

φ DUAL DIMENSIONING—SAE J390 JUN82

SAE Standard

Report of the Drawing Standards Committee and Metric Advisory Committee, approved July 1970, first revision prepared by the Metric Advisory Committee June 1982. Formerly HS J390.

Many U.S. manufacturing companies have for years been involved with product or design communication with companies in other countries. This frequently involves conflict between inch and metric measurement and dimensioning. With the rapidly growing use of metric measurement throughout the world, the need for both metric and inch dimensions on a single drawing has led to growing use of dual dimensioning of engineering drawings.

In 1965 the SAE Drawing Standards Committee started a project to produce a standard for dual dimensioning practice. The project has been very lengthy, due to strongly divergent points of view. In this period of development, the world use of metric units and the U.S. situation regarding potential metric use has been constantly changing and a consensus has been very difficult to reach.

After a number of years and many drafts, the finalizing of a dual dimensioning standard was handled by the SAE Technical Board, with assistance from the Board's Metric Advisory Committee. The final standard temporarily recognizes several approaches to displaying and identifying the two different values for each dimension, although only one is shown as preferred. It is anticipated that as the situation of metric use in the United States becomes more clear, a single standard practice can be defined.

1. General

1.1 Introduction—This document establishes a uniform method of combining inch-pound units and metric units of measure on the same engineering drawing. In this document "metric units" means the International System of Units (abbreviated SI) as described in SAE J916. Herein is guidance for converting from one system to the other while maintaining functional interchangeability.

1.2 Scope—This document covers a dual dimensioning practice that provides both U.S. customary inch-pound units and SI metric units for all dimensions on the field of the drawing. The scope does not include the "chart method"—whereby drawings are dimensioned only in SI units—with conversions to inch-pound units provided in chart form (usually computer-generated) on the drawing. Further information on the chart method is found in SAE Handbook Supplement J1066, "Recommended Guidelines for Company Metrication Programs in the Metalworking Industry."

1.3 Purpose—The purpose of this document is to provide an authoritative guide for uniform application of dual dimensioning on engineering drawings. SAE recognizes that a decision regarding preparation of engineering drawings during metric transition is an individual judgement based on needs and circumstances. While providing this information, SAE takes no official position concerning dual dimensioning. Issuance of this publication should not be construed as advocacy.

2. Standard Units

2.1 Inch-Pound Units—The inch-pound unit for linear dimensions is the inch with decimal dimensioning preferred. (One inch equals 25.4 mm, exactly.)

2.2 Metric Units—The metric unit, on engineering drawings, for linear dimensions is the millimeter.

2.3 Identification of Units—The inch and millimeter dimensions must be identified, one from the other as follows:

2.3.1 ALTERNATIVE METHODS—It is permissible to use one of the following methods of identification:

(a) Dimensions may be identified by relative position with the millimeter

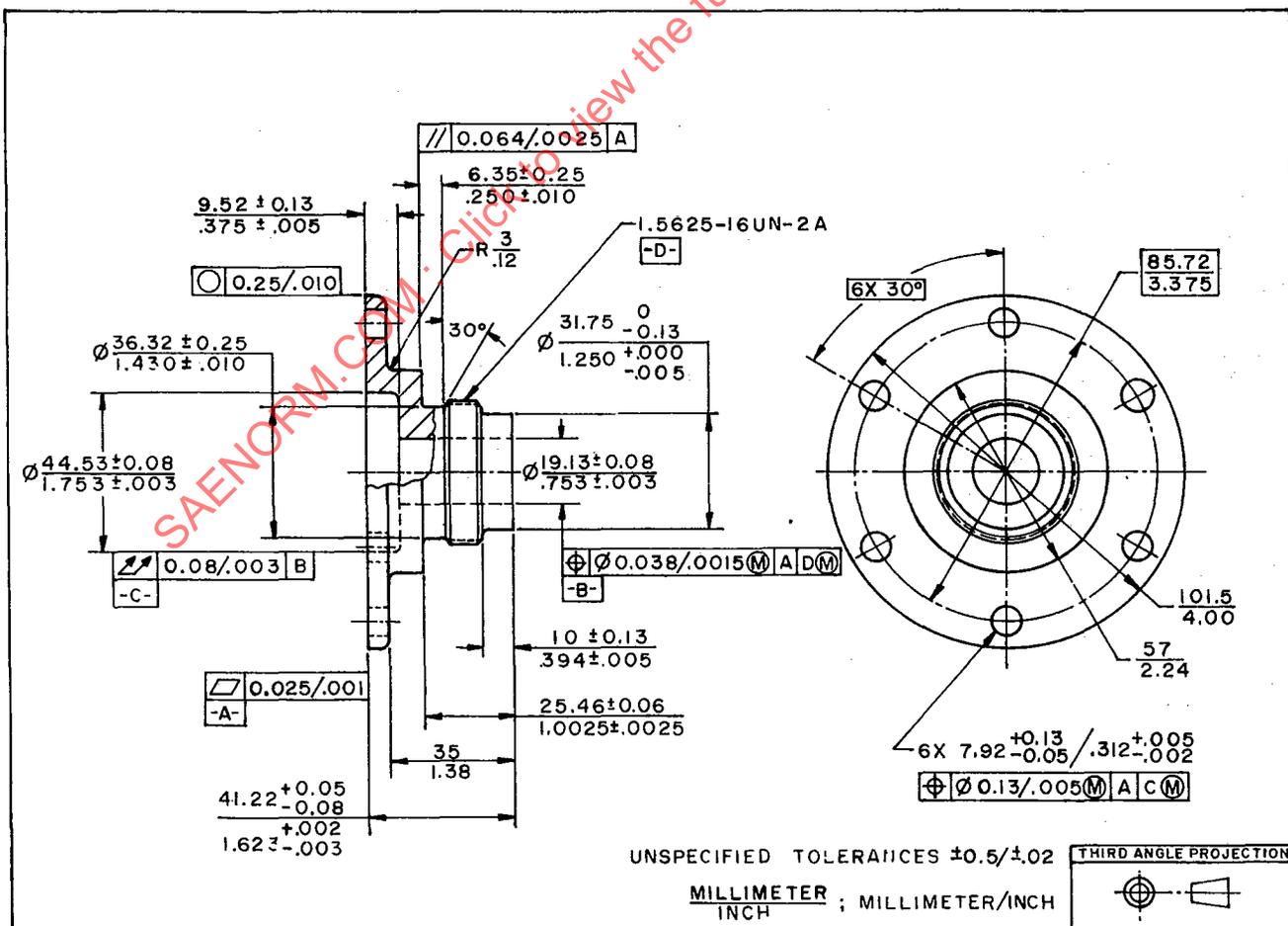
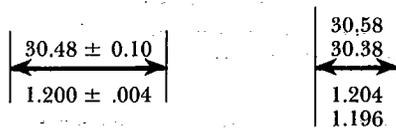


FIG. 1

dimension above or to the left of the inch dimensions.



$$30.48 \pm 0.10/1.200 \pm .004$$

(b) Position method as in (a) except with inch dimension above or to the left of the millimeter dimension.

(c) Square brackets [] surrounding the millimeter dimensions, placed adjacent to the inch dimensions (position optional).

(d) Square brackets [] surrounding the inch dimensions, placed adjacent to the millimeter dimensions (position optional).

2.3.2 Only one of the above methods of identification of units shall be used throughout a single drawing. Each drawing shall illustrate how to identify the inch and millimeter dimensions, by a note adjacent to or within the title block, such as:

MILLIMETER; MILLIMETER/INCH,
INCH

INCH ; INCH [MILLIMETER], etc.
[MILLIMETER]

or by reference to a drawing interpretation specification.

2.3.3 In converting existing drawings to dual-dimensioning, space limitations may sometimes make it impractical to locate dimensions as required for identification by position. In these cases it is permissible to show the converted dimension in a nearby associated location identified with the symbol mm or IN.

2.3.4 Units other than linear and all units used for other than normal drawing dimensions (e.g. notes or text) shall be identified with the appropriate symbol.

Examples: 13.6 N·m/10 LBF FT

OVERHANG LIMITED TO 12.7 mm/.50 IN

2.4 **Common Units**—Some units can be stated so that the call out will satisfy the units of both systems. That is, .06 inch per inch or 0.06 millimeter per millimeter can both be expressed simply as a ratio, 0.06:1, or in a note, such as TAPER 0.06:1.

2.5 **Angles**—Angular dimensions need no conversion. Angles stated in degrees and decimals of a degree, or in degrees, minutes, and seconds are common to the inch-pound and metric systems of measurement.

2.6 **Nominal Designations**—Nominal designations such as thread sizes and tire sizes will not be converted.

3. Principles

3.1 Millimeter Dimensioning Practices

3.1.1 A zero precedes a decimal point in a millimeter value of less than one:

Example: 0.13

3.1.2 Where unilateral tolerancing is used and either the plus or minus value is nil, this value shall be expressed by a single zero only.

Example:

$32 \begin{matrix} 0 \\ -0.02 \end{matrix}; 32 \begin{matrix} +0.02 \\ 0 \end{matrix}$

3.1.3 Nonsignificant zeros are not shown after the decimal point, in the composition of a millimeter value, except as follows:

(a) Where limit dimensioning is used and either the maximum or minimum dimension has digits following the decimal point, the other value shall have zeros added for uniformity.

Example: 25.00 not 25
 25.45 not 25.45

(b) Where bilateral tolerancing is used, both the plus and minus values shall have the same number of decimal places, using zeros where necessary.

Example: $32 \begin{matrix} +0.25 \\ -0.10 \end{matrix}$ not $32 \begin{matrix} +0.25 \\ -0.1 \end{matrix}$

3.1.4 The symbol ϕ and the abbreviation DIA are synonymous, defining a feature as diametral. Either may be used on a dual dimension drawing; however, both shall not be used on the same drawing. The application of

either the symbol ϕ or DIA is self explanatory. The symbol ϕ may either precede or follow the dimension.

Example: $\phi \frac{25.4}{1.00}$ or $\frac{25.4}{1.00} \phi$

3.1.5 The decimal sign for metric values shall be the same as that used for the inch decimal dimension, a dot (·).

3.1.6 Commas and spaces shall not be used to denote thousands in either inch or metric values.

Example: 32541 not 32,541 nor 32 541

4. Application

4.1 **New Drawings**—Dual dimensioning of new drawings is facilitated if all dimensions are shown in decimals.

4.2 **General Tolerances**—General tolerances usually expressed on a drawing as part of the format or as a general note shall be dual dimensioned.

4.3 **Symbols**—Geometric characteristic symbols for form and position and the related tolerancing procedure are recommended to be used on dual dimensioned drawings. See ANS I Y14.5.

4.3.1 Dual dimensioned drawings shall specify, by the ISO symbol as shown in Fig. 1, the angle of projection used. Although first angle projection is commonly used in countries where the metric measurement system is standard, it is recommended that third angle projection be used on dual dimensioned drawings that follow this document.

5. **Interchangeability**—Interchangeability of parts, functionally, physically, or both, is dependent upon the degree of round off accuracy used in converting an inch value to a metric value or a metric value to an inch value with the resultant placed on a drawing. For conversion principles, see ASTM E 380, Metric Practice Guide and SAE J916, Rules for SAE Use of SI (Metric) Units. Where considered necessary, dual dimensioned drawings, should identify the referee dimensional units to assure acceptability of product and repeatability of inspection practices.

6. **Drawing Application**—With the addition of a title block and applicable notes, Fig. 1 illustrates a typical dual dimensioned drawing.

APPENDIX A—TABLES AND CHARTS

CONVERSION FROM DECIMAL INCHES TO MILLIMETERS

in	mm	in	mm	in	mm
1	25.4	36	914.4	71	1803.4
2	50.8	37	939.8	72	1828.8
3	76.2	38	965.2	73	1854.2
4	101.6	39	990.6	74	1879.6
5	127.0	40	1016.0	75	1905.0
6	152.4	41	1041.4	76	1930.4
7	177.8	42	1066.8	77	1955.8
8	203.2	43	1092.2	78	1981.2
9	228.6	44	1117.6	79	2006.6
10	254.0	45	1143.0	80	2032.0
11	279.4	46	1168.4	81	2057.4
12	304.8	47	1193.8	82	2082.8
13	330.2	48	1219.2	83	2108.2
14	355.6	49	1244.6	84	2133.6
15	381.0	50	1270.0	85	2159.0
16	406.4	51	1295.4	86	2184.4
17	431.8	52	1320.8	87	2209.8
18	457.2	53	1346.2	88	2235.2
19	482.6	54	1371.6	89	2260.6
20	508.0	55	1397.0	90	2286.0
21	533.4	56	1422.4	91	2311.4
22	558.8	57	1447.8	92	2336.8
23	584.2	58	1473.2	93	2362.2
24	609.6	59	1498.6	94	2387.6
25	635.0	60	1524.0	95	2413.0
26	660.4	61	1549.4	96	2438.4
27	685.8	62	1574.8	97	2463.8
28	711.2	63	1600.2	98	2489.2
29	736.6	64	1625.6	99	2514.6
30	762.0	65	1651.0	100	2540.0
31	787.4	66	1676.4		
32	812.8	67	1701.8		
33	838.2	68	1727.2		
34	863.6	69	1752.6		
35	889.0	70	1778.0		

NOTE: All values in this table are exact.

FIG. A1