

NOT MEASUREMENT
SENSITIVE

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MILITARY STANDARD

METRIC SYSTEM
APPLICATION IN NEW DESIGN



AMSC N/A
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FOREWORD

1. This military standard is approved for use by all Departments and Agencies of the Department of Defense.

2. Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document should be addressed to: Commander, U.S. Army Missile Command, ATTN: AMSMI-RD-SE-TD-ST, Redstone Arsenal, AL 35898-5276 by using the Standardization Document Improvement Proposal (DD Form 1426) appearing at the end of this document or by letter.

3. This standard is intended to be referenced only in those contracts for which a decision has been made to design an item, equipment, or system in metric units.

4. Care must be exercised in specifying metric components because if they are specified prior to industrial production to adopted national metric standards, it could result in: (a) nonstandard metric configurations, (b) unnecessary items in the supply system, and (c) extra costs because DoD contracts might absorb initial conversion costs of the producing industries.

5. It is usually more practical to design and produce a "new" item, equipment, or system in metric than to convert existing designs or production hardware. This standard requires: (a) that new designs for the end items under contract be designed and expressed in metric units, and (b) that existing metric designed components (parts and assemblies) be selected providing they are technically adequate and available at an equal or lower life-cycle cost.

6. During an extended period of changeover to the use of the metric system on a national basis, commercial and other already-designed components will be available in a mix of straight inch-pound, hybrid, and metric designs.

7. Tailoring of the use of this standard to meet the requirements of specific contract is encouraged.

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1. SCOPE

1.1 Scope. This standard covers the detailed requirements for employing the metric system of measurement in new design and in accompanying documentation.

1.2 Purpose. The purpose of this standard is to describe how the metric system will apply to new design or existing subsystems/equipments, during design of new systems (ships, aircraft, missiles, etc.), in the selection of materials and components, and for configuration and functional description in accompanying documents.

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2. APPLICABLE DOCUMENTS

2.1 Government documents.

2.1.1 Specifications, standards, and handbooks. The following specifications, standards, and handbooks form a part of this document to the extent specified herein. Unless otherwise specified, the issues of these documents are those listed in the issue of the Department of Defense Index of Specifications and Standards (DODISS) and supplement thereto, cited in the solicitation (see 6.2).

STANDARDS

FEDERAL

FED-STD-376 - Preferred Metric Units for General Use by the Federal Government

MILITARY

MIL-STD-970 - Standards and Specifications, Order of Preference for the Selection of

(Unless otherwise indicated, copies of the federal and military specifications, standards, and handbooks are available from the Standardization Documents Order Desk, Bldg. 4D, 700 Robbins Ave., Philadelphia, PA 19111-5094.)

2.2 Non-Government publications. The following documents form a part of this document to the extent specified herein. Unless otherwise specified, the issues of the documents which are DoD adopted are those listed in the issue of the DODISS cited in the solicitation. Unless otherwise specified, the issues of documents not listed in the DODISS are the issues of the documents cited in the solicitation (see 6.2).

AMERICAN SOCIETY OF MECHANICAL ENGINEERS

ANSI/ASME Y14.5M - Dimensioning and Tolerancing

(Application for copies should be addressed to the American Society of Mechanical Engineers, 345 East 47th Street, New York, NY 10017.)

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INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS, INC.

ANSI/IEEE 268 - American National Standard for
Metric Practice

(Application for copies should be addressed to the Institute of Electrical and Electronics Engineers, Inc., 445 Hoes Lane, P.O. Box 1331, Piscataway, NJ 08855-1331.)

(Non-Government standards and other publications are normally available from the organizations that prepare or distribute the documents. These documents also may be available in or through libraries or other informational services.)

2.3 Order of precedence. In the event of a conflict between the text of this document and the references cited herein, the text of this document takes precedence. Nothing in this document, however, supersedes applicable laws and regulations unless a specific exemption has been obtained.

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3. DEFINITIONS

3.1 Dual dimensions. A former practice which included linear dimensions in views of a drawing in both metric and inch-pound units.

3.2 Dual indication. The inclusion, in text or on instrumentation and gaging, of a quantity (characteristic or dimension) in both metric and inch-pound units (for example: 700 kPa (100 lbf/in²)).

3.3 Hard conversion. The process of changing inch-pound measurement units to non-equivalent metric units which necessitates physical conversion changes outside those permitted by established measurement tolerances. NOTE: Although the term "hard conversion" is in general use, it is technically incorrect when applied to specific items because no "conversion" takes place. Instead, a new metric item requiring new item identification is created to replace the customary item. The new item is often referred to as being in "hard metric".

3.4 Hybrid. A combination or mixture of metric and inch-pound items.

3.5 Inch-pound units. Units based upon the inch and the pound, commonly used in the United States, and defined by the National Bureau of Standards (now the National Institute of Standards and Technology). In this standard, the term inch-pound unit includes other customary units, such as the degree Fahrenheit, Btu, horsepower, etc., that are used extensively in the United States at present.

3.6 Metric design. Product design using metric dimensions, selected as appropriate, without considering conceptual or physical conversion from inch-pound units.

3.7 Metric system, metric units.

3.7.1 SI units. Units belonging to the International System of Units, which is abbreviated SI (from the French Le Systeme International d'Unites), as interpreted or modified for use in the United States by the Secretary of Commerce (55 FR 52242, December 20, 1990). The SI is the modernized form of the metric system.

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3.7.2 Preferred metric units. Preferred metric units for use throughout the Department of Defense are:

- a. The SI units, together with their multiples and sub-multiples;
- b. Three other metric units -- the liter, hectare, and metric ton -- that are accepted for use with the SI units because of their practical importance; and
- c. A small number of other metric units, listed in FED-STD-376, that are accepted because of their use in specialized fields.

3.8 Soft conversion. The process of changing inch-pound measurement units to equivalent metric units within the acceptable measurement tolerances without changing the physical configuration. In other words, it is the same both before and after conversion.

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4. GENERAL REQUIREMENTS

This section is not applicable to this standard.

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5. DETAILED REQUIREMENTS

5.1 Metric units. Metric units, practices, and usages shall be in accordance with FED-STD-376 and ANSI/IEEE 268.

5.1.1 Preferred units. Unless otherwise specified, the preferred metric units for the commonly-used quantities shall be in accordance with FED-STD-376.

5.2 New design. New items designed under contract shall be of metric design. Hybrid design, however, is acceptable where required to accommodate existing customary items selected in accordance with 5.3. Any U.S. Government or non-Government standard adopted by DOD which establishes preferred metric modular sizes or other design standards shall be used to the maximum practical extent.

5.3 Existing items. Existing items shall be selected for use in accordance with the following guidelines, giving due consideration to interchangeability.

5.3.1 Material sizes. Metric sizes (e.g., sheet, plate, bar, rod, wire, etc.) shall be used when no cost or performance penalty will be incurred, or when additional first cost is justified by other considerations.

5.3.2 Components. Components shall be selected as follows:

a. Items designated as metric items in documents identified in Groups I, II, and III of MIL-STD-970.

b. All other items on the basis of lowest life cycle cost, whether metric or inch-pound.

5.3.3 Instrumentation. Unless otherwise specified or required by international agreement, instrumentation and gaging (temperature, pressure, etc.) shall show the indications in metric units. The actual construction of the instrument or gage may be either metric or inch-pound in accordance with 5.3.2.

5.4 Modification of existing inch-pound designs. Unless otherwise specified, the extent to which metric design is required in the modification of existing inch-pound designs shall be determined on an individual case basis, considering technical and economical feasibility or other factors.

5.5 Technical documentation. Technical documentation shall comply with the following:

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5.5.1 Engineering drawings.

a. New design. Values shall be expressed in metric units.

b. Existing design (including control drawings). Values shall be expressed in the unit system in which the item or items were designed.

c. Modified design. On new drawings prepared to describe existing inch-pound designs as modified, values describing the modified portion shall be expressed in the measurement units used in designing the modified portion. When metric conversion of any part of the design is required, applicable values shall be expressed in metric units.

d. Dual dimensioning. Dual dimensioning shall not be used, except that if dual dimensioned drawings exist prior to the issue of this standard that are otherwise acceptable they may be used.

e. Dimensioning and tolerancing. Dimensioning and tolerancing shall be in accordance with ANSI/ASME Y14.5M.

5.5.2 Specifications. Specifications prepared shall use the terminology of the unit system in which the item is to be designed.

5.5.3 Other technical data. Technical manuals, test reports, and other technical data shall use the terminology of the unit system in which the item is designed.

5.5.4 Interface devices. Interface features of devices that interface between inch-pound and metric items shall be specified in the system applicable to the item with which it mates. Non-interface features shall be specified in the system applicable to the overall design of the interface device.

5.5.5 Inch-pound and metric equivalents. Unless otherwise specified, the use of both inch-pound and metric equivalents is optional, except as required by 5.5.2, 5.5.3, and 5.5.4. When equivalents are included, they shall be specified as follows:

a. Dual indication (see 3.2). The metric value shall be stated first followed by the inch-pound value in brackets. Dual indications shall be permissible on scales or gages of indicators or measuring systems.

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b. Tabular form. Unless otherwise specified, table(s) may be included directly on the drawing or document. It shall translate all required values from one system of units to the other in ascending or descending order.

5.5.6 Metric identifier. A metric identifier, that is the word "METRIC", preferably enclosed in a rectangle, shall be placed on the field of the drawing near the title block on the first sheet. On other technical data, it shall be located in the vicinity of the document number. Lettering size shall be approximately the same as the drawing or document number.

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6. NOTES

(This section contains information of a general or explanatory nature that may be helpful, but is not mandatory.)

6.1 Intended use. This standard is intended to be referenced as a guide for applying metric measurements in new design and accompanying documentation.

6.2 Issue of DODISS. When this standard is used in acquisition, the applicable issue of the DODISS must be cited in the solicitation (see 2.1.1 and 2.2).

6.3 Subject term (keyword) listing.

Hybrid
International Bureau of Weights and Measures
Le Systeme International d'Unites
Metrication

6.4 Changes from previous issue. Marginal notations are not used in this revision to identify changes with respect to the previous issue due to the extensiveness of the changes.

Custodians:

Army - MI
Navy - SH
Air Force - 11

Preparing activity:

Army - MI
(Project MISC-0159)

Review activity:

Army - AV
Air Force: 12, 13, 15, 17, 19, 30,
45, 68, 69, 70, 71, 80,
82, 84, 85, 99

DLA - GS

User activity:

Navy - YD
Air Force - 90

STANDARDIZATION DOCUMENT IMPROVEMENT PROPOSAL

INSTRUCTIONS

The preparing activity must complete blocks 1, 2, 3, and 8. In block 1, both the document number and revision letter should be given.

2. The submitter of this form must complete blocks 4, 5, 6, and 7.

3. The preparing activity must provide a reply within 30 days from receipt of the form.

NOTE: This form may not be used to request copies of documents, nor to request waivers, or clarification of requirements on current contracts. Comments submitted on this form do not constitute or imply authorization to waive any portion of the referenced document(s) or to amend contractual requirements.

I RECOMMEND A CHANGE:

1. DOCUMENT NUMBER

MIL-STD-1476C

2. DOCUMENT DATE (YYMMDD)

930907

3. DOCUMENT TITLE

METRIC SYSTEM APPLICATION IN NEW DESIGN

4. NATURE OF CHANGE (Identify paragraph number and include proposed rewrite, if possible. Attach extra sheets as needed.)

5. REASON FOR RECOMMENDATION

6. SUBMITTER

a. NAME (Last, First, Middle Initial)

b. ORGANIZATION

c. ADDRESS (Include Zip Code)

d. TELEPHONE (Include Area Code)

7. DATE SUBMITTED (YYMMDD)

(1) Commercial

(2) AUTOVON
(If applicable)

8. PREPARING ACTIVITY

a. NAME

COMMANDER

U.S. ARMY MISSILE COMMAND

b. TELEPHONE (Include Area Code)

(1) Commercial

(2) AUTOVON

(205) 876-6980

746-6980

c. ADDRESS (Include Zip Code)

ATTN: AMSMI-RD-SE-TD-ST

REDSTONE ARSENAL, AL 35898-5270

IF YOU DO NOT RECEIVE A REPLY WITHIN 45 DAYS, CONTACT:

Defense Quality and Standardization Office

5203 Leesburg Pike, Suite 1403, Falls Church, VA 22041-3466

Telephone (703) 756-2340 AUTOVON 289-2340