IS : 3400 (Part XVII) - 1974

Indian Standard

METHODS OF TEST FOR VULCANIZED RUBBERS

PART XVII TEAR STRENGTH — ANGULAR TEST PIECE

UDC 678·43 : 620·176·245

INDIAN STANDARDS INSTITUTION
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
NEW DELHI 110001

rice Rs 2·50 *December* 1974

Indian Standard

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METHODS OF TEST FOR VULCANIZED RUBBERS

PART XVII TEAR STRENGTH — ANGULAR TEST PIECE

0. FOREWORD

0.1 This Indian Standard (Part XVII) was adopted by the Indian Standards Institution on 10 March 1974, after the draft finalized by the Rubber Products Sectional Committee had been approved by the Chemical Division Council.

0.2 The tear strength depends on the dimension of the test piece, speed of stretching, temperature of test and the stress distribution in the test piece; hence the test is satisfactory only for laboratory comparison and not as a service test. The tear strength is particularly susceptible to grain effects in vulcanized rubber.

0.3 Method of test for tear strength employing crescent test piece has already been published as Part XII of this standard.

0.4 This standard is mainly based on ASTM Designation D 624-54 (Reapproved 1970) 'Standard method of test for tear resistance of vulcanized rubber' issued by the American Society for Testing and Materials.

0.5 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*.

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1. SCOPE

1.1 This standard (Part XVII) prescribes the method for determination of tear resistance of the usual grades of soft vulcanized rubber employing an angular test piece. This method is not suitable for the testing of the material ordinarily classed as hard rubber.

2. APPARATUS

2.1 Tensile Testing Machine — The machine shall be power driven and of such capacity that the maximum load required to break the test specimen

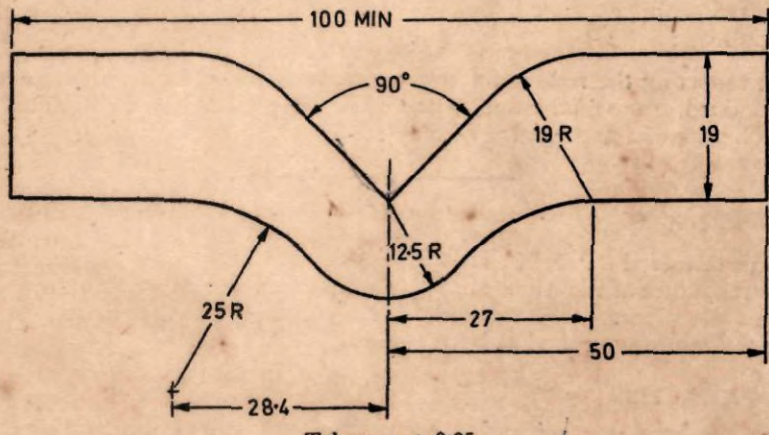
*Rules for rounding off numerical values (*revised*).

shall not exceed 85 nor be less than 15 percent of the rated capacity. The rate of travel of the grip shall be 50 ± 2 cm/min and shall be uniform at all times. The machine shall be equipped with a type of grip which tightens automatically and exerts a uniform pressure across the gripping surfaces increasingly as the tension increases, so as to prevent uneven slipping, and to favour failure of the specimen in its constricted section. It is advisable to have at the end of each grip a positioning device so that all specimens are inserted to the same depth in the jaws and are perpendicular to the direction of pull.

NOTE — Inertia (pendulum) type dynamometers are apt to give results which differ because of frictional and inertial effects. An inertia-less (for example, electronic or optical transducer type) dynamometer gives results which are free from these effects, and is therefore to be preferred.

2.1.1 *Calibration of Tensile Testing Machine* — The load scale and the recording mechanism shall be calibrated at least once a week to ensure that the load scale error does not exceed 2 percent of the applied load.

2.2 Die for Test Specimens — The specimens for tear resistance test shall be stamped out with the steel die conforming to the dimensions shown in Fig. 1, the cutting edges of which shall be kept sharp and free of all nicks to avoid leaving ragged edges on the specimens. It is important that the apex of the 90-degree angle be sharpened to provide a sharp corner. Good cutting edges are best obtained by careful honing. The rubber may be wetted with water or soap solution and shall be supported on a sheet of slightly yielding material (namely, leather or cardboard) on a flat rigid surface. Normally all test pieces shall be prepared with grain at right angles to their length.



Tolerance ± 0·05

All dimensions in millimetres.

FIG. 1 DIES FOR TEAR TEST SPECIMENS

3. TEST SPECIMEN

3.1 The test specimen shall conform to the shape shown in Fig. 1. The thickness of the specimen shall be measured, with the micrometer graduated to 0·1 mm exerting a total force of 200 g/cm² on the rubber. Four measurements of thickness in the region of the test area shall be made including one at the apex of 90-degree angle and the average value should be used. The thickness of the test piece shall not fall outside limits of 1·8 to 2·8 mm. The thickness in the region of the test area shall nowhere deviate by more than 2 percent from the mean.

NOTE — It is well known fact that vulcanized rubber exhibits a grain effect which influences its physical properties. In the case of heavily loaded compounds, the effect may produce a pronounced difference in physical properties. The grain direction shall be clearly marked on materials to be tested. Usual practice is to test with the grain running along the length of the specimen. Data so obtained shall be recorded as tear resistance (pulling) with the grain and it is assumed that unless otherwise specified, all test specimens are to be prepared in this manner. Where grain effects are significant and are to be evaluated, an additional set of test specimens shall be cut with grain running across the specimen. Data so obtained shall be recorded as tear resistance (pulling) across the grain.

3.2 Number of Test Specimens — Three specimens per sample shall be tested for tear resistance. The value reported shall be the average of those observed. If any value deviates more than 20 percent from this average, two additional specimens shall be tested and the median of all five values shall be reported.

4. TEMPERATURE OF TEST

4.1 Carry out the test at 27 ± 2°C unless otherwise specified. Some synthetic rubbers have markedly lower tear strength at elevated temperatures and hence tests may also have to be carried out at higher temperature, 100°C being the useful temperature.

5. PROCEDURE

5.1 Preparation of Sample from Finished Rubber Goods — If fabric is attached or embodied in rubber sample, remove the same before cutting the test piece. Preferably avoid the use of a swelling agent while removing the fabric, but benzene, chloroform or carbon tetrachloride may be used to wet the contacting surface, if necessary. Take care to avoid stretching of the rubber during the separation from the fabric, and if swelling liquid is used, allow the same to evaporate completely from the rubber surfaces after separation. Make the cloth marked surfaces smooth by buffing. Buff as and when necessary the rubber sample which is of uneven thickness or of thickness above the maximum specified for the test piece which is to be cut from it. If agreed to between the purchaser and the supplier, test pieces of thicknesses other than what have been prescribed

in **3.1** may be used. However, in such cases it shall be within the range of 0·8 to 3 mm. During buffing avoid undue heating of the rubber.

5.2 Conditioning of the Moulded Test Slab — The properties of vulcanized rubber change continuously with time, these changes being particularly rapid during the first 24 hours after vulcanization. Do not carry out any test within this period; for accurate comparisons between different rubbers it may be necessary to ensure that these are tested at substantially the same interval after vulcanization. Protect test slabs and test pieces as far as possible from light. Condition samples after any necessary preparation at 27 ± 2°C for not less than 3 hours immediately before testing. When carrying out tests at elevated temperature, the test piece shall be kept at that temperature for 15 minutes.

5.3 Determination of Tear Resistance — Clamp the specimen for test in the jaws of the testing machine, taking care that the 'bite' of the jaws shall be at the centre of the tab ends and in line with the direction of load application. Apply the load with a lower jaw speed of 50 cm per minute. After rupture of the specimen, note the breaking load from the dial or scale and record together with the average thickness of the specimen.

5.4 Calculation — Tear strength is calculated by dividing the load in kg by the thickness in centimetre of the test specimen and expressed as kg/cm thickness.

5.5 Report — The report shall state:

a) the calculated tear strength;

b) direction in which test piece is cut relative to grain; and

c) temperature of test, if other than 27 ± 2°C.