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SPECIFICATION FOR RUBBERS FOR THE DAIRY INDUSTRY

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MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
NEW DELHI 1

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Indian Standard

SPECIFICATION FOR RUBBERS FOR THE DAIRY INDUSTRY

0. FOREWORD

0.1 This Indian Standard was adopted by the Indian Standards Institution on 17 December 1971, after the draft finalized by the Rubber Products Sectional Committee had been approved by the Chemical Division Council.

0.2 Natural as well as synthetic rubbers are widely used in dairy equipment. This standard covers the whole range of rubber parts used in the dairy industry. This standard lays down the requirements for the various rubbers so that it will be possible to select a suitable type in the desired hardness range appropriate for the intended use. If the purchaser has any doubts on the right type of rubber for a specific application he should consult the rubber manufacturer.

0.3 It has not been found possible to specify limits and tests for detection of toxic materials which are capable of extraction from the rubber in significant quantities during use. However, for the guidance of the manufacturers, the compounding ingredients which have been found to be suitable by practical experience are given in Appendix A.

0.4 In the formulation of this standard considerable assistance has been derived from B.S. 1578 : 1965 'Specification for rubbers for the dairy industry' issued by British Standards Institution.

0.5 This standard contains clauses **4.2** and **5.1** which call for agreement between the purchaser and the supplier.

0.6 For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test or analysis, shall be rounded off in accordance with IS : 2-1960*. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

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1. SCOPE

1.1 This standard prescribes the requirements and methods of sampling and test for vulcanized non-oil resistant and oil resistant rubbers used in

*Rules for rounding off numerical values (*revised*).

the manufacture of rubber parts for the dairy industry suitable for use up to −10°C.

NOTE — The rubbers covered by this standard are adequately resistant to normal cleaning and sterilizing conditions.

1.2 The design and dimensional requirements of rubber parts are not covered by this standard.

2. TYPES AND GRADES

2.1 Types — This standard lays down the requirements for different types of rubber as follows:

a) *Type* A0 to A5 — Natural rubber or non-toxic general purpose synthetic rubber or blends thereof,

b) *Type* B1 to B5 — Acrylonitrile butadiene copolymer (NBR) non-staining or suitable blends with general purpose natural and synthetic rubbers, and

c) *Type* C1 to C5 — Polychloroprene rubbers.

2.2 Grades — The Type A rubbers shall be of two grades, namely, Grade 1 and Grade 2, depending on the physical properties.

3. REQUIREMENTS

3.1 General — Rubber articles for use in dairy applications shall not contain substances known to be toxic and which are capable of extraction from the rubber in significant quantities by any dairy product or by water or by steam. The rubber used shall not impart any objectionable taste, taint or odour to dairy products. If desired by the purchaser the nature of the compounding ingredients shall be disclosed.

3.2 Physical Requirements — The material shall comply with the requirements specified in Tables 1 to 4 for different types and grades.

3.3 Workmanship and Finish — Rubber products shall be free from physical defects such as patches, porosity, embedded foreign matter and shall not show excessive bloom, when examined visually.

4. MARKING AND PACKING

4.1 Marking — Individual rubber products for the dairy industry, wherever possible, shall be marked with the name of manufacturer or trade-mark, batch number, type and grade. Where it is not possible, marking shall be done on the package.

TABLE 1 REQUIREMENTS FOR NON-OIL RESISTANT COMPOUNDS OF NATURAL RUBBER OR NON-TOXIC GENERAL PURPOSE SYNTHETIC RUBBER OR BLENDS THEREOF TYPES A0 TO A5, GRADE 1

(*Clause* 3.2)

Sl No.	Characteristic	Requirements					
		Type A0	Type A1	Type A2	Type A3	Type A4	Type A5
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
i)	Hardness, IRHD	35^{+4}_{-5}	45^{+4}_{-5}	55^{+4}_{-5}	65^{+4}_{-5}	75^{+4}_{-5}	85 ± 5
ii)	Tensile strength, kgf/cm², *Min*	175	175	140	140	105	85
iii)	Elongation at break, percent, *Min*	700	600	500	350	250	150
iv)	Compression set, percent, *Max*	35	30	30	30	35	35
v)	Change in tensile strength after ageing for 7 days at 70°C in air oven, percent	+ 10 − 20	+ 10 − 20	+ 10 − 20	+ 10 − 20	+ 10 − 20	+ 10 − 20
vi)	Change in elongation at break after ageing for 7 days at 70°C in air oven, percent	+ 10 − 30	+ 10 − 30	+ 10 − 30	+ 10 − 30	+ 10 − 30	+ 10 − 30
vii)	Change in hardness after ageing for 7 days at 70°C in air oven, IRHD	+ 10 − 2	+ 10 − 2	+ 10 − 2	+ 10 − 2	+ 10 − 2	+ 10 − 2
viii)	Change in volume after 24 hours in steam at 100°C, percent, *Max*	12	12	12	15	15	15
ix)	Change in hardness after 24 hours in steam at 100°C, IRHD, *Max*	10	10	10	10	10	10

TABLE 2 REQUIREMENTS FOR NON-OIL RESISTANT COMPOUNDS OF NATURAL RUBBER OR NON-TOXIC GENERAL PURPOSE SYNTHETIC RUBBER OR BLENDS THEREOF TYPES A0 TO A5, GRADE 2

(*Clause* 3.2)

Sl No.	Characteristic	Requirements					
		Type A0	Type A1	Type A2	Type A3	Type A4	Type A5
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
i)	Hardness, IRHD	35^{+4}_{-5}	45^{+4}_{-5}	55^{+4}_{-5}	65^{+4}_{-5}	75^{+4}_{-5}	85 ± 5
ii)	Tensile strength, kgf/cm², *Min*	110	110	105	105	85	70
iii)	Elongation at break, percent, *Min*	500	500	400	300	200	100
iv)	Compression set, percent, *Max*	40	35	35	35	40	40
v)	Change in tensile strength after ageing for 7 days at 70°C in air oven, percent	$^{+10}_{-35}$	$^{+10}_{-35}$	$^{+10}_{-35}$	$^{+10}_{-35}$	$^{+10}_{-35}$	$^{+10}_{-35}$
vi)	Change in elongation at break after ageing for 7 days at 70°C in air oven, percent	$^{+10}_{-35}$	$^{+10}_{-35}$	$^{+10}_{-35}$	$^{+10}_{-35}$	$^{+10}_{-35}$	$^{+10}_{-35}$
vii)	Change in hardness after ageing for 7 days at 70°C in air oven, IRHD	$^{+10}_{-2}$	$^{+10}_{-2}$	$^{+10}_{-2}$	$^{+10}_{-2}$	$^{+10}_{-2}$	$^{+10}_{-2}$
viii)	Change in volume after 24 hours in steam at 100°C, percent, *Max*	15	15	15	20	20	20
ix)	Change in hardness after 24 hours in steam at 100°C, IRHD, *Max*	15	15	15	15	15	15

TABLE 3 REQUIREMENTS FOR ACRYLONITRILE BUTADIENE COPOLYMER (NBR) NON-STAINING OR SUITABLE BLENDS WITH GENERAL PURPOSE NATURAL AND SYNTHETIC RUBBERS TYPES B1 TO B5

(*Clause* 3.2)

Sl No.	Characteristic	Requirements				
		Type B1	Type B2	Type B3	Type B4	Type B5
(1)	(2)	(3)	(4)	(5)	(6)	(7)
i)	Hardness, IRHD	45^{+4}_{-5}	55^{+4}_{-5}	65^{+4}_{-5}	75^{+4}_{-5}	85 ± 5
ii)	Tensile strength, kgf/cm², *Min*	70	70	70	70	70
iii)	Elongation at break, percent, *Min*	450	350	250	175	100
iv)	Compression set, percent, *Max*	30	30	30	30	30
v)	Change in tensile strength after ageing for 3 days at 100°C in air oven, percent	± 25	± 25	± 25	+ 10 − 45	± 25
vi)	Change in elongation at break after ageing for 3 days at 100°C in air oven, percent	+ 10 − 45	+ 10 − 45	+ 10 − 45	+ 10 − 45	+ 10 − 45
vii)	Change in hardness after ageing for 3 days at 100°C in air oven, IRHD	+ 8 − 2	+ 8 − 2	+ 8 − 2	+ 8 − 2	+ 8 − 2
viii)	Change in volume after swelling in butter oil for 24 hours at 100°C, percent, *Max*	5	5	5	5	5
ix)	Change in hardness after swelling in butter oil for 24 hours at 100°C, IRHD, *Max*	5	5	5	5	5
x)	Change in volume after 24 hours in steam at 100°C, percent, *Max*	10	10	10	10	10
xi)	Change in hardness after 24 hours in steam at 100°C, IRHD, *Max*	5	5	5	5	5

TABLE 4 REQUIREMENTS FOR POLYCHLOROPRENE RUBBER — TYPES C1 TO C5

(*Clause* 3.2)

Sl No.	Characteristic	Requirements				
		Type C1	Type C2	Type C3	Type C4	Type C5
(1)	(2)	(3)	(4)	(5)	(6)	(7)
i)	Hardness, IRHD	45^{+4}_{-5}	55^{+4}_{-5}	65^{+4}_{-5}	75^{+4}_{-5}	85 ± 5
ii)	Tensile strength, kgf/cm², *Min*	85	105	105	105	105
iii)	Elongation at break, percent, *Min*	450	350	250	200	100
iv)	Compression set, percent, *Max*	30	30	30	30	30
v)	Change in tensile strength after ageing for 3 days at 100°C in air oven, percent	± 25	± 25	± 25	± 25	± 25
vi)	Change in elongation at break after ageing for 3 days at 100°C in air oven, percent	+ 10 − 45	+ 10 − 45	+ 10 − 45	+ 10 − 45	+ 10 − 45
vii)	Change in hardness after ageing for 3 days at 100°C in air oven, IRHD	+ 8 − 2	+ 8 − 2	+ 8 − 2	+ 8 − 2	+ 8 − 2
viii)	Change in volume after swelling in butter oil for 24 hours at 100°C, percent, *Max*	40	30	30	20	20
ix)	Change in hardness after swelling in butter oil for 24 hours at 100°C, IRHD, *Max*	10	10	10	10	10
x)	Change in volume after 24 hours in steam at 100°C, percent, *Max*	15	15	15	15	15
xi)	Change in hardness after 24 hours in steam at 100°C, IRHD, *Max*	10	10	10	10	10

4.1.1 The products may also be marked with the ISI Certification mark.

NOTE — The use of the ISI Certification Mark is governed by the provisions of the Indian Standards Institution (Certification Marks) Act, and the Rules and Regulations made thereunder. Presence of this mark on products covered by an Indian Standard conveys the assurance that they have been produced to comply with the requirements of that standard, under a well-defined system of inspection, testing and quality control during production. This system, which is devised and supervised by ISI and operated by the producer, has the further safeguard that the products as actually marketed are continuously checked by ISI for conformity to the standard. Details of conditions, under which a licence for the use of the ISI Certification Mark may be granted to manufacturers or processors, may be obtained from the Indian Standards Institution.

4.2 Packing — The material shall be packed as agreed to between the purchaser and the supplier so as to avoid damage during transit and deterioration in storage.

5. SAMPLING AND CRITERIA FOR CONFORMITY

5.1 The sampling and criteria for conformity shall depend on the product and shall be as agreed to between the purchaser and the supplier.

6. TESTS

6.1 Test Pieces — Wherever possible the specified test pieces shall be cut from the finished article. Where this is impracticable, the manufacturer shall, if required, supply sheets of vulcanizate 300 × 300 × 2·5 mm and 150 × 150 × 6·5 mm prepared from the same batch and vulcanized to the same degree as the consignment concerned, from which the necessary test pieces can be prepared.

6.2 Hardness — Hardness shall be determined in accordance with the method prescribed in IS : 3400 (Part II)-1965*.

6.3 Tensile Strength and Elongation at Break — Tensile strength and elongation at break shall be determined in accordance with the method prescribed in IS : 3400 (Part I)-1965† using Type 1 test piece.

6.4 Compression Set — Compression set shall be determined in accordance with the method prescribed in IS : 3400 (Part X)-1969‡ at 70 ± 2°C.

6.5 Swelling in Butter Oil — The percentage of swelling shall be determined in accordance with the method prescribed in IS : 3400 (Part VI)-1967§ with the test pieces having a thickness of 2·5 ± 0·25 mm. Butter oil to be used in this determination shall be prepared as described in **6.5.1**.

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*Methods of test for vulcanized rubbers: Part II Hardness.
†Methods of test for vulcanized rubbers: Part I Tensile stress-strain properties.
‡Methods of test for vulcanized rubbers: Part X Compression set at constant strain.
§Methods of test for vulcanized rubbers: Part VI Resistance to liquids.

6.5.1 Heat a portion of butter in a beaker to a temperature 50 to 60°C until the fat separates from the water and curd. Filter the fat layer through a dry filter paper into a dry vessel. If necessary re-filter the filtrate under the same conditions until it is clear and free from water.

6.6 Hardness After Swelling in Butter Oil — Hardness in IRHD shall be determined in accordance with the method prescribed in IS : 3400 (Part II)-1965* after the test piece has been subjected to swelling in butter oil for 24 hours at 100 ± 2°C.

6.7 Volume Change in Steam — Determine the volume change in accordance with IS : 3400 (Part VI)-1967† after exposure of a test piece of thickness 2·5 ± 0·25 mm to steam at 100°C for a period of 24 hours. The test piece shall be cooled for 30 minutes in water before the measurements are carried out.

6.8 Hardness After 24 h Steam Ageing at 100°C — Determine the hardness in IRHD of the test piece in accordance with the method prescribed in IS : 3400 (Part VI)-1967†.

6.9 Hardness After Accelerated Ageing — Determine the hardness in IRHD after ageing for 7 days at 70°C in an air oven in accordance with the method prescribed in IS : 3400 (Part IV)-1965‡.

6.10 Tensile Strength and Elongation at Break After Accelerated Ageing — Age the samples in an air oven in accordance with IS : 3400 (Part IV)-1965‡ for the time and at the temperature as indicated in Tables 3 and 4. Determine tensile strength and elongation at break of the aged sample in accordance with the method prescribed in IS : 3400 (Part I)-1965§.

APPENDIX A

(*Clause* 0.3)

RECOMMENDED COMPOUNDING INGREDIENTS

A-1. GENERAL

A-1.1 In giving the following data it is not intended to imply that the use of alternative materials may not give compounds of a suitable quality. The recommendations are, in every case, intended mainly to indicate types of materials which have been found, by practical experience, to be suitable in normal quantities.

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*Methods of test for vulcanized rubbers: Part II Hardness.
†Methods of test for vulcanized rubbers: Part VI Resistance to liquids.
‡Methods of test for vulcanized rubbers: Part IV Accelerated ageing.
§Methods of test for vulcanized rubbers: Part I Tensile stress-strain properties.

A-2. ACCELERATORS

A-2.1 Recommended accelerators of the tasteless type are thiuram disulphides or monosulphides, dithiocarbamates and suitable polyamines.

A-3. ANTIOXIDANTS

A-3.1 Where it is considered that an antioxidant be employed, the following materials are recommended:

a) Condensation products of acetone and aniline, and
b) Di-βnaphthyl-*p*-phenylenediamine (symmetric).

A-4. FILLERS

A-4.1 The following are recommended:

a) *China Clay — see* IS : 505-1968*.
b) *Barytes — see* IS : 1683-1960†.
c) *Blanc Fixe*
d) *Kieselguhr*
e) *Silica*
f) *Whiting — see* IS : 1685-1960‡.
g) *Carbon Black*

A-5. SOFTENERS

A-5.1 The following are recommended:

a) *Stearic Acid — see* IS : 1675-1960§.
b) *Petroleum Jelly*
c) *Light Coloured Non-Staining Mineral Oil*

*Specification for light kaolin (*first revision*).
†Specification for barytes for rubber industry.
‡Specification for whiting for rubber industry.
§Specification for stearic acid, technical.

INDIAN STANDARDS
ON
Rubber Products

IS :

443-1963 Methods of sampling and test for rubber hoses (*revised*)
444-1968 Water hose of rubber with woven textile reinforcement (*second revision*) (*superseding* IS : 445-1964)
446-1968 Air hose of rubber with woven textile reinforcement (*second revision*) (*superseding* IS : 3557-1965)
447-1968 Welding hose of rubber with woven textile reinforcement (*second revision*)
635-1968 Oil and solvent resistant hose of rubber with woven textile reinforcement (*second revision*)
636-1962 Fire fighting hose (rubber lined woven jacketed) (*revised*)
637-1965 Rubber tubings for general purposes (*revised*)
638-1965 Sheet rubber jointing and insertion rubber jointings (*revised*)
911-1968 Air hose of rubber with braided textile reinforcement (*second revision*) (*superseding* IS : 912-1963)
913-1968 Water hose or rubber with braided textile reinforcement (*second revision*) (*superseding* IS : 914-1963)
1677-1968 Agricultural spray hose of rubber with braided textile reinforcement (*second revision*)
1685-1960 Whiting for rubber industry
1741-1960 Latex foam rubber products
1867-1961 Rubber hot water bottles
2396-1968 Rubber hose for petrol and diesel fuels with braided textile reinforcement (*first revision*)
2410-1963 Suction hose of rubber for fire services
2414-1969 Cycle tyres (*first revision*)
2415-1969 Cycle rubber tubes (*first revision*)
2482-1965 Water suction hose of rubber, light duty
2765-1964 Radiator hose
3418-1968 Oil and solvent resistant hose of rubber with braided textile reinforcement (*first revision*)
3549-1965 Water suction and discharge hose of rubber, heavy duty
3565-1966 Rubber teats for feeding bottles
3572-1968 Welding hose of rubber with braided textile reinforcement (*first revision*)
3692-1965 Rubber closures (pharmaceuticals)
3701-1966 Rubber protective sheaths (condoms)
3867-1966 Rubber ice bags
4135-1967 Hospital rubber sheeting
4148-1967 Surgical rubber gloves
4149-1967 Post-mortem rubber gloves
4770-1968 Rubber gloves for electrical purposes
5079-1969 Rubber valve tubing for cycle tube valves
5137-1969 Cement grouting hose of rubber with woven textile reinforcement
5166-1969 Cement grouting hose of rubber with braided textile reinforcement
5192-1969 Vulcanized rubber compounds
5193-1969 Rubber sealing rings for domestic fruit and vegetable preserving jars
5270-1969 Rubber grommets for general purposes
5382-1969 Rubber sealing rings for gas mains, water mains and sewers
5424-1969 Rubber mats for electrical purposes
5680-1969 Rubber tubing for medical use
5783-1970 Rubber ward-dressing and porters' gloves
5797-1970 Electrically bonded aircraft fuelling rubber hose
5821-1970 Hot water hose of rubber with woven textile reinforcement
5894-1970 Rubber sand blast hose with braided textile reinforcement
5937-1970 Hot water hose of rubber with braided textile reinforcement
6058-1970 Rubber components for transfusion fluid bottles
6407-1971 Rubber aprons for hospital use
6417-1971 Rubber sand blast hose with woven textile reinforcement
6450-1971 Rubbers for the dairy industry