
**Recycled Polyethylene Terephthalate (rPET) Bottles for Food
Contact-Specification**



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This African Standard was prepared by **ARSO/TC 14, Food packaging and labelling**

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Recycled Polyethylene Terephthalate (rPET) Bottles for Food Contact -Specification

1. Scope

This draft African Standard specifies requirements, sampling and test methods for Recycled PET bottles, and recyclates (flakes and pellets) used for food contact applications.

It does not apply to industrial rejected PET bottles and does not apply to production of resins for non-food grade consumer applications.

2. Normative References

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

- ISO 472:2013 Plastics – Vocabulary
- ISO 12418- 2 Plastics — Post-consumer poly(ethylene terephthalate) (PET) bottle recyclates — Part 2: Preparation of test specimens and determination of properties
- ISO 13106:2014 Plastics — Blow-moulded polypropylene containers for packaging of liquid foodstuffs
- ISO 1158 Plastics —Vinyl chloride homopolymers and copolymers Determination of chlorine content
- ISO 1628-5:1998 Plastics— Determination of the viscosity of polymers in dilute solution using capillary viscometers Part 5: Thermoplastic polyester (TP) homopolymers and copolymers
- ASTM F1877-16 Standard Practice for Characterization of Particles
- ASTM D4532-15 Standard Test Method for Respirable Dust in Workplace Atmospheres Using Cyclone Samplers
- ASTM D6290-19 Standard Test Method for Color Determination of Plastic Pellets
- ASTM D7486-14 Standard Test Method for Measurement of Fines and Dust Particles on Plastic Pellets by Wet Analysis
- ASTM F2013-10 Standard Test Method for Determination of Residual Acetaldehyde in Polyethylene Terephthalate Bottle Polymer Using an Automated Static Head-Space Sampling Device and a Capillary GC with a Flame Ionization Detector
- ASTM E1347-06(2020) Standard Test Method for Color and Color-Difference Measurement by Tristimulus Colorimetry
- ASTM D4602-93(2020) Standard Guide for Nondestructive Testing of Pavements Using Cyclic-Loading Dynamic Deflection Equipment

3. Terms and Definitions

For the purpose of this standard, the definitions in-ISO 472 - Plastic vocabulary in addition to the following shall apply;

3.1 rPET

PET materials made by appropriate technologies from post- consumer PET material

3.2 bulk density

the weight per unit volume of plastic flakes or pellets.

3.3 water content

the quantity of water contained in plastic flakes or pellets.

3.4 recyclate

material resulting from the recycling of recyclable plastic waste

3.5 brimful capacity

The volume of water required to fill the container completely at $25 \pm 2^\circ\text{C}$.

3.6 flake

an aggregate of fragments from grinding and washing of post-consumer PET or pre consumer industrial PET

NOTE The shape of regrind depends both on the plastics being processed and the manner of processing.

3.7 intrinsic viscosity (IV)

intrinsic viscosity is related to the composition and molecular weight of PET resin and is a common descriptor of PET flowability of the measure of resin molecular weigh material's melting point, crystallinity and tensile strength

4. Requirements

4.1 General requirements

4.1.1 The recycled polyethylene terephthalate (rPET);shall be manufactured in compliance with good manufacturing practice so that, under normal or foreseeable conditions of use, they do not transfer their constituents to **food in quantities which could** endanger human health

The rPET resins shall be made from flakes, chips and pellets of carefully selected food grade PET bottles that are either coloured, clear or transparent.

4.2 Materials

rPET bottles shall be made from materials that comply with specifications below

4.2.1 The flakes from the PET bottles when tested shall meet the specification outlined in Table1

Note: A certificate of analysis including the test result for each batch of flakes, the sampling method and the number of replicate shall be retained.

Table 1: Quality Requirement for PET flakes.

Parameters	Requirement	Method of Test
Particle size (mm)	10 ± 2	ASTM F1877-16
Dust fraction %	≤0.1	ASTM D4532-5
Intrinsic Viscosity (IV) dl/g	0.74 - 0.84	ISO 1628- 5
Contamination due to labels (ppm)	≤1000	ISO 12418- 2.
Contamination due to Polyvinyl Chloride (PVC) (ppm)	≤ 5ppm	ISO 12418- 2.
Contamination due to Polyolefins (including adhesives) (ppm)	≤5.0	ISO 12418- 2
Metal (aluminum, steel) (ppm)	< 5	ISO 12418- 2

4.2.2 The quality requirement of the pellets made from the flakes shall be as specified in Table 2.

Table 2: Pellet Specifications specify test methods

Description	Units	Requirement	Limits	Test method
Color 3mm Thick plaques				
- Color L*	-	70	Min	ASTM D6290
- Color a*	-	-3	Min	
- Color b*	-	+10	Max	
Color Amorphous pellets (Indicative values only – interim processing step in processes)				
- Color L*		45	Min	ASTM D6290
- Color a*	-	-10	Min	
- Color b*	-	+1	Max	
Color Crystallized pellets				
- Color L*	-	67	Min	ISO 1628- 5
- Color a*	-	-3	Min	
- Color b*	-	+3	Max	
Intrinsic Viscosity	dl/g	0.78	Min	
Haze 3 mm Thick plaques	%	13	Max @550 nm	
PVC	ppm	40 (25% rPET use) 20 (50% rPET use)	Max (Total Chlorine Method)	ISO 1158
Metal (aluminum, steel) for 1 Kg	ppm	<5	Max	ISO 12418- 2
Fines	%	0.05	Max	ASTM D7486
Acetaldehyde Content	ppm	1.0	Max	ASTM F2013-10
Limonene	ppb	<20	Max & meets Corporate SRA requirements	TDS/GC/MS Analysis

Note; Pellet is a form of resin

4.3 Specific requirements

4.3.1 Quality requirements

The rPET bottle material when subjected to test shall conform to the quality requirement of the table 3.

Table 3: Quality Requirement for rPET Bottle

Parameter	Requirements	Method of Test
Acetaldehyde (ppm)	≤ 4 - ≥10	ASTM F2013-10
Intrinsic Viscosity (dL/g)	0.76 - 0.86	ISO 1628- 5
Colour L* (CIE)	> 70	ASTM E1347-06
Colour a* (CIE)	> -4	ASTM E1347-06
Colour b* (CIE)	< 14	ASTM E1347-06
Bulk density (kg/m ³)	820 ± 30	ASTM. D4602
Moisture (%))	< 0.2	ISO 12418- 2

4.3.2 Migration requirements

4.3.2.1 Overall Migration

In addition to complying with specifications of ARS 1716- Migration of constituents of plastic materials and articles intended to come into contact with foodstuffs and when tested according to the methods specified therein, the following shall apply;

4.3.2.2(i) Recycled polyethylene terephthalate (rPET); intended to be brought into contact with food intended for infants and young children shall not transfer their constituents to food simulants in quantities exceeding sixty milligrams of total of constituents released per kg of food simulant **(60 mg/kg)**

4.3.2.3 (ii) Recycled polyethylene terephthalate (rPET); shall not transfer their constituents to food simulants in quantities exceeding ten milligrams of total constituents released per dm² of food contact surface (10mg/dm²)

4.3.2.4 Specific Migration

Recycled polyethylene terephthalate (rPET); shall not release the following substances in quantities exceeding the specific migration limits below:

Table 4: Heavy metals

Sub.No	Substances	Maximum Limit mg/kg food or food simulant	Test methods
1	Aluminium	1	EN 13130 /2004
2	Ammonium	-	
3	Antimony	0.04	
4	Arsenic	ND	
5	Barium	1	
6	Cadmium	ND	
7	Calcium	1	
8	Chromium	ND	
9	Cobalt	0.05	
10	Copper	5	
11	Europium	0.05	
12	Gadolinium	0.05	
13	Iron	48	
14	Lanthanum	0.05	
15	Lead	ND	
16	Lithium	0.6	

Sub.No	Substances	Maximum Limit mg/kg food or food simulant	Test methods
17	Magnesium	1	
18	Manganese	0.6	
19	Mercury	ND	
20	Nickel	0.02	
21	Potassium	1	
22	Sodium	-	
23	Terbium	0.05	
24	Zinc	5	

5. Packaging

The rPET bottle immediately after manufacture shall be packed under hygienic conditions in a suitable protective covering that will preclude the ingress of dust, moisture and other foreign matter.

6. Labelling

Batch bottle shall be indelibly and legibly marked with the following information.

- a) manufacturer’s name and registered trademark, if any;
- b) date of manufacture;
- c) disposal and safety instructions;
- d) country of origin;
- e) dimension and carrying capacity of the bottle;
- f) batch or code number.
- g) international code of the plastic used/ Symbol to indicate it is rPET.



- h) The packages shall carry the symbol for food grade (carrying spoon or fork and cup e.g. Fig. 1) or the word “for food grade” on it



7. Sampling

7.1 Scale of Sampling

Samples shall be tested from each lot to ascertain the conformity of the lot to the requirements in table 3. The number of rPET bottles shall be selected at random from a lot as specified in Table 4.

Table 5 - Scale of Sampling

Number of Bottles in the lot	Number of Bottles to be Selected	Acceptance Number	Sub-sample Size
Up to 500	20	06	03
501 to 1200	32	10	03
1201 to 3200	50	14	05
3201 to 10000	80	20	08
10001 and above	125	28	13

8. Number of Tests

8.1 The rPET bottle shall be tested in line with the requirements specified in clause 4. Each rPET bottle selected as in 7.1 shall be inspected for packaging and marking criteria as specified in clause 6

8.2 In addition to the requirement outlined in table 3 and 4, the rPET bottle shall be tested for leakage, stacking, drop impact, and storage stability tests, using legislatively approved methods. (See Annex).

9. Conformity to Standard

The lot shall be declared as conforming to the requirement of this standard if the following conditions are satisfied:

- (a) Each rPET bottle inspected as in 8 satisfies the Labelling and packaging requirements.
- (b) Each rPET bottle tested as in 8 satisfies the relevant requirement for drop test. Include annex for drop test as in other ARS standards
- (c) The pellets as tested in 8 shall satisfy the quality requirements specified in Table 2
- (d) The material of the selected rPET bottle when subjected to test, shall conform to the requirement of 8

Annex A

Leakage test

Method 0.1 The method helps to determine the ability of a closure (on a container) to prevent leakage due to transportation vibration.

A-1 APPARATUS

A-1 apparatus

A-1.1 a vibrating table conforming to a relevant standard

A-1.2 PROCEDURE

A-1.2.1 fill the bottle to its normal capacity with the product/water and close it with the usual closure in the manner in which it is intended to be used.

A-1.2.2 Mount the bottle upside down rigidly on the vibrating table and subject to vibrations for 1 hour at a peak acceleration of 1g.

A-1.2.3 at the end of the test period, the closure shall show no indication of leakage, loss of tightness, backing off or popping.

A-1.3 PRECAUTIONS

A-1.3.1 before the test is carried out it should be ensured that the inner plug, if provided and cap are fully tightened.

Method 0.2

A2.1 Apparatus

A2.1.1 Compressed air supply

A source of compressed air and a pressure line with pressure regulator and indicator to provide uniform air pressure can be used for this test.

A2.1.2 Reservoir

A reservoir suitable to hold enough water so that the test container can be fully or partly immersed in it as required. In case of large containers, the reservoir might not be necessary, and could be functionally substituted by the use of a soap solution.

A2.2 Procedure

The leakage test shall be performed with the compressed air maintained at 35 KPa (0,35 bar). Connect the air line to the test container by tightly fitting the plunger with rubber plug in the mouth of the container. The test container shall be immersed in water while an internal air pressure is applied. The test container shall be kept under water in such a way as not to distort the test result.

Increase the air pressure until the predetermined pressure is obtained. Observe the container for any leakage by the bubbles of air escaping through the water. For large containers, detect the leakage by applying soap solution at various areas on the container. The formation of bubbles is an indication of leakage at those specific areas on the container.

Other acceptable techniques involve the use of pressure decay instrumentation. These can be single determination (manual) units or automated in-line units for detection of container leakage during production. With this technique, the container under test is injected with air to some specified overpressure, and the pressure is monitored for a specified period of time. If the pressure does not decay below a specified limit value at the end of the designated time period, the container under test is considered to be leak-free. Specific guidance should be obtained from the instrument supplier.

A2.3 Results

Any sign of rupture or leakage from the container other than from the closure shall be deemed to indicate failure. Container shall be retested if the leakage is detected from the closure, after necessary corrections have been made to correct the leakage. Localized bulging shall not be considered as rupture or leakage.

Annex B Drop impact test

B.1 Apparatus

Any suitable apparatus can be used provided that it conforms to the following requirements:

- a) permits accurate repositioning of the container to ensure an unobstructed fall from rest position and impact at the specified places or areas of the container;
- b) permits accurate and convenient control of the height of drop;
- c) provides a solid impact surface to absorb drop impact shock without deflection.

B.2 Drop height

Unless specified otherwise, or by agreement, the drop height shall be 1.2 m.

B.3 Procedure

Fill each test bottle to its nominal capacity with edible oil and close with its usual closure. If it is intended to be used with inner seal, the testing shall be carried out with the inner seal gasket or liner heat sealed to its neck face and capping outer closure.

The test containers selected randomly from a lot shall be divided into two sets of four samples each, designated as set 1 and set 2.

Drop the containers from predetermined height on to a rigid flat horizontal surface under free fall condition of set 1 squarely on their base (bottom) and set 2 on their side (the body of the container being parallel to the impacting floor) onto the dropping surface.

B.4 Results

The bottle shall not rupture nor shall there be any leakage from the walls of the container. Slight denting shall not be taken as failure of the bottle in test.

Annex C Stacking Test

C.1 Apparatus

Any suitable apparatus which provides the capability to apply the necessary force to the top face of the assembled container stack.

C.2 Procedure

Eight test containers shall be randomly selected and divided into two sets of four containers each, designated as set 1 and set 2.

Fill each test container to its nominal capacity with water and close with the usual closure to the nominal torque (if the liquid to be packed is of high viscosity, a liquid of similar viscosity should be used as the test medium).

Arrange the containers in two sets of 2 × 2 blocks on a rigid flat surface. Apply the designated top load, evenly distributed on a rigid flat plate placed on the unsupported container blocks for 24 h. The top load shall be sum of the total weight of identical packages stacked on top to a stack height of 3 m, and the weight of the top flat plate.

Examine the containers after 24 h. The containers shall not show any cracks or permanent buckling, leakage, or reduction in effectiveness of the closure or instability.

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Annex D Storage Stability Test

This shall be a type test. The test shall be carried out both at 38 ± 1 °C and 90 \pm 2. Percent RH (Accelerated conditions) and 27 ± 1 °C and 65 \pm 2 percent RH (standard conditions). The change in the free fatty acids (as percentage of oleic acid), moisture content, peroxide value as mill equivalent of oxygen per kilo fat (wherever applicable) and rancidity as per existing and traceable national or international legislation/standard on for evaluation of the effect of packaging and storage on the sensory qualities of foods and beverages, of the content shall be noted at the end of 60 and 180 days when tested under accelerated and standard conditions respectively. Bottles shall be accepted if the edible oil does not show rancidity or increase in the values of the moisture content, free fatty acids and peroxide value above the permissible limits specified therein in on edible oils at the end of 60 days and 180 days under accelerated and standard condition respectively.

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Bibliography

- *REGULATION (EC) No 1935/2004 of the European parliament and of the council of 27 October 2004, Amend 2019 on materials and articles intended to come into contact with food and repealing Directives 80/590/EEC and 89/109/EEC .*
- *REGULATION (EU) No 10/2011 of 14 January 2011 Amend 2023 on plastic materials and articles intended to come into contact with food*
- *COMMISSION REGULATION (EU) 2022/1616 of 15 September 2022 on recycled plastic materials and articles intended to come into contact with foods, and repealing Regulation (EC) No 282/2008.*
- *Commission Regulation EC No. 2023/2006 on good manufacturing practice for materials and articles intended to come into contact with food*

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