PART 2 - EVALUATION OF METROLOGICAL FEATURES

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1.0 MARKING - GENERALITIES

Reference: Sections 49 to 54 of the Specifications

Complete weighing devices and major components (indicating elements and load receiving/weighing elements) of devices tested separately must be marked with certain information in the manner required by the *Specifications Relating to Non Automatic Weighing Devices*. Complete devices in the same housing or made of non detachable major components are only required to bear one series of markings. Major components of complete devices must be marked individually if they can be separated and interfaced (mixed/matched) to other major components to form a device. Major components submitted for approval evaluation individually are tested separately and are also required to be marked individually.

Remote (secondary) weight displays, slave modules such as printers, keyboards, cash registers and other similar modules that are used in conjunction with approved devices are not required to be marked if they perform no significant metrological functions.

1.1 MARKING - COMPLETE DEVICES

This section applies to complete devices in the same housing or complete devices made of major detachable components interfaced together and not intended to be separated and used in conjunction with other individually approved major components to form different devices. For such devices, only one series of information is required.

The device must be marked with:

1.1.1 the **name or trademark** of the manufacturer or applicant.

1.1.2 a **model** designation that positively identifies the device type or design.

1.1.3 a distinctive **serial number**. The serial number must be prefaced by words, an abbreviation or a symbol that clearly identifies the number as the serial number.

1.1.4 its Canadian Weights and Measures **approval number**. The approval number must be prefaced with words or an abbreviation that positively identifies the number as the Canadian approval number.

Acceptable solutions	**or**	**MC AM- 4145**
Canadian Approval AM-4145	**or**	**CND W&M AM-4145**
	or	**AM-4145**

1.1.5 the **accuracy class**. The roman numerals I, II, III, III HD or IIII are the markings required to indicate the accuracy class. The roman numeral within an ellipse or a figure approximating an ellipse is the proper way to indicate the accuracy class. The word "Class" followed by the roman numeral is also acceptable.

1.1.6 the **maximum capacity (Max)** that the device can weigh.

1.1.7 the value of the **actual scale interval "d"**.

1.1.8 the value of the **verification scale interval "e"**, if different from "d". On Class III, III HD and IIII devices, multi-interval and multiple range devices, "e" must equal "d".

Note: 1. Max, "d" and "e", if different from "d", must be marked adjacent to the weight display.
2. If a device has a separate display for customers, Max, "d" and "e", if different from "d", must be marked adjacent to both the operator and the customer weight displays.
3. Max, "d" and "e", if different from "d", must be marked for all weight units that can be displayed (i.e., pounds and kilograms).

Ex: 10 kg x 5 g Max 10 kg/20 lb 10 kg (20 lb) x 5 g (0.01 lb)
20 lb x 0.01 lb d = 5 g/0.01 lb

4. The markings of Max, "d" and "e", if different from "d", adjacent to the weight display must reflect actual device operation. For instance, a device that is capable of being configured for either single or multiple range operation must be marked to reflect the configuration selected.

1.1.9 the operating **temperature range** if different than -10°C to 40°C. For Class I devices, the temperature range must be at least 5°C; for Class II devices, at least 15°C; and for Class III, III HD and IIII devices, at least 30°C.

Note: **Multiple range and multi-interval devices** must be marked with the weight ranges and the corresponding scale intervals. Devices with more than one class designation must be marked with each class designation in clear association with Max, "d", "e" (if different from "d") and the temperature range, if they are different for each class.

Acceptable solutions

1. Multi-interval device

0-3 kg (0-6 lb) x 1 g (0.002 lb)	or	Max 3\6 kg (6/15 lb)
3-6 kg (6-15 lb) x 2 g (0.005 lb)		d = 1\2 g (0.002/0.005 lb)

2. Device with more than one weighing range

W_1	W_2
Max 3 kg (6 lb)	6 kg (15 lb)
d = 1 g (0.002 lb)	2 g (0.005 lb)

3. Device with weighing ranges in different accuracy classes and restricted temperature ranges

W_1	W_2
II	III
Max 3 kg	15 kg
d = 0.01 g	10 g
e = 0.1 g	e = d
10°C/30°C	0°C/35°C

1.1.10 the **verification marks**. The device must have an area, either on the marking plate itself or on the device adjacent to the marking plate, suitable for the application of the verification marks. The

surface of this area must be at least 1.5 x 2.5 cm (½" x 1").

1.2 MARKING - INDICATING ELEMENTS

This section applies to indicating elements that are evaluated and tested separately. Such indicating elements are either submitted to approval evaluation separately or are major detachable components of a complete device and are intended to be used in conjunction with approved and compatible weighing elements to form different devices.

The indicating element must be marked with:

1.2.1 the **name or trademark** of the manufacturer or applicant.

1.2.2 a **model** designation that positively identifies the device type or design.

1.2.3 a distinctive **serial number**. The serial number must be prefaced by words, an abbreviation or a symbol that clearly identifies the number as the serial number.

1.2.4 its Canadian Weights and Measures **approval number**. The approval number must be prefaced with words or an abbreviation that positively identifies the number as the Canadian approval number. See acceptable solutions in section 1.1.4.

1.2.5 the **accuracy class**. The roman numerals I, II, III, III HD or IIII are the markings required to indicate the accuracy class. The roman numeral within an ellipse or a figure approximating an ellipse is the proper way to indicate the accuracy class. The word "Class" followed by the roman numeral is also acceptable.

1.2.6 the **maximum number of scale intervals (n_{max})**. If the indicating element is approved for two accuracy classes and has a different maximum number of scale intervals for each accuracy class, both maxima must be marked in clear association to the accuracy class designation.

Acceptable solutions

Class	III / III HD			III	III HD	III	n_{max} 3000
n_{max}	3000 / 8000	n_{max}	3000	8000		III HD	n_{max} 8000

1.2.7 the **maximum capacity "Max"**, the value of the **actual scale interval "d"** and the value of the **verification scale interval "e"**, if different from "d", must be marked on the indicator adjacent to the weight display when it is interfaced with a weighing element to form a device. This marking reflects the limitation of the complete weighing device. The technologist (ASL) will, however, ensure that indicators have provisions for the marking of this information. See the notes and examples below sections 1.1.8 and 1.1.9.

Note: for **multiple range devices, multi-interval devices** and **indicators with more than one accuracy class designation**, see the note below section 1.1.9.

1.2.8 the operating **temperature range,** if different than -10°C to 40°C. For Class I indicators, the temperature range must be at least 5°C; for Class II indicators, at least 15°C; and for Class III, III HD and IIII indicators, at least 30°C.

1.2.9 the **verification marks**. The indicator must have an area, either on the marking plate itself or on the indicator adjacent to the marking plate, suitable for the application of the verification marks. The surface of this area must be at least 1.5 x 2.5 cm (½" x 1").

1.3 MARKING - SOFTWARE

1.3.1 For software that is evaluated separate from hardware, the identifying information (manufacturer name, model number and approval number) must be visible on the video display terminal or printable when called up from the menu, or be continually displayed. For further information regarding the approval evaluation of software, the *DRAFT Metrological Software Specifications* should be consulted.

1.4 MARKING - LOAD RECEIVING/WEIGHING ELEMENTS

This section applies to weighing elements that are evaluated and tested separately. Such weighing elements are either submitted to approval evaluation separately or are major detachable components of a complete device and are intended to be used in conjunction with approved and compatible indicating elements to form different devices.

The weighing element must be marked with:

1.4.1 the **name or trademark** of the manufacturer or applicant.

1.4.2 a **model** designation that positively identifies the device type or design.

1.4.3 a distinctive **serial number**. The serial number must be prefaced by words, an abbreviation or a symbol that clearly identifies the number as the serial number.

1.4.4 its Canadian Weights and Measures **approval number**. The approval number must be prefaced with words or an abbreviation that positively identifies the number as the Canadian approval number. See acceptable solutions in section 1.1.4.

1.4.5 the **accuracy class**. The roman numerals I, II, III, III HD or IIII are the markings required to indicate the accuracy class. The roman numeral within an ellipse or a figure approximating an ellipse is the proper way to indicate the accuracy class. The word "Class" followed by the roman numeral is also acceptable.

1.4.6 the **maximum capacity (Max)** that the weighing element can weigh.

1.4.7 the value of the **minimum verification scale interval (e_{min})** for which the weighing element complies with the requirements and can be set.

1.4.8 the **maximum number of scale intervals (n_{max})** for which the weighing element complies with the requirements and can be set.

1.4.9 the operating **temperature range**, if different than -10°C to 40°C. For Class I weighing elements, the temperature range must be at least 5°C; for Class II weighing elements, at least 15°C; and for Class III, III HD and IIII weighing elements, at least 30°C.

1.5 MARKING - LOAD CELLS

The marking of load cells is not required until Measurement Canada institutes a load cell testing and approval program.

1.6. MARKING - READABILITY, LOCATION and PERMANENCE

1.6.1 The required information must be complete, legible, accessible and durable. If necessary for clarity, there must be defining words or authorized symbols associated with the numbers (i.e., model numbers, temperature range, etc.). See the list of acceptable defining words and symbols in Appendix 2-A. It is recommended that the height of capital letters be at least 2 mm (OIML R 76-1).

1.6.2 The required information must be appropriately located. Markings may be on either a marking plate affixed to a permanent part of the device, on the device itself, or both. Information that identifies the device (manufacturer name or trademark, model, serial and approval numbers) should be grouped together. Max, “d” and “e” (if different from “d”) must be marked adjacent to the weight display(s). See the note below sections 1.1.8 and 1.1.9 for additional information.

1.6.3 The marking must be visible without having to remove a permanent part of the device or having to move or lift the device. Markings must be available with minimum effort and be accessible without disassembly requiring the use of special tools or equipment.

Acceptable locations

1. Markings (and/or the marking plate) may be located on the top, sides or front of the device. Markings may be located beneath the platter and fastened to the scale structure if the platter is easily removable (small devices such as computing scales and bench scales).

2. **Weighing elements**. The required information must be on a surface that is an integral part of the chassis. If the information is on a label or a plate, it must be permanently attached to the device. A plate may be rivetted or welded but not affixed with bolts or screws.

3. **Weighing elements of large scales.** Identification information for the weighing elements of vehicle, axle load, floor, livestock, railroad track and large hopper or tank scales must be located near the point where the signal leaves the weighing element (this would be the transverse lever on a mechanical scale and on, or near, the junction box on an above ground scale). In the case of built-in weighing elements (flush mounted), the required information can be placed on the scale chassis and be accessible by the removal of a cover plate.

Non acceptable locations

1. - Under the scale
   - Inside a cabinet
   - On the back of the device or indicating element if it is difficult to move and is likely to be located near a wall
   - Marking plate affixed to the platter

1.6.4 If Max, “d” and “e”, if different from “d”, are displayed electronically, such as on a video display terminal, then they must be adjacent to the weight display and continuously displayed when the system is in the weighing mode.

1.6.5 The lettering must be permanent. This requirement also applies to words and symbols for measurement units adjacent to the weight display and to words and symbols that identify or indicate the status of metrologically significant annunciators. Perform the test described in LG-1.01 and grade the permanence of marking.

1.6.6 Plates or other materials (decals, labels or badges) on which the required information is marked must be made of durable material and permanently affixed to the device so that they cannot be easily removed and affixed to another device. Perform the test described in LG-1.02.

1.7 MARKING - SPECIAL APPLICATIONS

Certain device types are designed for specific applications. Such devices may incorporate features, perform certain functions or operate in a particular fashion that would not be acceptable for all applications. Since these devices may not meet all the usual requirements, their use is restricted to the specific applications for which they were designed. The device restriction must therefore be permanently and clearly marked adjacent to both the operator and customer weight displays.

Some examples:

Weight Classifiers Digital weight classifiers round weight values **up** to the next scale interval. They are designed to classify packages within price ranges for shipping, courier or postal applications. Weight classifiers would therefore not be appropriate for use in grocery store applications. Their use is restricted and they must be marked with the following: << WEIGHT CLASSIFICATION ONLY >> or << WEIGHT CLASSIFIER >> or << POSTAL SCALE >>.

Industrial devices Certain devices are designed for industrial applications. They do not incorporate features that are normally required for devices used in direct sales to consumers. For instance, they may not have a display for consumers; the tare feature may not comply with the requirements for devices used in direct sale applications, etc.. These devices, **if they resemble devices intended to be used in direct sale applications**, must be marked as follows to indicate that they are designed for industrial use only: <<NOT FOR USE IN DIRECT SALE TO THE PUBLIC>> or similar language.

1.7.1 The device is marked with the appropriate restriction.

1.8 MARKING - OPERATIONAL CONTROLS, INDICATIONS AND FEATURES

The marking of operational controls such as keys, push buttons and switches that are strictly for operator use is not required by Measurement Canada. Keys that are visible only to the scale operator need only be marked to the extent that a trained operator can understand the function of each key. It is however recommended that internationally recognized words and symbols be used.

Annunciators that are "metrologically" significant must be marked with words or acceptable symbols. The following are some examples of "metrologically" significant annunciators: centre of zero, "net", "gross" and "tare" weight indications, identification of the weighing element in use on a multi-deck weighing system, the range selected on a manual multiple range device, etc..

1.8.1 Annunciators for metrologically significant features are clearly and permanently marked.

LG-1.01 Permanence of the lettering

PURPOSE:

This test is aimed at evaluating the permanence of the information to be marked on the device, or a major detachable element evaluated separately, in order to determine if it will withstand wear and cleaning. Markings are subjected to the following tests to simulate accelerated wear. The markings are then compared to a typical set of markings exhibiting various degrees of wear, graded from excessive unacceptable wear (1) to minimal effect (7).

APPLICATION:

This test is to be applied to all mandatory markings including the manufacturer's name, the model and serial numbers, Max and “d”, the unit of measurement associated with weight indications (kg, lb), to other words or symbols associated with metrologically significant annunciators, etc..

TEST PROCEDURE:

Attempts are made to remove the marked information, whether on a badge (plate) or on the device itself, using the following means:

A. Rub over one letter of the marking twenty (20) times using an ink eraser in the same manner and with the same force as one would normally exert while erasing an inscription written with a ballpoint pen.

Note: For consistency of application, the laboratories use Eberhard Faber ink eraser type # 101.

B. Clean (rub 20 times) with the following cleansers which are presumed to be readily available:

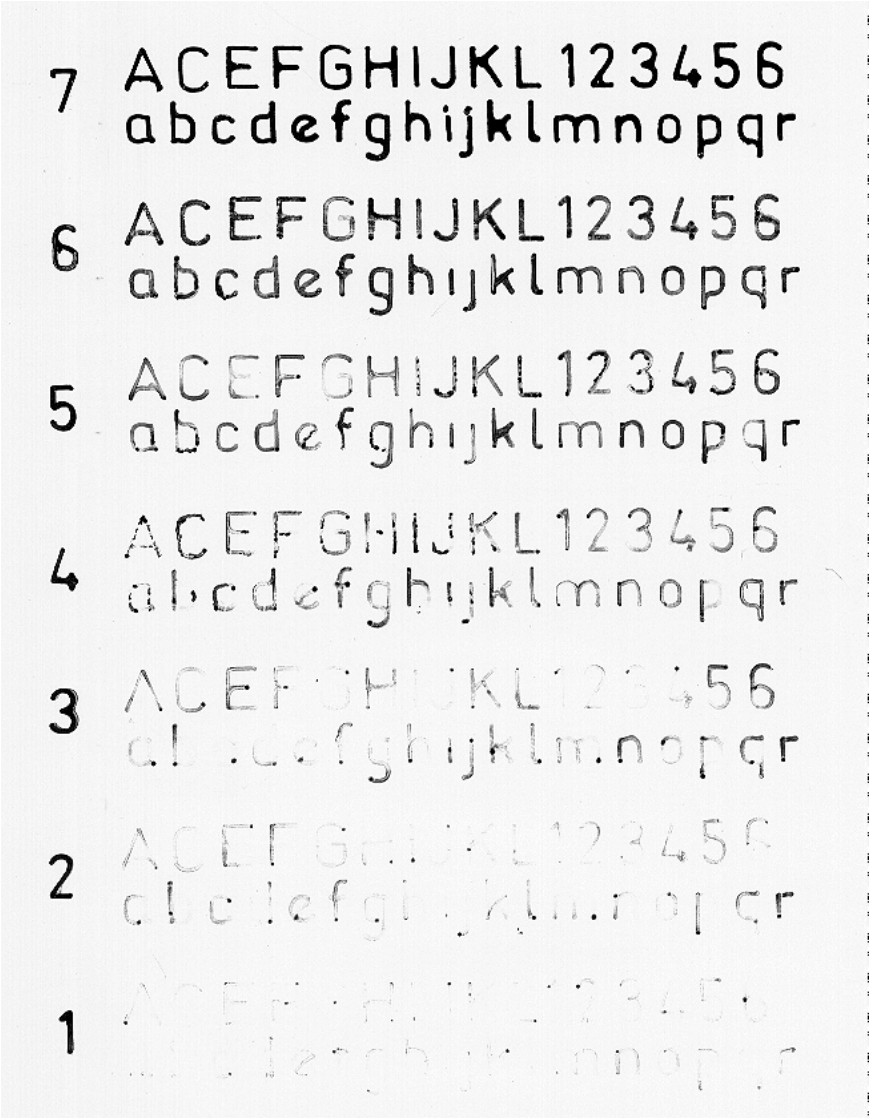
1. Cleansing liquid and a damp cloth
2. "Soft" household cleansing powder and a damp cloth
3. Window cleansing fluids and a damp cloth

Note: For consistency of application, the laboratories use “409" Bon Ami and Windex brands of products for the tests in parts B.1, B.2 and B.3.

INTERPRETATION OF RESULTS:

The information marked on the label is deemed to be permanent if, after the test, the label receives a grading of four (4) or better (see the sample on the next page).

SAMPLES
VARIOUS DEGREES OF WEAR



LG-1.02 Plate, decal - Permanence of installation and durability of the material

PURPOSE:

To determine whether the label bearing identification markings (manufacturer's name, model and serial numbers, approval number, initial inspection marks or label) is permanently affixed to the device.

TEST PROCEDURE:

An attempt is made to remove the specimen label(s) from the device by pulling it off or by prying off a metal badge that is only attached using adhesive. Any means of removal are allowed while a deliberate effort to conceal the removal is made. Such an attempt shall be made at either -10°C and 40°C or at the minimum and maximum operating temperatures specified by the manufacturer.

INTERPRETATION OF RESULTS:

An identification label is deemed to be permanently affixed to the device if it cannot be removed from the device and installed on another device without exhibiting readily observable signs of tampering. Acceptable indications of tampering are the destruction of the badge by tearing, permanent or extensive wrinkling, or the repeated exposure of the word "VOID" upon removal of the badge.

Notes:

1. A plate that is rivetted to the device is deemed to be permanently fastened if the part of the device to which it is attached is not removable.

2. For information such as lb/kg, motion annunciator, centre of zero annunciator, tare/net annunciator, Max, “d” and “e” (if different from “d”) adjacent to the weight display, etc. (other than the identification markings: manufacturer’s name, model, serial and approval numbers), a sticker that is sturdy and will not detach when subjected to the normal conditions of use of the device (heat, cold, humidity, cleaning) is acceptable. It does not have to be of the self-destructive type.

2.0 SEALING

Reference: Section 48 of the Specifications.

Electronic weighing devices must have provisions to the effect that a security seal must be broken, or an audit trail provided, before any adjustment affecting the performance of the device can be made. Only the metrological parameters: that can affect the measurement features, that have a significant potential for fraud, whose range extends beyond that appropriate for device compliance with the requirements or the suitability of the equipment, shall be sealed.

2.1 PHILOSOPHY FOR SEALING

The judgement as to whether or not a method of access represents a "significant potential for fraud" and thus requires sealing, will be based upon the following philosophies.

2.1.1 **The need to seal specific features depends upon:**

a. The ease with which the feature or the selection of the feature can be used to facilitate fraud; and

b. The likelihood that the use of the feature will result in fraud not being detected.

2.1.2 Features or functions that are routinely used by the operator as part of device operation, such as the setting and maintaining of unit prices in price look-up codes, are not sealable parameters.

2.1.3 If the selection of a parameter (or a set of parameters) would result in performance that would obviously be in error, such as the selection of parameters for different countries, then it is not necessary to seal the selection of these features.

2.1.4 If individual device characteristics are selectable from a "menu" or a series of programming steps, then access to the "programming mode" must be sealable.

2.1.5 If a device must undergo a physical act, such as the cutting of a wire and physically repairing the cut to reactivate the parameter, it would be considered an acceptable way to select parameters without requiring a physical seal or an audit trail.

2.2 SEALABLE PARAMETERS ON NON AUTOMATIC WEIGHING DEVICES

The following examples of adjustments, parameters and features to be sealed are to be considered "typical" or "normal". The list is not intended to be all inclusive and any other parameters that may affect the metrological functions of a device must be sealed.

If listed parameters or other parameters which may affect the metrological function of a device are not to be sealed, the manufacturer must demonstrate that the parameter will not affect the metrological performance of the device.

Typical Sealable Parameters	Typical Features or Parameters that are Not Required to be Sealed
! Coarse zero ! Span ! Linearity correction points ! Motion detection (on/off, bandwidth) ! Scale interval "d" (or location of the decimal point) ! Number of scale intervals ! Range of overcapacity ! Manual weight entries (on/off) ! AZSM (on/off and range of a single step) ! Zero and AZSM total range (if the range can be set for more than 4% and if this increases the weighing capacity) ! Filter (number of samples averaged for weight readings) ! Filter (averaging time for weight indications) ! Units of measurement (if not displayed or printed on the primary register)	! Product codes ! Commodity unit prices ! Zero and AZSM total range (if the range can be set for more than 4% but this **does not** increase the weighing capacity) ! Display update rate ! Selection of tare feature operation (keyboard, push button or automatic tare (on/off)) ! Weigh-in/weigh-out operation (on/off)

2.3 OTHER MECHANISMS REQUIRING SEALING

2.3.1 Junction boxes that have adjustment parameters (potentiometers, rheostats, resistors, etc.) must have provisions for applying security seals.

2.3.2 In the case of a complete scale consisting of an electronic indicator and a load receiving element incorporating a junction box or load cells that have built-in calibration/configuration capabilities, and for which the parameters can be changed "remotely" through the indicator keyboard, there must be provisions to seal load cell cables to the indicator and junction box.

2.3.3 If the device is equipped with an automatic or semi-automatic calibration mechanism, the mechanism must be inside the device and there must be provisions to apply security seals so that neither the mechanism nor the calibration process can be altered.

Automatic and Semi-Automatic Calibration Mechanism

An automatic or semi-automatic calibration mechanism is allowed provided the calibration mechanism is internal to the device and neither the mechanism nor the process can be manipulated in a fraudulent manner. Using the calibration mechanism, attempt to calibrate the device: when the device is off level; when there is a load on the platter; and when the weight indication is in motion. Also attempt to put a small load on the platter while the internal mechanism performs a calibration. No erroneous calibration may result from such manipulation.

2.4 PHYSICAL SEALS

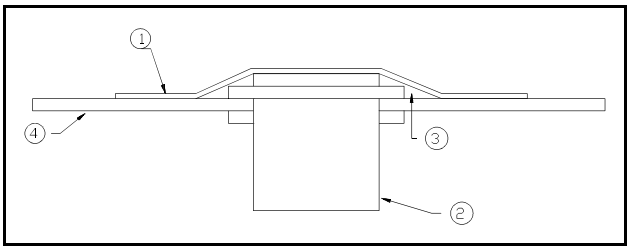
Physical seals comprise "lead" and wire seals, pressure sensitive seals, etc. They may be used to seal certain device categories, features and mechanisms (see sections 2.3 and 2.5).

2.4.1 Means of sealing must be located such that a seal can be applied without disassembly that exposes electronics. Any disassembly must be simple and not require excessive effort or the use of special tools. Devices must be sealable in a manner that prevents disassembly of the device by removing a panel or cabinet to gain access to the adjustments. Removing a protective cover plate to access a junction box is acceptable. Seals must be readily observable.

2.4.2 On small devices (portable) the means of sealing may be under the platter, if the platter can be lifted easily, under the scale or at the back of the scale if the scale is designed so that it can be turned upside down without damage to remove or apply security seals. When a “lead” and wire seal is located under the platform, there must be ample clearance to eliminate the possibility of interference between the seal and the platform.

2.4.3 When two bolts are used for a “lead” and wire seal, the distance between the bolts must be such that the seal will be broken if an attempt is made to unscrew the bolts. The use of a "free-standing bolt" (a bolt that simply passes through a panel and is held in place by a nut on the opposite side of the panel) is not acceptable. Such a bolt may be loosened to the extent that it will rotate in its position, thereby permitting the other bolt to be turned and the wire of the seal manoeuvred over the top of the bolt while turning the "free-standing" bolt to keep the wire from twisting.

2.4.4 Pressure sensitive seals are acceptable under certain conditions. If they cover a hole (e.g., through which a "calibration enable" switch would be activated) the hole must be covered with a suitable plug. The seal must not bridge so as to leave cavities or air pockets under the seal. Cavities and air pockets are weak points that could cause the seal to be easily damaged (see the illustration below).



1 Pressure sensitive (paper) seal
2 Keylock
3 Air pocket (void space)
4 Casing

2.4.5 A pressure sensitive security seal is not suitable in an adverse environment (rain, cold, washdown, etc.).

2.5 SEALING ELECTRONIC DEVICES

Electronic devices may be “sealed” by means of an audit trail. The audit trail must comply with the minimum requirements contained in the *DRAFT Specifications for Metrological Audit Trails*. Terms used in the following checklist are defined in the *DRAFT Specifications for Metrological Audit Trails* which can be found

in Appendix 2-B.

First, based upon its configuration and adjustment characteristics, determine to which category the device belongs.

Category 1 A device that does not have remote configuration capability. Usually a device of this category has internal, physical means of adjustment such as dip switches, or configuration and adjustments can only be made through the device keypad when it is in a "calibration" mode.

Category 2: A device offering remote configuration capability for its sealable parameters but providing sealable enabling/disabling hardware to control remote configuration use. Usually, a device of this category can be adjusted through the device keypad, remotely through the ports using an external apparatus such as a computer or using an external device such as an infrared handheld transmitter.

Category 3: A device that provides unrestricted access to its sealable parameters. These are complex devices that are often part of sophisticated measuring systems.

EXAMINATION OF CATEGORY 1 DEVICES

2.5.1 Access to sealable parameters is protected by:
a) a physical seal; or
b) an audit trail with two event counters (one for calibration, the second for configuration).

2.5.2 Event counters are non-resettable and have a capacity of at least 000 to 999.

2.5.3 Event counters increment appropriately.

2.5.4 Audit trail information must be capable of being retained in memory for at least 30 days while the device is without power.

2.5.5 Audit trail information must be readily accessible and easily readable.

2.5.6 Accessing the audit trail information for review shall be separate from the calibration mode.

2.5.7 Accessing the audit trail information must not affect normal operation of the device.

2.5.8 Accessing the audit trail information shall not require removal of any additional parts other than normal requirements to inspect the integrity of a physical security seal. (e.g., a key to open a locked panel may be required).

EXAMINATION OF CATEGORY 2 DEVICES

2.5.9 The physical hardware enabling access for remote communication is located at the device.

2.5.10 Access to sealable parameters is protected by:
a) physically sealable hardware, located at the device, enabling access for remote configuration; or
b) two event counters (one for calibration, the second for configuration)

2.5.11 The device must clearly indicate when it is in the configuration mode.

2.5.12 Event counters are non-resettable and have a capacity of at least 000 to 999.

2.5.13 Event counters increment appropriately.

2.5.14 If capable of printing in the calibration mode, it must print a message that it is in the calibration mode.

2.5.15 Audit trail information must be capable of being retained in memory for at least 30 days while the device is without power.

2.5.16 Audit trail information must be readily accessible and easily readable.

EXAMINATION OF CATEGORY 3 DEVICES

2.5.17 The device is equipped with an event logger.

2.5.18 The event logger automatically retains the identification of the parameter changed, the date and time of the change, and the new value of the parameter.

2.5.19 The event counter is non-resettable and has a capacity of at least 000 to 999.

2.5.20 The system is designed to be attached to a printer which can print the content of the audit trail.

2.5.21 The audit trail information must be capable of being retained in memory for at least 30 days while the device is out of power.

2.5.22 The event logger must have the capacity to retain records equal to ten times the number of sealable parameters in the device, but not more than 1000 records are required.

2.5.23 The event logger drops the oldest event when the memory capacity is full and a new entry is saved.

2.6 NOTICES OF APPROVAL

Provisions for sealing some devices or features may be complex and extensive. Certain devices may incorporate audit trails and, in addition, some of their features or mechanisms may be secured using two or more physical seals. Audit trails are also configured differently for different devices.

In order to ensure adequate sealing and proper use of audit trail information, Notices of Approval should provide sealing plans and detailed audit trail operating instructions, including how to enter and exit the audit trail, for each approved model of device.

3.0 INDICATION AND REGISTRATION - REPRESENTATION

Reference: Sections 3, 5, 6, 7, 30 to 38 of the Specifications.

The Specifications require that devices be provided with indicating and recording elements appropriate in design and amount, and that indications and recorded representations be clear, definite, accurate and easily readable under normal conditions of use of the device. There are several requirements that must be satisfied to facilitate the reading and interpretation of displayed weight values, while other requirements address the proper operation of indicating and recording elements.

3.1 VALUE OF "d" AND "e"

3.1.1 The maximum and minimum number of scale intervals must comply with section 3 of the Specifications.

3.1.2 The value of "d" (and "e") must be equal to 1×10^x, 2×10^x or 5×10^x of a legal unit of measurement (kilograms, grams, milligrams, pounds), where x is a negative or positive whole number, or zero.

3.1.3 The value of "d" (and "e") of analogue indicating devices may be equal to $1/2^n$ of a pound, ounce or any other Canadian whole units, where n is a positive whole number (1/2, 1/4, 1/8, 1/16, 1/32 pound, ounce).

3.1.4 For Class III, III HD and IIII devices, for multi-interval devices and multiple range devices, "e" must equal "d".

3.1.5 On Class I or II devices, other than a multiple range or multi-interval device, "e" may be larger than "d", and must be the value of the scale division immediately preceding the auxiliary reading means.

3.1.6 On a digital indicating device, if "e" is different from "d", "d" must be clearly differentiated from the other figures.

Acceptable solutions
1. The last digit ("d") may be shaded.
2. The last digit ("d") may appear in brackets.
3. The last digit ("d") may be smaller and set apart.

3.2 LEGIBLE, READABLE AND NON AMBIGUOUS

3.2.1 Indications and registrations of weights, prices, etc. must be designed and located so that reading the results is reliable, easy and unambiguous.

3.2.2 Digits must be uniform in size, shape and character (except if "e" ≠ "d").

3.2.3 Any indication of function or condition may not be represented in a manner that interferes with the interpretation of weight. For example, a "+" or "-" sign used as an over/under indication may not be placed adjacent to a weight value.

3.2.4 Except for postal scales, digital weight values must be in a single unit of measure across the weighing range. For any one indication of weight, only one unit of measure may be used.

3.2.5 Subordinate indications and recorded representations are appropriately designated or portrayed. A decimal point or a comma must be used to set apart decimal submultiple of the unit.

3.2.6 A digital device must display at least one digit to the left of the decimal point or comma, and all the digits to the right of the decimal point or comma. If a decimal point or comma is not used, at least one active decade plus any constant (fixed) zeros must be displayed. All decades to the right of a decimal point or comma must be active (no fixed zero).

Clarification:

Capacity	**Minimum zero indication**
25 x 0.01 lb	0.00 lb
5 000 x 1 lb	0
100 000 x 20 lb	00 lb * The last digit is a fixed zero

3.2.7 Displayed and printed values of gross, tare and net must be in the same units.

3.3 Video display terminal

3.3.1 If an indicator or a video display terminal provides the primary or the only weight indication for the scale when in the weighing mode, the weight display must be a continuous live display, in an area dedicated to the weight display, and clearly distinguished and separated from other information on the display.

3.4 Analogue Representation - dials, beams, poises, etc.

3.4.1 Scale marks (length, width and spacing) and indicators (pointers) must be designed and assembled so that reading the weighing results is easy and unambiguous. The overall inaccuracy of reading shall not exceed 0.2 e (OIML R 76-1 section 4.2.1).

The following are recommended minimum design requirements to ensure accuracy of reading, and overall accuracy of the device (compliance to 3.4.1).

Scale Marks

3.4.1.1 Scale marks must consist of lines (graduations) of equal thickness; the width or thickness of the lines must be constant, not less than 0.2 mm and not larger than the space between the lines.

3.4.1.2 Lines must vary in length to facilitate readings. The length of the shortest lines must be equal or longer than the width of the clear space between the lines.

3.4.1.3 The distance between the main scale marks must be uniform to ensure a linear indication across the scale.

3.4.1.4 The clear space between lines must be at least 0.75 mm.

Numbering

3.4.1.5 The scale interval of numbering must be constant and should not be greater than 25 times the scale interval of the device.

3.4.1.6 If the scale is projected on a screen, at least two numbered scale marks should appear in the projected zone.

3.4.1.7 The height and width of the numbers (real or apparent) should be proportional to the scale marks and so that the reading of the weighing results is easy and unambiguous.

Indicator (pointer)

3.4.1.8 The width of the pointer must not exceed the width of the graduation lines and the width of the clear space between weight graduations.

3.4.1.9 The portion of the pointer that extends along the length of graduation lines and that may be brought into coincidence with the lines must be of the same width.

3.4.1.10 The length of the pointer must be such that the tip is at least level with the middle of the shortest scale mark. If the pointer and the scale marks are in the same plane, the distance between the tip of the pointer and the end of the graduation lines must not exceed 1 mm.

3.4.1.11 Parallax effects must be reduced to the practical minimum. The clearance between the pointer and the scale marks should in no case exceed 1.5 mm.

Weighbeams

3.4.1.12 The scale marks (graduations) must consist of lines of equal thickness. The distance between graduations should not be less than 2 mm so that the normal machinery tolerance for notches or scale marks do not cause errors in the weighing results exceeding 0.2 e.

3.4.1.13 Graduation should be perpendicular to the beam.

3.4.1.14 The normal balance position of a weighbeam must be horizontal; the weighbeam must have equal travel above and below the horizontal. The total travel distance between trig loops and between other limiting stops near the weighbeam must be sufficient to ensure accurate reading. The following minimum distance are recommended:

Distance from the weighbeam fulcrum to the limiting stops (centimetres)	Minimum travel between the limiting stops (millimetres)
30 or less	10
+30 to 50	13
+50 to 100	18
more than 100	23

3.4.1.15 A shoulder or a stop shall be provided on each weighbeam bar to prevent a poise from

travelling and remaining back of the zero graduation.

Poises

3.4.1.16 No part of a poise (including the locking screw) shall be readily detachable. The adjusting material in a poise must be securely enclosed and firmly fixed in position and must not be in contact with the weighbeam. There must be no cavity that could accidentally hold foreign bodies.

3.4.1.17 A sliding poise, other than a hanging poise, on a notched weighbeam bar must have a pawl that will seat the poise in a definite and correct position in the notches, wherever in the notch the pawl is placed, and hold it there firmly and without appreciable movement.

3.4.1.18 Sliding poises must be provided with an indicating component. The indicating component of a poise must be sharply defined and the reading edge shall be parallel to the graduation lines.

Counterpoise Weights

3.1.4.19 Counterpoise weights shall comply with the requirements prescribed by sections 20, 72, 73, 77, 78 and 79 of the *Weights and Measures Regulations*.

4.0 RECORDED REPRESENTATION (PRINTED)

Reference: Sections 30 to 38, 66 and 67 of the Specifications.

The recording element (printer) of a device shall be appropriate and compatible with the device. Recorded representations must be clear, definite, accurate and easily readable. The interfacing of a printer to a device must not cause any alteration or degradation of the metrological characteristics of the device and must not facilitate the perpetration of fraud. The following are requirements that apply to printers and printed tickets.

4.1 All recorded values shall be permanent, legible and printed in digital format.

4.2 The device must indicate and print weight values in the same unit of measurement.

Added May 10, 1999

4.3 The value of d printed and the value of d displayed must be the same (except for postal scales and weight classifiers).

4.4 The value of d printed may be larger than the value of d displayed by a weight classifier provided that the measurement, the weight classification and the pricing are accurately determined. Tests must be performed at the turning points of price ranges (see part 6.0).

4.5 Except for weight classifiers, a printer must record the same value and number of decimal places as indicated on the display.

> **CLARIFICATION:**
>
> A digital indicator may display weight values in 0.005 kg and 0.01 lb scale intervals. The printer must therefore record weight values to 0.005 kg in metric and 0.01 lb when measuring in pounds. It may not record weight values to 0.010 lb.

Modified May 10, 1999

4.6 All recorded weight values, such as gross, tare, net, inbound and outbound weights, shall be clearly identified using acceptable words, abbreviations or symbols (see Appendix 2-A). However, if only one weight is printed, it does not have to be identified as the "net" weight.

Modified May 10, 1999

4.7 If the unit of measurement of the device can be externally selected by the user (lb/kg switch), the printer must record the proper unit of measurement along with the weight values. Preprinted tickets stating the weight unit are acceptable for indicators capable of displaying one weight unit only or which have an internal lb/kg switch.

4.8 Computation must be in mathematical agreement (gross weight - tare weight = net weight; unit price x net weight = total price, rounded off to the nearest cent).

Price computing devices

4.9 Unit prices must be printed when total prices are shown and both have to be clearly identified as the unit price and the total price.

Point of sale (POS) weighing systems

Definition: a weighing element or a non computing scale interfaced with an electronic cash register or computer. Usually, the cash register or computer reads the gross weight provided by the scale, assigns a tare through a PLU code and prints a net weight on the cash register tape. The cash register must not interfere with the operation of the scale. A stand alone price computing scale used in conjunction with an electronic cash register would not fall into this category.

4.10 The cash register tape must provide the information required by section 67 of the Specifications. That is, the net weight, the price per unit, the computed price, and the appropriate identification code or product name. Furthermore, in order to standardize content and layout, as well as adding clarity to POS receipts, it is recommended that the rules and the example found at the end of this section be followed. Please note that the identification code/product name has been left out of the example for clarity; this information is however required on actual POS receipts.

Note: A POS system may display the GROSS weight on the scale display and the NET weight on the cash register display; however, it must print the NET weight on the cash register tape. The scale of a POS system is not required to display the net weight nor provide an indication that a tare value has been entered.

Training mode is no longer required on POS systems.

Weight Classifiers

4.11 In the case of weight classifiers, it is acceptable if the printed ticket provides the weight only or the weight along with the total price to be paid. The unit price is not necessary since the total price to be paid is determined on the basis of weight ranges within the device's weighing capacity rather than on the basis of a price per unit.

Point of sale (POS) receipts

I	II	III	IV V	VI	VII	VIII	IX	
1	**kg or lb**	**@**	**$**	**12.49**	**/**	**kg or lb**	**$**	**12.49**
Must be identical to the scale display (interval size and capacity limitation) Must print a zero before the decimal point if the weight is less than 1 kg or lb A period or comma can be used as the decimal point	Must be lowercase letters The use of "lbs" or "#", as the symbol for pounds, is not acceptable	Can be replaced by: "at" ("à" in French)	Must be placed before or after the value in column V	Must be two digits after the decimal point Must be preceded by a zero, before the decimal point, if the value is less than one A period or comma can be used as the decimal point	Can be replaced by: "per" ("par" in French)	Must be lowercase letters The use of "lbs" or "#", as the symbol for pounds, is not acceptable	Required if there is only 1 space between columns VII and VIII Optional if there are two or more spaces between columns VII and VIII Can be placed before or after the value in column IX	Must be two digits after the decimal point Must be preceded by a zero, before the decimal point, if the value is less than one A period or comma can be used as the decimal point

* Note: Product identification code/name is also required

SPACING:
- A space is required between columns I and II (due to the use of "lb")
- At least 1 space is required between columns II and III
- At least 1 space is required between columns III and IV
- No space between columns IV and V, regardless of whether the "$" is placed before or after the "12.49"
- A space between columns V and VI is optional if the slash "/" is used. If the word "per" ("par" in French) is used then a space is required
- A space between columns VI and VII is optional if the slash "/" is used. If the word "per" ("par" in French) is used then a space is required
- At least 1 space is required between columns VII and VIII
- No space between columns VIII and IX, regardless of whether the "$" is placed before or after the "12.49"

5.0 VALUES DEFINED

Reference: Section 35 of the Specifications

Graduations, indications, and recorded values that are intended to have specific values as well as metrologically significant annunciators must be adequately identified by suitable words, abbreviations or symbols. These defining terms must be placed relative to graduations, indications, recorded values or annunciators and as close as practical to them without interfering with their readability. The proper symbols for SI units are found in Schedule I of the Weights and Measures Act; other acceptable abbreviation or symbols can be found in Appendix 2-A of this manual.

5.1 Graduations, weight indications must be properly defined by appropriate figures, words or symbols (lb, kg, ounces, tare, net weight, etc..).

5.2 Annunciators that are metrologically significant are defined with appropriate words or symbols.

Clarification:

1. Only metrologically significant annunciators are required to be identified, namely:
   - Unit price display
   - Total price display
   - Gross, Tare and Net displays and annunciators
   - Center of zero annunciator
   - lb/kg unit annunciator
   - Scale selection annunciator on a muti-platter device
   - Other annunciators required in this Manual

2. The metrological annunciators may be identified using durable labels except when the annunciator must be capable of changing automatically to reflect a change of status (Examples: Tare on/off, center of zero yes/no, lb/kg, etc.)

3. The position of the lb/kg toggle switch is not a sufficient indication of the unit in use.

5.3 Gross weight, Tare Weight and Net Weight, Inbound/Outbound Weight, Unit Price, Total Price and other required information must be adequately identified by names, abbreviations or symbols.

5.4 The names, abbreviations and symbols are suitably located.

5.5 If the device has an external key or switch (user key) to change the measurement unit (lb/kg), the printer must automatically print the appropriate unit of measurement.

5.6 The external user key or switch of a device must automatically change the measurement units (lb/kg key) associated with indicated and printed gross weight, tare and net weight.

Clarification:

1 If the device can operate only in a single unit of measurement, it is acceptable that the symbol or name identifying the unit of measurement is pre-printed on the ticket rather than printed by the device.

2. If only one weight value is printed, it is assumed that it is the net weight. In such a case, identifying the weight as to be the net weight is not required.

6.0 AGREEMENT OF REGISTRATIONS

Reference: Section 18 of the Specifications.

LG-6.01 Test for the agreement of registrations

PURPOSE

The purpose of this test is to establish the accuracy and reliability of communication among all means of indication and registration of a device. The means of indication and registration include primary and secondary indications, printers, computers and other recording means.

APPLICATION

This test is applicable when a device is equipped with two or more means of registration that register in the same units of measurement (i.e., primary indicator, secondary indicator, printer, etc.). The test applies to mechanical analogue devices and electronic digital indicating devices. If the device (or weight indicator) can be interfaced to a printer, a compatible printer must be attached to the device for the test.

The following test must be performed for each unit of measurement that the device can display.

TEST PROCEDURE

A) Zero the device.
B) Verify the agreement between indications and registrations at zero load (or the minimum load that can be printed).
C) Apply a load to the load receiving element and print.
D) By 1d steps, increase the load on the load receiving element by 10d, noting the registrations (including the printouts) at each step.
E) Repeat the test with different loads (e.g., close to zero load, at mid capacity, close to capacity).
D) Verify the agreement of all indications and registrations, including the printouts.

INTERPRETATION OF RESULTS

Weight indications and registrations must agree within the limits prescribed by the Specifications. The device complies with the requirements when the quantities indicated and/or printed are in agreement within the following limits:

1. **Electronic digital values** having the same value of verification scale interval must be in exact agreement;

Corrected May 10, 1999

2. **Analogue values** having the same value of verification scale interval must agree within 0.25 times the value of the verification scale interval;

3. **Mechanical digital values**, **electronic digital values having different verification scale intervals**, and **combined digital and analogue values** must agree within 0.6 times the value of the largest verification scale interval.

The agreement of registration requirements are applicable when indications and registrations of weight

values are in the same weighing mode (net, gross or tare). Indicated and registered net
Added weights must therefore agree, within the above limits, as must indicated and registered gross
May 10, 1999 weights and indicated and registered tare weights. However, this requirement is not intended to apply when a device indicates a gross weight and prints a net weight, as is the case with some POS systems.

Added The indication of a gross weight and the printing of a net weight is acceptable on POS systems
May 10, 1999 as well as weighing systems used in applications other than direct sales to the public.

WEIGHT CLASSIFIERS

The verification scale interval of a printing device (i.e., printer, computer) may be larger than the verification scale interval of the weight classifier to which it is interfaced. In addition to the "agreement of registration" test described above, a test at the turning points of price ranges is performed to ensure that in all circumstances packages are classified accurately.

Example: Weight classifier 10 kg x 5 g
Printing device with a scale interval of 10 g
Price ranges: 0 - 30 g (included)= $1.00
More than 30 g = $2.00

\# Apply a load so that the weight indication is 25 g.
Modified \# Print the weight and price. The ticket may print 20 g or 30 g, and must print $1.00.
May 10, 1999 \# Apply a load so that the weight indication is 30 g.
\# Print the weight and price. The printed weight must be 30 g, and the price must be $1.00.

A weight of 40 g and a price of $2.00 (second price range) may not be printed before the weight classifier indicates 35 grams.

LG-6.02 Suitability of unit conversion

PURPOSE:

To uncover registration errors resulting from an inadequate unit conversion mechanism. This type of error is found when a DUT internally calculates a mass indication in a unit of measurement prior to converting it, rounding it off and registering it in a different unit of measure.

APPLICATION:

To all DUT capable of indicating in a metric and in a non-metric unit of registration.

TEST PROCEDURE:

A. For each of the units of measurement in which the DUT is capable of registering, perform step B. and C.

B. Set the DUT to register in the unit of measurement being verified.

C. At least fourteen times, add a test load equal to **e** and each time, record the registration.

INTERPRETATION OF THE RESULTS:

The DUT is deemed to meet the requirements if for each unit of measurement tested, the registration did not skip any steps.

EXAMPLE OF NON COMPLIANCE

Applied Load (lbs)	Internal metric reading (kg)	Rounded to 0.05 kg (kg)	Conversion to lbs (lbs)	Indication in lbs (lbs)
49.6	22.4981816	22.5	49.60400899	49.6
49.7	22.5435408	22.55	49.71424012	49.7
49.8	22.5889	22.6	49.82447125	49.8
49.9	22.6342593	22.65	49.93470238	49.9
50	22.6796185	22.7	50.04493352	50
50.1	22.7249777	22.7	50.04493352	50 **(ERROR)**
50.2	22.770337	22.75	50.15516465	50.2
50.3	22.8156962	22.8	50.26539578	50.3
50.4	22.8610554	22.85	50.37562691	50.4
50.5	22.9064147	22.9	50.48585804	50.5
50.6	22.9517739	22.95	50.59608917	50.6
50.7	22.9971332	23.00	50.7063203	50.7
50.8	23.0424924	23.05	50.81655143	50.8
50.9	23.0878516	23.1	50.92678256	50.9
51	23.1332109	23.15	51.0370137	51
51.1	23.1785701	23.2	51.14724483	51.1
51.2	23.2239293	23.2	51.14724483	51.1 **(ERROR)**
51.3	23.2692886	23.25	51.25747596	51.3
51.4	23.3146478	23.3	51.36770709	51.4
51.5	23.3600071	23.35	51.47793822	51.5

CLARIFICATION:

1. Under section 39 of the Specifications, indicated and printed representations of NET, GROSS and TARE weights of a device must have the same value of verification interval e for any given load.

2. In the case of a secondary indicating element intended to duplicate, for the benefit of consumers, the information displayed by the operator's indicating element, the registration on both displays must be in the same graduation size and in the same unit of measurement. Furthermore, the printed registration intended for the consumers must be exactly as the indicated registration (e.g same graduation size and same unit of measurement).

3. An indicating element and a printer used in conjunction must at least register in the same unit of measurement. Supplementary information in other units of measurement may be provided by the indicator and/or printer.

4. A device may display weight values in two units of measurement simultaneously.

5. All weight indications and registrations must be within tolerances.

7.0 PRICE COMPUTING FEATURE

Reference: Sections 19, 30 to 35, 46 and 47 of the Specifications.

7.1 Price computing devices must print the unit price when the total price is printed.

7.2 Displayed and recorded monetary values must comply with applicable requirements of section 3, *Indication and Registration Representation*, and of section 5, *Values Defined* in this Guide (e.g. Value of d, legible and readable, number of digits, decimal representation, defining words and symbols, etc.).

7.3 Devices intended for direct sale to the public:

7.3.1 Devices must display the unit price when the total price is displayed.

7.3.2 When the device displays in kilograms, the unit price that can be entered and displayed is limited to Price/100 g and Price/kg.

7.3.3 When the device displays in Canadian units, the unit price that can be entered and displayed is limited to Price/pound.

7.3.4 When a device displays weight values on the basis of the gram or ounce, unit prices may also be entered and displayed on the same basis.

EXAMPLES:

1. A 2500 g x 1 g scale displays 1.5 kg as 1500 g. This scale displays weight values on the basis of the gram. Such a scale may display a price per gram.

2. A 5 kg x 0.001 kg displays 1.5 kg as 1.500 kg. This scale displays on the basis of the kilogram. The unit price that can be entered and displayed by that scale is limited to Price/kg and Price/100 g.

7.4 The Total Price Display Unit must have enough digits to indicate the computed total price on the basis of the maximum load that the device can weigh times the maximum value of unit price that it can accept.

CLARIFICATION:

The maximum unit price that can be entered is $99.99/kg and the maximum weight is 10.005 kg. Then, if if a unit price of $99.99/kg can be entered, the total price display must have enough digits to display $1004.90 (6 digits).

7.5 The total price must be calculated accurately and rounded to the nearest one cent, by multiplication of weight and unit price, both as indicated by the device. Perform the test described in LG-7.01

7.6 When the displayed weight is less than zero, the device must not be capable of displaying or printing a computed total price. Place a small load on the platter, tare it and remove it from the platter. A negative weight value should be displayed. Attempt to enter a unit price. Attempt to print this value.

7.7 When the scale indicates an overcapacity condition, the device must not be capable of displaying or printing a weight and/or computed total price.

7.8 The displayed weight and total price must be free floating, that is when the scale display a unit price, a weight and a total price, if the weight or the unit price is changed the total price must change accordingly.

FREE FLOATING SIGNAL

PURPOSE To ensure that the displayed net weight and total price are free floating. That is when the scale displays a unit price, a weight and a total price, if the weight or the unit price is changed, the total price must change accordingly.

PROCEDURE Price computing scale

- # Place a load on the platter.
- # Enter a unit price; a total price is now displayed. Ensure that the indicated monetary value is in mathematical agreement with the weight and unit price to the nearest cent.
- # Increase the load on the platter; the total price must increase accordingly.

Scale equipped with a tare display

- # Enter a Keyboard or a platter tare value.
- # Place a load greater then the value of the tare; the scale displays a gross weight, a tare weight and a net weight.
- # Ensure that the gross, tare and net values are in exact mathematical agreement.
- # Change the tare value; the net weight should change accordingly.

POS systems

- # Determine the keying sequence necessary to cause the device to compute a final price.
- # Place a load on the platter
- # Key in the complete sequence except the last keystroke required for price computation.
- # Change the load on the platter.
- # Operate the final keystroke to initiate price computation.

INTERPRETATION OF RESULTS

7.9 The device complies with the requirements if:

- in all circumstances, mathematical concordance is maintained; and
- in the case of a POS system, it computes total prices using the load on the scale at the time the final key was pushed, or produce an error signal, or lock out to prevent any price computation.

LG-7.01 Agreement of registration of monetary values

PURPOSE:

To determine if the scale computes accurately and rounds the values of total prices correctly.

APPLICATION:
Applicable to any price computing scales and POS systems.

TEST PROCEDURE:

A. Apply several loads to the scale and enter different prices

B. With a calculator determine the correct values, round them off to the appropriate decimal, and compare them to the total price indicated by the scale.

C. The following are suggested loads and unit prices:

Test #	Net Weight (kg)	Unit Price	Total Price	Correct Indication
A	0.01	$4.54	$0.04540	$0.05
B	0.01	$4.55	$0.04550	$0.05
C	0.01	$4.90	$0.04900	$0.05
D	0.01	$5.10	$0.05100	$0.05
E	0.01	$2.50	$0.02500	$0.02 or $0.03
F	0.01	$2.51	$0.02510	$0.03
G	0.651	$0.76	$0.49476	$0.49
H	0.652	$0.76	$0.49552	$0.50

D. Apply the following rounding rule:

Computed Results	Correct Indication
0.020	0.02
0.021	0.02
0.022	0.02
0.023	0.02
0.024	0.02
0.0250	0.02 or 0.03
0.0251	0.03

INTERPRETATION OF RESULTS:

The monetary registration is correct if for a net weight (as outlined in the "Net Weight" column in the above table) and a unit price (as outlined in the "Unit Price" column in the above table) yields the corresponding indication (as outlined in the "Correct Indication" column in the above table).

8.0 RECORDED REPRESENTATION OF GROSS, TARE AND NET WEIGHTS

Reference: Sections 19, 30 31, 32, and 33 of the Specifications

There are two primary requirements concerning the printing of weight values. First the recorded values must be mathematically correct and, second, the recorded values must be in agreement with the displayed values.

Two situations provide the greatest potential for non compliance with these requirements. One is when a platter tare is taken to the internal resolution of the scale and the scale indicates and records GROSS, TARE and NET weights. In the second, a scale sums the analog signal from two or more weighing elements and the scale indicates and records GROSS, TARE and NET weights.

LG-8.01 Agreement of registration of GROSS, TARE and NET weights

APPLICATION:

The following procedure is performed on an electronic scale when a tare is taken to the internal resolution and the scale can display and/or print GROSS, TARE and NET weights.

A. Place a load on the platter that results in a scale indication that is just below the zone of uncertainty (or upper edge of the interval) and press the push-button tare key.

B. Add more weight to the scale so the gross load is just above the zone of uncertainty (lower edge of the scale interval).

C. Compare the indicated and recorded values for the GROSS, TARE and NET weights. Values must be in mathematical agreement; indicated and printed values must be in agreement.

Example of possible non compliance on a 50 t x 10 kg

Load perceived by the scale to the internal resolution	Displayed and Recorded Values
45006 kg Gross 20004 kg tare 25002 kg Net	45010 kg Gross 20000 kg Tare 25000 kg Net

The following procedure is performed on an electronic scale that sums the analog signals from two or more weighing elements and the scale displays and prints GROSS, TARE and NET weights.

A. Place a load on each weighing element that results in a weight indication just below the zone of uncertainty (upper edge of the scale interval), or just above the zone of uncertainty (lower edge of the scale interval).

B. Compare the indicated and recorded values for the GROSS, TARE and NET weights. Values must be in mathematical agreement; indicated and printed values must be in agreement.

Examples of possible non compliance on a 300 kg x 0.1 kg scale

	Load to internal resolution	Displayed values	Load to internal resolution	Displayed values
Scale 1	25.04 kg	25.0 kg	25.06 kg	25.1 kg
Scale 2	25.04 kg	25.0 kg	25.06 kg	25.1 kg
Sum	50.08 kg	50.1 kg	50.12 kg	50.1 kg

INTERPRETATION OF RESULTS:

8.1 The device complies with the requirements if the displayed and printed values of GROSS, TARE and NET weights are in mathematical agreement (N + T = G); and displayed values agree with printed values.

9.0 MANUAL WEIGHT ENTRIES

Reference: Sections 30, 31, 32, 33 and 38 of the Specifications.

This section does not apply to keyboard tare entries (see section 17.0 for tare requirements).

Metrological features of a device used in trade must be of such design, composition and construction so as to ensure accurate measurement and minimize the potential for fraudulent use. Many devices incorporate features that allow the operator to enter a weight value through a numeric keypad or keyboard. This weight value can be displayed and/or printed with no load on the load receiving element.

Manual weight entries may be necessary in certain circumstances, such as POS systems, when credit must be given, or when generating labels for standard packages or correcting erroneous tickets. However, this capability may increase the potential for fraudulent device use if it is permitted without suitable precautions.

Manual weight entries can therefore be allowed under the following conditions:

9.1 The scale must be at gross load zero (load receiving element empty) and the scale indication must be at zero in the gross weight display mode before manual weight entries can be made.

9.2 The device must be incapable of weighing when it is processing or printing a manual weight entry.

9.3 Displayed and printed manual weight entries must be adequately defined and must be automatically identified as "Manual Weight", "Manual WT" or "MAN WT" (“poids manuel”, “pds manuel” or “PDS MAN”).

CLARIFICATION:

1. When a manual weight entry is printed and automatically identified as such, displaying the manual weight value is optional. If, however, the manual weight value is displayed, it must be properly identified as such.

2. Identification of a manual weight entry, with the proper term, must be done automatically without the need for operator intervention.

3. The use of a symbol to identify multiple manual weight entries is permitted provided that the symbol is defined on the same page as that on which the manual weight entries appear and the definition of the symbol is automatically printed by the recording element as part of the document.

4. The following symbols are **not** acceptable: MAN, MW

9.4 Manual weight entries must be an optional feature that can be enabled/disabled and sealed against use in applications where their use is inappropriate and could facilitate fraud.

10.0 INDICATING ZERO AND NEGATIVE VALUES

Reference: Sections 30 to 33, and 41 of the Specifications.

The purpose of the following requirements is: to ensure that devices can be set and maintained as close as possible to a true zero value; to eliminate possible confusion between under and over indicated weight values; and to ensure that the smallest value of scale interval for digital devices remains an adequate representation of device accuracy.

Indicating zero

10.1 The device must be provided with means to adequately indicate or record a "zero-balance" condition.

10.2 Automatic indicating devices must provide an out-of-balance indication on both sides of zero.

CLARIFICATION

1. Over/Under Indicators At least one graduation on each side of the zero reference must be provided. Clear indication must be provided to differentiate between the below zero and above zero portions of the chart.

2. Digital The minimum acceptable indication of a zero balance condition must be one of the following:
   a) if a decimal point or comma is used, at least one digit to the left and all digits to the right of the decimal point must be displayed;
   b) if a decimal point or comma is not used, at least one active decade plus any constant (fixed) zeros must be displayed;
   c) all decades to the right of a decimal point must be active, i.e. a fixed zero cannot appear to the right of a decimal point.

Examples:	**Max x d (kg)**	**Minimum Zero Indication**
	25 x 0.01	0.00
	5000 x 1	0
	50 000 x 10	00*****

***** The last digit may be fixed.

In the case of an electronic digital display, the zero balance indication may be a continuous digital weight indication or be indicated by other means provided that the scale either automatically inhibits the scale operation or returns to a digital weight indication when an out-of-zero balance condition exists **(See section on sleep mode)**.

10.3 A digital indicating scale must either automatically maintain a "center-of-zero" condition to ± 1/4 of **e** or less (AZSM) or have a center-of-zero indicator that defines the zero balance condition to ± 1/4 **e** or less. Class I or II devices with auxiliary indicating means must define a zero balance condition to ± ½ **d** only. Therefore, these devices are not required to have a center-of-zero annunciator or an AZSM. Perform test **LG-15.01.**

CLARIFICATION: If the zeroing range of AZSM is less than the width of zero (± 0.4 d), then a center of zero indication that defines the zero balance condition to ± 1/4 d or less is required. Otherwise the scale could possibly display zero and not be truly set to zero within ± 1/4 d. In this case, the operator would not be warned that the device needs to be re-zeroed.

10.4 If provided, the center-of-zero indicator must be inhibited at all displayed weight values other than zero ± 1/4 e (or 1/2 d for class I or II devices with auxiliary reading means).

10.5 On digital indicating devices, a + or - sign must not appear when the scale is indicating zero in any of the available units.

Displaying negative values

10.6 A display of negative value is required in the NET display mode when the GROSS weight is less than the TARE value.

10.7 A negative value must be indicated in a manner that cannot be confused with a positive weight value. A minus sign clearly associated with the weight indication may be used provided that it is located in a manner that does not interfere with the weight.

10.8 Blanking the display is a method that may also be used to indicate an under-zero condition when the device is in the GROSS mode (no tare); the scale may also display symbols which cannot be interpreted as a quantity value (e.g. EEEEEE, UNDERLOAD, S-1, etc.). A row of zeros, flashing zeros or flashing weight values are not acceptable means.

NOTES: 1. For devices such as hopper or tank scales, it is recommended to indicate a negative balance condition and an over-capacity condition differently so that the load condition is evident for the operator.

2. For devices such as hopper or tank scales, if blanking the indication is used, it is also recommended that the indicator has an annunciator to indicate "power on" so the operator does not think that the power has been lost when the display is blank.

Sleep Mode or Displaying Non Metrological Information

Definition: "sleep mode" means a function of a device that blanks partially or totally indications after a defined period of non use, in order to save the screen or to display information other than weights.

A device may go in a sleep mode or may display non metrological information such as advertisement, greetings, time and date, etc. provided that the following conditions are met:

10.9 The scale totally or partially blanks its indications or displays non metrological information only when the device is at GROSS load zero (no tare) and has reached a zero-balance condition.

10.10 If the device blanks its indications partially only or displays non metrological information, the displayed information cannot be construed as weight indications.

10.11 The scale must be provided with an automatic means to inhibit the weighing operation or return the

device to a continuous digital indication when the scale is in an out-of-balance condition. Perform the test described in LG-10.01.

10.12 Printing function must be inhibited when the device is in sleep mode.

ALTERNATIVE
A scale may go into "sleep mode" with a load on the platter, if the scale is designed to prevent any further weighing operation before the load is removed from the platter, all tares are cancelled and the device is reset to zero.

In this case the device must bear a special legend " The scale is set to zero when in the sleep mode" (or similar message) adjacent to the weight display for the customers' view.

LG-10.01 Means of Automatically Restoring Weight Indication

APPLICATION

This test will be performed on any electronic device with a sleep mode or capable of displaying non metrological messages.

PURPOSE

To ensure that the device has means of detecting when it is no longer in a zero-balance condition and restoring a weight indication; and also to ensure that the printing function is inhibited when in sleep mode.

TEST PROCEDURE

A. Ensure that the "sleep mode" function is activated;

B. Zero the device and wait until the device goes to the "sleep mode" or display non metrological messages;

C. In one firm motion (so as to prevent the AZSM from capturing part of the test load) apply a load equal to d. The non-zero/non-metrological registration must have been replaced by a mass registration equal to d;

D. Wait 5 minutes (or the normal delay for the device to return to the sleep mode) to see if the device will go into a "sleep" mode with a load on the platter;

E. Zero the device with the load on the platter and wait until the device goes to "sleep mode" or display non metrological messages;

F. Attempt to print;

G. In one firm motion, remove the 1 x d test load. The device must display a mass of - d, or provide an under-weight indication.

INTERPRETATION OF THE RESULTS

The device complies with the requirements if:

- it does not go into a "sleep" mode when there is a load on the platter;
- it returns to a weight indication when an off-zero condition exists; and
- the printing function is inhibited.

11.0 LOAD RECEIVING/WEIGHING ELEMENT

Reference: Sections 30 to 33 of the Specifications.

Scales used to weigh wet commodities such as fish, lobster, etc. are required to have a load-receiving element, generally a scoop or platform with raised edges, to effectively drain off liquid that would tend to accumulate on the scale. This requirement does not apply to small computing scales such as those used in supermarkets since few wet commodities are weighed. In those particular applications, the scoop or platter can be easily removed and cleaned to maintain the zero balance condition.

11.1 If the load receiving element is designed to received wet commodities, it must also be designed to drain effectively.

11.2 Tank or hopper scales and their associated piping or conduit must be designed to ensure proper drainage and complete delivery of products.

Scales must be designed such that the normal movement of load receiving elements (platform, pan, etc.) during use will not "bind" and interfere with the weighing operation. This is checked by shifting the load receiving element when loaded. Mechanical systems must be designed to reduce frictions.

11.3 The load receiving/weighing element is designed to remain centrally aligned under load; lateral movements of the platter or platform do not cause bindings or frictions that interfere with the weighing operations.

If a device has a locking feature, this feature must only have two stable positions corresponding to "lock" and "weigh" (no intermediate position), and weighing must only be possible in the "weigh" position. Electronic digital devices must "blank" and inhibit printing in the "locked" position.

11.4 The device locking feature (if any) has only two positions: "locked" and "weigh".

11.5 Weighing is possible only in the "weigh" position, and the locking feature does not interfere in any way with the weighing operation.

11.6 Overload protection (stoppers) must be set so that they do not interfere with weighing operation.

12.0 LOAD CELL - RELATIONSHIP OF V_{MIN} AND d

No requirements for the time being.

13.0 DAMPING MEANS AND UP-DATING RATE OF WEIGHT/PRICE DATA

Reference: Sections 30 to 33 of the Specifications

The weight indications must stabilize shortly after a load is applied to the scale. Weight indications must not oscillate significantly or update so slowly that intermediate weight values are misinterpreted as the final stable weight value. Weight indications, unit and total computed sale prices, after the weight indication is stable and after introduction of unit price, must remain visible while the load is on the platter to allow proper reading of the values.

ACCEPTABLE SOLUTIONS:

1. On a mechanical device, damping should achieve a stable indication after three to five half periods of oscillation.
2. For digital electronic devices, after a change in load, the previous indication should not **persist for longer than 1 second**.
3. (OIML criteria) On a price computing scale, indication of weight, unit price and total price should remain visible for at least 1 second after the weight indication is stable and after introduction of a unit price while the load is on the platter.
4. (OIML criteria) After the removal of the load, the indications may remain visible **for no more than 3 seconds** provided that the indication has been stable before and the indication should otherwise be zero. As long as there is a weight indication after removal of the load, it must not be possible to enter or change a unit price. Computed prices may remain visible while the platter is empty provided that this does not lead to confusion, measurement errors or fraud.

13.1 The mechanical device is equipped with an effective means for damping oscillations.

13.2 The electronic device up-dates the displayed weight information at a sufficient rate to prevent misinterpretation of the final weight value.

13.3 Indications of weight, and if applicable unit and total prices, are visible and stable when the load is on the platter.

13.4 A digital computing scale may continue to display computed price information following removal of the load provided that:

13.4.1 it does not display computed price information for more than 15 seconds (hold period);

13.4.2 it returns immediately to its zero weight reference;

13.4.3 it must automatically return to a "non-hold" or active mode at any time a new unit price is entered or the next load is placed on the platter;

13.4.4 it must return to an active mode and print the correct weight and price information for the current load conditions if it initiates label printing or a "print command" is given during the "hold" period.

14.0 LIMITS OF INDICATION

Reference: Sections 30 to 33, and 40 of the Specifications

Weighing devices shall neither indicate nor print weight values in excess of their maximum rated capacities (Max). Perform the following test.

LG-2.05 Overload tests

APPLICATION

Applicable to complete electronic weighing devices and to separate electronic weight indicators. If the units of registration can be changed without having to perform a re-calibration of the device, then perform individual tests for each and every unit which the device is capable of registering.

TEST PROCEDURE

Span

A) Stabilize and zero the device at nominal conditions;
B) Load the device to its maximum rated capacity;
C) Add loads until the device ceases to display weight values;
D) Record the last weight value indicated (WI); attempt to print or transmit data to external ports at overload condition [1].
E) Repeat the test for other units of measurement that the device can display.
WI ≤ Max + (5% Max or 9e)

Tare features

F) Remove the load and set the device to zero.
G) Enter a keyboard or a platter tare (T) equal to approximately 20% of Max .
H) Add loads until the device ceases to indicate/print weight values
I) Record the last value indicated (WI)
WI + T ≤ Max + (5% Max or 9e)

Note: Certain approved devices may incorporate a full or partial additive tare feature. An additive tare feature extend the weighing capacity of the scale. This must be taken into consideration when performing the blanking display test.

[1] On some devices, under overload conditions data are not transmitted through the port for printers; however, they are transmitted through the other ports.

Zero (To be performed if the scale can zero loads in excess of 4%)

J) Remove the load and set the device to zero.
K) Add a load in excess of 5% of Max (say 20%); zero that load **(Zl)**.
L) Add loads until the device ceases to display/ print weight values; Record the last value indicated **(WI)**
M) If the scale limits the amount that can be zeroed with a semi-automatic zero setting mechanism but the operation can be repeated several times, zero the maximum weight possible equal to or under 5% of Max. **WI + Zl ≤ Max + (5% Max or 9e)**

INTERPRETATION OF RESULTS:

14.1 The device is deemed to comply with the requirement if the device can not display or print weight values in excess of:

9 scale divisions, for computing scales other than weight classifiers and postal scales
or
105% of Max, for other scales

14.2 When over capacity, the device registration must blank within prescribed limits, or display a clear message that cannot be confounded with a weight value.

ACCEPTABLE SOLUTIONS:

1. Amongst others, the following means of indicating overcapacity are acceptable:
   - a row of "EEEEEEE"
   - a blank registration
   - the word "OVERCAPACITY"

2. Among others, the following means of indicating overcapacity are **not** acceptable:
   - displaying a flashing eights
   - displaying a row of zeros or eights

3. The same rules apply to printed information.

15.0 ZERO SETTING MECHANISMS

Reference: Sections 30 to 33, 40, 41, 42, 43 and 44 of the Specifications

There are several requirements that establish the proper operation of zero setting mechanisms to ensure accuracy and to prevent the perpetration of fraud or inadvertent measurement errors. These requirements depend upon the type of zero setting mechanisms and applications.

Definitions

Manual Zero-Setting Mechanism (MZSM): mechanism for setting the indication to zero by the operator (balance ball or potentiometer).

Semi Automatic Zero-Setting Mechanism (SAZSM): mechanism for setting the indication to zero automatically following a manual command (Push-button Zero).

Automatic Zero-Setting Mechanism (AZSM): mechanism for maintaining the zero indication within certain limits, automatically.

Initial Zero Setting Mechanism (IZSM): mechanism for setting the indication to zero automatically at the time the device is switched on and before it is ready to use.

15.1 Manual Zero-Setting Mechanism (MZSM)

15.1.1 If the balance at zero-load is achieved by the addition of supplementary material, the material must be enclosed in a cavity covered with a screw cap (or a cover with screws, etc.) so that it cannot be readily removed or altered and so that it cannot shift position in such a way that the balance condition of the device is affected during weighing operation.

15.1.2 If a device is provided with a balance ball and a captive screw or nut arrangement, the maximum effect must not exceed 4 verification intervals per revolution, and means must be provided to ensure sufficient friction to prevent a zero change during weighing operation.

15.1.3 A device intended for direct sales to the public may not be fitted with a MZSM unless operated only with a detachable tool .

15.1.4 The total range of zero setting (positive and negative portion) may not exceed 4% of the device capacity unless the gross load that can be weighed is not increased beyond the device capacity limit.

15.2 Semi Automatic Zero-Setting Mechanism (SAZSM)

15.2.1 The SAZSM must operate only when the scale provide a stable indication (See section 18.0, Motion Detection, test LG-18.01).

15.2.2 A SAZSM (Push Button Zero) must set the indication to only zero, within ± 1/4 e. The SAZSM of a Class I or II device equipped with an auxiliary reading means must set the indication to zero to ± 1/2 d. Perform the test described in LG-15.01.

15.2.3 The activation of SAZSM must not clear stored tare weight values. Enter a platter or keyboard tare and attempt to clear it by pressing the zero button when the platter is empty (zero or negative

indication) and loaded (positive weight indication).

15.2.4 The total zero-setting range (negative + positive) must not exceed 4% of the device capacity. The range may exceed 4% of Max provided that the gross load that can be weighed is not increased beyond the capacity limits of the device. Perform the test described in LG-15.03.

15.3 Automatic Zero-Setting Mechanism (AZSM)

15.3.1 The device AZSM must not re-zero (in one shot) a weight value in excess of 0.6 e. Perform the test described in LG-15.02.

15.3.2 The total zero-setting range (negative + positive) must not exceed 4% of the device capacity. The range may exceed 4% of Max provided that the gross load that can be weighed is not increased beyond the capacity limits of the device. Perform the test described in LG-15.03.

15.4 Initial zero Setting Mechanism (IZSM)

15.4.1 The IZSM must set the device to zero within ± 1/4 e. The IZSM of a Class I or II device equipped with an auxiliary reading means must set the indication to zero ± 1/2 d. Perform the test described in LG-15.01.

15.4.2 Determine if the value that can be "zeroed" by the device IZSM exceeds 20%. Perform the test described in LG-15.04. Record this value.

CLARIFICATION:

This information is needed to establish which procedure will be followed for certain performance tests.
If the IZSM range does not exceed 20%, the performance tests are done once with the maximum dead load. If the range exceeds 20%, certain performance tests are performed twice: one with the minimum dead load, the second with the maximum dead load.
Individual procedures described in Part III indicate to which value IZSM must be set.

15.4.3 The IZSM range of indicators tested and approved separately must not exceed 20%.

LG-15.01 Center-of-zero indication and setting zero within ± 1/4 e

APPLICATION:

Applicable to complete electronic scales and separate electronic indicators having SAZSM or IZSM or equipped with a "center-of-zero" indicator.

PURPOSE:

This test is to verify that the SAZSM and IZSM automatically set the device to zero within ± 1/4 of e, and to verify that the device range of center-of-zero indication is equal to or less than ± 1/4 e. Note that the range of center-of-zero indication of Class I or II devices equipped with auxiliary reading means is ± 1/2 of d. This must be taken into consideration when performing the following tests and interpreting the results. **Take into account that the ZU of weight classifiers is adjacent to the graduation.**

PROCEDURE: Setting zero to within ± 1/4 e.

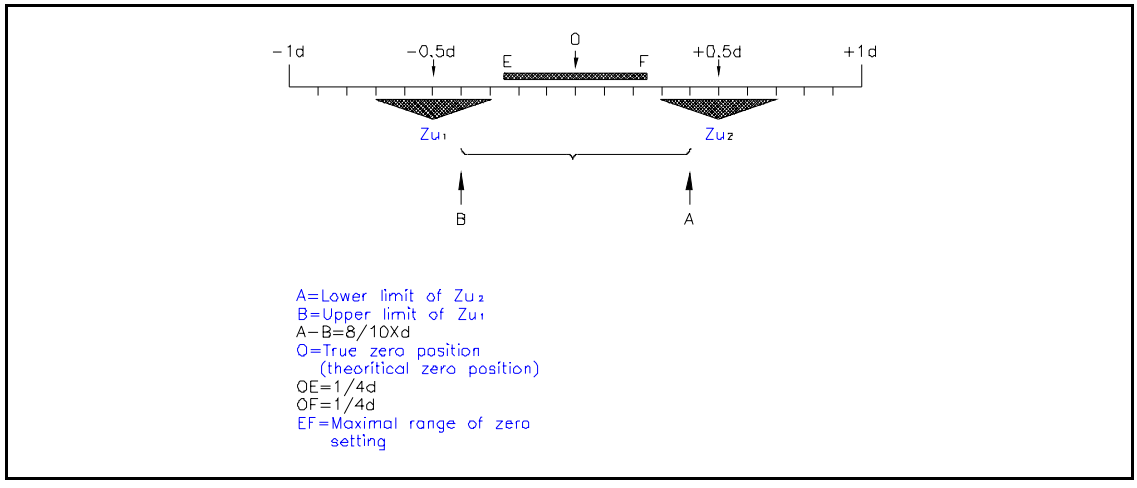
A) Switch the AZSM off or set its value to zero effect; zero the DUT.

B) Place a load of at least e (made of 1/10 e weights) on the platter and RE-ZERO the device.

C) Successively remove small denomination weights in 1/10 x e steps until the low end of the interval is reached (the indication begins to alternate between 0 and -1 e). Record the weights removed as being the negative portion of the interval.

D) Successively add small denomination weights in 1/10 x e steps until the high end of the interval is reached (the indication begins to alternate between 0 and +1 e). Record the value of the weights added and subtract the value of the weights recorded in C. The difference is the positive portion of the interval.

E) Determine if the zero position as set by the SAZSM does not deviate from the true zero reference point by more than 1/4 e. Generally, the zero position, as automatically set by the SAZSM, should coincide with the zero reference point; in such a case, the negative range would equal the positive range. See illustration.



F) Repeat the test by zeroing the device using the IZSM.

Width of the centre-of-zero indication (Annunciator)

G). Switch the AZSM off or set its value to ZERO effect.

H) Set the device to zero.

I) Place a load of at least e (made of 1/10 e weights) on the platter; zero the DUT.

J) Successively remove small denomination weights in 1/10 x e steps until the visual confirmation of zero goes off. Record the value of the weights removed as being the negative portion of the center of zero indication.

K) Successively add small denomination weights in 1/10 x e steps until the center-of-zero indicator goes off (positive limit). Record the difference between the value of the weights remaining on the platter and the value of the weight recorded in J as being the positive portion of the center-of-zero indication.

INTERPRETATION OF RESULTS

The DUT is deemed to comply with the requirements if the zero setting mechanisms automatically set the device to zero within ± 1/4 of e from the true zero reference point, and if the centre-of-zero annunciator indicate a zero balance condition within ± 1/4 e of the true zero reference point.

Note that for Class I or II devices with auxiliary reading means, the range is ± 0.5 d.

LG-15.02 AZSM - Maximum incremental load that can be zeroed.

PURPOSE:

To determine that the largest load that can be deposited monotonically (i.e., in one shot) on the device, while the DUT is at zero load, and zero is equal to or less than 0.6 x e.

PROCEDURE

Check for the addition of small loads:

A. Ensure that the AZSM is on; Zero the device

B. Place a known test load "A" equal to or greater than "e" (e.g:10xe), plus a load "B" equal to 0.7x"e" on the device load receiving element.

C. Remove known test load "A", wait at least 10 seconds to see if the device will automatically rezero test load "B".

D. If the device did not zero test load "B", repeat with smaller test loads (0.6 e, 0.5 e, 0.4 e, etc) to determined the maximum positive AZSM range. Record the maximum value that the AZSM rezeros.

Check for the removal of small loads:

E. Place a small known test load "A" equal to or greater than "e" (e.g. 10xe), plus a load "B" equal to 0.7 x"e" on the load receiving element.

F. Re-zero the device.

G. Remove all loads. A negative value ("A" + "B") should now be displayed.

H. Place the test load "A" back on the device and wait 10 seconds. The device should not reset to zero.

I. If the device resets to zero, repeat with smaller test loads "B" (0.6 e, 0.5 e, 0.4 e, etc) to determine the maximum negative AZSM range. Record the value.

INTERPRETATION OF RESULTS:

The device is deemed to comply with the requirement:

If after step "C", the device does not rezero automatically when there is only 0.7 x e left on the load receiving element (it is allowed to rezero automatically when there is a load equal to or less than 0.6 x e).

and

if after step "H", the device does not rezero automatically when the load is only 0.7 x e short of zero (it is allowed to rezero automatically when there is an apparent negative load equal to or less than 0.6 x e).

CLARIFICATION

The software of the device may allow the AZSM range to be set to different values (0.1e, 0.2e, 0.5e, 0.6e, 1e, 3e, etc..). Technologists must ensure that the AZSM can be set at a value that is within the maximum permissible value, and sealed.

LG-15.03 Re-Zero range (Maximum total range of SAZSM/AZSM/MZSM)

APPLICATION:

Applicable to complete electronic scales, electronic indicators, and mechanical scales equipped with balance ball type of zero setting.

PURPOSE:

This test is used to determine whether the total range of the *zero setting mechanism,* other than the initial zero-setting mechanism, exceeds 4%. If the total range exceeds 4%, to ensure that the gross load that can be weighed is not increased beyond the capacity limit of the device.

The procedure depends upon the type of zero setting mechanism. On mechanical devices, the procedure is relatively simple.

Mechanical Devices (beam scales, dial scales, etc.)

PROCEDURE

A. Place a load (8-10 % of Max) on the load receiving element.

B. Set the balance ball to the lowest setting (low end of the range) and note the indication.

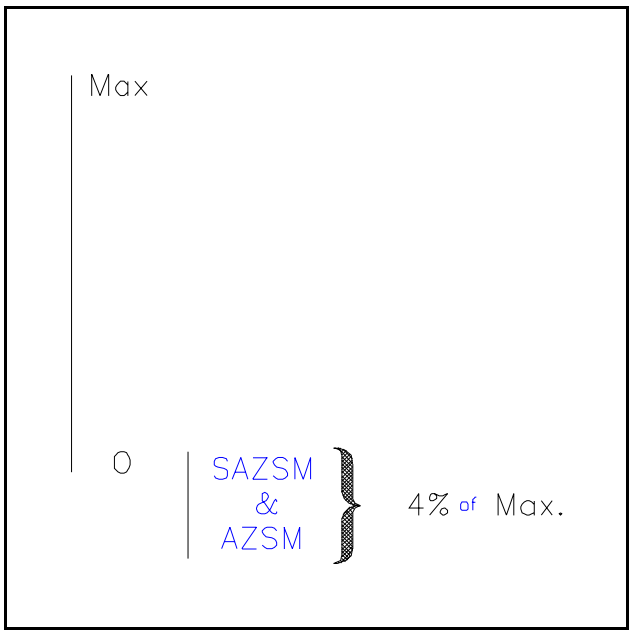
C. Set the balance ball to the highest setting (high end of the range) and record the indication.

INTERPRETATION OF RESULTS

The difference between the indications at the low and high ends must not exceed 4% of Max.

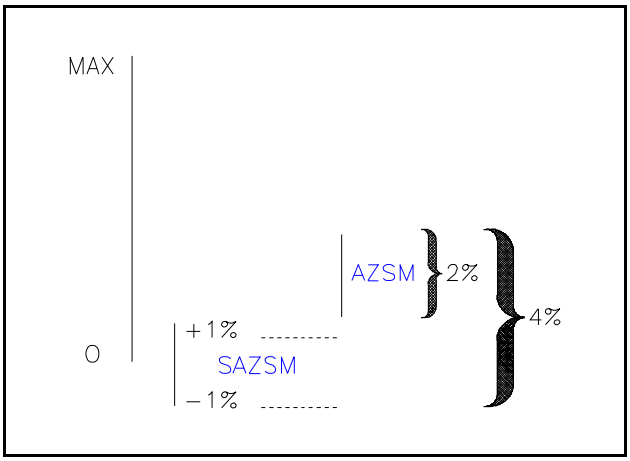
Electronic Digital Devices

On electronic devices, both the SAZSM and AZSM setting ranges must be determined. As illustrated below, in some scale designs, there is only one common parameter that limits the range over which both the SAZSM and the AZSM can function.



When so designed, it is relatively easy to determine the total range because one only has to find the SAZSM range using weights and then to confirm that the AZSM has also been disabled once the limits of the range have been reached. For this type of design, use METHOD 1: "WEIGHT METHOD".

In other scale designs, there are two distinct range limiting parameters; one for the SAZSM and one for the AZSM. See illustration below.



It is then necessary to find the limits of the SAZSM range and then to find the limits of the AZSM range. The total range is then a sum of the two. Unfortunately, it is difficult to find the AZSM range using small weights (or at least, it would necessitate a great number of small weights). For this reason, for such devices, use METHOD 2: "WATER METHOD".

PROCEDURES:

METHOD 1: "WEIGHT METHOD"

Determination of the negative portion of SAZSM/AZSM

A) Place on the LRE a load approximately equal to 6% of Max. This load should be made up of several smaller weights allowing for the gradual withdrawal of the load.

B) Activate the Initial Zero Setting Mechanism by switching the DUT "OFF" and "ON" (Note: on some devices, it may be necessary to unplug and replug the power cord in order to activate the IZSM). The DUT should then have zeroed the 6% load and display a zero registration.

C) By successively removing loads and activating the SAZSM (i.e.; zero button), determine to the nearest d the maximum load that can be removed from the LRE while still allowing the DUT to perform a semi-automatic zeroing.

D) Once the DUT no longer performs a semi-automatic zeroing (The scale is just below the low range of SAZSM), remove a load equal to 0.5e; wait few seconds. Remove an additional 0.5e. If the DUT's AZSM has not rezeroed the 1e (0.5e + 0.5e) (and thus the DUT is displaying a -1e registration), this will have confirmed that the SAZSM and AZSM both share the same range limit in the negative direction. Record the total amount of weights removed as being the **negative portion of the Total Range of SAZSM/AZSM.**

> **NOTE:**
>
> If the DUT's AZSM has rezeroed the 0.5 e load that was removed, and if the DUT appears to continue automatically zeroing additional 0.5 e loads upon removal, then the "Water Method" will be used to determined the AZSM range.

E) Restore all weights removed (thus restoring the 6% of Max on the LRE) and rezero using the SAZSM. (The DUT should now be indicating a zero registration).

Determination of the positive portion of SAZSM/AZSM

F) By successively adding loads and activating the SAZSM (i.e.; zero button), determine to the nearest e the maximum amount of load that can be added to the LRE while still allowing the DUT to perform a semi-automatic zeroing.

G) Once the DUT no longer performs a semi-automatic zeroing, add an additional load equal to 0.5 e; wait few seconds. Add an additional load of 0.5 e. If the DUT's AZSM has not rezeroed the 1e (0.5 e + 0.5 e) (and thus the DUT is displaying a +1 e registration) this will have confirmed that the SAZSM and AZSM both share the same range limit in the positive direction. Record the total amount of weights added in "F" as being the **positive portion of the Total Range of SAZSM/AZSM.**

> **NOTE:**
> If the DUT's AZSM has rezeroed the 0.5 e load that was added, and if it the DUT appears to continue automatically zeroing additional 0.5 e loads upon removal, then the "Water Method" will be used to determined the AZSM range.

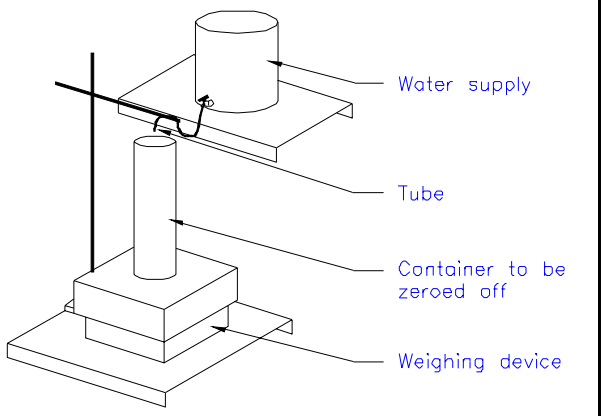
H) The sum of the positive and negative portion is the total range of SAZSM/AZSM. If the sum exceed 4% of Max, proceed with the test **METHOD 3: ZEROING TO CAPACITY**

METHOD 2: "WATER METHOD"

Determination of the total range of AZSM in a positive direction.

I) With the LRE empty, place an empty container on the DUT's load receiving element.

J) Re-zero the DUT using the IZSM by switching the DUT "OFF" and "ON" (Note: on some devices, it may be necessary to unplug and replug the power cord in order to activate the IZSM).



Note: Example of test assembly in the determination of the range of semi-automatic zero setting mechanism. In order to minimize the impact of falling drops of water, it is permissible to place the tubing against the receiving container so as to allow the water to run from the tube to the side of the container.

K) With weights, load the DUT so as to bring the scale to a load which is near the maximum load that can be re-zeroed using the AZSM (high end of the SAZSM range)(value determined in G). Re-zero the load using AZSM. The scale should indicate zero with a certain load on the platter.

L) Drop by drop, slowly fill the container with water so that the AZSM will continuously rezero the weight of water being added. In this manner, continue filling the container until the registration changes from zero (which will indicate that the positive limit of the AZSM range has been reached).

M) When the indication changes to a value other than zero (thus signalling that the total AZSM range has been exceeded), immediately stop the flow of water.

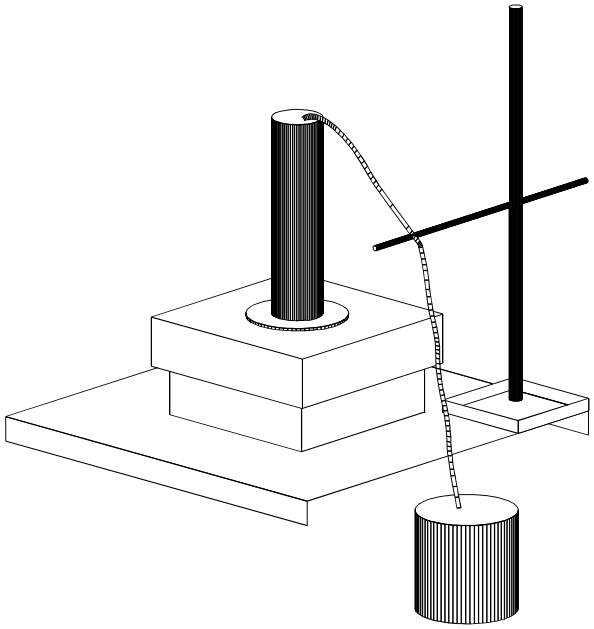
N) The range of AZSM going in a positive direction is the sum of the test weights on the platter and the weight of the water accumulated in the container.

Determination of the total range of AZSM in a negative direction.

O) With an empty LRE, Rezero the DUT (using the Push-Button zero).

P) Place on the LRE a container "A" filled with a quantity of water approximately equal to 10% of Max (or greater) and a hose as shown below.

Q) Add a quantity of test weights approximately equal to between 3 and 4% of Max.



R) Re-zero the DUT using the Initial Zero-Setting Mechanism by switching the DUT "OFF" and "ON".

S) Remove the test weights so as to bring the scale to a load near the maximum negative load that can be re-zeroed using the SAZSM (Low end of the SAZSM range)(Value determined in D). Re-zero the DUT using AZSM. The scale should indicate zero with a certain load on the plater.

T) Start the flow of water so as to empty slowly the container "A" so that the AZSM will continuously rezero the weight of water being removed. Collect water in an empty container "B" that was previously tared. In this manner, continue emptying the container until the registration changes from zero (which will indicate that the negative limit of the AZSM range has been reached).

U) When the indication changes to a value other than zero (thus signalling that the total AZSM Range has been exceeded), immediately stop the flow of water.

V) The sum of the test weights removed and the weight of water collected in the container "B" represents the negative portion of the AZSM range.

W) The sum of the positive and negative portion is the total range of SAZSM/AZSM. If the total value that can be zeroed exceed 4% of Max, proceed with **METHOD 3: ZEROING TO CAPACITY.**

METHOD 3: ZEROING TO CAPACITY

The purpose of this test is to determined if, by zeroing weight values in excess of 4%, the gross load that can be weighed is not increased beyond the device capacity limit.

X) Remove all weights (Platter empty). Perform an initial zero setting (unplug and replug the device).

Y) Place test weights equal to 4% of Max on the LRE. Zero the device.

Z) Place an additional load (L_1) (say 5% to 20% of Max) on the LRE. Zero that load. Load the device ("L_2") until it gives an overload indication. Record the last weight value indicated ("I"). The scale must give an overload indication within the specified gross load limit (e.i. "I" equal to or less than Max - L_1).

AA) If the scale limits the amount that can be zeroed at once with a SAZSM, but the operation can be repeated several times, zero the maximum possible load several times. The scale must give an overload indication within the specified gross load limit.

INTERPRETATION OF RESULTS

If the total SAZSM and/or AZSM range(s) exceed 4% of the device capacity, the device is deemed to have complied with the requirement if the gross load that can be weighed is not increased beyond the capacity limit of the device.

EXAMPLE: 15 kg x 0.005 kg computing scale

Step 1 0.600 kg (4%) placed on the scale; scale is zeroed. The scale indicates zero.
Step 2 An additional 5 kg is placed on the scale. The scale is zeroed.
Step 3 Load the scale until it indicates an overload condition. The maximum value that may be indicated is 10.045 kg (15 kg - 5 kg + 9d).

LG-15.04 IZSM Range (Maximum Range of Initial Zero Setting Mechanism)

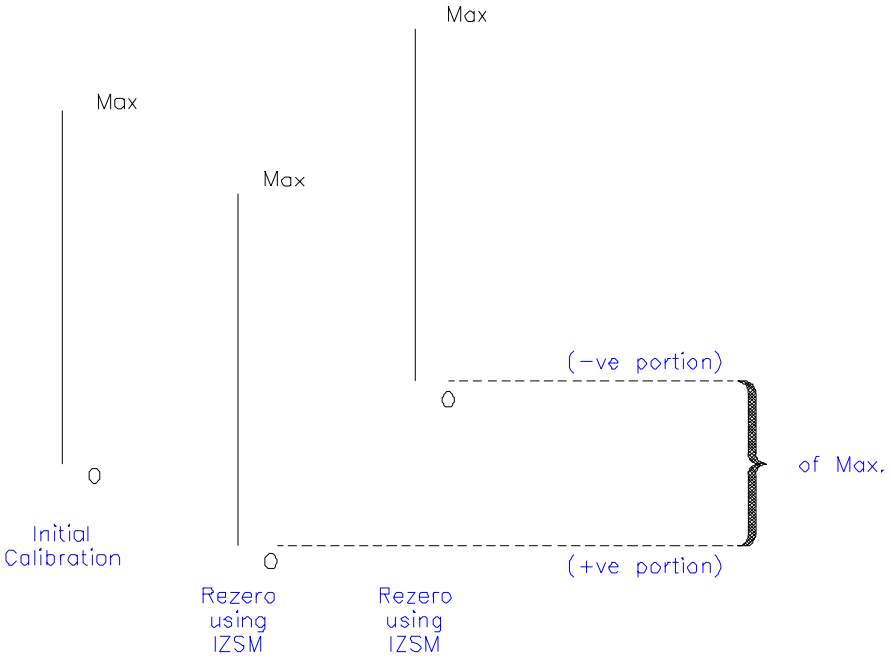
APPLICATION:

This test is applicable to electronic indicators and to complete electronic devices.

PURPOSE:

The purpose of this test is to determine whether or not the total range of the initial zero setting mechanism exceeds 20%. The initial zero setting mechanism is the mechanism that sets the scale to zero upon power up.

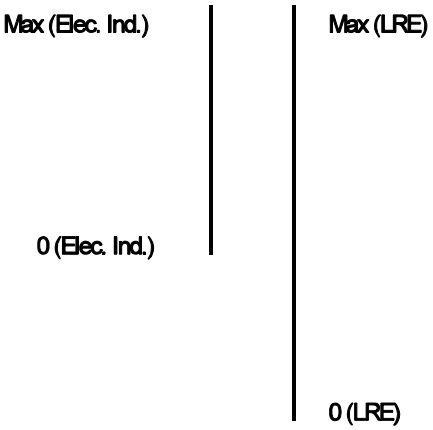
CLARIFICATION
Electronic indicators tested and approved separately
The load receiving element to which an electronic indicator tested and approved separately will be interfaced will not have been tested up to 200% of Max. Consequently, the maximum Initial Zero Setting Mechanism range of electronic indicators must be limited to 20% of Max.



TEST PROCEDURE

Electronic indicators

Note: The following explanation of the test procedure is based upon the use of a load receiving element connected to the electronic indicator because it is easier to explain the procedure this way. However, the actual test can be performed using a loadcell simulator or a rheostat provided that the basic principles are maintained. The procedure consists of calibrating the electronic indicator so that it only uses a small portion of the total capacity of the LRE.



A) Connect the indicator to a LRE and calibrate the indicator so that it is at a zero balance condition when the LRE is loaded at 50% of its maximum capacity and that it displays the number of intervals "n" (as requested by the applicant) when the LRE is fully loaded (Cap).

B) By trial and error, find the -ve portion of the electronic indicator's IZSM range by removing a load(s) from the LRE and by trying to zero it using the electronic indicator's IZSM. The IZSM is triggered by unplugging and replugging the power cord (Note: on some devices, it is sufficient to switch it off and on).

A.) Similarly, by trial and error, find the +ve portion of the electronic indicator's IZSM range by adding a load(s) to the LRE and by trying to zero it using the electronic indicator's IZSM.

Complete electronic scale

Note: Whenever possible, perform the procedure described above for electronic indicators tested separately; or.

D) Remove the platter in order to reach the lowest point of the IZSM range.

E) By trial and error, find the +ve portion of the electronic indicator's IZSM range by adding a load(s) to the LRE and by trying to zero it using the electronic indicator's IZSM. The IZSM is triggered by unplugging and replugging the power cord (Note: on some devices, it is sufficient to switch it off and on).

INTERPRETATION OF RESULTS

An electronic indicator tested and approved separately is deemed to comply with the requirements when the total range of the Initial Zero Setting Mechanism (absolute value of -ve portion of the range plus the +ve portion of the range) does not exceed 20% (or can be set to a maximum of 20% and sealed) of the DUT's maximum capacity (Max);

The IZSM range of a complete electronic device may exceed 20% of Max if the device performs within tolerances when the IZSM is set at the minimum and maximum points of its range.

When the IZSM range is limited to 20%, performance tests are conducted once: at the maximum IZSM setting. When the IZSM range exceeds 20%, certain performance tests are conducted twice: at the minimum and at the maximum setting of the range. See description of the performance tests in Part 3.

16.0 AVAILABLE SECTION

17.0 TARE

Reference: Section 31 of the Specifications.

Tare features must be designed and used to ensure accurate measurement and prevent the perpetration of fraud. There are numerous requirements that establish the proper operation of tare features depending upon the type of devices, the type of tare capability and the intended use of the device.

The extent of the requirements depends upon the application. For instance, design and operation requirements for devices used in direct sales to the public are more stringent than those applicable to devices used in other applications. In general, and unless otherwise specified for particular types of tare, devices must provide a clear indication for both the operator and the consumer that a tare value has been entered; platter and keyboard tare values must be visible at some point during the weighing process and the alteration of platter or keyboard tare values, during the weighing process, must be impossible without being noticed. On the other hand, devices that are used in industrial applications or in other applications where the consumer is not normally present need only provide the operator with a clear indication that a tare value has been entered and have a means to display the tare value on demand.

Definitions:

Auto-tare	means an automatic platter tare. With the scale indication at zero, the scale automatically tares, within a pre-determined range, the value of the first load (container) put on the platter. The net weight of the commodity is then determined.
Keyboard tare	means a fixed or percentage tare value entered through the keyboard (e.g. 20 g, 1.3%, etc.) or through one of the selectable tare keys to which tare values are assigned.
Percentage tare	means a tare value, expressed as a percentage (e.g. 5.6 %), that represents the percentage of tare material compared to the gross weight of the commodity. A percentage tare is one form of proportional tare.
Platter tare	means a tare entry achieved by placing an object (e.g. a container, bag, etc.) on the platter and pressing the tare key. The device then indicates zero as the net weight with the object on the platter.
Preprogrammed tare	means a tare value that has been entered, retained in the device memory and assigned to a PLU code or product name. It can be a fixed tare value and/or a proportional tare value.
Proportional tare	means a tare value, automatically calculated by the scale, proportional to the gross weight indicated by the scale. A proportional tare can be a percentage tare or a fixed tare value proportional to a range of gross weights (i.e., a 10 g tare for gross weights between 0 and 2 kg, a 20 g tare for gross weights between 2 and 4 kg, etc.). A proportional tare is, therefore, not limited to being a percentage tare.

17.1 Applicable to any type of scale or weighing system and to any type of tare

17.1.1 The tare mechanism must only operate in the backward direction (under-registration). Perform the test

described in LG-17.01.

17.1.2 The device must ignore or reject the entry of a zero tare value. The entry of a zero tare (or a 0% proportional tare) must not activate the "TARE ENTERED" or "NET" annunciator nor cause the display to automatically switch to the NET display mode. (Scales with a continuous tare display or tare display mode will indicate zero when the tare entry is zero. However, the entry of a zero tare must not cause the display to automatically switch to the net mode).

17.1.3 The tare value must be equal to the value of the displayed scale division for all methods of tare entry ($d_{tare} = d$). An attempt to enter a tare value that is not equal to "d" must be rejected or rounded off to the nearest scale interval (see section 22 for specific requirements pertaining to multi-interval and multiple range devices).

17.1.4 The tare weight signal must be "free floating". If the tare value is changed during the weighing operation, the net weight must be re-adjusted accordingly (NET + TARE = GROSS).

17.1.5 The sum of the TARE value entered or preprogrammed and the NET weight that can be weighed must not exceed the GROSS weight capability of the device (Max + 9 e for computing scales; Max + 5% for other scales). See overload test in section 14.

This does not preclude a device from having a full capacity tare plus a full capacity weighing range (additive tare). In such a case, tests for accuracy, repeatability, eccentricity, etc. must be performed based on the maximum weighing capacity with the maximum tare value entered.

17.1.6 It shall not be possible to enter a value of tare that exceeds the tare capability range (e.g., a tare entry of 6 kg on a scale with a tare range of 5 kg must be rejected and not taken as 5 kg).

17.1.7 Whenever NET, GROSS and TARE weights are indicated or printed, they must be in exact mathematical agreement (NET + TARE = GROSS) and the total price must be calculated on the basis of the net weight.

17.1.8 The use of any mechanism to select the unit of measure (lb/kg switch) must be inhibited when a tare is entered (through the keyboard, platter or preprogrammed) unless all weight values, including the tare value, are automatically converted and accurately rounded off to the nearest scale interval.

17.1.9 If a device is designed to automatically clear the tare after each weighing, it must also be designed to prevent the automatic clearing of a tare before a stable weight indication has been provided and the transaction completed.

CLARIFICATION: On a price computing scale, the transaction is only completed with the entry of a unit price and the computation of the total price. The removal of the commodity from the platter before the total price is computed must not automatically cancel the tare.

17.2 Platter and keyboard tare

17.2.1 Pressing the tare button once, or several times, with a load on the platter (platter tare) must set the

device to zero and only to zero.

17.2.2 Except for POS systems, the device must provide a visual confirmation or indication that a platter or keyboard tare has been entered (see the particular requirements for preprogrammed tares and POS systems).

ACCEPTABLE MEANS OF PROVIDING VISUAL CONFIRMATION:

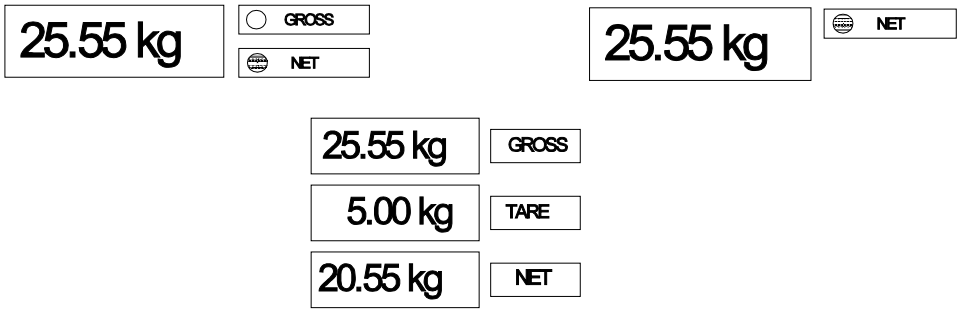
1. The device has a separate and continuous tare display.

2. The device displays simultaneously or in sequence (within a time interval of a few seconds), for both the operator and the consumer, the GROSS, TARE and NET weights with their proper descriptors.

3. The device displays the net weight only, with an annunciator (NET legend) near the weight display. Gross weight is displayed when the tare weight is zero and the NET legend or annunciator is off.

4. A legend, annunciator (TARE ENTERED) or similar statement is used to indicate that a tare value has been entered and the display indicates the net weight.

5. The device has selectable GROSS and NET weight display modes with proper descriptors.



6. It is recommended that video display terminals that are the primary indicators of devices simultaneously display the GROSS and TARE weights when the NET weight value has been determined.

Note: Annunciators or descriptors must go "on" when tares are entered; not "off".

17.2.3 The entry of a platter or keyboard tare must automatically override any previous tare entry or be rejected (i.e., they cannot be additive). A percentage tare value may however be entered in addition

to a fixed keyboard or platter tare value.

17.2.4 Unless a separate tare display is provided, the device must display a negative weight value when the weight of the load on the platter is smaller than the tare weight.

17.3 Preprogrammed tare (fixed or percentage)

17.3.1 Preprogrammed tare values may only be assigned (programmed) when the device is at gross load zero and in a "configuration" mode.

17.3.2 Fixed and/or percentage tares may be preprogrammed into PLU codes. PLU codes may be entered or changed at any time, whether or not a load is on the platter.

17.3.3 Except for POS systems, scales must display the NET weight ("net" legend on) when a preprogrammed tare is entered through a PLU code.

17.4 Percentage tare

17.4.1 Fixed and percentage tares may be added to obtain a total tare value for a transaction. For instance, a PLU code may be preprogrammed with cumulative fixed and percentage tares; or a fixed platter or keyboard tare may be entered first, and then, through a PLU code, a percentage tare applied.

17.4.2 If a device can sum fixed and percentage tare values, the two values must be added first and then the total tare value rounded off to the nearest scale interval. There is therefore no benefit in expressing percentage tare values with more than one decimal place (e.g. 1.5 %, 3.3 %, etc.).

Examples:

Scale	Total gross weight TGW	Fixed tare weight FTW	Gross weight GW = TGW-FTW	Percentage tare value %T	Percentage tare weight calculated GW x %T	Total gross weight TGW	Total tare (fixed + percentage)		Net weight NW
							Calculated	Rounded	
15 kg x 5 g	355 g	10 g	345 g	9.2 %	31.74 g	355 g	41.74 g	40 g	315 g
Multi-interval 0-2 kg x 1 g 2-5 kg x 5 g	2890 g	9 g	2881 g	11.2 %	322.672 g	2890 g	331.672 g	330 g[1]	2560 g
								332 g[2]	2558 g[3]

[1] Tare rounded to the nearest 5 g scale interval (interval for weighing range of the gross weight).
[2] Tare rounded to the nearest 2 g scale interval (interval for weighing range of the tare weight).
[3] See sections 22.1.7 and 22.1.10 for specific requirements applicable to multi-interval and multiple range devices.

17.4.3 The visual confirmation that a tare has been applied (i.e., “NET” annunciator) must only be enabled if the percentage tare multiplied by the gross weight represents one or more scale intervals after the appropriate rounding. The turning on of the “NET” annunciator must only occur if the net weight does not equal the gross weight (i.e., a tare has actually been applied to the gross weight).

Note: The percentage tare of a commodity is determined as follows:

$$\text{Percentage tare (\%T)} = \frac{\text{Tare weight}}{\text{Gross weight}} \times 100\ \%$$

Net weight (NW) is determined as follows:

$$NW = TGW - FTW - [(\%T)(TGW-FTW)]$$

17.5 Devices used for direct sale to the public

17.5.1 Except for preprogrammed tare, proportional tare and POS systems, when keyboard or platter tare values are entered the scale must comply with one of the following requirements:

17.5.1.1 the tare value is permanently indicated on a separate dedicated display; or

17.5.1.2 the tare value is indicated as a negative value when there is no load on the load receiving element;

17.5.2 A platter or keyboard tare value may not be entered, modified or cancelled unless the device is at gross load zero or the device indicates a negative weight value. This does not apply when the tare is continuously indicated on a separate dedicated display (or, as a minimum, the new tare value is clearly displayed to the customer at some point during the transaction) nor to a preprogrammed tare associated with a PLU.

EXAMPLE:

A platter or keyboard tare value is entered on a computing scale and a negative value is indicated. If the wrong tare value was entered, it may be cancelled and replaced by a new tare value when the platter is empty. This new tare value will be indicated as a negative weight value. However, the correction must not be possible with a commodity resting on the platter (positive weight indication). In such instances, the operator must remove the commodity from the platter and then cancel or change the tare value.

CLARIFICATION:

The zero indication/no load condition does not apply to a preprogrammed tare value. The idea being that the operator should not be capable of altering a tare value without providing the consumer with an indication that a new tare value has been entered. In the case of a preprogrammed tare associated with a PLU code, the tare value is rarely displayed. However, it is unlikely that the operator will select the wrong PLU code or product name, or change the PLU code during the weighing operation, to reduce the tare value. Such actions would affect the unit price and would be detectable by the consumer.

17.5.3 Platter or keyboard tare values may be retained between transactions.

17.5.4 Auto-tares are prohibited in direct sale to the public applications.

17.6 Devices intended for industrial applications or other applications where consumers are not

normally present

17.6.1 A tare may be cancelled or modified while a load is on the load receiving element provided that the device has means to indicate, on demand, the value of the tare. These means include a negative weight value displayed when the platter is empty or a means to recall the tare value. A clear indication must be provided to the operator that a tare has been entered or cancelled (a tare annunciator is sufficient).

17.6.2 Tare values may be retained between transactions.

17.6.3 Combined semi-automatic zero/tare buttons are permitted under the following conditions:

17.6.3.1 The requirements of section 15.2 for semi automatic zero setting mechanisms must be met. Namely the zero/tare mechanism operates only when the scale provides a stable indication; the mechanism sets the indication to zero, only, within ± 1/4 e (or ½ d for Class I and II devices equipped with auxiliary reading means); the zero range does not exceed 4% of scale capacity unless the gross load that can be weighed is not increased beyond scale capacity.

17.6.3.2 The scale is intended to be used exclusively for industrial applications or applications where consumers are not normally present.

17.6.3.3 The AZSM or Center-of-Zero annunciator must be effective when the device displays zero after a zero setting operation (within the zero range). The AZSM may also work when zero is indicated after a tare operation. See section 10.3.

17.6.3.4 The AZSM operates as prescribed in section 15.3. Namely, the AZSM does not re-zero weight values in excess of 0.6 e; the total AZSM range does not exceed 4% of scale capacity unless the gross load that can be weighed is not increased beyond scale capacity.

17.6.3.5 The scale must be permanently marked, near the weight display(s), with the legend "Not for Use in Direct Sale to the Public" or similar language and the ranges of both zero and tare operation (e.g. ZERO RANGE up to 7 d - TARE RANGE above 7 d).

17.6.3.6 The range of zero and tare operation must not be user selectable (i.e. fixed or, as a minimum, a sealable parameter).

17.6.3.7 Visibility of operation - the scale is required to display an indication ("NET" annunciator) that a tare has been entered when a weight value within the tare range is subtracted by activating the zero/tare button.

17.7 Point of sale systems

Definition: a weighing element or a non computing scale interfaced with an electronic cash register or

computer. Usually, the cash register or computer reads the gross weight provided by the scale, assigns a tare through a PLU code and prints a net weight on the cash register tape. The cash register must not interfere with the operation of the scale. A stand alone price computing scale used in conjunction with an electronic cash register would not fall into this category.

17.7.1 A POS system may display the GROSS weight on the scale display; however, it must print the NET weight on the cash register tape. The scale of a POS system is not required to display the net weight nor provide an indication that a tare value has been entered.

17.8 Multi-interval and multiple range scales

See section 22.0 of this manual.

17.9 Customers' scoreboard

See section 23.0 of this manual.

LG-17.01 Tare - Backward direction

PURPOSE

The following test is to ensure that a weight value (positive tare) cannot be added to the weight of a load being weighed.

APPLICATION

Applicable to complete electronic scales and electronic indicators equipped with a tare function.

TEST PROCEDURE:

Push button tare

A. Zero the DUT
B. Place a weight in excess of the AZSM range on the load receiving element, and re-zero the scale
C. Activate the tare mechanism (Push Button Tare), the scale should indicate zero.
D. Remove the weight; this should result in a negative indication
E. Attempt to take this value as tare using the push-button tare capability. The negative number should not be taken as a tare.

Key-Board Tare, Programmable Tare

A. Attempt to enter or pre-program a positive tare through the Key-board.

INTERPRETATION OF RESULTS

The DUT is deemed to comply with the requirement, if a "positive" value cannot be entered or programmed as a tare value.

18.0 MOTION DETECTION

Reference: Section 30 , 31, 32 and 45 of the Specifications

Electronic devices must have motion detection capability to prevent the device from zeroing (semi-automatic zero) or taring (platter tare) a part of the load when the semi-automatic zero or tare key is activated while a load is added, changed or removed from the platter.

Electronic devices equipped with a printer (or that have connection for a printer) must have motion detection capability to prevent the device from printing values before the weight display has stabilized. This reduces the possibility of recording incorrect weight values.

The following test procedure is used to asses the effectiveness of the motion detection feature.

LG-18.01 Motion Detection Test

APPLICATION:

Applicable to complete electronic scales, or to electronic indicators which are intended to be used as part of a non-automatic weighing electronic scale (tested by means of a load cell\dead load tester assembly or by means of a load cell simulator).

PURPOSE:

To determine if printing, zeroing or the entry of a tare is inhibited when motion is detected.
To evaluate the maximum range within which printing is possible in spite of motion.

TEST SEQUENCE:

A) Place a load within the weighing range on the platter and allow time for the indication to stabilize.

B) Induce a motion to the scale indications to a peak magnitude of at least 10 e (amplitude);

C) While disturbing the weight indication, activate the SAZSM and allow the oscillations to settle out. The scale may eventually zero the load or may reject the command.

D) While disturbing the load, attempt to activate the tare button (platter tare). The scale may eventually tare the load on the platter, or reject the command.

E) While disturbing the load, attempt to print. The scale may print a weight or reject the command.

F) Repeat the test at least five times for small loads (near zero) and loads near capacity.

Note: For larger capacity devices, it may not be convenient or practical to disturb the load by hand. A load of greater than 10 e may be applied or removed while activating the zero, tare, stored weight or print key.

Under laboratory conditions, since this is primarily an instrument test, a low capacity load cell or a load cell simulator may be connected to the device or the indicating element to simulate motion.

INTERPRETATION OF RESULTS:

The device complies with the requirements if zeroing, taring or printing the load on the platter is prevented, or is within 1 verification scale interval (e) for scales that have a maximum capacity of 2000 kg (5000 lb); or 3 verification scale intervals (e) for scale of more than 2000 kg (5000 lb), and if the printed weight is within the prescribed tolerances.

18.1 Push-button zero complies with the motion detection requirements

18.2 Push-button (platter) tare complies with motion detection requirements.

18.3 Stored weight key(s) comply with the motion detection requirements.

18.4 Printed weight values comply with motion detection requirements.

18.5 Printed values are within prescribed tolerances.

19.0 TILTING (OFF-LEVEL EFFECT)

Reference: Section 21 of the Specifications

Under section 21 of the Specifications, portable or movable devices, other than of the freely suspended type, must perform within tolerances when tilted up to 3°, in any direction. If they can perform within tolerances only when levelled, they must be equipped with permanent and sensitive level indicating means (usually a bubble level).

Vehicle mounted weighing devices such as onboard weighing systems for NH_3, onboard weighing systems for waste collection, and scales mounted on lift trucks must be able to provide an accurate weight reading up to at least 3°.

19.1 Portable or movable devices

Complete scales or load receiving elements other than onboard weighing devices must meet one of the following conditions:

19.1.1 The device weighs within prescribed tolerances, when off level by up to 3°; or

19.1.2 The device is equipped with a permanently installed level indicator as standard feature.

If the device is **NOT** equipped with a suitable level indicator, perform the tests described in LG-3.04 of Part III, Performance Tests.

If the device has a level indicating means, the following requirements must be met:

19.1.2.1 The level indicating means must be permanently and rigidly mounted on a permanent section of the scale. It must be located so as to be easily read. It must be protected from damage and must be sufficiently sensitive.

19.1.2.2 The level indicating means must be readily observable without disassembly that requires the use of tools.

CLARIFICATIONS:

1. On small portable devices, the level indicating means may be placed under the platter (if the platter can be lifted easily) or at the back of the scale (if it can be readily observed).

2. A bubble level placed under the platform of a movable floor scale is not acceptable if the platform is relatively heavy and requires tools or assistance to be lift up in order to access the level indicator.

3. The level indicating means must be permanently attached to a permanent part of the scale (e.g. it is not sufficient to attached it to the platter if the patter is removable).

19.1.2.3 The level indicating means must be sufficiently sensitive. Perform the test described in LG3.05, Part III , Performance Tests.

19.2 Onboard weighing systems

Definitions: a weighing device designed as an integral part of or attached to or secured to the frame, chassis, lifting mechanism or the bed of a mobile equipment such as a vehicle, trailer, tractor, or forklift.

19.2.1 The device provide a weight indication up to 3° in any upright direction.

19.2.2 The device weighs within tolerances when off level by the largest of

a) 3° ; or
b) the maximum inclination at which a weight indication is still provided.

19.2.3 The weight indication blanks when the inclination is such that the device ceases to weigh accurately.

19.2.4 Scales mounted on lift trucks (or similar vehicles) must blank their indications when the lift truck is moving, unless the scale can provide an accurate weight indication. Perform an accuracy (in-motion) test using different loads within the capacity range of the device. The test must simulate actual conditions of use.

Note: See the complete test procedure LG-3.04, Part 3, Performance Tests.

20.0 SEGMENT VERIFICATION

It is recommended that electronic devices incorporate a test system for verifying all relevant signs of the indicator in their active and non-active state sufficiently long to be checked by the operator.

CLARIFICATION:

1. The relevant signs of an indicator are those that are metrologically significant: digits for gross, net and tare weights; + or - signs; tare or NET annunciator; centre of zero light; etc..

2. The following means of verifying signs are acceptable:

   - Test sequence initiated by pressing a special button
   - Test sequence initiated by pressing key or a sequence of keys
   - Test sequence initiated by turning the scale off and on

THIS IS NOT A REQUIREMENT

21.0 MULTIPLE DECK WEIGHING SYSTEMS

Reference: Sections 30 to 33 of the Specifications

An indicator and/or printer may be connected to more than one weighing element provided that the weighing system is designed to ensure accuracy of the transactions, and to prevent erroneous measurements or fraud.

Two basic Multiple Deck Weighing Systems are used in trade:

1) a system where only one weighing element can be selected and use at a time; and

2) a system where all the weighing elements can operate simultaneously. Each weighing element may have its own indicating element; all indicating elements being connected to a summing weight indicator. Or the weighing elements are connected to a specially designed multi-deck indicating element that can display simultaneous or alternating weight values from the individual weighing elements, and can display the sum of the weights. This second type of Multiple Deck Weighing system is normally used to weigh vehicles.

21.1 Systems where only one weighing element can be selected and use at a time (Multiplex).

Each separate weighing element and the indicating element is considered a separate scale and must be tested accordingly. In addition to other applicable requirements:

21.1.1 The system or scale must prohibit the use of any weighing element that is not in use (only one weighing element at a time).

21.1.2 The indicating element must automatically provide a clear and continuous indication of which load-receiving element is in use (i.e. Scale A, Scale B, Scale C; Scale 1, Scale 2, etc..). The indication must be visible from the operator's normal position.

21.1.3 Weighing elements must be clearly and permanently identified with the corresponding identification.

21.1.4 The printer must provide on the ticket, for each weighing, a clear registration indicating which weighing element was used (Scale A, Scale B , etc..).

21.1.5 When an operator-activated function (Setting zero, entering a tare value, selecting or clearing a function, etc..) is performed on one particular weighing element, functions or parameters of other weighing elements must not be affected or altered. Perform the test described in LG-21.01

21.1.6 Unless the indicator has independent AZSMs, one for each individual weighing element, individual Centre-of-Zero indicators (annunciators), one for each weighing element, must be provided. Centre-of-Zero indicators must provide a continuous signal (remain active) regardless of which weighing element is selected.

It is preferable to identify scale weighing elements as scale A, scale B, etc. rather than scale 1, scale 2. Numbers that could be confused with weight indications is not acceptable.

21.2 Systems where all the weighing elements can operate simultaneously (Vehicle scales, vehicle axle weighing scales); each weighing element has its own dedicated display that are interfaced to a summing display.

21.2.1.1 each weight indicator must be clearly and permanently identified (i.e. Scale 1, Scale 2, Total weight, etc..). Each weight display and its associated weighing element is considered a separate scale and must meet all applicable requirements.

21.2.1.2 When an operator-activated function (Setting zero, entering a tare value, selecting or clearing a function, etc..) is performed on one particular weighing element, functions or parameters of other weighing elements must not be affected. Perform the test described in LG-21.01

21.2.1.3 Unless the indicator has independent AZSMs, one for each individual weighing element, individual Centre-of-Zero indicators (annunciator), one for each weighing element, must be provided. Centre-of-Zero indicators must provide a continuous signal (remain active) regardless of which weighing element is selected.

21.2.2.4 Weighing elements must be clearly and permanently identified with the corresponding identification (Scale A, Scale B, etc..).

21.1.2.5 The printer must automatically register the printed weight associated with the weighing element identification that was used (Scale A, scale B, etc)

21.2.1.6 The value of verification scale interval must be the same for all displays including the summing display.

21.2.1.7 The summing weight display must perform within tolerances; must not indicate nor record any weight values when one individual weighing element exceeds its capacity; must sum any tare entries in the individual indicators; must have a free floating weight signal for summing individual indicators; and must be in mathematical agreement with the sum of all the individual indicators.

LG-21.01 Alteration of settings or data entries

PURPOSE

The purpose of this test is to ensure that when a setting is performed or a function is activated on one particular weighing element, functions or settings of the other weighing elements are not changed or altered.

APPLICATION

Applicable to any Multiple Deck Weighing Systems or indicator intended for Multiple Deck Weighing Systems

TEST PROCEDURE

A) Zero each individual weighing element

B) Place a small load (say 5 e) on one of the load weighing element; zero that weighing element; verify if zero balance condition of the other weighing elements have changed;

C) Enter a platter or key board tare for each selection of weighing elements in each weighing; clear or change the tare value on one weighing element; verify if tare values of the weighing elements have been altered.

D) Place different combination of loads on the weighing elements; ensure that the weight are correctly and accurately indicated; ensure that the printed weights agree with indicated weights and are properly identified.

E) If applicable, ensure that the summing weight display perform within tolerances; does not indicate nor record any weight values when one individual weighing element exceeds its capacity; sums any tare entries in the individual indicators; has a free floating weight signal for summing individual indicators; and is in mathematical agreement with the sum of all the individual weight displays.

INTERPRETATION OF RESULTS

The device complies with the requirements if functions performed on individual weighing element does not affect the settings or entries of other weighing elements; if the indicated and printed weights are accurate and identified as required; and if the summing weight display meets the requirements of E above.

22.0 MULTI-INTERVAL DEVICES AND MULTIPLE RANGE DEVICES

Reference: Sections 3, 5, 6, 8, 9, 16, 31 to 33 of the Specifications

This section provides additional guidelines for the examination and testing of multi-interval and multiple range devices.

Note: a weight indicator tested separately will be set and tested for a maximum number of intervals (n_{max}) and for a minimum value of verification scale interval (e_{min}) across the range.

22.1 Multi-interval devices

Multi-interval device means a device having one weighing range which is divided into partial weighing ranges each with different scale intervals, with the weighing range determined automatically according to the load applied (pre-determined ranges/intervals), both on increasing and decreasing loads.

Intervals and capacities

22.1.1 On a multi-interval device, the value of the verification scale interval of a particular range must be lower than the value of the verification scale interval of the next range ($e_1 < e_2 < e_3$, etc.)

22.1.2 Each partial range of a multi-interval device must have the same value of scale interval for both increasing and decreasing loads. The verification scale interval e must equal the scale interval d.

22.1.3 Each partial range of a multi-interval device must have the number of scale intervals (n) required by section 3 of the Specifications.

Example: each range of a Class III device must have a minimum of 500 n and a maximum of 10 000 n. The number of scale intervals "n" for each weighing range is determined by dividing the scale capacity for each range by the verification scale interval "e" for each range. See the following illustration:

Partial Weighing Range (Capacity)	e	n	Max / e
0-3 kg	1 g	3000	3000/1
3-6 kg	2 g	3000	6000/2
6-15 kg	5 g	3000	15 000/5

Example of a device that would not satisfy the above section 22.1.3

Weighing ranges	e	n
First 0 - 1 kg	1 g	1000
Second 1 - 5 kg	5 g	1000
Third 5 - 8 kg	20 g	☞ **400**

Example of a device that satisfies section 22.1.3

Weighing ranges	e	n
First 0 - 1 kg	1 g	1000
Second 1 - 5 kg	2 g	2500
Third 5 - 8 kg	5 g	1600

22.1.4 **It is recommended (OIML requirements)** that the maximum capacity of a partial weighing range of a multi-interval device (except the last range) must satisfy the requirements of the following table:

Class	I	II	III	IIII
Max_i/e_{i+1}	≥ 50 000	≥ 5 000	≥ 500	≥ 50

Tare features

22.1.5 The maximum tare value that may be entered shall not exceed Max $_1$.

22.1.6 Whenever gross and tare weights fall in different weighing ranges, the net weight must always be in mathematical agreement with the gross and tare weights that are displayed and recorded (simultaneously or in sequence) (gross = tare + net).

22.1.7 The tare value must be equal to the value of the displayed scale division for all methods of tare entry ($d_{tare} = d$). An attempt to enter, in the first range of a multi-interval scale, a tare value that is not equal to d must be rejected or rounded off to the nearest scale interval. Example: a multi-interval scale has a 2 g interval in the first range and 5 g in the second range. A keyboard entry of 5 g in the first range must be either rounded to 4 or 6 g or rejected.

22.1.8 Weight values (Net or Gross) must always begin with the lowest weighing range on the device regardless of the amount of keyboard or platter tare that is taken. Example: a multi-interval scale has two ranges: first 0-2 kg by 2 g, and second 2-5 kg by 5 g. A platter tare of 1 kg is taken; the device indicates zero. Then, the device must indicate the net weight from 0 up to 2 kg in intervals of 2 g; and from 2 up to 4 kg, in intervals of 5 g.

22.1.9 When Gross, Tare and Net weights are indicated or printed, there shall be mathematical agreement in all circumstances. The tare value must be **rounded off** to permit mathematical agreement. Example: A multi-interval device has two ranges . The first range 0-2 kg by 2 g, and the second 2-5 by 5 g. A key board tare of 1.998 kg is entered (in 2 g divisions); a gross load of 2.115 (in 5 g divisions) is put on the platter. The net weight indicated must be either 0.116 kg or 0.118 kg (first range; rounded off to 2 g division). If the gross, net and tare weights are indicated, they must be as follows:

	Gross	Tare	Net
either	2.115 kg	**1.999 kg**	0.116 kg
or	2.115 kg	**1.997 kg**	0.118 kg

22.1.10 A tare value entered in the lower range may be either rounded off to the nearest value of the interval of the higher range in which the weighing occurs, or kept unchanged. In the latter case, the net weight could possibly be displayed with an interval smaller than the interval of the range in which the weighing occurs. When a device displays or prints the gross, net and tare values, in all cases the mathematical equation "tare + net weight = gross weight" must be satisfied. *Example: a multi-interval scale has a 2 g interval from 0 to 2 kg, and 5 g from 2 kg to 10 kg. A tare of 12 g is entered in the first range and the gross weight is 2500 g (second range). The scale may display either 2488 g (tare stored as 12 g) or 2490 g (rounded off to 10 g).*

> **Note:** **OIML**: tare must be rounded off (R 76-1, section 4.7.1)
> **U.S.**: tare must be either rounded **up** or kept unchanged (Pub 14 page 1-44)
> The rounding off of the tare value is the method prefered by Measurement Canada. MC may allow only this method sometime in the future.

Marking

22.1.11 The capacity and verification scale interval must be conspicuously marked near the weight display (See section 1.1.6, 1.1.7 and 1.1.8 of this manual).

Performance

CLARIFICATION:

1. For any test performed on a multi-interval scale, the tolerance is a function of the verification scale interval **e** of the range corresponding to the test load used.
2. The smallest value of the verification scale interval applies to the tests to determine the maximum value of AZSM, the maximum permissible error for the return to zero test and for the creep-return to zero test, etc. The motion detection requirement must be satisfied for each partial range. The shift test must be performed at one-half of the capacity of each partial weighing range.
3. temperature effect on no load: the tolerance (one verification scale interval/ 5°C) applies to the smallest verification scale interval.
4. time (half hour creep/return to zero): The deviation on returning to zero as soon the indication has stabilized, after the removal of any load which has remained on the device for half hour, shall not exceed **0.5** $\mathbf{e_1}$.
5. Devices equipped with keyboard or platter tare must meet the tolerances for net loads for any tare taken up to the maximum tare capacity.

22.2 Multiple range devices

Multiple range device means a device having two or more weighing ranges with different maximum capacities and different scale intervals for the same load receptor, each range extending from zero to its maximum capacity (two or more devices in one). The selection of the range may be manual or automatic.

Number of intervals and capacity

22.2.1 Each range of a multiple range device must have the number of scale intervals (n) as required by section 3 of the Specifications.

22.2.2 For each range, e must equal d.

Zero setting feature

22.2.3 The zero setting feature in any weighing range must also be effective in the greater weighing ranges, if switching to a greater weighing range is possible while the device is loaded. The deviation from zero must be no more than 0.25 **e**. This is applicable to manual selection or automatic changing of weighing ranges.

Selection of the weighing range

22.2.4 i) Manual selection of the weighing ranges is allowed from a smaller to a greater weighing range at any load;

ii) It is allowed from a greater to a smaller weighing range when there is no load on the platter, and the indication is zero or at a negative net value. The tare operation must be cancelled and zero must be set to **± 0.25 e_1**, both automatically.

22.2.5 i) Automatic changeover of the weighing range is allowed from a smaller to the following greater weighing range when the load exceeds the maximum gross weight of the range being operated;

ii) It is allowed from a greater to a smaller weighing range when there is no load on the platter and the indication is zero or at a negative net value; the tare operation must be cancelled and zero must be set to **± 0.25 e_1**, both automatically.

Tare features

22.2.6 The tare value may only be transfered from one weighing range to another one with a larger verification scale interval.

22.2.7 The tare operation shall be effective also in the greater weighing range, if switching to a greater weighing range is possible when the device is loaded.

22.2.8 The tare value must be equal to the value of the displayed scale division for all methods of tare entry (d_{tare} = d). An attempt to enter, in the lower range of a multiple range scale, a tare value that is not equal to d must be rejected or rounded off to the nearest scale interval. *Example: a scale has a 2 g interval in the first range and 5 g in the second range. A keyboard entry of 5 g in the first range must be either rounded to 4 or 6 g or rejected.*

22.2.9 A tare value entered in the lower range **must be rounded off** to the nearest interval of the higher range in which the NET weighing occurs. *Example: an automatic multiple range scale has a 2 g interval from 0 to 2 kg (lower range), and 5 g from 0 kg to 10 kg (higher range). A tare of 13 g is entered in the lower range and the gross weight is 2500 g (second range). The tare value must be rounded to 15 g and the scale must display 2485 g (rounded off to 15 g).*

Note:	**OIML**: tare transfered only from the lowest to the largest range and rounded off to the scale interval (R 76-1, section 4.7.1). **U.S.**: tare transfer only from the lowest to the largest range and must be **rounded up** (Publication 14, page 1-46)

22.2.10 In all cases, the mathematical equation TARE + NET must = GROSS (indicated and printed).

Indication of the range in use

22.2.11 The range in which the device operates shall automatically and clearly be indicated for both the operator and the consumers.

CLARIFICATION:

If a scale has a decimal point and a different number of decimal places in each weighing range, the position of the decimal point and the number of digits following is an adequate definition of the weighing range in use. If the weighing range does not utilize a decimal point and differing numbers of decimal places (e.g. scale division are 20, 50 and 100 lb), another method must be provided to indicate the weighing range in use. A display of the capacity by division with an annunciator located near the weight display such as the following is acceptable:

		Range in use
Range 1	20 x 0.005 kg	●
Range 2	5 x 0.002 kg ☼	

Marking

22.2.12 Each weighing capacity by division must be clearly indicated near the weight display. If the manufacturer chooses to indicate which weighing range is in operation using the method recommended above (with annunciator), no other marking of capacity by division is required.

Performance

CLARIFICATION:

1. Each weighing range of a **multiple range scale** is considered to be an individual scale and must be evaluated accordingly.

2. temperature effect on no load the tolerance (one verification scale interval/ 5°C) applies to the smallest verification scale interval.

3. time (half hour creep/return to zero) The deviation on returning to zero from Max_1 shall not exceed 0.5 e_1. The deviation on returning to zero from Max_i shall not exceed 0.5 e_i.

   Furthermore, after returning to zero from any load greater than Max_1, and immediately after switching to the lowest weighing range (manually or automatically), the indication near zero must not vary by more than e_1 during the following 5 minutes.

23.0 DEVICES USED FOR DIRECT SALE TO THE PUBLIC

Reference: Sections 30 to 33, 46, 47, 50, 59 and 60 of the Specifications

Several requirements apply to devices intended to be used for direct sale to the public. These requirements are to ensure that transactions are accurate and that customers normally present during the weighing operations are provided with sufficient information so that they can observe and understand the weighing process.

23.1.1 The device must be provided with a display (customer display) that duplicates all significant metrological information displayed for the operator (Weight, unit price, total price, tare weight, annunciators for "net" weight or "tare entered", centre-off-zero light, etc.); or, as a minimum, the scale must have a connection for a separate duplicate display (Customer display must be submitted to the Laboratory for evaluation).

23.1.2 Customers' scoreboard Scoreboards on vehicle scales, livestock scales, etc. do not require approval. However they must have the following features:

- the weight indication must be free floating;
- they must either indicate a negative sign or blank when the weight indication on the scale is behind zero;
- they must blank when the weight indication exceeds the scale capacity (Max + 105%);
- they must indicate the unit of measurement. Note that a sign adjacent to the weight indication is sufficient when there is only one unit of measurement; if there is a lb/kg switch on the primary indicator, the scoreboard must indicate the unit in use;
- they must be able to indicate zero;
- they must indicate the weighing mode (gross, net, tare)
- **Max**, **d** and **e**, if different than d must be marqued near the weight display

23.2 (Reminder) See item 7.3, Section 7.0 in this manual:

23.2.1 The devices must display the unit price if the total price is displayed;

23.2.2 if the device displays in kilograms, the unit price that can be entered and displayed is limited to Price/100 g and Price/kg; if the device displays in Canadian units, the unit price that can be entered and displayed is limited to Price/pound; if the device displays weight values on the basis of the gram or ounce, unit prices may also be entered and displayed on that basis.

23.3 (Reminder) See item 17.4, Section 17.0 in this manual:

23.3.1 Except for pre-programmed tare, proportional tares and POS systems, when keyboard or platter tare values are entered, the scale must comply with one of the following requirement:

23.3.1.1 the tare value is permanently indicated on a separate display; or

23.3.1.2 the tare value is indicated as a negative value when there is no load on the load receptor.

23.3.2 A platter or keyboard tare value may not be entered, modified or cancelled unless the device is at gross load zero or the device indicates a negative weight value. This does not apply when the tare is continuously indicated on a separate display and to pre-programmed tare.

23.3.3 Platter or keyboard tares may retained between transactions.

EXAMPLE: A platter or keyboard tare value is entered in a computing scale; a negative value is indicated. If the wrong tare value was entered, it may be cancelled and replaced by a new tare value when the platter is empty. This new tare value will be indicated as a negative weight value. However, the correction must not be possible with the commodity resting on the platter (positive weight indication). The operator must remove the commodity from the receptor and then cancel or change the tare value.

CLARIFICATION: The zero indication/no load condition does not apply to a preprogrammed tare value. The idea is that the operator should not be capable of altering a tare value without providing the consumer with an indication that a new tare value was entered. In the case of a pre-programmed tare associated with a PLU code, the tare value is rarely displayed. However, it is unlikely that the operator will select the wrong PLU code or product name, or change the PLU code during the weighing operation to reduce the tare value. It would affect the unit price which would be detectable by the consumer.

23.3.4 Auto-tares are prohibited in direct sale to the public applications.

Note: Devices that are not intended for direct sale to the public but resemble those approved for direct sale to the public, must be marked as follows: << NOT FOR USE IN DIRECT SALE TO THE PUBLIC>> or words that convey the same meaning. The marking must be permanent and located near the weight display so that it is readily observable by the user.

24.0 WEIGH-IN/WEIGH-OUT SYSTEMS

Reference: Sections 30 to 33 of the Specifications

A weigh-in/weigh-out system is typically a vehicle scale in which an inbound truck is weighed either loaded or empty, the inbound weight is stored, the truck is then emptied or loaded as the case may be, the outbound truck is weighed and the larger of the two weights (outbound or stored weight) is printed as the gross weight, the other printed as the tare weight and the difference computed as the net weight. Inbound weights, recalled weight values, and gross, tare and net weights must be identified to clearly document the transaction. The storage, recalling, and printing actions are limited so that they do not facilitate fraud. The followings are the main requirements for inbound/outbound weighing systems.

24.1 Any inbound weight values must be recorded and automatically identified as such (assigned to a client name or number). If inbound weights are not printed at the time the weigh-in operation is performed, the inbound weight information must not be lost during a power interruption.

24.2 The gross, tare and net weight values must be recorded (printed) in an automatic sequence when the outbound weight value is obtained.

24.3 The recorded weight value is not required to be automatically identified as a gross weight value, provided that the other two weight values are clearly and automatically identified as net and tare.

24.4 If a device can indicate and/or record in two and more weight units, all gross, tare and net weight values shall be automatically recorded in the same weight units. This condition must be met regardless which weight unit is being displayed.

24.5 Any weigh-in/weigh-out weight values stored in the memory register shall automatically clear and not be retained in memory after a complete transaction of gross, tare and net has been recorded.

24.6 Any recorded weighing value from the memory register shall be automatically identified and defined (client name or number).

24.7 Tare values shall not be stored as negative values. (Negative numbers shall not be accepted).

24.8 Keyboard tare entries shall not be accepted into weigh-in/weigh-out memory registers.

24.9 If the system is equipped with a tare memory register for weighing gross, tare and net separate from the weigh-in/weigh-out feature, the tare weight shall not interact with the weigh-in/weigh-out feature.

24.10 The data processing system performing the weigh-in/weigh out operation shall only accept weight values when the scale indicator is in the gross mode, or give an error signal.

25.0 NON METROLOGICAL FUNCTIONS

Reference: Sections 32 and 33 of the Specifications

A device may perform functions, other than metrological, such as accounting functions provided that those non metrological functions do not alter the device metrological characteristics or functions, and neither lead to measurement errors nor facilitate the perpetration of fraud.

25.1 Non metrological functions do not alter the device metrological characteristics or functions, and neither lead to measurement errors nor facilitate the perpetration of fraud.

APPENDIX 2-A

The following table lists acceptable defining words and symbols for the marking of devices. This list does not standardize the abbreviation or symbols that must be used, rather it identifies abbreviations or symbols routinely used. Other abbreviations or symbols, such as those internationally recognized (OIML), are also acceptable.

Corrected May 10, 1999

Abbreviations and symbols accepted in Canada			
Units	**Definition**	**Acceptable symbol**	**Not Acceptable**
kilogram	basic unit	kg	KG, kilo
gram	$^1/_{1\,000}$ kg	g	gr, gm, G, GM
pound	0.45359237 kg	lb	LB, lbs, #
ounce	$^1/_{16}$ pound (or 437 ½ grains)	oz	OZ
dram	$^1/_{16}$ ounce	dr	DR
grain	$^1/_{7\,000}$ pound	gr	GRN, grn, GN, g
tonne (or metric ton)	1 000 kg	t	T, TN, tn
ton	2 000 pounds	tn	t, TN, T
cental (or hundredweight)	100 pounds	ctl or cwt	
troy ounce	480 grains	tr oz	
carat	200 milligrams	ct	c
	Zero key or center of zero indicator	→0←	
	Tare entered	→T◇	

Abbreviations and symbols accepted in Canada			
Units	**Definition**	**Acceptable symbol**	**Not Acceptable**
	Accuracy class	Class I, II, III, III HD, IIII, or symbols enclosed in an ellipse such as: I or II	*I, II, III, III HD, IV or 1, 2, 3, 3 HD, 4*
	Maximum number of scale intervals	n_{max}	
	Minimum verification scale interval	e_{min}	
	Value of the actual scale interval	d	
	Value of the verification scale interval	e	
	Number of scale intervals	n	
	Gross weight	gross, G, GR	
	Tare	tare, T, TA	
	Net weight	net, N, NT	
	Manual weight entry	manual weight MAN WT, MANUAL WT, MAN WEIGHT	M, MW, MAN

Additional authorized symbols

Corrected
May 10, 1999

Units	Symbols	Units	Symbols
Acre	no symbol allowed	Inch (pouce)	in (po)
Bushel (boisseau)	bu	Link (chaînon)	li (chon)
Chain (chaîne)	ch	Mile (mille)	mi
Dram (drachme)	dr	Peck (quart de boisseau)	pk
Fluid dram (drachme fluide)	fl dr	Pint (chopine)	pt (chop)
Fluid ounce (once fluide)	fl oz	Quart (pinte)	qt (pte)
Foot (Pied)	ft (pi)	Rod, perch, pole (perche)	no symbol allowed
Furlong	no symbol allowed	Ton (tonne)	tn
Gallon	gal	Yard (verge)	yd (vg)
Gill (roquille)	gi		

Appendix 2-B Draft Specifications for Metrological Audit Trails (May 1996)

Title

Specifications Relating to the Design, Composition, Performance and Use of Metrological Audit Trails.

1.0 Application

1.1 These Specifications apply to audit trails incorporated in weighing and measuring devices and systems.

2.0 Interpretation

2.1 In these specifications,

Adjustment	means a change in the value of any of a device's sealable calibration or sealable configuration parameters.
Adjustment Mode	means an operational mode of a device which enables the user to make adjustments to sealable parameters, including changes to configuration parameters.
Audit Trail	means an electronic count and/or information record of the changes to the values of the calibration or configuration parameters of a device.
Calibration Parameter	means any adjustable parameter that can affect measurement or performance accuracy, and due to its nature, needs to be updated on an ongoing basis to maintain device accuracy.
Configuration Parameter	means any adjustable or selectable parameter for a device feature that can have an affect on the accuracy of a transaction or can significantly increase the potential for fraudulent use of the device and, due to its nature, needs to be updated only during device installation or upon replacement of a component.
Enabling/Disabling Sealable Hardware	means physically sealable hardware, such as a two-position switch, located on a remotely configurable device, that enables and inhibits the capability to receive adjustment values or changes to sealable configuration parameters from a remote source.
Event	means an action in which one or more changes are made to configuration parameters, or adjustments are made to one value (or a set of values) for a calibration parameter, while in the adjustment mode.
Event Counter	means a non-resettable counter that increments once for each time the mode that permits changes to sealable parameters is entered and one or more changes are made to sealable calibration or configuration parameters of a device.

Event Logger	means a form of audit trail containing a series of records where each record contains the number from the event counter corresponding to a change to a sealable parameter, the identification of the parameter that was changed, the time and date when the parameter was changed and the new value of the parameter.
Physical Seal	means a physical mechanism, such as lead and wire, used to seal access to a device's adjustable parameters that require to be sealed.
Remote Configuration Capability	means the ability to adjust a weighing or measuring device or change its sealable parameters from or through some other device which is not itself necessary to the operation of the weighing or measuring device or is not a permanent part of that device.
Remote Device	means a device that (1) is not required for the measurement operation of the primary device or computing the transaction information in one or more of the available operating modes for commercial measurements, or (2) is not a permanent part of the primary device. In the context of this paper, a remote device has the ability to adjust the weighing or measuring device or change its sealable configuration parameters.
Remotely Configurable Device	means any weighing or measuring device with remote configuration capability that permits sealable configuration or calibration parameters to be deleted, appended to, modified, or substituted in whole or in part by downloading over any type of communications link from another device, such as a geographically local or remote console or computer, whether or not the secondary apparatus is part of the network connecting the devices.
Seal	means, as a verb, to make a device secure so that access to adjustments and other sealable parameters will be detectable.
Sealable Parameter	means calibration and configuration parameters that are required to be sealed.
Unrestricted Access to Sealable Parameters	means that a physical security seal is not present, so that access to sealable parameters is available from a remote device at any time at the request of an authorized operator subject to the operating status of the weighing or measuring device.

3.0 Categories of Devices

3.1 Category 1: A device that does not have remote configuration shall be sealed as described in the appropriate section of Table A.

3.2 Category 2: A device offering remote configuration capability for its sealable parameters and providing enabling/disabling hardware to control remote configuration use shall be sealed as described in the appropriate section of Table A.

3.3 Category 3: A device that provides unrestricted access to its sealable parameters shall be sealed as described in the appropriate section on Table A.

Table A: Categories of Devices and Methods of Sealing

Categories of Device	Methods of Sealing
Category 1: No remote configuration capability.	Physical seal or two event counters: one for calibration parameters and one for configuration parameters.
Category 2: Remote configuration capability but access is controlled by physical hardware.	Enabling/disabling hardware access for remote communication must be located at the device and must be sealed using a physical seal or two event counters: one for calibration parameters and one for configuration parameters.
Category 3: Remote configuration capability may be unlimited or controlled by a software switch (ex. password).	An event logger is required in the device.

4.0 Event Counters

4.1 The minimum form of audit trail shall consist of two event counters: one for calibration parameters and one for configuration parameters.

4.2 Each event counter shall have a capacity of at least 1000 values (ex. 0 to 999).

4.3 An event counter for calibration parameters or configuration parameters shall increment only once regardless of the number of changes made while in the adjustment mode. If the mode is accessed and no changes are made, this does not constitute an event and the counter shall not increment.

5.0 Event Loggers

5.1 The event logger shall contain the following information, as a minimum:
- i) a count of the events;
- ii) date and time;
- iii) parameter identification, and
- iv) new value.

5.1.1 The information described in section 5.1 shall be automatically entered in the event logger by the device each time a sealable parameter is changed.

5.1.2 Additional relevant information is permitted, such as the identification of the person who made the adjustment or the old value of the parameter that was changed. Information that is not directly related to the changes to sealable parameters, such as transaction data, operator inventory records, or shift totals shall be excluded when event logger contents are displayed or printed.

5.1.3 The event counter described in section 5.1 shall increment once for each change to a sealable parameter since each new value must be retained in the event logger.

5.1.4 The date referred to in section 5.1 shall include the year, month and day; the time shall include the hour and minutes. This information shall be presented in a recognizable format.

5.2 A hard-copy printout of the contents of the event logger shall be available upon demand from the device or from an associated device on site.

5.3 An event logger shall have the capacity of at least ten times the number of sealable parameters; however, not more than one thousand events are required to be retained for all parameters combined.

5.3.1 When the storage memory of the event logger has been filled to capacity, any new event will cause the oldest event to be deleted.

5.3.2 The event counter used in an event logger shall continue to increment to capacity although the event logger may retain fewer records than the count capacity of the event counter.

6.0 Centralized Event Logger

6.1 A centralized event logger may be used when several "satellite" devices are interfaced to a host computer or other host instrument with remote configuration capability.

6.2 When changes to sealable parameters are made at the device, rather than through the host instrument containing the centralized event logger, the changes shall be transferred to and maintained in the centralized event logger.

6.3 It shall not be possible to circumvent the device containing the centralized event logger. If the event logger is inhibited, or disconnected, the attached network of devices shall be inoperable and impossible to adjust electronically when in the network configuration.

6.4 When the same values for a change to a sealable parameter are sent from the host instrument to several satellite devices, this shall be considered a single event.

6.5 When changes to sealable parameters are made to individual devices, the centralized event logger shall identify both the device and the parameter that was changed.

6.6 A device installed in a "stand-alone" operation must have the minimum form of audit trail required by Table A.

7.0 Category 2 Devices - Remote Configuration Mode

7.1 When a remotely configurable device is in remote configuration mode, the device shall either:

i) not indicate or record (if equipped with a printer) values; or,
ii) provide a clear and continuous indication that the device is in remote configuration mode. Any printed ticket or receipt shall include a message with each ticket or receipt that the device is in an adjustment mode.

NOTE: A "clear and continuous indication" must discourage the use of the device for normal transactions when in an adjustment mode. This may consist of a partial obscuring of the indication, an alternate display message, or some other obvious indication. The lighting of an annunciator is not sufficient. If values can be printed when in an adjustment mode, the system shall record a message to indicate that the device is in an adjustment mode.

8.0 Audit Trail Integrity

8.1 The audit trail shall be:

i) stored in non-volatile memory and retained for at least 30 days if power is removed from the device; and
ii) protected from unauthorized erasure, seizure, substitution, or modification.

9.0 Audit Trail Access

9.1 The inspector shall have ready access to audit trail information for the purpose of printing or viewing its contents.

9.2 Access to the audit trail for the purpose of review shall be separate from the calibration and configuration modes.

9.3 Access to the audit trail for the purpose of review shall not affect the normal operation of a device before or after accessing the information.

9.4 Access to the audit trail information shall not require the removal of any parts of a device other than normal requirements to inspect the integrity of a physical seal.

NOTE: A key (for a panel lock, for example), is acceptable to gain access and view the contents of the audit trail. Such access may be through the "supervisor's mode" of a device.

10.0 Displayed and Recorded Information

10.1 The displayed and/or printed form of the audit trail shall be readily interpretable by the enforcement official.

10.2 The information contained in the audit trail shall be displayed and/or printed in order, from the most recent event to the oldest event. The device shall be capable of displaying all the information for a single event on one line at one time, or it shall display the information in readily understandable blocks of data.

11.0 Sealable Parameters

11.1 Subject to subsections 11.2, 11.3, 11.4, and 11.5, calibration and configuration parameters that can affect measurement performance of a device, the accuracy of a transaction, or can significantly increase the potential for fraudulent use, shall be sealed.

NOTE: The need to seal specific features also depends upon:
i) The ease with which the feature or the selection of the feature can be used to facilitate fraud; and
ii) The likelihood that the use of the feature will result in fraud not being detected.

11.2 The adjustment mode containing sealable parameters shall access only sealable parameters. Features and functions that are routinely used by the operator as part of the device operation, such as setting unit prices and maintaining unit prices in price look-up (PLU) codes stored in memory, are not sealable parameters. Access to these features shall be separate from the access to sealable parameters.

11.3 When the selection of a parameter or a set of parameters will result in device performance that will obviously be in error, such as the selection of parameters for a different country, the selection of the parameter or set of parameters in question is not required to be sealed.

11.4 Access to any programming mode or menu that allows individual characteristics of a device to be selected and changed must be sealed.

11.5 Any physical act, such as cutting a wire and physically repairing the cut to reactivate the parameter, is considered an acceptable way to select parameters without requiring a physical seal or an audit trail.

11.6 A list of adjustments, features and parameters that require to be sealed is found in Table B. This list is not intended to be all inclusive.

NOTE: A device manufacturer must demonstrate that any features that are not sealed will not affect the metrological performance of the device.

Table B: Sealable Parameters

Non-Automatic Weighing Devices	Liquid Measuring Devices
Calibration Parameters	**Calibration Parameters**
Zero (coarse).	Mechanical accuracy adjustor, electronic meter factor or any other type of accuracy adjustment parameter and associated flow rate if applicable.
Sensitivity (span).	
Linearity correction points.	Mass flow meter zero and span adjustments.
Configuration Parameters	**Configuration Parameters**
Motion detection (on/off, bandwidth).	Temperature, pressure and density or other auxiliary sensor zero, span and offset settings.
Scale interval (value of *d* or location of decimal).	Units of measurement (if not displayed or printed on the primary register).
Number of scale divisions.	Temperature compensation table, liquid coefficient of expansion or, compressibility factors or tables used if not indicated on a printed ticket.
Range of overcapacity.	Liquid density (if not displayed or printed on the primary register).
Automatic zero setting mechanism (on/off and range of a single step).	Vapour pressure of liquids if used in calculations to establish quantity.
Zero and automatic zero setting mechanism total range (if the range can be set for more than 4% and if this increases the device weighing capacity).	Meter or sensor temperature compensation factors if used.
Filter (number samples averaged for weight readings).	False or missing pulse limit for dual pulse systems.
Filter (averaging time for weight indications).	Automatic temperature, pressure, or density (ATC, APC, ADC) compensation on/off status.
Units of measurement (if not displayed or printed on the primary register).	Sensor auto/manual data input modes if not apparent when the device is used or not printed on a ticket.
	Dual pulse checking feature on/off status.
	Flow control settings (optional).
	Filtering constants.

11.7 Sealable parameters for conveyor belt scales shall include those listed for non automatic weighing devices as

well as the following:

i) Length of the weighing element;

ii) Number of pulses per unit of length (or equivalent);

iii) Maximum belt speed;

iv) Maximum/minimum instantaneous load (units of mass), or maximum/minimum rate of product flow (mass per unit length);

v) Finest increment of registration of the Master Weight Totalizer;

vi) Alarm levels;

vii) Any associated filtering functions;

viii) Summing box; and

ix) Displacement transducer casing.

11.8 Sealable parameters for discontinuous totalizing automatic weighing devices, such as bulkweighers and automatic hopper scales shall include those listed for non automatic weighing devices as well as interlocks (software or hardware, control panel, etc.) that monitor level sensors, limit switches, motion detectors or any other interlocks.

11.9 Sealable parameters for in-motion rail weighing systems shall include those listed for non automatic weighing devices as well as the following:

i) Maximum and minimum weighing speed for legal for trade weighing;

ii) Restrictions on train travel direction for legal for trade weighing (if applicable);

iii) Maximum number of wagons that shall be weighed as part of a legal for trade weighing (if such a limitation is imposed on the device); and

iv) Any associated filtering functions.