# 1957 HANDBOOK OF SCREW-THREAD STANDARDS FOR FEDERAL SERVICES

As Approved 1957

## SECTION I. INTRODUCTION

### 1. PURPOSE OF FEDERAL STANDARDS FOR THREADED PRODUCTS

The purpose of this Handbook is to present complete dimensional data upon which specifications may be based for threaded products for Government requirements. So far as practicable, these data are intended to conform to generally accepted commercial practice, although certain special requirements of the Government necessitate the inclusion of some standards not generally applicable outside of the Government services. References are cited throughout the text to the standards promulgated by the American Standards Association, and to such other published standards as are in agreement with the specifications herein.

There are included in the body of the Handbook specifications for threaded products and gages, embodying sufficient information to permit the writing of definite and complete specifications for the purchase of screw-thread products. In the appendixes there is arranged supplementary information of both a general and a technical nature, including such specifications as are not intended to be mandatory.

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## SECTION II. NOMENCLATURE, DEFINITIONS, AND LETTER SYMBOLS

### 1. INTRODUCTORY

The purposes of this section [1] are to establish uniform practices with regard to: (1) Screw-thread nomenclature, and (2) letter symbols for designating dimensions of screw threads for use on drawings, in tables of dimensions which set forth dimensional standards, and in other records, and for expressing mathematical relationships.

[1] This standard is in general agreement with American Standard ASA B1.7, "Nomenclature, Definitions, and Letter Symbols for Screw Threads," published by The American Society of Mechanical Engineers, 29 West 39th St., New York 18, N. Y. The latest revision should be consulted when referring to such standards.

TABLE II.3.—*Identification designations* [1] [2]

| Designation | Thread series | References | |
|---|---|---|---|
| | | ASA Standards | Handbook H28 (1957), section No. |
| Acme-C | Acme threads, centralizing | B1.5 | XII. |
| Acme-G | Acme threads, general purpose | B1.5 | XII. |
| Stub Acme | Stub Acme thread | B1.8 | XIII. |
| AMO | American Standard microscope objective thread | B1.9 | XIV. |
| N. Butt | National Buttress thread | B1.1 | Appendix 1. |
| NC | American National coarse thread series | B1.1 | Appendix 1. |
| NF | American National fine thread series | B1.1 | Appendix 1. |
| NEF | American National extra-fine thread series | B1.1 | Appendix 1. |
| 8N | American National 8-thread series | B1.1 | Appendix 1. |
| 12N | American National 12-thread series | B1.1 | Appendix 1. |
| 16N | American National 16-thread series | B26, B33.1 | X. |
| NH | American National hose coupling and fire hose coupling threads | B57.1 | IX. |
| NGO | American National gas outlet thread | B1.4 | V. |
| NM | National Miniature thread series | B1.1 | Appendix 2. |
| NS | Special threads of American National form | B1.1 | III. |
| NC | American Standard coarse thread series | B1.1 | III. |
| NF | American Standard fine thread series | B2.1 | VII. |
| NPT | American Standard taper pipe thread | B2.2 | VIII. |
| NPTF | American Standard taper pipe thread (dryseal) | B2.1 | VII. |
| NPTR | American Standard taper pipe thread for railing fittings | B2.1 | VII. |
| NPS | American Standard straight pipe thread | B2.1 | VII. |
| NPSC | American Standard straight pipe thread in couplings | B2.2 | VIII. |
| NPSF | American Standard internal straight pipe thread (dryseal) | B2.2 | VIII. |
| NPSI | American Standard intermediate internal straight pipe thread (dryseal) | B2.1 | VII. |
| NPSM | American Standard straight pipe thread for mechanical joints | B2.1 | VII. |
| NPSL | American Standard straight pipe thread for locknuts and locknut pipe threads | B2.1, B33.1 | X. |
| NPSH | American Standard straight pipe thread for hose couplings and nipples | [3] | [3]. |
| ANPT | Aeronautical taper pipe thread | Under development | |
| RMS | American Standard surveying instrument mounting thread | B1.1 | III. |
| UNC | Unified coarse thread series | B1.1 | III. |
| UNEF | Unified selected diameter-pitch combinations of the extra-fine thread series | B1.1 | III. |
| UNF | Unified fine thread series | B1.1 | III. |
| UN | Unified selected diameter-pitch combinations of the 8-, 12-, and 16-thread series | B1.1 | IV. |
| UNS | Unified threads of selected special diameters, pitches, and lengths of engagement | | |

[1] Methods of designating multiple threads are shown in ASA B1.5 Acme Screw Threads, and Part III of Handbook H28 (1957).
[2] All threads, except NGO, are right hand, unless otherwise designated. For NGO threads, designations "RH" or "LH" are required.
[3] Military Specification MIL-P-7105, Pipe Threads, Taper, Aeronautical National Form.

## SECTION III. UNIFIED THREAD FORM AND THREAD SERIES FOR BOLTS, MACHINE SCREWS, NUTS, TAPPED HOLES, AND GENERAL APPLICATIONS

### 1. INTRODUCTION

The Unified thread standards,[2] which have been agreed upon by standards bodies of Canada, the United Kingdom, and the United States, constitute the basic American standards for fastening screw threads. They are a complete and integrated system of threads for fastening purposes in mechanisms and structures. Their outstanding characteristic is general interchangeability of threads achieved through the standardization of thread form, diameter-pitch combinations, and limits of size.

The standards have as their original basis the work done about a century ago by William Sellers in the United States and Sir Joseph Whitworth in Great Britain. Throughout the intervening years there have been many further developments and revisions, culminating in the system of Unified Threads approved and adopted for use by all inch-using countries.

Unification of screw thread standards received its impetus from the need for interchangeability among the billions of fasteners used in the complex equipment of modern warfare which was, and continues to be made in different countries. Equally important, however, are international trade in mechanisms of all kinds and the servicing of transportation equipment which moves from country to country. These have made unification not only highly advantageous but practically essential. In sizes ¼ in. and larger, complete unification of certain thread series and six tolerance classes was signalized by the signing of an accord on November 18, 1948. Since that time a limited unification of seven sizes only for attachment purposes has been extended into smaller sizes. Although thread sizes less than ¼ in. have not been unified, the tolerances and allowances based on Unified formulation are applied to these sizes in the United States and Canada, and they are known as American Standard threads.

In relation to previous American practice, as covered by appendixes 1 and 2 of this Handbook, Unified threads have substantially the same thread form and are mechanically interchangeable with American National threads of the same diameter and pitch.

The principal differences between the two systems relate to the application of allowances, the variation of tolerances with size, difference in amount of pitch diameter tolerance on external and internal threads, and differences in thread designations. Under the Unified system an allow-

[2] The Unified thread standards presented in this section are in general agreement with ASA B1.1, "Unified and American Screw Threads," published by the ASME, 29 West 39th Street, New York 18, N. Y.; also with CSA B1.1, "Standard for Unified and American Screw Threads," published by the Canadian Standards Association, Ottawa, Canada; and with British Standard 1580, "Unified Screw Threads," published by the British Standards Institution, 2 Park Street, London, W. 1. The latest revision should be consulted when referring to such standards.

ance is provided on both the classes 1A and 2A external threads, whereas under the American National system only the class 1 external thread has an allowance. Under the Unified system, the pitch diameter tolerance of an internal thread is 30 percent greater than that of the external thread, but such tolerances are equal under the American National system. Unified tolerances and allowances for both standard and special diameter-pitch combinations are derived from the same formula, but American National tolerances for special threads have a different basis from that for some standard threads.

## 2. THE UNIFIED FORM OF THREAD

1. ANGLE OF THREAD.—The basic angle of thread between the flanks of the thread, measured in an axial plane, is 60°. The line bisecting this 60° angle is perpendicular to the axis of the screw thread.

2. FORM OF CREST.—The form of the crest of external threads is flat. The crest of the basic thread form of the external thread shall be truncated from the sharp crest an amount equal to $H/8$, where $H$ is the depth of the fundamental triangle. The form of the crest of internal threads is flat and the crest shall be truncated from the sharp crest an amount equal to $H/4$.

3. FORM OF ROOT.—The crest clearances allowed are such as to permit rounded root forms in both the external and internal threads. Rounded roots are required in some applications and are made by tools that are purposely rounded. Otherwise, rounded roots may be the result of tool wear.

4. CLEARANCE AT MINOR DIAMETER.—A clearance is provided at the minor diameter of the internal thread by truncating from the sharp crest an amount equal to $H/4$.

5. CLEARANCE AT MAJOR DIAMETER.—A clearance is provided at the major diameter of the internal thread by making the thread form at the root such that its width is less than $p/8$.

6. ILLUSTRATIONS.—Figure III .1 shows the design forms (maximum material condition) of the external and internal threads of the Unified form of thread.

7. BASIC THREAD DATA.—The basic thread data for all standard pitches of the Unified form of thread are given in table III.1.

TABLE III.1.—*Thread data, Unified thread form (see fig. III.2)*

| Threads per inch, | Pitch, | Flat at internal thread crest, | Flat at internal thread root and external thread crest, | Height of sharp v-thread, | Truncation of internal thread root and external thread crest, | Truncation of external thread root, | Half addendum of external thread, | Truncation of internal thread crest, | Addendum of external thread, | Height of internal thread and depth of thread engagement, | Height of external thread, | Twice the external thread addendum*, | Difference between max. major and pitch diameters of internal thread, | Double height of internal thread, | Double height of external thread, |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | $F_{cn}=$ | $F_{cx}=$ | $H=$ | $f_{cn}=$ $f_{cx}=$ | $s_{rx}=$ | $\frac{3}{16}H=$ | $f_{cn}=$ | $h_{ax}=$ | $h_n=$ $h_x=$ | $h_x=$ | $h_3=$ $2h_{ax}=$ | | $2h_n=$ | |
| $n$ | $p$ | $p/4=$ 0.25$p$ | $p/8=$ 0.125$p$ | 0.866025$p$ | $H/8=$ 0.10825$p$ | $H/6=$ 0.14434$p$ | 0.16238$p$ | $H/4=$ 0.21651$p$ | $\frac{3}{8}H=$ 0.32476$p$ | $\frac{5}{8}H=$ 0.54127$p$ | $\frac{17}{24}H=$ 0.61343$p$ | $\frac{3}{4}H=$ 0.649519$p$ | $\frac{13}{12}H=$ 0.79386$p$ | $1\frac{1}{4}H=$ 1.08253$p$ | $1\frac{5}{12}H=$ 1.22687$p$ |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 |
| | *in.* | *in.* | *in.* | *in.* | *in.* | *in.* | *in.* | *in.* | *in.* | *in.* | *in.* | *in.* | *in.* | *in.* | *in.* |
| 80 | 0.012500 | 0.00312 | 0.00156 | 0.010825 | 0.00135 | 0.00180 | 0.00203 | 0.00271 | 0.00406 | 0.00677 | 0.00767 | 0.008119 | 0.00992 | 0.01353 | 0.01534 |
| 72 | .013889 | .00347 | .00174 | .012028 | .00150 | .00200 | .00226 | .00301 | .00451 | .00752 | .00852 | .009021 | .01103 | .01504 | .01704 |
| 64 | .015625 | .00391 | .00195 | .013532 | .00169 | .00226 | .00254 | .00338 | .00507 | .00846 | .00958 | .010149 | .01240 | .01691 | .01917 |
| 56 | .017857 | .00446 | .00223 | .015465 | .00193 | .00258 | .00290 | .00387 | .00580 | .00967 | .01095 | .011599 | .01418 | .01933 | .02191 |
| 48 | .020833 | .00521 | .00260 | .018042 | .00226 | .00301 | .00338 | .00451 | .00677 | .01128 | .01278 | .013532 | .01654 | .02255 | .02556 |
| 44 | .022727 | .00568 | .00284 | .019682 | .00246 | .00328 | .00369 | .00492 | .00738 | .01230 | .01394 | .014762 | .01804 | .02460 | .02788 |
| 40 | .025000 | .00625 | .00312 | .021651 | .00271 | .00361 | .00406 | .00541 | .00812 | .01353 | .01534 | .016238 | .01985 | .02706 | .03067 |
| 36 | .027778 | .00694 | .00347 | .024056 | .00301 | .00401 | ‡.00451 | .00601 | .00902 | .01504 | .01704 | .018042 | .02205 | .03007 | .03408 |
| 32 | .031250 | .00781 | .00391 | .027063 | .00338 | .00451 | .00507 | .00677 | .01015 | .01691 | .01917 | .020297 | .02481 | .03383 | .03834 |
| 28 | .035714 | .00893 | .00446 | .030929 | .00387 | .00515 | .00580 | .00773 | .01160 | .01933 | .02191 | .023197 | .02835 | .03866 | .04382 |
| 27 | .037037 | .00926 | .00463 | .032075 | .00401 | .00535 | .00601 | .00802 | .01203 | .02005 | .02272 | .024056 | .02940 | .04009 | .04544 |
| 24 | .041667 | .01042 | .00521 | .036084 | .00451 | .00601 | .00677 | .00902 | .01353 | .02255 | .02556 | .027063 | .03308 | .04511 | .05112 |
| 20 | .050000 | .01250 | .00625 | .043301 | .00541 | .00722 | .00812 | .01083 | .01624 | .02706 | .03067 | .032476 | .03969 | .05413 | .06134 |
| 18 | .055556 | .01389 | .00694 | .048113 | .00601 | .00802 | .00902 | .01203 | .01804 | .03007 | .03408 | .036084 | .04410 | .06014 | .06816 |
| 16 | .062500 | .01562 | .00781 | .054127 | .00677 | .00902 | .01015 | .01353 | .02030 | .03383 | .03834 | .040595 | .04962 | .06766 | .07668 |
| 14 | .071429 | .01786 | .00893 | .061859 | .00773 | .01031 | .01160 | .01546 | .02320 | .03866 | .04382 | .046394 | .05670 | .07732 | .08763 |
| 13 | .076923 | .01923 | .00962 | .066617 | .00833 | .01110 | .01249 | .01665 | .02498 | .04164 | .04719 | .049963 | .06107 | .08327 | .09437 |
| 12 | .083333 | .02083 | .01042 | .072169 | .00902 | .01203 | .01353 | .01804 | .02706 | .04511 | .05112 | .054127 | .06615 | .09021 | .10224 |
| 11½ | .086957 | .02174 | .01087 | .075307 | .00941 | .01255 | .01412 | .01883 | .02824 | .04707 | .05334 | .056480 | .06903 | .09413 | .10668 |
| 11 | .090909 | .02273 | .01136 | .078730 | .00984 | .01312 | .01476 | .01968 | .02952 | .04921 | .05577 | .059047 | .07217 | .09841 | .11153 |
| 10 | .100000 | .02500 | .01250 | .086603 | .01083 | .01443 | .01624 | .02165 | .03248 | .05413 | .06134 | .064952 | .07939 | .10825 | .12269 |
| 9 | .111111 | .02778 | .01389 | .096225 | .01203 | .01604 | .01804 | .02406 | .03608 | .06014 | .06816 | .072169 | .08821 | .12028 | .13632 |
| 8 | .125000 | .03125 | .01562 | .108253 | .01353 | .01804 | .02030 | .02706 | .04059 | .06766 | .07668 | .081190 | .09923 | .13532 | .15336 |
| 7 | .142857 | .03571 | .01786 | .123718 | .01546 | .02062 | .02320 | .03093 | .04639 | .07732 | .08763 | .092788 | .11341 | .15465 | .17527 |
| 6 | .166667 | .04167 | .02083 | .144338 | .01804 | .02406 | .02706 | .03608 | .05413 | .09021 | .10224 | .108253 | .13231 | .18042 | .20448 |
| 5 | .200000 | .05000 | .02500 | .173205 | .02165 | .02887 | .03248 | .04330 | .06495 | .10825 | .12269 | .129904 | .15877 | .21651 | .24537 |
| 4½ | .222222 | .05556 | .02778 | .192450 | .02406 | .03208 | .03608 | .04811 | .07217 | .12028 | .13632 | .144338 | .17641 | .24056 | .27264 |
| 4 | .250000 | .06250 | .03125 | .216506 | .02706 | .03608 | .04059 | .05413 | .08119 | .13532 | .15336 | .162380 | .19846 | .27063 | .30672 |

* Equivalent to the "basic height" h of the original American National form.

NOTE.—$h_{ax}=f_{cn}=\frac{H}{4}$.

$h_{dn}=h_{ax}=\frac{3}{8}H$.