BS ISO 13106:2014

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# Plastics — Blow-moulded polypropylene containers for packaging of liquid foodstuffs

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INTERNATIONAL STANDARD

**ISO 13106**

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# Plastics — Blow-moulded polypropylene containers for packaging of liquid foodstuffs

*Plastiques — Récipients en polypropylène moulés par soufflage pour l'emballage de denrées alimentaires liquides*

Reference number
ISO 13106:2014(E)

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Case postale 56 • CH-1211 Geneva 20
Tel. + 41 22 749 01 11
Fax + 41 22 749 09 47
E-mail copyright@iso.org
Web www.iso.org

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# Foreword

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The committee responsible for this document is ISO/TC 61, *Plastics*, Subcommittee SC 11, *Products*.

INTERNATIONAL STANDARD ISO 13106:2014(E)

# Plastics — Blow-moulded polypropylene containers for packaging of liquid foodstuffs

**WARNING — This International Standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this International Standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.**

## 1 Scope

This International Standard provides the requirements of polypropylene resins intended for use in blow-moulded, round containers with capacities up to, and including two litres intended for the packaging of liquids for human consumption. This International Standard also provides tolerances on mass, dimensions, methods of sampling, testing, and performance requirements.

NOTE It is not to be implied that polypropylene resins are the only polymers suitable for these applications, as many other polymers, including PE-HD, PET, etc. are also suitable.

## 2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. 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 291:2008, *Plastics — Standard atmospheres for conditioning and testing*

ISO 1873-1, *Plastics — Polypropylene (PP) moulding and extrusion materials — Part 1: Designation system and basis for specifications*

ISO 1873-2, *Plastics — Polypropylene (PP) moulding and extrusion materials — Part 2: Preparation of test specimens and determination of properties*

ISO 15270, *Plastics — Guidelines for the recovery and recycling of plastics waste*

ISO 2859-1, *Sampling procedures for inspection by attributes — Part 1: Sampling schemes indexed by acceptance quality limit (AQL) for lot-by-lot inspection*

## 3 Terms and definitions

For the purposes of this document, the following definitions of terms apply.

NOTE For detailed definitions of terms found in this International Standard, refer to ISO 472. Neck height (H) for containers produced using ISBM technology is the perpendicular distance from highest point of the neck face to bottom plane of the support ledge. The brimful capacity can also be measured using special volume testing equipment (Annex B). For bottles and lipped containers, nominal capacity is approximately 90 % of the brimful capacity.

**3.1**
**extrusion blow-moulded container**
container formed from an extruded parison of heat-softened thermoplastic, blow-moulded by the application of air pressure which forces it against the inside walls of a blow mould

**3.2**
**injection blow-moulded container**
container formed from an injection-moulded parison that is transferred, while hot, to a blow-mould to form the container

**3.3**
**injection stretch blow-moulded container**
container formed from an injection-moulded parison or reheated pre-form that is stretched prior to blow-moulding to impart bi-axial orientation

**3.4**
**container body**
principal part of a container, usually the largest piece containing the sides

Note 1 to entry: In bottles, the body is the main portion of the bottle without the neck.

**3.5**
**shoulder**
sloped area of a container between the neck area and the body of the container

**3.6**
**neck**
part of a container where shoulder cross-section area decreases to form the finish

**3.7**
**neck finish**
plastic forming the opening of a container and shaped to accommodate a specific closure

Note 1 to entry: Neck finish is a threaded, ribbed, or plain part of the container including sealing surface to accommodate a threaded or press fit closure, lug, and cap, heat sealing gasket or liner and the tamper evidence features.

**3.8**
**seal surface**
lip portion of the neck finish that makes contact with the sealing gasket or liner to form a seal

**3.9**
**closure**
device used to seal off the opening of the container for product containment and providing a barrier to external contaminants

**3.10**
**overall height**
**OH**
height of a finished empty container at its highest point excluding the closure and fitment

**3.11**
**diameter**
**D**
external diameter of the finished empty container at a specified height, expressed as the mean of the two perpendicular diameters, or as the circumference divided by 3,141 6 at the same specified height

**3.12**
**neck height**
**H**
perpendicular distance from the highest point of the plane including the neck face to the nearest point of the finished container shoulder

**3.13**
**external neck diameter**
**E**
external diameter of the neck, excluding thread, measured as the mean of two perpendicular diameters avoiding the part line

**3.14**
**internal neck diameter**
**I**
minimum internal diameter of the neck, whether it is parallel, tapered, or internally threaded

**3.15**
**thread diameter**
**T**
external diameter of the neck thread measured as the mean of two perpendicular diameters avoiding the parting line

**3.16**
**neck ovality**
difference between the maximum and the minimum neck diameters

**3.17**
**fill level**
level to which a container shall be filled to achieve designated quantity of the content or nominal capacity

**3.18**
**head space**
space between the fill level of a container and the seal surface

**3.19**
**brimful capacity**
volume of liquid held by the container when filled to the point of overflowing while standing on a flat horizontal level with all closures removed

Note 1 to entry: The brimful capacity, also called as “overflow capacity”.

**3.20**
**nominal capacity**
volume of the liquid foodstuff the container is intended to hold

**3.21**
**conditioning atmosphere and test temperature**
atmosphere in which a sample or test specimen is kept before being subjected to a test shall be in accordance with ISO 291, unless otherwise agreed upon by the interested parties, e.g. for testing at high or low temperatures

Note 1 to entry: The preferred set of conditions in ISO 291 is standard atmosphere (23 ± 2) °C and (50 ± 2) % relative humidity. Other set of conditioning atmosphere as mentioned in ISO 291 can also be used, provided such conditioning is reported.

## 4 Raw material

The grade designation(s) described in ISO 1873-1 and ISO 1873-2 for polypropylene shall be used to describe the raw material.

Since polypropylene is suitable for use in blow-moulded containers, the specification of grades to be used will depend on many factors including the specific application, type of liquid foodstuff intended to be packed and which kind of filling method to be used, filling capacity of container, container design, and conversion process to be used. In all cases, the choice of a specific grade shall be determined by its suitability for the intended application and agreement between the interested parties.

## 5 Container capacity

When the container is filled to nominal capacity, the liquid level shall correspond to the fill level, but below the bottom of the neck. The purchaser of the container shall specify the minimum brimful capacity, fill level, and the head space according to the filling temperature and filling process used.

## 6 Container mass

The container mass shall be adequate to meet the overall requirements of the application. The mass of the closure shall not be included in mass of the container. The tolerance for container mass shall be as specified in Table 1.

**Table 1 — Container mass tolerance**

| **Mass of the container**, g | **Tolerance**, % |
|---|---|
| Up to, and including 10 | ±10,0 |
| Over 10 up to, and including 25 | ±7,5 |
| Over 25 | ±5,0 |

The accuracy of weighing shall be to the nearest 0,1 g for containers with tare weight up to 25 g, and 0,5 g for containers beyond 25 g and up to 100 g.

## 7 Tolerance on dimensions

### 7.1 General

The shape and dimensions of the container shall be as specified by the user and in accordance with desired capacity. The tolerance on dimensions is valid for finished empty containers. The dimensions of filled containers might show differences.

### 7.2 Wall thickness

The minimum wall thickness at any point on the container surface shall be sufficient to meet the requirements of the intended application and this International Standard. The wall thickness shall be measured in accordance with the methods described in Annex C. In many cases, a minimum wall thickness of 0,2 mm has been found reasonable.

### 7.3 Overall height (OH)

The tolerance on container overall height shall be maximum of ±1,5 %. The height shall be measured in accordance with the methods described in Annex D.

### 7.4 Diameter (D)

The tolerance on container diameter shall be maximum of ±1,5 %. The diameter shall be measured in accordance with the methods described in Annex E.

### 7.5 Neck height (H)

The tolerance on neck height shall be maximum of ±1,5 %. The neck height shall be measured in accordance with the methods described in Annex F.

### 7.6 External neck diameter (E)

The tolerance on external neck diameter shall be maximum of ±1,0 %. The external neck diameter shall be measured in accordance with the methods described in Annex G.

The neck height and external neck diameter shall be designed in accordance with the container filling and handling equipment, and shall be as agreed between the container, the closure manufacturer, and the purchaser.

### 7.7 Internal neck diameter (I)

The tolerance on internal neck diameter shall be maximum of ±1,0 %. The internal neck diameter shall be measured in accordance with the methods described in Annex G.

### 7.8 Thread diameter (T)

The tolerance on thread diameter shall be maximum of ±1,0 %. The major and minor thread diameter shall each be measured in accordance with the methods described in Annex G.

### 7.9 Neck ovality

The tolerance on neck ovality shall be maximum of ±1,0 %. The neck ovality shall be measured in accordance with the methods described in Annex G.

## 8 Performance requirements

### 8.1 General

Following are the container performance requirements provided for general guidance. Specific applications can require different or additional requirements agreed upon between the interested parties.

### 8.2 Closure leakage test

The container filled with water and closed with a closure or a fitment designed to heat seal the specified neck finish according to closure supplier's specification, shall not exhibit any leakage when held vertically upside down for 30 min. The container can be kept on a blotting paper in this position for easy identification of leakage.

### 8.3 Drop impact resistance test

The container, when subjected to drop impact test as per the method described in Annex H, shall show no sign of rupture or leakage. For containers intended to be stored or used in temperature conditions below 0°C, testing shall be carried out at a temperature appropriate to the condition of use.

### 8.4 Stack load test

The containers shall not exhibit any cracks, permanent deformation, leakage, or stack instability when tested in accordance with the method described in Annex I.

### 8.5 Leakage test

The containers, when tested by the methods described in Annex J, shall not exhibit any sign of rupture or leakage from the container.

### 8.6 Ink adhesion test

The printed containers, when tested by the method described in Annex K, shall show no sign of printed ink or paint removal.

### 8.7 Compatibility test

Containers intended for use in packaging liquid food shall meet the appropriate regional, national, and international requirements for food packaging. Appropriate testing shall be conducted as specified by the user to ensure the efficacy of the container to be used for its intended purpose.

## 9 Statutory marking

The blow-moulded containers conforming to this International Standard shall be marked, embossed, or labelled with the following information:

a) the manufacturer's name, identification mark, or trade mark;

b) the reference number of this International Standard, ISO 13106;

c) the recycling identification code or symbol as per ISO 15270.

## 10 Sampling and criterion for conformity

### 10.1 Sampling criterion

Each manufacturer shall maintain traceable production records based on their unique lot identification procedure.

For ascertaining the conformity of the containers to this International Standard, testing shall be conducted for each lot. The sampling criteria shall be in accordance with ISO 2859-1 and as given in Table 2.

For drop impact resistance and stack load tests, one set of sample containers as given in the test methods (Annex H and Annex I) shall be drawn from the lot and these shall be subjected to the respective tests. The sample shall pass the tests for the lot in respect of drop impact resistance and stack load requirements.

Ink adhesion testing is applicable only to printed containers. Compatibility testing to confirm conformance to the requirements of the application shall be conducted when changes are made in the raw materials used to produce containers (e.g. material composition, formulation, and functional additive masterbatch, etc.)

**Table 2 — Sampling criterion**

| Lot size | Sample size | Permissible number of defects |
|---|---|---|
| 501 – 1 200 | 32 | 1 |
| 1 201 – 3 200 | 50 | 2 |
| 3 201 – 10 000 | 80 | 3 |
| 10 001 – 35 000 | 125 | 5 |
| 35 001 – 150 000 | 200 | 7 |
| >150 000 | 300 | 10 |

### 10.2 Number of tests and criteria for conformity

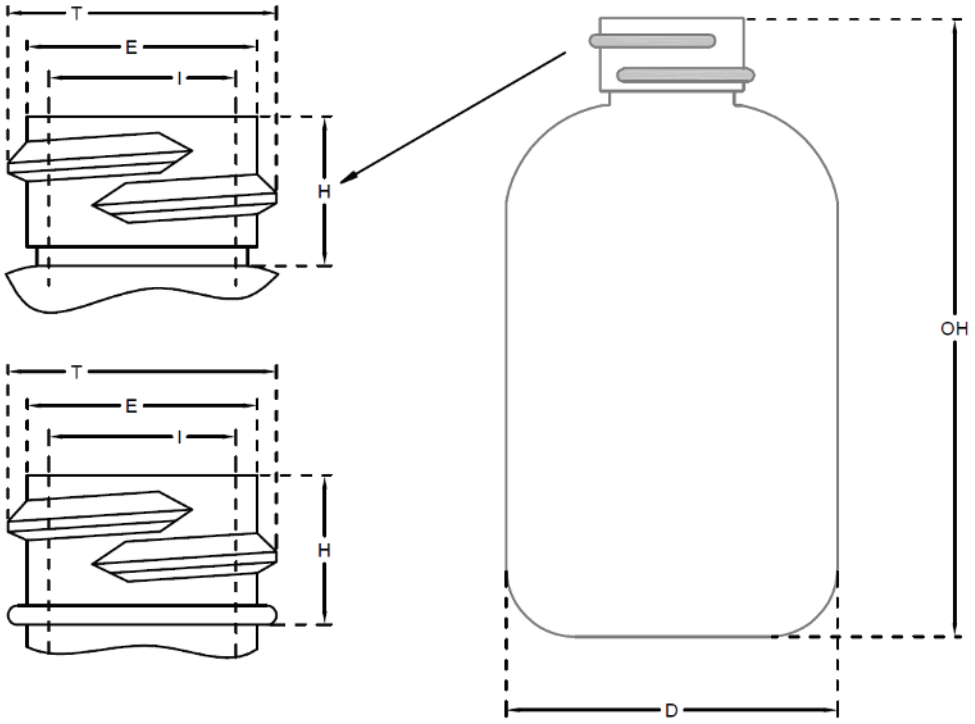
The number of tests and criteria of conformity shall be determined according to Table 3.

**Table 3 — Number of tests and criterion for conformity**

| Characteristics | Clause/Ref. | No. of tests | Criteria for conformity |
|---|---|---|---|
| Brimful capacity | Clause 5 | According to column 2 of Table 2 | The number of defective containers should not exceed the corresponding number in column 3 of Table 2 |
| Container mass | Clause 6/ Table 1 | | |
| Dimensions | 7.3 to 7.9 | | |
| Closure leakage test | 8.2 | | |
| Hydrostatic pressure test | 8.5 | | |
| Ink adhesion test | 8.6 | | |
| Wall thickness | 7.2 | According to column 2 of Table 2 | All the containers satisfy the relevant requirements as given in 7.2 |
| Drop impact resistance test | 8.3 | Two sets of four container samples | All the containers satisfy the relevant requirements as given in 8.3 and 8.4 |
| Stack load | 8.4 | | |

# Annex A
(normative)

# Container and neck finish descriptions




**Key**

OH overall height
D diameter
H neck height
I internal neck diameter
E external neck diameter
T thread diameter

**Figure A.1 — Schematic diagram of container and neck with corresponding legend**

# Annex B
(normative)

# Determination of brimful capacity

## B.1 Apparatus

A rigid transparent plastic disc of 2 mm thickness with a hole in the centre. The disc shall be big enough to completely cover the neck face of the container.

Weighing balance to determine the mass of container to an accuracy of 0,1 g.

## B.2 Procedure

Weigh the empty container and the rigid transparent plastic disc to an accuracy of 0,1 g.

Fill the container with water to within approximately 3 mm of brim. Place the rigid transparent plastic disc on the neck face and top-up by carefully pouring water through the hole with a dropper or a pipette, until the water is seen just contacting the underside of the disc.

Weigh the filled container, together with the rigid transparent plastic disc to an accuracy of 0,1 g. The difference in weighing is the mass of the water recorded in grams. The results shall be expressed to the nearest 0,1 g. Alternately, the volume of water can be measured directly to the nearest millilitre.

## B.3 Results

The mass of the water in grams or volume of water measured is numerically equal to the brimful capacity of the container in millilitres.

# Annex C
(normative)

# Measurement of container wall thickness

## C.1 Apparatus

A suitable instrument, e.g. micrometer, vernier caliper, non-contact instrument, etc. having a measurement accuracy of 0,02 mm.

## C.2 Procedure

Cut the container body horizontally into three equal sections, top, middle, and bottom. Measure the wall thickness at four places, 90° apart and offset from the parting line, in each section. Take average of four readings and report as wall thickness at top, middle, and bottom.

### C.2.1 Micrometer method

Measure the wall thickness with a micrometer or screw gauge fitted with ball point tip.

### C.2.2 Dial caliper gauge method

Measure the wall thickness with the help of dial caliper fitted with spherical anvils. Care shall be taken to avoid movement of the container during measurement as this can affect the reading obtained.

### C.2.3 Non-contact instrument method

Measure the wall thickness according to the manufacturer's instructions.

## C.3 Results

The wall thickness is recorded as the mean of the four readings each for top, middle, and bottom sections.

# Annex D
(normative)

# Measurement of container overall height

## D.1 Apparatus

Micrometer height gauge or non-contact instrument having a measurement accuracy of 0,10 mm.

## D.2 Procedure

Place the container upright on a flat surface and measure the distance between the bottom of the container to the highest point of the container using a micrometer height gauge or non-contact instrument at two positions as follows:

a) close to, but avoiding the part line;

b) at 90° to the position specified at a).

## D.3 Results

The height is recorded as the mean of the two readings.

# Annex E
(normative)

# Measurement of diameter for round container

## E.1 Apparatus

A suitable instrument, e.g. micrometer, vernier caliper, circumference gauge non-contact instrument, etc. having a measurement accuracy of 0,10 mm.

## E.2 Procedure

The diameter of the container shall be measured at three different sections of the container body, top, middle, and bottom.

### E.2.1 Method A

Using a micrometer or vernier caliper, measure the diameter as follows:

a) close to, but avoiding the part line;

b) at 90° to the position specified at a).

The diameter at each section is recorded as the mean of the two diameters at right angles.

### E.2.2 Method B

Using a circumference gauge, measure the circumference. Record the diameter as the circumference divided by 3,141 6.

### E.2.3 Non-contact instrument method

Measure the diameter according to the manufacturer's instructions.

## E.3 Results

The container diameter shall be recorded as the mean of the diameters at three different sections, top, middle, and bottom.

# Annex F
(normative)

# Measurement of neck height

## F.1 Apparatus

Micrometer depth gauge or non-contact instrument having a measurement accuracy of 0,02 mm.

## F.2 Procedure

### F.2.1 Micrometer depth gauge method

Place the anvil of the depth gauge on the neck face and move the instrument laterally until the spindle touches the outermost neck feature. Ensure that the tip of the spindle is allowed to touch the container shoulder and read the scale.

### F.2.2 Non-contact instrument method

Measure the neck height according to the manufacturer's instructions.

## F.3 Results

Record the neck height as the mean of the two readings taken at right angles at the neck face.

# Annex G
(normative)

# Measurement of neck and thread diameters and neck ovality

## G.1 Apparatus

Micrometer, vernier caliper, or non-contact instrument having an accuracy of measurement of 0,02 mm.

## G.2 Procedure

### G.2.1 Micrometer or caliper method

Measure the external and internal neck diameters and thread diameter as shown in (Annex A) with the vernier or micrometer as follows:

a) close to, but avoiding the part line;

b) at 90° to the position specified at a).

### G.2.2 Non-contact instrument method

Measure the diameters according to the manufacturer's instructions.

## G.3 Results

The diameter is recorded as the mean of two diameters at right angles. For determination neck ovality, record the difference between two external neck diameters measured perpendicular to each other in millimetres.

# Annex H
(normative)

# Drop impact resistance test

## H.1 Apparatus

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

a) permits accurate prepositioning 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.

## H.2 Drop height

Unless specified otherwise, or by agreement, the drop height shall be 1,2 m.

## H.3 Procedure

Fill each test container to its nominal capacity with water and close with its usual closure. If the container 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.

## H.4 Results

The container shall not rupture nor shall there be any leakage from the walls of the container. Slight distortion of the container shall not be considered a failure.

If the liquid foodstuff to be packed is of high viscosity, the material itself or a suitable material of similar viscosity is recommended as test medium instead of water. For containers intended to be stored or used at temperature conditions below 0°C, a lower test temperature drop impact test is recommended. The filled containers shall be conditioned at an appropriate sub-ambient temperature for 4 h or at conditions as agreed upon by the interested parties. The drop impact test shall be carried out immediately once the chilled containers are taken out of the cold storage, as per the procedure specified above.

# Annex I
(normative)

# Stack load test

## I.1 Apparatus

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

## I.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.

# Annex J
(normative)

# Leakage test

## J.1 Apparatus

### J.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.

### J.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.

## J.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.

## J.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 K
(normative)

# Ink adhesion test for printed containers

## K.1 Procedure

Apply two strips of 25 mm wide transparent pressure sensitive tape or cellophane tape to the printed area of container; one piece down the height and the other round the circumference of the container. Press the tape firmly on to the container and leave it for 15 s.

Remove the tape by pulling slowly at about 1 cm/s pulling rate from one end at 90° to the container surface.

## K.2 Results

There shall be no removal of the print from surface of the container and the print shall be legible to the naked eye after the test.

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