

INFORMATION BROCHURE

for the essential and vegetable oils industry
with respect to the marking and
accuracy requirements for
prepackages under legal
metrology control



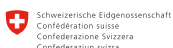
SAEOPA

Southern African Essential
Oil Producers' Association



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0. BACKGROUND

One element of quality infrastructure [QI] is *metrology, the science of measurement* with its common definition of units for length, mass, time, temperature, electric current, luminous intensity, and substance.

Metrology is divided into three basic overlapping activities:

- i. **Scientific metrology** is concerned with the establishment of units of measurement, the development of new measurement methods, the realisation of measurement standards, and the transfer of traceability from these standards to users in a society.
- ii. **Industrial, applied or technical metrology** is concerned with the application of measurements to manufacturing and other processes and their use in society, ensuring the suitability of measurement instruments, their calibration and quality control.
- iii. **Legal metrology** focuses on activities that result from statutory requirements and concern measurements, units of measurement, measuring instruments and methods of measurement, and which are performed by competent bodies. Such statutory requirements may arise from the need for the protection of health, public safety, the environment, enabling taxation, protection of consumers and fair trade.

Legal metrology further involves the legislated use of metrology (through technical regulations) to ensure that fair weights and measures are applied in both national and international trade (for both imports and exports).

Typical activities in this field include the type approval of measuring instruments used in trade (e.g., retail scales and fuel pumps), and their ongoing verification, the inspection of measuring instruments and prepackages, the application of sanctions in cases of non-compliance with legislation and the calibration of measurement standards used by the regulator and the industry.

The above encapsulates the responsibility of the Legal Metrology unit of the National Regulator for Compulsory Specifications (NRCS). Model regulations for measuring instruments and prepackages used in legal metrology are developed by the International Organization of Legal Metrology (OIML), and are adopted nationally, usually through the national standards body, the South African Bureau of Standards (SABS), as a basis for national standards.

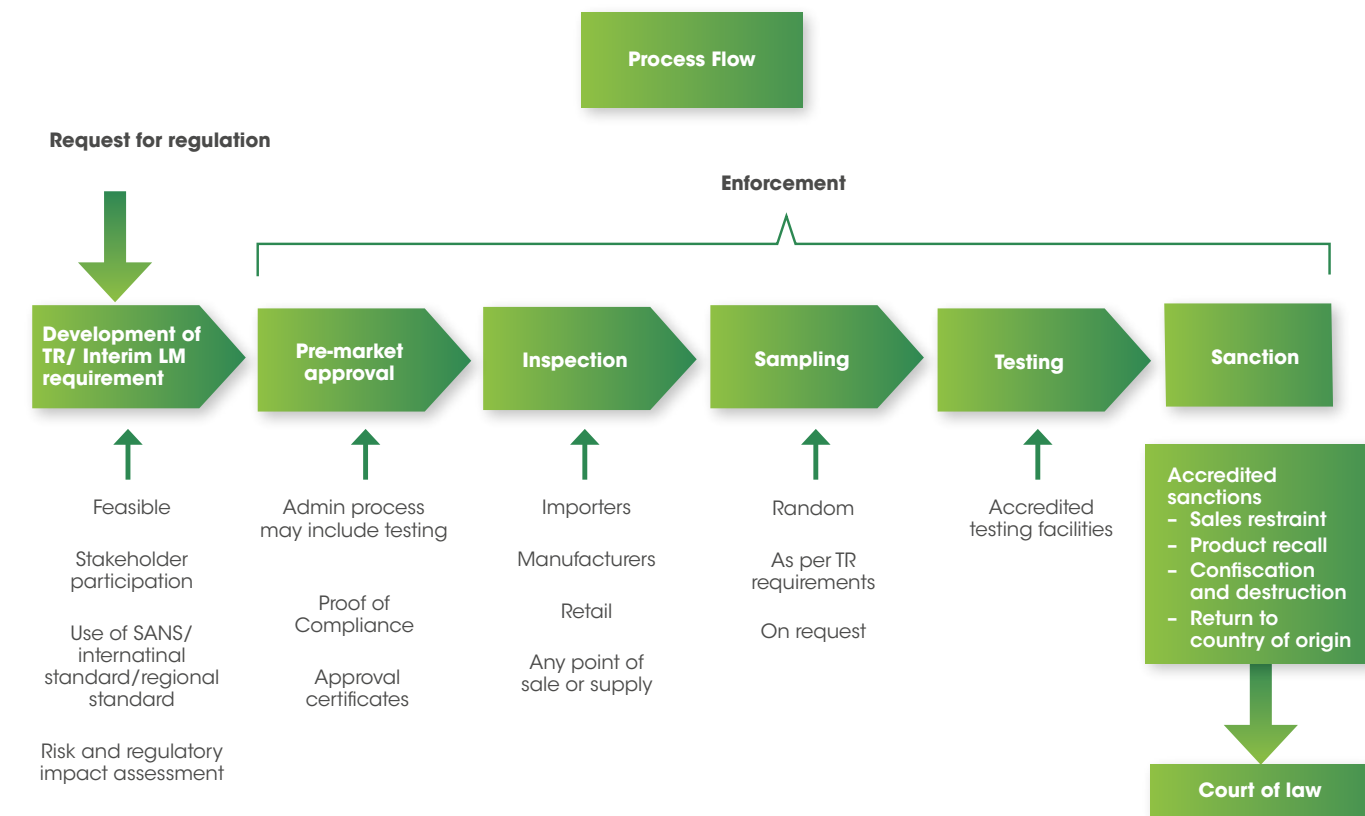
A **technical regulation** can be defined as:

- the requirements and/or administrative provisions *laid down by government*
- in respect of any measuring instrument, a product which includes product characteristics or related processes, or a service (normally specified in a South African National Standard [SANS]);
- which may affect fair trade, public health and safety, or the *environment*;
- has been declared as **mandatory**;
- *by the Minister*; and
- published as a notice in a government gazette.

Legal Metrology as a unit within the NRCS is responsible for regulating legal metrology activities in South Africa under the auspices of the Legal Metrology Act (Act 9 of 2014) and Legal Metrology Regulations, 2017.

The Legal Metrology Act mandates the NRCS Legal Metrology unit with the responsibility of regulating all measurable products and services, measurements in trade, health, safety, the environment, and all measuring instruments used for a prescribed purpose.

The NRCS uses harmonised technical regulations to regulate its activities, as illustrated below:





The International Organisation of Legal Metrology (OIML) enables economies to put in place an effective legal metrology infrastructure that are mutually compatible and internationally recognised.

The African Union, through the Intra-Africa Metrology System (AFRIMETS), facilitates intra-African and international trade, and ensure the safety, health, and consumer and environmental protection of its citizens through the Pan African Quality Infrastructure (PAQI). This resulted in the African Continental Free Trade Agreement (AfCFTA).

On regional level, the Southern Africa Development Community (SADC) promotes sustainable and equitable economic growth and socio-economic development in Southern Africa through the South African Development Community Co-operation in Legal Metrology (SADCMEL), which gave effect to the SADC's Technical Barriers to Trade (TBT) annex to the SADC Protocol on Trade.

1. REFERENCE DOCUMENTS

- i. Legal Metrology Act, Act 9 of 2014;
- ii. Legal Metrology Regulations, 2017;
- iii. SANS 289 (based on harmonised requirements in SADCMEL Document 1 and OIML R 79) – *Labelling requirements for prepackaged products and general requirements for the sale of goods*; and
- iv. SANS 458 (based on harmonised requirements in SADCMEL Document 4 and OIML R 87) – *Tolerances permitted for the accuracy of measurements made in terms of legal metrology legislation including the measurement of goods when prepackaged or when measured at the time of sale or in pursuance of a sale, and requirements for the inspection prepackages*.

2. DEFINITIONS

Prepackaged (product)/prepackage means any commodity that is made up as a unit or entity and whose quantity has been determined and indicated on its label before being offered for sale, irrespective of whether such unit or entity is enclosed in a container, wrapped in any manner, or unenclosed.

Net quantity means a quantity of the identified product in the prepackage, exclusive of wrappers and any other material packaged with such product, unless specifically allowed by these requirements.

Principal display panel means the part of a package that is most likely to be displayed, presented, shown or examined under normal and customary conditions of display.

Nominal quantity means the quantity of product in a prepackage that is declared on the label by the packer.

Content of a prepackage means the actual quantity of product in a prepackage.

Actual quantity means the product that a prepackage contains as determined by measurement as carried out by legal metrology officials.

T is the tolerable deficiency permitted in the quantity of product in a prepackage.

Inadequate prepackage means a non-conforming prepackage that has a negative error, with a quantity less than the nominal quantity.

A **T error** is defined as an inadequate prepackage found to contain an actual quantity less than the nominal quantity minus the applicable tolerable deficiency (T) allowed for that prepackage, but not less than twice the applicable tolerable deficiency ($2T$) for the nominal quantity for that prepackage.

A **2T error** is defined as an inadequate prepackage found to contain an actual quantity less than the nominal quantity minus twice the applicable tolerable deficiency (T) allowed for that prepackage for the nominal quantity.

Inspection lot batch means the definite quantity of some prepackages produced at one time under conditions that are presumed uniform, and from which a sample is drawn and inspected to determine compliance with specified requirements for acceptance or rejection of the inspection lot as a whole.

Packing material/tare/packaging/packaging material is everything of the prepackage that is meant to be left over after use of the product, except for items naturally contained in the product.

Approval of measuring instruments [MIs] for every type of measuring instrument used for a “prescribed purpose” is subject to type approval, unless excluded by regulation.

Prescribed purpose means such purpose as may be prescribed in relation to the use, possession, manufacture or import of any measuring instrument; the manner and result of measurement in the fields of trade, health, safety and environment and any other measurement of a legal nature; and the expression of the quantity of any product.

Verification of measuring instruments [MIs] for all measuring instruments, including those used by the State for a “prescribed purpose,” are subject to initial verification and subsequent verification in accordance with the relevant legal metrology technical regulations, unless the measuring instrument is exempted by regulation from verification.

To “**verify**” a measuring instrument means the procedure of examining a MI and issuing of a verification certificate, and, if required, marking it with a verification mark that ascertains and confirms that the measuring instrument complies with a legal metrology technical regulation, and includes initial verification and subsequent verification.

Trade means and includes the making, effecting, or concluding of any contract, bargain, sale, purchase or transaction, sale of land, or any payment in connection therewith; any payment for services rendered; *the collection of tolls, rates, taxes, fines or other fees; and any measurement of a legal nature in connection with which any measuring instrument is used.*

3. ABBREVIATIONS / ACRONYMS

AfCFTA	African Continental Free Trade Agreement
AFRIMETS	Intra-Africa Metrology System
ATM	Average tare mass
LMA	Legal Metrology Act
LMR	Legal Metrology Regulations
MIs	Measuring instruments
NRCS	National Regulator for Compulsory Specifications
OIML	International Organization of Legal Metrology
PAQI	Pan African Quality Infrastructure
SABS	South African Bureau of Standards
SADCMEL	South African Development Community Co-operation in Legal Metrology
SADC	South African Development Community
SANS	South African National Standard
SANS 289	South African National Standard 289 (<i>Labelling requirements for prepackaged products and general requirements for the sale of goods</i>)
SANS 458	South African National Standard 458 (Tolerances permitted for the accuracy of measurements made in terms of legal metrology legislation, including the measurement of goods when prepackaged or when measured at the time of sale or in pursuance of a sale, and requirements for the inspection prepackages)
SI (units)	International System of Units
TBTs	Technical barriers to trade

4. LABELLING REQUIREMENTS FOR PREPACKAGED PRODUCTS (PREPACKAGES) SANS 289 (SADCMEL DOCUMENT 1) (OIML R 79)

Certain requirements in OIML R 79 are left to the individual member countries of OIML to decide upon in their national legislation. SADC, under the SADC Protocol on Trade, decided to harmonise these requirements regionally to ensure the eradication of technical barriers to trade (TBTs) within the region and to facilitate trade between members of the SADC region and internationally. This harmonisation work has been carried out by the SADC Co-operation Structure dealing with legal metrology, SADCMEL.

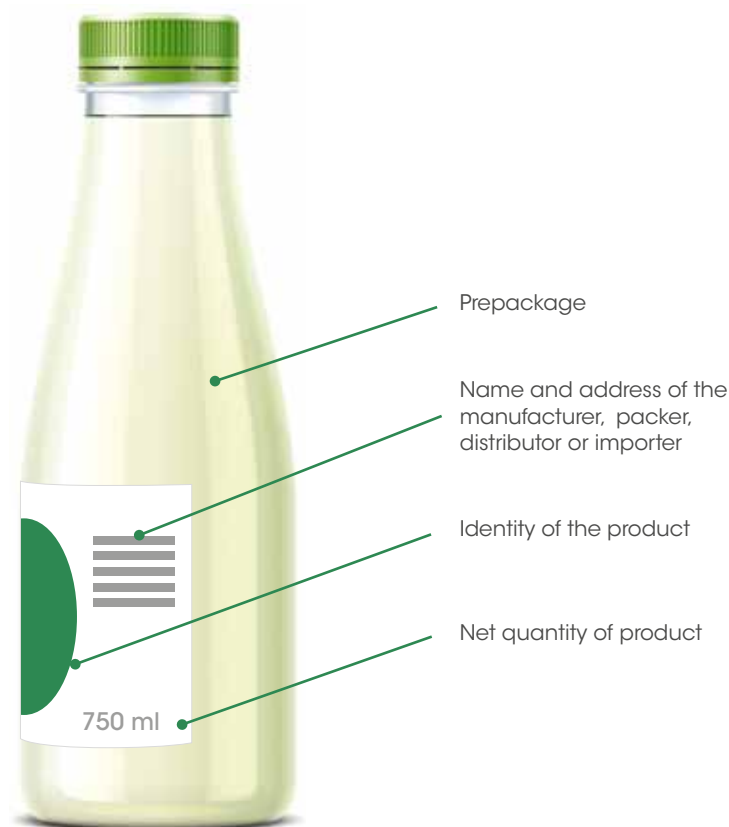
The only major difference between OIML R 79 and the regionally harmonised standard dealing with the labelling of prepackages in respect with legal metrology, SADCMEL Document 1, on which the SANS 289 is also based, is that OIML R 79 requires the net quantity of a product to be marked on its principal display panel, whereas the SADCMEL Document 1 allows for the net quantity to be marked anywhere on the prepackage, except the base of the prepackage. Care should therefore be taken when exporting prepackages to economies who has fully implemented the requirements of OIML R 79.

In OIML R 79, the principal display panel is the part of a prepackage that is designed to be visible under normal conditions of display for sale.

Note: This is normally the main or front panel of the prepackage, and there could be more than one.

The requirements of this information brochure are based on SANS 289 – Labelling requirements for prepackaged products and general requirements for the sale of goods.

4.1 General requirements for labelling



Labelling requirements for prepackaged products (prepackages) and general requirements for the sale of goods subject to legal metrology control are given in SANS 289.

This standard covers requirements for the labelling of prepackaged products with regard to:

- the identity of the product;
- the name and place of business of the manufacturer, packer, distributor, importer or retailer; and
- the net quantity of the product.

SANS 289 also covers general requirements for the sale of goods, such as the units of measurements and symbols (Annex A/4.5 of SANS 289), the type size of letters and numerals for statements of net quantity (Annex B/4.5 of SANS 289), special requirements for certain products (Annex C/4.9 of SANS 289), goods exempted from quantity indication (Annex D of SANS 289/4.10), and prescribed sizes in which certain products must be packaged (Annex E/4.8 of SANS 289).

Other legislation might exist for labelling requirements for reasons of health, safety or tax, or for other purposes such as date label for sale of use, and storage temperature. Such labelling should be taken into account, as applicable or appropriate.

Declarations of ingredients on package labels or nutritional information of food products, whether compulsory or not, are not covered in the requirements of this standard.



The required markings shall be in at least one of the official languages of the country in which the prepackage is sold.

Note: Some countries may require more than one official language.



Prepackaged products shall be labelled in accordance with this standard before being offered for sale.

In this context, prepackaged (product)/prepackage means any commodity that is made up as a unit or entity and for which its quantity has been determined and indicated on its label before being offered for sale, irrespective of whether such unit or entity is enclosed in a container, wrapped in any manner, or unenclosed.

Net quantity means a quantity of the identified product in the prepackage, exclusive of wrappers and any other material packaged with such product, unless specifically allowed by these requirements.

Principal display panel means the part of a package that is most likely to be displayed, presented, shown or examined under normal and customary conditions of display.

4.2 Marking the identity of the product

The principal display panel on a prepackage shall bear a description of the identity of the product unless the wrapper is transparent, thus rendering the product easily identifiable.

The identity of the product shall be a conspicuous feature of the principal display panel and shall be in such type size (the height of the characters), and so positioned as to make it easy to read and understand. Legal metrology legislation does not issue any requirements for the height of these characters.

The identity of the product (also see possible classification of the identity of the product under Annex E of SANS 289), shall be in terms of at least one of the following designations in the order of preference listed:

- the name (which could include the brand name);
- the common or usual name of the product (e.g., scented essential oil); and
- the generic name or other appropriately descriptive term, such as a specification, which includes a statement of function.

4.3 Marking the name and place of business of the manufacturer, packer, distributor or importer on the label of a prepackage

The name and address of the business of the person responsible for any of the following shall be conspicuously marked on the label: manufacturing; packaging; distributing; importing; or retailing the product.

When the product is not manufactured or packaged by the person whose name appears on the label, the name may be qualified by a phrase that reveals the connection such person has with the product, for example "manufactured for ...", "distributed by ...", "marketed by ...", "imported by ...", or "sold by ..."



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The statement of the place of business shall include a complete physical address or a mailing (postal) address, or both. A website address or social media address does not fulfil the requirements of being a mailing address.



It might be the address of a head office, provided that the responsible person at such head office is able to identify the address of the packaging plant. In cases where a code is used to identify a packaging plant, the manufacturer shall disclose the meaning of the code to any inspector requiring it.

4.4 How to correctly mark the net quantity on a prepackaged product

The label of a prepackaged product, except a label on a surface clearly intended as a base, shall bear a declaration of the net quantity of the product in a unit of measurement and according to the requirements of 4.5 or by number, as applicable.

4.5 Units of measurement and symbols

Units of measurement shall be expressed in either words or symbols e.g., 10 g or 10 gram.

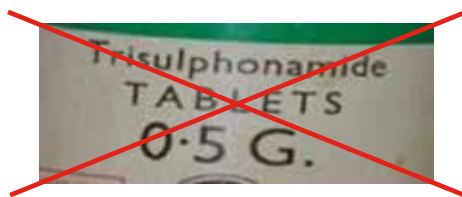
Table A.1 provides the units and the appropriate symbols for measurements.

Table A.1. Units of measurement

Unit	Symbol
milligram	mg
gram	g
kilogram	kg
ton	t
hectolitre	hL or hl
litre	L or l
centilitre	cL or cl
millilitre	mL or ml
micrometre	µm
millimetre	mm
centimetre	cm
decimetre	dm
metre	m
square millimetre	mm ²
square centimetre	cm ²
square metre	m ²
cubic centimetre	cm ³
cubic decimetre	dm ³
cubic metre	m ³

Note: The script letters ℓ for litre and g for gram are acceptable within the SADC region but these symbols might not be accepted in countries outside the region, and packers should be informed accordingly.

The names of the unit or symbol may not be written with capital letters e.g., 10 g is correct, but 10 G is incorrect; 15 mL is correct, but 15 ML is incorrect.



Neither a period (full stop) nor the letter "s" shall be used after any of the symbols e.g., 10 gram is correct, but 10 grams is incorrect.

A single space shall be used to separate the number from the unit of measurement e.g., 10 gram and not 10gram.



Appropriate phrases such as "net", "net mass", "net contents", or "net quantity" may be used in the declaration of the net quantity. Such phrases may appear either before or after the net quantity declaration e.g., net mass 10 g or 10 g net mass. The use of the phrase "weight" or "net weight" is not acceptable.

The words "approximately" and "when packed" shall not be used in the declaration of the net quantity unless specifically permitted for certain products, e.g., seeds.

The unit used depends on the type of measure and net quantity of product. Table A.2 indicates the correct unit to use for a variety of measures and net quantities.

Table A.2. Choice of units

Type of measure	Net quantity of product (q)	Units
Volume (liquids)	$q < 1\,000\text{ mL}$ $1\,000\text{ mL} \leq q < 100\text{ L}$ $100\text{ L} \leq q$	mL (ml) or cL (cl) L (l) L (l) or hL (hl)
Volume – cubic (solids)	$q \leq 1\,000\text{ cm}^3$ (1 dm ³) $1\text{ dm}^3 < q < 1\,000\text{ dm}^3$ $1\,000\text{ dm}^3 \leq q$	cm ³ , mL (ml) dm ³ , L (l) m ³
Mass	$q < 1\text{ g}$ $1\text{ g} \leq q < 1\,000\text{ g}$ (1 kg) $1\text{ kg} \leq q < 1\,000\text{ kg}$ $1\,000\text{ kg} \leq q$	mg g kg kg or t
Length	$q < 1\text{ mm}$ $1\text{ mm} \leq q < 1\,000\text{ mm}$ (100 cm) $100\text{ cm} \leq q$	µm or mm mm or cm m
Area	$q \leq 100\text{ cm}^2$ (1 dm ²) $1\text{ dm}^2 < q < 100\text{ dm}^2$ (1 m ²) $1\text{ m}^2 \leq q$	mm ² or cm ² dm ² m ²

The decimal indicator shall be either the comma or a dot on the line e.g., 10,5 mL or 10.5 mL.

A prepackaged product may be marked with an equivalent quantity statement in a non-International System of Units (SI) element, provided that the equivalent statement shall not be more prominent or appear more times than the required metric statement e.g., 1 kg (2.20 lb).



The **net** quantity shall be marked on the prepackages at the initial place of packaging or at importation, provided that:

- prepackages, contained in a correctly marked outer container which is likely to be opened in the retail for individual sale of the prepackages therein, shall each be marked with a quantity indication in accordance with this requirement, unless exempted.
- where a package contains a number of items, which have themselves been prepackaged in accordance with the requirements of this standard, the outer container need only make known the number of items and their individual quantities. In cases where the items have different quantities, the outer container shall make known the number of items of each quantity and their respective quantities. Outer containers shall also comply with the requirements for product identification (see SANS 289 clause 3), and the details of the final packer (see SANS 289 clause 4).

4.6 Expression of quantities by mass, volume, length and area

The net quantity shall be expressed in terms of the largest whole unit of mass, volume, length, area, or a combination of these units in accordance with the units of measurement and symbols as discussed above, provided that where the quantity is indicated on a label printed by a measuring instrument approved for trade use, the quantity may be expressed as a decimal fraction of a measuring unit.

The net quantity statement for a specific product shall be expressed in the most appropriate measuring unit, subject to the following rules, or unless otherwise specified in Annex E of SANS 289:

- volume at 20 °C, if the product is liquid or viscous in its normal state of use. The reference temperature does not need to appear on the label; or
- mass, if the product is solid, semi-solid or viscous, a mixture of solid and liquid, or the solid part of a mixture of a solid and liquid (drained mass).

A prepackage may contain, as an integral part of the contents, a free quantity of the same type of product, provided that the following conditions are fulfilled:

- the quantity to be paid for (excluding the free quantity), the free quantity, and the total quantity contained in the package, shall each be declared on the package according to the requirements of this standard;
- the quantities declared shall be in the same measuring unit or multiples or submultiples thereof;
- the total quantity contained in the package as declared shall conform to the applicable requirements for accuracy of measurement; and
- where specific quantities are prescribed for a product in Annex E of SANS 289, the quantity, excluding the free quantity, shall be the prescribed quantity.

A prepackage may be marked with a reference to a reduced price.

The statement of quantity on a prepackage to which a free quantity of goods is attached as a separate component, shall make known the quantity of such package, exclusive of such free quantity.

Statements of the net quantity shall appear in easily legible boldface type or print that contrasts conspicuously with the background and with other information on a package. However, when the value of the net quantity is blown, embossed, or moulded on the surface of the package, it does not need to contrast with the background, and all other required label information shall be provided conspicuously elsewhere on the surface or on a label.

Statements of net quantity shall be in letters and numerals in a minimum type size determined in accordance with the requirements of Annex B of SANS 289. See Table B.1 below.

Table B.1 Minimum height of numbers and letters

Net contents (C)	Minimum height of numbers and letters in mm
$C \leq 50$ g or mL	2
$50 \text{ g or mL} < C \leq 200$ g or mL	3
$200 \text{ g or mL} < C \leq 1$ kg or L	4
$1 \text{ kg or L} < C$	6

4.7 Significance of numbers on labels

The number used on a label shall not contain more than three figures, irrespective of where the decimal indicator is placed, e.g., 1,25 mL, 10 mL, 10,5 mL, 100 mL, provided that the following three exceptions are permitted:

- statements of a quantity less than a whole number may contain decimal fractions up to three places, e.g., 0,855 mL.
- where the quantity is indicated on a label printed by a measuring instrument approved for trade use, the quantity may have more than three figures, for example 1,355 kg.
- quantities of less than a whole number shall be shown in the decimal system with the figure zero preceding the decimal mark, e.g., 0,855 mL.

A statement such as "half kilogram" or common fractions, e.g., $\frac{1}{4}$, shall not be used.

4.8 Prescribed quantities

Certain goods shall only be packaged in the sizes prescribed in Annex E of SANS 289. See the table below as an example of a product resorting under Annex E:

Item	Product	Quantity to be expressed	Prescribed quantities
21	Edible oils	Volume	Any quantities less than 10 mL, then in integral multiples of 5 mL from 10 mL up to and including 100 mL, then in integral multiples of 25 mL above 100 mL up to and including 1 L and integral multiples of 250 mL above 1 L.

From the table, the quantity of edible oils can only be expressed in volume and in the following prescribed quantities:

- Any quantity less than 10 mL (1 mL, 2 mL, 3 mL, ..., 10 mL);
- then above 10 mL in 5 mL integral multiples as follows: 15 mL, 20 mL, 25 mL, 30 mL, ..., 85 mL, 90 mL, 95 mL, 100 mL; then
- any quantity above 100 mL in 25 mL integral multiples as follows: 125 mL, 150 mL, 175 mL, ..., 950 mL, 975 mL, 1 L, 1,25 L, 1,5 L, 1,75 L, ..., etc.

4.9 Misleading practices

Packages shall be manufactured, constructed or displayed in such a manner that a purchaser might not reasonably be misled with respect to the quantity or identity of the product(s) contained therein.

Packages shall be filled in such a manner that a purchaser might not reasonably be misled with respect to the quantity or identity of the product it contains, taking into consideration any recognised and accepted production practices that might be necessary for the manufacturer or packer. If a consumer cannot fully view the product in a prepackage, it shall be considered to be filled, and shall be misleading if it contains non-functional slack fill.

Slack fill is the difference between the actual capacity of the packaging material and the volume of product it contains. Non-functional slack fill is the empty space in a prepackage that is filled to less than its capacity.

Slack fill might be necessary for the following reasons:

- protection of the product;
- the requirements of machines used for enclosing the contents of the prepackage;
- unavoidable product settling during shipping and handling; and
- the need for the prepackage to perform a specific function (e.g., where packaging plays a role in the preparation or consumption of food), where such function is inherent to the nature of the product, and is clearly communicated to consumers.

If the prepackaged product is labelled on more than one location of its package, the quantity information on all labels shall be equivalent and in accordance with this standard.

Prepackaged goods that are permitted to be sold other than by reference to a measuring unit or number (e.g., exempted from a quantity indication – see Annex D in SANS 289), shall bear no direct or indirect reference alluding to quantity in terms of any measuring unit or by number. This requirement includes numbers which might be construed as such a reference, unless the indication conforms to these requirements, is unambiguous, and the actual quantity conforms to any applicable tolerance requirements.

4.10 Special requirements for certain products under Annex C allows for alternative positioning of markings

Barrels or drums with a volume not less than 100 L may have their net quantity indication marked on the head, irrespective of where the other required information is marked, provided that the quantity marking is legible and conspicuous.

4.11 Goods exempted from quantity indication under Annex D

A quantity of goods in prepackaged form, being a free sample, provided that either the words "free sample" or the words "not for sale" are prominently marked on the package.

The undermentioned solid or liquid goods prepackaged in quantities less than those specified:

- general merchandise not otherwise specified 10 g or 10 mL (this will be dependent on the product being classified under Table E.1 of Annex E of SANS 289).

A transparent package, being a combined package, containing items of goods of the same kind and of the same quantity, provided that:

- the number of such items in such combined package does not exceed 12 and that such items are all clearly visible; and
- where such items should bear a quantity statement, such statement is marked in accordance with the relevant requirements of this standard, and is clearly visible on at least one such unit.

A transparent package, being a combined package, containing items of goods of different kinds or different quantities (or both), provided that:

- the number of such items in such combined package does not exceed 12 and that such items are all clearly visible, and
- where such items should bear a quantity statement, such statement is marked in accordance with the relevant requirements of this standard and is clearly visible on each such item.

5. ACCURACY REQUIREMENTS FOR PREPACKAGED PRODUCTS (PREPACKAGES) SANS 458 (SADCMEL DOCUMENT 4) (OIML R 87)

Certain requirements in OIML R 87 are left to the individual member countries of OIML to decide upon in their national legislation. SADC, under the SADC Protocol on Trade, decided to harmonise these requirements regionally to ensure the eradication of TBTs within the region, and to facilitate trade between members of the SADC region and internationally. This harmonisation work has been carried out by the SADC Co-operation Structure dealing with legal metrology, SADCMEL.

The statistical methods contained in SANS 458 and SADCMEL Document 4 are based on that of OIML R87:2004.

Several reports, namely Sim¹, Willink², and Field³, pointed out that OIML R 87:2004 contained imprecise and hard-to-interpret statements of the lot testing requirements, and also some errors in calculation. Specifically, both Sim and Willink pointed out that the 2004 version contained errors in 4.2, Table 2, in that the sample sizes and the acceptable number of prepackages with T errors did not guarantee the probability of rejecting an unacceptable lot being at least 0.9. Willink also noted that OIML R 87 did not use the requirement that there are no $2T$ errors in the sample in the probability calculations. OIML has decided to correct these errors, however small, by giving the probabilistic and statistical assumptions and reasoning that underpin the acceptance sampling presented in the Recommendation.

The requirements of OIML R 87:2016 have not been adopted as harmonised requirements in SADC and South Africa, and this brochure is therefore based on the requirements of OIML R87:2004.

5.1 Tolerances permitted for the accuracy of measurements of products (including prepackaged products)

This standard specifies legal metrology requirements for:

- the accuracy of measurements regulated by legal metrology legislation, including the measurement of goods when prepackaged or at the time of sale, in constant or random (non-constant) nominal quantities of mass, volume, linear measure, area, or count;
- sampling plans and procedures for use by legal metrology officials in verifying the quantity of product in prepackages; and
- examination of the quantity of product in prepackages, including the determination of average tare masses.

¹ Sim, C. H. (2007). *Requirements and process control for quantity of product in prepackages*. *Metrologia* 44, 29–34.

² Willink, R. (2008). *Report for measurement and product safety service on OIML R87 (2004 E) and other documents*. Report.

³ Field, J. (2007). *OIML R 87 sampling schemes*. Report.

5.2 Important terminology to understand



Nominal quantity means the quantity of product in a prepackage that is declared on the label by the packer.



Content of a prepackage means the actual quantity of product in a prepackage.



Actual quantity means the product that a prepackage contains as determined by measurement, as carried out by legal metrology officials.

T is the tolerable deficiency permitted in the quantity of product in a prepackage. See Table 1.

Table 1. Tolerable deficiencies in actual content for prepackages that contain general products

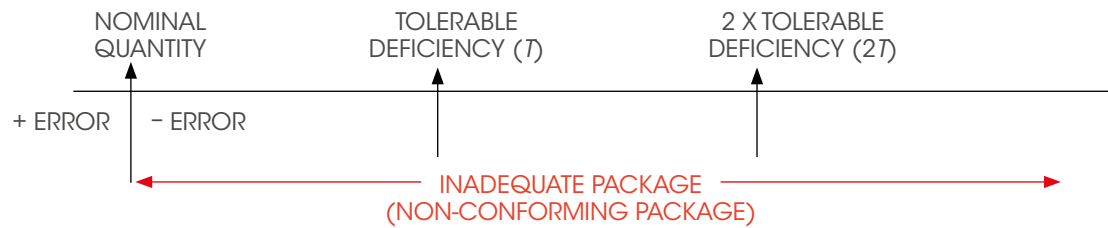
Nominal quantity of product (Qn) in g or mL	Tolerable deficiency (T) ^a	
	Percent of Qn	g or mL
0 to 50	9	–
50 to 100	–	4,5
100 to 200	4,5	–
200 to 300	–	9
300 to 500	3	–
500 to 1 000	–	15
1 000 to 10 000	1,5	–
10 000 to 15 000	–	150
Above 15 000	1	–

^a T values are to be rounded up to the next tenth of a gram or a millilitre for Qn less than or equal to 1 000 g or 1 000 mL, and to the next whole gram or millilitre for Qn higher than 1 000 g or 1 000 mL.

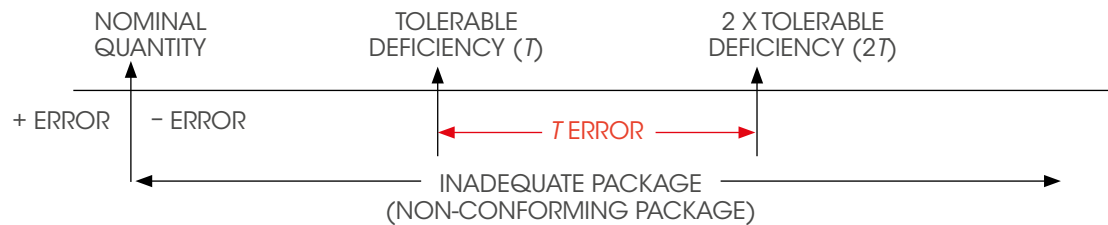
Examples to determine the tolerance of a prepackage:

- nominal quantity of product is 50 mL – as per the table, the tolerance allowed for the package is 9%. 9% of 50 mL is 4.5 mL.
- nominal quantity of product is 75 mL – as per the table, the tolerance allowed for the 75 mL package is 4.5 mL.
- nominal quantity of product is 150 g – as per the table, the tolerance allowed for the package is 4.5%; 4.5 % of 150 g is 6.75 g.

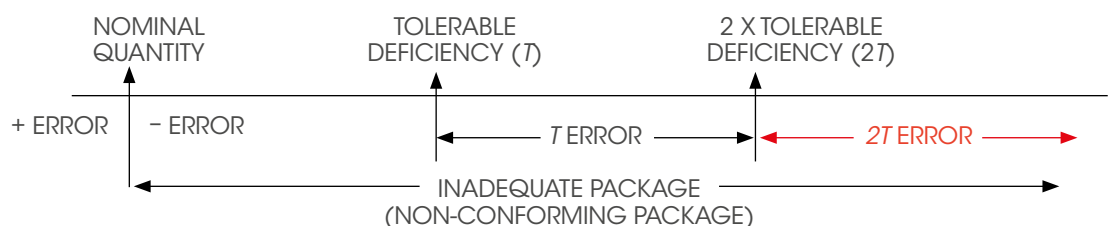
Inadequate prepackage means a non-conforming prepackage that has a negative error with a quantity less than the nominal quantity.



A **T error** is defined as an inadequate prepackage found to contain an actual quantity less than the nominal quantity, minus the applicable tolerable deficiency (T) allowed for that prepackage, but not less than twice the applicable tolerable deficiency ($2T$) for the nominal quantity for that prepackage.



A **2T error** is defined as an inadequate prepackage found to contain an actual quantity less than the nominal quantity, minus twice the applicable tolerable deficiency (T) allowed for that prepackage for the nominal quantity.



Inspection lot batch means the definite quantity of some prepackages produced at one time under conditions that are presumed uniform, and from which a sample is drawn and inspected to determine compliance with specified requirements for acceptance or rejection of the inspection lot as a whole.

Packing material/tare/packaging/packaging material is everything of the prepackage that is meant to be left over after use of the product, except for items naturally contained in the product.

5.3 General requirements for compliance

All goods shall be sold by net quantity, excluding the quantity of any packaging material, unless exemption is given for specific types of goods in SANS 458 or in any other applicable legal metrology legislation.

5.4 Suitability of instruments

An instrument used for measuring shall be an instrument that complies with the following requirements:



- it shall be of an approved type, if type approval is required by legislation;



- it shall have a valid verification status;

- the in-service maximum permissible error for the quantity measured shall not exceed the applicable tolerable deficiency (T) in Table 1 for the goods being measured;
- it shall not be used below any minimum quantity permitted to be measured as specified in type approval documentation or in any other applicable legislation; and
- instruments used at the time of sale and for checking purposes shall be of a type permitted by legislation for direct sales to the public.

5.5 Prepackages other than those made up for sale on the retail premises from which they are sold using a suitable instrument

Prepackages shall comply with the applicable requirements of SANS 458 at any level of distribution, including the point-of-pack, during import, distribution and wholesale transactions, and retail sale (e.g., where prepackages are offered or exposed for sale or sold).

Where necessary, packers shall make allowance for possible shrinkage or loss of quantity after packing.

The following requirements need to be met to ensure the quantity in prepackages for quantity control purposes:

Average requirement

In the case of prepackages with a constant nominal quantity, the average actual quantity of the product in prepackages in an inspection lot shall be at least equal to the nominal quantity.

In the case of prepackages with a random nominal quantity, the total actual quantity of the product in prepackages in an inspection lot shall be at least equal to the total nominal quantity.

Individual prepackage requirement

The actual quantity of product in a prepackage shall accurately reflect the nominal quantity, but reasonable deviations are prescribed for certain prepackages (see Table 1 for applicable tolerable deficiencies).

Prepackages for which tolerable deficiencies are prescribed shall comply with the following requirements:

- not more than 2,5% of prepackages shall have a negative error exceeding the tolerable deficiency given in the table for applicable tolerable deficiencies, as applicable (T error); and
- no prepackage shall have a negative error exceeding twice the tolerable deficiency prescribed in the table for applicable tolerable deficiencies, as applicable ($2T$ error).

5.6 Standard reference temperatures for prepackaged liquid products

Unless otherwise specified in applicable legislation, liquid products packed in accordance with the requirements of SANS 458 and marked with a quantity by volume, shall comply with applicable requirements when at a temperature of 20 °C.

5.7 Inspection procedures for sampling and testing by an NRCS officials

Note: The sampling plans and procedures for use by legal metrology officials in verifying the quantity of product in prepackages are not recommended for use in the quantity control processes of the packer. Packers are advised to develop their own sampling plans and procedures that will ensure the accuracy of content of prepackages for quantity control purposes.

The prescribed tests shall be performed in accordance with quality acceptance inspection by sampling prepackages at any level of distribution, including the point-of-pack; during import, distribution and wholesale transactions; and retail sales. Relevant test procedures are given in Annex B. This standard does not preclude a legal metrology official from conducting any other test at any level of distribution for the purpose of verifying that prepackages comply with the requirements of this or any other standard.

5.8 Accuracy of measurement of inspection equipment

Unless otherwise prescribed, inspection measuring instruments shall have a resolution of not more than 0,1T of the prepackage being measured in the case of instruments with digital indication, and not more than 0,2T of the prepackage being measured in the case of instruments with analogue indication that permits interpolation between discreet divisions, e.g., analogue weighing instruments, glass measures and tape measures.

Any error on the measuring instrument shall be taken into consideration when measurements are made.

5.9 Outline procedure for inspecting compliance with the average requirement when prepackages are sampled

When compliance with the average requirement is determined by means of sampling of an inspection lot, the procedure detailed in i.–vii. below shall be used:

- i. Determine the actual error on each prepackage in the selected sample.
- ii. Calculate the total prepackage error by adding together the individual prepackage errors determined in i.
- iii. Divide the total prepackage error by the sample size to calculate the average error.
- iv. Evaluate the sample for compliance, and:
 - if the average error in iii. is zero or a positive number, the inspection lot passes, or
 - if the average error is a negative number, proceed to v.
- v. Compute the standard deviation of the individual prepackage errors found in i.
- vi. Compute the sample error limit by multiplying the standard deviation, determined in v, with the sample correction factor given in column 3 of Table 2 or Table 3, as applicable, for the relevant sample size given in column 2.
- vii. Correct the average error by adding the sample error limit determined in vi. to the average error and evaluate the sample for compliance:
 - if the corrected average error is zero or a positive number, the inspection lot passes, or
 - if the corrected average error is a negative number, the inspection lot fails.

5.10 Characteristics of inspection lots and sampling plans

Inspection batch (lot) sizes is determined as follows at the premises of a packer when hourly production is known:

- when hourly production exceeds 10 000 units – the batch size shall equal one hour's production, irrespective of actual size per hour.
- when hourly production is 10 000 units or less – the lot size shall not exceed 10 000 pre-packages irrespective of actual size of production, and therefore will be defined as 10 000 units.

The legal metrology official will use this inspection lot size to determine which of the sampling plans in Tables 2 and 3 will be used to determine the sample size, sample correction factor, and number of prepackages permitted to have T errors.

Table 2 should be used for all prepackages, provided that, when the prepackages are destroyed in order to carry out the test, and if absolutely necessary for economic or practical reasons that a smaller sample size is required, Table 3 may be used.

In the case of inspection lots of less than 100 prepackages, sampling should not be utilised and 100% of the inspection lot should be measured.

Table 2. Sampling plan for non-destructive testing

1	2	3	4
Number of prepackages in an inspection lot	Number of prepackages in the sample (sample size)	Sample correction factor Sample correction factor X standard deviation of the sample (s) = sample error limit (see 6)	Number of prepackages in a sample permitted to have T errors
100 to 500	50	0,379	3
501 to 3 200	80	0,295	5
More than 3 200	125	0,234	7

Table 3. Sampling plan for destructive testing

1	2	3	4
Number of prepackages in an inspection lot	Number of prepackages in the sample (sample size)	Sample correction factor Sample correction factor X standard deviation of the sample (s) = sample error limit (see 6)	Number of prepackages in a sample permitted to have T errors
100 and above	20	0,640	1

6. INSPECTION PROCEDURE OUTLINE USED BY LEGAL METROLOGY OFFICIAL FOR THE DETERMINATION OF THE QUANTITY IN PREPACKAGES

The following procedures, as applicable, are used by legal metrology officials in verifying the quantity of product in prepackages, but they are not recommended for use in the quantity control processes of the packer. Packers are advised to develop their own sampling plans and procedures that will ensure the accuracy of content of prepackages for quantity control purposes.

6.1 General

Section 6 gives an example of inspection procedures used by legal metrology officials for checking the quantity of product in prepackages.

6.2 Outline procedure with an example

A manufacturer produces 500 prepackages per hour with a nominal quantity of 100 g. The inspector will be using sampling to determine the compliance of the manufactured inspection lot.

6.2.1 Define the inspection lot.

The inspection lot of 500 prepackages per hour is identified in Table 2 as an inspection lot falling between 100 to 500.

6.2.2 Where sampling of the inspection lot to determine compliance is to be carried out, determine a sample size appropriate for the inspection lot from column 1 of Table 2.

As per Table 2 for an inspection lot of 500, the number of prepackages to be sampled by the inspector is identified as 50 prepackages.

6.2.3 Determine the tolerable deficiency (T), if any, appropriate for the nominal quantity (quantities) of the prepackage.

In accordance with Table 1, based on the nominal quantity of 100 g, the tolerable deficiency allowed for the individual prepackage is determined as 4.5 g.

6.2.4 Determine the number of prepackages equal to 2,5% of the inspection lot that are allowed to have a T error. Where sampling will be used, determine the number of prepackages allowed to have a T error from column 4 of Table 2.

As per Table 2, the number of prepackages in this sample permitted to have T errors is 3.

6.2.5 Measure and record the net quantity of each prepackage.

Use suitable measuring instrument for the purpose of determining the net quantity for each prepackage. Various methods are available for this purpose, namely gravimetric or volumetric (see SANS 458 Annex B, clauses B.3 and B.4).

The following results (in gram) were recorded for the sample:

102	99	99	96	96
103	101	102	97	93
98	104	104	96	97
103	100	91	97	99
102	95	99	109	96
97	99	98	96	96
96	103	103	98	97
100	101	98	97	96
99	97	107	98	98
98	96	104	96	99

where

Net mass of prepackage
(packing material removed)

6.2.6 Determine the individual prepackage error.

102 +2	99 -1	99 -1	96 -4	96 -4
103 +3	101 +1	102 +2	97 -3	93 -7
98 -2	104 +4	104 +4	96 -4	97 -3
103 +3	100 0	91 -9	97 -3	99 -1
102 +2	95 -5	99 -1	109 +9	96 -4
97 -3	99 -1	98 -2	96 -4	96 -4
96 -4	103 +3	103 +3	98 -2	97 -3
100 0	101 +1	98 -2	97 -3	96 -4
99 -1	97 -3	107 +7	98 -2	98 -2
98 -2	96 -4	104 +4	96 -4	99 -1

where

Net mass of prepackage
Individual prepackage error

6.2.7 Determine if the inspection results comply with the individual prepackage requirement.

6.2.7.1 In the case of prepackages where no tolerable deficiency is allowed, the inspection lot fails if any prepackage is found to have a negative error.

If the prepackages measured comply with this requirement, the average of the sample will be correct and there is no need to carry out any further evaluation.

6.2.7.2 In the case of prepackages where a tolerable deficiency is prescribed, compare all negative individual prepackage errors obtained in 6.2.6 with the value(s) for T determined in 6.2.3, and the number of prepackages allowed to have a T error as determined in 6.2.4, and proceed as follows:

- if the number of prepackages that have a T error exceeds the number determined in 6.2.4, the inspection lot fails; or
- if any prepackage has a $2T$ error, the inspection lot fails; or
- if the prepackages for which a tolerable deficiency is prescribed comply with this requirement, proceed to 6.2.8.

102 +2	99 -1	99 -1	96 -4	96 -4
103 +3	101 +1	102 +2	97 -3	93 -7
98 -2	104 +4	104 +4	96 -4	97 -3
103 +3	100 0	91 -9	97 -3	99 -1
102 +2	95 -5	99 -1	109 +9	96 -4
97 -3	99 -1	98 -2	96 -4	96 -4
96 -4	103 +3	103 +3	98 -2	97 -3
100 0	101 +1	98 -2	97 -3	96 -4
99 -1	97 -3	107 +7	98 -2	98 -2
98 -2	96 -4	104 +4	96 -4	99 -1

where

Net mass of prepackage
Individual prepackage error

Determine how many pre-packages have a T error?
Three (3) x T errors (highlighted in green).

From Table 2, for an inspection lot of 100 to 500, the number of prepackages allowed to have T errors is 3. The inspection lot therefore complies with this requirement.

How many pre-packages have a $2T$ error?

None of the prepackages have a $2T$ error, and therefore the inspection lot complies with this requirement. If the inspection lot had one or more $2T$ errors, this inspection lot would have failed.

Proceed to 6.2.8

6.2.8 Determine if the inspection results comply with the average prepackage requirement, following the steps in 6.2.8.1 or 6.2.8.2 to 6.2.8.5, as applicable.

6.2.8.1 Where sampling is not used and all prepackages in the inspection lot are measured, calculate the total prepackage error by adding together the individual prepackage errors determined and evaluate for compliance.

If the total prepackage error is:

- a) equal to zero or a positive number, the inspection lot passes, or
- b) a negative number, the inspection lot fails.

The requirements of 6.2.8.1 would not be applicable in this case because sampling is used in this example.

Example to explain the requirement of 6.2.8.1 where sampling is not used (full population of production):

A manufacturer produces only 25 prepackages per hour with a nominal quantity of 100 g.

The legal metrology official was not able to do sampling, due to the fact that so few packages were produced and the official therefore tested all prepackages manufactured in one hour to determine their compliance.

The following results were recorded for the 25 prepackages:

102 +2	99 -1	99 -1	96 -4	96 -4
103 +3	101 +1	102 +2	97 -3	93 -7
98 -2	104 +4	104 +4	96 -4	97 -3
103 +3	100 0	91 -9	97 -3	99 -1
102 +2	95 -5	99 -1	109 +9	96 -4

where

Net mass of prepackage
Individual prepackage error

Total prepackage error = sum of individual prepackage errors = -22 g.
This is a negative number, and thus the batch fails. $(-22 \text{ g} / 25 = -0,88 \text{ g})$.

6.2.8.2 Where sampling of the inspection lot is used to determine compliance, carry out the following procedure:

- calculate the total prepackage error by adding together the individual prepackage errors determined; and
- divide the total prepackage error by the sample size to calculate the average error.

From 6.2.6:

102 +2	99 -1	99 -1	96 -4	96 -4
103 +3	101 +1	102 +2	97 -3	93 -7
98 -2	104 +4	104 +4	96 -4	97 -3
103 +3	100 0	91 -9	97 -3	99 -1
102 +2	95 -5	99 -1	109 +9	96 -4
97 -3	99 -1	98 -2	96 -4	96 -4
96 -4	103 +3	103 +3	98 -2	97 -3
100 0	101 +1	98 -2	97 -3	96 -4
99 -1	97 -3	107 +7	98 -2	98 -2
98 -2	96 -4	104 +4	96 -4	99 -1

where

Net mass of prepackage
Individual prepackage error

The total pre-package error calculated = -55 g.

The average error = total pre-package error divided by the sample size of 50 = -1,10 g.

6.2.8.3 Evaluate the average error in 6.2.8.2(b) for compliance.

If the average error is:

- a) equal to zero or a positive number, the inspection lot passes, and no further action is necessary, or
- b) a negative number, proceed as in 6.2.8.4.

The average error is a negative number (-1,10 g), and we therefore need to proceed to 6.2.8.4.

6.2.8.4 Correct the average error as follows:

- a) compute the standard deviation of the individual prepackage errors determined in 6.2.6; and
- b) compute the sample error limit by multiplying the standard deviation determined in 6.2.8.4(a) with the sample correction factor given in column 3 of Table 2 or Table 3, as applicable, for the relevant sample size given in column 2; and
- c) correct the average error by adding the sample error limit determined in 6.2.8.4(b) to the average error 6.2.8.2, and evaluate the sample for compliance in accordance with 6.2.8.5.

From 6.2.6:

The standard deviation is calculated using the following formula:

$$\sigma = \sqrt{\frac{(x_1^2 + x_2^2 + x_3^2 + \dots + x_n^2) - [(x_1 + x_2 + x_3 + \dots + x_n)^2 / n]}{n - 1}}$$

Prepackage number	Net quantity	Declared quantity	Error	Error to the power of 2
1	102	100	2	4
2	99	100	-1	1
3	99	100	-1	1
4	96	100	-4	16
5	96	100	-4	16
6	103	100	3	9
7	101	100	1	1
8	102	100	2	4
19	97	100	-3	9
10	93	100	-7	49
11	98	100	-2	4
12	104	100	4	16
13	104	100	4	16
14	96	100	-4	16
15	97	100	-3	9
16	103	100	3	9
17	100	100	0	0
18	91	100	-9	81
19	97	100	-3	9
20	99	100	-1	1
21	102	100	2	4
22	95	100	-5	25
23	99	100	-1	1
24	109	100	9	81
25	96	100	-4	16
26	97	100	-3	9
27	99	100	-1	1
28	98	100	-2	4
29	96	100	-4	16
30	96	100	-4	16
31	96	100	-4	16
32	103	100	3	9

Prepackage number	Net quantity	Declared quantity	Error	Error to the power of 2
34	103	100	3	9
34	98	100	-2	4
35	97	100	-3	9
36	100	100	0	0
37	101	100	1	1
38	98	100	-2	4
39	97	100	-3	9
40	96	100	-4	16
41	99	100	-1	1
42	97	100	-3	9
43	107	100	7	49
44	98	100	-2	4
45	98	100	-2	4
46	98	100	-2	4
47	96	100	-4	16
48	104	100	4	16
49	96	100	-4	16
50	99	100	-1	1
Sum of errors			-55	
Sum of the errors to the power of 2				641

$$\sigma = \sqrt{\frac{(641) - [(-55)^2 / 50]}{50-1}}$$

$$\sigma = \sqrt{\frac{(641) - [60,5]}{49}}$$

$$\sigma = \sqrt{11,8469388}$$

$$\sigma = 3,441938$$

Compute the sample error limit by multiplying the standard deviation with the sample correction factor given in column 3 of Table 2 or Table 3, as applicable, for the relevant sample size given in column 2.

Sample correction factor in Table 2 for 50 samples = 0,379.

Sample error limit = $\sigma \times \text{sample correction factor} = 3,441938 \times 0,370 = 1,3044$.

Now correct the average error by adding the sample error limit to the average error.

Corrected average error = average error + sample error limit = $-1,10 + 1,3044 = 0,2044$.

6.2.8.5 If the corrected average error is

- a) zero or a positive number, the inspection lot passes, or
- b) a negative number, the inspection lot fails.

The corrected average error is 0,2044, a positive number, and the lot therefore passes.

6.3 Special procedures for quantity determination by gravimetric means

Gravimetric method means that a mass measurement is used to determine the quantity of a volume using the density and the following formula:

$$\rho \text{ (density)} = \frac{m}{v}$$

6.3.1 Determination of the net quantity of product and the average mass of packing material

6.3.1.1 When non-destructive testing is undertaken, it is necessary to subtract the mass of the packing material from the actual gross mass of the prepackage to determine the net quantity of product therein. The average mass of the packing material is used if the criteria in Table 4 are complied with.

Determine the net quantity of product Q_p using the following equation:

$$Q_p = Q_g - QT.$$

where

Q_p is the net quantity of product;

Q_g is the gross mass of the prepackage; and

QT is the average tare mass of the packing material.

Packing material / tare / packaging/ packaging material is everything of the prepackage that is meant to be left over after use of the product, except for items naturally contained in the product

6.3.1.2 Determine the average mass of the packing material by the following the steps in 6.3.1.2.1 to 6.3.1.2.7.

6.3.1.2.1 Unused packing material of the same type may be used for the prepackages being inspected. Packing material that has been used as part of a prepackage, and has been separated from the product and cleaned using normal household procedures, may also be used.

6.3.1.2.2 Packing material used for the average mass determination shall be clean and dry.

Note: The packing material should not be dried in an oven.

6.3.1.2.3 Randomly select an initial tare sample of 10 or more packing materials (e.g., from the sample taken from an inspection lot or from a lot of unused packing materials at the point-of-pack), and measure the mass of each packing material.

When packing material from the inspection lot is used, first measure and record the gross mass of each prepackage to be opened for tare determination for use in 6.3.1.2.5.

From our previous example in 6.2.6, we are using the option to first measure and record the gross mass of each package to be opened for tare determination:

110.9	107.7	108.1	105.3	105.5
102	99	99	96	96
8.9	8.7	9.1	9.3	9.5
113.1	109.8	111.6	105.9	101.6
103	101	102	97	93
10.1	8.8	9.6	8.9	8.6

where

Gross mass of prepackage Net mass of prepackage Mass of empty packing material
--

6.3.1.2.4 Where prepackages are filled with a protective gas, this forms part of the packing material and where prepackages are sealed under a vacuum, this will affect the actual net mass determination. First measure, in both cases, each prepackage in the sample selected as a tare sample in 6.3.1.2.3 with the packing material in its normal state, ready for sale. Puncture the prepackage (packing material) to allow the contents to attain atmospheric pressure and again measure each prepackage in the sample. Determine the effect of the gas or vacuum, as applicable, by subtracting the mass of each punctured prepackage from the mass of the respective sealed prepackage. Determine the effect of the gas or the vacuum by using the following equation:

$$A = B - C$$

where

A is the effect of the gas or the vacuum;

B is the mass of the sealed prepackage; and

C is the mass of the punctured prepackage.

Determine the average mass of the effect of the gas or the vacuum, and add this algebraically to the mass of the average tare value determined in accordance with 6.3.1.2.5 and Table 4, as applicable (i.e., added gas will increase the tare value, and vacuum will reduce the tare value).

6.3.1.2.5 Add together the individual packing material masses determined in 6.3.1.2.3 and divide by the number of samples to determine the average tare mass (ATM).

Inspection lot number	Gross mass	Net mass	Mass of empty packing material
1.	110.9 g	102 g	8.9 g
2.	107.7 g	99 g	8.7 g
3.	108.1 g	99 g	9.1 g
4.	105.3 g	96 g	9.3 g
5.	105.5 g	96 g	9.5 g
6.	113.1 g	103 g	10.1 g
7.	109.8 g	101 g	8.8 g
8.	111.6 g	102 g	9.6 g
9.	105.9 g	97 g	8.9 g
10.	101.6 g	93 g	8.6 g
Total	1079.5 g	988 g	91.5 g
Average tare mass – ATM			9.15 g

Calculate the sample standard deviation of the initial tare sample and proceed in accordance with one of the criteria in Table 4.

Table 4. Criteria for the determination of tare mass

If	Then
The ATM is equal to or less than 10 % of the nominal quantity of product	Use the ATM to determine the actual quantity of product in the prepackages in accordance with 6.3.1.2.6
The ATM exceeds 10 % of the nominal quantity, and the standard deviation determined in 6.3.1.2.5 is equal to or less than 0,25T	Use a total of 25 packing materials to compute the ATM and determine the actual quantity of product in the prepackages in accordance with 6.3.1.2.6
The ATM exceeds 10 % of the nominal quantity, and the standard deviation determined in 6.3.1.2.5 exceeds 0,25T	An ATM cannot be used. It is necessary to determine and use each individual tare mass (destructive testing). Determine the actual quantity of product in each prepackage in accordance with 6.3.1.2.6

6.3.1.2.6 Measure the individual prepackage gross mass and subtract the average mass of the packing material determined in 6.3.1.2.5 or the actual mass of each packing material, as applicable, (see Table 4 for criteria) to determine the actual net mass of the prepackages.

10 % of the nominal quantity of the product = $0.1 \times 100 \text{ g} = 10 \text{ g}$

The ATM determined was 9.15 g. The ATM determined (9.15 g) is thus equal to or less than 10 % of the nominal quantity of the product determined (10 g).

Therefore the ATM determined for the 10 prepackages can be used to calculate the quantity of the product in all the prepackages in the lot.

In this case it is also not necessary to calculate the sample standard deviation of the initial tare sample.

If the ATM calculated exceeds 10 % of the nominal quantity of the product, the criteria of the next row of Table 4 shall be evaluated.

For this purpose, the standard deviation determined in 6.3.1.2.5 is required.

If the standard deviation determined in 6.3.1.2.5 is equal to or less than 0,25T, a total of 25 packing materials will need to be used to compute the ATM.

Thus, an additional 15 packing materials will have to be emptied to determine the ATM.

Note: In this case it would have been more cost and time effective to do destructive testing.

6.3.1.2.7 Determine the actual error of each prepackage by subtracting the nominal quantity from the actual net mass of each prepackage.

6.4 Special procedures for quantity determination by volumetric means

If necessary and the required accuracy of measurement can be achieved, determine the net quantity of individual prepackages in 6.2.5 by making use of a certified volumetric measure. This method is not recommended for liquids with characteristics that do not allow complete draining from the packing material. The requirements in 6.4.1 to 6.4.4 apply when this method is used.

6.4.1 Requirements for use of volumetric measures

6.4.1.1 Volumetric measures calibrated as wet (delivery) measures (usually marked "Ex" on the measure to indicate that it was wetted with water before calibration) shall be used as follows: a) before initial use, wet the measure by filling it at least to the prepackage nominal quantity with water, empty and drain for the drainage period specified on the calibration certificate; and b) after every measurement, empty the liquid that has been measured, rinse the volumetric measure with water and drain for the drainage time specified on the calibration certificate, before each subsequent measurement.

Note: In this case the liquid being measured should preferably be compatible with water to avoid an unwanted reaction with the water used to wet the measure before testing.

6.4.1.2 Volumetric measures calibrated as dry (container) measures (usually marked "In" on the measure to indicate that it was dry when calibrated) shall be used as follows:

- a) before initial use, ensure that the volumetric measure is completely dry; and
- b) after every measurement, empty the liquid that has been measured, rinse the volumetric measure with water and dry before the next measurement.

6.4.2 Temperature of measurement

Before measurement, stabilize the liquid at the reference temperature specified in 4.9. Should this not be practical, use the coefficient of expansion of the liquid being measured to correct the volume at the temperature of measurement to volume at the specified reference temperature.

6.4.3 Emptying of prepackages

Drain the contents of prepackages into the volumetric measure as completely as possible. Any method may be used to facilitate draining, provided that it does not affect the characteristics or quantity of the liquid, and that any change in temperature is taken into account.

6.4.4 Determination of individual prepackage error

Determine the individual prepackage error by subtracting the nominal quantity (Q_n) of the prepackage from the actual net quantity as measured using the volumetric measure.

NOTES

[illegible]

ABOUT THE PROJECT

This publication is sponsored by the project "Strengthening the quality of essential and vegetable oils exports from South Africa," within the framework of UNIDO-SECO Global Quality and Standards Programme (GQSP).

The Global Quality and Standards Programme (GQSP) is a large-scale programme, which was designed to encourage systematic trade development along specific value chains by strengthening quality infrastructure institutions and service providers, enhancing the compliance capacity of private sector actors, particularly SMEs, and creating a culture of quality among all stakeholders. The GQSP is funded by the Swiss Confederation, through the Swiss State Secretariat for Economic Affairs (SECO) and implemented by UNIDO.

The objective of the GQSP South Africa (GQSP-SA) project is to strengthen the quality and standards compliance capacity to facilitate market access for SMEs in the essential and vegetable oils value chain destined for food, health and cosmetic markets.

This publication provides valuable information to the reader on one element of quality infrastructure, namely legal metrology as it applies to the essential and vegetable oils industry.

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