

IS : 3708 (Part 3)-1985

Indian Standard

METHODS OF TEST FOR
NATURAL RUBBER LATEX

PART 3 DETERMINATION OF DENSITY

NRL : 6

(*First Revision*)

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MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
NEW DELHI 110002

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Indian Standard
**METHODS OF TEST FOR
NATURAL RUBBER LATEX**
PART 3 DETERMINATION OF DENSITY
NRL : 6
(First Revision)

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Indian Standard
METHODS OF TEST FOR
NATURAL RUBBER LATEX
PART 3 DETERMINATION OF DENSITY
NRL : 6
(*First Revision*)

0. FOREWORD

0.1 This Indian Standard (Part 3) (First Revision) was adopted by the Indian Standards Institution on 8 March 1985, after the draft finalized by the Rubber Sectional Committee had been approved by the Petroleum, Coal and Related Products Division Council.

0.2 Test methods for rubber latex had been originally covered in the following Indian Standards:

For natural rubber latex

IS : 3708 (Part 1)-1966*

IS : 3708 (Part 2)-1968†

For styrene butadiene rubber latex

IS : 4511 (Part 1)-1967‡

Since some of the test methods covered in the above standards were common, the concerned committee had decided some years ago to unify and publish a separate series of methods of test which would be applicable to all types of latices — natural as well as synthetic. Accordingly, the following six test methods had been covered under IS : 9316.

*Methods of test for natural rubber latex: Part 1 Dry rubber content, sludge content, density, total alkalinity, KOH-number, mechanical stability, volatile fatty acid number, pH, total nitrogen, total copper, total iron, total manganese and total ash.

†Methods of test for natural rubber latex, Part 2.

‡Methods of tests for styrene-butadiene rubber (SBR) latices: Part 1 Determination of dry polymer, pH, density, residual styrene, bound styrene and soap content.

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IS : 9316 Methods of test for rubber latex:

- Part 1-1979 Determination of surface tension
- Part 2-1979 Determination of viscosity
- Part 3-1979 Determination of coagulum content
- Part 4-1979 Determination of total solids content
- Part 5-1979 Drawing of samples
- Part 6-1982 Determination of pH

0.2.1 As a result of further rethinking on the subject, it has now been decided to re-designate the test methods common to natural and synthetic rubber latices as RL series; test methods for natural rubber latex as NRL series and test methods for styrene-butadiene rubber latex as SBRL series. Consequently, test methods for rubber latex have been rationalized into the following three series:

- a) IS : 9316 Unified methods of test applicable to both natural and synthetic rubber latices — RL series;
- b) IS : 3708 Methods of test applicable to natural rubber latex — NRL series; and
- c) IS : 4511 Methods of test applicable to styrene-butadiene rubber latex — SBRL series.

0.3 The existing Indian Standards under IS : 3708 (Parts 1* and 2†), IS : 4511 (Part 1‡) and IS : 9316 (Parts 1 to 6) are being gradually replaced by separate standards under the above three series, designated by the appropriate NRL, SBRL or RL series, respectively.

0.3.1 The methods covered under NRL 13, NRL 14 and NRL 15 of IS : 3708 (Part 1)-1966 which are also under revision, have been proposed to be covered under the RL series in IS : 9316 (*under revision*).

0.4 In order to facilitate cross-reference, it has been decided to retain the original discrete NRL series numbers assigned to various test methods in IS : 3708 (Parts 1 and 2) in the revised parts of IS : 3708.

0.4.1 For proper referencing of the existing test methods and the new methods under revision, a statement showing corresponding methods is given in Appendix A.

0.5 In preparing the above series, the need to align the test methods with the corresponding ISO standards/DIS/DP wherever available has also

*Methods of test for natural rubber latex: Part 1 Dry rubber content, sludge content, density, total alkalinity, KOH-number, mechanical stability, volatile fatty acid number, pH, total nitrogen, total copper, total iron, total manganese and total ash.

†Methods of test for natural rubber latex, Part 2.

‡Methods of tests for styrene-butadiene rubber (SBR) latices: Part 1 Determination of dry polymer, pH, density, residual styrene, bound styrene and soap content.

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been taken into account for updating the test methods. In the preparation of this standard, assistance has been derived from ISO 705-1974 'Natural rubber latex — Determination of density', issued by the International Organization for Standardization (ISO).

0.6 Density determination is used to calculate the mass of a measured volume of latex in locations where it is not possible to weigh directly. For such purposes it is essential that the density be determined on a latex sample containing the same amount of air as it contained when the volume was measured. Before sampling, the latex is, therefore, allowed to stand for a minimum period of 24 hours to ensure the removal of air bubbles.

0.7 In reporting the result of a test or analysis made in accordance with this standard, if the final value, observed or calculated, is to be rounded off, it shall be done in accordance with IS : 2-1960*.

1. SCOPE

1.1 This standard (Part 3) prescribes a method for the determination of density of natural rubber latex of *Hevea brasiliensis*, uncompounded, unvulcanized, and which may contain preservatives and has a total solids content up to 63 percent.

2. TERMINOLOGY

2.0 For the purpose of this test, the following definition shall apply.

2.1 Density — The mass divided by the volume at a stated temperature. The units shall be stated.

3. OUTLINE OF THE METHOD

3.1 The density of latex is determined by density bottle method and the result is expressed as g/ml at a definite temperature. A correction is applied, if the temperature of bulk of the latex differs from the temperature of sample taken for density determination.

4. APPARATUS

4.1 Chemical Balance

4.2 Constant Temperature Bath — accurate to within $\pm 0.2^{\circ}\text{C}$ and adjustable to a temperature above or below room temperature.

4.3 Density Bottle — 50-ml capacity having a ground-glass stopper perforated by a capillary and a ground-glass cap and, if desired, an evacuated jacket.

*Rules for rounding off numerical values (revised).

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4.4 Two Conical Flasks — of at least 200-ml capacity, each fitted with a rubber stopper, a short glass inlet tube with a rubber blowing ball at the external end and a glass outlet tube reaching nearly to the bottom of the flask.

5. PROCEDURE

5.1 Adjust the temperature of the constant temperature bath to the desired temperature. Stir the sample of latex gently without introducing air bubbles. Fill one of the conical flasks with a suitable amount of the latex and place in the bath. Likewise, partly fill the second conical flask with freshly boiled distilled water and place in the bath. Weigh the clean and dry density bottle with stopper and cap to the nearest 0.001 g and immerse up to its neck in the bath with the ground-glass stopper in place but not the cap. Bring the density bottle and, the latex and water in the two conical flasks to the temperature of the constant temperature bath. This will require a minimum of about 3 hours in the case of a jacketed bottle and 20 minutes in the case of an unjacketed bottle. First blow a few millilitres of latex from the conical flask containing the latex and discard. Then blow sufficient latex from the conical flask into the density bottle to fill it completely. Put the stopper in place and wipe the top surface immediately clean, taking care not to remove any latex from the capillary tube. Remove the bottle from the bath and place the ground glass cap on immediately. Dry the outside with the minimum of handling and then weigh the bottle to the nearest 0.001 g. Empty the density bottle and wash free from latex with water. Immerse the bottle again in the bath as before. Fill the bottle with water by blowing from the second conical flask and allow to stand for 5 minutes. Empty the bottle and completely refill, while still immersed in the bath by the same procedure.

5.1.1 Put the stopper in place and wipe the top surface immediately dry, taking care not to remove any water from the capillary tube. Remove the bottle from the bath and place the ground glass cap on immediately. Dry the outside with the minimum of handling and weigh the bottle to the nearest 0.001 g. The results of duplicate tests shall agree within 0.001 g/ml.

6. CALCULATION

6.1 Calculate the density of the latex from the following formula:

$$D = \frac{M_L \times D_w}{M_w}$$

where

D = density of latex at the temperature of the constant temperature bath in g/ml,

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M_L = mass in g of latex in the density bottle,

D_w = density of water at the bath temperature in g/ml, and

M_w = the mass in g of water in the density bottle.

6.2 If the temperature of the density determination of the sample tubes differs from that of the bulk of the latex, apply a correction by calculation, using Table 1, as follows:

$$D = A + B - C$$

where

D = density of latex,

A = density measured at temperature of test,

B = correction value from table for temperature of test and *DRC* of latex, and

C = correction value from table for temperature of bulk of latex and *DRC* of latex.

TABLE 1 DENSITY CONVERSION VALUES FOR NATURAL RUBBER LATEX

(Clause 6.2)

TEMPER- ATURE °C	DENSITY OF WATER g/ml	CORRECTION FOR DRY RUBBER CONTENT										
		20 per- cent g/ml	25 per- cent g/ml	30 per- cent g/ml	35 per- cent g/ml	40 per- cent g/ml	45 per- cent g/ml	50 per- cent g/ml	55 per- cent g/ml	60 per- cent g/ml	65 per- cent g/ml	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	
0	0.999 87	0.000 0	0.000 0	0.000 0	0.000 0	0.000 0	0.000 0	0.000 0	0.000 0	0.000 0	0.000 0	
2	0.999 97	0.000 2	0.000 3	0.000 4	0.000 4	0.000 5	0.000 6	0.000 6	0.000 7	0.000 8	0.000 8	
4	1.000 00	0.000 5	0.000 6	0.000 8	0.000 9	0.001 0	0.001 2	0.001 3	0.001 4	0.001 6	0.001 7	
6	0.999 97	0.000 8	0.001 0	0.001 2	0.001 4	0.001 6	0.001 8	0.002 0	0.002 2	0.002 4	0.002 6	
8	0.999 88	0.001 1	0.001 4	0.001 7	0.001 9	0.002 2	0.002 5	0.002 7	0.003 0	0.003 2	0.003 5	
10	0.999 73	0.001 5	0.001 9	0.002 2	0.002 5	0.002 8	0.003 2	0.003 5	0.003 8	0.004 1	0.004 4	
12	0.999 52	0.002 0	0.002 4	0.002 8	0.003 1	0.003 5	0.003 9	0.004 2	0.004 6	0.004 9	0.005 3	
14	0.999 27	0.002 5	0.002 9	0.003 4	0.003 8	0.004 2	0.004 6	0.005 0	0.005 4	0.005 8	0.006 2	
16	0.998 97	0.003 0	0.003 5	0.004 0	0.004 5	0.004 9	0.005 4	0.005 9	0.006 3	0.006 8	0.007 2	
18	0.998 62	0.003 5	0.004 1	0.004 6	0.005 2	0.005 7	0.006 2	0.006 7	0.007 2	0.007 7	0.008 2	
20	0.998 23	0.004 1	0.004 7	0.005 3	0.005 9	0.006 5	0.007 0	0.007 6	0.008 1	0.008 6	0.009 2	
22	0.997 80	0.004 8	0.005 4	0.006 0	0.006 6	0.007 3	0.007 9	0.008 5	0.009 0	0.009 6	0.010 2	
24	0.997 32	0.005 4	0.006 1	0.006 8	0.007 4	0.008 1	0.008 7	0.009 4	0.010 0	0.010 6	0.011 2	
26	0.996 81	0.006 1	0.006 8	0.007 5	0.008 2	0.008 9	0.009 6	0.010 3	0.010 9	0.011 6	0.012 2	
28	0.996 26	0.006 8	0.007 6	0.008 3	0.009 0	0.009 8	0.010 5	0.011 2	0.011 9	0.012 6	0.013 3	
30	0.995 67	0.007 6	0.008 4	0.009 1	0.009 9	0.010 7	0.011 4	0.012 2	0.012 9	0.013 6	0.014 3	
32	0.995 05	0.008 3	0.009 2	0.010 0	0.010 8	0.011 6	0.012 4	0.013 1	0.013 9	0.014 6	0.015 4	
34	0.994 40	0.009 1	0.010 0	0.010 8	0.011 7	0.012 5	0.013 3	0.014 1	0.014 9	0.015 7	0.016 4	
36	0.993 71	0.009 9	0.010 8	0.011 7	0.012 6	0.013 4	0.014 3	0.015 1	0.015 9	0.016 7	0.017 5	
38	0.992 99	0.010 8	0.011 7	0.012 6	0.013 5	0.014 4	0.015 3	0.016 1	0.017 0	0.017 8	0.018 6	
40	0.992 24	0.011 7	0.012 6	0.013 5	0.014 5	0.015 4	0.016 3	0.017 2	0.018 1	0.018 9	0.019 7	

APPENDIX A

(Clause 0.4.1)

TABLE SHOWING CORRESPONDENCE OF THE VARIOUS METHODS OF TEST COVERED IN THE EXISTING IS : 9316 (PARTS 1 TO 5)-1979, IS : 9316 (PART 6)-1982, IS : 3708 (PART 1)-1966, IS : 3708 (PART 2)-1968, IS : 4511 (PART 1)-1967 WITH THE REVISION/PROPOSED REVISION OF IS : 9316, IS : 3708 AND IS : 4511

Test Method	EXISTING TEST METHODS		PROPOSED REVISION		REMARKS
	IS No.	Part (Series)	IS No.	Series	
(1)	(2)	(3)	(4)	(5)	(6)
RL SERIES					
Determination of surface tension	IS : 9316-1979	Part 1	IS : 9316	Part 1 (RL : 1)	{ Under Revision }
Determination of viscosity	IS : 9316-1979	Part 2	IS : 9316	Part 2 (RL : 2)	
Determination of coagulum content	IS : 9316-1979	Part 3	IS : 9316	Part 3 (RL : 3)	
Determination of total solids content	IS : 9316-1979	Part 4	IS : 9316	Part 4 (RL : 4)	
Drawing of samples	IS : 9316-1979	Part 5	IS : 9316	Part 5 (RL : 5)	
Determination of pH	IS : 9316-1982	Part 6	IS : 9316	Part 6 (RL : 6)	{ Under Revision }
Determination of total copper	IS : 3708-1966	Part 1 (NRL : 13)	IS : 9316	Part 7 (RL : 7)	
Determination of total iron	IS : 3708-1966	Part 1 (NRL : 14)	IS : 9316	Part 8 (RL : 8)	
Determination of total manganese	IS : 3708-1966	Part 1 (NRL : 15)	IS : 9316	Part 9 (RL : 9)	
NRL SERIES					
Determination of dry rubber content	IS : 3708-1966	Part 1 (NRL : 1)	IS : 3708	Part 1 (NRL : 1)	{ Under Revision }
Determination of sludge content	IS : 3708-1966	Part 1 (NRL : 5)	IS : 3708	Part 2 (NRL : 5)	
Determination of density	IS : 3708-1966	Part 1 (NRL : 6)	IS : 3708	Part 3 (NRL : 6)	
Determination of total alkalinity	IS : 3708-1966	Part 1 (NRL : 7)	IS : 3708	Part 4 (NRL : 7)	
Determination of KOH-number	IS : 3708-1966	Part 1 (NRL : 8)	IS : 3708	Part 5 (NRL : 8)	
Determination of mechanical stability	IS : 3708-1966	Part 1 (NRL : 9)	IS : 3708	Part 6 (NRL : 9)	

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EXISTING TEST METHODS			PROPOSED REVISION		REMARKS
Test Method (1)	IS : No. (2)	Part (Series) (3)	IS : No. (4)	Series (5)	
NRL SERIES					
Determination of volatile fatty acid number	IS : 3708-1966	Part 1 (NRL : 10)	IS : 3708	Part 7 (NRL : 10)	
Determination of total nitrogen	IS : 3708-1966	Part 1 (NRL : 12)	IS : 3708	Part 8 (NRL : 12)	
Determination of total ash	IS : 3708-1966	Part 1 (NRL : 16)	IS : 3708	Part 9 (NRL : 16)	
Determination of boric acid	IS : 3708-1968	Part 2 (NRL : 17)	IS : 3708	Part 10 (NRL : 17)	
Determination of magnesium	IS : 3708-1968	Part 2 (NRL : 18)	IS : 3708	Part 11 (NRL : 18)	
SBRL SERIES					
Determination of dry polymer	IS : 4511-1967	Part 1 (SBRL : 1)	IS : 4511	Part 1 (SBRL : 1)	Under Revision
Determination of density	IS : 4511-1967	Part 1 (SBRL : 6)	IS : 4511	Part 2 (SBRL : 6)	
Determination of residual styrene (volatile unsaturates)	IS : 4511-1967	Part 1 (SBRL : 8)	IS : 4511	Part 3 (SBRL : 8)	
Determination of bound styrene	IS : 4511-1967	Part 1 (SBRL : 9)	IS : 4511	Part 4 (SBRL : 9)	
Determination of soap content	IS : 4511-1967	Part 1 (SBRL : 10)	IS : 4511	Part 5 (SBRL : 10)	

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INTERNATIONAL SYSTEM OF UNITS (SI UNITS)

Base Units

QUANTITY	UNIT	SYMBOL
Length	metre	m
Mass	kilogram	kg
Time	second	s
Electric current	ampere	A
Thermodynamic temperature	kelvin	K
Luminous intensity	candela	cd
Amount of substance	mole	mol

Supplementary Units

QUANTITY	UNIT	SYMBOL
Plane angle	radian	rad
Solid angle	steradian	sr

Derived Units

QUANTITY	UNIT	SYMBOL	DEFINITION
Force	newton	N	1 N = 1 kg.m/s ²
Energy	joule	J	1 J = 1 N.m
Power	watt	W	1 W = 1 J/s
Flux	weber	Wb	1 Wb = 1 V.s
Flux density	tesla	T	1 T = 1 Wb/m ²
Frequency	hertz	Hz	1 Hz = 1 c/s (s ⁻¹)
Electric conductance	siemens	S	1 S = 1 A/V
Electromotive force	volt	V	1 V = 1 W/A
Pressure, stress	pascal	Pa	1 Pa = 1 N/m ²