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INTERNATIONAL ORGANIZATION FOR STANDARDIZATION

ISO RECOMMENDATION
R 67

MUSCOVITE MICA
BLOCKS, THINS AND FILMS

METHODS FOR GRADING BY SIZE

1st EDITION

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For each individual country the only valid standard is the national standard of that country.

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CONTENTS

FOREWORD

I. For many years Indian mica producers have been using a uniform system of size-grading for muscovite mica, which has been adopted by various other producing countries, such as Brazil, Canada, the Union of South Africa, U.S.A., etc. and has been generally used in international trade. This ISO Recommendation, though based on the Indian system, has been prepared by Technical Committee ISO / TC 56, *Mica*, after taking due account also of the requirements of the consuming countries.

II. The scope of this ISO Recommendation is limited to the size-grading of muscovite mica blocks, thins and films, while another ISO Recommendation is under preparation by ISO/TC 56 for the grading of splittings. These two ISO Recommendations will cover the size-grading of the entire range of the commercial forms of muscovite mica.*

III. Besides size-grading, muscovite mica is classified visually as to quality. Since the methods of quality classification, based on visual appreciation, are subjective, while those for size-grading are objective, ISO / TC 56 decided to issue a separate ISO Recommendation for visual quality classification.**

IV. The present ISO Recommendation R 67 gives a new set of grade designations, together with the corresponding existing grade designations. The new designations are based on metric units and are taken from the Preferred Numbers *** with a view to simplifying the notation, rationalizing the grading method and facilitating understanding, in case the metric system is more universally adopted in the future. In order to differentiate between the old and the new grade designations,

— the word "size" is adopted for the new grades,
— while the word "grade" or "number" is retained for the old grades;

e.g. size 630, new system = grade OOEE Special, old system,
size 40, new system = grade No. 4, old system.

V. Requirements in respect of the minimum thickness of mica blocks appear to vary in different consuming countries. For this reason, in defining mica blocks, two minimum thicknesses are recognized:

either 0.20 mm (0.008 in),
or 0.18 mm (0.007 in),

as may be agreed between the buyer and the seller (see clause 2.1.12). Producing countries are prepared to supply mica blocks to either of these limits.

VI. The presence of "V" cuts in full-trimmed mica has been a point of much discussion in ISO / TC 56. While all Committee members agreed that specifying the minimum yield of a piece of mica (see clause 4.1.1) would automatically limit the presence of "V" cuts, the representative of the French Member Body expressed the opinion that it would be desirable not to allow any "V" cut at all.

VII. With a view to making allowance for unavoidable variations during mica processing and to facilitating commercial transactions, tolerances are admitted on all sizes of blocks, thins and films. However, for acceptance inspection, ISO / TC 56 decided that tolerances

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* Grading of phlogopite mica, which represents, with muscovite mica, the two principal types of mica, may be dealt with by further ISO Recommendations.

** Under consideration.

*** See ISO Recommendations R 3, *Preferred Numbers - Series of Preferred Numbers*, and R 17, *Guide to the Use of Preferred Numbers and of Series of Preferred Numbers.*

are subject to agreement between the buyer and the seller and, unless otherwise stated, such agreed tolerances should be taken as substitutes for, and not as additional to, the tolerances given in this ISO Recommendation.

VIII. In drafting this ISO Recommendation, the following publications have been taken into consideration, in addition to some unpublished material of various standards organizations:

(1) ASTM D 351-52 T. Tentative Specifications for Natural Muscovite Mica Based on Visual Quality. American Society for Testing Materials.

(2) ASTM D 748-49 T. Specifications for Natural Block Mica and Mica Films Suitable for Use in Fixed Mica-Dielectric Capacitors. American Society for Testing Materials.

(3) Pub. MEI—1952. Standards for Manufactured Electrical Mica. National Electrical Manufacturers' Association, U.S.A.

(4) Pub. No. 11 LXXVII. 11—1943. Standard Sizes and Qualities of Indian Muscovite Mica Including Notes on Establishing such a Standard. Geological Survey of India.

(5) I.C.* No. 7258. September 1943. Strategic Mica. U.S.A. Department of Interior, Bureau of Mines.

(6) IS: 13—1949. Tentative Indian Standard Methods for Grading Processed Mica. Indian Standards Institution.

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* Information Circular.

ISO Recommendation R 67 June 1958

MUSCOVITE MICA
BLOCKS, THINS AND FILMS
METHODS FOR GRADING BY SIZE

1. SCOPE

This ISO Recommendation describes a standard method for grading muscovite mica blocks, thins and films according to size and includes trimming requirements and definitions of relevant terms used in the trade. For the complementary classification of muscovite mica according to visual quality, a separate ISO Recommendation is under consideration.

2. TERMINOLOGY

2.1 Definitions. For the purposes of this ISO Recommendation, the following definitions apply:

2.1.1 *Crude mica* — Crude crystals or books, as extracted from the mine.

2.1.2 *Cobbing* — Process of removing dirt and rock from crude mica.

2.1.3 *Rifting* — Process of splitting cobbed mica into sheets of suitable thicknesses.

2.1.4 *Trimming* or *dressing* — Process of removing major flaws from rifted mica. Trimming may be accomplished with fingers, sickle, knife, shears or guillotine and mica is then named after the implement used, such as sickle-trimmed mica, thumb-trimmed mica.

2.1.5 *Sickle-trimmed* or *sickle-dressed mica* — Crude mica cobbed, rifted and trimmed or dressed with a sickle to eliminate major flaws and left with irregular outline and bevelled edges.

2.1.6 *Knife-trimmed* or *knife-dressed mica* — Sickle-trimmed or sickle-dressed mica, further refined with a knife to eliminate interior defects and also such defects as may have been overlooked by the sickle-cutter.

2.1.7 *Thumb-trimmed* or *thumb-dressed mica* — Rifted mica, trimmed with thumb and fingers.

2.1.8 *Full-trimmed* or *full-dressed mica* — Rifted mica, trimmed on all sides, eliminating all cracks, reeves and cross-grains.

2.1.9 *Half-trimmed* or *half-dressed mica* — Rifted mica trimmed on two sides, with at least two thirds of the pieces trimmed on two adjacent sides, and the balance of the pieces trimmed on the two parallel long sides, with no cracks extending into the area by which the piece is graded. The foregoing does not apply to sizes 06 and 16 (grades 6 and 5 1/2), for which at least one of any two trimmed sides must be free of cracks, and no cracks may extend into the area by which the piece is graded. The mica should be capable of permitting the cutting of rectangles of accepted size and quality with a mass loss not exceeding 60 per cent based on the total inspection sample.

2.1.10 *Madras rounds* — Madras mica, cut with shears into oval or circular shapes.

2.1.11 *Commercial forms of mica* — Mica known as Blocks, Thins, Films and Splittings.

2.1.12 *Blocks* — Knife-trimmed or knife-dressed mica of a specified minimum thickness which may be, with a maximum tolerance of 5 per cent (by mass)—

either 0.20 mm (0.008 in) with a tolerance limit at 0.18 mm (0.007 in),
or 0.18 mm (0.007 in) with a tolerance limit at 0.15 mm (0.006 in),

as agreed between the buyer and the seller (see Foreword, clause V).

2.1.13 *Thins* — Knife-trimmed or knife-dressed mica in any specified thickness between 0.05 mm (0.002 in) and 0.18 mm (0.007 in).

2.1.14 *Films* — Knife-trimmed or knife-dressed mica split to any specified range of thicknesses.

2.1.15 *Splittings** — Laminae split from blocks and thins.

2.1.16 *Scrap* — Mica by-product obtained in the course of producing graded mica.

2.1.17 "*A*" — Series of rulings or striations intersecting at an angle of about 60°.

2.1.18 *Cracks* — Irregular visible fractures within a crystal that may be natural or may arise from blasting, rough handling, etc.

2.1.19 *Cross-grains* or *Jatahi* or *Reeves* — Tangled laminations giving imperfect cleavage which results in tears or breaks during splitting.

2.1.20 *Haircracks* or *hairline cracks* — Minute irregular cracks that are barely noticeable until mica is split into films, resulting in torn films.

2.1.21 *Herring-bones* — Numerous rulings that intersect to form a series of "V's", the legs making angles of about 120° and meeting at the apex to produce a herring-bone, horse-tail or feather structure.

2.1.22 *Hole* — Perforation through the laminae.

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* A complete definition is still under discussion.

2.1.23 *Ribboned* or *ruled mica* — Mica which breaks into strips because of parallel fractures.

2.1.24 *Ribs* or *ridges* — Parallel crenulations in the form of steps.

2.1.25 *Tangle sheet* — Piece of mica that splits well in some places but tears in others, producing a large percentage of partial films. Sometimes the term is applied to the intergrowth of mica crystals.

2.1.26 *"V" cuts* or *figure cuts* — Edge cuts converging towards the central area of the mica piece.

2.1.27 *Wedge* — Piece of mica which, on splitting, yields pieces thicker at one end than at the other.

3. GRADING METHOD

3.1 Principle. The standard grading method for all full-trimmed muscovite mica is based on the maximum usable rectangle (usable area) that may be cut from the specimen, and not on the total area. For half-trimmed muscovite mica, see clause 2.1.9. Madras rounds and certain variations of thumb-trimmed mica are graded on the basis of the usable circle.

3.2 Grade designations. The grade designations for muscovite mica blocks, thins and films and the corresponding areas of the usable rectangles, with minimum dimensions of the shorter side, are given in Table 1 (page 9) and shown in the chart (page 11). Each grade contains a fair distribution of sizes from the minimum to the maximum area specified for the grade.

3.3 Sequence of operations. All specimens to be graded are trimmed prior to grading. The trimmed specimens are graded according to the procedure laid down in section 5. In addition to size-grading, all muscovite blocks, thins and films meet in the usable rectangle the requirements of the desired visual quality, as specified in the relevant ISO Recommendation contemplated.

4. TRIMMING

4.1 Full-trimmed muscovite mica blocks, thins and films are trimmed to remove all cracks, holes, reeves, cross-grains, etc. so as to comply with the specifications for the desired visual quality. Trimming follows the natural contour of the mica. As far as possible, all marginal cracks are removed by recutting.

4.1.1 *Usable rectangle.* The total area of each piece of full-trimmed mica for sizes 40 (grade 4) and above should not exceed 1.54 times the area of the largest usable rectangle or in other words, the total area should have a rectangular yield of at least 65 per cent, with the tolerance that no more than 5 per cent of blocks, by mass, may have a yield less than 65 per cent. For full-trimmed mica up to size 20 (grade 5), the total area of each piece should not exceed twice the area of the largest usable rectangle or in other words, the total area should have a rectangular yield of at least 50 per cent, with the tolerance that no more than 5 per cent of blocks, by mass, may have a yield of less than 50 per cent.

4.2 **Half-trimmed mica** is trimmed on two sides. At least two thirds of the pieces are trimmed on two adjacent sides, while the balance is trimmed on the two parallel long sides, with no cracks extending into the usable rectangle (area by which the piece is graded). For sizes 06 and 16 (grades 6 and 5 $^{1}/_{2}$), at least one of any two trimmed sides must be free of cracks, and no cracks may extend into the usable rectangle.

4.2.1 *Usable rectangle.* For half-trimmed blocks or thins, the usable rectangle is the total area within the rectangle of acceptable size and quality, which should be not less than 40 per cent of the total area, based on the total inspection sample; that is, its cutting should involve a mass loss not exceeding 60 per cent of the mass of the total inspection sample.

4.3 **"V" cuts.** If limitation as to their size, number and frequency is desired, it is subject to agreement between the buyer and the seller. If mica without any "V" cut is demanded by the buyer, it is supplied by the seller subject to mutual agreement.

4.4 **Finishing.** Muscovite mica blocks are finished with sickle- or knife-cut bevelled edges.

5. GRADING PROCEDURE

5.1 **Grading chart.** The range of the areas and the minimum dimensions of the shorter side of the usable rectangle for the various grades, given in Table 1 (page 9), applies for the grading of all muscovite mica blocks, thins and films. A grading chart, based on this table and shown on page 11, or templates prepared in accordance with it, are used for grading in accordance with the procedure described in clause 5.2.

TABLE 1. **Standard grading table for muscovite mica blocks, thins and films**

Grade designation		Area of usable rectangle				Minimum dimension of shorter side of usable rectangle		Permissible strip tolerance
New*	Old	Square centimetres		Square inches		cm	in	
(Size)	(Grade or number)	from (incl.)	to (excl.)	from (incl.)	to (excl.)			
630	OOEE Special	645.2 and more		100 and more		10.2	4	Nil
500	OEE Special	516.1	645.2	80	100	10.2	4	Nil
400	EE Special	387.1	516.1	60	80	10.2	4	Nil
315	E Special	309.7	387.1	48	60	10.2	4	Nil
250	Special	232.3	309.7	36	48	8.9	$3^1/_2$	Nil
160	1	154.8	232.3	24	36	7.6	3	5 per cent of pieces having width down to and including 5.1 cm (2 in)
100	2	96.8	154.8	15	24	5.1	2	5 per cent of pieces having width down to and including 3.8 cm ($1^1/_2$ in)
63	3	64.5	96.8	10	15	5.1	2	5 per cent of pieces having width down to and including 3.8 cm ($1^1/_2$ in)
40	4	38.7	64.5	6	10	3.8	$1^1/_2$	5 per cent of pieces having width down to and including 2.5 cm (1 in)
20	5	19.4	38.7	3	6	2.5	1	Nil
16	$5^1/_2$	14.5	19.4	2.25	3	2.2	$^7/_8$	Nil
06	6	6.4	14.5	1	2.25	1.9	$^3/_4$	Nil
05	7	4.8	6.4	0.75	1	1.6	$^5/_8$	Nil

* This method of grade designation must be considered as a first step towards a unified classification of all forms of mica based on a series of preferred numbers (see Foreword).

5.1.1 *Thumb-trimmed mica* may also be graded according to the following additional grades, based on the usable circle:

TABLE 2. **Thumb-trimmed mica**

Grade	Diameter of usable circle	
	Centimetres	Inches
Small punch	2.54	1
Punch	3.81	1.5
Circle	5.08	2

5.1.2 *Madras rounds* are graded to yield usable circles of the following diameters:

TABLE 3. **Madras rounds**

Grade	Diameter of usable circle
	Millimetres
25 to 29	25 to 29
30 to 34	30 to 34
35 to 39	35 to 39
40 to 44	40 to 44
45 to 49	45 to 49
50 to 54	50 to 54
55 and upwards	55 and upwards

5.2 Grading procedure. The specimen to be graded is laid upon the chart or the corresponding template so that it covers point 0 and has its maximum and minimum dimensions extending along and covering lines 0A and 0B respectively. It is shifted until the usable area completely covers the largest rectangle, determined by a diagonal extending from 0 to a point lying in one of the regions designated—

05 (No. 7)	40 (No. 4)
06 (No. 6)	... and so on ...
16 (No. 5 1/2)	500 (OEE Special)
20 (No. 5)	630 (OOEE Special)

The number of the region, in which the diagonal of the rectangle terminates, designates the size (grade or number) of the sample.

5.2.1 *Blocks.* All dimensions apply to the smaller surface measured from the foot of the bevel-trimmed edge.

5.2.2 *Cracks.* In no case should a crack extend into the usable area.

6. TOLERANCE

In any one batch or shipment, a tolerance of 5 per cent by mass of the next lower grade is permitted.