

SADCMEL

DOCUMENT 4

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 of prepackages.

FOREWORD

This document covers requirements normally regulated by Legal Metrology legislation for measurement accuracies pertaining to service delivery or when goods are measured for sale and is not concerned with other regulations such as those pertaining to tolerances for specified ingredients etc. It is based on the requirements of the International Organisation of Legal Metrology (OIML) Recommendation R87 "Quantity of Product in prepackages". It was drafted with input from all member countries and associate members with the aim of harmonising technical regulations pertaining to the accuracy of legal measurements and the removal of barriers to trade within the SADC Region, as required by the SADC Protocol on Trade.

Included in the document are tolerance and related requirements including inspection methods for all measurements, which reflect the needs of Legal Metrology authorities within the SADC Region. This document is thus a complete set of requirements covering all types of measurements irrespective of their application in the market place or the place or time of measurement.

It was agreed at the 17th SADCMEML meeting on 3 May 2005 to accept this document as a final document.

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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 of prepackages.

1 Scope

This Standard specifies Legal Metrology requirements for:

- 1.1 Accuracy of measurements regulated by legal metrology legislation including the measurement of goods when measured at the time of sale or when prepackaged in constant or random (non-constant) nominal quantities of mass, volume, linear measure, area, or count.
- 1.2 Sampling plans and procedures for use by legal metrology officials in verifying the quantity of product in prepackages.
NOTE: The sampling plans are not suitable for use in the quantity control processes of packers.
- 1.3 Examination of the quantity of product in prepackages including determination of average tare masses, the drained quantity of products in a liquid medium, and the actual quantity of frozen products.
- 1.4 Special conditions pertaining to products that may lose moisture (desiccating) after packing and foodstuffs in a liquid medium that is not intended to be consumed.

NOTE: The requirements in this Standard are based on the international recommendations specified in OIML R 87 and are applicable in the SADC Region. Packers for export outside of the SADC Region are advised to familiarise themselves with the requirements of the country of intended export.

2 Normative References

OIML R 87 "Quantity of product in prepackages"

3 Definitions

- 3.1 Actual quantity – The actual quantity of product that a prepackage in fact contains as determined by measurements made by legal metrology officials.
- 3.2 Average error – The sum of individual prepackage errors considering their arithmetic sign divided by the number of prepackages in the sample.
- 3.3 Content of a prepackage – The actual quantity of product in a prepackage.

- 3.4 Inadequate prepackage (also called a non-conforming prepackage) – A prepackage with an individual prepackage quantity less than the nominal quantity (also called a negative error).
- 3.4.1 An inadequate prepackage found to contain an actual quantity less than the nominal quantity minus the applicable tolerable deficiency (T) but not less than twice the applicable tolerable deficiency ($2T$) for the nominal quantity, is deemed to have a $T1$ error (see 3.15).
- 3.4.2 An inadequate prepackage found to contain an actual quantity less than the nominal quantity minus twice the applicable tolerable deficiency (T) for the nominal quantity, is deemed to have a $T2$ error (see 3.15).
- 3.5 Individual prepackage error – The difference between the actual quantity of product in a prepackage and its nominal quantity.
- 3.6 In-service maximum permissible error – The maximum permissible error allowed on an instrument when in service and used for measurements regulated by legal metrology legislation.
- 3.7 Inspection lot (also called a “batch”) - A 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 conformance with specified criteria for acceptance or rejection of the inspection lot as a whole.
- 3.8 Nominal Quantity (Q_n) - The quantity of product in a prepackage declared on the label.
- 3.9 Non-automatic instrument – An instrument that requires the intervention of the operator during the measurement process to determine the measurement result or to decide that it is acceptable.
- A non- automatic instrument may be:
- Electronic, mechanical or a combination of the two as applicable
 - Graduated or non-graduated
 - Self-indicating, semi self indicating or non self-indicating
- 3.10 Packing material (also called tare, packaging or packaging material) - Everything of the prepackage that is meant to be left over after use of the product, except for items naturally in the product. Use includes consumption or subjecting to a treatment.
NOTE: Packing material is generally used to contain, protect, handle, deliver, preserve, transport, display, inform about and serve as an aid (e.g., food serving tray) while using the product it contains.
- 3.11 Prepackage - Combination of a product and any packing material in which it is prepacked.
- 3.12 Prepackaged product - Any commodity that is made up as a unit or entity and for which its quantity has been determined and indicated on its label prior to being offered for sale irrespective of whether such unit or entity is enclosed in a container, wrapped in any manner or unenclosed.

- 3.13 Random sampling – Sample prepackages are chosen randomly (i.e., they all have the same probability to be included in the sample).
- 3.14 Sample size (n) – The required number of prepackages taken from an inspection lot and used to provide information that will serve as the basis for a decision on the conformance of the inspection lot.
- 3.15 Tolerable deficiency (T) (also called the tolerable negative error) – The deficiency in quantity of product permitted in a prepackage (see 3.4).
- 3.16 Valid verification status – The status of a measuring instrument that conforms to all the legal metrology requirements for initial and/or subsequent verification.

4. Metrological requirements

4.1 General

4.1.1 Goods to be sold by net quantity

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 this standard or any other applicable legal metrology legislation.

4.1.2 All quantity markings to comply

The requirements of this standard apply to all quantities marked on a prepackage in accordance with any legal metrology legislation prescribing requirements for the labelling of prepackages or otherwise indicated at the time of measurement including any supplementary statements of quantity unless appropriately qualified.

4.2 General measurements and the measurement of goods at the time of sale

- 4.2.1 A suitable instrument shall be used for any measurement regulated by legal metrology legislation including quantities of goods when taken from bulk and measured at the time of sale (see 4.4 for suitability of instruments).
- 4.2.2 The quantities referred to in 4.2.1 shall not be deficient of the quantity represented, indicated or marked unless such deficiency is due to an error on the instrument used and is within the permitted maximum error for such instrument at the point of measurement.

4.3 Prepackages made up for sale on the retail premises from which they are sold

- 4.3.1 The net quantity of the product in prepackages, made up for sale on the retail premises from which they are sold by individually measuring each package, shall be determined by means of a suitable measuring instrument conforming to the requirements of 4.4 unless the requirements of 4.3.3 apply. If the instrument

used for the prepackaging is not available to consumers, another suitable non-automatic measuring instrument shall be made available to consumers for checking the quantity of such prepackages.

- 4.3.2 The quantity of the product in the prepackages referred to in 4.3.1 shall not be deficient of the net quantity represented, indicated or marked unless such deficiency is due to an error on the instrument used and is within the maximum error permitted for such instrument. The packer shall not exploit the permitted tolerances on instruments. The average and individual prepackage requirements in 4.5.2 and 4.5.3 do not apply. Unless otherwise exempted, prepackers shall make allowance for a possible shrinkage or loss of quantity after packing to ensure that prepackages comply with all requirements of this standard at the time of sale to consumers.
- 4.3.3 Where prepackages are made up on a retail premises for distribution and sale on another premises the requirements of 4.5 apply to such prepackages. In the case where such packages are also sold on the premises where they are prepacked a suitable non-automatic measuring instrument, as specified in 4.4, shall be made available to consumers for checking the quantity of such prepackages.
- 4.3.4 The requirements of 4.3.1 and 4.3.2 shall not apply to bread sold by mass and baked in the retail for sale on the premises at which baked, which shall comply with the requirements of 4.5. In this case a suitable non-automatic measuring instrument, as specified in 4.4, shall be made available to consumers for checking the quantity of such bread.

4.4 Suitability of instruments

An instrument used for measuring in terms of 4.2.1, 4.3.1 and the instrument for checking in terms of 4.3.1 and 4.3.3 shall be an instrument that fulfils the following conditions.

- a) It shall be of an approved type if type approval is required by legislation.
- b) It shall have a valid verification status.
- c) The permitted in-service maximum permissible error for the quantity measured shall not exceed the applicable tolerable deficiency (T) in Table A.1a) or b) for the goods being measured.
- d) It shall not be used below any minimum quantity permitted to be measured as specified in type approval documentation or any other applicable legislation.
- e) Instruments used in terms of 4.2.1 and for checking purposes in terms of 4.3.1 and 4.3.3 shall be of a type permitted by legislation for direct sales to the public.

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

- 4.5.1 Prepackages other than those referred to in 4.3.1 but including those made up on a retail premises for which the requirements of 4.3.3 apply, shall meet the applicable requirements of this Standard at any level of distribution including at the point-of-pack, 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 a possible shrinkage or loss of quantity after packing.

4.5.2 Average requirement – For 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. For 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 total nominal quantity.

Note: If compliance to this requirement is determined by sampling an inspection lot (see 5.4.4), the criteria for statistically valid results and method of application prescribed in 5.4 are applicable.

4.5.3 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 Annex A for applicable tolerable deficiencies).

Prepackages for which tolerable deficiencies are prescribed shall conform to the following requirements:

a) Not more than 2.5% of prepackages shall have a negative error greater than the tolerable deficiency prescribed in Annex A, as applicable (*T1* error).

Note: If the actual quantity of product in prepackages is estimated by sampling an inspection lot according to the requirements of 5.4.4, the relevant criteria for acceptance of the inspection lot prescribed in Column 4 of Table 1a) or b), are applicable.

b) No prepackage shall have a negative error greater than twice the tolerable deficiency prescribed in Annex A, Table A.1a) or b), as applicable (*T2* error).

4.6 Prepackaged products with special allowances for loss of quantity

4.6.1 The products specified in Annex A, Tables A.2 and A.3, when packed by mass in packages that are not hermetically sealed, shall comply with the requirements of 4.3.2 or 4.5, as applicable, for at least:

a) For the goods specified in Table A.2, 7 days after the day of packing; or

b) For the goods specified in Table A.3, 12 hours after packing or baking as applicable, or up until delivery by the packer or baker to a dealer for resale or to an end user in the case of direct sale to an end user, whichever is the longer period.

After the elapse of this period the individual package deficiency may be exceeded due to moisture loss and the average requirement need not be fulfilled.

4.6.2 Wine and other alcoholic beverages when packed in a container, or having an enclosure, that is not moisture retaining, shall comply with the requirements of 4.3.2 or 4.5 for at least 12 months after the month of packing.

4.7 Prepackaged foodstuffs on which the drained mass shall be indicated

4.7.1 When a solid foodstuff is packed in a liquid medium prescribed in 4.7.2, the drained net mass of the foodstuff shall be indicated on the label in addition to the total net mass and the drained net mass shall conform to the requirements in 4.5. Annex C gives the method of determining the drained mass.

4.7.2 A liquid medium means the following products, possibly in mixtures and also where frozen or quick-frozen, provided that the liquid is merely an adjunct to the essential elements of that preparation and is thus not a decisive factor for the purchase:

- a) aqueous solutions of food acids,
- b) aqueous solutions of salts,
- c) aqueous solutions of sugars,
- d) aqueous solutions of other sweetening substances,
- e) brine,
- f) fruit or vegetable juices in the case of fruit or vegetables,
- g) mixtures of edible oil and water
- h) vinegar,
- i) water.

Savoury sauces, such as tomato sauce or gravy, are not included and products packed in these need not be marked with their drained mass.

4.8 Tolerable deficiencies

Tolerable deficiencies are prescribed in Annex A.

4.8.1 Table A.1a) specifies the tolerable deficiencies (*T*) for all prepackages not mentioned in Table A.1b).

4.8.2 Table A.1b) specifies tolerable deficiencies for specific products.

4.8.3 Table A.2 specifies the desiccating products to which the requirements of 4.6 apply.

4.9 Standard reference temperatures for prepackaged liquid products

Unless otherwise specified in applicable legislation, liquid products packed in accordance with the requirements of 4.5 and marked with a quantity by volume shall comply with applicable requirements when at a temperature of 20 °C and products that need to remain frozen to maintain their consistency for intended use shall comply with applicable requirements when at the temperature required to maintain their consistency. Liquid products packed according to the requirements of 4.3 shall comply with applicable requirements at the temperature at which measured.

4.10 Frozen or glazed products

- 4.10.1 In cases where products in prepackages are frozen with added water or glazed to preserve their quality, any excess ice or the glaze shall be regarded as packing material when determining the net quantity of the prepackages. Annex D prescribes the method of determining the net quantity of prepackages in which the product is frozen or glazed.
- 4.10.2 Where other applicable legislation makes provision for the net mass to include moisture (including liquids such as brine) absorbed during the processing and freezing of the product, to a prescribed maximum limit, the actual moisture loss between the frozen and unfrozen prepackage up to the maximum prescribed limit, shall be taken into consideration when the error on such prepackage is determined. This is only applicable in cases where products are thawed according to the requirements of annex D before inspection.
- 4.10.3 In the case of frozen products, if no water is added at the time of freezing, the net mass shall be determined in the frozen state exclusive of packing material.

5. Reference test for metrological requirements for prepackages

The following requirements, as applicable, shall be used for the inspection of all prepackages provided that the requirements of section 4. of this Standard are respected.

NOTE: The requirements in 5.3 and 5.4 are based on the statistical principles of control given in Annex E.

5.1 Inspection procedures

The prescribed tests shall be performed in accordance with quality acceptance inspection by sampling prepackages at any level of distribution including at the point-of-pack, import, distribution and wholesale transactions, and sale. Relevant test procedures are given in Annexes B, C and D. 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 meet the requirements of this or any other Standard.

5.2 Accuracy of measurement

- 5.2.1 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 for 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. Irrespective of the method used the uncertainty of measurement when measuring the actual content of a prepackage shall not exceed $0,2 T$ of the prepackage being measured.

- 5.2.2 When inspecting measurements made in terms of 4.2 or prepackages made up in compliance with 4.3, the errors on the instruments used for the respective measurements shall be taken into consideration. Should these instruments comply with the requirements of 4.4 they may be used to measure the goods being inspected if this is practical.

5.3 Procedure for inspecting the average requirement when sampling prepackages

When compliance with the average requirement in 4.5.2 is determined by means of sampling an inspection lot, the following procedure shall be used.

- 5.3.1 Determine the actual error on each prepackage in the selected sample.
- 5.3.2 Calculate the total prepackage error by adding together the individual prepackage errors determined in 5.3.1.
- 5.3.3 Divide the total prepackage error by the sample size to calculate the average error.
- 5.3.4 Evaluate the sample for compliance.
- a) If the average error in 5.3.3 is zero or a positive number the inspection lot passes.
 - b) If the average error is a negative number proceed to 5.3.5.
- 5.3.5 Compute the standard deviation of the individual prepackage errors found in 5.3.1.
- 5.3.6 Compute the sample error limit by multiplying the standard deviation determined in 5.3.5 by the sample correction factor given in column 3 of Table 1 a) or b), as applicable, for the relevant sample size given in column 2.
- 5.3.7 Correct the average error by adding the sample error limit determined in 5.3.6 to the average error and evaluate the sample for compliance.
- a) If the corrected average error is zero or a positive number the inspection lot passes.
 - b) If the corrected average error is a negative number the inspection lot fails.

5.4. Characteristics of inspection lots and sampling plans

When compliance of prepackages is determined by means of sampling an inspection lot, the following criteria shall be used to determine the characteristics of the inspection lot, the sample size, sample correction factor and number of prepackages permitted to have $T1$ errors.

- 5.4.1 Inspection lots shall be assumed to be homogeneous if there is no indication to the contrary.
- 5.4.2 Sample prepackages shall be selected using random sampling.

5.4.3 An inspection lot taken from the production line shall consist of all prepackages not rejected by a checking system. Care shall be taken to prevent other than normal operating adjustments or other corrective actions in the production and prepackage filling process. Sample prepackages must be collected after the point of final checking by the packer.

When sample prepackages are:

- a) collected from the production line, the size of the inspection lot shall be equal to the maximum hourly output of the production line without any restriction as to the inspection lot size.
- b) not collected from the production line at the premises of the packer, and when:
 - i) the production line output exceeds 10 000 prepackages per hour, the size of the inspection lot shall be equal to the maximum hourly output of the production line without any restriction as to the inspection lot size, or
 - ii) the production line output is less than or equal to 10 000 prepackages per hour, the size of the inspection lot shall not exceed 10 000 prepackages.
- c) selected from an inspection lot at a location other than the premises of the packer or where the production line output can not be determined, the largest sample size prescribed in Table 1 a) or b) as applicable, shall be used.

5.4.4 The following sampling plans shall be used to determine the sample size, sample correction factor and number of prepackages permitted to have $T1$ errors. Table 1a) shall be used for all prepackages provided that when the prepackages must be destroyed in order to carry out the test and if absolutely necessary for economic or practical reasons a smaller sample size is required, Table 1b) may be used. For inspection lots of less than 100 prepackages, sampling shall not be utilised and 100% of the inspection lot shall be measured.

Table 1a)

Sampling Plan for non-destructive testing

Column 1	Column 2	Column 3	Column 4
Inspection lot size	Sample Size	Sample Correction Factor Sample Correction Factor X Standard Deviation of the sample (s) = Sample error limit (See 5.3.6)	Number of prepackages in a sample allowed to have <i>T1</i> errors
100 to 500	50	0.379	3
501 to 3200	80	0.295	5
More than 3 200	125	0.234	7

Table 1b)

Sampling Plan for destructive testing

Column 1	Column 2	Column 3	Column 4
Inspection lot size	Sample Size	Sample Correction Factor Sample Correction Factor X Standard Deviation of the sample (s) = Sample error limit (See 5.3.6)	Number of prepackages in a sample allowed to have <i>T1</i> errors
100 and above	20	0.640	1

Annex A

(Normative)

TOLERABLE DEFICIENCIES FOR PREPACKAGES AND PRODUCTS WITH SPECIAL REQUIREMENTS

Table A.1a)

Tolerable deficiencies in actual content for prepackages containing general products not otherwise specified in Table A.1b)

Nominal Quantity of Product (Q_n) in g or mL	Tolerable Deficiency (T) ^a	
	Percent of Q_n	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 g or mL for Q_n less than or equal to 1 000 g or mL and to the next whole g or mL for Q_n higher than 1 000 g or mL.		
Nominal Quantity of Product (Q_n) for all linear dimensions^b		
	Percent of Q_n	
Q_n of 5 m or less	No tolerable deficiency allowed	
Q_n greater than 5 m	2	
^b Includes all dimensions such as length, width, thickness, diameter and circumference etc.		
Nominal Quantity of Product (Q_n) in area		
	Percent of Q_n	
All Q_n	3	
Nominal Quantity of Product (Q_n) in count		
	Percent of Q_n	
Q_n of 50 items or less	No tolerable deficiency allowed	
Q_n greater than 50 items	1 ^c	
^c Compute the T value by multiplying the nominal quantity by 1 percent and rounding the result up to next whole number. The value may be larger than 1 percent due to the rounding but this is accepted because the products are whole items and cannot be divided.		
Nominal Quantity of Solids (Q_n) sold by cubic measure		
	Percent of Q_n	
All Q_n	2	

Table A.1b)

Tolerable deficiencies in actual content for prepackages containing specified products

ITEM	PRODUCT	TOLERABLE ERROR Percent of Qn	
		Deficiency	Excess
1	Bread (all types)	5%	10% applicable only to bread required to be sold by mass but exempted from a quantity indication
2	Fresh fruit and vegetables	5%	Unrestricted
3	Poultry packed in mass bands and with the nominal mass declared as the lowest mass in the band	0	Unrestricted
4	Industrial and medical gasses including dissolved gasses but excluding liquid petroleum gasses	5%	Unrestricted
5	Seed sold by number	Quantities not greater than 50 items = 0 Greater than 50 items but not greater than 1 000 items = 2% Greater than 1 000 = 4% (See applicable note in Table A.1a)	Unrestricted
6	Coal, anthracite, coke and charcoal	As prescribed in table A.1a)	10% applicable only when required to be sold by mass but exempted from a quantity indication.
7	Liquid Petroleum Gasses (Propane and Butane and mixtures thereof)	3%	Unrestricted
8	Sheet width and length for perforated rolls and width and total length for unperforated rolls of tissue paper which is sold as or under the name of toilet paper or which has the appearance of toilet tissue paper when wound in the form of a roll with a width not exceeding 140 mm	2%	Unrestricted

Table A.2

Products packed by mass that shall comply with the requirements of clause 4.6.1a)

ITEM	PRODUCT
1	Camphor
2	Carbonate of soda
3	Cheese
4	Dried fruit
5	Dried fish and dried meat products
6	Epsom salts
7	Fertilisers
8	Fresh fruit and vegetables excluding mushrooms
9	Pasta products
10	Seed
11	Seed potatoes
12	Soap (household and laundry bars)
13	Soap (flakes, powders and detergent powders)
14	Soap (toilet and medicinal)
15	Sorghum malt
16	Tobacco/ snuff
17	Twines/ cordage
18	Washing salts
19	Wool (knitting)
20	Yeast

Table A.3

Products packed by mass that shall comply with the requirements of clause 4.6.1b)

ITEM	PRODUCT
1	Bread (all types)
2	Cake and other flour confectionery
3	Mushrooms

Annex B

(Normative)

INSPECTION PROCEDURE OUTLINE FOR THE DETERMINATION OF THE QUANTITY IN PREPACKAGES

B.1 General.

This Annex gives inspection procedures for checking the quantity of product in prepackages packed in accordance with 4.5 and incorporates the applicable requirements of clause 5. It may be used as it is with due consideration of specific requirements prescribed for individual products or groups of products or to develop equivalent procedures more suitable to identified circumstances. Applicable requirement shall be used when inspecting prepackages packed in accordance with 4.3.2.

B.2 Procedure

B.2.1 Define the inspection lot according to 5.4.

B.2.2 Where sampling of the inspection lot to determine compliance is to be used, determine a sample size appropriate for the inspection lot from Column 1 of Table 1 a) or b) depending on whether or not destructive testing will be used.

NOTE: The sample size in Table 1 b) should only be used where absolutely necessary (see 5.4.4).

B.2.3 Determine the tolerable deficiency (T), if any, appropriate for the nominal quantity(ies) of the prepackages according to Annex A (see 4.8).

NOTE: Where random quantity prepackages are inspected the random quantities may fall within different ranges of tolerable deficiency and each prepackage will need to be compared with its respective tolerable deficiency in B.2.7.

B.2.4 Determine the number of prepackages equal to 2.5% of the inspection lot that are allowed to have a $T1$ error if sampling will not be used. Where sampling will be used determine the number of prepackages allowed to have a $T1$ error from Column 4 of Table 1a) or b) as applicable (see 4.5.3).

NOTE: This clause is ignored if the prepackages are allowed no deficiency.

B.2.5 Measure and record the net quantity of each prepackage. To determine the net quantity of certain prepackages the following procedures are applicable:

- a) B.3 gives requirements for inspection by gravimetric means including the determination of tare masses.
- b) B.4 gives requirements for inspection by volumetric means.
- c) B.5 gives requirements for inspecting linear measurements.
- d) Annex C gives requirements for determining the drained mass of a foodstuff that is packed in a liquid medium.
- e) Annex D gives requirements for determining the net quantity of prepackages containing frozen products with added water or glazed products.

B.2.6 Determine the individual prepackage error (see B.3, B.4 or B.5 as applicable).

B.2.7 Determine if the inspection results comply with the individual prepackage requirement in 4.5.3 as follows.

B.2.7.1 For prepackages where no tolerable deficiency is allowed the inspection lot fails if any prepackage is found to have a negative error in B.2.6. If the prepackages measured pass this requirement the average of the sample will be correct and there is no need to carry out any further evaluation.

B.2.7.2 For prepackages where a tolerable deficiency is prescribed, compare all negative individual prepackage errors obtained in B.2.6 with the value(s) for T determined in B.2.3 and the number of prepackages allowed to have a $T1$ error as determined in B.2.4.

- a) If the number of prepackages having a $T1$ error exceeds the number determined in B.2.4, the inspection lot fails.
- b) if any prepackage has a $T2$ error the inspection lot fails.

If the prepackages for which a tolerable deficiency is prescribed pass this requirement proceed to B.2.8.

B.2.8 Determine if the inspection results comply with the average prepackage requirement in 4.5.2.

B.2.8.1 Where sampling is not used and all prepackages in the inspection lot were measured, calculate the total prepackage error by adding together the individual prepackage errors determined in B.2.6 and evaluate for compliance. If the total prepackage error is:

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

B.2.8.2 Where sampling of the inspection lot is used to determine compliance, carry out the following procedure as prescribed in 5.3:

- I. Calculate the total prepackage error by adding together the individual prepackage errors determined in B.2.6.
- II. Divide the total prepackage error by the sample size to calculate the average error.
- III. Evaluate the sample for compliance. If the average error in II. is:
 - a) Equal to zero or a positive number the inspection lot passes.
 - b) If the average error is a negative number proceed to IV.
- IV. Compute the standard deviation of the individual prepackage errors determined in B.2.6.

- V. Compute the sample error limit by multiplying the standard deviation determined in IV. by the sample correction factor given in column 3 of Table 1 a) or b), as applicable, for the relevant sample size given in column 2.
- VI. Correct the average error by adding the sample error limit determined in V. to the average error and evaluate the sample for compliance.
 - a) If the corrected average error is zero or a positive number the inspection lot passes.
 - b) If the corrected average error is a negative number the inspection lot fails.

B 3 Special procedures for quantity determination by gravimetric means

B.3.1 Determination of net quantity and average mass of packing material

When non destructive testing is undertaken it is necessary to subtract the mass of the packing material (see 3.10) 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 B.1 are complied with.

Actual Quantity of Product = Mass of the prepackage – Average mass of the packing material

The following requirements apply to the determination of the average mass of packing material:

- B.3.1.1 Use may be made of unused packing material of the same type used for the prepackages being inspected or use may be made of packing material that has been used as part of a prepackage and has been separated from the product and cleaned using normal household procedures used by consumers of the product (e.g., the material should not be dried in an oven).
- B.3.1.2 Packing material used for the average mass determination shall be clean and dry.
- B.3.1.3 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 B.3.1.5.
- B 3.1.4 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. In both cases each prepackage in the sample selected as a tare sample in B.3.1.3 shall first be measured with the packing material in its normal state ready for sale. The prepackage (packing material) shall then be punctured to allow the contents to attain atmospheric pressure and each prepackage in the sample shall again be measured. 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.

Effect of gas or vacuum = Mass of sealed prepackage – Mass of punctured prepackage

Determine the average mass of the effect of the gas or vacuum and add this algebraically to the mass of the average tare value determined according to B.3.1.5 and Table B.1, as applicable (ie. added gas will increase the tare value and vacuum will reduce the tare value).

B 3.1.5 Add together the individual packing material masses determined in B.3.1.3 and divide by the number of samples to determine the Average Tare Mass (ATM). Calculate the sample standard deviation of the initial tare sample and proceed according to one of the criteria in Table B.1:

Table B.1

Criteria for determination of tare masses

If	Then
The ATM is equal to or less than 10 percent of nominal quantity of product	Use the ATM to determine the actual quantity of product in the prepackages according to B.3.1.6.
The ATM is greater than 10 percent of the nominal quantity and the standard deviation determined in B.3.1.5 is equal to or less than 0.25 <i>T</i>	Use a total of 25 packing materials to compute the ATM and determine the actual quantity of product in the prepackages according to B.3.1.6.
The ATM is greater than 10 percent of the nominal quantity and the standard deviation determined in B.3.1.5 is greater than 0.25 <i>T</i>	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 according to B.3.1.6

B.3.1.6 Measure the individual prepackage gross mass and subtract the average mass of the packing material determined in B.3.1.5 or the actual mass of each packing material, as applicable, (see Table B.1 for criteria) to determine the actual net mass of the prepackages.

NOTE: Where the average mass of the packing material is used for prepackages with a constant nominal quantity an alternative procedure is to add the average mass of the packing material to the nominal quantity to obtain a calculated gross mass and subtract this from the individual gross masses to determine the individual prepackage errors in B.3.1.7.

B.3.1.7 Determine the actual error of each prepackage by subtracting the nominal quantity from the actual net mass of each prepackage.

B.3.2 Determination of the quantity of liquid by gravimetric means

When gravimetric testing is used to determine the actual contents of prepackages containing liquids labelled in units of volume, calculate the nominal mass of liquid product in the prepackage taking air buoyancy into consideration by using the following formula. The density of the liquid shall be at the specified reference

temperature. Liquid products shall comply with applicable requirements when at the reference temperatures specified in 4.9.

$$\text{Nominal volume calculated from mass (g)} = \frac{\text{Mass of the product (g)} \times 0.99985}{\text{Liquid density (g/mL)} - 0.0012}$$

$$\text{Calculated nominal mass (g)} = \frac{\text{Volume (mL)} \times [\text{Liquid density (g/mL)} - 0.0012]}{0.99985}$$

NOTE: The above formulae compensates for the affect of the difference in air buoyancy between the liquid being measured and masspieces used to calibrate inspection scales and having a density equal to 8 g/mL.

When errors are determined by comparing the actual masses of the liquid with the calculated nominal mass, the tolerable deficiencies (*T*) shall be determined from table A.1a) according to the marked nominal volume and then also converted to the calculated mass, using the above formula, before checking the errors for compliance.

B.4 Special procedures for quantity determination by volumetric means

If necessary and the required accuracy of measurement can be achieved the net quantity of individual prepackages in B.2.5 may be determined 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 following requirements apply when this method is used.

B.4.1 Requirements for use of volumetric measures

B.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):

- 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.
- 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 prior to testing.

B.4.1.2 Volumetric measures calibrated as a dry (container) measures (usually marked **In** on the measure to indicate that it was dry when calibrated):

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

B.4.2 Temperature of measurement

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

B.4.3 Emptying of prepackages

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

B.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.

B.5 Special procedures for quantity determination of linear measurements

B.5.1 When an article is marked with more than one dimension (e.g. timber marked with its length, width and thickness) each dimension shall be inspected separately for compliance. If any dimension on the articles in the inspection lot being inspected fails either the individual prepackage or average requirement, the inspection lot fails.

B.5.2 Where the actual dimension of an article appears to be inconsistent (e.g. the width varies), at least five measurements at approximately equal intervals along the length of the dimension being inspected shall be made to determine the average dimension for each article. The average value of the dimension shall then be used to evaluate compliance. In cases where a minimum value (of a dimension) is marked (e.g. minimum thickness) the average dimension does not apply and none of the measurements made shall be less than the marked minimum value.

B.6 Use of templates to determine volume

Templates designed for use with measuring container bottles may be used to determine the volume of liquid contained therein provided that bottles and associated templates are manufactured according to a controlled process that will ensure the accuracy of measurement required in 5.2.1, as applicable, and that the use thereof is acceptable to the national responsible body.

Annex C

(Normative)

DRAINED QUANTITY OF FOODSTUFFS PACKED IN A LIQUID MEDIUM

The following test method shall be used when determining the actual quantity of foodstuffs (drained mass) when packed in a liquid medium to check for compliance with 4.7.

C.1 TIME OF INSPECTION

The drained mass shall be determined after the equilibrium of solution process is completed. An inspection may be carried out from the time that the prepackages are ready to be marketed according to the manufacturer or distribution has taken place and up to the end of any period specified in the third column of Table C.1. An inspection shall not be carried out prior to the elapse of the period given in the second column of Table C.1 should the manufacturer indicate that the prepackages are not ready to be marketed.

Table C.1

Period of time for inspection

Product	Period of Time for inspection	
	From	To
Fruit, vegetables and other vegetable foodstuffs (except for strawberries, raspberries, blackberries, kiwis, loganberries)	30 days after packaging	Tenability
Strawberries, raspberries, blackberries, kiwifruit, loganberries	30 days after packaging	2 years after packaging
Products made from salted fish, anchovies, sardines, marinades, stewed fish goods, preserved fish; mussels, shrimps and suchlike.	Immediately after packaging	14 days after packaging
Marinades of fried fish	48 hours after packaging	14 days after packaging
Sausages and other meat products	5 days after packaging	Tenability
Other products	14 days after packaging	Tenability

C.2 Inspection sample

The sample determined in B.2.2 and used to check for compliance of the net quantity of prepackages, shall be used.

NOTE: As this will be a destructive test the whole inspection lot can never be used.

C.3 Temperature of sample

The samples shall be stored within the temperature range specified by the packer or between 20 °C and 24 °C, inclusive, for a period of 12 hours before testing.

C.4 Apparatus required

C.4.1 For draining the product from a prepackage, use a flat sieve with a square mesh having a nominal aperture size of 2.8 mm and a nominal wire thickness of 1.2 mm. The diameter of this sieve should be 20 cm for use with prepackages of 850 mL or less, and 30 cm for use with containers over 850 mL. If the nominal quantity is 2.5 kg or more, the quantity may, after weighing the whole amount, be divided among several sieves.

C.4.2 For determination of mass, the weighing instrument shall meet the requirements of 5.2.1.

C.5 Determination of the actual quantity of product

C.5.1 Determine the mass of the sieve and its drip pan.

C.5.2 Open the prepackage and pour the product and liquid medium across the sieve. Distribute the product and liquid medium over the surface of the sieve but do not shake the material on the sieve. Tilt the sieve to an angle of approximately 17 to 20 degrees from horizontal to facilitate draining. Carefully invert by hand all solid product, or parts thereof, with cups or cavities if they fall on the sieve with cups or cavities up. Drain the cups or cavities in soft products (e.g., sliced fruit) by tilting the sieve. Drain for two minutes.

C.5.3 Weigh the pre-weighed drip pan and sieve containing the product and calculate the drained mass of the product as follows:

$$P = P_{e2} - P_{e1}$$

where: P = drained mass of the product
P_{e1} = mass of the clean sieve and drip tray
P_{e2} = mass of the sieve and drip tray plus product after draining

C.5.4 Before the sieve is again used ensure that it is clean and free of product debris. The sieve need not be dry as long as it is weighed accurately immediately before being used.

Annex D

(Normative)

TEST PROCEDURES FOR DETERMINING THE ACTUAL QUANTITY OF FROZEN PRODUCTS WITH ADDED WATER AND GLAZED PRODUCTS

The following test methods, as applicable, shall be used when determining the net quantity of prepackages in B.2.5 when the contents of the prepackages are frozen with added water or glazed. In the case of frozen products, if no water is added at the time of freezing this procedure is not used and the net mass shall be determined in the frozen state exclusive of packing material.

NOTE: As this will be a destructive test the sampling according to B.2.2 will be used.

D.1 Apparatus required

- D.1.1 For draining the water from a product use a flat sieve with diameters as prescribed in the relevant procedures and having square mesh openings with a nominal aperture size of 2.8 mm and a nominal wire thickness of 1.2 mm.
- D.1.2 For determination of mass, the weighing instrument shall meet the requirements of 5.2.1.

D.2 Frozen Fruits and Vegetables

- D.2.1 Determine the mass of the appropriate sieve and its drip pan after wetting the sieve and draining for two minutes. For prepackages with a nominal quantity not greater than 1.4 kg the sieve shall have a diameter of 20 cm. For prepackages with a nominal quantity greater than 1.4 kg the sieve shall have a diameter of 30 cm.
- D.2.2 Immerse the prepackage in water maintained at $25\text{ }^{\circ}\text{C} \pm 10\text{ }^{\circ}\text{C}$ with a continuous water flow. If the prepackage is not water-tight, place it in a plastic bag and remove any excess air using a vacuum and then seal it securely. Avoid agitating the prepackage while it is thawing. When all of the ice has melted remove it from the water bath and wipe it dry. Open the prepackage with care and a minimum of agitation.
- D.2.3 Transfer the product to the sieve by distributing evenly in one sweeping motion. Incline the sieve to approximately 17 to 20 degrees from the horizontal to facilitate drainage without shifting the product. Drain for two minutes.
- D.2.4 Weigh the pre-weighed drip pan and sieve containing the product and determine the actual net quantity of the product.

D.3 Glazed fish and fishery products (products covered with a film of ice to preserve their quality).

- D.3.1 Determine the mass of the appropriate sieve and its drip pan after wetting the sieve and draining for two minutes. For prepackages with a nominal quantity not greater than 900 g the sieve shall have a diameter of 20 cm. For prepackages with a nominal quantity greater than 900 g the sieve shall have a diameter of 30 cm.
- D.3.2 Remove the product from the prepackage and place it in a wire mesh basket large enough to hold the contents. Subject the product to a gentle spray of cold water until the ice glaze is removed. Agitate the product with care to avoid damage or loss of any natural water contained in the product.
- D.3.3 Transfer the product to the sieve and incline the sieve to approximately 17 to 20 degrees from the horizontal to facilitate drainage without shifting the product. Drain for two minutes.
- D.3.4 Weigh the pre-weighed drip pan and sieve containing the product and determine the actual net quantity of the product.

D.4 Frozen fish and fishery products

- D.4.1 Determine the mass of the appropriate sieve and its drip pan after wetting the sieve and draining for two minutes. For prepackages with a nominal quantity not greater than 450 g the sieve shall have a diameter of 20 cm. For prepackages with a nominal quantity greater than 450 g the sieve shall have a diameter of 30 cm.
- D.4.2 Open the prepackage and place the product in a wire mesh basket large enough to hold the contents of the prepackage and with openings small enough to retain the product while thawing. Immerse the wire mesh basket in a water bath (e.g., a 15 L container of water) at $25\text{ }^{\circ}\text{C} \pm 10\text{ }^{\circ}\text{C}$ so that the top of the basket extends above water level. Introduce water at $25\text{ }^{\circ}\text{C} \pm 10\text{ }^{\circ}\text{C}$ at the bottom of the container in a continuous flow until all excess ice has melted. Care must be taken not to remove any water occurring naturally in the product and it is recommended that the frozen core of each item is not completely defrosted unless this contains added water.
- D.4.3 Transfer the product to the sieve and incline the sieve to approximately 17 to 20 degrees from the horizontal to facilitate drainage without shifting the product. Drain for two minutes.
- D.4.4 Weigh the pre-weighed drip pan and sieve containing the product and determine the actual net quantity of the product.

D.5 Frozen Poultry

If the poultry being inspected is encompassed with ice or it is suspected that water was added to the abdominal cavity before or during the freezing process, the following method is used to thaw the product.

- D.5.1 Remove the carcass from the packing material and place it in a strong waterproof

plastic bag with the abdominal cavity facing towards the closed end of the bag. The bag shall be big enough to ensure that it can be sealed properly but shall not be unduly large. Remove as much air as possible from the bag by compressing and close securely.

NOTE: Until such time as this test is carried out the samples should be kept frozen under the conditions in which they were stored before selection as the inspection sample.

D.5.2 Immerse the bag containing the frozen carcass in a bath of water maintained at $42\text{ }^{\circ}\text{C} \pm 1\text{ }^{\circ}\text{C}$ with the closed end positioned such th at water from the bath cannot leak into the bag. It may be held in position by means of weights if necessary.

D.5.3 The bag shall be left in the bath of water until all excess ice is melted. If necessary to check that all excess ice has melted, the bag may be opened and the temperature in the abdominal cavity measured.

NOTE: To prevent the loss of natural water in the product, the flesh of the poultry should remain frozen as far as possible, and only surrounding ice should be melted.

D.5.4 Determine the mass of a drip pan and 20 cm sieve after wetting the sieve and draining for five minutes.

D.5.5 Remove the carcass from the bag and place in the sieve with the abdominal cavity facing down and allow to drain for five minutes. If the abdominal cavity contains offal packed in separate packing material, take the offal out of the packing material and place it in the sieve with the carcass to drain.

D.5.6 Weigh the pre-weighed drip pan and sieve containing the carcass and offal, if applicable, and determine the actual net quantity of the product.

Annex E

(Informative)

Statistical principles of control

The requirements of this document are based on the following statistical principles of control.

E.1 Uncertainties

The expanded uncertainties at the 95 percent confidence level associated with measuring instruments and test methods used for determining quantities shall not exceed 0.2 T. Examples of the source of uncertainty include the maximum permissible error and repeatability in measuring instruments, variations in packing materials, and fluctuations in density determinations caused by the differing amounts of solids in the liquid or temperature changes.

E.2 Significance levels

E.2.1 The significance level for Type I Risk (the value which is the upper limit of this type of error) shall be 0.005. The tests shall determine if the average of the quantity of product in a prepackage has a one-sided significance level of 99.5 percent using coefficients as derived from Student's t distribution:

$$\alpha_p \leq 0.5 \% \text{ for } \mu = Q_n$$

That is, the probability of rejecting a correctly filled inspection lot with $\mu = Q_n$ shall not exceed 0.5 percent.

E.2.2 The test for Type II Risk¹ shall have a significance level α_p of:

$$\alpha_p \leq 5\% \text{ for } p = 2.5\%$$

that is, the probability (p) of rejecting a inspection lot containing 2.5 percent of inadequate prepackages shall not exceed 5 percent.

E.2.3 Significance level of the tests for percentage of inadequate prepackages (Type II risk) shall detect inspection lots in at least 90 percent of the cases:

- for which the average fill is less than $(Q_n - 0.74 \sigma)$ where σ is the sample standard deviation of the quantity of product in the prepackages of the inspection lot, and
- lots that contain 9 percent inadequate prepackages.

AMENDMENT CONTROL SHEET

NOTE: Amended wording will be ratified at formal SADC MEL meetings and will be contained in the relevant minutes.

DOCUMENT VERSION AMMENDED	AMENDMENT NUMBER AND DATE	CLAUSE AMENDED
Revision 0: 2 May 2005	Amendment 1: 24/10/2005	4.3.2
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Revision 0: 2 May 2005	Amendment 1: 24/10/2005	Item 8 Table A.25.3.2
Revision 0: 2 May 2005	Amendment 1: 24/10/2005	B.3.15
Revision 0: 2 May 2005	Amendment 1: 24/10/2005	Table B.1
Revision 1: 24 October 2005	Amendment 2: 13/10/2006	B.3.1.4 (correct spelling of "effect")
Revision 2: 13/10/2006	Amendment 3: 9/5/2008	B.4.3.1
Revision 2: 13/10/2006	Amendment 3: 9/5/2008	B.4.3.3
Revision 2: 13/10/2006	Amendment 3: 9/5/2008	B.4.3.4 (new clause added)