



M4.1 SCOPE.

M4.1.1 Purpose. This SECTION establishes the method of converting an existing INCH drawing to a METRIC drawing by the use of dual dimensioning. Using dual dimensions on drawings is discouraged. However, when used or encountered, the methods, options and preferences are presented herein.

M4.2 APPLICABLE DOCUMENTS. Note: DoD Policy Memo 05-3 “Elimination of Waivers to Cite Military Specifications and Standards in Solicitation and Contracts” has eliminated the need for waivers to use MIL-SPECS and MIL-STDS on DoD contracts. (See PREFACE 1, Section 2)

SAE J390	Dual Dimensioning Engineering Drawings
ASME Y14.5M	Dimensioning and Tolerancing
IEEE/ASTM SI 10	Standard For Use of the International System of Units (SI); The Modern Metric System

M4.3 DEFINITIONS. Not Applicable

M4.4 MODIFY EXISTING DRAWING FORM. Preferred in the U.S.

M4.4.1 Drawing Modification To Identify Metric. The existing drawing form shall be modified to indicate dual-dimensioning.

M4.4.2 Line Out Reference To Dimensions In Inches. Line out existing note which states that all dimensions are in inches. See FIGURE M4-2.

M4.4.3 Line Out Reference To Tolerances In Inches. Line out existing tolerances, in tolerance block, as inch tolerances. See FIGURE M4-2.

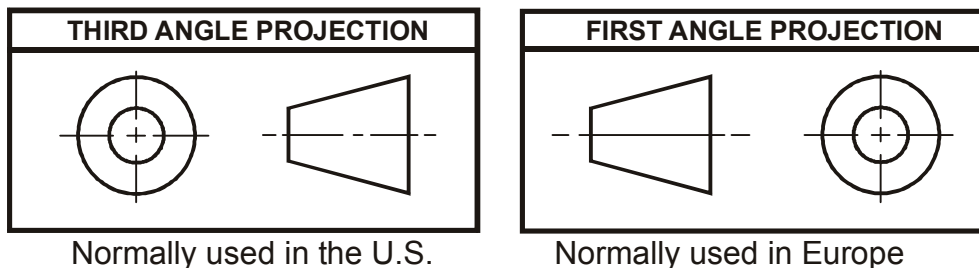
M4.4.4 Add a Metric Tolerance Block. Add a METRIC Tolerance Block to the drawing near the Title Block which shall specify the metric tolerance of all items mentioned in the original tolerance block; tolerances on decimal dimensions, including hole diameters, and etc as required. See FIGURE M4-2.

M4.4.5 Add Metric Notation To General Notes. Add the following note to the general drawing notes: See FIGURE M4-3.

e.g. X. DIMENSIONS AND VALUES IN BRACKETS ARE METRIC.

M4.5 IDENTIFY AS A METRIC DRAWING.

M4.5.1 Projection Symbol. Many foreign countries use first angle projection. Third angle projection is normal in the United States. Therefore, identify by showing the international projection symbol, and the word "THIRD ANGLE" near the title block. See FIGURE M4-1.



PROJECTION SYMBOL
FIGURE M4-1



"METRIC" PROMINENTLY DISPLAYED NEAR THE TITLE BLOCK. LETTERS TO BE EQUIVALENT IN SIZE TO DRAWING NUMBER.

ADD METRIC TOLERANCE IDENTIFICATION

LINE THROUGH INCH TOLERANCE IDENTIFICATION

THIRD ANGLE PROJECTION 		QTY. RECD.		CAGE CODE	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION	
METRIC		UNLESS OTHERWISE SPECIFIED, DIMENSIONS ARE IN INCHES.		CONTRACT NO.		DATE	
TOLERANCES—MILLIMETER		DIMENSIONS ARE IN INCHES		DRAWN		CHECK	
ON ALL HOLE DIAMETERS		TOLERANCES		DESIGN		DESIGN ACTIVITY	
UNDER 0.35	+0.050 -0.013	13.01 THRU 19.50	+0.20 -0.03	TREATMENT		SIMILAR TO	
0.35 THRU 3.00	+0.10 -0.02	19.51 THRU 26.00	+0.25 -0.03	FINISH		ACT. WT.	CALC. WT.
3.01 THRU 6.50	+0.12 -0.03	26.01 THRU 50.0	+0.30 -0.03	NO NOT SCALE DRAWING		CUSTOMER	
6.51 THRU 13.00	+0.15 -0.03	OVER 50.0	+0.40 -0.03	TREATMENT		CUSTOMER	
ON DECIMAL DIMENSIONS	.XX ± 0.25 .X ± 0.8 X < 3 ± 1 X > 3 ± 2.5	ON ANGULAR DIMENSIONS		USED ON		APPLICATION	
	MACHINED ±0°30' LOCATING ±0°30' FORMED ±2° CHAMFERS ±5°	NEXT	FINAL	QTY. REQD. PER ASSY.	NEXT ASSY.	APPLICATION	
		PART DASH NO.					

TITLE BLOCK MODIFICATION

TITLE BLOCK MODIFICATION
FIGURE M4-2



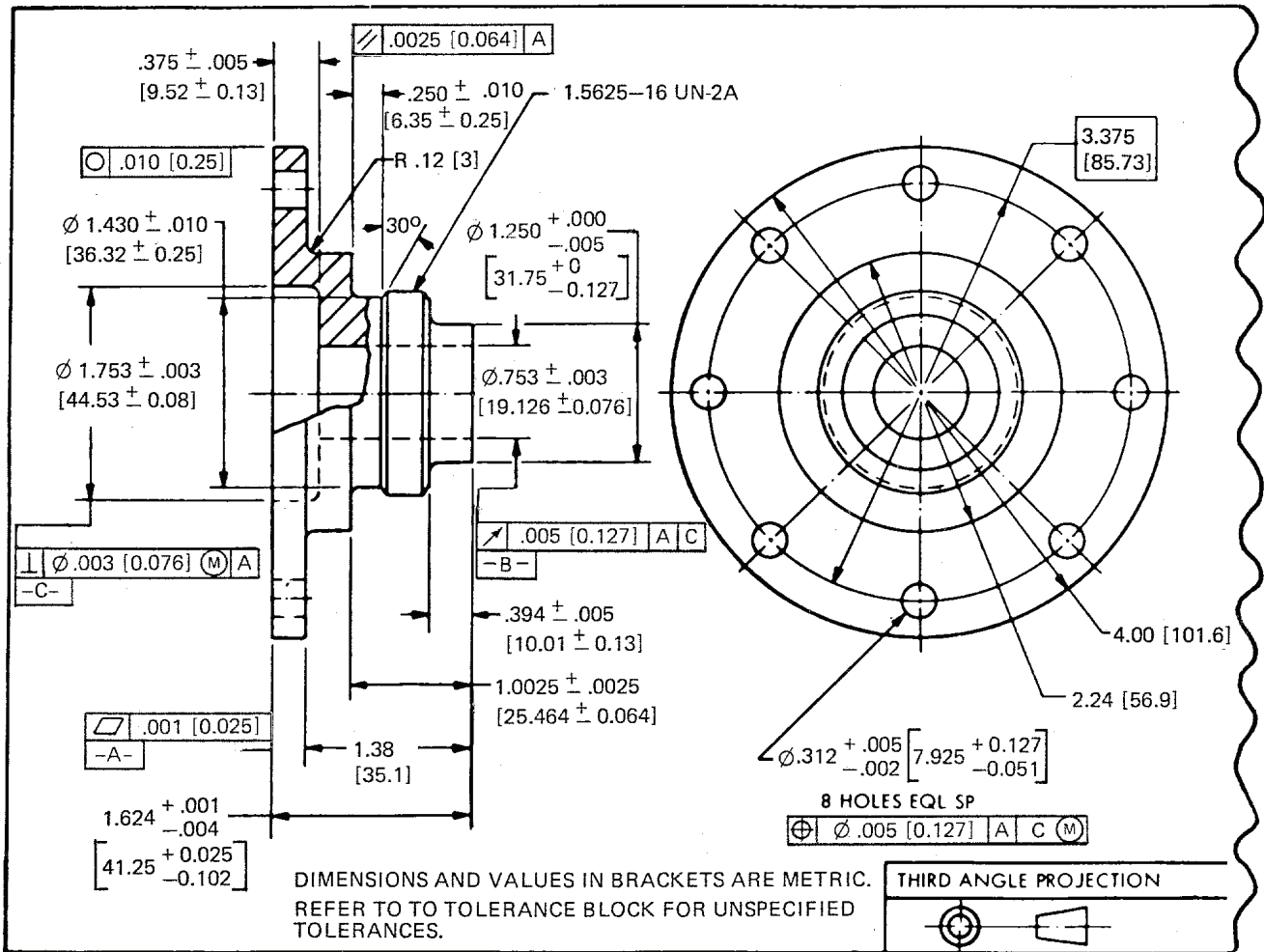
M4.6 EQUIVALENT DIMENSIONS.

NOTE: Inspection may be performed using either customary or metric measurements.

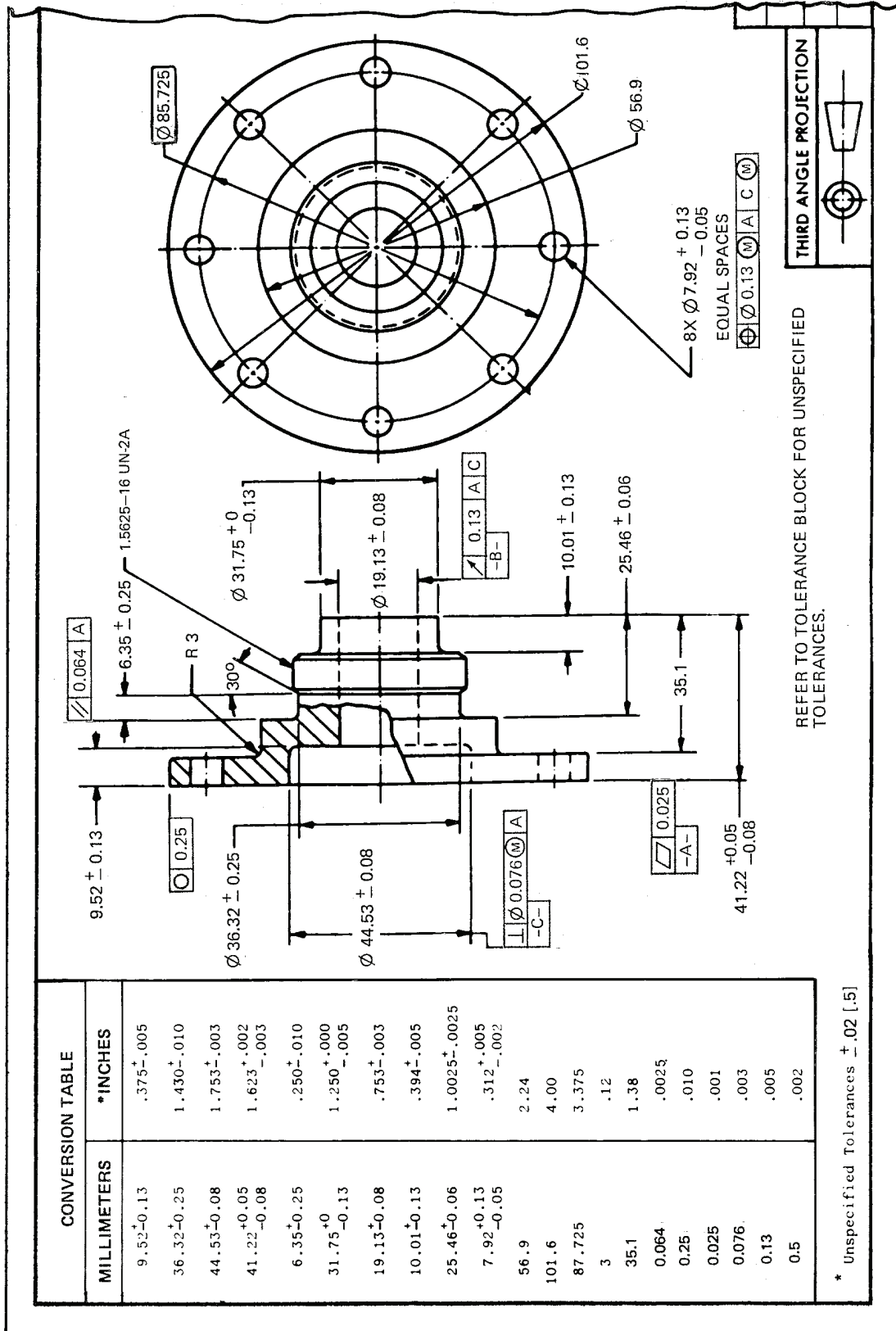
M4.6.1 Accuracy of Converted Metric Dimensions. Metric dimensions and values shall be equated as accurately as practical, while remaining within the specified tolerance limits of the inch drawing.

M4.6.2 Identification Of Metric Dimensions By Use Of Brackets. On the field of the drawing, metric dimensions may be shown in brackets [] below or to the right of the inch dimension, See FIGURE M4-3 or a conversion table whereby the dimensions on the drawings are in SI units – with the conversions to inch units provided in table form on the field of the drawing. See FIGURE M4-3a.

NOTE: Do not use parenthesis around metric dimensions. Parenthesis are reserved for reference dimensions.



METRIC DIMENSIONS SHOWN IN BRACKETS
FIGURE M4-3



INCH DIMENSIONS SHOWN IN A CONVERSION TABLE
FIGURE M4-3a



M4.6.3 Selection Of Direct Tolerancing Method. Plus and minus tolerances may be applied directly to the dimension or a limit dimension may be used. However, the method used in the metric conversion shall be the same as the method used in the inch drawing. (See FIGURE M4-4.)

M4.6.4. Method Selected To Remain Constant. Only one of the methods of identification of units shown in FIGURE M4-4 is permitted throughout a single drawing. The reciprocal of what is illustrated in FIGURE M4-4 is permissible.

M4.6.4.1 Dimension Line Used To Separate Dimensions. The dimension line may be used to separate the inch and the metric dimensions.

POSITION OF DIMENSIONS	DIMENSIONS SHOWN ON DRAWING

DIMENSION LINE USED TO SEPARATE INCH AND METRIC DIMENSIONS
FIGURE M4-4

M4.6.5 Alternate Methods Permissible for Dual Dimensioning as Specified in SAE J390.

M4.6.6 Preferred Choice Of Conversion Method To Metric Dimensions. The use of dual dimensions on drawings is discouraged except where the dimensions must interface with existing installation. If necessary, the use of the conversion table illustrated in FIGURE M4-3a is the preferred method. Once a method of inscribing dual dimensions is selected, it must be clearly described in a note on the drawing.

- a. Dimensions may be identified by relative position with the “inch” dimension above or to the left of the “millimeter” dimension. See FIGURE M4-3 (*Preferred*).
- b. Position method as in (a) except with “millimeter” dimension above or to the left of the “inch” dimension.



- c. Square brackets “[]” surrounding the “millimeter” dimensions, placed adjacent to the “inch” dimensions. (Positional Optional) See FIGURE M4-4. (*Position to the right preferred.*)
- d. Square brackets “[]” surrounding the “inch” dimensions, placed adjacent to the “millimeter” dimensions. (Positional Optional)

NOTE: SAE J390 does not take a “Preferred” position and therefore any of the alternate methods “a” thru “d” may be encountered from other design activities.

M4.7 UNITS OTHER THAN LINEAR DIMENSIONS.

M4.7.1 Angles. Angles presented in degrees, seconds and minutes, or in degrees and decimal parts of a degree, are common to inch and metric system of measurement.

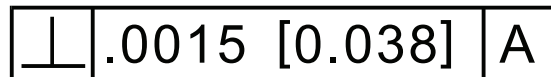
M4.7.2 Metric Conversion Shall Not Apply To Nominal Sizes. Nominal sizes such as screw threads, pipe sizes, wood cross section, and other estimated standard sizes shall **NOT** be converted to metric dimensions.

M4.7.3 Metric Conversion May Not Apply To Standard Parts. Military, industry, or company standard parts may be used without converting to metric units.

M4.7.4 Interface Dimensions. Interface dimensions for holes, cutouts, etc. are to be dual dimensioned except as described in the paragraph above.

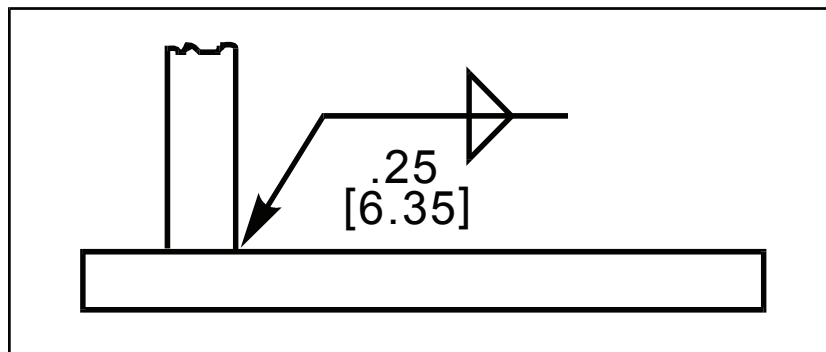
M4.7.5 Units Other Than Linear Dimensions. Units other than linear dimensions that appear on a drawing shall be converted to the appropriate SI unit. Example: Gallons per hour, to liters per hour.

M4.7.6 Using Geometric Dimension And Tolerances. Drawings that include geometric tolerances for form, orientation, position, etc. shall have the metric value added. See FIGURES 4M-3, 4M-3a and 4-M5.



FEATURE CONTROL FRAME
FIGURE M4-5

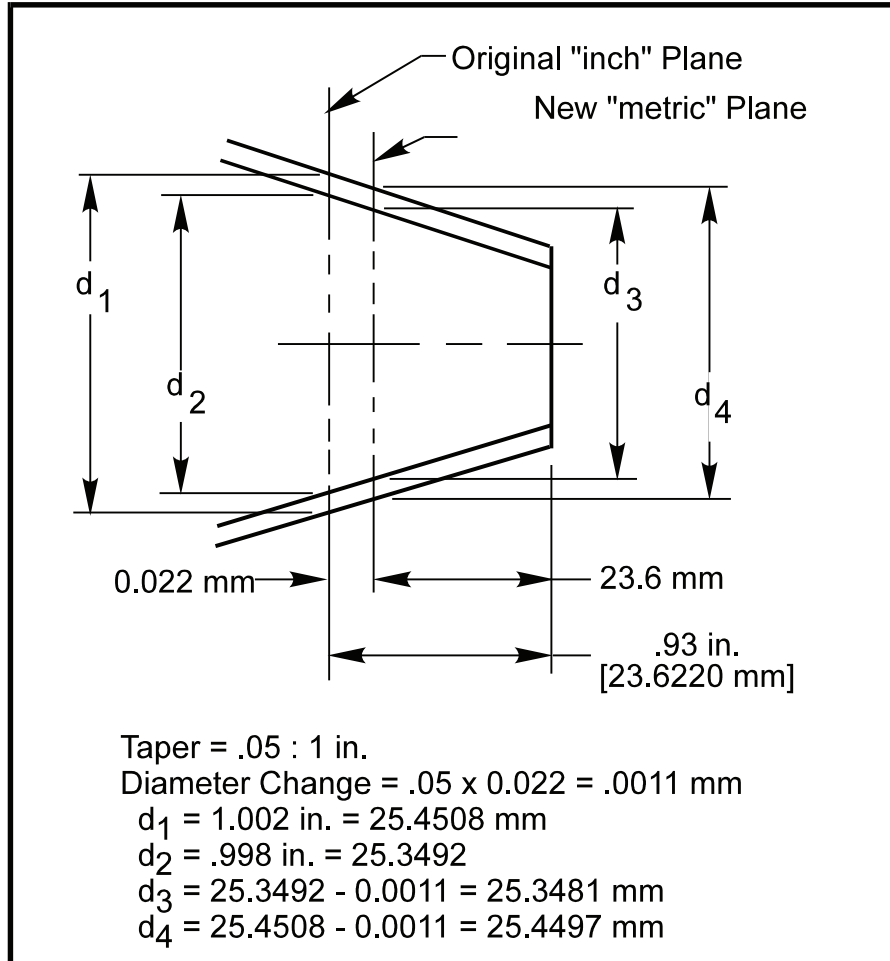
M4.7.7 Using Welding Symbols. Welding symbols containing numerical values shall have metric values added. The drawing shall clearly indicate the customary and the SI metric units. FIGURE M4-6.



METRIC VALUE ADDED TO WELDING SYMBOL
FIGURE M4-6



M4.7.8 Taper Callout Conversion. Taper callout may be converted from inch per inch of taper to millimeter per millimeter of taper, or may be expressed as a ratio, as .05:1. See FIGURE M4-7.



TAPER CALLOUT CONVERSION INCH TO METRIC
FIGURE M4-7

A cone of taper .05:1 has a diameter of 1.000±.002 inch in a reference plane located by the non-toleranced dimension .9300 inch. By virtue of the taper of the cone, the limits of the tolerance zone depend on the position of the reference plane. Consequently, if the dimension .9300 in. equals 23.6220 mm is rounded off to 23.600 mm (a reduction of 0.022 mm), each of the two original limits, when converted exactly into millimeters, must be corrected by 0.022 x .05 = 0.0011 mm before being rounded off. See FIGURE M4-7.



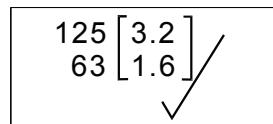
M4.7.9 Equivalent Metric Values For Surface Roughness Are Given In TABLE M4-1.

Roughness Value		Roughness Value	
Micro - inches	Micro - meters [μ m]	Micro - inches	Micro - meters [μ m]
* 1	0.025	50	1.25
* 2	0.050	* 63	1.6
* 4	0.100	80	2.0
5	0.125	90	2.2
6	0.15	100	2.5
* 8	0.20	* 125	3.2
10	0.25	* 250	6.3
13	0.32	320	8.0
* 16	0.40	400	10.0
20	0.50	* 500	12.5
25	0.63	800	20.0
* 32	0.80	* 1000	25.0
40	1.00	* 2000	50.0

* PREFERRED VALUES

STANDARD VALUES FOR ROUGHNESS HEIGHT RATINGS
TABLE M4-1

M4.7.9.1 Apply Metric Values For Surface Roughness To Drawing As Shown In FIGURE M4-8.



SURFACE ROUGHNESS
FIGURE M4-8

M4.7.10 Equivalent Metric Standard Values For Waviness Height Rating Are Given In TABLE M4-2.

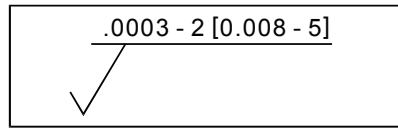
Inches	Millimeters	Inches	Millimeters
* .00002	0.0005	* .001	0.025
.00003	0.0008	* .002	0.05
* .00005	0.0012	.003	0.08
.00008	0.002	* .005	0.12
* .0001	0.0025	.008	0.20
* .0002	0.005	* .010	0.25
.0003	0.008	.015	0.38
* .0005	0.012	.020	0.50
.0008	0.020	* .030	0.80

* PREFERRED VALUES

WAVINESS HEIGHT RATING CONVERSION INCH TO METRIC
TABLE M4-2



M4.7.10.1 Apply Metric Values For Waviness Height Rating As Shown In FIGURE M4.9.



WAVINESS HEIGHT RATING SYMBOL
FIGURE M4-9

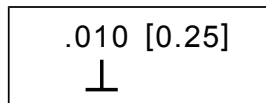
M4.7.11 Metric Values For Roughness Width Cutoff Are Given In TABLE M4-3.

INCHES	MILLIMETERS
.010	0.25
*.030	0.80
.100	2.5

* PREFERRED RATINGS

STANDARD VALUES FOR ROUGHNESS WIDTH CUTOFF
TABLE M4-3

M4.7.11.1 Apply Metric Values For Roughness Width Cutoff As Shown In FIGURE M4-10.



ROUGHNESS WIDTH CUTOFF SYMBOL
FIGURE M4-10



NOTES: