IS : 5188 - 1985

Indian Standard

SPECIFICATION FOR COLD POLYMERIZED OIL-EXTENDED RAW STYRENE-BUTADIENE RUBBER

(First Revision)

Amd No. 1 Aug 99

UDC 678·762·2 — 134·622

INDIAN STANDARDS INSTITUTION
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
NEW DELHI 110002

Gr 3

October 1985

AMENDMENT NO. 1 SEPTEMBER 1999
TO
IS 5188 : 1985 SPECIFICATION FOR COLD POLYMERIZED OIL-EXTENDED RAW STYRENE-BUTADIENE RUBBER

(First Revision)

(*Page* 4, *clause* 2.1) — Substitute the following for the existing:

'**2.1 Description** — The material shall be free from any foreign matter and manufactured by cold polymerization process using mixed resin acid and fatty acid soap as emulsifer, sodium chloride and sulphuric acid or acid as coagulant so as to comply with the requirements of Table 1.'

(*Page* 6, *clause* 4.1.1) — Substitute the following for the existing:

'4.1.1 The material may also be dusted with talc and packed in HDPE woven sacks, laminated paper bag having an inner LDPE liner so as to have 33 bales per tonne weighing approximately 30 kg per bag.'

(PCD 14)

JD/RPM/ Amdt. Sep 99 need : Aug 99

10/24

Reprography Unit, BIS, New Delhi, India

AMENDMENT NO. 1 SEPTEMBER 1999
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(PCD 14)

Reprography Unit, BIS, New Delhi, India

Indian Standard

SPECIFICATION FOR COLD POLYMERIZED OIL-EXTENDED RAW STYRENE-BUTADIENE RUBBER

(First Revision)

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Indian Standard

SPECIFICATION FOR COLD POLYMERIZED OIL-EXTENDED RAW STYRENE-BUTADIENE RUBBER

(First Revision)

0. FOREWORD

0.1 This Indian Standard (First Revision) was adopted by the Indian Standards Institution on 13 August 1985, after the draft finalized by the Rubber Sectional Committee had been approved by the Petroleum, Coal and Related Products Division Council.

0.2 This standard was first published in 1969. In this revision requirements for total ash, Mooney viscosity and solvent extract have been modified and additional requirement for specific gravity has been included. In the absence of an acceptable test method for the estimation of gel content, it is envisaged to include the same in due course of time when an accurate method is made available. For compounding test receipe based on high abrasion furnace (HAF) carbon black has been prescribed with consequential changes in the requirements of compounded rubber.

0.3 This standard specifies requirements for oil-extended raw styrene-butadiene rubber (SBR) manufactured by cold polymerization normally below 5°C. This corresponds to the commercially known SBR 1712; this number is allotted by the International Institute of Synthetic Rubber Producers' Inc, USA. The following stabilizers which are staining in nature are generally used in its production:

a) An acetone-diphenylamine reaction product; and

b) A mixture of alkylated diphenylamines.

NOTE — Styrenated phenol at 1·2 to 2·0 percent by mass may also be added.

0.4 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

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

the rounded off value should be the same as that of the specified value in this standard.

1. SCOPE

1.1 This standard prescribes requirements and the methods of sampling and test for highly aromatic oil-extended raw styrene-butadiene rubber (SBR), obtained by copolymerization of styrene and butadiene at low temperature.

2. REQUIREMENTS

2.1 Description — The material shall be free from any foreign matter and manufactured by cold polymerization process using mixed rosin acid and fatty acid soap as emulsifier, sodium chloride and sulphuric acid as coagulants and a staining type stabilizer so as to comply with the requirements given in Table 1.

TABLE 1 REQUIREMENTS FOR COLD POLYMERIZED OIL-EXTENDED RAW STYRENE-BUTADIENE RUBBER

Sl No.	Characteristic	Requirement		Method of Test
		Min	*Max*	
(1)	(2)	(3)	(4)	(5)
i)	Volatile matter, percent by mass	—	0·75	•SBR : 1 or 2 of IS : 4518 (Part 1) - 1967*
ii)	Total ash, percent by mass	—	0·5	SBR : 3
iii)	Organic acid, percent by mass	3·9	5·7	SBR : 4
iv)	Soap, percent by mass	—	0·50	SBR : 5
v)	Antioxidant, percent by mass	1·0	1·8	SBR : 6
vi)	Bound styrene, percent by mass	21·5	25·5	SBR : 7
vii)	Mooney viscosity, ML_{1+4} at 100°C	42	56	SBR : 8
viii)	Solvent extract, percent by mass	30·0	36·6	SBR : 9 of IS : 4518 (Part 2)-1971†
ix)	Relative density	0·94	0·96	Appendix A

*Methods of test for styrene-butadiene rubbers (SBR) : Part 1 Determination of volatile matter, total ash, organic acid, soap, antioxidants, bound styrene and mooney viscosity.

†Methods of test for styrene-butadiene rubbers (SBR) : Part 2 Determination of solvent extract and oil content.

2.2 The physical requirements of the material when compounded according to the method prescribed in Appendix B cured for the time specified in col 3 of Table 2 and tested as prescribed in col 6 shall be as given in col 4 and 5 of the table.

TABLE 2 PHYSICAL REQUIREMENTS OF COMPOUNDED RUBBER

Sl No.	Characteristic	Cure Time (Minutes)	Requirement		Method of Test
			Min	*Max*	
(1)	(2)	(3)	(4)	(5)	(6)
i)	Compounded viscosity, ML_{1+4} at 100°C	—	—	65	SBR : 8 of IS : 4518 (Part 1)-1967*
ii)	Tensile strength, MPa (approx kgf/cm²)	35	16·5 (165)	—	IS : 3400 (Part 1)-1977†
iii)	Percent elongation at break	35	330	—	
iv)	Modulus at 300 percent elongation, cure temperature, 145°C MPa (approx kgf/cm²)	25	6·0 (60)	12·5 (125)	
		35	9·0 (90)	15·5 (155)	
		50	10·0 (100)	16·5 (165)	

*Methods of test for styrene-butadiene rubbers (SBR): Part 1 Determination of volatile matter total ash, organic acid, soap, antioxidants, bound styrene and mooney viscosity.

†Methods of test for vulcanized rubbers : Part 1 Tensile stress-strain properties (*first revision*).

3. MARKING

3.1 The material shall be clearly marked with the letters 'OEP' (denoting oil extended product), net mass, batch number, type of rubber, year of manufacture and trade-mark, if any.

3.1.1 The material 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 processers, may be obtained from the Indian Standards Institution.

4. PACKING

4.1 The material shall be wrapped in polyethylene sheets and then in paper bags.

NOTE — Low density polyethylene sheets which are easily dispersible in rubber and of the following description are generally found suitable:

Thickness, mm	0·030 to 0·040
Relative density	0·92
Melting point	109°C

4.1.1 The material may also be dusted with talc and packed in paper bags so as to have 33 bales per tonne weighing approximately 30 kg per bag.

5. SAMPLING AND CRITERIA FOR CONFORMITY

5.1 The scale of sampling and criteria for conformity of a consignmetn of the rubber to this standard shall be as prescribed in IS : 5599-1970*.

APPENDIX A
(*Clause* 2.1)

DETERMINATION OF RELATIVE DENSITY IN RUBBER

A-1. RELATIVE DENSITY

A-1.1 Determine the relative density using the pycnometer with alcohol in place of water to eliminate the errors due to air bubbles. Take measurements at a temperature between 24·5 and 25·5°C, unless the coefficient of expansion of the rubber product is known, in that case make the determination at any convenient temperature and correct to 25°C.

A-1.2 Calculation

$$\text{Relative density at } 25°\text{C} = 0{\cdot}9971 \times \frac{M_1}{M_1-(M_2-M_3)} \times D$$

where

M_1 = mass of specimen,
M_2 = mass of pycnometer filled with specimen and alcohol,
M_3 = mass of pycnometer filled with alcohol, and
D = density of alcohol at 25°C.

*Methods for sampling of raw rubber.

APPENDIX B
(*Clause* 2.2)

COMPOUNDING OF RUBBER FOR PHYSICAL TESTING

B-1. MIXING MILL

B-1.1 The laboratory mixing mill has two parallel and cylindrical hardened steel rolls 152·5 ± 2·5 mm in outside diameter. The rolls are fitted with adjustable guides to allow a maximum working width of 265 ± 15 mm. The mill has provisions for maintaining the temperatures of the roll surfaces at 50 ± 5°C during the mixing of the rubber. The two rolls rotate at different speeds. The speed of the slow roll is 24 ± 2 rev/min and the friction ratio is 1:1·4.

B-1.1.1 If mills having ratios of fast to slow roll speeds lower than 1·4 are used, modifications in the mixing conditions given under procedure may be required to obtain results comparable to those obtained with the standard mill.

B-1.1.2 The mill is designed to permit adjustment of the distance between the rolls from 0·2 mm or less to 3·0 mm or more.

B-2. PREPARATION OF MIX FOR VULCANIZATION

B-2.1 Using a sample of styrene-butadiene copolymer selected in accordance with IS : 5599-1970* make a mix of the following composition, the batch mass being four times the formula mass expressed in grams.

Name of the Material	*Parts by Mass*
Raw styrene-butadiene rubber	100·00
Sulphur (conforming to IS : 8851-1978 †)	1·75
Stearic acid (conforming to type 4 or type 5 of IS : 1675-1971‡)	1·00
High abrasion furnace (HAF) carbon black (conforming to IS : 7497 - 1974§)	50·00
Zinc oxide (conforming to IS : 3399 - 1973 ‖)	3·00
N-tertiary butyl-2-benzothiazole sulphenamide (TBBS)	1·00

*Methods for sampling of raw rubber.

†Specification for sulphur for rubber industry.

‡Specification for stearic acid, technical (*first revision*).

§Specification for high abrasion furnace (HAF) carbon black.

‖ Specification for zinc oxide for rubber industry (*first revision*).

B-3. METHOD OF MIXING

B-3.1 The duration in minutes for mixing is given against each of the following steps.

		Duration (Min)
B-3.1.1	Band the rubber with the mill opening set at 1·1 mm and make 3/4 cuts every 30 s from alternate sides, roller temperature being 50 ± 5°C.	7
B-3.1.2	Add the sulphur slowly and evenly across the rubber.	2
B-3.1.3	Add the stearic acid. Make one 3/4 cut from each side.	2
B-3.1.4	Add the carbon black evenly across the mill at uniform rate. When about half the black has been incorporated, open the mill to 1·4 mm and make one 3/4 cut from each side. Then add the remainder of the carbon black, including the black that has dropped into the mill pan. When all the black has been incorporated, open the mill to 1·8 mm and make one 3/4 cut from each side.	12
B-3.1.5	Add the zinc oxide and N-tert-Butyl-2-benzo-thiozole Sulphenamide (TBBS) with the mill opening at 1·8 mm.	3
B-3.1.6	Make three 3/4 cuts from each side.	3
B-3.1.7	Cut the batch from the mill. Set the mill opening to 0·8 mm and pass the rolled batch end-wise through the rolls six times.	2
		31

B-3.1.8 Sheet the batch to an approximate thickness of 6 mm and check the mass. Remove sufficient sample for mooney viscosity testing.

B-3.1.9 Sheet the batch to an approximately 2·2 mm for preparing test slabs or to the appropriate thickness for preparing ring specimens.

B-3.1.10 Condition the batch for 2 to 24 hours after mixing and prior to vulcanizing.

B-4. TEST SLAB MOULD

B-4.1 The mould used shall have a depth between 1·90 and 2·00 mm for dumb-bell shaped test pieces and shall be capable of moulding square test

slabs of side length 150 mm from which specimens may be cut with a die as given in Fig. 1 of IS : 3400 (Part 1) - 1977*.

B-5. PLATEN PRESS VULCANIZATION

B-5.1 Bring the mould to vulcanization temperature of 145°C within ±0·5°C in the closed press, and hold at this temperature for at least 20 min before the unvulcanized pieces are inserted. Verify the temperature of the mould by means of a thermocouple or other suitable temperature measuring device inserted in one of the overflow grooves and in intimate contact with the mould.

B-5.2 Open the press, insert the unvulcanized pieces in the mould and close the press in the minimum time possible. When the mould is removed from the press to insert the pieces, precautions should be taken to prevent excessive cooling of the mould by contact with cool metal surfaces or by exposure to air draughts.

B-5.3 The time of vulcanization shall be considered to be the period between the instant the pressure is applied fully and the instant the pressure is released. Hold the mould under a minimum pressure of 3·5 MPa on the cavity areas during vulcanization.

As soon as the press is opened, remove the vulcanized sheet from the mould and cool in water (room temperature or lower) for 10 to 15 min. Then wipe dry the sheets cooled in water and reserve for test. In both of the preceding operations, take care to prevent undue stretching or deformation.

B-5.4 Store at the standard temperature of 27 ± 2°C and relative humidity 65 ± 5.

B-5.5 For all test purposes the minimum time between vulcanization and testing shall be 16 hours.

B-5.6 Maximum time between vulcanization and testing shall be 4 w eek and for evaluation intended to be comparable, the tests, as far as possible, shall be carried out after the same time interval.

*Methods of test for vulcanized rubbers: Part 1 Tensile stress-stain properties (*first revision*).

(*Continued from page 2*)

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Indian Standard

RUBBER GLOVES — ELECTRICAL PURPOSES — SPECIFICATION

(First Revision)

1 SCOPE

This standard prescribes requirements, methods of sampling and test for rubber insulating gloves for electrical purposes.

2 REFERENCES

The following Indian Standards are necessary adjuncts to this standard:

IS No.	*Title*
1876 : 1961	Method for voltage measurement by means of sphere-gaps (one sphere earthed)
1885 (Parts 1 to 66)	Electrotechnical vocabulary
3400	Methods of test for vulcanized rubbers:
(Part 1) : 1987	Tensile stress—strain properties (*second revision*)
(Part 4) : 1987	Accelerated ageing (*second revision*)
(Part 13) : 1983	Tension set (*first revision*)
(Part 17) : 1974	Tear strength — angular test pieces
(Part 20) : 1977	Resistance to ozone
3708	Methods of test for natural rubber latex:
(Part 8) : 1986	Determination of total nitrogen (NRL : 12) (*first revision*)
(Part 9) : 1986	Determination of total ash (NRL : 16) (*first revision*)
7503 (Parts 1 to 6)	Glossary of terms used in rubber industry

3 TERMINOLOGY

3.0 For the purpose of this standard, the definitions given in various parts of IS 1885, IS 7503 and the following shall apply.

3.1 Type Tests

Tests carried out to prove conformity with the specification. These are intended to prove the general qualities, design and raw material of a given type of gloves.

3.2 Acceptance Tests

Tests carried out on samples taken from a lot for the purpose of acceptance of the lot.

3.3 Routine Tests

Tests carried out at manufacturer's works on each glove to check the requirements which are likely to vary during production.

4 TYPES

4.1 This standard cover following four types of gloves:

Type 1 — For use at voltage not exceeding 650 ac rms

Type 2 — For use at voltage not exceeding 1 100 ac rms

Type 3 — For use at voltage not exceeding 7 500 ac rms

Type 4 — For use at voltage not exceeding 17 000 ac rms.

4.1.1 Type 1 gloves shall be the wrist type (close fitting), while Type 2, Type 3 and Type 4 shall be gauntlet type.

5 REQUIREMENTS

5.1 Composition

5.1.1 Type 1 gloves shall be made from good quality natural rubber.

5.1.2 Types 2, 3 and 4 gloves shall be made from good quality natural or synthetic rubber or from a mixture thereof.

5.2 Construction

The gloves shall be made either by dipping, if latex is used or from calendered sheets. The gloves shall have a smooth finish and the cuff edges shall be finished with a roll or a reinforcing strip of rubber, unless specified otherwise.

If gloves are made from calendered sheets, all joints shall be made by butting or skiving the edges closely together and strengthening both sides by means of strips or tapes of the same material as the sheets. These shall be suitably vulcanized to conform to the requirements of the specification.

5.3 Shape and Size

Type 1 gloves shall be of the shape as given in Fig. 1 and Types 2 to 4 gloves shall be of loose fitting shape as given in Fig. 2. The recommended sizes are given in Annex A.

5.4 Length

The minimum internal length from the tip of the second finger to the edge of the cuff shall be 250 mm for the wrist type and 400 mm for gauntlet type.

5.5 Thickness

The thickness of the gloves when determined as in Annex C shall meet the requirements specified in Table 1.

Table 1 Thickness of Gloves

(*Clause* 5.5)

Type	Minimum Thickness at		Maximum Thickness (*Both*)
	Crotch[1] Area	Non-crotch Area	
(1)	(2)	(3)	(4)
	mm	mm	mm
1	0·50	0·55	0·95
2	0·70	0·80	1·25
3	0·80	0·95	1·50
4	1·05	1·30	2·30

[1]Crotch area is a circular area 12·5 mm radius whose centre is at intersection of the plane of the axis of the fingers (or thumb) and a lines at the crotch, midway between the base of the adjacent fingers (or thumb) and extending from palm to the back of the glove.

5.6 The gloves shall have a smooth surface and shall be free on both inner and outer surfaces from visual defects like patches, blisters, porosity, embedded foreign matter or other physical defects which may be detected at the time of inspection or testing.

5.7 The rubber forming the gloves and also the seams, in case of gloves that are built up from sheet, shall comply with requirements given in Table 2.

5.8 Proof (Test) Voltage and Leakage Current

Each glove shall withstand the 50 Hz ac proof (test) voltage (rms value) according to the method prescribed in Annex F. The test voltage shall be applied continuously for 1 minute and the glove shall withstand it without breakdown and the leakage current shall not be more than as prescribed in col 6 of Table 3.

5.9 Breakdown Voltage

Gloves when tested according to the method prescribed in Annex G, shall not breakdown at voltage below the value shown against each type in Table 4.

NOTE — The gloves subjected to breakdown test shall NOT be used for electrical protection any more.

5.10 Ozone Resistance

Type 4 gloves shall show no visible defects when tested in accordance with Annex H. Any visible signs of ozone deterioration of the glove material, such as, cracking, pitting, breaks, etc, shall be considered as failure.

6 TESTS

6.1 Classification of Tests

6.1.1 *Type Tests*

The following shall constitute type tests:

a) Thickness (*see* **5.5**);
b) Tensile strength (*see* **5.7**);
c) Elongation at break (*see* **5.7**);
d) Tension set (*see* **5.7**);
e) Tensile stress at 200 percent elongation (*see* **5.7**);
f) Tear strength (*see* **5.7**);
g) Tensile strength and elongation at break after heat ageing (*see* **5.7**);
h) Puncture resistance (*see* **5.7**);
j) Moisture absorption (*see* **5.7**);
k) Nitrogen content (for natural rubber only) (*see* **5.7**);
m) Ash content (for natural rubber only) (*see* **5.7**);
n) Proof voltage and leakage current (*see* **5.8**);
p) Breakdown voltage (*see* **5.9**); and
q) Ozone resistance (for type 4 only) (*see* **5.10**).

6.1.1.1 Five samples shall be submitted for testing. The testing authority shall issue a type approval certificate, if the gloves are found to comply with the requirements as given in **6.1.1**.

6.1.1.2 In case of failure in one or more type tests, the testing authority may call for fresh samples not exceeding twice the number of original samples and subject them to the test(s) in which failure occurred. If, in the repeat test(s) no failure occurs, the tests may be considered to have been satisfied.

6.1.2 *Acceptance Tests*

The following shall constitute acceptance test:

a) Thickness (*see* **5.5**),
b) Tensile strength and ultimate elongation (*see* **5.7**).
c) Puncture resistance (*see* **5.7**).
d) Moisture absorption (*see* **5.7**).
e) Proof voltage and leakage current (*see* **5.8**).
f) Breakdown voltage (*see* **5.9**).

6.1.2.1 The number of samples for acceptance tests shall be as specified. However, a recommended plan of sampling is given in Annex J.

6.1.3 *Routine Tests*

a) Thickness (*see* **5.5**).
b) Proof voltage and leakage current (*see* **5.8**).

Table 2 Requirements for Material Forming the Gloves
(Clause 5.7)

Sl No.	Characteristic	Requirement		Method of Test, Ref to	
		Type 1	Types 2, 3 & 4	Annex of This Standard	Other
(1)	(2)	(3)	(4)	(5)	(6)
i)	Tensile strength, MPa, *Min*	17	10	—	3400 (Part 1) : 1987
ii)	Tensile stress at 200 percent elongation, MPa, *Min*	2	2	—	do
iii)	Elongation at break percent, *Min*	600	500	—	do
iv)	Tear strength, kN/m, *Min*	14	14	—	3400 (Part 17) : 1974
v)	Tension set[1]), percent, *Max*	20	25	—	3400 (Part 13) : 1983
vi)	Moisture absorption mg/cm², *Max*	5	5	D	—
vii)	Change in tensile strength, after accelerated ageing at 70 ± 2°C for 168 h percent of original, *Min*	80	90	—	3400 (Part 4) : 1987; and 3400 (Part 1) : 1987
viii)	Change in elongation at break, after accelerated ageing at 70 ± 2°C of 168 h, percent of original, *Min*	80	80	—	do
ix)	Puncture resistance, kN/m	18	18	E	—
x)	For natural rubber only				
	a) Nitrogen content, percent of dry rubber content, *Max*	0·2	—	—	3708 (Part 8) : 1986
	b) Ash content, percent, *Max*	1·0	—	—	3708 (Part 9) : 1986

[1]) Extend the sample to 100 percent elongation for a duration of 10 minutes and recovery time of 30 minutes then measure the final length between the bench marks.

Table 3 Proof (Test) Voltage and Leakage Current Requirements
(Clause 5.8)

Sl No.	Type of Glove	Working Voltage (rms) of Gloves, *Max*	Proof (Test) Voltage (rms)	Leakage Current (rms) at Working Voltage, *Max*	Leakage Current (rms) at Proof Voltage
		V	V	μA	mA
(1)	(2)	(3)	(4)	(5)	(6)
i)	1	650	5 000	400	4
ii)	2	1 100	10 000	600	8
iii)	3	7 500	17 000	4 000	14
iv)	4	17 000	25 000	8 000	16

Table 4 A.C. Breakdown Voltage Requirements
(Clause 5.9)

Sl No.	Type of Glove	Minimum Breakdown Voltage (V) (rms), *Min*
(1)	(2)	(3)
i)	1	6 000
ii)	2	12 000
iii)	3	20 000
iv)	4	30 000

7 PACKING AND MARKING

7.1 Packing

The gloves may be packed in polyethylene bags and sealed or as agreed to between the purchaser and the supplier.

NOTE — Materials, such as copper, manganese and substances which are oily greasy or tarry in nature have deleterious effect on rubber. Containers with internal surfaces made of such materials should, therefore be avoided.

7.2 Marking

The gloves shall be marked indelibly at the back with the following information:

a) Size and type of glove;

b) Maximum working potential in bolts, followed by the word 'working' in brackets;

c) Indentification of the source of manufacture; and

d) Month and year of manufacture.

7.2.1 The gloves shall be colour coded as given below to indicate the rated potential:

Black for Type 1

Blue for Type 2

Green for Type 3

Red for Type 4

7.2.2 The gloves may also be marked with the Standard Mark.

8 TIME LAPSE BETWEEN RECEIPT OF MATERIAL AND TESTING

8.1 For all the test purposes, the minimum time between vulcanization and testing shall be 16 h.

8.1.1 For product tests, whenever possible, the time between vulcanization and testing should not exceed 4 months. In other cases, tests shall be made within 2 months from the date of receipt of the product by the customer.

9 TEST PIECE

9.1 Wherever possible, for all tests, test pieces shall be cut from the finished article. Where this is not possible, the manufacturer shall provide test slabs from the same batch of rubber compound and vulcanized to the same degree and in the same manner as that of the rubber from which gloves have been manufactured.

ANNEX A
(*Clause* 5.3)

RECOMMENDED DIMENSIONS FOR DIFFERENT SIZES OF RUBBER GLOVES FOR ELECTRICAL PURPOSES

A-1 The recommended dimension of various parts of Type 1 glove shown in Fig. 1 are given in Table 5.

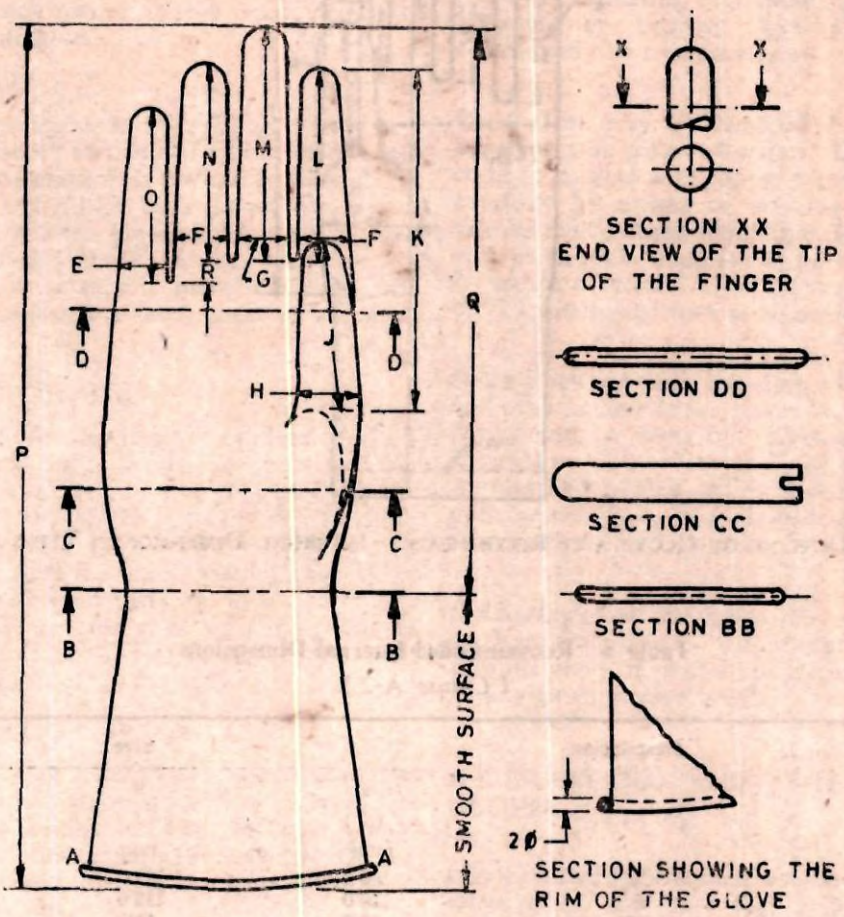

FIG. 1 DIMENSIONS FOR RIGHT HAND RUBBER GLOVE (TYPE 1)

Table 5 Recommended Dimensions For Type 1 Gloves
(*Clause* A-1)

Sl No.	Description	Dimension	Tolerance
(1)	(2)	(3)	(4)
		mm	mm
1	Perimeter at *AA*	210	± 3
2	Perimeter at *BB*	185	± 3
3	Perimeter at *CC*	240	± 3
4	Perimeter at *DD*	205	± 3
5	Circumference at *E*	60	± 2
6	Circumference at *F*	63	± 2
7	Circumference at *G*	65	± 2
8	Circumference at *H*	70	± 2
9	Length at *J*	61	± 2
10	Length at *K*	120	± 2
11	Length at *L* and *N*	72	± 2
12	Length at *M*	82	± 2
13	Length at *O*	62	± 2
14	Length at *P*	280	± 3
15	Length at *Q*	105	± 3
16	Length at *R*	9	± 1

NOTE — All the dimensions given here are outside dimensions. Circumference at *E*, *F*, *G* and *H* is to be measured at a point 5 mm less than the length of the respective finger as measured from the tip.

A-2 The recommended dimensions of various parts of Types 2 to 4 glove shown in Fig. 2 are given in Table 6.

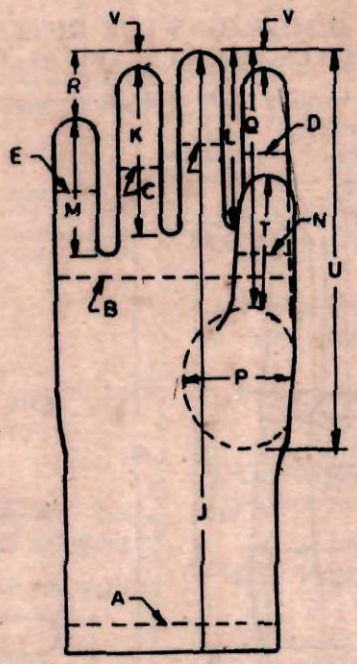

FIG. 2 OUTLINE OF GLOVE AND RECOMMENDED INTERNAL DIMENSIONS (TYPES 2 TO 4)

Table 6 Recommended Internal Dimensions
(*Clause* A-2)

	Description	Size		
		8	9	11
	(1)	(2)	(3)	(4)
		mm	mm	mm
Circumference at	*A*	220·0	235·0	270·0
	B	220·0	235·0	270·0
	C[1]	58·0	62·0	70·0
	D[1]	60·0	65·0	75·0
	E[1]	55·0	60·0	70·0
	N[1]	70·0	80·0	90·0
	Wrist, *Min*	265·0	265·0	265·0
	Gauntlet, *Min*	355·0	355·0	355·0
Length at	*K*	65·0	70·0	80·0
	L	75·0	80·0	90·0
	M	55·0	60·0	67·0
	P[2]	45·0	50·0	55·0
	Q	110·0	115·0	130·0
	R	28·0	30·0	33·0
	T	57·0	60·0	65·0
	U	170·0	178·0	195·0
	V	9·0	9·0	10·0

[1] Circumference is measured half-way between crotch and tip.

[2] Applies to built-up gloves only.

ANNEX B

(See Foreword)

CARE, MAINTENANCE, INSPECTION, RE-TEST AND USE OF RUBBER GLOVES FOR ELECTRICAL PURPOSES

B-0 GENERAL

B-0.1 This annex relates to the maintenance of gloves after purchase.

B-1 STORAGE

Each pair of gloves shall be stored unfolded in a separate container[1)] in a dry, dark and cool place where the temperature is preferably about 27 ± 2°C. Gloves which have been issued for service but are not actually in use should be kept in their containers, which should not be used for any other purpose, or in such a place that they will not be easily subjected to mechanical or chemical damage.

B-2 ISSUING FOR USE

Gloves intended for linemen and outdoor workers should be issued in a protective container free from grease and oil, and of a type suited to the class of work for which they should be used. When the gloves are to be kept in tool boxes, they may be kept in fibre, wooden or other suitable material containers in order to protect from sharp tools or oils rags or cloth. Gloves issued for the sole purpose of emergency use shall be kept in waterproof containers.

B-3 EXAMINATION BEFORE USE

B-3.1 Before being used, every glove *shall* be subjected to visual examination inside and outside (the inside is liable to be cut by finger nails). If, as a result of this examination, either of the gloves is considered unsafe, the pair should be submitted for re-test.

B-3.2 Air Leakage Test

Subject each glove to air leakage test by gripping the cuff in each hand swinging the glove around itself so as to roll up the cuff and retain the air in the glove. Glove found defective or suspected to be defective shall not be used.

B-4 PRECAUTIONS IN USE

B-4.1 Gloves shall not be unnecessarily exposed to heat or light or allowed to come into contact with oil, grease, oil of turpentine, motor spirit or strong acid.

B-4.2 When protector gloves are used, they shall be worn over the rubber gloves. If the protector gloves become damp, oily, or greasy, they should be removed. Protectors should be removed from the rubber gloves when these are not in use.

B-4.3 Gloves become soiled by different materials like dust, insulating compounds, paints, corrosion products of copper (overhead lines) and occasionally by transformer oil.

B-4.4 Dust may be removed by washing and brushing with soap and water. Gloves that have come in contact with copper have to be cleaned carefully by means of washing and brushing. Gloves thus cleaned should be rinsed thoroughly with clean water and have to be dried thoroughly by means of heated air (maximum temperature 65°C) and dusted with talc powder.

B-4.5 For removing insulating compounds, paints and other materials the gloves should be quickly wiped with solvents like acetone, carbon tetrachloride or trichloroethylene and then immediately washed and treated as in **B-4.4**. Motor spirit, petroleum hydrocarbon solvent shall not be used to remove such compounds.

B-4.6 Any glove which becomes wet in use shall be thoroughly dried. Where heated air is blown into the glove, it should not cause the temperature of any glove to exceed 65°C.

B-5 INSPECTION AND RE-TESTING OF GLOVES

Gloves issued for frequent use *shall* be re-tested intervals of not more than 6 months. Gloves issued for occasional use shall be re-tested after use or in any case at intervals of not more than 12 months. Gloves kept in stores should be re-tested at intervals of not more than 12 months. Surface defects, not visible on initial acceptance test and inspection may develop with use, resulting from the breaking of blisters in the rubber or from foreign matter breaking through the surface. All gloves which show any defects when returned after use shall be rejected and destroyed. Each glove shall be stretched by hand to ensure that mechanical strength is adequate. Those which appear to be in good condition shall be re-tested as follows:

a) The gloves are given a single electrical test in accordance with the appropriate test potential as specified in Table 3 (that is, according to the rated potential) and in the manner described in Annex F.

b) In the re-test no glove shall break down or show a current leakage in excess of the maximum specified in Table 3 whichever is appropriate.

[1)] Certain materials, such as copper, manganese and substances which are oily, greasy, or tarry in nature have a deleterious effect on rubber. Containers made of or containing such materials on their interior surfaces should, therefore, be avoided.

Only those gloves that pass this test shall be accepted as satisfactory and shall then be treated in the manner described in **B-4.6**, all other gloves shall be rejected and destroyed.

B-6 SALVAGE

When only one glove of a pair is rejected, the other where possible, may be re-mated with a similar glove of the same size and make; the resulting pair, after re-testing, may be placed in serviceable stock. No glove shall be turned inside out for re-mating.

ANNEX C

(*Clause* 5.5)

MEASUREMENT OF THICKNESS

C-1 APPARATUS

C-1.1 Dial Gauge

A micrometer dial gauge, graduated so as to read accurately to the nearest 0·02 mm.

C-1.2 Procedure

Measure the thickness of each glove at not less than four points at the back and four points on the fore part of the palm. Take also measurements at one or more points in the crotch between thumb and index finger and in the crotches between the fingers. The thickness measured shall fall within the maximum and minimum limits specified in Table 1.

ANNEX D

[*Table* 2, *Sl. No* (vi)]

METHOD OF TEST FOR MOISTURE ABSORPTION

D-1 APPARATUS

D-1.1 Analytical Balance

Capable of weighing to 0·001 g.

D-1.2 Oven

Capable of maintaining uniform temperature of 50 ± 3°C and 70 ± 1°C.

D-2 TEST SPECIMEN

A bar 75 mm × 25 mm having the thickness of material.

D-3 CONDITIONING

Condition three specimens of materials in air oven for 24 h at 50 ± 3°C, cool in a desiccator and immediately weigh to the nearest 0·001 g.

D-4PROCEDURE

D-4.1 Place the conditioned specimens in a container of distilled water at a temperature of 70 ± 1°C for 48 ± 2 h supported on edge and entirelyimmersed. At the end of the period, remove the specimens from the water and cool at room temperature. Remove all surface water with a dry cloth, and weigh the specimens to the nearest 0·001 g immediately.

D-5 CALCULATION AND REPORT

$$\text{Increase in mass, mg/cm}^2 = \frac{(M_2 - M_1)\,1\,000}{A}$$

where

M_1 = mass, in g, of conditioned specimen;

M_2 = mass, in g, of specimen after immersion; and

A = area, in cm², of specimen.

The report shall include the average for three specimens as follows:

a) Increase in mass during immersion, and

b) Any observations as to warping, cracking or change in appearance of specimens.

ANNEX E

[*Table* 2, *Sl No.* (ix)]

METHOD OF TEST FOR PUNCTURE RESISTANCE

E-1 APPARATUS

E-1.1 Universal Test Machine

of minimum capacity 1 kN with an accuracy of ± 1N.

E-1.2 Two Flat Metal Plates Having Concentric Openings

One of the plates shall have a circular opening 6 mm in diameter to allow the passage of a stainless steel needle. The other plate shall have an opening 25 mm in diameter to provide a fixed free area through which specimen may elongate while being subjected to the pressure of the needle point. The edges of the opening shall be rounded to a radius of approximately 0·8 mm.

The needle shall be made from 5 mm diameter type 304 stainless steel rod. The rod shall be machined at one end rounded to a radius of 0·8 mm.

E-2 TEST SPECIMEN

At least 40 mm × 40 mm size.

E-3 PROCEDURE

Position the needle perpendicular to the specimen on the tensile testing maching so that the point contacts the specimen through the small hole in the plate. Drive the needle through the specimen at a rate of approximately 10 mm/sec. Measure the maximum force required to perform the puncturing operation to the nearest 2 N.

ANNEX F

(*Clause* 5.8)

METHOD OF TEST FOR PROOF (TEST) VOLTAGE AND LEAKAGE CURRENT

F-1 VOLTAGE MEASUREMENTS

F-1.1 Apparatus

The apparatus shall consist of the following:

a) A source of alternating electrical current, approximately 50 cycles per second and of approximately sine wave-form.

b) A step-up transformer having one end of the secondary winding earthed. The ratio of the peak potential to the rms potential of the secondary winding of the transformer is within the limits of $\sqrt{2} \pm 5$ percent of $\sqrt{2}$ (1·34 to 1·48) under the test conditions. The rating of the testing set is not more than 2 kVA and not less than 1/2 kVA per glove being tested.

c) Suitable controlgear and means for input voltage variation.

d) *Potential (Voltage) Measuring Equipment* — This may be a peak or other type of voltmeter connected across the input winding, output winding or a special voltage winding or across a porting of the output winding. Any instrument used should be calibrated against a sphere gap in parallel with a load equivalent to the normal test load. Any rms instrument may, however, be calibrated against a peak voltmeter, provided that there is adequate evidence that the latter is free from errors due, for example, to frequency changes, brush discharger or re-entrant waveforms (*see* IS 1876 : 1961).

e) A milliammeter or other current-measuring equipment.

f) A bath in which the gloves may be immersed in tap water at a temperature of 27 ± 2°C.

g) Insulating clips for suspending the gloves.

F-1.2 Procedure

F-1.2.1 *Preparation for Test*

Clean before the commencement of each test, the cuffs of the gloves with industrial alcohol in order to prevent flash-over occurring through water seeping along the chalked surfaces. Immerse each glove in tap water (at 27 ± 2°C) up to 40 mm from the edge of the cuff and fill with tap water to the same level. Immerse the glove in this way for a period of 1 hour before test. Hold the glove in position by means of insulating clips. The water inside and outside the glove forms the internal and external electrodes respectively. Connect the inner electrode to the high voltage supply by means of chains or wires. Earth the external electrode through the milliammeter circuit.

F-1.2.2 Raise to potential applied across the test electrodes from zero to the approximate rms test value as rapidly as is consistent with its value being observed on the measuring instrument but not less than 1 kV per second.

F-1.2.2.1 Test the gloves for the leakage current at the working voltage as indicated in Table 3 depending on the types of gloves and maintain this potential for one minute. Test for only break-down in voltage and measure the leakage current. The gloves shall not pass a current more than specified in the said table for such class during the last 15 seconds. Destroy the gloves which fail in above test.

F-1.2.2.2 For such gloves which meet the requirements in **F-1.2.2.1** increase the voltage in the same set up from the working potential to the test potential indicated in Table 3 and maintain at that level for 1 minute. The leakage current shall not exceed the value mentioned for such class of gloves in Table 3. Gloves which fail in above test should be rejected.

F-1.3 Results

Report any sudden fall in voltage and read the leakage current from the reading of the current measuring instrument during the last 15 seconds.

ANNEX G

(*Clause* 5.9)

METHODS OF TEST FOR BREAKDOWN VOLTAGE (BDV)

G-1 APPARATUS

G-1.1 The apparatus shall consist of the following:

a) A source of alternating electrical current, approximately 50 cycles per second and of approximately sine wave-form.

b) A step-up transformer having one end of the secondary winding earthed. The ratio of the peak potential to the rms potential of the secondary winding of the transformer is within the limits of $\sqrt{2} \pm 5$ percent of $\sqrt{2}$ (1·34 to 1·48) under the test conditions. The rating of the testing set is not more than 2 kVA and not less than 1/2 kVA per glove being tests.

c) Suitable controlgear and means for input voltage variation.

d) Potential (voltage) measuring equipment. This may be a peak or other type of voltmeter connected across the input winding, output winding or a special voltage winding or across a porting of the output winding. Any instrument used should be calibrated against a sphere gap in parallel with a load equivalent to the normal test load. Any rms instrument may, however, be calibrated against a peak voltmeter, provided that there is adequate evidence that the latter is free from errors due, for example, to frequency changes, brush discharges or re-entrant wave-forms (*see* IS 1876 : 1961).

e) A milliammeter or other current-measuring equipment.

f) A bath in which the gloves may be immersed in tap water at a temperature of 27 ± 2°C.

g) Insulating clips for suspending the gloves.

G-2 PROCEDURE

G-2.1 Preparation for Test

a) Clean the cuffs of the gloves with industrial alcohol before the commencement of each test in order to prevent flashover occurring through water seeping along chalked surfaces.

b) Immerse each glove in tap water at 27 ± 2°C to a depth of 40 mm from the edge of the cuff and fill with tap water to same level.

G-2.2 Apply test voltage at 10 percent of the expected BDV of the glove and increase it at a rate of 1kV/sec until breakdown occur or until 1·2 times the expected breakdown voltage has been reached. Record the maximum voltage observed at breakdown.

ANNEX H

(*Clause* 5.10)

METHOD OF TEST FOR OZONE RESISTANCE

H-1 APPARATUS

See 3 of IS 3400 (Part 20) : 1977.

H-2 TEST SPECIMEN

100 mm × 150 mm specimen of the glove material.

H-3 PROCEDURE

H-3.1 Suitably condition the specimen by keeping flat for 24 h. Drape the specimen over a 25 mm diameter metal tube of sufficient length to completely underlie the specimen, while possessing additional length for the required mounting supports. Electrically ground the metal tubing clamp the free ends of the specimen beneath the tubing along the upper half of the cylindrically shaped electrode surface.

H-3.1.1 Place a piece of flat, aluminium sheet foil, approximately 50 to 100 mm, over the draped specimen so as to provide adequate separation distance to prevent flash-over between the foil and the metal test. Connect electrode wire to the aluminium foil.

H-3.2 Energize the outer electrode (metal foil) to 15 kV potential from a suitably rated potential transformer energized from its low voltage winding through a continuously variable auto transformer. Incorporate an over current protecting device into the low voltage control circuit for protection in case of an electrical breakdown.

H-3.3 Determine the ozone resistance of the specimen qualitatively by inspection, after 1 hour exposure period in the test apparatus at the 15 kV potential. Test at least two specimens from each sample glove selected. Take two specimens from the same section of the sample glove.

NOTE — The rate of ozone degradation is inversely proportional to the relative humidity of the surrounding air. Empirical data indicate, however, that visible ozone effects are evident over a broad range of ambient humidities under these test conditions.

ANNEX J

(*Clause* 6.1.2.1)

SCALE OF SAMPLING

J-1 LOT

J-1.1 In a consignment of all the gloves of the same type, and manufactured from the same type of rubber under essentially similar conditions of production shall be grouped together to constitute a lot.

J-1.1.1 Samples shall be selected and tested from each lot separately for ascertaining its conformity or otherwise to the requirements of this specification.

J-2 NUMBER OF TESTS AND CRITERIA FOR CONFORMITY

J-2.1 Each glove in the lot shall be examined for workmanship and tested for leakage current. The gloves failing to meet the requirements for workmanship or leakage current shall be rejected and only those which pass in these requirements shall constitute the lot for other tests.

J-2.2 The number of gloves to be selected at random from a lot shall depend upon the size of the lot and shall be in accordance with col 1 and 2 of Table 7.

J-2.2.1 The gloves to be selected from the lot shall be chosen at random. In order to ensure the randomness of selection, random number tables shall be followed.

In case random number tables are not available, the gloves may be selected from the lot in the following manner:

Starting from any glove in the lot, the gloves shall be counted as 1,2....., r and so on in one order. Every rth glove thus counted shall be withdrawn to constitute the sample, where r is the integral part of N/n (N and n being the lot size and the corresponding sample size respectively). This procedure shall be followed till the required number of gloves for the sample are obtained.

J-2.3 All the gloves selected according to **J-2.2** shall be examined for size, length and thickness. Any glove failing in one or more of these characteristics shall be considered as defective. If the number of defectives found in the sample is less than or equal to the corresponding permissible number given in col 3 of Table 7, the lot shall be declared as conforming to these requirements, otherwise not.

Table 7 Scale of Sampling and Permissible Number of Defectices

(Clause J-2.2)

No. of Gloves in the Lot	For Size, Length and Thickness		For Remaining Tests	
	Sample Size	Permissible No. of Defectives	Sub-sample Size	Permissible No. of Defectives
(1)	(2)	(3)	(4)	(5)
N	*n*	*n*		
Up to 100	8	0	3	0
101 to 150	13	0		
151 to 300	20	0		
301 to 500	32	1	6	0
501 to 1 000	50	2		
1 001 to 3 000	80	3	9	0
3 001 and above	125	5		

J-2.3.1 In the case of those lots which have been found unsatisfactory according to **J-2.3**, all the gloves may, depending upon the agreement between the purchaser and the supplier, be inspected for these characteristics and the defective ones removed.

J-2.4 The lot having been found satisfactory for size, length and thickness shall be tested for all the other tests. For this purpose a sub-sample of size given in col 4 of Table 7 shall be taken at random and first subjected to the minimum breakdown voltage test. All the gloves in the sub-sample shall pass the test for the lot to be declared as satisfactory.

J-2.4.1 For subjecting to mechanical tests, the sub-sample shall be divided into groups of three gloves. The test specimens shall then be taken from the glove in accordance with **J-3.1** and tested. A glove shall be considered as defective if any of the test specimen, taken and tested, fails. The lot shall be considered as satisfactory, if none of the gloves is found defective.

J-3 SAMPLING POSITION

J-3.1 The sampling position for taking specimens for various tests shall be as shown in Fig. 3. The gloves shall be slit up outer finger side and laid with outside surface up for stamping cut test pieces. The number of test pieces and code for the various test pieces are indicated in Fig. 3 and Table 8.

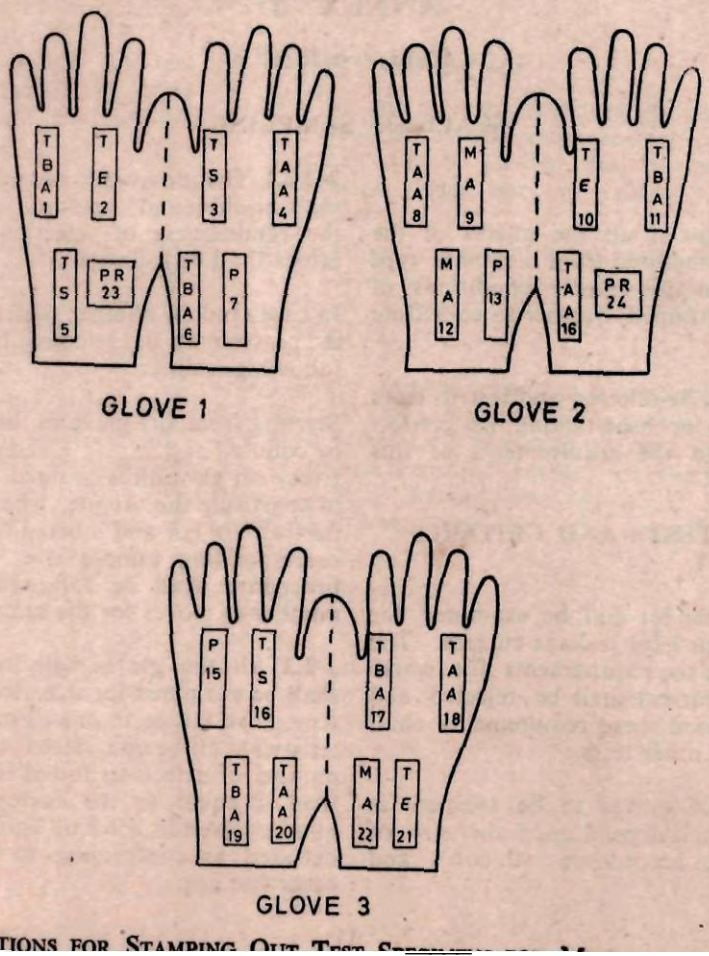

FIG. 3 POSITIONS FOR STAMPING OUT TEST SPECIMENS

Table 8 Sampling Position

(*Clause* J-3.1)

Sl No.	Properties to be Tested	Code for the Test Pieces	Test Piece No. as Indicated in Fig. 3	
			Front	Back
(1)	(2)	(3)	(4)	(5)
i)	*Tensile strength and elongation at* break before ageing	*TBA*	1,19	6,11,17
ii)	Tensile strength and elongation at break after ageing	*TAA*	8,20	4,14,18
iii)	*Tension set*	*P*	13,15	7
iv)	Tensile strength of 200 percent elongation	*TE*	2	10,21
v)	Tear strength	*TS*	5,16	3
vi)	Moisture absorption	*MA*	9,12	22
vii)	Puncture resistance	*PR*	23	24