

ASME Y14.36-2018

[Revision of ASME Y14.36M-1996 (R2008)]

Surface Texture Symbols

**Engineering Product Definition and
Related Documentation Practices**

AN AMERICAN NATIONAL STANDARD



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Related Documentation Practices**

AN AMERICAN NATIONAL STANDARD



**The American Society of
Mechanical Engineers**

Two Park Avenue • New York, NY • 10016 USA

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FOREWORD

The revision of this Standard includes changes and additions that reflect advancements in the field of surface texture. The successful completion of this Standard is due to the members of the Y14.36 and B46.1 committees. This revision was influenced by changes in the ISO 1302 and ASME Y14.41 standards and investigations by the Joint Advisory Committee 1 (Y14/B89) on the Specification of Notation to Support Requirements for Size and Geometric Tolerances.

Major changes include the

- (a) renumbering of all the paragraphs and figures
- (b) addition of a textual presentation method
- (c) reorganization of surface texture parameters associated with the surface texture symbol
- (d) addition of symbol locations for previously unstated parameters
- (e) ability to specify multiple wavelength domains
- (f) inclusion of all-around and all-over symbols
- (g) elimination of the material removal allowance value
- (h) clarification of how to orient the surface texture symbol
- (i) addition of lay symbol proportions
- (j) ability to annotate surface texture symbols on digital models
- (k) ability to annotate lay and measurement direction on drawing graphic sheets and digital data sets (3D model)

This Standard was approved as an American National Standard on June 15, 2018.

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Engineering Product Definition and Related Documentation Practices

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SURFACE TEXTURE SYMBOLS

1 GENERAL

1.1 Scope

This Standard establishes methods to designate surface texture controls. It includes symbolic and textual methods for specifying roughness, waviness, and other surface texture information on drawings, in specifications, or in other documents.

1.2 ASME Y14 Series Conventions

The conventions in [paras. 1.2.1](#) through [1.2.9](#) are used in this and other ASME Y14 Standards.

1.2.1 Mandatory, Recommended, Guidance, and Optional Words

- (a) The word “shall” establishes a requirement.
- (b) The word “will” establishes a declaration of purpose on the part of the design activity.
- (c) The word “should” establishes a recommended practice.
- (d) The word “may” establishes an allowed practice.
- (e) The words “typical,” “example,” or “for reference” or the Latin abbreviation “e.g.” indicates suggestions given for guidance only.
- (f) The word “or” used in conjunction with a requirement or a recommended practice indicates that there are two or more options for complying with the stated requirement or practice.
- (g) The phrase “unless otherwise specified” or “UOS” shall be used to indicate a default requirement. The phrase is used when the default is a generally applied requirement, and an exception may be provided by another document or requirement.

1.2.2 Cross-Reference of Standards. Cross-reference of standards in text with or without a date following the standard designator shall be interpreted as follows:

- (a) Reference to other ASME Y14 standards in the text without a date following the standard designator indicates that the issue of the standard identified in the References section shall be used to meet the requirement.
- (b) Reference to other ASME Y14 standards in the text with a date following the standard designator indicates that only that issue of the standard shall be used to meet the requirement.

1.2.3 Invocation of Referenced Standards. The following examples define the invocation of a standard when specified in the References section and referenced in the text of this Standard:

(a) When a referenced standard is cited in the text with no limitations to a specific subject or paragraph(s) of the standard, the entire standard is invoked. For example, “Dimensioning and tolerancing shall be in accordance with ASME Y14.5” is invoking the complete standard because the subject of the standard is dimensioning and tolerancing, and no specific subject or paragraph(s) within the standard are invoked.

(b) When a referenced standard is cited in the text with limitations to a specific subject or paragraph(s) of the standard, only the paragraph(s) on that subject is invoked. For example, “Assign part or identifying numbers in accordance with ASME Y14.100” is invoking only the paragraph(s) on part or identifying numbers because the subject of the standard is engineering drawing practices, and part or identifying numbers is a specific subject within the standard.

(c) When a referenced standard is cited in the text without an invoking statement such as “in accordance with,” the standard is invoked for guidance only. For example, “For gauging principles, see ASME Y14.43” is only for guidance, and no portion of the standard is invoked.

1.2.4 Parentheses Following a Definition. When a definition is followed by a standard referenced in parentheses, the standard referenced in parentheses is the source for the definition.

1.2.5 Notes. Notes depicted in this Standard in all uppercase letters are intended to reflect actual drawing entries. Notes depicted in initial uppercase or lowercase letters are to be considered supporting data to the contents of this Standard and are not intended for literal entry on drawings. A statement requiring the addition of a note with the qualifier “such as” is a requirement to add a note, and the content of the note is allowed to vary to suit the application.

1.2.6 Acronyms and Abbreviations. Acronyms and abbreviations are spelled out the first time used in this Standard followed by the acronym or abbreviation in parentheses. The acronym is used thereafter throughout the text.

1.2.7 Units. The International System of Units (SI) is featured in this Standard. It should be understood that U.S. Customary units could equally have been used without prejudice to the principles established.

1.2.8 Figures. The figures in this Standard are intended only as illustrations to aid the user in understanding the practices described in the text. In some cases, figures show a level of detail as needed for emphasis. In other cases,

figures are incomplete by intent so as to illustrate a concept or facet thereof. The absence of figure(s) has no bearing on the applicability of the stated requirements or practice. To comply with the requirements of this Standard, actual data sets shall meet the content requirements set forth in the text. To assist the user of this Standard, a listing of the paragraph(s) that refer to an illustration appears in the lower right-hand corner of each figure. This listing may not be all inclusive. The absence of a listing is not a reason to assume inapplicability. Some figures are illustrations of models in a three-dimensional environment. The absence of dimensioning and tolerancing annotations in a view may indicate that the product definition is defined in 3D. Dimensions that locate or orient and are not shown are considered basic and shall be queried to determine the intended requirement. When the letter “h” is used in figures for letter heights or for symbol proportions, select the applicable letter height in accordance with ASME Y14.2. Multiview drawings contained within figures are third-angle projection.

1.2.9 Precedence of Standards. The following are ASME Y14 standards that are basic engineering drawing standards:

ASME Y14.1, Decimal Inch Drawing Sheet Size and Format
 ASME Y14.1M, Metric Drawing Sheet Size and Format
 ASME Y14.2, Line Conventions and Lettering
 ASME Y14.3, Orthographic and Pictorial Views
 ASME Y14.5, Dimensioning and Tolerancing
 ASME Y14.24, Types and Applications of Engineering Drawings
 ASME Y14.35, Revision of Engineering Drawings and Associated Documents
 ASME Y14.38, Abbreviations and Acronyms for Use on Drawings and Related Documents
 ASME Y14.41, Digital Product Definition Data Practices
 ASME Y14.100, Engineering Drawing Practices

All other ASME Y14 standards are considered specialty types of standards and contain additional requirements or make exceptions to the basic standards as required to support a process or type of drawing.

2 REFERENCES

The following revisions of American National Standards form a part of this Standard to the extent specified herein. A more recent revision may be used provided there is no conflict with the text of this Standard. In the event of a conflict between the text of this Standard and the references cited herein, the text of this Standard shall take precedence.

ASME B46.1-2009, Surface Texture
 ASME Y14.2-2014, Line Conventions and Lettering

ASME Y14.3-2012, Orthographic and Pictorial Views
 ASME Y14.5-2009, Dimensioning and Tolerancing
 ASME Y14.38-2007, Abbreviations and Acronyms for Use on Drawings and Related Documents
 ASME Y14.41-2012, Digital Product Definition Data Practices
 Publisher: The American Society of Mechanical Engineers (ASME), Two Park Avenue, New York, NY 10016-5990 (www.asme.org)

ISO 1302, Geometrical Product Specifications (GPS) — Indication of Surface Texture in Technical Product Documentation
 Publisher: International Organization for Standardization (ISO), Central Secretariat, Chemin de Blandonnet 8, Case Postale 401, 1214 Vernier, Geneva, Switzerland (www.iso.org)

3 DEFINITIONS

See B46.1 for surface texture parameter definitions.

4 SURFACE TEXTURE SYMBOLS

4.1 Control and Modifier Data

Surface texture controls shall be designated with symbols or text. The symbol or text methods shall be used when a single requirement or several different requirements apply to a given surface. The symbols or text shall appear on the field of the drawing, in the title block, or referenced on a specification sheet.

4.2 Basic Surface Texture Symbol

The basic surface texture symbol denotes the surface texture parameters that are a requirement for a surface. See [Figure 4-1](#), illustration (a). When using this symbol, the general surface texture requirements shall be shown on the drawing or on a referenced specification. For symbol proportions, see [Figure A-1](#).

4.3 Symbol Modifiers

The following modifiers allow surface texture parameters to be applied that are different from what is specified on the drawing or on a referenced specification sheet to specific surfaces.

4.3.1 Material Removal Required (MRR). When it is necessary to indicate that a surface shall be produced by removing material, a horizontal line shall be added to the basic surface texture symbol. See [Figure 4-1](#), illustration (b).

4.3.2 No Material Removed (NMR). When it is necessary to indicate that a surface shall be produced without material removal, a circle is added to the basic surface texture symbol. See [Figure 4-1](#), illustration (c).

4.3.3 Any Process Allowed (APA). When the symbols in paras. 4.3.1 and 4.3.2 are not shown, any process is allowed (APA) for achieving the surface texture.

4.3.4 Expanded Surface Texture Symbol. A horizontal line drawn to the right of the long leg of the basic surface texture symbol shall be used when surface texture values, production method, treatment, coating, or other information are specified that are different from the requirements on the drawing or on a referenced specification sheet. See Figure 4-1, illustrations (d) through (f).

4.4 Symbol Position Descriptions

The placement of required data and values in the symbol shall be as shown in Figure 4-2. The letters shown in Figure 4-2 represent the following surface characteristics:

- a = transmission band [short and long wavelength cutoff value(s) and associated filter types]
- b = surface texture parameter designation and limit value(s)
- c = evaluation length expressed as a number of samples (n) or in millimeters (inches)
- d = calculation type
- e = lay symbol
- f = material removal modifiers
- g = surface application modifier
- h = processing notes

The subscript numbered letters in Figure 4-2 show the location of additional surface characteristics that apply to the surface. When more surface characteristics are required, the horizontal line of the surface texture symbol may be raised and the long leg may be lengthened to provide more vertical space.

4.4.1 Lay Symbols. Symbols for designating the direction of lay (surface marks) are shown in Figure 4-3. See Figure A-2 for symbol proportions.

4.4.2 Parallel. In the orthographic view, the lay is approximately parallel to the line representing the surface to which the surface texture symbol is applied. See Figure 4-3, illustration (a).

4.4.3 Perpendicular. In the orthographic view, the lay is approximately perpendicular to the line representing the surface to which the surface texture symbol is applied. See Figure 4-3, illustration (b).

4.4.4 Angular. The lay is angular in both directions to the surface to which the symbol is applied. See Figure 4-3, illustration (c).

4.4.5 Multidirectional. The lay is multidirectional relative to the surface to which the symbol is applied. See Figure 4-3, illustration (d).

4.4.6 Circular. The lay is approximately circular relative to the surface to which the symbol is applied. See Figure 4-3, illustration (e).

4.4.7 Radial. The lay is approximately radial relative to the surface to which the symbol is applied. See Figure 4-3, illustration (f).

4.4.8 Particulate. The lay is nondirectional or protuberant (cast surface). See Figure 4-3, illustration (g).

4.5 Symbol Placement

The vertex of the symbol's angled legs shall be placed

- (a) on a line representing the surface
- (b) on an extension line of the surface
- (c) attached to the horizontal portion of a leader line directed to the surface, or
- (d) attached to a feature control frame directed to the surface

The symbol may be specified with a diameter dimension. When the basic surface texture symbol is used, with or without MRR, NMR, or APA, it may be applied at any angle. When the expanded surface texture symbol is used, the parameter information shall be read from the bottom of the drawing graphic sheet (see Figure 4-4).

4.6 Textual Presentation of Surface Texture Requirements

When surface texture requirements are presented as a textual entry, the standard display method illustrated in Figure 4-5 shall be used. The letters relate to the surface texture parameters (see para. 4.5 and Figures 4-2 and 4-5). The lay symbol abbreviations used in the textual presentation are as shown in ASME Y14.38. Use "MULTD" for the multidirectional lay abbreviation.

4.6.1 Sequence Format. The text positions for data entry sequence shall be in the order shown in Figure 4-2. Two forward slashes are used to divide separate parameter sequences after item "d."

5 APPLICATIONS AND ASSOCIATED VALUES

5.1 Applicability of Controls

When a surface texture symbol is used, it relates to the entire surface or area to which it is applied. Surface texture requirements comprised of either symbols or the textual presentation method may be applied by the use of general notes, contained in a title block, or defined in other specifications. Surfaces that require different parameters than those stated in the title block or other specification shall be identified in the field of the drawing with their own surface texture symbols and requirements. Only those items or values necessary to specify and verify the required surface texture characteristics shall be included (see Figure 4-4). See ASME B46.1 for default values.

5.1.1 Areas of Transition. Features that blend or transition between surfaces, such as chamfers, fillets, and cutter ramps, shall conform to the roughest adjacent finished area unless otherwise specified.

5.1.2 Plated or Coated Surfaces. Drawings or specifications for plated or coated parts shall indicate whether the surface texture values apply before, after, or both (see Figure 5-1).

5.1.3 Single Surface Control. Unless otherwise specified, the surface texture requirements apply only to the indicated surface.

5.1.4 Multiple Surface Control. A single surface texture control may be applied to multiple surfaces using multiple leaders as shown in Figure 4-4 or by using the all-around or all-over modifiers. The use of modifiers is limited to the graphic symbol only (see Figures 5-2 and 5-3).

5.1.4.1 Application of All-Around Modifier. When the same surface texture is required on all surfaces around a part outline, the surface texture symbol may be modified to apply all around. This is achieved by adding the all-around symbol to the intersection of the angled and horizontal leg of the surface texture symbol. In an orthographic view, the symbol is applied to an edge of a surface that represents a closed outline. See Figure 4-1, illustration (e) and Figure 5-2. Only eight surfaces shown on the 3D representation of the part are controlled by the all-around modifier applied in the orthographic view (the front and rear surfaces not included). Surfaces shall be indicated independently if any ambiguity arises from the all-around indication.

5.1.4.2 Application of All-Over Modifier. When the same surface texture is required for all surfaces of a part, the surface texture symbol may be modified to apply all

over. This is achieved by adding the all-over symbol to the intersection of the angled and horizontal leg of the surface texture symbol. See Figure 4-1, illustration (f) and Figure 5-3. All ten surfaces shown on the 3D representation of the part are controlled by the all-over modifier.

5.1.5 Applied to a Supplemental Line. If required, surface texture symbols shall be applied to a model as described in paras. 5.1.5.1 and 5.1.5.2.

5.1.5.1 Lay Direction. The lay shall be shown with a supplemental line with arrows on each end. See Figure 4-3, illustrations (a) and (b) and ASME Y14.41.

5.1.5.2 Measurement Direction. A supplemental line with no arrows shall be applied to the feature surface that shows the measurement direction. See Figure 5-4 and ASME Y14.41.

6 EXAMPLE DESIGNATIONS

6.1 Examples

Figure 6-1 illustrates examples of surface texture symbols and requirements with explanations and recommendations for textual entries.

6.2 Symbols for Special or Multiple Operations

When surface roughness control of several operations is required within a given area, or on a given surface, surface qualities shall be designated as in Figure 6-2, illustration (a). When a surface is produced by one particular process or a series of processes, they shall be specified as shown in Figure 6-2, illustration (b). Where a surface requirement is needed on a portion of a designated surface, a note shall be added at the symbol giving the requirements and the area involved. An example is illustrated in Figure 6-2, illustration (c).

Figure 4-1 Surface Texture Symbols

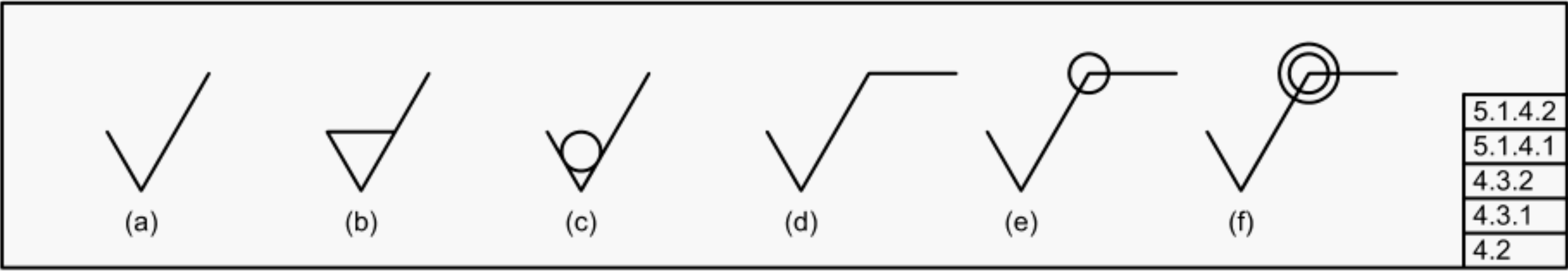


Figure 4-2 Value Application

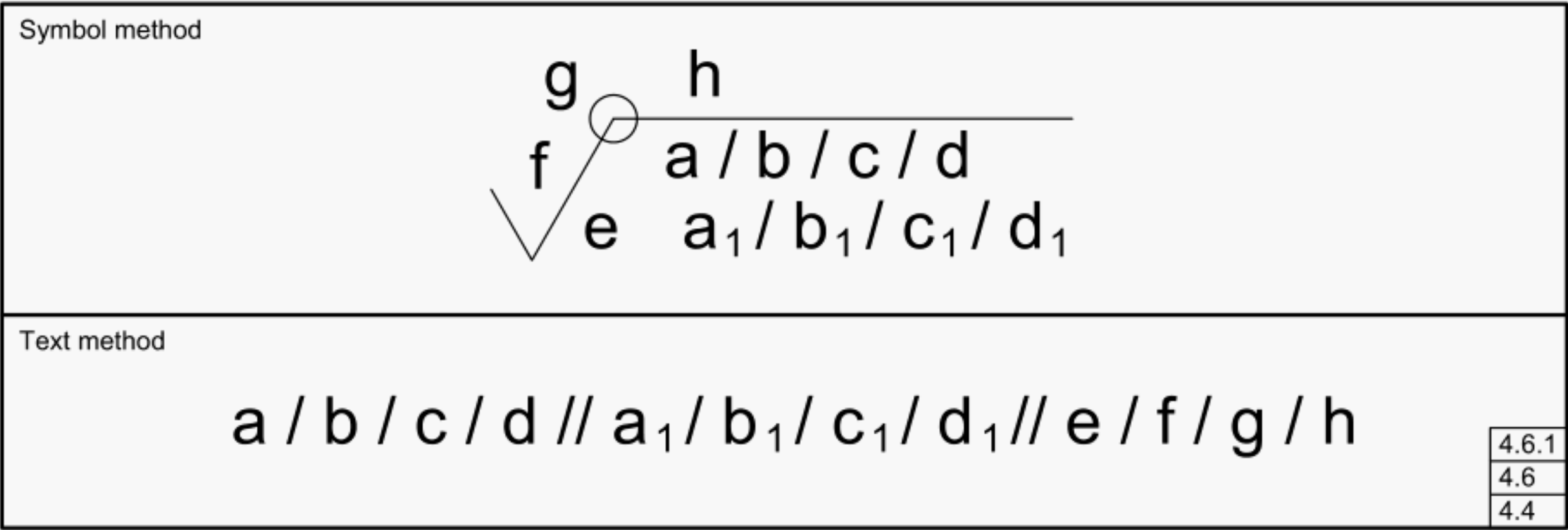


Figure 4-3 Lay Symbols

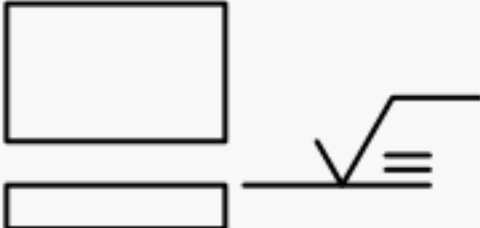

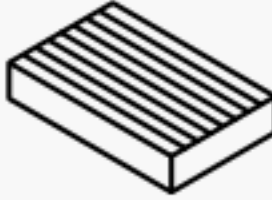
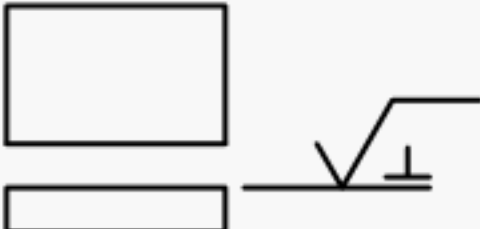
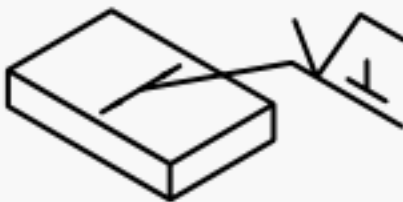
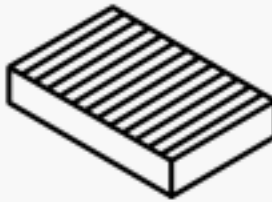
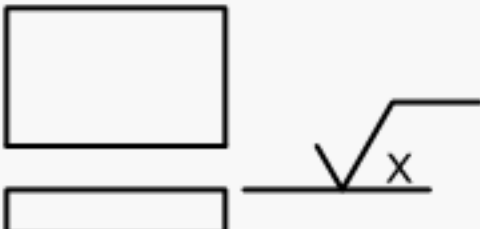
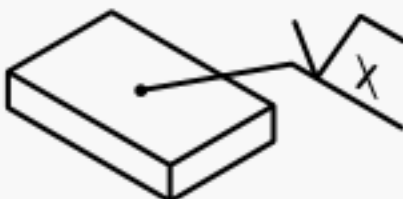
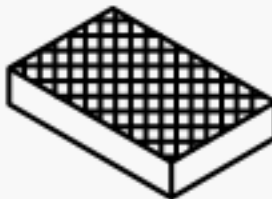
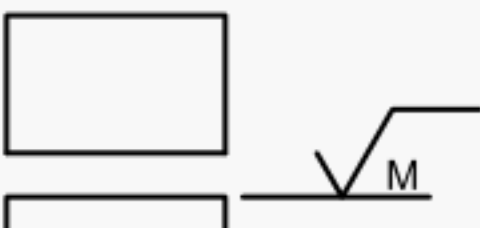
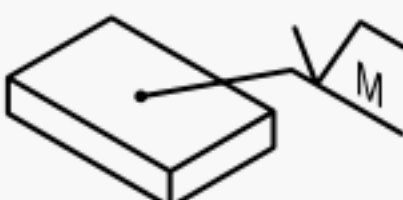
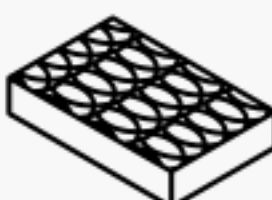
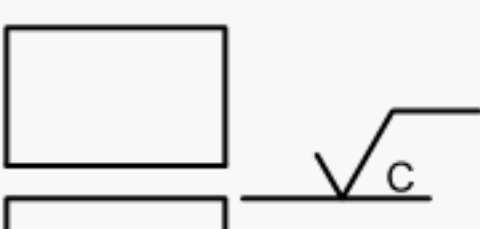
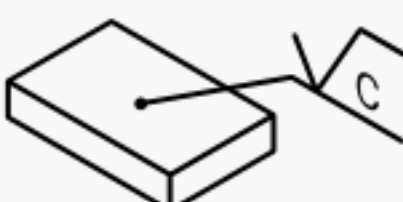

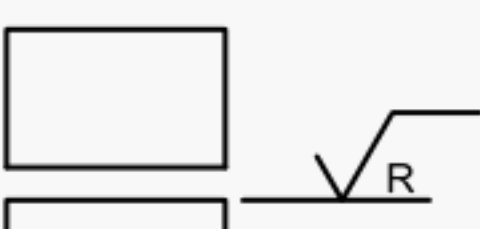
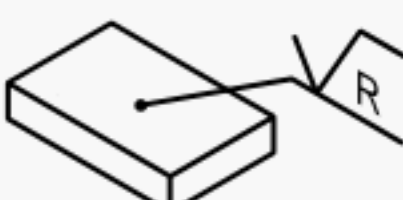


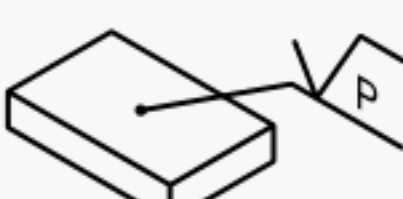
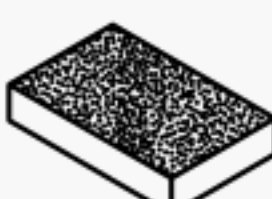
This on the orthographic view	or this on the model	means this on the workpiece
(a) 		
(b) 		
(c) 		
(d) 		
(e) 		
(f) 		
(g) 		 <div>5.1.5.1 4.4.1</div>

Figure 4-4 Location of Surface Texture Symbols

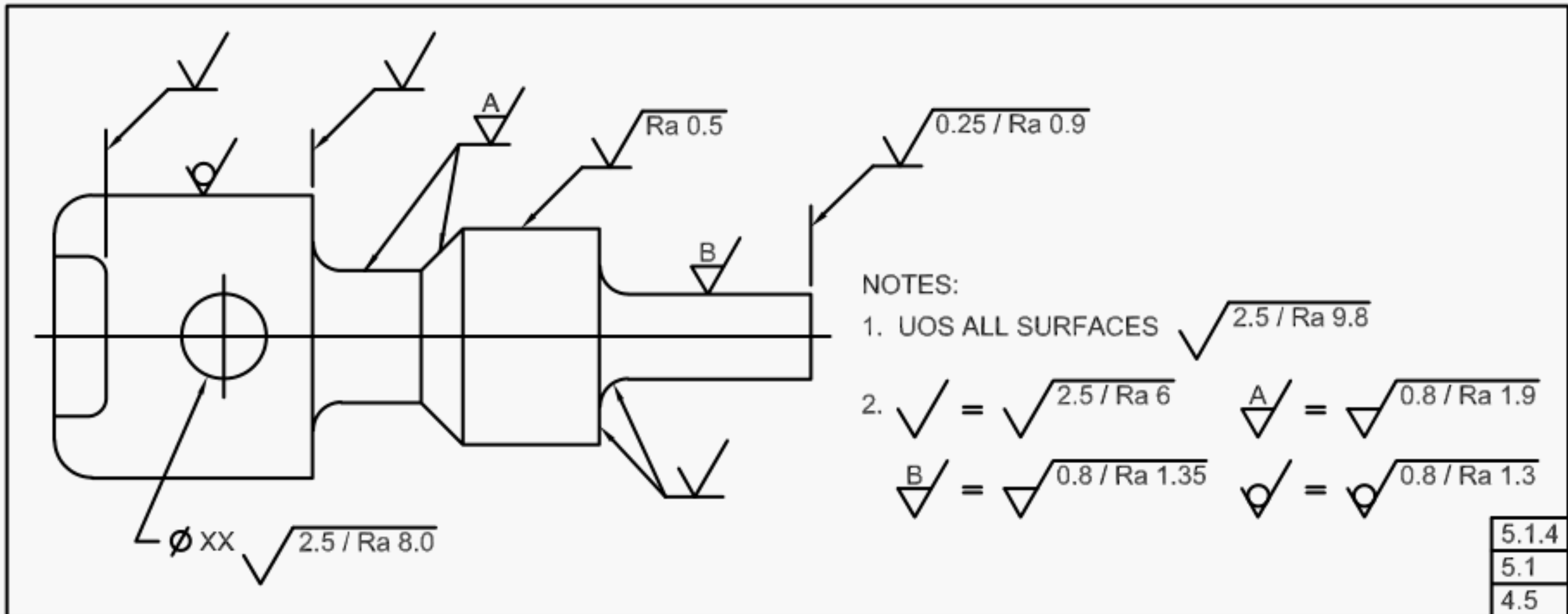


Figure 4-5 Text Example of Surface Texture Requirements

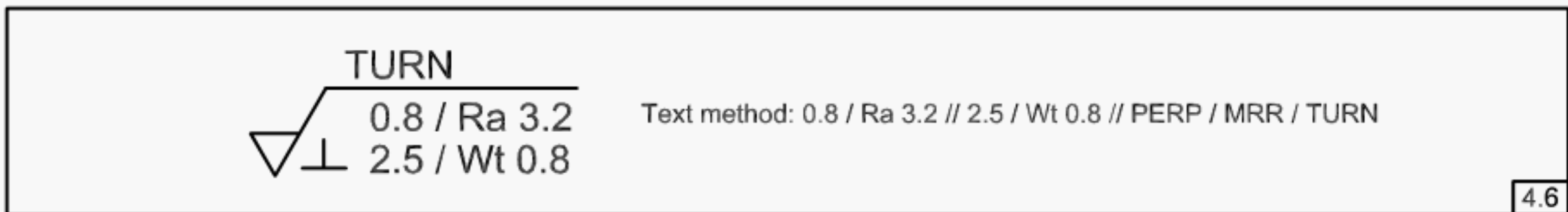


Figure 5-1 Requirements Related to Plating or Coating

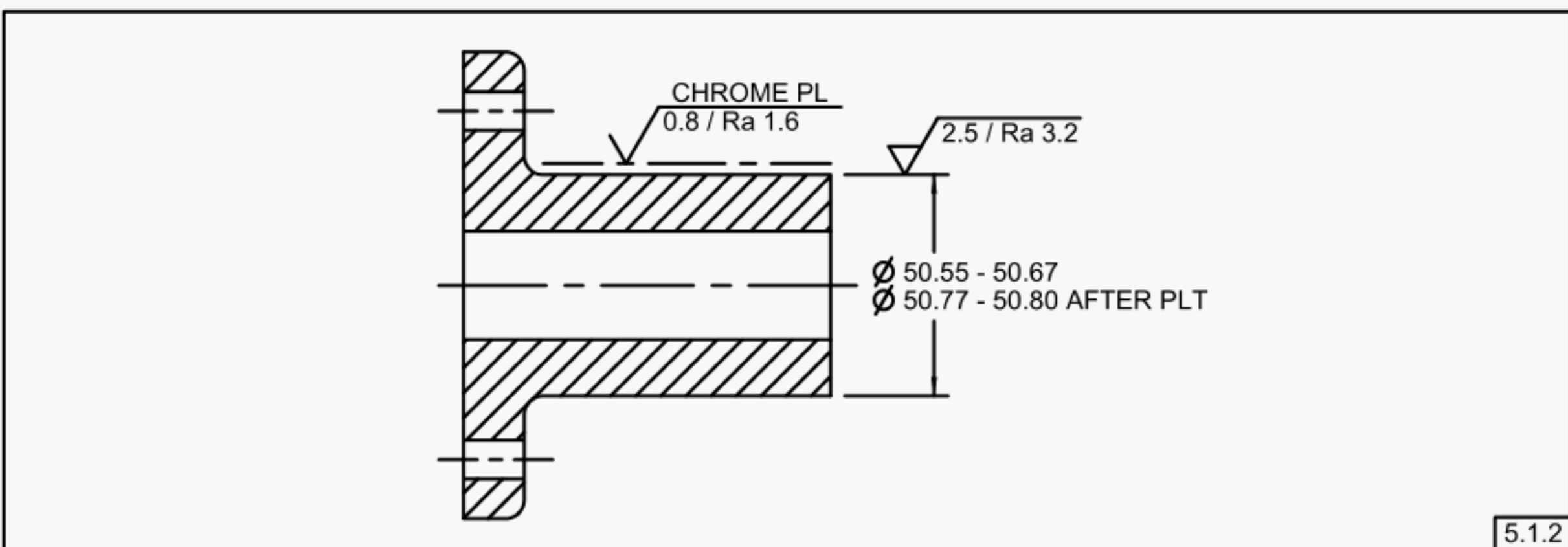


Figure 5-2 Surface Application Modifier All Around

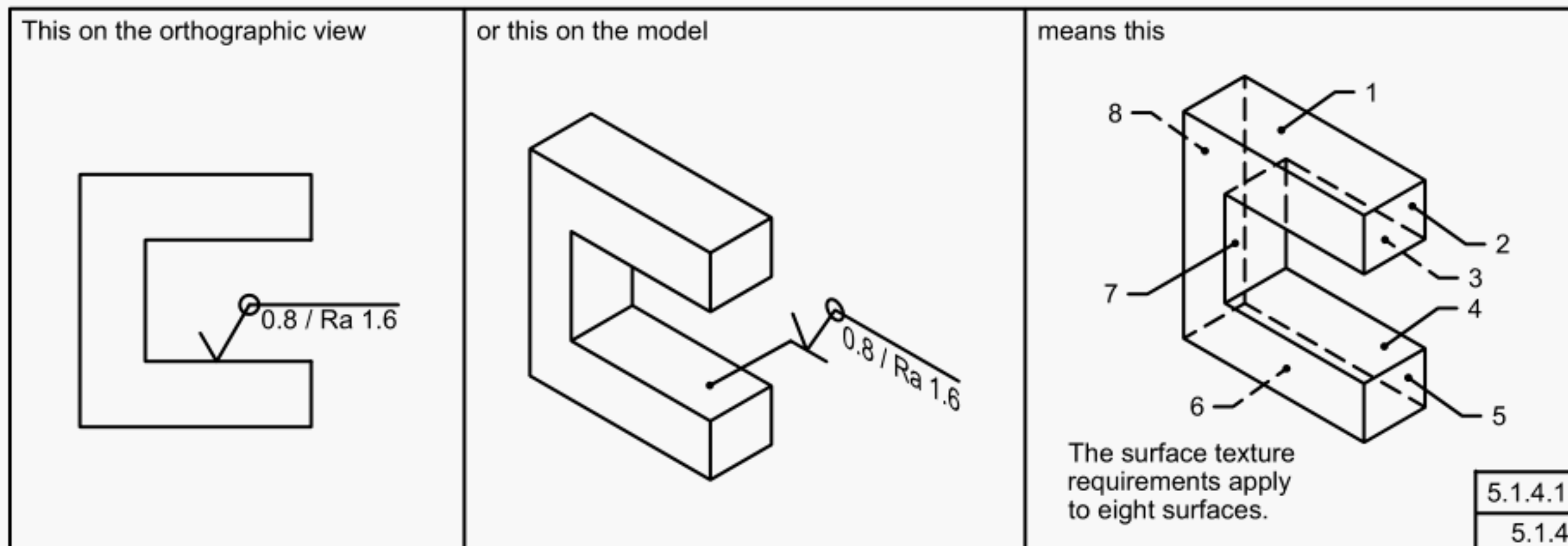


Figure 5-3 Surface Application Modifier All Over

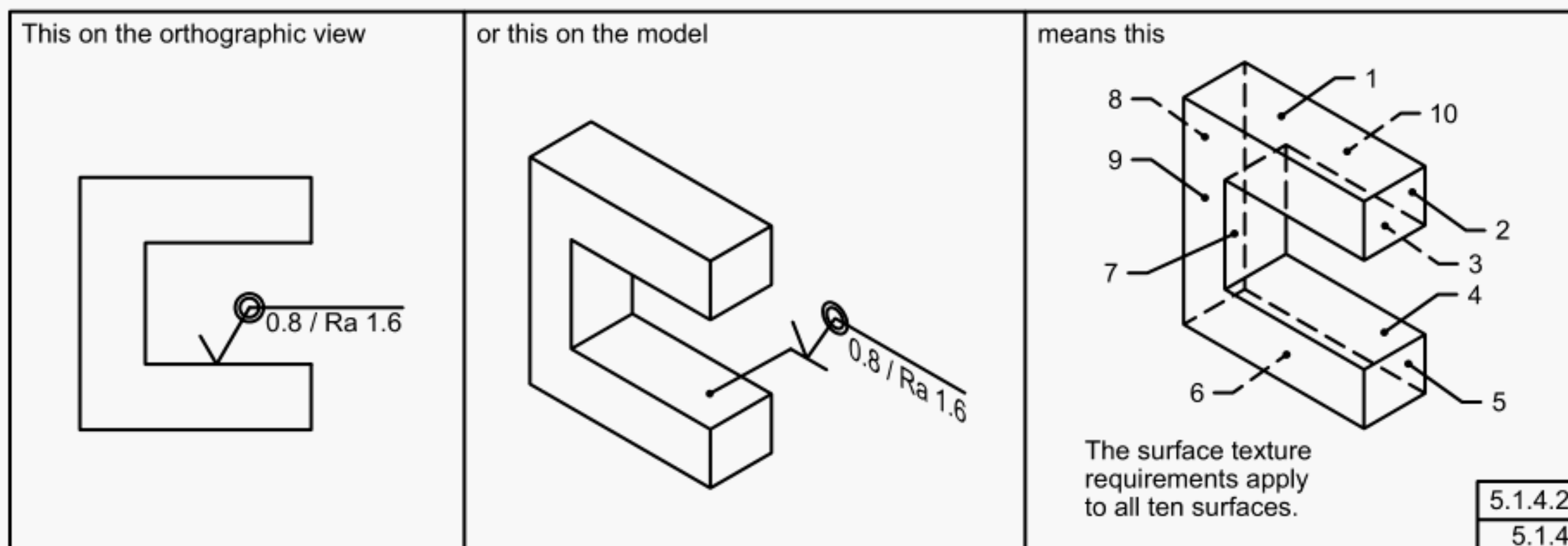


Figure 5-4 Surface Texture Applied to a Measurement Direction Supplemental Line

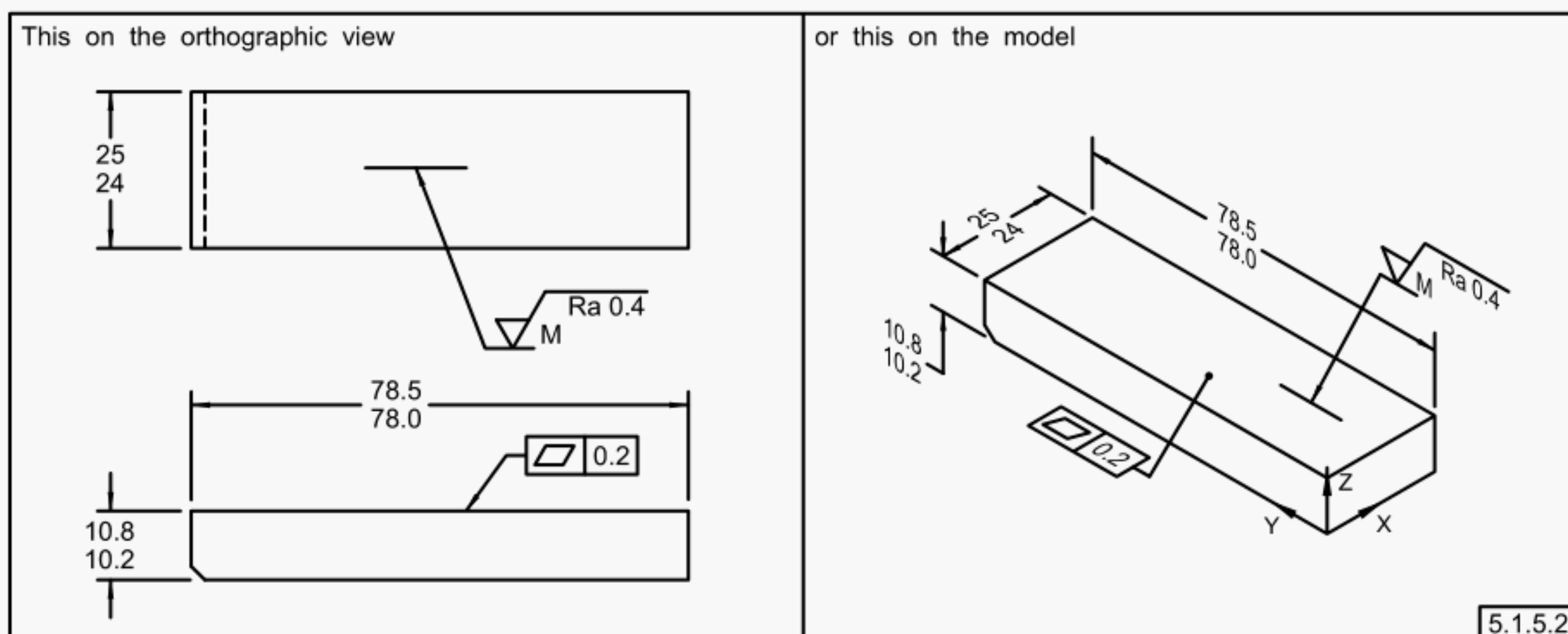
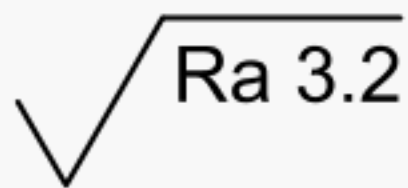
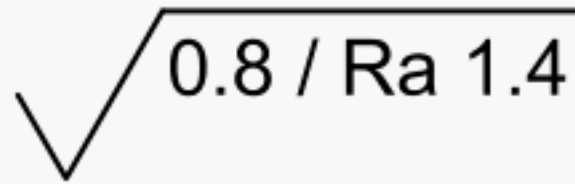
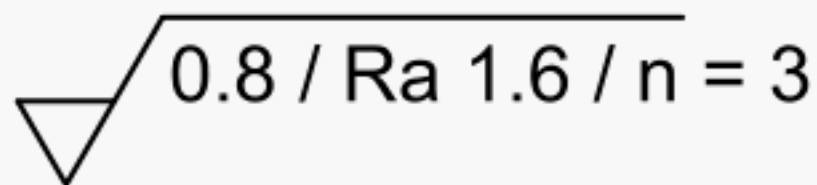


Figure 6-1 Surface Texture Symbol Application Examples

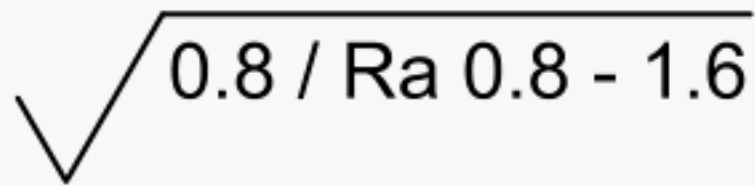
The maximum roughness average is 3.2 μm . Any process is acceptable. (A default upper cutoff or transmission band value must be stated elsewhere.)
Text method: Ra 3.2



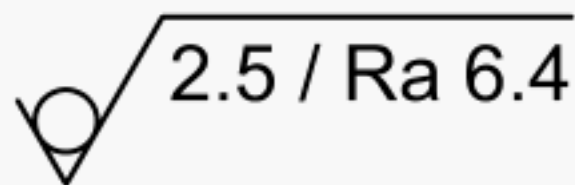
The upper cutoff value is 0.8 mm, and the maximum roughness average is 1.4 μm .
Any process is acceptable.
Text method: 0.8 / Ra 1.4



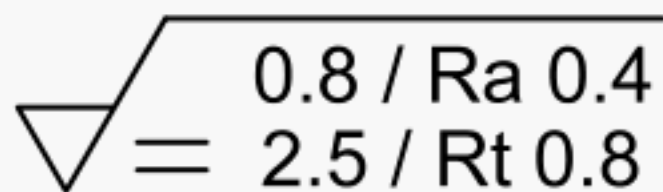
The upper cutoff value is 0.8 mm, and the maximum roughness average is 1.6 μm .
Three sample lengths are used to find the average.
Material removal is required.
Text method: 0.8 / Ra 1.6 / n = 3 // MRR



The upper cutoff value is 0.8 mm, and the roughness average is between 0.8 μm and 1.6 μm .
Any process is acceptable.
Text method: 0.8 / Ra 0.8 – 1.6



The upper cutoff value is 2.5 mm, and the maximum roughness average is 6.4 μm .
No material removal is required.
Text method: 2.5 / Ra 6.4 // NMR



The first upper cutoff value is 0.8 mm, and the maximum roughness average is 0.4 μm .
The second upper cutoff value is 2.5 mm, and the maximum profile height is 0.8 μm .
Parallel lay. Material removal is required.
Text method: 0.8 / Ra 0.4 // 2.5 / Rt 0.8 // PRL / MRR

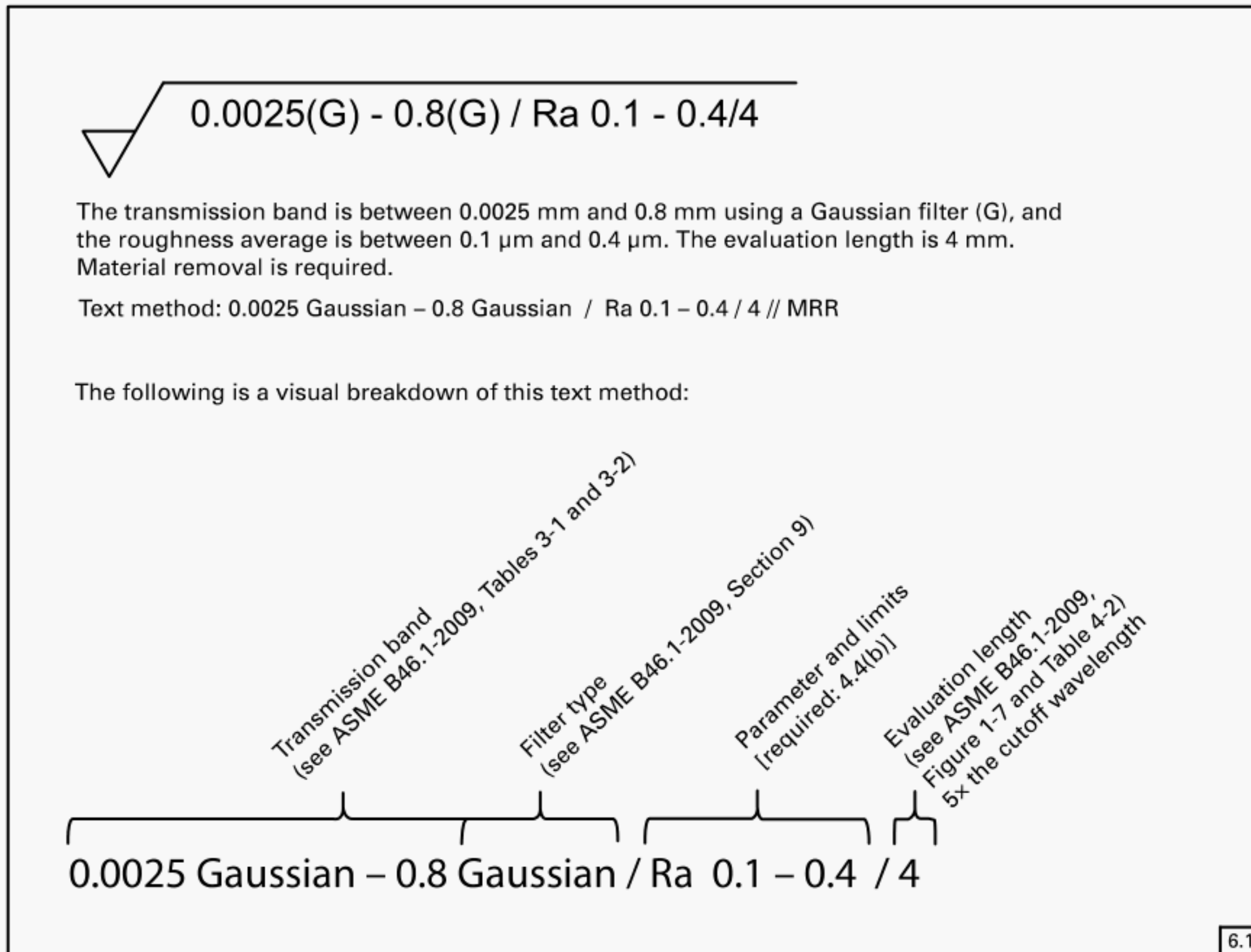

Figure 6-1 Surface Texture Symbol Application Examples (Cont'd)

Figure 6-1 Surface Texture Symbol Application Examples (Cont'd)


 0.0025 - 0.8 / Ra 0.05 - 0.2
 0.0025 - 0.8 / Rz 5
 0.8 - 8 / Wt 0.5

The first transmission band is between 0.0025 mm and 0.8 mm, and the roughness average is between 0.05 μm and 0.2 μm .
 The second transmission band is between 0.0025 mm and 0.8 mm, and the maximum roughness height is 5 μm .
 The third transmission band is between 0.8 mm and 8 mm, and the waviness height is 0.5 μm .
 Material removal is required.

Text method: 0.0025 - 0.8 / Ra 0.05 - 0.2 // 0.0025 - 0.8 / Rz 5 // 0.8 - 8 / Wt 0.5 // MRR


 0.0025 - 0.8 / Ra 0.20 - 0.43 / n = 5
 0.0025(G) - 0.8(G) / Rpk 5 / 0.37 / n = 5
 0.0025 - 0.8 / Rpm 0.5 / n = 5
 0.0025 - 0.8 / Rpq 0.14 / n = 5
 0.0025 - 0.8 / Rmr (5.0%, 2.0) / 70% MIN / n = 5

All parameters use a transmission band between 0.0025 mm and 0.8 mm and five samples.
 The first roughness average is between 0.20 μm and 0.43 μm .
 The second transmission band uses a Gaussian filter. The maximum roughness reduced peak height is 0.37 μm .
 The average maximum profile peak height is 0.5 μm .
 The roughness profile parameter is 0.14 μm .
 The roughness material ratio is 5.0%, 2.0 / 70% min.
 Perpendicular lay. Material removal is required.

Text method: 0.0025 - 0.8 / Ra 0.20 - 0.43 / n = 5 // 0.0025 Gaussian - 0.8 Gaussian / Rpk 5 / 0.37 / n = 5 //
 0.0025 - 0.8 / Rpm 0.50 / n = 5 // 0.0025 - 0.8 / Rpq 0.14 / n = 5 //
 0.0025 - 0.8 / Rmr (5.0%, 2.0) / 70% MIN / n = 5 // PERP / MRR


 0.0025(G) - 0.8(G) / Ra 0.20 - 0.60 / 4
 0.0025(G) - 0.8(G) / Rz 1.40 - 4.20 / 4
 0.0025(G) - 0.8(G) / Rmax 7.50 / 4
 2.5(G) / Wt 8.0 / 12.5

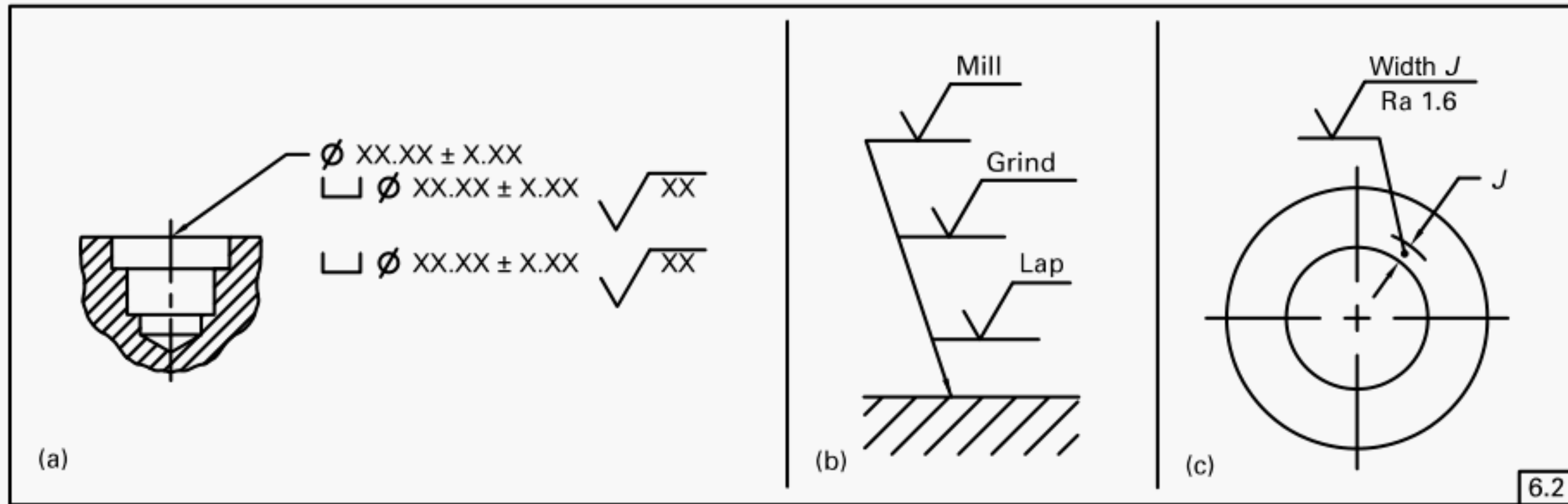
The first three parameter transmission bands are between 0.0025 mm and 0.8 mm using a Gaussian filter.
 The roughness average is between 0.20 μm and 0.60 μm for 4 mm.
 The average maximum profile height is between 1.40 μm and 4.20 μm for 4 mm.
 The maximum roughness depth is 7.50 μm for 4 mm.
 The fourth transmission band upper cutoff value is 2.5 mm using a Gaussian filter, and the waviness height is 8.0 μm for 12.5 mm.
 Perpendicular lay. Material removal is required.

Text method: 0.0025 Gaussian - 0.8 Gaussian / Ra 0.20 - 0.60 / 4 // 0.0025 Gaussian - 0.8 Gaussian / Rz 1.40 - 4.20 / 4 //
 0.0025 Gaussian - 0.8 Gaussian / Rmax 7.50 / 4 // 2.5 Gaussian / Wt 8.0 / 12.5 // PERP / MRR

6.1

GENERAL NOTE: A forward slash is used to divide the different parts of the surface texture information. A dash is used to separate low and high values. Parentheses are used to enclose reference information.

Figure 6-2 Special Designation Examples



NONMANDATORY APPENDIX A

GRAPHIC PROPORTIONS

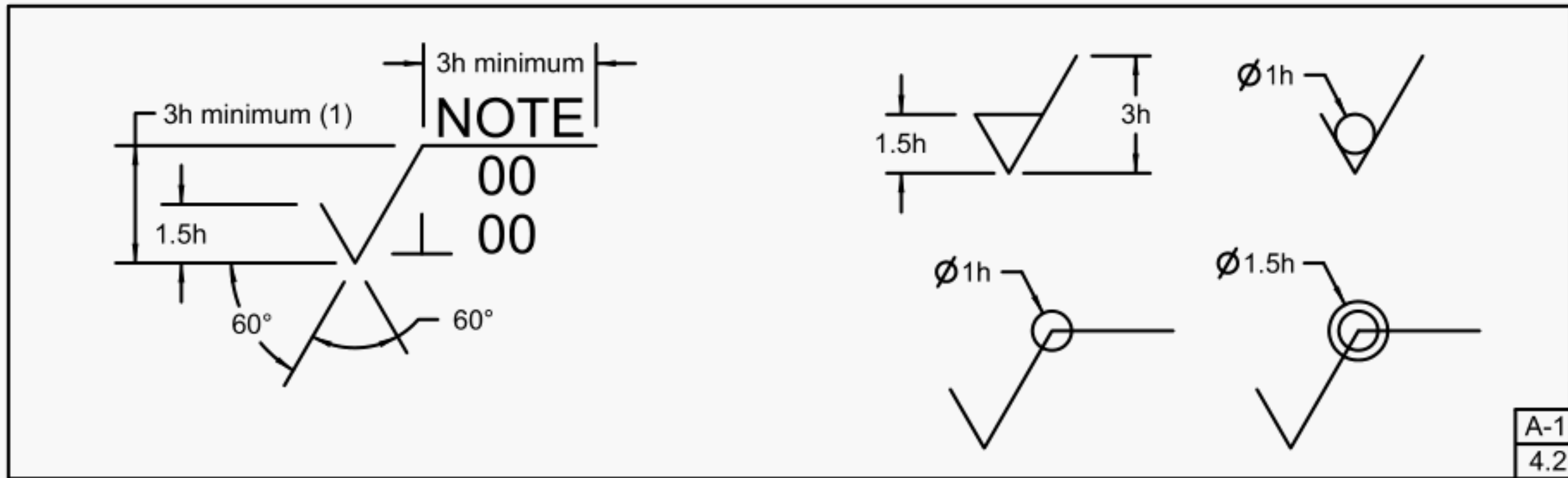
A-1 SURFACE TEXTURE SYMBOL PROPORTIONS

The recommended proportions for drawing the surface texture symbol are shown in [Figure A-1](#). The letter height and line width should be the same as that prescribed for dimensions and dimension lines (see ASME Y14.2).

A-2 LAY SYMBOL PROPORTIONS

The recommended proportions for drawing the lay symbols are shown in [Figure A-2](#).

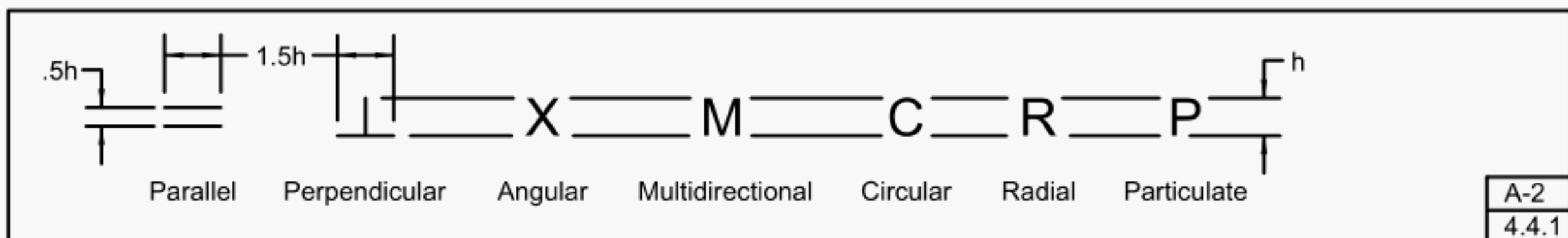
Figure A-1 Surface Texture Symbols and Construction



GENERAL NOTE: h = letter height.

NOTE: (1) This dimension is increased by 1.5 for each line of values beyond the two lines shown below the horizontal line.

Figure A-2 Lay Symbols



GENERAL NOTE: h = letter height.

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