.
- (b) If the consecutive-car test train consists of between ten and twenty cars, inclusive, it shall be run over the scale a minimum of five times in each mode of operation following the final calibration.
- (c) If the consecutive-car test train consists of more than twenty cars, it shall be run over the scale a minimum of three times in each mode of operation.

(Added 1990) (Amended 1992)

**N.5. Uncoupled-in-Motion Railroad Weighing System.** – An uncoupled-in-motion scale shall be tested statically before being tested in motion by passing railroad reference weight cars over the scale. When an uncoupled-in-motion railroad weighing system is tested, the car speed and the direction of travel shall be the same as when the scale is in normal use. The minimum in-motion test shall be three reference weight cars passed over the scale three times. The cars shall be selected to cover the range of weights that are normally weighed on the system and to reflect the types of cars normally weighed.

(Added 1993)

**N.6. Nominal Capacity of Prescription Scales.** – The nominal capacity of a prescription scale shall be assumed to be one-half apothecary ounce, unless otherwise marked. (Applicable only to scales not marked with an accuracy class.)

**T. Tolerances Applicable to Devices not Marked I, II, III, III L, or IIII****T.1. Tolerance Values.**

**T.1.1. General.** – The tolerances applicable to devices not marked with an accuracy class shall have the tolerances applied as specified in Table T.1.1. Tolerances for Unmarked Scales.

(Amended 1990)

**T.1.2. Postal and Parcel Post Scales.** – The tolerances for postal and parcel post scales are given in Table T.1.1. Tolerances for Unmarked Scales and Table 5. Maintenance and Acceptance Tolerances for Unmarked Postal and Parcel Post Scales.

(Amended 1990)

Table T.1.1. Tolerances for Unmarked Scales						
Type of Device	Subcategory	Minimum Tolerance	Acceptance Tolerance	Maintenance Tolerance	Decreasing-Load Multiplier <sup>1</sup>	Other Applicable Requirements
Vehicle, axle-load, livestock, railway track (weighing statically), crane, and hopper (other than grain hopper)		Class III L, T.N.3.1 (Table 6) and T.N.3.2.			1.0	T.N.2., T.N.3., T.N.4.1., T.N.4.2., T.N.4.3., T.N.4.4., T.N.5., T.N.7.2., T.N.8.1.4. <sup>4</sup> , T.N.9.
Grain test scales	n ≤ 10 000 n > 10 000	Class III, T.N.3.1. (Table 6) and T.N.3.2. Class II, T.N.3.1. (Table 6) and T.N.3.2.			1.0	T.N.8.1.4. <sup>4</sup> , T.N.9.
Railway track scales weighing in motion		T.N.3.6. except that for T.N.3.6.2. (a), no single error shall exceed four times the maintenance tolerance.			1.0	T.N.8.1.4. <sup>4</sup> , T.N.9.
Monorail scales, in-motion		T.N.3.8.			1.0	T.N.8.1.4. <sup>4</sup> , T.N.9.
Customer-operated bulk-weighing systems for recycled materials		± 5 % of applied material test load. Average error on 10 or more test loads ≤ 2.5 %.			1.0	T.N.8.1.4. <sup>4</sup> , T.N.9.
Wheel-load weighers and portable axle-load scales	Tested individually or in pairs <sup>2</sup>	0.5 d or 50 lb, whichever is greater	1 % of test load	2 % of test load	1.5 <sup>3</sup>	T.N.8.1.4. <sup>4</sup> , T.N.9.
Prescription scales		0.1 grain (6 mg)	0.1 % of test load	0.1 % of test load	1.5	T.N.8.1.4. <sup>4</sup> , T.N.9.
Jewelers' scales	Graduated	0.5 d	0.05 % of test load	0.05 % of test load	1.5	T.N.8.1.4. <sup>4</sup> , T.N.9.
	Ungraduated	Sensitivity or smallest weight, whichever is less				
Dairy-product test scale	Loads < 18 g 18 g load	0.2 grain 0.2 grain	0.2 grain 0.3 grain	0.2 grain 0.5 grain	1.5	T.N.8.1.4. <sup>4</sup> , T.N.9.
Postal and parcel post scales designed/used to weigh loads < 2 lb	Loads < 2 lb	15 grain, 1 g, 1/32 oz, 0.03 oz, or 0.002 lb	15 grain, 1 g, 1/32 oz, 0.03 oz, or 0.002 lb	15 grain, 1 g, 1/32 oz, 0.03 oz, or 0.002 lb	1.5	T.N.8.1.4. <sup>4</sup> , T.N.9.
	Loads ≤ 2 lb	Table 5	Table 5	Table 5		
Other postal and parcel post scales		Table 5	Table 5	Table 5	1.5	T.N.8.1.4. <sup>4</sup> , T.N.9.
All other scales	n > 5000	0.5 d or 0.05 % of scale capacity, whichever is less	0.05 % of test load	0.1 % of test load	1.5	T.N.2.5., T.N.4.1., T.N.4.2., T.N.4.3., T.N.5., T.N.7.2., T.N.8.1.4. <sup>4</sup> , T.N.9.
	n ≤ 5000	Class III, T.N.3.1., Table 6 and T.N.3.2.			1.0	T.N.2., T.N.3., T.N.4.1., T.N.4.2., T.N.4.3., T.N.5., T.N.7.2., T.N.8.1.4. <sup>4</sup> , T.N.9.
<sup>1</sup> The decreasing load test applies only to automatic indicating scales.			<sup>3</sup> The decreasing load test does not apply to portable wheel load weighers.			
<sup>2</sup> If marked and tested as a pair, the tolerance shall be applied to the sum of the indication.			<sup>4</sup> T.N.8.1.4. Operating Temperature. is nonretroactive and effective for unmarked devices manufactured as of January 1, 1981.			

(Table Added 1990; Amended 1992 and 1993)

<b>Table 5. Maintenance and Acceptance Tolerances for Unmarked Postal and Parcel Post Scales</b>					
<b>Scale Capacity (lb)</b>	<b>Test Loads (lb)</b>	<b>Maintenance Tolerance (±)</b>		<b>Acceptance Tolerance (±)</b>	
		<b>(oz)</b>	<b>(lb)</b>	<b>(oz)</b>	<b>(lb)</b>
0 to 4, inclusive*	0 to 1, inclusive	$\frac{1}{32}$	0.002	$\frac{1}{32}$	0.002
	over 1	$\frac{1}{8}$	0.008	$\frac{1}{16}$	0.004
over 4*	0 to 7, inclusive	$\frac{3}{16}$	0.012	$\frac{3}{16}$	0.012
	7+ to 24, inclusive	$\frac{3}{8}$	0.024	$\frac{3}{16}$	0.012
	24+ to 30, inclusive	$\frac{1}{2}$	0.030	$\frac{1}{4}$	0.015
	over 30	0.1 % of Test Load		0.05 % of Test Load	

\*See Table T.1.1. for scales designed and/or used to weigh loads less than 2 lb.

## T.2. Sensitivity Requirement (SR).

**T.2.1. Application.** – The sensitivity requirement (SR) is applicable to all nonautomatic-indicating scales not marked I, II, III, III L, or IIII, and is the same whether acceptance or maintenance tolerances apply.

**T.2.2. General.** – Except for scales specified in paragraphs T.2.3. Prescription Scales through T.2.8. Railway Track Scales: 2 d, 0.2 % of the scale capacity, or 40 lb, whichever is least.

**T.2.3. Prescription Scales.** 6 mg (0.1 grain).

### T.2.4. Jewelers' Scales.

**T.2.4.1. With One-Half Ounce Capacity or Less.** – 6 mg (0.1 grain).

**T.2.4.2. With More Than One-Half Ounce Capacity.** – 1 d or 0.05 % of the scale capacity, whichever is less.

### T.2.5. Dairy-Product Test Scales.

**T.2.5.1. Used in Determining Butterfat Content.** – 32 mg (0.5 grain).

**T.2.5.2. Used in Determining Moisture Content.** – 19 mg (0.3 grain).

**T.2.6. Grain Test Scales.** The sensitivity shall be as stated in T.N.6. Sensitivity. (Amended 1987)

### T.2.7. Vehicle, Axle-Load, Livestock, and Animal Scales.

**T.2.7.1. Equipped With Balance Indicators.** – 1 d.

**T.2.7.2. Not Equipped With Balance Indicators.** – 2 d or 0.2 % of the scale capacity, whichever is less.

**T.2.8. Railway Track Scales.** – 3 d or 100 lb, whichever is less.

### T.3. Sensitivity Requirement, Equilibrium Change Required.

The minimum change in equilibrium with test loads equal to the values specified in T.2. Sensitivity Requirements (SR) shall be as follows:

- (a) **Scale with a Trig Loop but without a Balance Indicator.** – The position of rest of the weighbeam shall change from the center of the trig loop to the top or bottom, as the case may be.
- (b) **Scale with a Single Balance Indicator and Having a Nominal Capacity of Less Than 250 kg (500 lb).** – The position of rest of the indicator shall change 1.0 mm (0.04 in) or one division on the graduated scale, whichever is greater.
- (c) **Scale with a Single Balance Indicator and Having a Nominal Capacity of 250 kg (500 lb) or Greater.** – The position of rest of the indicator shall change 6.4 mm (0.25 in) or one division on the graduated scale or the width of the central target area, whichever is greater. However, the indicator on a batching scale shall change 3.2 mm (0.125 in) or one division on the graduated scale, whichever is greater.
- (d) **Scale with Two Opposite-Moving Balance Indicators.** – The position of rest of the two indicators moving in opposite directions shall change 1.0 mm (0.04 in) with respect to each other.
- (e) **Scale with Neither a Trig Loop nor a Balance Indicator.** – The position of rest of the weighbeam or lever system shall change from the horizontal, or midway between limiting stops, to either limit of motion.

## T.N. Tolerances Applicable to Devices Marked I, II, III, III L, and IIII.

### T.N.1. Principles.

**T.N.1.1. Design.** – The tolerance for a weighing device is a performance requirement independent of the design principle used.

**T.N.1.2. Accuracy Classes.** – Weighing devices are divided into accuracy classes according to the number of scale divisions (n) and the value of the scale division (d).

**T.N.1.3. Scale Division.** – The tolerance for a weighing device is related to the value of the scale division (d) or the value of the verification scale division (e) and is generally expressed in terms of d or e.

### T.N.2. Tolerance Application.

**T.N.2.1. General.** – The tolerance values are positive (+) and negative (-) with the weighing device adjusted to zero at no load. When tare is in use, the tolerance values are applied from the tare zero reference (zero net weight indication); the tolerance values apply to the net weight indication for any possible tare load using certified test loads. (Amended 2008)

**T.N.2.2. Type Evaluation Examinations.** – For type evaluation examinations, the tolerance values apply to increasing and decreasing load tests within the temperature, power supply, and barometric pressure limits specified in T.N.8.

**T.N.2.3. Subsequent Verification Examinations.** – For subsequent verification examinations, the tolerance values apply regardless of the influence factors in effect at the time of the conduct of the examination. (Also see G-N.2. Testing with Nonassociated Equipment.)

**T.N.2.4. Multi-Interval and Multiple Range (Variable Division-Value) Scales.** – For multi-interval and multiple range scales, the tolerance values are based on the value of the scale division of the range in use.

**T.N.2.5. Ratio Tests.** – For ratio tests, the tolerance values are 0.75 of the applicable tolerances.

**T.N.3. Tolerance Values.**

**T.N.3.1. Maintenance Tolerance Values.** – The maintenance tolerance values are as specified in Table 6. Maintenance Tolerances.

**T.N.3.2. Acceptance Tolerance Values.** – The acceptance tolerance values shall be one-half the maintenance tolerance values.

**T.N.3.3. Wheel-Load Weighers and Portable Axle-Load Weighers of Class III.** – The tolerance values are two times the values specified in T.N.3.1. Maintenance Tolerance Values and T.N.3.2. Acceptance Tolerance Values.  
(Amended 1986)

**T.N.3.4. Crane and Hopper (Other than Grain Hopper) Scales.** – The maintenance and acceptance tolerances shall be as specified in T.N.3.1. Maintenance Tolerance Values and T.N.3.2. Acceptance Tolerance Values for Class III L, except that the tolerance for crane and construction materials hopper scales shall not be less than 1 d or 0.1 % of the scale capacity, whichever is less.  
(Amended 1986)

<b>Table 6.</b>				
<b>Maintenance Tolerances</b>				
<b>(All values in this table are in scale divisions)</b>				
<b>Tolerance in Scale Divisions</b>				
	<b>1</b>	<b>2</b>	<b>3</b>	<b>5</b>
<b>Class</b>	<b>Test Load</b>			
I	0 - 50 000	50 001 - 200 000	200 001 +	
II	0 - 5 000	5 001 - 20 000	20 001 +	
III	0 - 500	501 - 2 000	2 001 - 4 000	4 001 +
III	0 - 50	51 - 200	201 - 400	401 +
III L	0 - 500	501 - 1 000	(Add 1d for each additional 500 d or fraction thereof)	

**T.N.3.5. Separate Main Elements: Load Transmitting Element, Indicating Element, Etc.** – If a main element separate from a weighing device is submitted for type evaluation, the tolerance for the element is 0.7 that for the complete weighing device. This fraction includes the tolerance attributable to the testing devices used.

**T.N.3.6. Coupled-In-Motion Railroad Weighing Systems.** – The maintenance and acceptance tolerance values for the group of weight values appropriate to the application must satisfy the following conditions:  
(Amended 1990 and 1992)

**T.N.3.6.1.** – For any group of weight values, the difference in the sum of the individual in-motion car weights of the group as compared to the sum of the individual static weights shall not exceed 0.2 %.  
(Amended 1990)

**T.N.3.6.2.** – If a weighing system is used to weigh trains of five or more cars, and if the individual car weights are used, any single weight value within the group must meet the following criteria:

- (a) no single error may exceed three times the static maintenance tolerance;
- (b) not more than 5 % of the errors may exceed two times the static maintenance tolerance; and
- (c) not more than 35 % of the errors may exceed the static maintenance tolerance.

(Amended 1990 and 1992)

**T.N.3.6.3.** – For any group of weight values wherein the sole purpose is to determine the sum of the group, T.N.3.6.1. alone applies.  
(Amended 1990)

**T.N.3.6.4.** – For a weighing system used to weigh trains of less than five cars, no single car weight within the group may exceed the static maintenance tolerance.  
(Amended 1990 and 1992)

**T.N.3.7. Uncoupled-in-Motion Railroad Weighing Systems.** – The maintenance and acceptance tolerance values for any single weighment within a group of non-interactive (i.e., uncoupled) loads, the weighment error shall not exceed the static maintenance tolerance.  
(Amended 1992)

**T.N.3.8. Dynamic Monorail Weighing System.** – Acceptance tolerance shall be the same as the maintenance tolerance shown in Table 6. Maintenance Tolerances. On a dynamic test of twenty or more individual test loads, 10 % of the individual test loads may be in error, each not to exceed two times the tolerance. The error on the total of the individual test loads shall not exceed  $\pm 0.2$  %. (See also Note in N.1.3.5.1. Dynamic Monorail Weighing Systems) *For equipment undergoing type evaluation, a tolerance equal to one-half the maintenance tolerance values shown in Table 6. Maintenance Tolerances shall apply.*  
[Nonretroactive January 1, 2002]  
(Added 1986) (Amended 1999 and 2001)

**T.N.3.9. Materials Test on Customer-Operated Bulk Weighing Systems for Recycled Materials.** – The maintenance and acceptance tolerance shall be  $\pm 5$  % of the applied materials test load except that the average error on ten or more test materials test loads shall not exceed  $\pm 2.5$  %.  
(Added 1986)

**T.N.3.10. Prescription Scales with a Counting Feature.** – In addition to Table 6. Maintenance Tolerances (for weight), the indicated piece count value computed by a Class I or Class II prescription scale counting feature shall comply with the tolerances in Table T.N.3.10. Maintenance and Acceptance Tolerances in Excess and in Deficiency for Count.

<b>Table T.N.3.10. Maintenance and Acceptance Tolerances in Excess and in Deficiency for Count</b>	
<b>Indication of Count</b>	<b>Tolerance (piece count)</b>
0 to 100	0
101 to 200	1
201 or more	0.5 %

(Added 2003)

**T.N.3.11. Tolerances for Substitution Test.** – Tolerances are applied to the scale based on the substitution test load.  
(Added 2003)

**T.N.3.12. Tolerances for Strain-Load Test.** – Tolerances apply only to the test weights or substitution test loads.  
(Added 2003)

**T.N.4. Agreement of Indications.**

**T.N.4.1. Multiple Indicating/Recording Elements.** – In the case of a scale or weighing system equipped with more than one indicating element or indicating element and recording element combination, where the indicators or

indicator/recorder combination are intended to be used independently of one another, tolerances shall be applied independently to each indicator or indicator/recorder combination.

(Amended 1986)

**T.N.4.2. Single Indicating/Recording Element.** – In the case of a scale or weighing system with a single indicating element or an indicating/recording element combination, and equipped with component parts such as unit weights, weighbeam and weights, or multiple weighbeams that can be used in combination to indicate a weight, the difference in the weight value indications of any load shall not be greater than the absolute value of the applicable tolerance for that load, and shall be within tolerance limits.

(Amended 1986)

**T.N.4.3. Single Indicating Element/Multiple Indications.** – In the case of an analog indicating element equipped with two or more indicating means within the same element, the difference in the weight indications for any load other than zero shall not be greater than one-half the value of the scale division (d) and be within tolerance limits.

(Amended 1986)

**T.N.4.4. Shift or Section Tests.** – The range of the results obtained during the conduct of a shift test or a section test shall not exceed the absolute value of the maintenance tolerance applicable and each test result shall be within applicable tolerances.

(Added 1986)

**T.N.4.5. Time Dependence.** – A time dependence test shall be conducted during type evaluation and may be conducted during field verification provided test conditions remain constant.

(Amended 1989 and 2005)

**T.N.4.5.1. Time Dependence: Class II, III, and IIII Non-automatic Weighing Instruments.** – A non-automatic weighing instrument of Classes II, III, and IIII shall meet the following requirements at constant test conditions. During type evaluation, this test shall be conducted at  $20\text{ }^{\circ}\text{C} \pm 2\text{ }^{\circ}\text{C}$  ( $68\text{ }^{\circ}\text{F} \pm 4\text{ }^{\circ}\text{F}$ ):

- (a) When any load is kept on an instrument, the difference between the indication obtained immediately after placing the load and the indication observed during the following 30 minutes shall not exceed  $0.5 e$ . However, the difference between the indication obtained at 15 minutes and the indication obtained at 30 minutes shall not exceed  $0.2 e$ .
- (b) If the conditions in (a) are not met, the difference between the indication obtained immediately after placing the load on the instrument and the indication observed during the following 4 hours shall not exceed the absolute value of the maximum permissible error at the load applied.
- (c) The deviation on returning to zero as soon as the indication has stabilized, after the removal of any load which has remained on the instrument for 30 minutes, shall not exceed  $0.5 e$ .

For a multi-interval instrument, the deviation shall not exceed  $0.5 e_1$  (where  $e_1$  is the interval of the first partial weighing range or segment of the scale).

On a multiple range instrument, the deviation on returning to zero from  $\text{Max}_i$  (load in the applicable weighing range) shall not exceed  $0.5 e_i$  (interval of the weighing segment). Furthermore, after returning to zero from any load greater than  $\text{Max}_1$  (capacity of the first weighing range) and immediately after switching to the lowest weighing range, the indication near zero shall not vary by more than  $e_1$  (interval of the first weighing range) during the following 5 minutes.

(Added 2005) (Amended 2006)

**T.N.4.5.2. Time Dependence: Class III L Non-automatic Weighing Instruments.** – A non-automatic weighing instrument of Class III L shall meet the following requirements:

- (a) When any load is kept on an instrument, the difference between the indication obtained immediately after placing the load and the indication observed during the following 30 minutes shall not



exceed 1.5 e. However, the difference between the indication obtained at 15 minutes and the indication obtained at 30 minutes shall not exceed 0.6 e.

- (b) If the conditions in (a) are not met, the difference between the indication obtained immediately after placing the load on the instrument and the indication observed during the following 4 hours shall not exceed the absolute value of the maximum permissible error at the load applied.
- (c) The deviation on returning to zero as soon as the indication has stabilized, after the removal of any load which has remained on the instrument for 30 minutes, shall not exceed one-half of the absolute value of the applicable tolerance for the applied load for Class III L devices.

(Added 2005)

**T.N.4.6. Time Dependence (Creep) for Load Cells During Type Evaluation.** – A load cell (force transducer) marked with an accuracy class shall meet the following requirements at constant test conditions:

- (a) **Permissible Variations of Readings.** – With a constant maximum load for the measuring range ( $D_{max}$ ) between 90 % and 100 % of maximum capacity ( $E_{max}$ ), applied to the load cell, the difference between the initial reading and any reading obtained during the next 30 minutes shall not exceed the absolute value of the maximum permissible error (mpe) for the applied load (see Table T.N.4.6. Maximum Permissible Error (mpe) for Load Cells During Type Evaluation). The difference between the reading obtained at 20 minutes and the reading obtained at 30 minutes shall not exceed 0.15 times the absolute value of the mpe (see Table T.N.4.6. Maximum Permissible Error (mpe) for Load Cells During Type Evaluation).
- (b) **Apportionment Factors.** – The mpe for creep shall be determined from Table T.N.4.6. Maximum Permissible Error (mpe) \* for Load Cells During Type Evaluation using the following apportionment factors ( $p_{LC}$ ):

$p_{LC} = 0.7$  for load cells marked with S (single load cell applications),  
 $p_{LC} = 1.0$  for load cells marked with M (multiple load cell applications), and  
 $p_{LC} = 0.5$  for Class III L load cells marked with S or M.

(Amended 2006)

(Added 2005)

<b>Table T.N.4.6.</b>			
<b>Maximum Permissible Error (mpe)* for Load Cells During Type Evaluation</b>			
<b>mpe in Load Cell Verifications Divisions (v) = <math>p_{LC}</math> x Basic Tolerance in v</b>			
Class	$p_{LC} \times 0.5 v$	$p_{LC} \times 1.0 v$	$p_{LC} \times 1.5 v$
I	0 - 50 000 v	50 001 v - 200 000 v	200 001 v +
II	0 - 5 000 v	5 001 v - 20 000 v	20 001 v +
III	0 - 500 v	501 v - 2 000 v	2 001 v +
III	0 - 50 v	51 v - 200 v	201 v +
III L	0 - 500 v	501 v - 1 000 v	(Add 0.5 v to the basic tolerance for each additional 500 v or fraction thereof up to a maximum load of 10 000 v)

v represents the load cell verification interval  
 $p_{LC}$  represents the apportionment factors applied to the basic tolerance  
 $p_{LC} = 0.7$  for load cells marked with S (single load cell applications)  
 $p_{LC} = 1.0$  for load cells marked with M (multiple load cell applications)  
 $p_{LC} = 0.5$  for Class III L load cells marked with S or M  
 \* mpe =  $p_{LC}$  x Basic Tolerance in load cell verifications divisions (v)

(Table Added 2005) (Amended 2006)

**T.N.4.7. Creep Recovery for Load Cells During Type Evaluation.** – The difference between the initial reading of the minimum load of the measuring range ( $D_{\min}$ ) and the reading after returning to minimum load subsequent to the maximum load ( $D_{\max}$ ) having been applied for 30 minutes shall not exceed:

- (a) 0.5 times the value of the load cell verification interval (0.5 v) for Class I, II, and III load cells,
- (b) 0.5 times the value of the load cell verification interval (0.5 v) for Class III load cells with 4000 or fewer divisions,
- (c) 0.83 times the value of the load cell verification interval (0.83 v) for Class III load cells with more than 4000 divisions, or
- (d) 1.5 times the value of the load cell verification interval (1.5 v) for Class III L load cells.

(Added 2006) (Amended 2009)

**T.N.5. Repeatability.** – The results obtained from several weighings of the same load under reasonably static test conditions shall agree within the absolute value of the maintenance tolerance for that load, and shall be within applicable tolerances.

**T.N.6. Sensitivity.** – This section is applicable to all nonautomatic-indicating scales marked I, II, III, III L, or IIII.

**T.N.6.1. Test Load.**

- (a) The test load for sensitivity for nonautomatic-indicating vehicle, axle-load, livestock, and animal scales shall be 1 d for scales equipped with balance indicator, and 2 d or 0.2 % of the scale capacity, whichever is less, for scales not equipped with balance indicators.
- (b) For all other nonautomatic-indicating scales, the test load for sensitivity shall be 1 d at zero and 2 d at maximum test load.

**T.N.6.2. Minimum Change of Indications.** – The addition or removal of the test load for sensitivity shall cause a minimum permanent change as follows:

- (a) for a scale with trig loop but without a balance indicator, the position of the weighbeam shall change from the center to the outer limit of the trig loop;
- (b) for a scale with balance indicator, the position of the indicator shall change one division on the graduated scale, the width of the central target area, or the applicable value as shown below, whichever is greater:

Scale of Class I or II: 1 mm (0.04 in),

Scale of Class III or IIII with a maximum capacity of 30 kg (70 lb) or less: 2 mm (0.08 in),

Scale of Class III, III L, or IIII with a maximum capacity of more than 30 kg (70 lb): 5 mm (0.20 in);

- (c) for a scale without a trig loop or balance indicator, the position of rest of the weighbeam or lever system shall change from the horizontal or midway between limiting stops to either limit of motion.

(Amended 1987)

**T.N.7. Discrimination.**

**T.N.7.1. Analog Automatic Indicating (i.e., Weighing Device With Dial, Drum, Fan, Etc.).** – A test load equivalent to 1.4 d shall cause a change in the indication of at least 1.0 d. (See N.1.5. Discrimination Test)

**T.N.7.2. Digital Automatic Indicating.** – A test load equivalent to 1.4 d shall cause a change in the indicated or recorded value of at least 2.0 d. This requires the zone of uncertainty to be not greater than three-tenths of the value of the scale division. (See N.1.5.1. Digital Device)

**T.N.8. Influence Factors.** – The following factors are applicable to tests conducted under controlled conditions only, provided that:

- (a) types of devices approved prior to January 1, 1986, and manufactured prior to January 1, 1988, need not meet the requirements of this section,
  - (b) new types of devices submitted for approval after January 1, 1986, shall comply with the requirements of this section, and
  - (c) all devices manufactured after January 1, 1988, shall comply with the requirements of this section.
- (Amended 1985)

**T.N.8.1. Temperature.** – Devices shall satisfy the tolerance requirements under the following temperature conditions:

**T.N.8.1.1.** If not specified in the operating instructions for Class I or II scales, or if not marked on the device for Class III, III L, or IIII scales, the temperature limits shall be: –10 °C to 40 °C (14 °F to 104 °F).

**T.N.8.1.2.** If temperature limits are specified for the device, the range shall be at least that specified in Table T.N.8.1.2. Temperature Range by Class.

<b>Table T.N.8.1.2. Temperature Range by Class</b>	
<b>Class</b>	<b>Temperature Range</b>
I	5 °C (9 °F)
II	15 °C (27 °F)
III, III L, and IIII	30 °C (54 °F)

**T.N.8.1.3. Temperature Effect on Zero-Load Balance.** – The zero-load indication shall not vary by more than:

- (a) three divisions per 5 °C (9 °F) change in temperature for Class III L devices; or
  - (b) one division per 5 °C (9 °F) change in temperature for all other devices.
- (Amended 1990)

**T.N.8.1.4. Operating Temperature.** – Except for Class I and II devices, an indicating or recording element shall not display nor record any usable values until the operating temperature necessary for accurate weighing and a stable zero balance condition have been attained.

**T.N.8.2. Barometric Pressure.** – Except for Class I scales, the zero indication shall not vary by more than one scale division for a change in barometric pressure of 1 kPa over the total barometric pressure range of 95 kPa to 105 kPa (28 in to 31 in of Hg).

**T.N.8.3. Electric Power Supply.**

**T.N.8.3.1. Power Supply, Voltage and Frequency.**

- (a) Weighing devices that operate using alternating current must perform within the conditions defined in paragraphs T.N.3. Tolerance Values through T.N.7. Discrimination, inclusive, when tested over the range of –15 % to +10 % of the marked nominal line voltage(s) at 60 Hz, or the voltage range marked by the manufacturer, at 60 Hz.
- (Amended 2003)

- (b) Battery operated instruments shall not indicate nor record values outside the applicable tolerance limits when battery power output is excessive or deficient.

**T.N.8.3.2. Power Interruption.** – A power interruption shall not cause an indicating or recording element to display or record any values outside the applicable tolerance limits.

**T.N.9. Radio Frequency Interference (RFI) and Other Electromagnetic Interference Susceptibility.** – The difference between the weight indication due to the disturbance and the weight indication without the disturbance shall not exceed one scale division (d); or the equipment shall:

- (a) blank the indication, or
- (b) provide an error message, or
- (c) the indication shall be so completely unstable that it cannot be interpreted, or transmitted into memory or to a recording element, as a correct measurement value.

The tolerance in T.N.9. Radio Frequency Interference (RFI) and Other Electromagnetic Interference Susceptibility is to be applied independently of other tolerances. For example, if indications are at allowable basic tolerance error limits when the disturbance occurs, then it is acceptable for the indication to exceed the applicable basic tolerances during the disturbance. **Editors' Note:** Following the 1997 NCWM Annual Meeting, the text in this paragraph was revised with concurrence of the S&T Committee to clarify its application.

(Amended 1997)

## **UR. User Requirements**

**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.<sup>4</sup>

### **UR.1.1. General.**

- (a) For devices marked with a class designation, the typical class or type of device for particular weighing applications is shown in Table 7a. Typical Class or Type of Device for Weighing Applications.
- (b) For devices not marked with a class designation, Table 7b. Applicable to Devices not Marked with a Class Designation applies.

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<sup>4</sup> Purchasers and users of scales such as railway track, hopper, and vehicle scales should be aware of possible additional requirements for the design and installation of such devices.

(Footnote Added 1995)

<b>Table 7a.</b> <b>Typical Class or Type of Device for Weighing Applications</b>	
<b>Class</b>	<b>Weighing Application or Scale Type</b>
I	Precision laboratory weighing
II	Laboratory weighing, precious metals and gem weighing, grain test scales
III	All commercial weighing not otherwise specified, grain test scales, retail precious metals and semi-precious gem weighing, animal scales, postal scales, vehicle on-board weighing systems with a capacity less than or equal to 30 000 lb, and scales used to determine laundry charges
III L	Vehicle scales, vehicle on-board weighing systems with a capacity greater than 30 000 lb, axle-load scales, livestock scales, railway track scales, crane scales, and hopper (other than grain hopper) scales
III	Wheel-load weighers and portable axle-load weighers used for highway weight enforcement
<p><b>Note:</b> A scale with a higher accuracy class than that specified as “typical” may be used. (Amended 1985, 1986, 1987, 1988, 1992, and 1995)</p>	

<b>Table 7b.</b> <b>Applicable to Devices not Marked with a Class Designation</b>	
<b>Scale Type or Design</b>	<b>Maximum Value of d</b>
Retail Food Scales, 50 lb capacity and less	1 oz
Animal Scales	1 lb
Grain Hopper Scales Capacity up to and including 50 000 lb Capacity over 50 000 lb	10 lb (not greater than 0.05 % of capacity) 20 lb
Crane Scales	not greater than 0.2 % of capacity
Vehicle and Axle-Load Scales Used in Combination Capacity up to and including 200 000 lb Capacity over 200 000 lb	20 lb 50 lb
Railway Track Scales With weighbeam Automatic indicating	20 lb 100 lb
Scales with capacities greater than 500 lb except otherwise specified	0.1 % capacity (but not greater than 50 lb)
Wheel-Load Weighers	0.25 % capacity (but not greater than 50 lb)
<p><b>Note:</b> For scales not specified in this table, G-UR.1.1. and UR.1. apply. (Added 1985) (Amended 1989)</p>	

**UR.1.2. Grain Hopper Scales.** – The minimum number of scale divisions for a Class III Hopper Scale used for weighing grain shall be 2000.

**UR.1.3. Value of the Indicated and Recorded Scale Division.** – *The value of the scale division as recorded shall be the same as the division value indicated.*

*[Nonretroactive as of January 1, 1986]*

(Added 1985) (Amended 1999)

**UR.1.3.1. Exceptions.** – The provisions of UR.1.3. Value of the Indicated and Recorded Scale Division shall not apply to:

(a) Class I scales, or

(b) Dynamic monorail weighing systems when the value of d is less than the value of e.

(Added 1999)

**UR.1.4. Grain-Test Scales: Value of the Scale Divisions.** – The scale division for grain-test scales shall not exceed 0.2 g for loads through 500 g, and shall not exceed 1 g for loads above 500 g through 1000 g.

(Added 1992)

**UR.1.5. Recording Element, Class III L Railway Track Scales.** – *Class III L Railway Track Scales must be equipped with a recording element.*

*[Nonretroactive as of January 1, 1996]*

(Added 1995)

## **UR.2. Installation Requirements.**

**UR.2.1. Supports.** – A scale that is portable and that is being used on a counter, table, or the floor shall be so positioned that it is firmly and securely supported.

**UR.2.2. Suspension of Hanging Scale.** – A hanging scale shall be freely suspended from a fixed support when in use.

**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.

**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.*

*[Nonretroactive as of January 1, 1973]*

**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.

(Amended 1985)

### **UR.2.6. Approaches.**

**UR.2.6.1. Vehicle Scales.** – *On the entrance and exit end(s) 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*

(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.*

*[Nonretroactive as of January 1, 1976]*

(Amended 1977, 1983, 1993, and 2006)

**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.

**UR.2.7. Stock Racks.** – A livestock or animal scale shall be equipped with a suitable stock rack, with gates as required, which shall be securely mounted on the scale platform. Adequate clearances shall be maintained around the outside of the rack.

**UR.2.8. Hoists.** – On vehicle scales equipped with means for raising the load-receiving element from the weighing element for vehicle unloading, means shall be provided so that it is readily apparent to the scale operator when the load-receiving element is in its designed weighing position.

**UR.2.9. Provision for Testing Dynamic Monorail Weighing Systems.** – *Provisions shall be made at the time of installation of a dynamic monorail weighing systems for testing in accordance with N.1.3.5.1. Dynamic Monorail Weighing Systems (a rail around or other means for returning the test carcasses to the scale being tested).*

*[Nonretroactive as of January 1, 1998]*

(Added 1997) (Amended 1999)

**UR.3. Use Requirements.**

**UR.3.1. Recommended Minimum Load.** – A recommended minimum load is specified in Table 8 since the use of a device to weigh light loads is likely to result in relatively large errors.

<b>Table 8. Recommended Minimum Load</b>		
<b>Class</b>	<b>Value of Scale Division (d or e*)</b>	<b>Recommended Minimum Load (d or e*)</b>
I	equal to or greater than 0.001 g	100
II	0.001 g to 0.05 g, inclusive	20
III	equal to or greater than 0.1 g	50
III L	All**	20
III	All	50
III	All	10
<p>*For Class I and II devices equipped with auxiliary reading means (i.e., a rider, a vernier, or a least significant decimal differentiated by size, shape or color), the value of the verification scale division “e” is the value of the scale division immediately preceding the auxiliary means. For Class III and III L devices the value of “e” is specified by the manufacturer as marked on the device; “e” must be less than or equal to “d.”</p> <p>**A minimum load of 10 d is recommended for a weight classifier marked in accordance with a statement identifying its use for special applications.</p> <p>(Amended 1990)</p>		

**UR.3.1.1. Minimum Load, Grain Dockage Determination.** – When determining the quantity of foreign material (dockage) in grain, the weight of the sample shall be equal to or greater than 500 scale divisions.

(Added 1985)

**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. Span Maximum Load.

(Added 1996)

<b>Table UR.3.2.1. Span Maximum Load</b>								
<b>Distance in Feet Between the Extremes of any Two or More Consecutive Axles</b>	<b>Ratio of CLC to Maximum Load (“r” factor) Carried on Any Group of Two or More Consecutive Axles.</b>							
	<b>2 axles</b>	<b>3 axles</b>	<b>4 axles</b>	<b>5 axles</b>	<b>6 axles</b>	<b>7 axles</b>	<b>8 axles</b>	<b>9 axles</b>
4 <sup>1</sup>	1.000		<b>INSTRUCTIONS:</b> 1. Determine the scale’s CLC. 2. Count the number of axles on the vehicle in a given span and determine the distance in feet between the first and last axle in the span. 3. Multiply the CLC by the corresponding multiplier in the table*. 4. The resulting number is the scale’s maximum concentrated load for a single span based on the vehicle configuration.  *See note and formula on next page.					
5 <sup>1</sup>	1.000							
6 <sup>1</sup>	1.000							
7 <sup>1</sup>	1.000							
8 and less <sup>1</sup>	1.000	1.000						
More than 8 <sup>1</sup>	1.118	1.235						
9	1.147	1.257						
10	1.176	1.279						
11	1.206	1.301						
12	1.235	1.324						
13	1.265	1.346	1.490	1.651				
14	1.294	1.368	1.510	1.669				
15	1.324	1.390	1.529	1.688	1.853			
16	1.353	1.412	1.549	1.706	1.871			
17	1.382	1.434	1.569	1.724	1.888			
18	1.412	1.456	1.588	1.743	1.906			
19	1.441	1.478	1.608	1.761	1.924			
20	1.471	1.500	1.627	1.779	1.941			
21	1.500	1.522	1.647	1.798	1.959			
22	1.529	1.544	1.667	1.816	1.976			
23	1.559	1.566	1.686	1.835	1.994			
24	1.588	1.588	1.706	1.853	2.012	2.176		
25	1.618	1.610	1.725	1.871	2.029	2.194		
26		1.632	1.745	1.890	2.047	2.211		
27		1.654	1.765	1.908	2.065	2.228		
28		1.676	1.784	1.926	2.082	2.245	2.412	
29		1.699	1.804	1.945	2.100	2.262	2.429	
30		1.721	1.824	1.963	2.118	2.279	2.445	
31		1.743	1.843	1.982	2.135	2.297	2.462	
32		1.765	1.863	2.000	2.153	2.314	2.479	2.647
33			1.882	2.018	2.171	2.331	2.496	2.664
34			1.902	2.037	2.188	2.348	2.513	2.680
35			1.922	2.055	2.206	2.365	2.529	2.697
36			2.000 <sup>2</sup>	2.074	2.224	2.382	2.546	2.713
37			2.000 <sup>2</sup>	2.092	2.241	2.400	2.563	2.730
38			2.000 <sup>2</sup>	2.110	2.259	2.417	2.580	2.746
39			2.000	2.129	2.276	2.434	2.597	2.763
40			2.020	2.147	2.294	2.451	2.613	2.779
41			2.039	2.165	2.312	2.468	2.630	2.796
42			2.059	2.184	2.329	2.485	2.647	2.813
43			2.078	2.202	2.347	2.502	2.664	2.829
44			2.098	2.221	2.365	2.520	2.681	2.846
45			2.118	2.239	2.382	2.537	2.697	2.862



<b>Table UR.3.2.1. Span Maximum Load</b>								
<b>Distance in Feet Between the Extremes of any Two or More Consecutive Axles</b>	<b>Ratio of CLC to Maximum Load (“r” factor) Carried on Any Group of Two or More Consecutive Axles.</b>							
	<b>2 axles</b>	<b>3 axles</b>	<b>4 axles</b>	<b>5 axles</b>	<b>6 axles</b>	<b>7 axles</b>	<b>8 axles</b>	<b>9 axles</b>
46			2.137	2.257	2.400	2.554	2.714	2.879
47			2.157	2.276	2.418	2.571	2.731	2.895
48			2.176	2.294	2.435	2.588	2.748	2.912
49			2.196	2.313	2.453	2.605	2.765	2.928
50			2.216	2.331	2.471	2.623	2.782	2.945
51			2.235	2.349	2.488	2.640	2.798	2.961
52			2.255	2.368	2.506	2.657	2.815	2.978
53			2.275	2.386	2.524	2.674	2.832	2.994
54			2.294	2.404	2.541	2.691	2.849	3.011
55			2.314	2.423	2.559	2.708	2.866	3.028
56			2.333	2.441	2.576	2.725	2.882	3.044
57			2.353 <sup>3</sup>	2.460	2.594	2.742	2.899	3.061
58				2.478	2.612	2.760	2.916	3.077
59				2.496	2.629	2.777	2.933	3.094
60				2.515	2.647	2.794	2.950	3.110
<p><b>*Note:</b> This table was developed based upon the following formula. Values may be rounded in some cases for ease of use.</p> $W = r \times 500 \left[ \left( \frac{LN}{N-1} \right) + 12N + 36 \right]$ <p><sup>1</sup> Tandem Axle Weight.  <sup>2</sup> Exception – These values in the third column correspond to the maximum loads in which the inner bridge dimensions of 36, 37, and 38 feet are considered to be equivalent to 39 feet. This allows a weight of 68 000 lb on axles 2 through 5.  <sup>3</sup> Corresponds to the Interstate Gross Weight Limit.</p>								

**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. However:

- (a) the weight of a coupled combination may be determined by uncoupling the various elements (tractor, semitrailer, trailer), weighing each unit separately as a single draft, and adding together the results, or
- (b) the weight of a vehicle or coupled-vehicle combination may be determined by adding together the weights obtained while all individual elements are resting simultaneously on more than one scale platform.

**Note:** This paragraph does not apply to highway-law-enforcement scales and scales used for the collection of statistical data.  
(Added 1992)

**UR.3.4. Wheel-Load Weighing.**

**UR.3.4.1. Use in Pairs.** – When wheel-load weighers or portable axle-load weighers are to be regularly used in pairs, both weighers of each such pair shall be appropriately marked to identify them as weighers intended to be used in combination.

**UR.3.4.2. Level Condition.** – A vehicle of which either an axle-load determination or a gross-load determination is being made utilizing wheel-load weighers or portable axle-load weighers, shall be in a reasonably level position at the time of such determination.

**UR.3.5. Special Designs.** – A scale designed and marked for a special application (such as a prepackaging scale or prescription scale with a counting feature) shall not be used for other than its intended purpose<sup>5</sup>.

(Amended 2003)

**UR.3.6. Wet Commodities.** – Wet commodities not in watertight containers shall be weighed only on a scale having a pan or platform that will drain properly.

(Amended 1988)

**UR.3.7. Minimum Load on a Vehicle Scale.** – A vehicle scale shall not be used to weigh net loads smaller than:

- (a) 10 d when weighing scrap material for recycling or weighing refuse materials at landfills and transfer stations;
- (b) 50 d for all other weighing.

As used in this paragraph, scrap materials for recycling shall be limited to ferrous metals, paper (including cardboard), textiles, plastic, and glass.

(Amended 1988, 1992, and 2006)

**UR.3.8. Minimum Load for Weighing Livestock.** – A scale with scale divisions greater than 2 kg (5 lb) shall not be used for weighing net loads smaller than 500 d.

(Amended 1989)

**UR.3.9. Use of Manual Weight Entries.** – Manual gross or net weight entries are permitted for use in the following applications only:

- (a) when a point-of-sale system interfaced with a scale is giving credit for a weighed item;
- (b) when an item is pre-weighed on a legal for trade scale and marked with the correct net weight;
- (c) when a device or system is generating labels for standard weight packages;
- (d) when postal scales or weight classifiers are generating manifests for packages to be picked up at a later time;  
or
- (e) when livestock and vehicle scale systems generate weight tickets to correct erroneous tickets.

(Added 1992) (Amended 2000 and 2004)

**UR.3.10. Dynamic Monorail Weighing Systems.** – When the value of d is different from the value of e, the commercial transaction must be based on e.

(Added 1999)

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<sup>5</sup> Prepackaging scales and prescription scales with a counting feature (and other commercial devices) used for putting up packages in advance of sale are acceptable for use in commerce only if all appropriate provisions of Handbook 44 are met. Users of such devices must be alert to the legal requirements relating to the declaration of quantity on a package. Such requirements are to the effect that, on the average, the contents of the individual packages of a particular commodity comprising a lot, shipment, or delivery must contain at least the quantity declared on the label. The fact that a prepackaging scale may overregister, but within established tolerances, and is approved for commercial service is not a legal justification for packages to contain, on the average, less than the labeled quantity.

(Amended 2003)

**UR.3.11. Minimum Count.** – A prescription scale with an operational counting feature shall not be used to count a quantity of less than 30 pieces weighing a minimum of 90 e.

(Added 2003)

**Note:** The minimum count as defined in this paragraph refers to the use of the device in the filling of prescriptions and is different from the minimum sample piece count as defined in S.1.2.3. and as required to be marked on the scale by S.6.6.

(Note Added 2004)

**UR.3.12. Correct Stored Piece Weight.** – For prescription scales with a counting feature, the user is responsible for maintaining the correct stored piece weight. This is especially critical when a medicine has been reformulated or comes from different lots.

(Added 2003)

#### **UR.4. Maintenance Requirements.**

**UR.4.1. Balance Condition.** – The zero-load adjustment of a scale shall be maintained so that, with no load on the load-receiving element and with all load-counterbalancing elements of the scale (such as poises, drop weights, or counterbalance weights) set to zero, the scale shall indicate or record a zero balance condition. A scale not equipped to indicate or record a zero-load balance shall be maintained in balance under any no-load condition.

**UR.4.2. Level Condition.** – If a scale is equipped with a level-condition indicator, the scale shall be maintained in level.

**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 engineering department of the manufacturer of the scale, and by the weights and measures authority having jurisdiction over the scale.

(Amended 1996)

**UR.5. Coupled-in-Motion Railroad Weighing Systems.** – A coupled-in-motion weighing system placed in service on or after January 1, 1991, should be tested in the manner in which it is operated, with the locomotive either pushing or pulling the cars at the designed speed and in the proper direction. The cars used in the test train should represent the range of gross weights that will be used during the normal operation of the weighing system. Except as provided in N.4.2. Weighing Systems Placed in Service Prior to January 1, 1991, and Used to Weigh Trains of Ten or More Cars and N.4.3.(a) Weighing Systems Placed in Service on or After January 1, 1991, and Used to Weigh Trains of Ten or More Cars, normal operating procedures should be simulated as nearly as practical. Approach conditions for a train length in each direction of the scale site are more critical for a weighing system used for individual car weights than for a unit-train-weights-only facility, and should be considered prior to installation.

(Added 1990) (Amended 1992)

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