



Standard Classification for Natural Muscovite Block Mica and Thins Based on Visual Quality¹

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This standard has been approved for use by agencies of the U.S. Department of Defense.

^{ε1} NOTE—The units statement in subsection 1.8 was corrected editorially in July 2008.

1. Scope

1.1 This classification covers the determination of commercially available natural muscovite block mica and is intended to be independent of the basic color of the mica or its source.

1.2 Muscovite mica is characterized by having an optical axial angle between 50 and 75° (see [Appendix X1](#)); and has a weight loss when heated for 5 min at 600°C not exceeding 0.2 % (based on the weight after drying at 120°C).

1.3 The visual system of classifying the quality of natural muscovite mica covered by this specification is based upon relative amounts of visible foreign inclusions such as air bubbles, stains, and spots in combination with relative amounts and types of waviness, as well as other physical properties. In this system, a perfectly clear, transparent, flat specimen of mica is the visual standard of perfection. Increasing amounts of visual defects lower the visual quality, and a total of 13 levels of visual quality are covered by this standard. This method of classification, generally known as the Bengal India System, is purely qualitative and is entirely dependent on personal opinion and judgment.

1.4 The standards for visual quality classification that are covered in this classification are the best commercially available concept of the various qualities and their relative positions. Variations in the methods of using and applying these standards from those herein defined may be specified by the purchaser, or defined by agreement between the supplier and the purchaser.

1.5 Standard size classifications are defined, based upon available usable rectangular areas and the minimum dimensions of the rectangles that the pieces will yield. Precautions to be taken in making thickness measurements are also described.

1.6 This standard covers the following two definite forms of commercial preparation:

1.6.1 *Form 1*—Full-trimmed natural block mica, 0.007 in. (0.178 mm) minimum thickness.

1.6.2 *Form 2*—Partially-trimmed natural block mica, 0.007 in. minimum thickness.

1.7 The basic color of mica, such as white, ruby, light green, dark green, brownish green, and rum, as well as other colors, and the method of controlling the color and other problems associated with the basic color, are not a part of this classification.

1.8 The values stated in inch-pound units are to be regarded as standard. The values given in parentheses are mathematical conversions to SI units that are provided for information only and are not considered standard.

1.9 Section 5 is technically identical to procedures specified in ISO 67-1981.

1.10 Section 6 differs somewhat in procedure from ISO 5972-1978, but data obtained by either should be identical.

1.11 Section 7 is technically identical to procedures specified in ISO 2185-1972.

2. Referenced Documents

2.1 *ASTM Standards*:²

[D374 Test Methods for Thickness of Solid Electrical Insulation](#) (Withdrawn 2013)³

¹ This classification is under the jurisdiction of ASTM Committee D09 on Electrical and Electronic Insulating Materials and is the direct responsibility of Subcommittee D09.19 on Dielectric Sheet and Roll Products.

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² For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

³ The last approved version of this historical standard is referenced on www.astm.org.

D1711 Terminology Relating to Electrical Insulation

2.2 ISO Publications:

ISO 67-1981 Muscovite Mica Blocks, Thins, and Films—Grading by Size⁴

ISO 2185-1972 Muscovite Mica Blocks, Thins, and Films—Visual Classification⁴

ISO 5972-1978 Mica Blocks, Thins, Films, and Splittings— Measurement of Thickness⁴

3. Terminology

3.1 For definitions of terms relating to mica refer to Terminology D1711, Part III.

3.2 Definitions of Terms Specific to This Standard:

3.2.1 “A”—a series of rulings or striations intersecting at an angle of about 60°.

3.2.2 *blocks*—mica thickness of 0.007 in. (0.178 mm) minimum thickness, full-trimmed, unless otherwise designated.

3.2.3 *buckle*—one or more large depression(s) and elevation(s).

3.2.4 *cracks*—irregular fractures within the crystal that may be natural or may arise from blasting, rough handling, etc.

3.2.5 *full-trimmed mica*—mica trimmed on all sides with all cracks, reeves, and cross-grains removed.

3.2.6 *haircracks or hairline cracks*—minute, irregular cracks that are barely noticeable until mica is split into films, resulting in production of torn films.

3.2.7 *reeves or cross grains*—tangled laminations giving imperfect cleavage, that results in tears or breaks during splitting.

3.2.8 *ribboned or rules mica*—mica that breaks into narrow strips because of parallel fractures.

3.2.9 *ribs or ridges*—crenulations in the form of steps.

3.2.10 *ripple*—multiple short waves.

3.2.11 *stains*—stains arise from foreign materials, resulting in a partial or total loss of transparency. They may be in the form of specks or patches of appreciable area for example, slight stain, “vegetable” stain, clay stain, black stain, red stain, black speckled, light dot or spot, black, red or green dot or spot, etc. (see “inclusions” in Terminology D1711).

3.2.12 *stones and stone holes*—small embedded crystals or holes resulting from them.

3.2.13 *thins*—knife-dressed mica, 0.002 in. (0.05 mm) to less than 0.007 in. (0.18 mm) in thickness. They may be classified as follows:

3.2.13.1 Thins, 0.002 to 0.004 in. (0.05 to 0.10 mm), and

3.2.13.2 Thick-thins, 0.004 to 0.007 in. (0.10 to 0.18 mm).

3.2.14 *unmanufactured mica*—commercial form of mica known as blocks, thins, films, and splittings, as described.

3.2.15 *waves*—alternate elevations and depressions that may be classified as slight, medium, or heavy.

4. Significance and Use

4.1 The properties included in this standard are those required to control the visual quality, usable area, thickness, hardness, and stiffness.

5. Grading for Size

5.1 *Full-Trimmed*—All full-trimmed mica blocks and thins shall be fully trimmed to remove all cracks, holes, reeves, and cross-grains according to the quality desired. As far as possible, all marginal cracks should be removed by recutting. The average area of the pieces for Grade 4 and larger shall be not more than 1.54 times the average area of the largest usable rectangles. This would constitute a minimum yield of 65 %. For Grades 5 and smaller, the average area of the pieces shall be not more than two times the average area of the largest usable rectangles. This would constitute a yield of 50 %.

5.2 *Half-Trimmed*—For half-trimmed mica, follow the grading described in 5.1 for trimmed sides with no cracks extending from the trimmed sides, except for sizes 6 and 5½ on which only side must be trimmed free of cracks. On the untrimmed sides, no defects of the designated quality are acceptable within the minimum rectangle of the designated grade.

5.3 *Natural Block and Thins*—Natural block and thins, muscovite mica shall be graded for size according to the area of the rectangle (maximum rectangle for full-trimmed, maximum rectangle of designated quality for half-trimmed) having at least the minimum dimension of one side for the specified grade. The area within such a rectangle shall meet the requirements of the quality specified by the purchaser as listed in Table 1.

5.4 *Method of Grading for Size*—The Standard ASTM Chart shown in Fig. 1 shall be used for grading natural block and thins, muscovite mica according to size. In grading natural block mica and thins for size, all dimensions apply to the smaller surface measured from the foot of the bevel-trimmed edge. The specimen to be graded shall be laid upon the chart so that it covers point

⁴ Available from American National Standards Institute (ANSI), 25 W. 43rd St., 4th Floor, New York, NY 10036, <http://www.ansi.org>.

TABLE 1 ASTM Grade Sizes of Muscovite Uncut Mica Block and Thins

ASTM Grade Sizes	Area of Minimum Rectangle		Minimum Dimension of One Side	
	in. ²	Equivalent, cm ²	in.	Equivalent, mm
OEEE Special	100	650	4	100
OEE Special	80	520	4	100
EE Special	60	390	4	100
E Special	48	310	4	100
A-1 (Special)	36	235	3½	89
No. 1	24	155	3	76
No. 2	15	97	2	51
No. 3	10	65	2	51
No. 4	6	40	1½	38
No. 5	3	20	1	25
No. 5½	2¼	15	7⁄8	22
No. 6	1	6.5	¾	19

O and has its maximum and minimum dimensions extending along and covering lines OA and OB, respectively. The specimen shall be shifted until the usable area completely covers the largest rectangle, determined by a diagonal extending from point O to or beyond a point on any of the curves. The number of the curve at the greatest distance from O cut by the diagonal of the rectangle designates the grade of the specimen.

6. Thickness of Block Mica

6.1 Measure the thickness with a micrometer as specified in Test Methods **D374**. In determining thickness of mica that must be kept within small permissible variations, or where two or more specimens are to be measured at once, use Method A of Test Methods **D374**. Where the maximum accuracy is not required, Method B may be used.

6.2 Because of the abrasive nature of mica, test the micrometer frequently for conformity to the requirements specified in Test Methods **D374**. Clean the anvil and spindle as frequently as necessary to prevent the accumulation of mica dust on the surfaces and to preserve the accuracy of the measurements. To clean, close the micrometer lightly on a clean sheet of bond paper and move the paper between the surfaces.

6.3 Be careful, when moving from one measurement location to another, to maintain the surfaces of the anvil and spindle parallel to the surfaces of the specimen at all times, so as to avoid scratching the mica and accumulating mica dust under the micrometer surfaces, thereby causing false readings.

7. Classification of Visual Quality of Block Mica

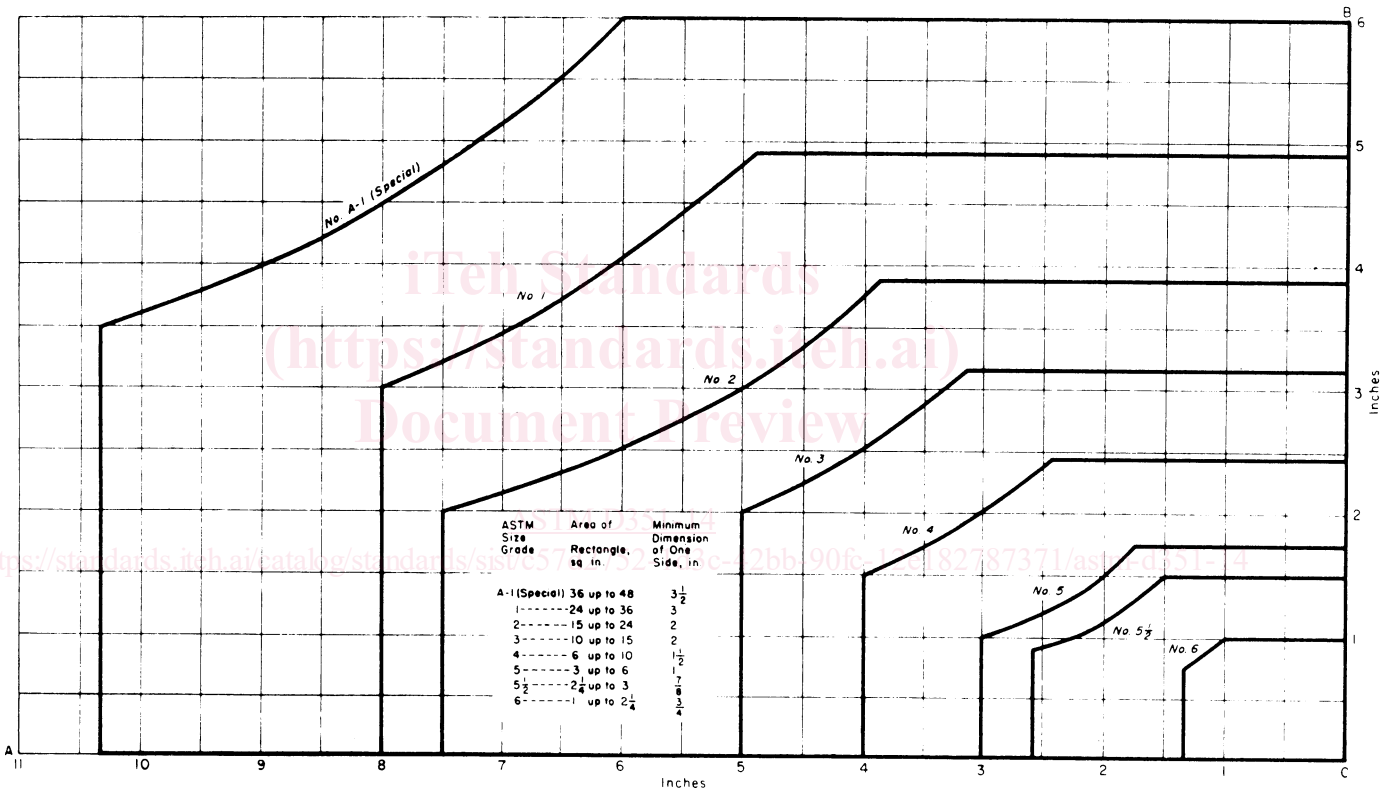
7.1 The classification of the visual quality of muscovite blocks and thins shall fall into the following thirteen categories:

- 7.1.1 V-1 Clear
- 7.1.2 V-2 Clear and Slightly Stained
- 7.1.3 V-3 Fair Stained
- 7.1.4 V-4 Good Stained
- 7.1.5 V-5 Stained A Quality
- 7.1.6 V-5.1 Stained A1 Quality
- 7.1.7 V-6 Stained B Quality
- 7.1.8 V-7 Heavy Stained
- 7.1.9 V-8 Densely Stained
- 7.1.10 V-9 Black Dotted
- 7.1.11 V-10 Black Spotted
- 7.1.12 V-11 Black Stained
- 7.1.13 V-12 Black/Red Stained

7.2 The classification of the visual quality of block mica shall be judged in accordance with the requirements specified in **Table 2** using the visual descriptions given.

8. Keywords

8.1 Bengal India System; block; classification; foreign inclusions; form; grading; muscovite mica; size; thins; visual quality



NOTE 1—This chart may be readily extended for Grades OOOE Special, OEE Special, EE Special, and E Special, using the information given in Table 1 of ASTM Specification D351.

FIG. 1 ASTM Chart for Grading Natural Muscovite Block and Film Mica

TABLE 2 Quality Classification of Muscovite Block and Thins Based on Visual Properties^{A,B}

Visual Quality Classification	Air Inclusions				Waviness					Hardness																									
	Crystallographic Discoloration	Air Inclusions				Smokey Stains	Mineral Stains	Vegetable Stains	Clay Stains	Waviness					Hardness		Stones and Holes	Buckles	Reeves	Ridges	Tears	Cracks	Hairline Cracks	Wedge	Tangle Sheet	Herringbones	Sand Blast								
		Very Slight ^A	Slight ^B	Medium	Heavy					Flat	Nearly Flat	Slight	Medium	Heavy	Hard	Soft																			
V-1 Clear	x	x	x	x	x	x	x	x	x	✓	x	x	x	x	✓	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	
V-2 Clear and Slightly Stained	✓ ^C	✓	x	x	x	x	x	x	x	✓	✓	x	x	x	✓	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	
V-3 Fair Stained	✓ ^C	✓	✓	x	x	x	x	x	x	✓	✓	✓	x	x	✓	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	
V-4 Good Stained	✓ ^C	✓	✓	✓ ^D	x	x	x	x	x	✓	✓	✓	✓	x	✓	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	
V-5 Stained A Quality	✓	✓	✓	✓	✓ ^E	x	x	✓ ^C	x	✓	✓	✓	✓	x	✓	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	
V-5.1 Stained A1 Quality	✓	✓	✓	✓	✓ ^F	x	✓ ^G	✓ ^C	x	✓	✓	✓	✓	✓	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	
V-6 Stained B Quality	✓	✓	✓	✓	✓	x	✓ ^H	✓ ^H	✓ ^H	✓	✓	✓	✓	✓	✓	x	x	✓ ^C	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
V-7 Heavy Stained	✓	✓	✓	✓	✓	x	✓ ^H	✓ ^I	x	✓	✓	✓	✓	✓	✓	x	x	✓	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
V-8 Densely Stained	✓	✓	✓	✓	✓	✓ ^I	✓ ^I	✓ ^I	✓ ^I	✓	✓	✓	✓	✓	✓	S	✓	✓	✓	✓	x	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
V-9 Black Dotted	✓	✓	✓	✓	✓	x	✓ ^J	✓	x	✓	✓	✓	✓	x	✓	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
V-10 Black Spotted	✓	✓	✓	✓	✓	x	✓	✓	x	✓	✓	✓	✓	x	✓	x	x	✓ ^C	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
V-11 Black Stained	✓	✓	✓	✓	✓	✓	✓ ^H	✓	✓	✓	✓	✓	✓	x	✓	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	✓
V-12 Black/Red Stain	✓	✓	✓	✓	✓	✓	✓ ^H	✓	✓	✓	✓	✓	✓	x	✓	S	x	✓ ^C	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x

Clear

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TABLE 2—Continued

Visual Quality Classification	Air Inclusions					Waviness					Hardness																			
V-2 Clear and Slightly Stained	√C	√	*	*	*	*	*	*	*	√	√	*	*	*	√	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
V-3 Fair Stained	√C	√	√	*	*	*	*	*	*	√	√	√	*	*	√	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
V-4 Good Stained	√C	√	√	√B	*	*	*	*	*	√	√	√	√	*	√	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
V-5 Stained A Quality	√	√	√	√	√E	*	*	√C	*	√	√	√	√	*	√	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
V-5.1 Stained A1 Quality	√	√	√	√	√F	*	√G	√C	*	√	√	√	√	√	√	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
V-6 Stained B Quality	√	√	√	√	√	*	√H	√H	√H	√	√	√	√	√	√	*	*	√C	*	*	*	*	*	*	*	*	*	*	*	*
V-7 Heavy Stained	√	√	√	√	√	*	√H	√H	*	√	√	√	√	√	√	*	*	√	*	*	*	*	*	*	*	*	*	*	*	*
V-8 Densely Stained	√	√	√	√	√	√	√H	√H	√H	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
V-9 Black Dotted	√	√	√	√	√	*	√H	√H	√H	√	√	√	√	√	√	*	*	√	*	*	*	*	*	*	*	*	*	*	*	*
V-10 Black Spotted	√	√	√	√	√	*	√H	√H	√H	√	√	√	√	√	√	*	*	√	*	*	*	*	*	*	*	*	*	*	*	*
V-11 Black Stained	√	√	√	√	√	√	√H	√H	√H	√	√	√	√	√	√	*	*	√	*	*	*	*	*	*	*	*	*	*	*	*
V-12 Black/Red Stain	√	√	√	√	√	√	√H	√H	√H	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√

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