U.S. DEPARTMENT OF COMMERCE
NATIONAL BUREAU OF STANDARDS

SCREW-THREAD STANDARDS FOR FEDERAL SERVICES 1957

Amends in part H28 (1944) (and in part its 1950 Supplement)

HANDBOOK H28 (1957)—Part II

The National Bureau of Standards

Functions and Activities

The functions of the National Bureau of Standards are set forth in the Act of Congress, March 3, 1901, as amended by Congress in Public Law 619, 1950. These include the development and maintenance of the national standards of measurement and the provision of means and methods for making measurements consistent with these standards; the determination of physical constants and properties of materials; the development of methods and instruments for testing materials, devices, and structures; advisory services to government agencies on scientific and technical problems; invention and development of devices to serve special needs of the Government; and the development of standard practices, codes, and specifications. The work includes basic and applied research, development, engineering, instrumentation, testing, evaluation, calibration services, and various consultation and information services. Research projects are also performed for other government agencies when the work relates to and supplements the basic program of the Bureau or when the Bureau's unique competence is required. The scope of activities is suggested by the listing of divisions and sections on the inside of the back cover.

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The results of the Bureau's work take the form of either actual equipment and devices or published papers. These papers appear either in the Bureau's own series of publications or in the journals of professional and scientific societies. The Bureau itself publishes three monthly periodicals, available from the Government Printing Office: The Journal of Research, published in four separate sections, presents complete scientific and technical papers; the Technical News Bulletin presents summary and preliminary reports on work in progress; and Basic Radio Propagation Predictions provides data for determining the best frequencies to use for radio communications throughout the world. There are also five series of nonperiodical publications: Monographs, Applied Mathematics Series, Handbooks, Miscellaneous Publications, and Technical Notes.

Information on the Bureau's publications can be found in NBS Circular 460, Publications, of the National Bureau of Standards ($1.25) and its Supplement ($1.50), available from the Superintendent of Documents, Government Printing Office, Washington 25, D.C.

UNITED STATES DEPARTMENT OF COMMERCE • Frederick H. Mueller, *Secretary*
NATIONAL BUREAU OF STANDARDS • A. V. Astin, *Director*

NATIONAL BUREAU OF STANDARDS HANDBOOK H28 (1957)

SCREW-THREAD STANDARDS FOR FEDERAL SERVICES 1957

PART II

PIPE THREADS, INCLUDING DRYSEAL PIPE THREADS; GAS CYLINDER VALVE OUTLET AND INLET THREADS; HOSE COUPLING, INCLUDING FIRE-HOSE COUPLING THREADS; AND HOSE CONNECTIONS FOR WELDING AND CUTTING EQUIPMENT

Amends in part H28 (1944) (and in part its 1950 Supplement)

[Issued November 16, 1959]

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Foreword

This volume is the second of a series of three into which the 1957 edition of NBS Handbook H28 is divided.

Part I, published in September 1957, includes standards for screw threads which are commonly applied to bolts, screws, nuts, and other similar fasteners. Such threads are variously designated as Unified, American, American National, and Unified Miniature threads.

Part III is in process of development and will include standards for Acme, Stub-Acme, Buttress, and miscellaneous threads.

With the exception of sections IX and X, and appendix 5, Handbook H28 (1944) and the 1950 Supplement thereto, are superseded by Parts I and II of Handbook H28 (1957) and the Federal Specifications listed in appendix 6 of Part I of H28 (1957).

Archibald T. McPherson, *Chairman,*
Interdepartmental Screw Thread Committee.

APPROVAL BY THE SECRETARIES OF DEFENSE AND COMMERCE

The accompanying Handbook H28 (1957), Part II, on screw-thread standards for Federal Services, submitted by the Interdepartmental Screw Thread Committee, is hereby approved for use by the Departments of Defense and Commerce.

For the
Secretary of Defense

Secretary of Commerce

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1957 HANDBOOK OF SCREW-THREAD STANDARDS FOR FEDERAL SERVICES, Part II

As Approved 1958

SECTION VII. AMERICAN STANDARD PIPE THREADS (EXCEPT DRYSEAL AND HOSE COUPLING TYPES) [1]

1. INTRODUCTION

The American Standard for Pipe Threads, originally known as the Briggs Standard, was formulated by Mr. Robert Briggs. For several years around 1862 Mr. Briggs was superintendent of the Pascal Iron Works of Morris, Tasker & Co., Philadelphia, Pa., and later engineering editor of the Journal of the Franklin Institute. After his death on July 24, 1882, a paper by Mr. Briggs containing detailed information regarding American pipe and pipe thread practice, as developed by him when superintendent of the Pascal Iron Works, was read before the Institution of Civil Engineers of Great Britain. This is recorded in the Excerpt Minutes, volume LXXI, Session 1882–83, part 1, of that Society.

It is of interest to note that the nominal sizes (diameters) of pipe 10 inches and under, and the pitches of the thread were for the most part established between 1820 and 1840.

By publishing his data, based on years of practice, Mr. Briggs was the means of establishing definite detail dimensions. The Briggs formula did not provide for the internal threads or gaging requirements for making taper threaded joints. It established only the external thread on pipe, with no tolerance.

In 1886 the large majority of American manufacturers threaded pipe to practically the Briggs Standard, and acting jointly with The American Society of Mechanical Engineers they adopted it as a standard practice that year, and master plug and ring gages were made.

Later, at various conferences, representatives of the manufacturers and the ASME established additional sizes, certain details of gaging, tolerances, special applications of the standard and, in addition, tabulated the formulas and dimensions more completely than was done by Mr. Briggs.

Until the manufacturers adopted the Briggs thread in 1886, it seems that each manufacturer of necessity threaded his pipe and fittings according to his best judgment. After 1886 there was some attempt to work toward better interchangeability. However, the need for a better gaging practice resulted in the adoption of the thin ring gage and the truncation of the plug and ring gages to gage the flanks of the thread. This practice of threading fittings and couplings which provide threads to make up joints with a wrench was standardized about 1913.

In 1913 a Committee on the Standardization of Pipe Threads was organized for the purpose of reediting and expanding the Briggs Standard. The American Gas Association and The American Society of Mechanical Engineers served as joint sponsors. After 6 years of work this committee completed the revised standard for taper pipe threads, which was published in the ASME Transactions of 1919. During this period the thin ring gage was established, and the crests of the thread plug and ring gages were truncated. This standard was adopted by, and appeared in the various reports of the National Screw Thread Commission.

In the years that followed, the need for a further revision of this American Standard became evident, as well as the necessity of adding to it the recent developments in pipe threading practice. Accordingly, the Sectional Committee on the Standardization of Pipe Threads, B2, was organized in 1927 under the joint sponsorship of the AGA and the ASME. The specifications in this section are in agreement with the current standard developed by that committee.

Substantially the same standard for taper pipe threads, but with various additional refinements in gaging, is issued as Military Specification MIL-P-7105.

1. Types of Pipe Threads.—The various types of pipe threads included in this section have right-hand threads unless otherwise specified.

(*a*) *Pipe threads*.—The following types of pipe threads are included in this section: [2]

NPT—American Standard taper pipe threads for general use. (p. 2.)

NPSC—American Standard straight pipe threads in pipe couplings. (p. 7.)

NPTR—American Standard taper pipe threads for railing joints. (p. 7.)

NPSM—American Standard straight pipe threads for free-fitting mechanical joints for fixtures. (p. 9.)

NPSL—American Standard straight pipe threads for loose-fitting mechanical joints with locknuts. (p. 9.)

(*b*) *UNS threads for use on thin-wall tubing*.—Data are included in this section on p. 11 on

[1] This section is substantially in agreement with the present issue of ASA B2.1, "American Standard Pipe Threads (Except Dryseal)," which is published by the ASME, 29 West 39th Street, New York 18, N.Y. The latest revision should be consulted when referring to this ASA standard.

[2] Dryseal pipe threads are included in section VIII, p. 18. American National straight pipe threads for loose-fitting mechanical joints for hose couplings, NPSH, are included in section X, p. 91.

UNS straight threads of the 27-thread series in sizes ¼ to 1 in. for use on thin-wall tubing.

2. THREAD DESIGNATIONS.—The letters in the thread designation symbols have the following significance:

N = American (National)[2a] Standard
P = Pipe
T = Taper
S = Straight; also Special
C = Coupling
M = Mechanical
L = Locknut
R = Railing fittings
U = Unified

For left-hand threads, add "–LH" to the designation for the corresponding right-hand thread.

3. APPENDIX.—Appendix 7 contains the following additional information on the pipe threads covered by this section:

- Definitions and letter symbols.
- Suggested twist drill diameters for drilled hole sizes for the pipe threads shown in section VII.
- Pitch diameters of taper pipe threads shown in their relation to E_1, basic pitch diameter.
- Threading of pipe for American Standard threaded steel flanges.
- Taper and straight threads for rigid steel conduit and fittings.
- Internal straight pipe threads in finished drums and external threads on plugs.

2. AMERICAN STANDARD PIPE THREAD FORM

The form of thread profile specified in this section shall be known as the "American Standard Pipe Thread Form." There are shown in figure VII.1 the relations as specified herein for form of thread and general notation.

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

2. TRUNCATION AND THREAD HEIGHT.—The height of the sharp V thread, H, is

$$H = 0.866025p = 0.866025/n$$

where

p = pitch of thread
n = threads per inch.

The basic maximum depth of the truncated thread, h (see fig. VII.1), is based on factors entering into the manufacture of cutting tools and the making of tight joints.

$$h = 0.800p = 0.800/n$$

The crest and root of pipe threads are truncated [3] a minimum of $0.033p$.

The maximum depth of truncation for the crest and root of these pipe threads will be found in table VII.1.

The sketch at the head of table VII.2, giving a sectional view of this standard thread form, represents the truncated thread form by a straight line. However, when closely examined, the crests and roots of commercially manufactured pipe threads appear slightly rounded and it is intended that the pipe threads of product shall be acceptable when crest and root of the tools or chasers lie within the limits set up in table VII.1.

3. SPECIFICATIONS FOR TAPER PIPE THREADS FOR GENERAL USE, NPT

Threads made in accordance with these specifications consist of an external taper and an internal taper thread, to form the normal type of joint having general application on pipe and fittings. See figure VII.2.

1. THREAD DESIGNATION AND NOTATION.—American Standard taper pipe threads are designated by specifying in sequence the nominal size, number of threads per inch, and the symbols for thread series and form as shown in the following example:

3/8—18NPT

Standard notation applicable to American Standard taper pipe threads is shown in figure VII.3.

2. FORM OF THREAD.—The form of thread of American Standard taper pipe threads is as specified in pars. 1 and 2, above.

3. TAPER OF THREAD.—The taper of the thread is 1 in 16 or 0.75 in./ft. measured on the diameter and along the axis.

4. DIAMETER OF THREAD.—The basic pitch diameters of the taper thread are determined by the following formulas [4] based on the outside diameter of the pipe and the pitch of the thread:

$$E_0 = D - (0.05D + 1.1)\,1/n = D - (0.05D + 1.1)p$$
$$E_1 = E_0 + 0.0625L_1$$

where

D = outside diameter of pipe,
E_0 = pitch diameter of thread at end of pipe,
E_1 = pitch diameter of thread at the gaging notch or large end of internal thread,
L_1 = normal engagement by hand between external and internal threads,
n = threads per inch.

5. LENGTH OF THREAD.—The basic length of the effective external taper thread, L_2, is determined by the following formula based on the outside diameter of the pipe and the pitch of the thread:

[2a] The N is derived from earlier nomenclature that included the word "National."
[3] The crests and roots of the external and internal threads may be truncated either parallel to the pitch line or parallel to the axis.

[4] For the 1/8—27 and 1/4—18 sizes, E_1 approx. $= D - (0.05D + 0.827)p$.

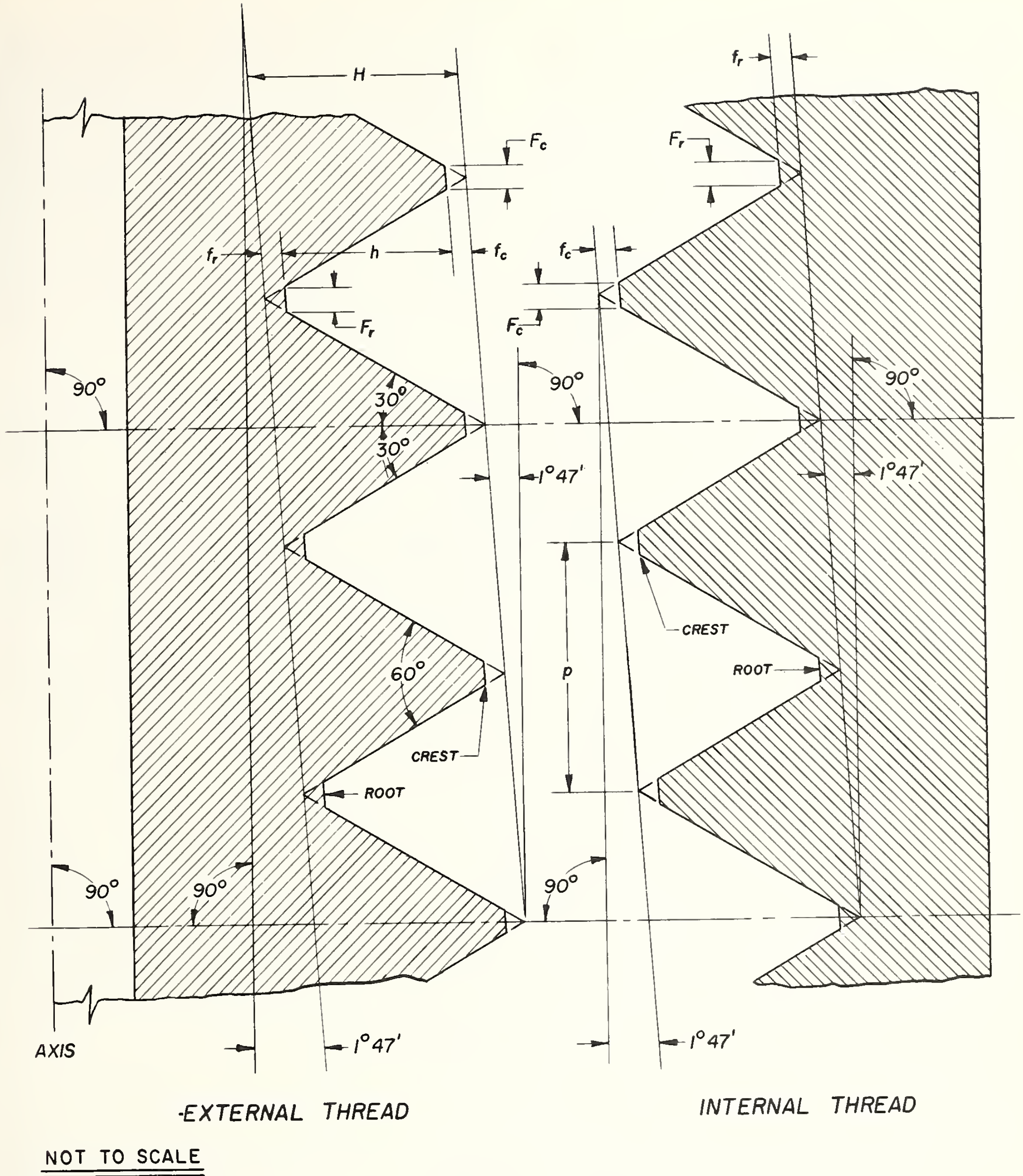


FIGURE VII.1.—*Basic form of American Standard taper pipe thread*

NOTATION

H=0.866025p=height of 60° sharp V thread
h=0.800000p=height of thread on product
p=1/n=pitch (measured parallel to axis)
n=number of threads per inch
f_c=depth of truncation at crest
f_r=depth of truncation at root
F_c=width of flat at crest
F_r=width of flat at root

NOTE—For a symmetrical straight screw thread, $H=\cot\alpha/2n$. For a symmetrical taper screw thread, $H=(\cot\alpha-\tan^2\beta\ \tan\alpha)/2n$, so that the exact value for an American Standard taper pipe thread is $H=0.865743p$ as against $H=0.866025p$, the value given above. For an 8-pitch thread, which is the coarsest standard taper pipe thread pitch, the corresponding values of H are 0.108218 in. and 0.108253 in. respectively, the difference being 0.000035 in. This difference being too small to be significant, the value of $H=0.866025p$ continues to be in use for threads of 3/4 in. or less taper per foot on the diameter.

$$L_2 = (0.80D + 6.8)1/n = (0.80D + 6.8)p$$

where

D = outside diameter of pipe,

n = threads per inch.

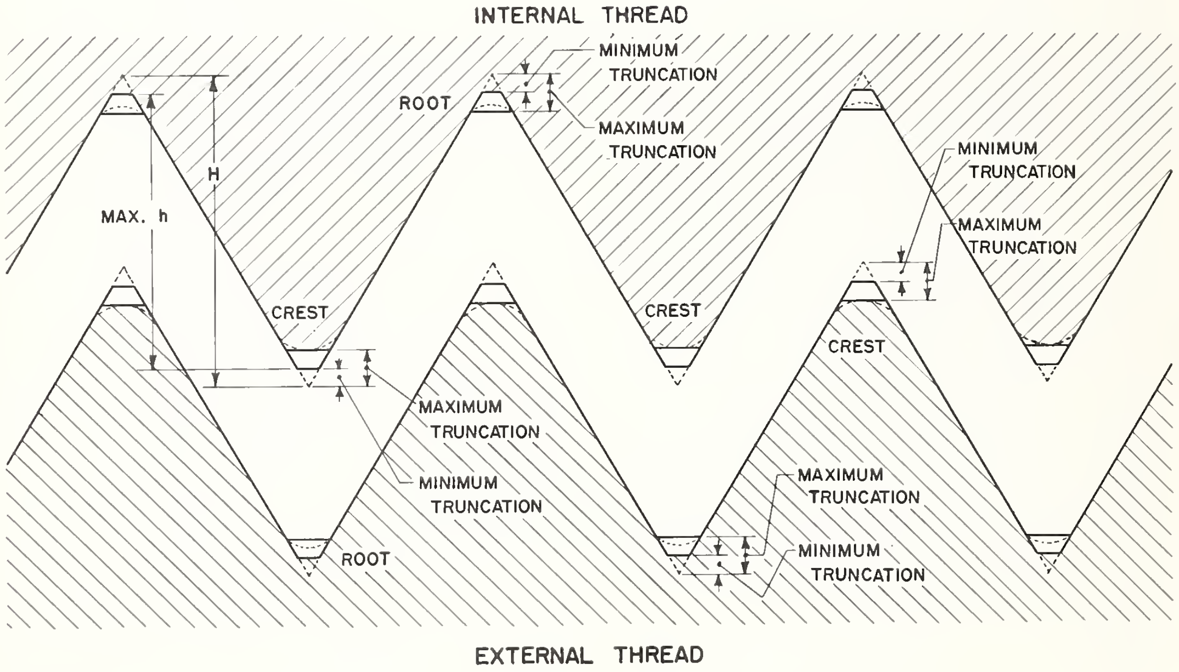
This formula determines directly the length of effective thread which includes two usable threads slightly imperfect at the crest.

6. ENGAGEMENT BETWEEN EXTERNAL AND INTERNAL TAPER THREADS.—The normal length of engagement between external and internal taper threads when screwed together handtight is shown in column 6, table VII.2. This length is controlled by the construction and use of the gages. It is recognized that in special applications, such as flanges for high pressure work, longer thread engagement is used, in which case the pitch diameter (dimension E_1 in figure over table VII.2) is maintained and the pitch diameter E_0 at the end of pipe is proportionately smaller.

7. BASIC DIMENSIONS.—The basic dimensions of taper pipe threads, derived from the above specifications, are given in table VII.2.

8. MANUFACTURING TOLERANCE ON PRODUCT.—The maximum allowable variation in the commercial product is 1 turn of the inspection (working) gage large or small from the basic dimensions (see pars. 4 and 5, p. 14).

TABLE VII.1.—*Limits on crest and root truncation of American Standard external and internal taper pipe threads, NPT* [a]



Threads per inch, n	Height of sharp V thread, H	Height [b] of thread, h		Truncation, f					Equivalent width of flat, F				
		Max	Min	Minimum		Maximum		Tolerance	Minimum		Maximum		Tolerance
1	2	3	4	5	6	7	8	9	10	11	12	13	14
	in.	*in.*	*in.*	*formula*	*in.*	*formula*	*in.*	*in.*	*formula*	*in.*	*formula*	*in.*	*in.*
27	0.03208	0.02963	0.02496	0.033p	0.0012	0.096p	0.0036	0.0024	0.038p	0.0014	0.111p	0.0041	0.0027
18	.04811	.04444	.03833	.033p	.0018	.088p	.0049	.0031	.038p	.0021	.102p	.0057	.0036
14	.06186	.05714	.05071	.033p	.0024	.078p	.0056	.0032	.038p	.0027	.090p	.0064	.0037
11½	.07531	.06957	.06261	.033p	.0029	.073p	.0063	.0034	.038p	.0033	.084p	.0073	.0040
8	.10825	.10000	.09275	.033p	.0041	.062p	.0078	.0037	.038p	.0048	.072p	.0090	.0042

[a] The basic dimensions of the American Standard taper pipe thread are given in inches to four and five decimal places. While this implies a greater degree of precision than is ordinarily attained, these dimensions are so expressed for the purpose of eliminating errors in computations. The limits specified in this table are intended to serve as a guide for establishing limits of the thread elements of taps, dies, and thread chasers. These limits may be required on product.

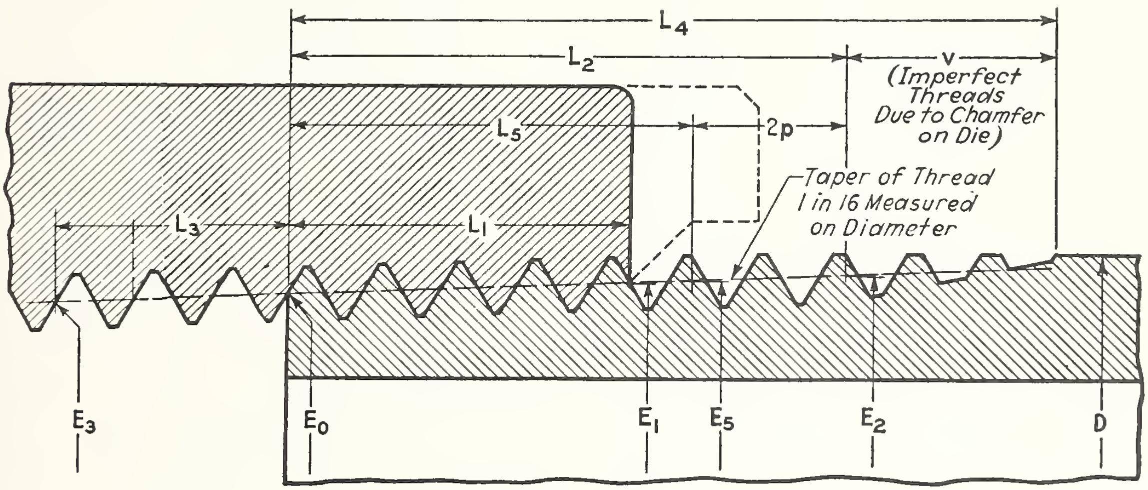
[b] Dimensions of gages, such as plain taper plug and ring gages, which depend on maximum and minimum truncations, columns 5 to 8, inclusive, shall be determined by applying the thread heights in columns 3 and 4 to the basic pitch diameter, E_0 or E_1. Step values of tolerance notches are 16 times (col. 3—col. 4), rather than 32 times (col. 9).

9. Tolerances on Thread Elements.—The permissible variations in thread elements on steel products and all pipe made of steel, wrought iron, or brass, exclusive of butt-weld pipe, are given in table VII.3. This table is a guide for establishing limits of the thread elements of taps, dies, and thread chasers. These limits may be required on product threads.

On pipe fittings and valves (not steel) for steam pressures 300 lbs. and below, it is intended that plug and ring gage practice, as set up in this standard, will provide for a satisfactory check of accumulated variations of taper, lead, and angle in such product. Therefore, no tolerances on thread elements have been established for this class.

For service conditions, where more exact check is required, procedures have been developed by industry to supplement the regulation plug and ring gage method of gaging.

Table VII.2.—*Basic dimensions of American Standard taper pipe threads, NPT* [a]



Nominal pipe size	Outside diameter of pipe, D	Threads per inch, n	Pitch of thread, p	Pitch diameter at beginning of external thread, E_0	Handtight engagement			Effective thread, external		
					Length, [b] L_1		Diameter, [c] E_1	Length, [d] L_2		Diameter, E_2
1	2	3	4	5	6	7	8	9	10	11
in.	*in.*		*in.*	*in.*	*in.*	*thds*	*in.*	*in.*	*thds*	*in.*
1/16	0.3125	27	0.03704	0.27118	0.160	4.32	0.28118	0.2611	7.05	0.28750
1/8	.405	27	.03704	.36351	.1615	4.36	.37360	.2639	7.12	.38000
1/4	.540	18	.05556	.47739	.2278	4.10	.49163	.4018	7.23	.50250
3/8	.675	18	.05556	.61201	.240	4.32	.62701	.4078	7.34	.63750
1/2	.840	14	.07143	.75843	.320	4.48	.77843	.5337	7.47	.79179
3/4	1.050	14	.07143	.96768	.339	4.75	.98887	.5457	7.64	1.00179
1	1.315	11½	.08696	1.21363	.400	4.60	1.23863	.6828	7.85	1.25630
1¼	1.660	11½	.08696	1.55713	.420	4.83	1.58338	.7068	8.13	1.60130
1½	1.900	11½	.08696	1.79609	.420	4.83	1.82234	.7235	8.32	1.84130
2	2.375	11½	.08696	2.26902	.436	5.01	2.26627	.7565	8.70	2.31630
2½	2.875	8	.12500	2.71953	.682	5.46	2.76216	1.1375	9.10	2.79062
3	3.500	8	.12500	3.34062	.766	6.13	3.38850	1.2000	9.60	3.41562
3½	4.000	8	.12500	3.83750	.821	6.57	3.88881	1.2500	10.00	3.91562
4	4.500	8	.12500	4.33438	.844	6.75	4.38712	1.3000	10.40	4.41562
5	5.563	8	.12500	5.39073	.937	7.50	5.44929	1.4063	11.25	5.47862
6	6.625	8	.12500	6.44609	.958	7.66	6.50597	1.5125	12.10	6.54062
8	8.625	8	.12500	8.43359	1.063	8.50	8.50003	1.7125	13.70	8.54062
10	10.750	8	.12500	10.54531	1.210	9.68	10.62094	1.9250	15.40	10.66562
12	12.750	8	.12500	12.53281	1.360	10.88	12.61781	2.1250	17.00	12.66562
14 OD	14.000	8	.12500	13.77500	1.562	12.50	13.87262	2.2500	18.90	13.91562
16 OD	16.000	8	.12500	15.76250	1.812	14.50	15.87575	2.4500	19.60	15.91562
18 OD	18.000	8	.12500	17.75000	2.000	16.00	17.87500	2.6500	21.20	17.91562
20 OD	20.000	8	.12500	19.73750	2.125	17.00	19.87031	2.8500	22.80	19.91562
24 OD	24.000	8	.12500	23.71250	2.375	19.00	23.86094	3.2500	26.00	23.91562

[a] The basic dimensions of the American Standard taper pipe thread are given in inches to four or five decimal places. While this implies a greater degree of precision than is ordinarily attained, these dimensions are the basis of gage dimensions and are so expressed for the purpose of eliminating errors in computations.

[b] Also length of thin ring gage and length from gaging notch to small end of plug gage.

[c] Also pitch diameter at gaging notch (handtight plane).

[d] Also length of plug gage.

Nominal pipe size	Wrench makeup length for internal thread: Length, L_3		Wrench makeup length for internal thread: Diameter, E_3	Vanish threads, V		Over-all length external thread, L_4	Nominal perfect [e] external threads: Length, L_5	Nominal perfect [e] external threads: Diameter, E_5	Height of thread, h	Increase in diameter per thread, $0.0625/n$	Basic [f] minor diameter at small end of pipe, K_0
1	12	13	14	15	16	17	18	19	20	21	22
in.	*in.*	*thds*	*in.*	*in.*	*thds*	*in.*	*in.*	*in.*	*in.*	*in.*	*in.*
1/16	0.1111	3	0.26424	0.1285	3.47	0.3896	0.1870	0.28287	0.02963	0.00231	0.2416
1/8	.1111	3	.35656	.1285	3.47	.3924	.1898	.37537	.02963	.00231	.3339
1/4	.1667	3	.46697	.1928	3.47	.5946	.2907	.49556	.04444	.00347	.4329
3/8	.1667	3	.60160	.1928	3.47	.6006	.2967	.63056	.04444	.00347	.5676
1/2	.2143	3	.74504	.2478	3.47	.7815	.3909	.78286	.05714	.00446	.7013
3/4	.2143	3	.95429	.2478	3.47	.7935	.4029	.99286	.05714	.00446	.9105
1	.2609	3	1.19733	.3017	3.47	.9845	.5089	1.24543	.06957	.00543	1.1441
1 1/4	.2609	3	1.54083	.3017	3.47	1.0085	.5329	1.59043	.06957	.00543	1.4876
1 1/2	.2609	3	1.77978	.3017	3.47	1.0252	.5496	1.83043	.06957	.00543	1.7265
2	.2609	3	2.25272	.3017	3.47	1.0582	.5826	2.30543	.06957	.00543	2.1995
2 1/2	.2500[g]	2	2.70391	.4337	3.47	1.5712	.8875	2.77500	.10000	.00781	2.6195
3	.2500[g]	2	3.32500	.4337	3.47	1.6337	.9500	3.40000	.10000	.00781	3.2406
3 1/2	.2500	2	3.82188	.4337	3.47	1.6837	1.0000	3.90000	.10000	.00781	3.7375
4	.2500	2	4.31875	.4337	3.47	1.7337	1.0500	4.40000	.10000	.00781	4.2344
5	.2500	2	5.37511	.4337	3.47	1.8400	1.1563	5.46300	.10000	.00781	5.2907
6	.2500	2	6.43047	.4337	3.47	1.9462	1.2625	6.52500	.10000	.00781	6.3461
8	.2500	2	8.41797	.4337	3.47	2.1462	1.4625	8.52500	.10000	.00781	8.3336
10	.2500	2	10.52969	.4337	3.47	2.3587	1.6750	10.65000	.10000	.00781	10.4453
12	.2500	2	12.51719	.4337	3.47	2.5587	1.8750	12.65000	.10000	.00781	12.4328
14 OD	.2500	2	13.75938	.4337	3.47	2.6837	2.0000	13.90000	.10000	.00781	13.6750
16 OD	.2500	2	15.74688	.4337	3.47	2.8837	2.2000	15.90000	.10000	.00781	15.6625
18 OD	.2500	2	17.73438	.4337	3.47	3.0837	2.4000	17.90000	.10000	.00781	17.6500
20 OD	.2500	2	19.72188	.4337	3.47	3.2837	2.6000	19.90000	.10000	.00781	19.6375
24 OD	.2500	2	23.69688	.4337	3.47	3.6837	3.0000	23.90000	.10000	.00781	23.6125

[a] The basic dimensions of the American Standard taper pipe thread are given in inches to four or five decimal places. While this implies a greater degree of precision than is ordinarily attained, these dimensions are the basis of gage dimensions and are so expressed for the purpose of eliminating errors in computations.

[e] The length L_5 from the end of the pipe determines the plane beyond which the thread form is imperfect at the crest. The next two threads are perfect at the root. At this plane the cone formed by the crests of the thread intersects the cylinder forming the external surface of the pipe. $L_5 = L_2 - 2p$.

[f] Given as information for use in selecting tap drills. (See appendix 7, p. 102.)

[g] Military Specification MIL–P–7105 gives the wrench makeup as three threads for 3 in. and smaller. The E_3 dimensions are: Size 2½ in., 2.69609 and size 3 in., 3.31719.

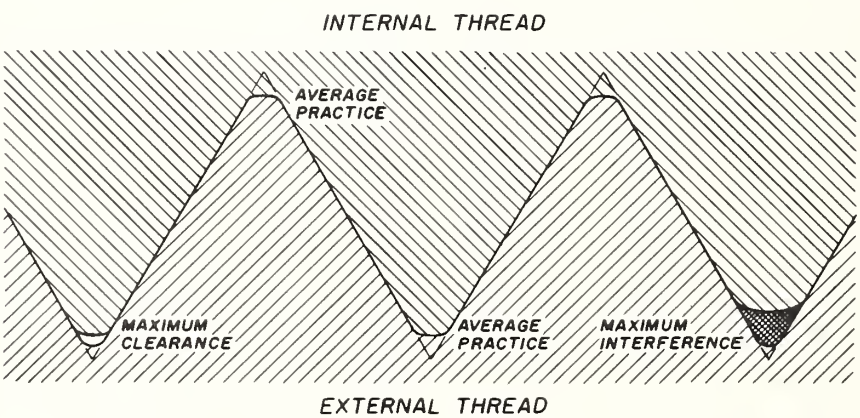


FIGURE VII.2.—*American Standard taper pipe threads for pressuretight joints, NPT.*

(When threaded joints are made up wrench tight with lubricant or sealer, it is intended that the flanks shall be in contact.)

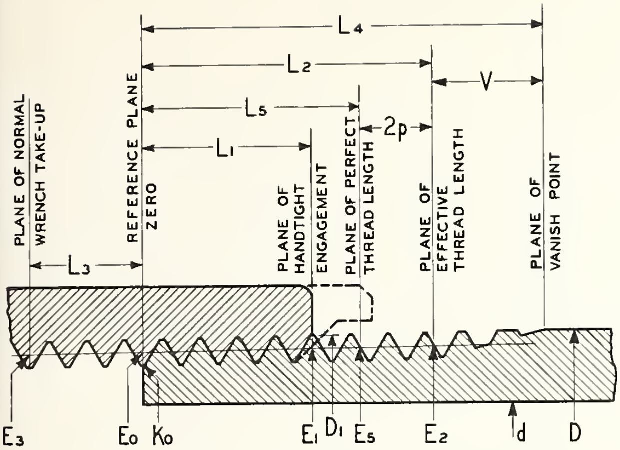


FIGURE VII.3.—*American Standard taper pipe thread notation.*

TABLE VII.3—*Tolerances on taper, lead, and angle of pipe threads of steel products and all pipe of steel, wrought-iron, or brass (exclusive of butt-weld pipe)*

Nominal pipe size	Threads per inch	Taper on pitch line		Lead in length of effective threads	60° angle of threads
		Max	Min		
1	2	3	4	5	6
in.		*in./ft*	*in./ft*	*in.* ±	*deg.* ±
1/16, 1/8	27	7/8	11/16	0.003	2 1/2
1/4, 3/8	18	7/8	11/16	.003	2
1/2, 3/4	14	7/8	11/16	[a].003	2
1, 1 1/4, 1 1/2, 2	11 1/2	7/8	11/16	[a].003	1 1/2
2 1/2 and larger	8	7/8	11/16	[a].003	1 1/2

[a] The tolerance on lead shall be ±0.003 in./in. on any size threaded to an effective thread length greater than 1 in.

NOTE.—For tolerances on depth of thread see table VII.1, and for tolerances on pitch diameter see par. 8, p. 4.
The limits specified in this table are intended to serve as a guide for establishing limits of the thread elements of taps, dies, and thread chasers. These limits may be required on product threads.

4. SPECIFICATIONS FOR INTERNAL STRAIGHT THREADS IN PIPE COUPLINGS, NPSC

Threads in pipe couplings made in accordance with these specifications are straight (parallel) threads of the same thread form as the American Standard taper pipe thread specified in par. 1 and 2, p. 2. They are used to form pressuretight joints when assembled with an American Standard external taper pipe thread and made up *with* lubricant or sealer. The resulting joints are recommended for comparatively low pressures only. The American Standard Coupling Straight Pipe Thread is designated as shown in the following example:

1/8—27NPSC

The dimensions and pitch diameter tolerances are specified in table VII.4. The pitch diameter tolerances correspond to one and one-half turns large or small of the standard taper pipe thread. The major and minor diameters vary with the pitch diameter, as the American Standard pipe thread form is maintained.

TABLE VII.4.—*Dimensions of internal straight threads in pipe couplings (pressuretight joints with lubricant or sealer), NPSC*

Nominal pipe size	Threads per inch	Minor [a] diameter	Pitch diameter [b]	
		Min	Min	Max
1	2	3	4	5
in.		*in.*	*in.*	*in.*
1/8	27	0.342	0.3701	0.3771
1/4	18	.440	.4864	.4968
3/8	18	.577	.6218	.6322
1/2	14	.715	.7717	.7851
3/4	14	.925	.9822	.9956
1	11 1/2	1.161	1.2305	1.2468
1 1/4	11 1/2	1.506	1.5752	1.5915
1 1/2	11 1/2	1.745	1.8142	1.8305
2	11 1/2	2.219	2.2881	2.3044
2 1/2	8	2.650	2.7504	2.7739
3	8	3.277	3.3768	3.4002
3 1/2	8	3.777	3.8771	3.9005
4	8	4.275	4.3754	4.3988

[a] As the American Standard pipe thread form is maintained the major and the minor diameters of the internal thread vary with the pitch diameter.
[b] Attention is called to the fact that the actual pitch diameter of the straight tapped hole will be slightly smaller than the values given when gaged with a taper plug gage as specified in par. 8(e), p. 18.

5. SPECIFICATIONS FOR RAILING JOINT TAPER PIPE THREADS, NPTR

Railing joints require a rigid mechanical thread joint with external and internal taper threads.

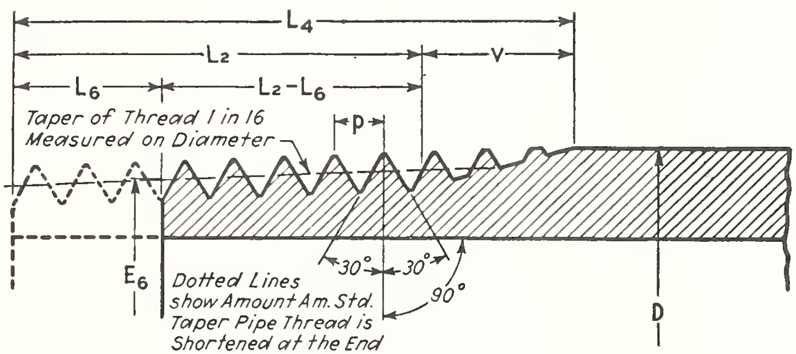
The external thread is basically the same as the American Standard taper pipe thread, except that it is shortened to permit the use of the larger end of the pipe thread (see fig. in table VII.5.). The dimensions of these external and internal threads are shown in table VII.5. A recess in the fitting provides a covering for the last scratch or imperfect threads on the pipe.

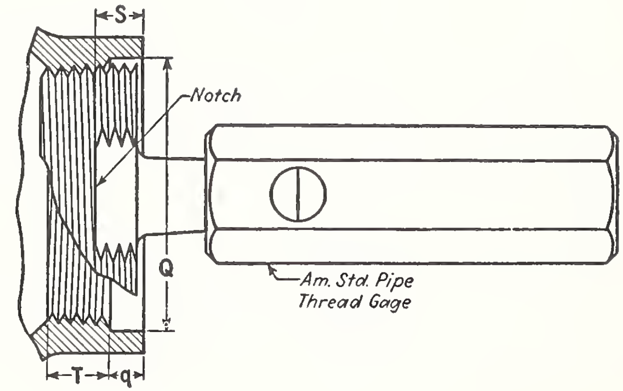
The form of thread is the same as the form of the American Standard taper pipe thread shown in figure VII.1. An NPTR thread is designated as shown in the following example:

1/2—14NPTR

The gaging of these threads is specified in table VII.5. The maximum allowable variation in the external thread is no turns large and one turn small. The maximum allowable variation in the internal thread is one turn large, no turns small.

TABLE VII.5.—*Dimensions of external and internal taper pipe threads for railing joints (mechanical joints), NPTR* [a]





Nominal pipe size	Outside diameter of pipe, D	Threads per inch	Height of thread	Pitch diameter at end of external thread, E_6	Shortening of Am. Std. pipe thread, L_6		Length of effective thread, L_2-L_6		Total length of external thread, max, L_4-L_6		Imperfect threads due to chamfer of die, max, V		Depth of recess in fitting, min, q	Diameter of recess in fitting, min, Q	Length, min, T	Distance gage [b] notch comes below face of fitting, S	
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
in.	*in.*		*in.*	*in.*	*in.*	*thds*	*in.*	*thds*	*in.*	*thds*	*in.*	*thds*	*in.*	*in.*	*in.*	*in.*	*thds*
½	0.840	14	0.0571	0.7718	0.214	3	0.320	4.47	0.499	6.98	0.179	2½	0.18	0.86	0.25	0.286	4
¾	1.050	14	.0571	.9811	.214	3	.332	4.64	.510	7.15	.179	2½	.18	1.07	.25	.286	4
1	1.315	11½	.0696	1.2299	.261	3	.422	4.85	.639	7.35	.217	2½	.22	1.34	.30	.348	4
1¼	1.660	11½	.0696	1.5734	.261	3	.446	5.13	.707	8.13	.261	3	.26	1.68	.39	.348	4
1½	1.900	11½	.0696	1.8124	.261	3	.463	5.32	.724	8.33	.261	3	.26	1.92	.43	.348	4
2	2.375	11½	.0696	2.2853	.261	3	.496	5.70	.757	8.70	.261	3	.26	2.40	.43	.348	4
2½	2.875	8	.1000	2.7508	.500	4	.638	5.10	1.013	8.10	.375	3	.38	2.90	.63	.625	5
3	3.500	8	.1000	3.3719	.500	4	.700	5.60	1.075	8.60	.375	3	.38	3.53	.63	.625	5
3½	4.000	8	.1000	3.8688	.500	4	.750	6.00	1.125	9.00	.375	3	.38	4.04	.63	.625	5
4	4.500	8	.1000	4.3656	.500	4	.800	6.40	1.175	9.40	.375	3	.38	4.54	.63	.625	5

[a] These dimensions agree with those developed by the Manufacturers Standardization Society of the Valve and Fittings Industry. Thread lengths are specified to three decimal places for convenience.

[b] American Standard taper pipe thread plug gage (see par. 8, p. 11).

6. SPECIFICATIONS FOR STRAIGHT PIPE THREADS FOR MECHANICAL JOINTS,[2] NPSM, NPSL, NPSH

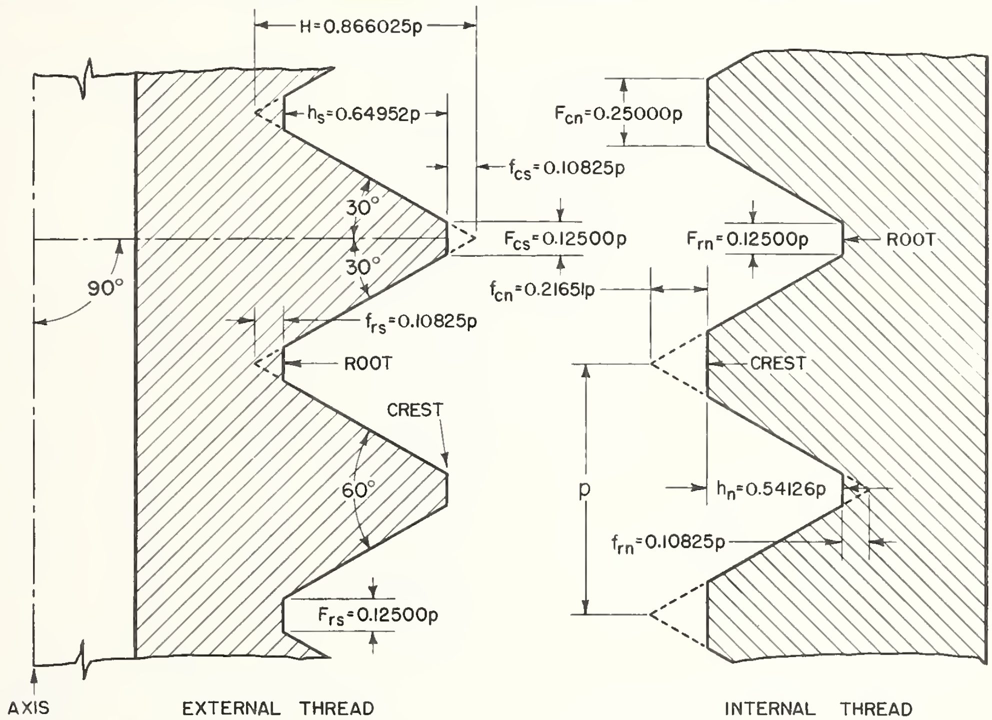
While external and internal taper pipe threads are recommended for pipe joints in practically every service, there are certain types of joints where straight pipe threads are used to advantage. Three of these straight pipe thread joints are covered by this handbook, all of which are based on the pitch diameter of the American Standard taper pipe thread at the gaging notch (Dimension E_1 of table VII.2) but have various truncations at crest and root as described below. These three types of joints are as follows:

Type 1. Free-fitting mechanical joints for fixtures, table VII.6, both external and internal, NPSM.

Type 2. Loose-fitting mechanical joints with locknuts, table VII.7, both external and internal, NPSL.

[2] See footnote 2, p. 1.

TABLE VII.6.—*Dimensions of external and internal straight pipe threads for mechanical joints (free-fitting), NPSM*



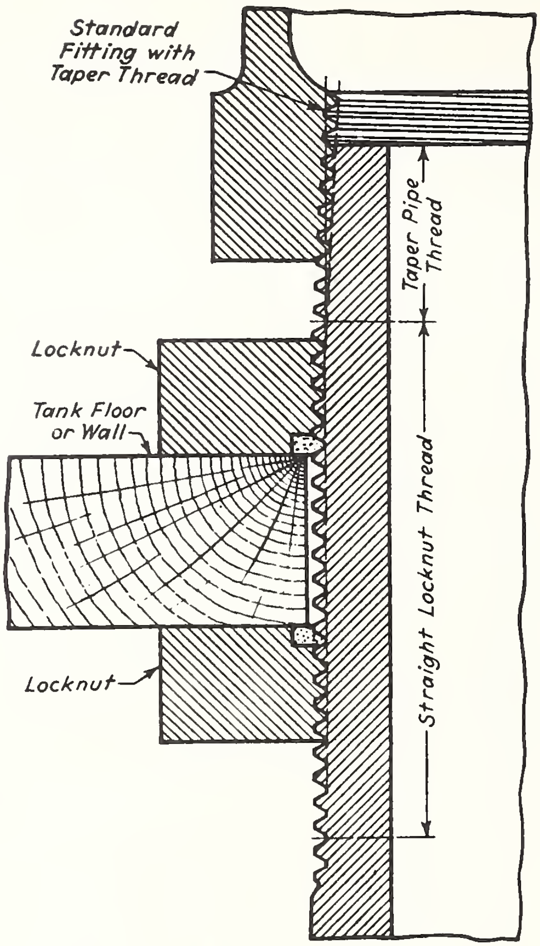
Nominal pipe size	Threads per inch	External thread, class 2A					Internal thread, class 2B			
		Allowance	Major diameter		Pitch diameter		Minor diameter		Pitch diameter	
			Max	Min	Max	Min	Min	Max	Min [a]	Max
1	2	3	4	5	6	7	8	9	10	11
in.		*in.*	*in.*	*in.*	*in.*	*in.*	*in.*	*in.*	*in.*	*in.*
⅛	27	0.0011	0.397	0.390	0.3725	0.3689	0.358	0.364	0.3736	0.3783
¼	18	.0013	.526	.517	.4903	.4859	.468	.481	.4916	.4974
⅜	18	.0014	.662	.653	.6256	.6211	.603	.612	.6270	.6329
½	14	.0015	.823	.813	.7769	.7718	.747	.759	.7784	.7851
¾	14	.0016	1.034	1.024	.9873	.9820	.958	.970	.9889	.9958
1	11½	.0017	1.293	1.281	1.2369	1.2311	1.201	1.211	1.2386	1.2462
1¼	11½	.0018	1.638	1.626	1.5816	1.5756	1.546	1.555	1.5834	1.5912
1½	11½	.0018	1.877	1.865	1.8205	1.8144	1.785	1.794	1.8223	1.8302
2	11½	.0019	2.351	2.339	2.2944	2.2882	2.259	2.268	2.2963	2.3044
2½	8	.0022	2.841	2.826	2.7600	2.7526	2.708	2.727	2.7622	2.7720
3	8	.0023	3.467	3.452	3.3862	3.3786	3.334	3.353	3.3885	3.3984
3½	8	.0023	3.968	3.953	3.8865	3.8788	3.835	3.848	3.8883	3.8988
4	8	.0023	4.466	4.451	4.3848	4.3771	4.333	4.346	4.3871	4.3971
5	8	.0024	5.528	5.513	5.4469	5.4390	5.395	5.408	5.4493	5.4598
6	8	.0024	6.585	6.570	6.5036	6.4955	6.452	6.464	6.5060	6.5165

[a] Column 10 is the same as the pitch diameter at the end of internal thread, E_1, *basic* (see table VII.2, col. 8).

NOTE: The minor diameters of external threads and major diameters of internal threads are those as produced by commercial straight pipe dies and commercial ground straight pipe taps.

The major diameter of the external thread has been calculated on the basis of a truncation of $0.10825p$, and the minor diameter of the internal thread has been calculated on the basis of a truncation of $0.21651p$ to provide no interference at crest and root when product is gaged with gages made in accordance with par. 8(d), p. 18.

TABLE VII.7.—*Dimensions of external and internal straight pipe threads for locknut connections (loose-fitting mechanical joints), NPSL*



Nominal pipe size	Threads per inch	External threads				Internal threads		
		Allowance	Maximum[a] major diameter	Pitch diameter		Minimum[a] minor diameter	Pitch diameter	
				Max	Min		Min	Max
1	2	3	4	5	6	7	8	9
in.		*in.*	*in.*	*in.*	*in.*	*in.*	*in.*	*in.*
1/8	27	0.0023	0.409	0.3840	0.3805	0.362	0.3863	0.3898
1/4	18	.0035	.541	.5038	.4986	.470	.5073	.5125
3/8	18	.0035	.678	.6409	.6357	.607	.6444	.6496
1/2	14	.0045	.844	.7963	.7896	.753	.8008	.8075
3/4	14	.0045	1.054	1.0067	1.0000	.964	1.0112	1.0179
1	11 1/2	.0054	1.318	1.2604	1.2523	1.208	1.2658	1.2739
1 1/4	11 1/2	.0055	1.663	1.6051	1.5970	1.553	1.6106	1.6187
1 1/2	11 1/2	.0054	1.902	1.8441	1.8360	1.792	1.8495	1.8576
2	11 1/2	.0054	2.376	2.3180	2.3099	2.265	2.3234	2.3315
2 1/2	8	.0078	2.877	2.7934	2.7817	2.718	2.8012	2.8129
3	8	.0078	3.503	3.4198	3.4081	3.344	3.4276	3.4393
3 1/2	8	.0078	4.003	3.9201	3.9084	3.845	3.9279	3.9396
4	8	.0078	4.502	4.4184	4.4067	4.343	4.4262	4.4379
5	8	.0079	5.564	5.4805	5.4688	5.405	5.4884	5.5001
6	8	.0078	6.620	6.5372	6.5255	6.462	6.5450	6.5567
8	8	.0078	8.615	8.5313	8.5196	8.456	8.5391	8.5508
10	8	.0078	10.735	10.6522	10.6405	10.577	10.6600	10.6717
12	8	.0078	12.732	12.6491	12.6374	12.574	12.6569	12.6686

[a] As the American Standard straight pipe thread form of thread is maintained the major and the minor diameters of the internal thread and the minor diameter of the external thread vary with the pitch diameter. The major diameter of the external thread is usually determined by the diameter of the pipe. These theoretical diameters result from adding the depth of the truncated thread ($0.666025 \times p$) to the maximum pitch diameters in column 5, and it should be understood that commercial pipe will not always have these maximum major diameters.

The locknut thread is established on the basis of retaining the greatest possible amount of metal thickness between the bottom of the thread and the inside of the pipe.

In order that a locknut may fit loosely on the externally threaded part, an allowance equal to the "increase in pitch diameter per turn" is provided with a tolerance of 1 1/2 turns for both external and internal thread (see table 7.8, p. 107).

Type 3. Loose-fitting mechanical joints for hose couplings, NPSH.[2]

(a) *Thread designations.*—The above types of straight pipe threads for mechanical joints are designated by specifying in sequence the nominal size, number of threads per inch, form (straight) and symbol of the thread series, as follows:

⅛—27NPSM
⅛—27NPSL
1—11 ½NPSH

(b) *Pitch and flank angle.*—The pitch and flank angle are the same as the corresponding dimensions of the taper pipe thread described in pars. 1 and 2, p. 2.

(c) *Diameter of thread.*—The basic pitch diameter for both the external and internal straight pipe threads is equal to the pitch diameter of the American Standard taper pipe thread at the gaging notch (dimension E_1 of table VII.2), which is the same as the large end of the internal taper pipe thread.

1. Free-Fitting Mechanical Joints for Fixtures, NPSM.—Standard iron, steel, and brass pipe are often used for special applications where there are no internal pressures. Where straight thread joints are required for mechanical assemblies, straight pipe threads are often found more suited or convenient.

The dimensions of these threads, as given in table VII.6, are for pipe thread connections where the parts are assembled in the shop and where reasonably close fit of the mating parts is desired.

2. Loose-Fitting Mechanical Joints With Locknuts, NPSL.—The American Standard external locknut thread is designed to produce a pipe thread having the largest diameter that it is possible to cut on standard pipe. Ordinarily straight internal threads are used with these straight external threads providing a loose fit. The dimensions of these threads are given in table VII.7. It will be noted that the maximum major diameter of the external thread is slightly greater than the nominal outside diameter of the pipe. The normal manufacturer's variation in pipe diameter provides for this increase.

One application of the use of a taper pipe thread in combination with a locknut thread which has been in use for some time is that shown over table VII.7. It consists of the nipple threaded joint used to connect standpipes with the floor or wall of water supply tanks.

[2] See footnote 2, p. 1.

7. SPECIFICATIONS FOR UNIFIED SPECIAL STRAIGHT SCREW THREADS FOR USE ON THIN-WALL TUBING, UNS

UNS Unified special screw threads in the 27-thread series in sizes ¼ to 1 in. are recommended for general use on thin-wall tubing. The class of thread is to be 2A and 2B.

The limits of size of these threads and the minimum length of complete thread are given in table VII.8.

1. Thread Form.—The Unified form of thread profile as specified in part I, section III, shall be used.

2. Thread Designation.—The method to be used for the designation of the tubing thread is shown in the following example:

¼—27UNS–2A

3. Gages.—The specifications for gages as presented in part I, section VI, apply to these threads. For identification, each gage shall be plainly marked with the thread designation in accordance with the previous paragraph.

8. GAGES AND GAGE TOLERANCES FOR AMERICAN STANDARD PIPE THREADS

1. Design of Gages.—Gages for American Standard pipe threads are of the standard type or the limit type, as described below. Gages should conform to the designs recommended in Commercial Standard CS8 for pipe thread plug

Table VII.8.—*Limits of size of Unified special screw threads for use on thin-wall tubing, UNS–2A, UNS–2B*

Nominal size and threads per inch	External, 2A							Internal, 2B						Minimum[a] length of complete thread
	Allowance	Major diameter		Pitch diameter			Minor diameter	Minor diameter		Pitch diameter			Major diameter	
		Max	Min	Max	Min	Tolerance		Min	Max	Min	Max	Tolerance	Min	
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
	in.	*in.*	*in.*	*in.*	*in.*	*in.*	*in.*	*in.*	*in.*	*in.*	*in.*	*in.*	*in.*	*in.*
¼—27	0.0010	0.2490	0.2423	0.2249	0.2214	0.0035	0.2036	0.210	0.219	0.2259	0.2304	0.0045	0.2500	0.268
5⁄16—27	.0010	.3115	.3048	.2874	.2839	.0035	.2661	.272	.281	.2884	.2929	.0045	.3125	.289
⅜—27	.0011	.3739	.3672	.3498	.3462	.0036	.3285	.335	.344	.3509	.3556	.0047	.3750	.310
.390—27	.0011	.3889	.3822	.3648	.3612	.0036	.3435	.350	.359	.3659	.3706	.0047	.3900	.315
7⁄16—27	.0011	.4364	.4297	.4123	.4087	.0036	.3910	.397	.406	.4134	.4181	.0047	.4375	.331
½—27	.0011	.4989	.4922	.4748	.4711	.0037	.4535	.460	.469	.4759	.4807	.0048	.5000	.352
9⁄16—27	.0011	.5614	.5547	.5373	.5336	.0037	.5160	.522	.531	.5384	.5432	.0048	.5625	.372
⅝—27	.0011	.6239	.6172	.5998	.5960	.0038	.5785	.585	.594	.6009	.6059	.0050	.6250	.393
¾—27	.0012	.7488	.7421	.7247	.7208	.0039	.7034	.710	.719	.7259	.7310	.0051	.7500	.435
⅞—27	.0012	.8738	.8671	.8497	.8458	.0039	.8284	.835	.844	.8509	.8560	.0051	.8750	.477
1–27	.0012	.9988	.9921	.9747	.9707	.0040	.9534	.960	.969	.9759	.9811	.0052	1.0000	.518

[a] Based on formula: Minimum length of complete thread = ⅓ basic major diam (col. 14)+0.185 in. (5 threads).

and ring gages 12 in. and smaller. Larger sizes should be of suitable design.

(*a*) *Standard type gages.*—A set of standard or basic type gages consists of a taper-threaded plug gage and a taper-threaded ring gage (see figs. VII.4 and VII.5). The plug gages are made to dimensions given in table VII.9 with a gaging notch located a distance L_1 from the small end. The thin ring gages have a length equal to dimension L_1. These rings are fitted to the plugs, coming flush at the notch within tolerances as given in table VII.10. The roots of the threads on these gages should be undercut beyond the sharp V to a width of $0.116p$, to facilitate finishing. The crests are to be truncated an amount equal to $0.100p$, as illustrated in figure VII.5. In locating the basic gaging notch, the plane of the bottom of the notch should intersect the following thread flank or side at or near the pitch cone.

The ring gage shall be fitted to the plug so that, when assembled handtight, the gaging face will be flush with the small end of the plug, and the opposite face will be flush with the gaging notch on the plug within tolerances as given in table VII.10.

(*b*) *Limit type gages.*—There are occasions when it is desirable to check the maximum and minimum limits of taper threaded product directly with a limit working gage rather than with a standard basic working gage, which necessitates counting the turns by which the gage overtravels or fails to come up to the basic surface on the product. To meet this requirement, the design of limit gage shown in figure VII.6 has been developed as an alternative to the recognized standard type plug and ring gages. These gages retain the basic notch on the plug together with the basic surface of the ring, and in addition include two notches, or steps, on both plug and ring, one the maximum and one the minimum. The retention of the basic step or notch is not essential but facilitates checking against the master and reference gages and also provides a convenient means of checking the maximum and minimum steps. The limit gage thread form, tolerances, etc., are the same as specified for the corresponding standard type gages.

(*c*) *Triroll gages.*—The triroll taper pipe thread gage, which functions in a manner similar to a taper thread ring gage of the limit type, has the additional advantage that the taper, thread angle, lead, and thread form may be examined visually by observing the contact between the gage rolls and the thread. A plain taper triroll gage may also be used to gage major diameter. This gage permits measurement of taper deviation which may be examined visually, or for all practical purposes be measured by inserting two thickness gages between the gage rolls and the major diameter of the product, one on each side, at the point of extreme gap. This gage has a flush-pin arrangement with basic, maximum, and minimum steps on the body which represent the thread size, and maximum and minimum steps on the flush pin corresponding to the limits on crest truncation.

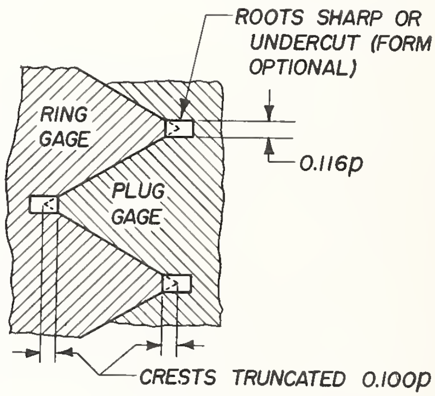


FIGURE VII.5.—*Form of gage thread.*

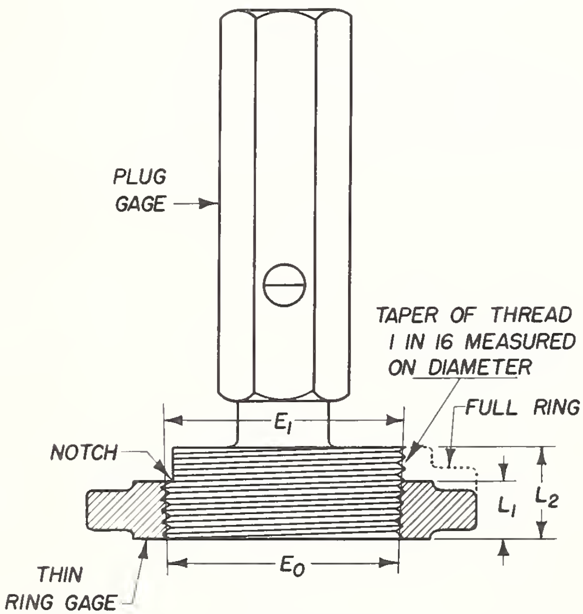


FIGURE VII.4.—*American Standard taper pipe thread plug and thin ring gages.*

NOTE.—The illustration shows standard design for sizes 2-inch and smaller; larger sizes are of slightly different designs.

2. CLASSES OF GAGES.—Gages of the following types may be used to completely cover gage requirements:

1—Master gages used to check reference gages.
2—Reference gages used to check working and inspection gages.
3—Inspection (or working) gages used for inspection in the final acceptance of threads and to check threads during manufacture.

(*a*) *Master gages.*—The set of master gages consists of two taper threaded plug gages and one thin ring gage (see figs. VII.4 and VII.5). The plug gages are made to dimensions given in table

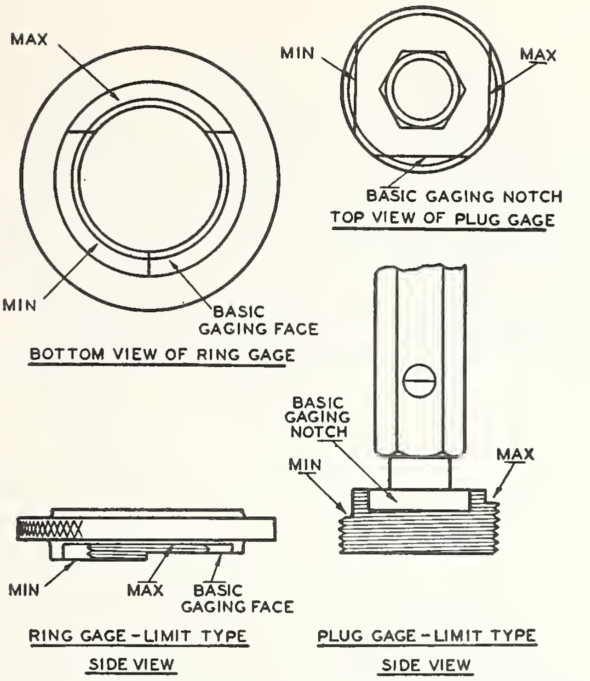


FIGURE VII.6.—*Alternative form of taper pipe thread limit plug and thread ring gages.*

VII.9. They are constructed of hardened steel with a gaging notch located a distance L_1 (table VII.2) from the small end. The thin ring gages have a length equal to dimension L_1. These rings are fitted to the plugs coming flush at the notch. The roots of the threads on these gages should be undercut beyond the sharp V to facilitate finishing. The crests of one plug and the ring gage are truncated an amount equal to $0.10p$ as illustrated in fig. VII.5. The crests of the other plug gage are truncated an amount equal to $0.033p$ (see par. 3(a) below for tolerances). The set of master gages is primarily for the use of gage and tool manufacturers and for accurate comparison in checking reference gages.

The set of master gages should be made to the basic dimensions shown in table VII.9 as accurately as possible, but in no event exceeding the tolerances specified in table VII.10. Each master gage should in addition be accompanied by a record of the measurements of all elements of the thread.

(*b*) *Reference gages.*—The set of reference gages consists of taper threaded plug and ring gages (see figs. VII.4 and VII.5). They are identical in design and have the same thread form as the set of master gages. They are made of hardened steel to dimensions given in table VII.9 (see par. 3(b) below for tolerances). The reference gages are used primarily for checking working and inspection gages.

Each reference gage should be accompanied by a record of the decimal part of a turn that it varies large or small from the basic dimensions.

Caution—It must be understood that two gages will not necessarily mate in accordance with the computed value that each may be off from basic.

(*c*) *Inspection (working) gages.*—The sets of inspection (working) gages consist of taper thread plug and ring gages of either the standard type or the limit type, and are used for checking the product. These gages are made of hardened steel to dimensions given in table VII.9 (see par. 3(b) below for tolerances).

It is to be noted that these gages are truncated at the crest an amount equal to $0.1p$, so that they bear only on the flanks of the thread. Thus, although they do not check the crest truncations specified in table VII.1, they are satisfactory for the inspection of the general run of product. When it is deemed necessary to determine whether or not such truncations are within the limits specified, or particularly to see that the maximum truncation is not exceeded, it is necessary to make further inspection. For this purpose optical projection, or MIL–P–7105 specification gages, may be used.

In locating the basic gaging notch the plane of the bottom of the notch should intersect the following thread flank or side at or near the pitch cone.

3. GAGE TOLERANCES.—In the manufacture of gages, variations from basic dimensions are unavoidable. Furthermore, gages will wear in use. In order to fix the maximum allowable variations of gages, tolerances have been established.

(*a*) *Master gage tolerances.*—The set of master gages should be made to the basic dimensions as accurately as possible but in no event exceeding the tolerances specified in table VII.10. Each master gage should in addition be accompanied by a record of the measurements of all elements of the thread (see par. 3(*c*) below).

(*b*) *Reference and inspection (working) gage tolerances.*—These gages should be made to the basic dimensions and should be within the tolerances for individual elements as specified in table VII.10. The maximum wear on inspection (working) gages shall not be more than the equivalent of one-half turn from the basic dimensions.

(*c*) *Relation of lead and angle deviations to pitch diameter tolerances of gages.*—When it is necessary to compute from measurements the decimal part of a turn that a gage varies from the basic dimensions which is required for master and reference gages, tables VII.11 and VII.12 should be used. Table VII.11 gives the correction in diameter for angle deviations and table VII.12 gives the correction in diameter for lead deviations. These corrections are always added to the pitch diameter in the case of external threads and subtracted in the case of internal threads regardless of whether or not the lead or angle deviations are plus or minus.

The diameter equivalent for lead and angle deviations plus the pitch diameter deviations multiplied by 16 gives the longitudinal variation from basic at the gaging notch. This longitudinal variation divided by the pitch equals the decimal part of a turn that the gage varies from basic at the gaging notch.

4. Gaging External Taper Threads.—In gaging external taper threads, the ring gage, figure VII.7, is screwed handtight on the pipe or external thread. The thread is within the permissible tolerance when the gaging face of the working or inspection ring gage is not more than 1 turn, large or small, from being flush with the end of the thread, as indicated in figure VII.7, allowance being made for any variation in the gage from basic dimensions.

5. Gaging Internal Taper Threads.—In gaging internal taper threads, the plug gage, figures VII.4 and VII.6, is screwed handtight into the fitting or coupling. The thread is within the permissible tolerance when the gaging notch of the working or inspection plug gage is not more than 1 turn, large or small, from being flush with the end of the thread, as indicated in figure VII.8, allowance being made for any variation in the gage from basic dimensions.

6. Gaging Chamfered, Countersunk, or Recessed Threads.—When the internal thread is chamfered, countersunk, or recessed, the notch

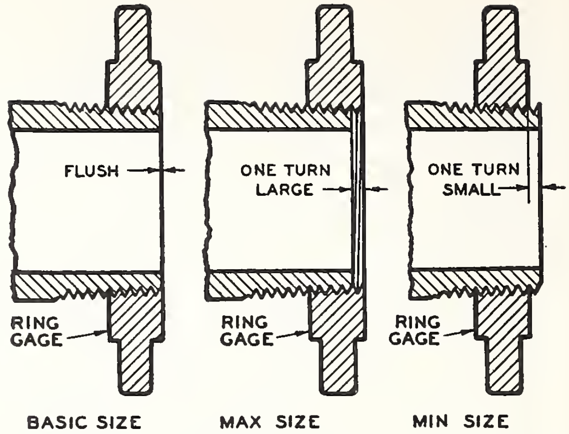


Figure VII.7.—*Gaging external taper threads with thin ring gage.*

should be flush with the bottom of the chamfer, which shall be considered as being the intersection of the chamfer cone and the pitch cone of the thread (see view B, fig. VII.9). In general, this depth is equal to one-half thread or approximately $p/2$ from the face of the valve or fitting.

Table VII.9.—*Basic dimensions of threaded plug and ring gages for American Standard taper pipe threads, NPT*

Nominal size of pipe	Threads per inch, n	Pitch, p	Major diameters of plug gages [a], [b]: At small end, $E_0+\left(\frac{0.666025}{n}\right)=D_0$	Major diameters of plug gages: At gaging notch, $E_1+\left(\frac{0.666025}{n}\right)=D_1$	Major diameters of plug gages: At large end, full ring, $E_2+\left(\frac{0.666025}{n}\right)=D_2$	Pitch diameters of plug and ring gages: At small end, E_0	Pitch diameters of plug and ring gages: At gaging notch, E_1	Pitch diameters of plug and ring gages: At large end, full ring, E_2	Minor diameters of ring gages [a]: At small end, $E_0-\left(\frac{0.666025}{n}\right)$	Minor diameters of ring gages: At gaging notch, $E_1-\left(\frac{0.666025}{n}\right)$	Minor diameters of ring gages: At large end, full ring, $E_2-\left(\frac{0.666025}{n}\right)$	Increase in diameter per thread, $\left(\frac{0.0625}{n}\right)$	Thickness of thin ring, L_1	Thickness of full ring, L_2
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
in.		*in.*	*in.*	*in.*	*in.*	*in.*	*in.*	*in.*	*in.*	*in.*	*in.*	*in.*	*in.*	*in.*
1/16	27	0.03704	0.29585	0.30585	0.31217	0.27118	0.28118	0.28750	0.24651	0.25651	0.26283	0.00231	0.160	0.26111
1/8	27	.03704	.38818	.39827	.40467	.36351	.37360	.38000	.33884	.34893	.35533	.00231	.1615	.26385
1/4	18	.05556	.51439	.52863	.53950	.47739	.49163	.50250	.44039	.45463	.46550	.00347	.2278	.40178
3/8	18	.05556	.64902	.66402	.67450	.61201	.62701	.63750	.57501	.59001	.60050	.00347	.240	.40778
1/2	14	.07143	.80600	.82600	.83936	.75843	.77843	.79179	.71086	.73086	.74422	.00446	.320	.53371
3/4	14	.07143	1.01525	1.03644	1.04936	.96768	.98887	1.00179	.92011	.94129	.95422	.00446	.339	.54571
1	11½	.08696	1.27154	1.29654	1.31422	1.21363	1.23863	1.25630	1.15572	1.18072	1.19839	.00543	.400	.68278
1¼	11½	.08696	1.61504	1.64129	1.65922	1.55713	1.58338	1.60130	1.49922	1.52547	1.54339	.00543	.420	.70678
1½	11½	.08696	1.85400	1.88025	1.89922	1.79609	1.82234	1.84130	1.73817	1.76442	1.78339	.00543	.420	.72348
2	11½	.08696	2.32593	2.35418	2.37422	2.26902	2.29627	2.31630	2.21111	2.23836	2.25839	.00543	.436	.75652
2½	8	.12500	2.80278	2.84541	2.87388	2.71953	2.76216	2.79062	2.63628	2.67891	2.70737	.00781	.682	1.13750
3	8	.12500	3.42388	3.47175	3.49888	3.34062	3.38850	3.41562	3.25737	3.30525	3.33237	.00781	.766	1.20000
3½	8	.12500	3.92075	3.97207	3.99888	3.83750	3.88881	3.91562	3.75425	3.80556	3.83237	.00781	.821	1.25000
4	8	.12500	4.41763	4.47038	4.49888	4.33438	4.38712	4.41562	4.25112	4.30387	4.33237	.00781	.844	1.30000
5	8	.12500	5.47398	5.53255	5.56188	5.39073	5.44929	5.47862	5.30748	5.36604	5.39537	.00781	.937	1.40630
6	8	.12500	6.52935	6.58922	6.62388	6.44609	6.50597	6.54062	6.36284	6.42272	6.45737	.00781	.958	1.51250
8	8	.12500	8.51685	8.58328	8.62388	8.43359	8.50003	8.54062	8.35034	8.41678	8.45737	.00781	1.063	1.71250
10	8	.12500	10.62357	10.70419	10.74888	10.54531	10.62094	10.66562	10.46206	10.53768	10.58237	.00781	1.210	1.92500
12	8	.12500	12.61607	12.70107	12.74888	12.53281	12.61781	12.66562	12.44956	12.53456	12.58237	.00781	1.360	2.12500
14 OD	8	.12500	13.85825	13.95588	13.99888	13.77500	13.87262	13.91562	13.69175	13.78937	13.83237	.00781	1.562	2.25000
16 OD	8	.12500	15.84575	15.95900	15.99888	15.76250	15.87575	15.91562	15.67925	15.79250	15.83237	.00781	1.812	2.45000
18 OD	8	.12500	17.83325	17.95825	17.99888	17.75000	17.87500	17.91562	17.66675	17.79175	17.83237	.00781	2.000	2.65000
20 OD	8	.12500	19.82075	19.95357	19.99888	19.73750	19.87031	19.91562	19.65425	19.78706	19.83237	.00781	2.125	2.85000
24 OD	8	.12500	23.79575	23.94419	23.99888	23.71250	23.86094	23.91562	23.62925	23.77768	23.83237	.00781	2.375	3.25000

[a] These dimensions are based on a crest truncation of $0.1p$ for pipe thread gages, which insures bearing of the gage on the sides of the thread, when the product thread is cut with a slightly dull tool, instead of at the roots of the thread.

[b] Second plug gage to be larger to provide for major diameters of $E_0+\frac{0.8}{n}$ at small end, $E_1+\frac{0.8}{n}$ at gaging notch, and $E_2+\frac{0.8}{n}$ at large end, full ring.

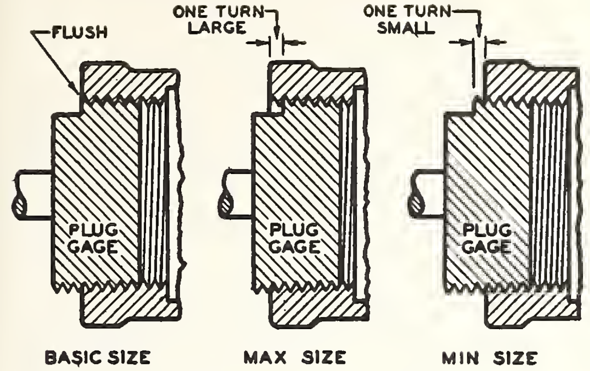


FIGURE VII.8.—*Gaging internal taper threads.*

7. DIRECT MEASUREMENT.—Taper pipe threads on the product are regularly checked only by gaging, but where a more exact check may be needed on threaded pipe made of steel, wrought iron, or brass, and on other threaded products of steel, direct measurement of threads may be specified.

8. GAGING OF STRAIGHT PIPE THREADS.—(*a*) *Types of gages.*—Gages to properly control the production of these straight threads should be either straight "go" and "not go" gages or the regular American Standard taper pipe thread gages as indicated below.

(*b*) *Use of straight and taper gages.*—Straight "go" and "not go" gages should be used for all types of threaded joints where both the external and internal threads are straight. Taper plug gages may be used for the internal threads of all types of mechanical joints where the external thread is tapered and the internal thread is straight.

TABLE VII.10.—*Tolerances for American Standard reference and inspection (working) taper pipe thread plug and ring gages, NPT*

Nominal pipe size	Threads per inch	Tolerance on pitch diameter [a]	Tolerance on lead [b, d]		Tolerance on half angle [c]		Tolerance on taper [d, e]		Tolerance on major diameter [f]	Tolerance on minor diameter [g]	Total cumulative tolerances on pitch diameter		Standoff between plug and ring gages at gaging notch for dimensions at opposite extreme tolerance limits [h]
			Plugs	Rings	Plugs	Rings	Plugs	Rings	Plugs	Rings	Plugs	Rings	
1	2	3	4	5	6	7	8	9	10	11	12	13	14
in.		*in.* ±	*in.*	*in.*	*min.* ±	*min.* ±	*in.* +	*in.* −	*in.* −	*in.* +	*in.*	*in.*	*in.*
1/16	27	0.0002	0.0002	0.0003	15	20	0.0003	0.0006	0.0004	0.0004	0.00080	0.00118	0.032
1/8	27	.0002	.0002	.0003	15	20	.0003	.0006	.0004	.0004	.00080	.00118	.032
1/4	18	.0002	.0002	.0003	15	20	.0004	.0007	.0006	.0006	.00092	.00134	.036
3/8	18	.0002	.0002	.0003	15	20	.0004	.0007	.0006	.0006	.00092	.00134	.036
1/2	14	.0003	.0002	.0003	10	15	.0006	.0009	.0010	.0010	.00097	.00142	.038
3/4	14	.0003	.0002	.0003	10	15	.0006	.0009	.0010	.0010	.00097	.00142	.038
1	11½	.0003	.0003	.0004	10	15	.0008	.0012	.0010	.0010	.00121	.00170	.047
1¼	11½	.0003	.0003	.0004	10	15	.0008	.0012	.0010	.0010	.00121	.00170	.047
1½	11½	.0003	.0003	.0004	10	15	.0008	.0012	.0010	.0010	.00121	.00170	.047
2	11½	.0003	.0003	.0004	10	15	.0008	.0012	.0010	.0010	.00121	.00170	.047
2½	8	.0005	.0004	.0005	7	10	.0010	.0014	.0016	.0016	.00158	.00211	.059
3	8	.0005	.0004	.0005	7	10	.0010	.0014	.0016	.0016	.00158	.00211	.059
3½	8	.0005	.0004	.0005	7	10	.0010	.0014	.0016	.0016	.00158	.00211	.059
4	8	.0005	.0004	.0005	7	10	.0010	.0014	.0016	.0016	.00158	.00211	.059
5	8	.0005	.0004	.0005	7	10	.0010	.0014	.0016	.0016	.00158	.00211	.059
6	8	.0005	.0004	.0005	7	10	.0010	.0014	.0016	.0016	.00158	.00211	.059
8	8	.0005	.0004	.0005	7	10	.0010	.0014	.0020	.0020	.00158	.00211	.059
10	8	.0005	.0004	.0005	7	10	.0010	.0014	.0020	.0020	.00158	.00211	.059
12	8	.0005	.0004	.0005	7	10	.0010	.0014	.0020	.0020	.00158	.00211	.059
14 OD	8	.0008	.0005	.0006	7	10	.0010	.0014	.0030	.0030	.00206	.00271	.076
16 OD	8	.0008	.0005	.0006	7	10	.0010	.0014	.0030	.0030	.00206	.00271	.076
18 OD	8	.0008	.0005	.0006	7	10	.0010	.0014	.0030	.0030	.00206	.00271	.076
20 OD	8	.0008	.0005	.0006	7	10	.0010	.0014	.0030	.0030	.00206	.00271	.076
24 OD	8	.0008	.0005	.0006	7	10	.0010	.0014	.0030	.0030	.00206	.00271	.076

[a] To be measured at the gaging notch of plug gage.
[b] Allowable variation in lead between any two threads in L_1 length of gage (figs. VII.4 and VII.6).
[c] In solving for the correction in diameter for angle deviations, the average deviation in half angle for the two sides of thread regardless of their signs should be taken.
[d] The lead and taper on plug and ring gages shall be measured along the pitch line, omitting the imperfect threads at each end.
[e] Allowable variation in taper, in L_1 length of gage (figs. VII.4 and VII.6).
[f] Tolerance on major diameter of plug gage at gaging notch.
[g] Tolerance on minor diameter of ring gage at large end.
[h] Maximum possible interchange standoff, any ring against any plug other than its master plug, may occur when taper deviations are zero and all other dimensions are at opposite extreme tolerance limits. Average standoff should be well within these maximum limits.

NOTE.—The large end of the ring gage shall be flush with the gaging notch of its master plug gage when assembled handtight within ±0.002 in. for sizes 1/16 to 2 in., inclusive, within ±0.003 in. for sizes 2½ to 12 in., inclusive, and within ±0.005 in. for sizes 14 in. and larger.

The tolerances for the length L_1 from small end to gaging notch of the plug gage (figs. VII.4 and VII.6) shall be +0.000 and −0.001 for sizes 1/16 to 2 in., inclusive, and +0.000 and −0.002 for sizes 2½ in. and larger.

The tolerances for the over-all thread length L_2 of the plug gage (figs. VII.4 and VII.6) shall be +0.005 and −0.000 for sizes 1/16 in. to 2 in., inclusive, and +0.010 and −0.000 for sizes 2½ in. and larger.

Tolerances for the thickness L_3 of the ring gage (figs. VII.4 and VII.6) shall be +0.001 and −0.000 for sizes 1/16 to 2 in., inclusive, and +0.002 and −0.000 for sizes 2½ in. and larger.

Table VII.11.—*Diameter equivalent of deviation in half included angle for tools and gages* [a]

Deviation, [b] $\delta\alpha$	8 threads per inch	$11\frac{1}{2}$ threads per inch	14 threads per inch	18 threads per inch	27 threads per inch
1	2	3	4	5	6
min.	*in.*	*in.*	*in.*	*in.*	*in.*
1	0.00006	0.00004	0.00003	0.00002	0.00002
2	.00011	.00008	.00006	.00005	.00003
3	.00017	.00012	.00010	.00007	.00005
4	.00022	.00016	.00013	.00010	.00007
5	.00028	.00019	.00016	.00012	.00008
6	.00034	.00023	.00019	.00015	.00010
7	.00039	.00027	.00022	.00017	.00012
8	.00045	.00031	.00026	.00020	.00013
9	.00050	.00035	.00029	.00022	.00015
10	.00056	.00039	.00032	.00025	.00017
11	.00062	.00043	.00035	.00027	.00018
12	.00067	.00047	.00038	.00030	.00020
13	.00073	.00051	.00042	.00032	.00022
14	.00078	.00054	.00045	.00035	.00023
15	.00084	.00058	.00048	.00037	.00025
16	.00089	.00062	.00051	.00040	.00027
17	.00095	.00066	.00054	.00042	.00028
18	.00101	.00070	.00058	.00045	.00030
19	.00106	.00074	.00061	.00047	.00031
20	.00112	.00078	.00064	.00050	.00033
21	.00117	.00082	.00067	.00052	.00035
22	.00123	.00086	.00070	.00055	.00036
23	.00129	.00089	.00074	.00057	.00038
24	.00134	.00093	.00077	.00060	.00040
25	.00140	.00097	.00080	.00062	.00041
26	.00145	.00101	.00083	.00065	.00043
27	.00151	.00105	.00086	.00067	.00045
28	.00157	.00109	.00089	.00070	.00046
29	.00162	.00113	.00093	.00072	.00048
30	.00168	.00117	.00096	.00075	.00050
45	.00252	.00175	.00144	.00112	.00075
60	.00336	.00233	.00192	.00149	.00099

[a] In solving for the diameter equivalent of angle deviations the average deviation in half angle for the two sides of the thread regardless of their signs should be taken.

[b] Diameter equivalent$=1.53812p \tan \delta\alpha$, where $\delta\alpha$=deviation in half angle of thread.

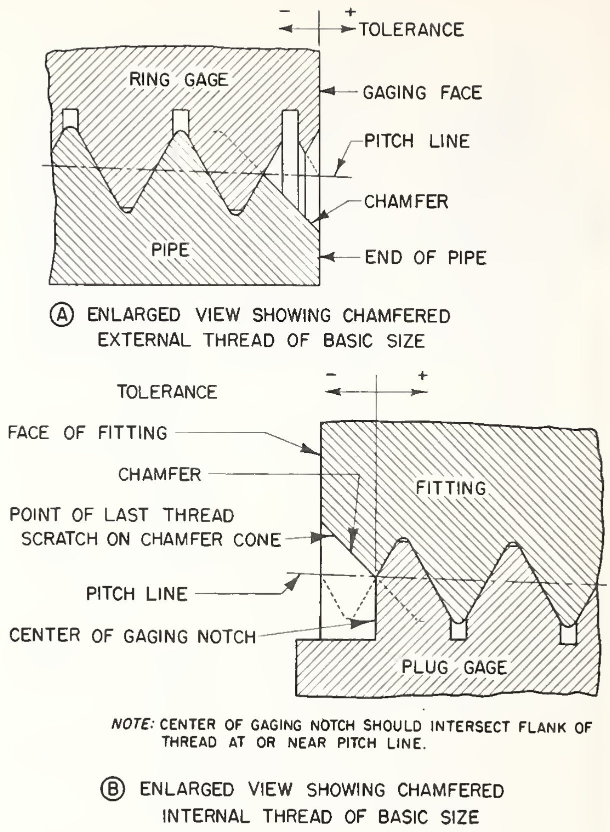


Figure VII.9.—*Gaging of chamfered threads* (see par. 6, p. 14).

Note.—The chamfer illustrated is at 45° angle and is $\frac{1}{2}$ pitch in depth. However, these details are not requirements and are given only for information on the illustration shown. The chamfered portion of thread, and the full chamfer cone, are indicated by dotted lines.

Table VII.12.—*Diameter equivalent of deviation in pitch for tools and gages* [a]

Deviation, δp	0.00000	0.00001	0.00002	0.00003	0.00004	0.00005	0.00006	0.00007	0.00008	0.00009
1	2	3	4	5	6	7	8	9	10	11
in.	*in.*	*in.*	*in.*	*in.*	*in.*	*in.*	*in.*	*in.*	*in.*	*in.*
0.00000	0.00000	0.00002	0.00003	0.00005	0.00007	0.00009	0.00010	0.00012	0.00014	0.00016
0.00010	.00017	.00019	.00021	.00023	.00024	.00026	.00028	.00029	.00031	.00033
0.00020	.00035	.00036	.00038	.00040	.00042	.00043	.00045	.00047	.00048	.00050
0.00030	.00052	.00054	.00055	.00057	.00059	.00061	.00062	.00064	.00066	.00068
0.00040	.00069	.00071	.00073	.00074	.00076	.00078	.00080	.00081	.00083	.00085
0.00050	.00087	.00088	.00090	.00092	.00094	.00095	.00097	.00099	.00100	.00102
0.00060	.00104	.00106	.00107	.00109	.00111	.00113	.00114	.00116	.00118	.00120
0.00070	.00121	.00123	.00125	.00126	.00128	.00130	.00132	.00133	.00135	.00137
0.00080	.00139	.00140	.00142	.00144	.00145	.00147	.00149	.00151	.00152	.00154
0.00090	.00156	.00158	.00159	.00161	.00163	.00165	.00166	.00168	.00170	.00171
0.00100	.00173	.00175	.00177	.00178	.00180	.00182	.00184	.00185	.00187	.00189
0.00110	.00191	.00192	.00194	.00196	.00197	.00199	.00201	.00203	.00204	.00206
0.00120	.00208	.00210	.00211	.00213	.00215	.00217	.00218	.00220	.00222	.00223
0.00130	.00225	.00227	.00229	.00230	.00232	.00234	.00236	.00237	.00239	.00241
0.00140	.00242	.00244	.00246	.00248	.00249	.00251	.00253	.00255	.00256	.00258
0.00150	.00260	.00262	.00263	.00265	.00267	.00268	.00270	.00272	.00274	.00275
0.00160	.00277	.00279	.00281	.00282	.00284	.00286	.00288	.00289	.00291	.00293
0.00170	.00294	.00296	.00298	.00300	.00301	.00303	.00305	.00307	.00308	.00310
0.00180	.00312	.00313	.00315	.00317	.00319	.00320	.00322	.00324	.00326	.00327
0.00190	.00329	.00331	.00333	.00334	.00336	.00338	.00339	.00341	.00343	.00345
0.00200	.00346	.00348	.00350	.00352	.00353	.00355	.00357	.00359	.00360	.00362

[a] Diameter equivalent$=1.732\delta p$, where δp=deviation in pitch between any two threads.

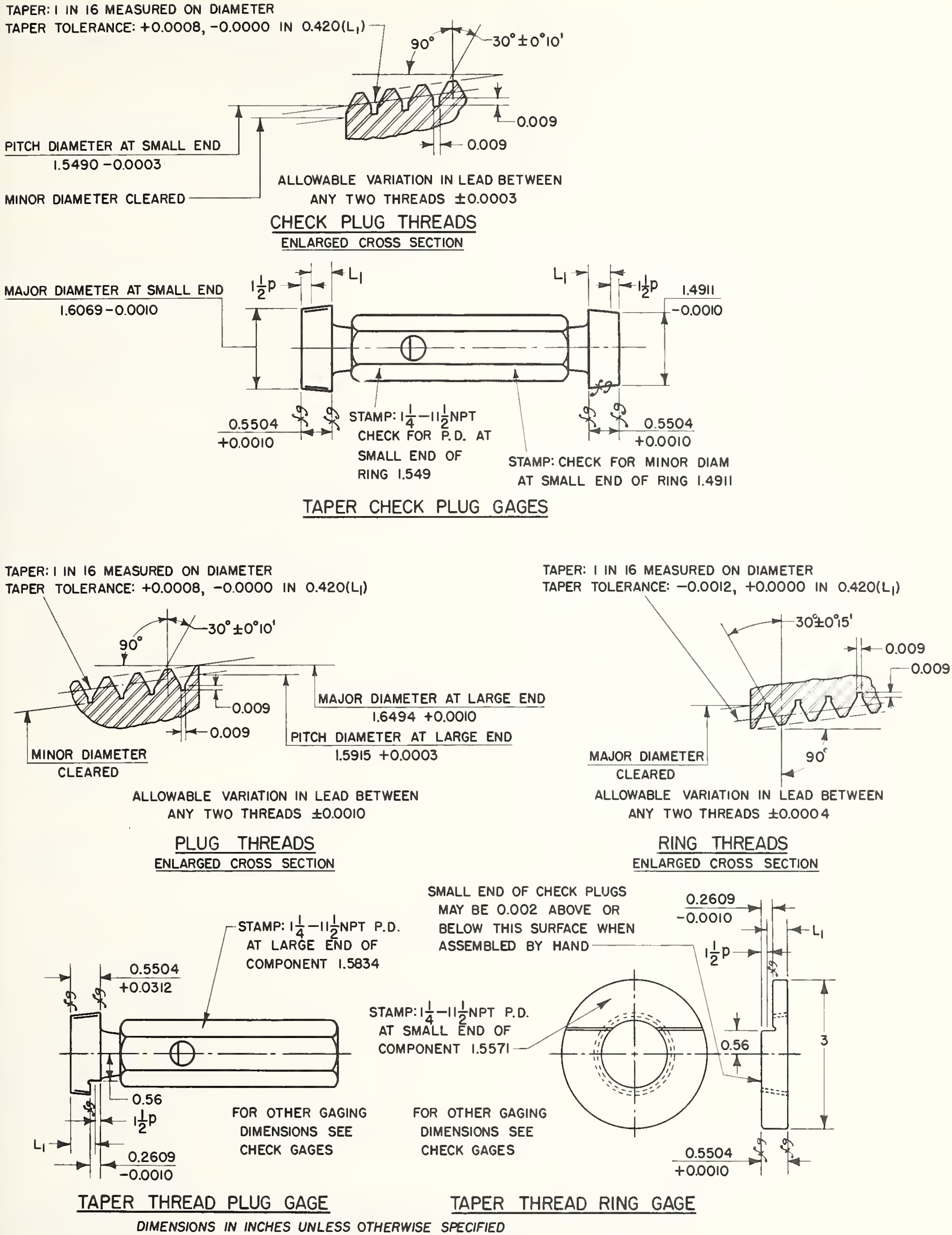


FIGURE VII.10.—*Method of marking and dimensioning taper pipe thread gages.*

(c) *Gaging pressuretight joints.*—Taper thread gages shall be used to gage straight internal pipe threads forming part of pressuretight joints where the external thread is tapered.

The gaging notch on the American Standard taper pipe thread plug gage shall come flush with the end of the American Standard coupling straight pipe thread, NPSC, table VII.4, p. 7, or with the bottom of chamfer, if chamfered, allowing a tolerance of one and one-half turns large or small to gage.

(d) *Gage dimensions.*—The straight "go" and "not go" plug and ring gages used for checking mechanical joint threads, tables VII.6 and VII.7, p. 9 and 10, shall be made to the pitch diameter limits specified in the product tables in accordance with standard practice for straight thread gages.

The minimum major diameter of the "go" thread plug gage shall be equal to the minimum pitch diameter of the internal thread plus an amount equal to $0.649519p$. The maximum major diameter of the "not go" thread plug gage shall be equal to the maximum pitch diameter of the internal thread plus an amount equal to ⅔ of $0.649519p$ ($=0.433013p$).

The maximum minor diameter of the "go" thread ring gage shall be equal to the maximum pitch diameter of the external thread minus an amount equal to $0.649519p$. The minimum minor diameter of the "not go" thread ring gage shall be equal to the minimum pitch diameter of the external thread minus an amount equal to ⅔ of $0.649519p$ ($=0.433013p$).

(e) *Gage tolerances.*—The tolerances on all gages should be in accordance with the gage tolerances specified for American Standard taper pipe thread, NPT, gages in table VII.10, p. 15.

9. Marking and Dimensioning of Gages.—Each gage shall be marked so as clearly to indicate the nominal size of pipe, threads per inch, and the proper thread series designation as given in the respective section of this standard. Taper pipe thread gages shall be marked and dimensioned in accordance with figure VII.10.

SECTION VIII. DRYSEAL AMERICAN STANDARD PIPE THREADS [5]

1. INTRODUCTION

The significant feature of these threads is control of truncation at the crest and root to assure metal to metal contact coincident with or prior to flank contact. Contact at the crest and root prevents spiral leakage and insures pressuretight joints without the use of a lubricant or sealer. See figure VIII.1. If not functionally objectionable, lubricants may be used to minimize the possibility of galling in assembly.

The principal uses for this thread during its development were for refrigerant, marine, automotive, and aircraft fuel and oil line fittings, drain and filler plugs, ordnance gas shells, chemical bombs, etc.

External Dryseal pipe threads are tapered only. Internal Dryseal pipe threads may be either straight or tapered, as specified. All Dryseal pipe threads are right-hand.

1. Thread Types.—Dryseal pipe threads are of four types, as follows:

Type 1—Dryseal American Standard Taper Pipe Thread, NPTF
Type 2—Dryseal SAE Short Taper Pipe Thread, PTF-SAE SHORT
Type 3—Dryseal American Standard Fuel Internal Straight Pipe Thread, NPSF
Type 4—Dryseal American Standard Intermediate Internal Straight Pipe Thread, NPSI

2. Thread Designations.—The above types of Dryseal pipe threads are designated by specifying in sequence the nominal size, number of threads per inch, form (Dryseal), and symbol of the thread series, as follows:

1/8—27 DRYSEAL NPTF
1/8—27 DRYSEAL PTF-SAE SHORT
1/8—27 DRYSEAL NPSF
1/8—27 DRYSEAL NPSI

Each of the letters in the symbols has a definite significance as follows:

N=American (National)[2a] Standard
P=Pipe
T=Taper
S=Straight
F=Fuel and Oil
I=Intermediate

3. Appendix.—Appendix 7 contains the following additional information on the pipe threads covered by this section:

Definitions and letter symbols.
Suggested twist drill diameters for drilled hole sizes for Dryseal pipe threads.
Pitch diameters of taper pipe threads shown in their relation to E_1, basic pitch diameter.
Special short, PTF-SPL SHORT; special extra short, PTF-SPL EXTRA SHORT; fine thread, F-PTF; and special diameter-pitch combination, SPL-PTF, Dryseal pipe threads.
Dryseal dimensions derived from superseded dimensions of L_1 equals 0.1800 for the ⅛—27 size and 0.2000 for the ¼—18 size.

2. THREAD FORM

The angle between the flanks of the thread is 60° when measured on an axial plane and the line bisecting this angle is perpendicular to the axis

[5] This section is substantially in agreement with the present issue of ASA B2.2, "American Standard Dryseal Pipe Threads," which is published by the ASME, 29 West 39th Street, New York 18, N.Y. The latest revision should be consulted when referring to this ASA standard.

[2a] See p. 1.

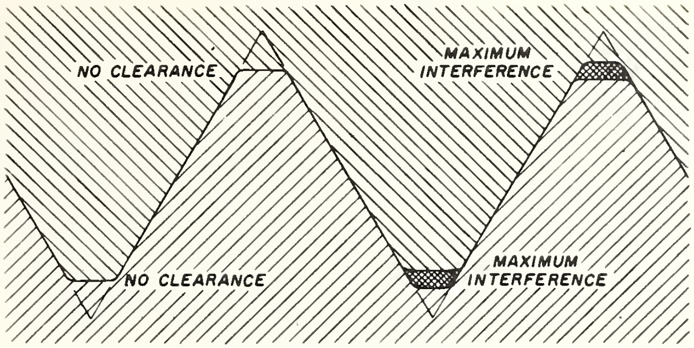


FIGURE VIII.1.—*Dryseal American Standard pipe threads for pressuretight joints.*

NOTE.—When threaded joints are made up wrench tight without lubricant or sealer, it is intended that the flanks and the crests and roots shall be in contact

of both the taper and straight threads. Tolerances on thread elements are described in par. 2, below and given in table VIII.1.

The sketches at the head of table VIII.2 give a sectional view of this modified thread form. When the crests and roots of commercially manufactured product are examined closely, they will be found to be slightly rounded at the edges. It is intended that the pipe threads of this form on products shall be acceptable when the entire crests and roots lie within the minimum limits of table VIII.2.[6]

[6] The crests and roots of the external and internal threads may be truncated either parallel to the pitch line or parallel to the axis.

1. MANUFACTURING TOLERANCE ON PRODUCT.—The maximum allowable variation in the commercial product is 1 turn large or 1 turn small from the gaging notch on plug and gaging face of ring when gages are screwed up firmly by hand on or in the product. Proper allowance shall be made for any variation of the gage from basic dimensions.

2. TOLERANCES ON THREAD ELEMENTS.—The permissible variations in thread elements on steel products and all pipe made of steel, wrought iron, or brass, exclusive of butt-weld pipe, are given in table VIII.1. This table is a guide for establishing limits of the thread elements of taps, dies, and thread chasers. These limits may be required on product threads. Limits and tolerances for crest and root truncations are given in table VIII.2.

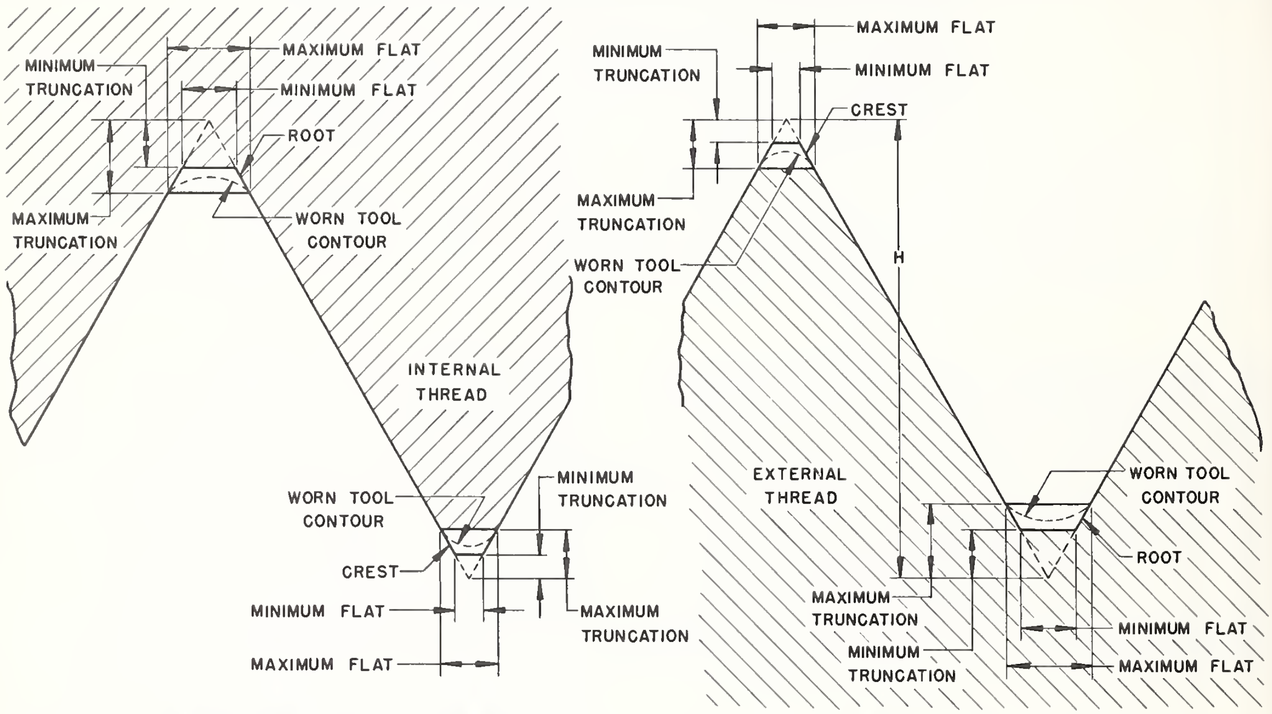
TABLE VIII.1.—*Tolerances on taper, lead, and angle for Dryseal American Standard threads on pipe and fittings*

Nominal pipe size	Threads per inch	Taper on pitch line		Lead in length of effective thread	30° half angle of threads
		Max	Min		
1	2	3	4	5	6
in.		*in./ft*	*in./ft*	*in.* ±	*deg* ±
1/16, 1/8	27	13/16	11/16	0.0010	1
1/4, 3/8	18	13/16	11/16	.0015	1
1/2, 3/4	14	13/16	11/16	.0020	1
1, 1 1/4, 1 1/2, 2	11 1/2	13/16	11/16	[a] .0025	3/4
2 1/2, 3	8	13/16	11/16	[a] .0040	3/4

[a] For sizes 2 1/2 in. and larger, the tolerance on lead shall not exceed 0.003 in. in any inch of thread length. Sizes 1, 1 1/4, 1 1/2, and 2 in. with threads of special length greater than 1 in. shall be subject to same lead tolerance specified for the 2 1/2 in. size.

NOTE.—For tolerances on height of thread see table VIII.2 and for tolerances on pitch diameter see par. 1, p. 19.

Table VIII.2.—*Limits of size on crest and root truncations of Dryseal American Standard external and internal taper pipe threads for pressuretight joints without lubricant or sealer, NPTF*



Threads per inch	Height of sharp V thread, *H*	Height of thread, *h*		Truncation, *f*					Equivalent width of flat, *F*				
		Maximum	Minimum	Minimum		Maximum		Tolerance	Minimum		Maximum		Tolerance
1	2	3	4	5	6	7	8	9	10	11	12	13	14
	in.	*in.*	*in.*	*formula*	*in.*	*formula*	*in.*	*in.*	*formula*	*in.*	*formula*	*in.*	*in.*
27 Crest	0.03208	0.02685	0.02426	0.047*p*	0.0017	0.094*p*	0.0035	0.0018	0.054*p*	0.0020	0.108*p*	0.0040	0.0020
27 Root				.094*p*	.0035	.140*p*	.0052	.0017	.108*p*	.0040	.162*p*	.0060	.0020
18 Crest	.04811	.04117	.03856	.047*p*	.0026	.078*p*	.0043	.0017	.054*p*	.0030	.090*p*	.0050	.0020
18 Root				.078*p*	.0043	.109*p*	.0061	.0018	.090*p*	.0050	.126*p*	.0070	.0020
14 Crest	.06186	.05500	.05236	.036*p*	.0026	.060*p*	.0043	.0017	.042*p*	.0030	.070*p*	.0050	.0020
14 Root				.060*p*	.0043	.085*p*	.0061	.0018	.070*p*	.0050	.098*p*	.0070	.0020
11½ Crest	.07531	.06661	.06313	.040*p*	.0035	.060*p*	.0052	.0017	.046*p*	.0040	.069*p*	.0060	.0020
11½ Root				.060*p*	.0052	.090*p*	.0078	.0026	.069*p*	.0060	.103*p*	.0090	.0030
8 Crest	.10825[a]	.09613	.09275	.042*p*	.0052	.055*p*	.0069	.0017	.048*p*	.0060	.064*p*	[a].0080	.0020
8 Root				.055*p*	.0069	.076*p*	.0095	.0026	.064*p*	.0080	.088*p*	[a].0110	.0030

[a] There is reason to doubt the practicability of the 8 tpi flat widths in hard materials on account of the volume of metal to be displaced.

3. SPECIFICATIONS FOR TYPE 1, DRYSEAL TAPER PIPE THREAD, NPTF

This series of threads applies to both external and internal threads of full length and is suitable for pipe joints in practically every type of service. These threads are generally conceded to be superior for strength and seal. Use of the internal tapered thread in hard or brittle materials having thin sections will minimize trouble from fracture.

Dimensional data for these threads are given in table VIII.4. Interchangeability between the various types of Dryseal standard and SAE SHORT threads shown in this section is given in table VIII.3. Interchangeability between the NPTF thread and Dryseal special threads, PTF-SPL SHORT and PTF-SPL EXTRA SHORT, is given in table 7.9, p. 109.

TABLE VIII.3.—*Interchangeability between the various types of standard Dryseal threads* [a]

Dryseal thread:			For assembly with Dryseal thread:		
Type	Table	Description	Type	Table	Description
1	2	3	4	5	6
1	VIII.4	NPTF (tapered), ext. thd.	1 2 3 4	VIII.4 VIII.6 VIII.7 VIII.8	NPTF (tapered), int. thd. PTF-SAE SHORT (tapered), int. thd. NPSF (straight), int. thd. NPSI (straight), int. thd.
1	VIII.4	NPTF (tapered), int. thd.	1 2	VIII.4 VIII.5	NPTF (tapered), ext. thd. PTF-SAE SHORT (tapered), ext. thd.
2 [b,c]	VIII.5	PTF-SAE SHORT (tapered), ext. thd.	4 1	VIII.8 VIII.4	NPSI (straight), int. thd. NPTF (tapered), int. thd.
2 [b,d]	VIII.6	PTF-SAE SHORT (tapered), int. thd.	1	VIII.4	NPTF (tapered), ext. thd.
3 [e]	VIII.7	NPSF (straight), int. thd.	1	VIII.4	NPTF (tapered), ext. thd.
4 [e,f]	VIII.8	NPSI (straight), int. thd.	2 1	VIII.5 VIII.4	PTF-SAE SHORT (tapered), ext. thd. NPTF (tapered), ext. thd.

[a] Interchangeability between Dryseal threads shown in this section and Dryseal special threads, PTF-SPL SHORT and PTF-SPL EXTRA SHORT, is given in table 7.9, p. 109. An assembly with straight internal pipe threads and taper external pipe threads is frequently more advantageous than an all taper thread assembly, particularly in automotive and other allied industries where economy and rapid production are paramount considerations. Dryseal threads are not used in assemblies in which both components have straight pipe threads.

[b] Trouble-free assemblies and pressuretight joints without the use of lubricant or sealer can best be assured where both components are threaded with NPTF (full length) threads. This should be considered before specifying PTF-SAE external or internal threads.

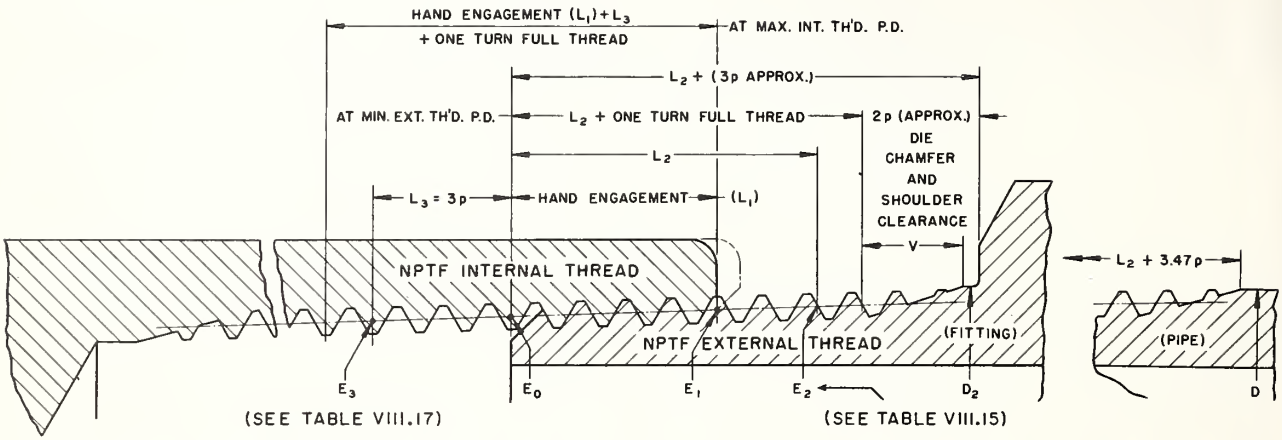
[c] PTF-SAE SHORT external threads are primarily intended for assembly with type 4 NPSI internal threads but can also be used with type 1 NPTF internal threads. They are not designed for, and at extreme tolerance limits may not assemble with, type 2 PTF-SAE SHORT internal threads or type 3 NPSF internal threads.

[d] PTF-SAE SHORT internal threads are primarily intended for assembly with type 1 NPTF external threads. They are not designed for, and at extreme tolerance limits may not assemble with, type 2 PTF-SAE SHORT external threads.

[e] There is no external thread for the NPSF or NPSI types of threads.

[f] NPSI internal threads are primarily intended for assembly with type 2 PTF-SAE SHORT external threads but will also assemble with full length type 1 NPTF external threads.

TABLE VIII.4.—*Basic dimensions of Dryseal American Standard taper pipe thread, NPTF* [a]



Size	Pitch, p	Pitch diameter at end of external thread, E_0	Pitch diameter at end of internal thread, E_1	Hand engagement, L_1		External [b] basic full thread length, L_2		Vanish thds, V, plus full thd tolerance plus shoulder clearance, $(V+3p/2)$		Shoulder length, $(L_2+3p$, approx.)	External thread for draw, (L_2-L_1)		Internal [c] basic full thread length, (L_1+L_3)		Outside diameter of fitting, D_2	Outside diameter of pipe, D
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
	in.	*in.*	*in.*	*in.*	*thds*	*in.*	*thds*	*in.*	*thds*	*in.*	*in.*	*thds*	*in.*	*thds*	*in.*	*in.*
1/16—27	0.03704	0.27118	0.28118	0.160	4.32	0.2611	7.05	0.1139	3.075	0.3750	0.1011	2.73	0.2711	7.32	0.315	0.3125
1/8 —27	.03704	.36351	.37360	.1615	4.36	.2639	7.12	.1112	3.072	.3750	.1024	2.76	.2726	7.36	.407	.405
1/4 —18	.05556	.47739	.49163	.2278	4.10	.4018	7.23	.1607	2.892	.5625	.1740	3.13	.3945	7.10	.546	.540
3/8 —18	.05556	.61201	.62701	.240	4.32	.4078	7.34	.1547	2.791	.5625	.1678	3.02	.4067	7.32	.681	.675
1/2 —14	.07143	.75843	.77843	.320	4.48	.5337	7.47	.2163	3.028	.7500	.2137	2.99	.5343	7.48	.850	.840
3/4 —14	.07143	.96768	.98887	.339	4.75	.5457	7.64	.2043	2.860	.7500	.2067	2.89	.5533	7.75	1.060	1.050
1 —11 1/2	.08696	1.21363	1.23863	.400	4.60	.6828	7.85	.2547	2.929	.9375	.2828	3.25	.6609	7.60	1.327	1.315
1 1/4—11 1/2	.08696	1.55713	1.58338	.420	4.83	.7068	8.13	.2620	3.013	.9688	.2868	3.30	.6809	7.83	1.672	1.660
1 1/2—11 1/2	.08696	1.79609	1.82234	.420	4.83	.7235	8.32	.2765	3.180	1.0000	.3035	3.49	.6809	7.83	1.912	1.900
2 —11 1/2	.08696	2.26902	2.29627	.436	5.01	.7565	8.70	.2747	3.159	1.0312	.3205	3.69	.6969	8.01	2.387	2.375
2 1/2—8	.12500	2.71953	2.76216	.682	5.46	1.1375	9.10	.3781	3.025	1.5156	.4555	3.64	1.0570	8.46	2.893	2.875
3 —8	.12500	3.34062	3.38850	.766	6.13	1.2000	9.60	.3781	3.025	1.5781	.4340	3.47	1.1410	9.13	3.518	3.500

[a] See general specifications preceding tables and table VIII.3. For drilled hole sizes see appendix 7, p. 104.

[b] Tabulated external basic full thread lengths include chamfers not exceeding one pitch (thread) length. Design size full thread length should equal the external basic full thread length plus one pitch.

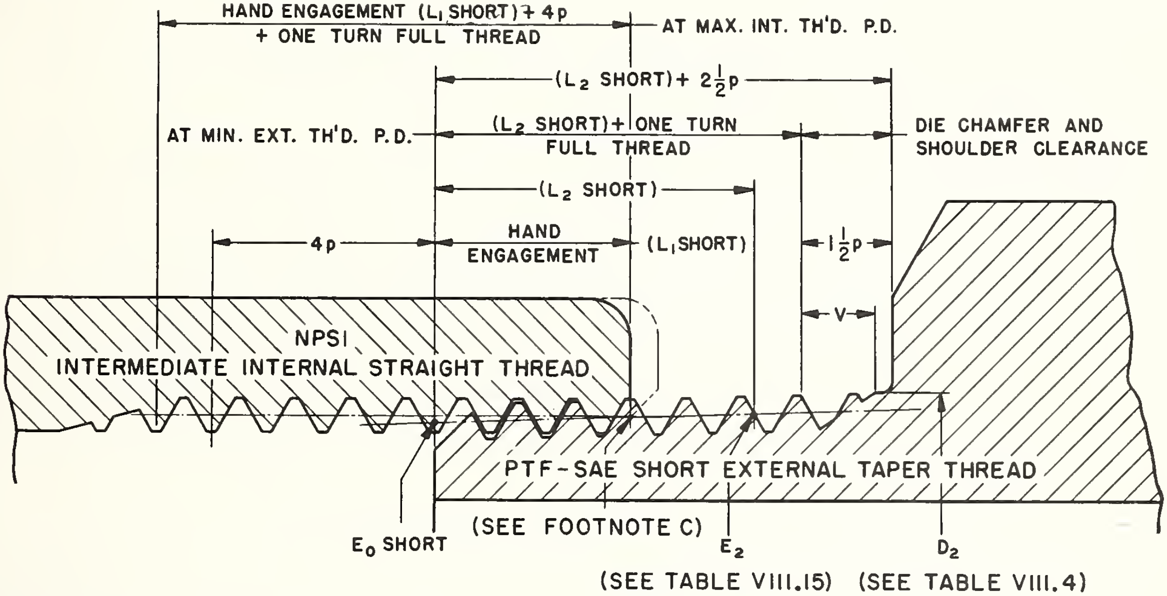
[c] Tabulated internal basic full thread lengths do not include countersink beyond the intersection of the pitch line and the chamfer cone (gaging reference point). Design size full thread length should equal the internal basic full thread length plus one pitch.

4. SPECIFICATIONS FOR TYPE 2, DRYSEAL TAPER PIPE THREAD, PTF–SAE SHORT, EXTERNAL

External threads of this series conform in all respects with the NPTF threads except that the full thread length has been shortened by eliminating one thread at the small end for increased clearance and economy of material.

Dimensional data for these threads are given in table VIII.5. Interchangeability between the various types of Dryseal Standard and SAE SHORT threads is given in table VIII.3. Interchangeability between the PTF–SAE SHORT, External thread and Dryseal special threads, PTF-SPL SHORT and PTF-SPL EXTRA SHORT, is given in table 7.9, p. 109.

Table VIII.5.—*Basic dimensions of Dryseal SAE Short External taper pipe thread, PTF–SAE SHORT, External* [a]



Size	Pitch, p	Pitch diameter at end of external thread, E_0 short	L_1		Hand engagement, L_1 short		External [b] basic full thread length, L_2 short		Vanish thds, V, plus full thd toler plus shoulder clearance, ($V+3p/2$)		Minimum shoulder length, (L_2 short $+2\frac{1}{2}p$)	External thread for draw, (L_2 short $-L_1$ short)		Internal [c] basic full thread length, (L_1 short $+4p$)	
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
	in.	*in.*	*in.*	*thds*	*in.*	*thds*	*in.*	*thds*	*in.*	*thds*	*in.*	*in.*	*thds*	*in.*	*thds*
1/16—27	0.03704	0.27349	0.160	4.32	0.1230	3.32	0.2241	6.05	0.0926	2.50	0.3167	0.1011	2.73	0.2711	7.32
1/8—27	.03704	.36582	.1615	4.36	.1244	3.36	.2268	6.12	.0926	2.50	.3194	.1024	2.76	.2726	7.36
1/4—18	.05556	.48086	.2278	4.10	.1722	3.10	.3462	6.23	.1389	2.50	.4851	.1740	3.13	.3945	7.10
3/8—18	.05556	.61548	.240	4.32	.1844	3.32	.3522	6.34	.1389	2.50	.4911	.1678	3.02	.4067	7.32
1/2—14	.07143	.76289	.320	4.48	.2486	3.48	.4623	6.47	.1786	2.50	.6409	.2137	2.99	.5343	7.48
3/4—14	.07143	.97214	.339	4.75	.2676	3.75	.4743	6.64	.1786	2.50	.6528	.2067	2.89	.5533	7.75
1—11½	.08696	1.21906	.400	4.60	.3130	3.60	.5958	6.85	.2174	2.50	.8132	.2828	3.25	.6609	7.60
1¼—11½	.08696	1.56256	.420	4.83	.3330	3.83	.6198	7.13	.2174	2.50	.8372	.2868	3.30	.6809	7.83
1½—11½	.08696	1.80152	.420	4.83	.3330	3.83	.6365	7.32	.2174	2.50	.8539	.3035	3.49	.6809	7.83
2—11½	.08696	2.27445	.436	5.01	.3490	4.01	.6695	7.70	.2174	2.50	.8869	.3205	3.69	.6969	8.01
2½—8	.12500	2.72734	.682	5.46	.5570	4.46	1.0125	8.10	.3125	2.50	1.3250	.4555	3.64	1.0570	8.46
3—8	.12500	3.34844	.766	6.13	.6410	5.13	1.0750	8.60	.3125	2.50	1.3875	.4340	3.47	1.1410	9.13

[a] See general specifications preceding tables and table VIII.3. For drilled hole sizes see appendix 7, p. 104.

[b] Tabulated external basic full thread lengths include chamfers not exceeding one pitch (thread) length. Design size full thread length should equal the external basic full thread length plus one pitch.

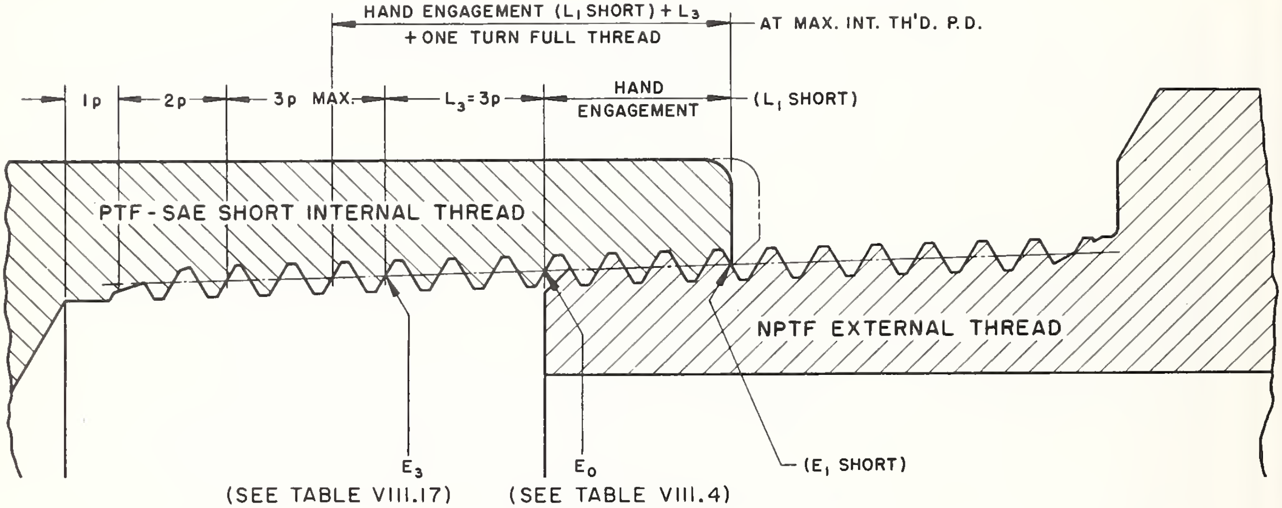
[c] Tabulated internal basic full thread lengths do not include countersink beyond the intersection of the pitch line and the chamfer cone (gaging reference point). Design size full thread length should equal the internal basic full thread length plus one pitch.

5. SPECIFICATIONS FOR TYPE 2, DRYSEAL TAPER PIPE THREAD, PTF-SAE SHORT, INTERNAL

Internal threads of this series conform in all respects with NPTF threads except that the full thread length has been shortened by eliminating one thread at the large end.

Dimensional data for these threads are given in table VIII.6. Interchangeability between the various types of Dryseal standard and SAE SHORT threads is given in table VIII.3. Interchangeability between the PTF-SAE SHORT, Internal thread and Dryseal special threads, PTF-SPL SHORT and PTF-SPL EXTRA SHORT, is given in table 7.9, p. 109.

Table VIII.6.—*Basic dimensions of Dryseal SAE Short Internal taper pipe thread, PTF-SAE SHORT, Internal* [a]



Size	Pitch, p	Pitch diameter at end of int thread, E_1 short	L_1		Hand engagement, L_1 short		Internal basic [b] full thread length, (L_1 short $+L_3$)		Hole depth for SAE short tap
1	2	3	4	5	6	7	8	9	10
	in.	*in.*	*in.*	*thds*	*in.*	*thds*	*in.*	*thds*	*in.*
1/16—27	0.03704	0.27887	0.160	4.32	0.1230	3.32	0.2341	6.32	0.4564
1/8—27	.03704	.37129	.1615	4.36	.1244	3.36	.2356	6.36	.4578
1/4—18	.05556	.48815	.2278	4.10	.1722	3.10	.3389	6.10	.6722
3/8—18	.05556	.62354	.240	4.32	.1844	3.32	.3511	6.32	.6844
1/2—14	.07143	.77397	.320	4.48	.2486	3.48	.4629	6.48	.8915
3/4—14	.07143	.98441	.339	4.75	.2676	3.75	.4819	6.75	.9105
1—11½	.08696	1.23320	.400	4.60	.3130	3.60	.5739	6.60	1.0956
1¼—11½	.08696	1.57795	.420	4.83	.3330	3.83	.5939	6.83	1.1156
1½—11½	.08696	1.81691	.420	4.83	.3330	3.83	.5939	6.83	1.1156
2—11½	.08696	2.29084	.436	5.01	.3490	4.01	.6099	7.01	1.1316
2½—8	.12500	2.75435	.682	5.46	.5570	4.46	.9320	7.46	1.6820
3—8	.12500	3.38069	.766	6.13	.6410	5.13	1.0160	8.13	1.7660

[a] See general specifications preceding tables and table VIII. 3. For drilled hole sizes see appendix 7, p. 104.

[b] Tabulated internal basic full thread lengths do not include countersink beyond the intersection of the pitch line and the chamfer cone (gaging reference point). Design size full thread length should equal the internal basic full thread length plus one pitch.

6. SPECIFICATIONS FOR TYPE 3, DRYSEAL FUEL INTERNAL STRAIGHT PIPE THREAD, NPSF

Threads of this series are straight (cylindrical) instead of tapered. They are generally used in soft or ductile materials which will adjust at assembly to the taper of external threads but may also be used in hard or brittle materials where the section is heavy.

Dimensional data for these threads are given in table VIII.7. Interchangeability between the various types of Dryseal standard and SAE SHORT threads is given in table VIII.3. Interchangeability between the NPSF thread and Dryseal special threads, PTF-SPL SHORT and PTF-SPL EXTRA SHORT, is given in table 7.9, p. 109.

Table VIII.7.—*Dryseal American Standard fuel internal straight pipe thread limits, NPSF* [a]

Size	Pitch diameter [b]		Minor [c] diameter	Design size [g] minimum length of full thread	
	Max [d,e]	Min [e,f]	Min		
1	2	3	4	5	6
	in.	*in.*	*in.*	*in.*	*thds.*
1/16—27	0.2803	0.2768	0.2482	5/16	8.44
1/8—27	.3727	.3692	.3406	5/16	8.44
1/4—18	.4904	.4852	.4422	15/32	8.44
3/8—18	.6257	.6205	.5776	1/2	9.00
1/2—14	.7767	.7700	.7133	21/32	9.19
3/4—14	.9872	.9805	.9238	21/32	9.19
1—11½	1.2365	1.2284	1.1600	25/32	8.98

[a] See general specifications preceding the tables and table VIII.3. For drilled hole sizes see appendix 7, p. 104.
[b] The pitch diameter of the tapped hole as indicated by the taper plug gage is slightly larger than the values given due to the gage having to enter approximately 3/8 turn to engage first full thread.
[c] As the Dryseal American Standard pipe thread form is maintained, the major and minor diameters of the internal thread vary with the pitch diameter.
[d] Col. 2 is the same as the E_1 pitch diameter of thread at large end of internal thread (table VIII.4) minus (small) 3/8 thread taper.
[e] Taps that produce tapped holes to the above limits in cast iron, steel, and brass will produce tapped holes approximately 0.001 in. smaller in zinc and similar soft metals. Plug-gage turns engagement should be reduced accordingly.
[f] Column 3 is column 2 reduced by 1½ turns.
[g] Tabulated internal full thread lengths do not include countersink beyond the intersection of the pitch line and the chamfer cone (gaging reference point).

7. SPECIFICATIONS FOR TYPE 4, DRYSEAL INTERMEDIATE INTERNAL STRAIGHT PIPE THREAD, NPSI

Threads of this series are straight (cylindrical) instead of tapered. They are generally used in hard or brittle materials where the section is heavy and where there is little expansion at assembly with the external taper threads.

Dimensional data for these threads are given in table VIII.8. Interchangeability between the various types of Dryseal threads is given in table VIII.3. Interchangeability between the NPSI thread and Dryseal special threads, PTF-SPL SHORT and PTF-SPL EXTRA SHORT is given in table 7.9, p. 109.

Table VIII.8.—*Dryseal American Standard intermediate internal straight pipe thread limits, NPSI* [a]

Size	Pitch diameter [b]		Minor [c] diameter	Design size [g] minimum length of full thread	
	Max [d,e]	Min [e,f]	Min		
1	2	3	4	5	6
	in.	*in.*	*in.*	*in.*	*thds.*
1/16—27	0.2826	0.2791	0.2505	5/16	8.44
1/8—27	.3750	.3715	.3429	5/16	8.44
1/4—18	.4938	.4886	.4457	15/32	8.44
3/8—18	.6292	.6240	.5811	1/2	9.00
1/2—14	.7812	.7745	.7180	21/32	9.19
3/4—14	.9917	.9850	.9283	21/32	9.19
1—11½	1.2420	1.2338	1.1655	25/32	8.98

[a] See general specifications preceding tables and table VIII.3. For drilled hole sizes see appendix 7, p. 104.
[b] The pitch diameter of the tapped hole as indicated by the taper plug gage is slightly larger than the values given due to the gage having to enter approximately 3/8 turn to engage first full thread.
[c] As the Dryseal American Standard pipe thread form is maintained, the major and minor diameters of the internal thread vary with the pitch diameter.
[d] Column 2 is the E_1 pitch diameter of thread at large end of internal thread (table VIII.4) plus (large) 5/8 thread taper.
[e] Taps that produce tapped holes to the above limits in cast iron, steel, and brass will produce tapped holes approximately 0.001 in. smaller in zinc and similar soft metals. Plug-gage turns engagement should be reduced accordingly.
[f] Column 3 is column 2 reduced by 1½ turns.
[g] Internal thread tabulated full thread lengths do not include countersink beyond the intersection of the pitch line and the chamfer cone (gaging reference point).

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8. GAGES AND GAGE TOLERANCES

1. DESIGN OF GAGES.—Gages for Dryseal pipe threads should conform with the dimensions for the gages shown herein. The thread form shall conform to that specified in par. 2, p. 18 except that crests of the threads on the plug and ring gages shall be truncated $0.20p$ to $0.25p$. These truncations will be as shown in table VIII.9. The form of the root clearance for the gages is optional. Tolerances on dimensions other than truncation shall conform to those specified in table VIII.10.

2. RELATION OF LEAD AND ANGLE DEVIATIONS TO PITCH DIAMETER TOLERANCES OF GAGES.—When it is necessary to compute from measurements the decimal part of a turn that a gage varies from the basic dimensions, which is required for master and reference gages, tables VII.11 and VII.12, p. 16, should be used. Table VII.11 gives the corrections in diameter equivalents for angle deviations and table VII.12 gives the diameter equivalents for lead deviations. These values are always added to the pitch diameter in the case of external threads and subtracted in the case of internal threads regardless of whether or not the lead or angle deviations are plus or minus.

The diameter equivalents for lead and angle deviations plus the pitch diameter multiplied by 16 gives the longitudinal variation from basic at the gaging notch. This longitudinal variation divided by the pitch equals the decimal part of a turn that the gage varies from basic at the gaging notch.

3. GAGING OF DRYSEAL PIPE THREADS.—The three accepted methods of gaging Dryseal pipe threads with threaded plug and ring gages are:

(a) Position method of gaging with basic-notch gages,

(b) Limit method of gaging with step-limit gages, and

(c) Turns-engagement method of gaging with basic-notch or step-limit gages.

All methods of gaging external Dryseal threads involve the use of two ring thread gages, the (L_1) thin-ring thread gage for checking the virtual diameter over the hand engagement of (L_1) thread length and the (L_2) full ring gage for checking the virtual diameter over the remainder of the full thread length and the taper over the full thread length.

All methods of gaging internal Dryseal threads involve the use of two plug thread gages, the (L_1) plug thread gage for checking the virtual diameter over the hand engagement or (L_1) thread length and the (L_3) plug thread gage for checking virtual

TABLE VIII.9.—*Crest truncation of threads of Dryseal pipe thread gages*

Threads per inch	Truncation	
	Max	Min
1	2	3
	in.	*in.*
27	0.0093	0.0074
18	.0139	.0111
14	.0179	.0143
11½	.0217	.0174
8	.0312	.0250

Table VIII.10.—*Tolerances for reference and inspection (working) plug and ring gages, NPTF*

Nominal pipe size	Threads per inch	Tolerance on pitch diameter [a]	Tolerance on lead [b,d]		Tolerance on half angle [c]		Tolerance on taper [d,e]		Tolerance on major diameter [f]	Tolerance on minor diameter [g]	Total cumulative tolerances on pitch diameter		Standoff between plug and ring gages at gaging notch for dimensions at opposite extreme tolerance limits [h]
			Plugs	Rings	Plugs	Rings	Plugs	Rings	Plugs	Rings	Plugs	Rings	
1	2	3	4	5	6	7	8	9	10	11	12	13	14
in.		*in.* ±	*in.*	*in.*	*min* ±	*min* ±	*in.* +	*in.* −	*in.* −	*in.* +	*in.*	*in.*	*in.*
1/16	27	0.0002	0.0002	0.0003	15	20	0.0003	0.0006	0.0004	0.0004	0.00080	0.00118	0.032
1/8	27	.0002	.0002	.0003	15	20	.0003	.0006	.0004	.0004	.00080	.00118	.032
1/4	18	.0002	.0002	.0003	15	20	.0004	.0007	.0006	.0006	.00092	.00134	.036
3/8	18	.0002	.0002	.0003	15	20	.0004	.0007	.0006	.0006	.00092	.00134	.036
1/2	14	.0003	.0002	.0003	10	15	.0006	.0009	.0010	.0010	.00097	.00142	.038
3/4	14	.0003	.0002	.0003	10	15	.0006	.0009	.0010	.0010	.00097	.00142	.038
1	11½	.0003	.0003	.0004	10	15	.0008	.0012	.0010	.0010	.00121	.00170	.047
1¼	11½	.0003	.0003	.0004	10	15	.0008	.0012	.0010	.0010	.00121	.00170	.047
1½	11½	.0003	.0003	.0004	10	15	.0008	.0012	.0010	.0010	.00121	.00170	.047
2	11½	.0003	.0003	.0004	10	15	.0008	.0012	.0010	.0010	.00121	.00170	.047
2½	8	.0005	.0004	.0005	7	10	.0010	.0014	.0016	.0016	.00158	.00211	.059
3	8	.0005	.0004	.0005	7	10	.0010	.0014	.0016	.0016	.00158	.00211	.059

[a] To be measured at the gaging notch of plug gage.
[b] Allowable variation in lead between any two threads in L_1 length of gage.
[c] In solving for the correction in diameter for angle deviations, the average deviation in half angle for the two sides of thread regardless of their signs should be taken.
[d] The lead and taper on plug and ring gages shall be measured along the pitch line, omitting the imperfect threads at each end.
[e] Allowable variation in taper in L_1 length of gage.
[f] Tolerance on major diameter of plug gage at gaging notch.
[g] Tolerance on minor diameter of ring gage at large end.
[h] Maximum possible interchange standoff, any ring against any plug other than its master plug, may occur when taper deviations are zero and all other dimensions are at opposite extreme tolerance limits. Average standoff should be well within these maximum limits.

Note.—The tolerances for the length L_1 from small end to gaging notch of the plug gage shall be +0.000 and −0.001 for sizes 1/16 to 2 in., inclusive, and +0.000 and −0.002 for sizes 2½ in. and larger. The tolerances for the overall thread length L_2 of the plug gage shall be +0.005 and −0.000 for sizes 1/16 to 2 in., inclusive, and +0.010 and −0.000 for sizes 2½ in. and larger. Tolerances for the thickness L_1 of the ring gage shall be −0.000 and +0.001 for sizes 1/16 to 2 in., incl., and −0.000 and +0.002 for sizes 2½ in. and larger.

diameter of the thread beyond the hand engagement length and taper over the full thread length.

As indicated in the separate descriptions of the various gaging methods, coordination of the two ring thread gages for external threads and coordination of the two plug thread gages for internal threads control and check thread taper and length. The gages cannot be correlated, however, for external threads of minimum virtual diameter or internal threads of maximum virtual diameter unless the design size full thread length of the threads is one thread longer than basic full thread length.

Inspection (working) gages should not be used if worn beyond the basic dimensions by more than ½ turn (thread). It is recommended that the standoff from the reference gage be determined for each inspection (working) gage and that values be taken into consideration when the gage is used. All gages for Dryseal threads should be kept under careful surveillance and the standoff value revised as the gage wears.

The threads of tools and the threads of a percentage of the product or casts in the case of internal threads should be projected as a check on thread form and truncation. Although projection is strongly recommended, the truncation at major diameter of internal thread and minor diameter of external thread may be checked respectively with special plug and ring gages with thread angle reduced to clear the flank of the threads; and the truncation at minor diameter of internal taper thread and major diameter of external taper thread may be checked respectively with plain taper plug gages and plain taper ring gages. Internal straight thread truncation at minor diameter may be checked with plain plug gages.

(a) *Position method of gaging with basic-notch gages.*—The position method of gaging Dryseal threads with plug thread and ring thread gages is a visual check of the position of the gages in relation to the product. It involves estimating the position of a notch or step on the thread gages in relation to the gaging point of the product within the allowable tolerance.

While the method is the same as that used for years past in checking conventional pipe threads without the Dryseal feature, the gages are different with respect to truncation of threads, the crests of the threads at the minor diameter of the ring gages and the major diameter of the plug gages being truncated to a greater extent to clear the increased truncation of the product thread. Another distinction is that the Dryseal (L_2) ring is counterbored larger than the thread diameter at the small end, a distance equal to the (L_1) thread length minus one pitch. Conventional rings and plugs, however, may be converted to Dryseal by grinding the crests to conform with the width of flats specified for Dryseal gages, and grinding a counterbore in the (L_2) ring gage.

The gages are turned or screwed handtight into or onto the threaded product, the position of the gage notch in relation to the product reference point being noted to determine whether the standoff exceeds the allowable tolerance. Allowance must be made for excessive chamfer at the small

TABLE VIII.11.—*Position method of gaging Dryseal pipe threads with basic-notch gages*

Thread to be gaged	Gaged with—		Gaging applicable to—	Threads are within the allowable tolerance when the product reference point is flush with the gage reference point within the following tolerances:	
1	2	3	4	5	6
Dryseal [a] NPTF, external	NPTF (L_1) and NPTF (L_2) basic-notch Dryseal ring thread gages	Table VIII.15	All sizes	Plus (small) 1 turn	Minus (large) 1 turn
Dryseal [a] PTF-SAE SHORT, external			All sizes	Plus (small) 0 turn	Minus (large) 1½ turns
				Threads are within the allowable tolerance when the product reference point is flush with the gage notch within the following tolerances:	
DRYSEAL [b] NPTF, internal	NPTF (L_1) basic-notch Dryseal plug thread gage and NPTF (L_3) basic-notch Dryseal plug thread gage	Table VIII.16 and Table VIII.17	All sizes	Plus (large) 1 turn	Minus (small) 1 turn
DRYSEAL [b] PTF-SAE SHORT, internal			All sizes	Plus (large) 0 turn	Minus (small) 1½ turns
DRYSEAL [c] NPSF, internal	NPTF (L_1) basic-notch Dryseal plug thread gage	Table VIII.16	All sizes	Plus (large) 0 turn	Minus (small) 1½ turns
DRYSEAL [c] NPSI, internal			All sizes	Plus (large) 1 turn	Minus (small) ½ turn

[a] As a check on taper, the (L_1) and (L_2) ring thread gages shall gage the same within ½ turn.
[b] As a check on taper, the (L_1) and (L_3) plug gages shall gage the same with relation to their respective notches within ½ turn.
[c] As depth is gaged without regard to gage notches, any of the (L_3) Dryseal plug thread gages may be used to check the full thread length of internal straight pipe threads.

end of the external threads and the large end of internal threads, the product reference point in the first instance being the beginning of the first thread on the chamfer, and in the second instance being the intersection of the pitch cone and the chamfer cone, i.e., approximately ½ pitch below the point of last scratch on chamfer cone (see fig. VIII.2).

See table VIII.11 for the gages to be used on the various types of Dryseal threads and for the gaging tolerances to be applied.

(*b*) *Limit method of gaging with step-limit gages.*—The limit method of gaging Dryseal pipe threads with step-limit plug thread and ring thread gages is a visual check of the position of the gages in relation to the product. Plug and ring gages with maximum and minimum limit notches are provided for the different thread types. The location of the limit notches on the ⅛ and ¼ in. plugs eliminates the necessity for gaging correction.

TABLE VIII.12.—*Limit method of gaging Dryseal pipe threads with step-limit gages*

Thread to be gaged	Gaged with:		Remarks
1	2	3	4
DRYSEAL [a] NPTF, external	NPTF (L_1) step-limit Dryseal ring thread gage and NPTF (L_2) step-limit Dryseal ring thread gage	Table VIII.18 Table VIII.19	Threads are within the allowable tolerance when the product reference point is on or between the limit notches.
DRYSEAL [a] PTF-SAE SHORT, external	PTF-SAE (L_1 Short) step-limit Dryseal ring thread gage and PTF-SAE (L_2 Short) step-limit Dryseal ring thread gage	Table VIII.22 Table VIII.23	
DRYSEAL [a] NPTF, internal	NPTF (L_1) step-limit Dryseal plug thread gage and NPTF (L_3) step-limit Dryseal plug thread gage	Table VIII.20 Table VIII.21	
DRYSEAL [a] PTF-SAE SHORT, internal	PTF-SAE (L_1 Short) step-limit Dryseal plug thread gage and PTF-SAE (L_3 Short) step-limit Dryseal plug thread gage	Table VIII.24 Table VIII.25	
DRYSEAL [b] NPSF, internal	NPSF (L_1 Short) step-limit Dryseal plug thread gage	Table VIII.24	
DRYSEAL [b] NPSI, internal	NPSI (L_1) step-limit Dryseal plug thread gage	Table VIII.26	

[a] As a check on taper, the gages shall gage the same with relation to their respective notches within ½ turn.
[b] As depth is gaged without regard to limit notches, any of the (L_3) Dryseal plug thread gages may be used to check the full thread length of internal straight pipe threads.

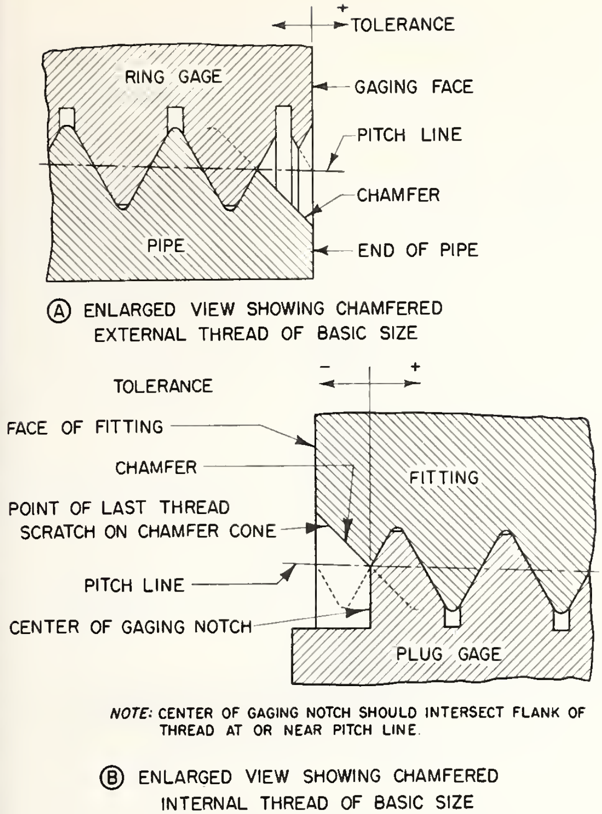


FIGURE VIII.2.—*Gaging of chamfered threads* (see pars. 3(a) and 3(b), pp. 27 and 28).

NOTE—The chamfer illustrated is at 45° angle and is ½ pitch in depth. However, these details are not requirements and are given only for information on the illustration shown. The chamfered portion of thread, and the full chamfer cone, are indicated by dotted lines.

The gages are turned or screwed handtight into or onto the threaded product, the position of the product reference point in relation to the limit notches on the gage being noted. Allowance must be made for excessive chamfer at the small end of external threads and the large end of internal threads, the product reference point in the first instance being the beginning of the first thread on the chamfer, and in the second instance being the intersection of the pitch diameter cone and the chamfer cone, i.e., approximately ½ pitch below the point of last scratch on chamfer cone (see fig. VIII.2).

See table VIII.12 for the gages to be used on the various types of Dryseal threads and for the gaging tolerances to be applied.

(c) *Turns-engagement method of gaging with basic-notch or step-limit gages.*—The turns-engagement method of gaging threaded products with plug thread and ring thread gages is a tactile check of the position of the gages in relation to the product. In checking by this method, either the basic-notch or the step-limit gages may be used. The gages are turned or screwed into or onto the threaded product and the turns to remove the gages are counted. This method compensates for gage chamfer and eliminates the variable of product chamfer.

The basic turns engagement of the (L_1) ring thread gages (tables VIII.15, VIII.18, and VIII.22) with Dryseal external taper pipe threads is the product of the (L_1) thread length of the ring gage used and the threads per inch, minus one turn to compensate for chamfer of the external threads and chamfer of the ring gages. Values for basic turns engagement are shown in table VIII.13.

The basic turns engagement of the (L_2) ring thread gages (tables VIII.15, VIII.19, and VIII.23) with Dryseal external taper pipe threads is the product of the (L_2) thread length and the threads per inch, minus 1¼ turns to compensate for chamfer of the external threads and the chamfer and taper of the ring gages. Values for basic turns engagement are shown in table VIII.13.

The basic turns engagement of the (L_1) plug thread gages (tables VIII.16, VIII.20, VIII.24, and VIII.26) with Dryseal internal pipe threads is the product of the (L_1) thread length (table VIII.4) and the threads per inch, minus ½ turn to compensate for chamfer on plug gages. Values for basic turns engagement are shown in table VIII.13.

The basic turns engagement of the (L_3) plug thread gages (tables VIII.17, VIII.21, and VIII.25) with Dryseal internal pipe threads is the (L_1) thread length (table VIII.4) plus three threads, multiplied by the threads per inch, minus ¾ turn to compensate for chamfer and taper on plug gages. Values for basic turns engagement are shown in table VIII.13.

See table VIII.14 for the gages to be used on the various types of Dryseal threads and for the gaging tolerances to be applied.

4. MARKING OF GAGES.—Gages shall be marked as shown in the following examples:

Basic-notch ⅛—27 DRYSEAL NPTF(L_1)
Step-limit 1—11½ DRYSEAL PTF–SAE SHORT (L_1 Short)

Tables VIII.15, VIII.16, and VIII.17 cover basic-notch gages. Tables VIII.18 through VIII.26 cover step-limit gages. The last part of the gage marking is specified on tables VIII.15 through VIII.26.

TABLE VIII.13.—*Basic turns engagement*

Size	Basic turns engagement of gages				
	L_1 Rings		All L_2 rings, tables VIII.15, VIII.19, and VIII.23	All L_1 plugs, tables VIII.16, VIII.20, VIII.24, and VIII.26	All L_3 plugs, tables VIII.17, VIII.21, and VIII.25
	Basic-notch, table VIII.15	Step-limit, tables VIII.18, and VIII.22			
1/16—27	3.32	3.32	5.80	3.82	6.57
1/8—27	3.36	3.36	5.87	3.86	6.61
1/4—18	3.10	3.10	5.98	3.60	6.35
3/8—18	3.32	3.32	6.09	3.82	6.57
1/2—14	3.48	3.48	6.22	3.98	6.73
3/4—14	3.75	3.75	6.39	4.25	7.00
1—11½	3.60	3.60	6.60	4.10	6.85
1¼—11½	3.83	3.83	6.88	4.33	7.08
1½—11½	3.83	3.83	7.07	4.33	7.08
2—11½	4.01	4.01	7.45	4.51	7.26
2½—8	4.46	4.46	7.85	4.96	7.71
3—8	5.13	5.13	8.35	5.63	8.38

TABLE VIII.14.—*Turns-engagement method of gaging Dryseal pipe threads with basic-notch or step-limit gages*

Thread to be gaged	Gaged with:		Nominal [a] turns engagement equals:	Tolerance:	
1	2	3	4	5	6
DRYSEAL [b] NPTF, external	Any combination of (L_1) and (L_2) Dryseal ring thread gages	Tables VIII.15 VIII.18 VIII.19 VIII.22 VIII.23	Basic turns engagement	Plus (small) 1 turn	Minus (large) 1 turn
DRYSEAL [b] PTF-SAE SHORT, external			One turn less than basic turns engagement	Plus (small) 1 turn	Minus (large) ½ turn
DRYSEAL [c] NPTF, internal	Any combination of (L_1) and (L_3) Dryseal plug thread gages	VIII.16 VIII.17 VIII.20 VIII.21 VIII.24 VIII.25 VIII.26	Basic turns engagement	Plus (large) 1 turn	Minus (small) 1 turn
DRYSEAL [c] PTF-SAE SHORT, internal			One turn less than basic turns engagement	Plus (large) 1 turn	Minus (small) ½ turn
DRYSEAL [d] NPSF, internal	Any of the (L_1) Dryseal plug thread gages	VIII.16 VIII.20 VIII.24 VIII.26	One turn less than basic turns engagement	Plus (large) 1 turn	Minus (small) ½ turn
DRYSEAL [d] NPSI, internal			Basic turns engagement	Plus (large) 1 turn	Minus (small) ½ turn

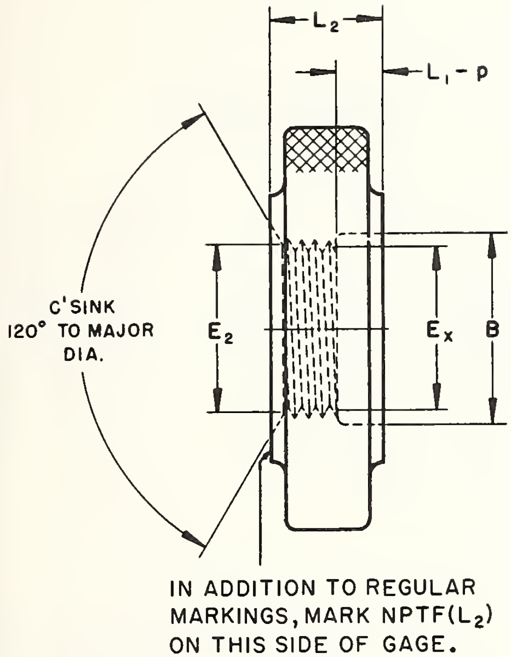
[a] See table VIII.13 for basic turns engagement.

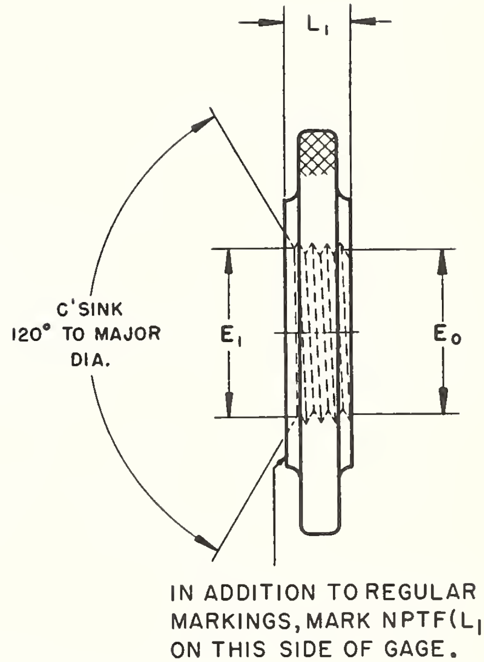
[b] As a check on taper, the difference in turns engagement of the (L_1) and (L_2) Dryseal ring thread gages shall be within ½ turn of the difference between the basic turns engagement of the ring thread gages.

[c] As a check on taper, the difference in turns engagement of the (L_1) and (L_3) Dryseal plug thread gages shall not be less than 2¼ turns nor more than 3¼ turns.

[d] As depth is gaged without regard to limit notches, any of the (L_3) Dryseal plug thread gages may be used to check the full thread length of internal straight pipe threads.

TABLE VIII.15.—*Basic dimensions of Dryseal American Standard taper pipe thread (L_1 and L_2) basic-notch ring gages, NPTF*



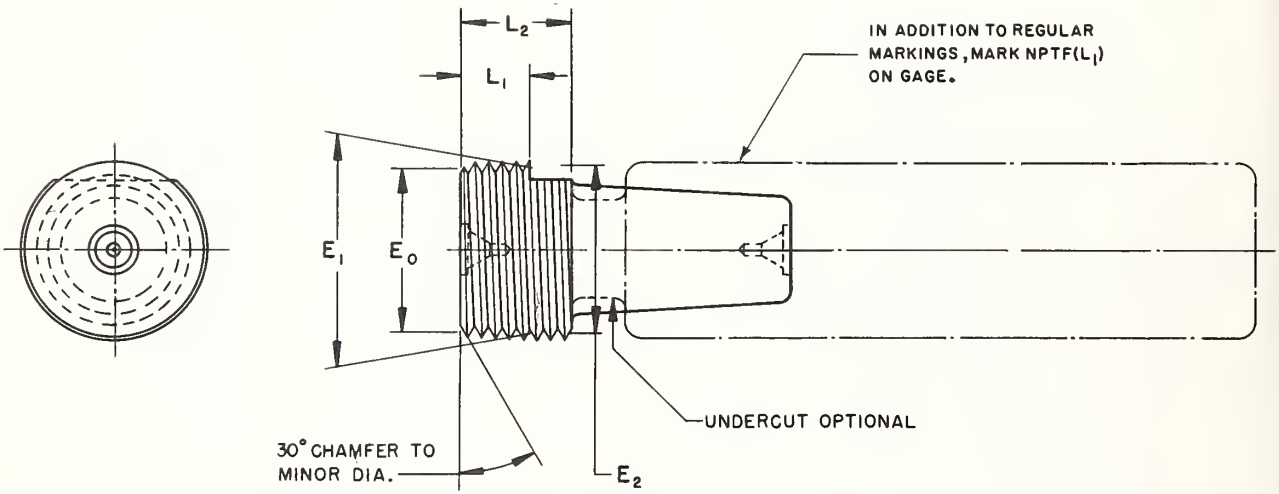


Size	(L_2) basic-notch full-ring gages							(L_1) basic-notch thin-ring gages				
	L_2	Pitch diameter, E_2	Minor [a] diameter at large end	Pitch diameter at L_1-p, E_x	Minor [a] diameter at L_1-p	L_1-p	C'bore diameter, B	L_1	Pitch diameter, E_1	Minor [a] diameter at large end	Pitch diameter, E_0	Minor [a] diameter at small end
1	2	3	4	5	6	7	8	9	10	11	12	13
	in.	*in.*	*in.*	*in.*	*in.*	*in.*	*in.*	*in.*	*in.*	*in.*	*in.*	*in.*
1/16—27	0.26113	0.28750	0.27024	0.27886	0.26160	0.12296	3/8	0.1600	0.28118	0.26392	0.27118	0.25392
1/8—27	.26385	.38000	.36274	[b].37129	[b].35403	[b].12446	15/32	[b].1615	[b].37360	[b].35634	.36351	.34625
1/4—18	.40178	.50250	.47661	[b].48816	[b].46227	[b].17224	19/32	[b].2278	[b].49163	[b].46574	.47739	.45150
3/8—18	.40778	.63750	.61161	.62354	.59765	.18444	23/32	.2400	.62701	.60112	.61201	.58712
1/2—14	.53371	.79179	.75850	.77396	.74067	.24857	7/8	.3200	.77843	.74514	.75843	.72514
3/4—14	.54571	1.00179	.96850	.98440	.95111	.26757	1 3/32	.3390	.98887	.95558	.96768	.93439
1—11 1/2	.68278	1.25630	1.21577	1.23320	1.19267	.31304	1 11/32	.4000	1.23863	1.19810	1.21363	1.17310
1 1/4—11 1/2	.70678	1.60130	1.56077	1.57794	1.53741	.33304	1 11/16	.4200	1.58338	1.54285	1.55713	1.51660
1 1/2—11 1/2	.72348	1.84130	1.80077	1.81690	1.77637	.33304	1 15/16	.4200	1.82234	1.78181	1.79609	1.75556
2—11 1/2	.75652	2.31630	2.27577	2.29084	2.25031	.34904	2 1/2	.4360	2.29627	2.25574	2.26902	2.22849
2 1/2—8	1.13750	2.79062	2.73237	2.75434	2.69609	.55700	2 15/16	.6820	2.76216	2.70391	2.71953	2.66128
3—8	1.20000	3.41562	3.35737	3.38068	3.32243	.64100	3 9/16	.7660	3.38850	3.33025	3.34062	3.28237

[a] Minor diameter is based on crest minimum truncation of $0.20p$.

[b] This dimension has been revised. For the superseded dimension see subsection 9, appendix 7, p. 109.

TABLE VIII.16.—*Basic dimensions of Dryseal American Standard taper pipe thread (L_1) basic-notch plug gages, NPTF*

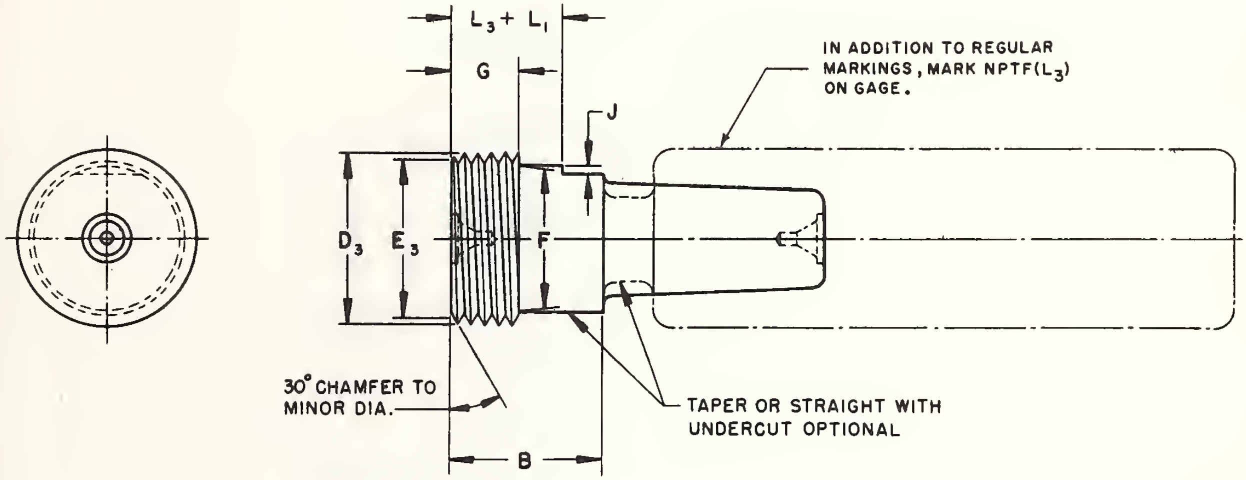


Size	L_1	L_2	Small end		Gaging notch		Large end	
			Pitch diameter, E_0	Major diameter [a]	Pitch diameter, E_1	Major diameter [a]	Pitch diameter, E_2	Major diameter [a]
1	2	3	4	5	6	7	8	9
	in.	*in.*	*in.*	*in.*	*in.*	*in.*	*in.*	*in.*
1/16—27	0. 1600	0. 26113	0. 27118	0. 28844	0. 28118	0. 29844	0. 28750	0. 30476
1/8—27	[b]. 1615	. 26385	. 36351	. 38077	[b]. 37360	[b]. 39086	. 38000	. 39726
1/4—18	[b]. 2278	. 40178	. 47739	. 50328	[b]. 49163	[b]. 51752	. 50250	. 52839
3/8—18	. 2400	. 40778	. 61201	. 63790	. 62701	. 65290	. 63750	. 66339
1/2—14	. 3200	. 53371	. 75843	. 79170	. 77843	. 81170	. 79179	. 82506
3/4—14	. 3390	. 54571	. 96768	1. 00095	. 98887	1. 02214	1. 00179	1. 03506
1—11½	. 4000	. 68278	1. 21363	1. 25416	1. 23863	1. 27916	1. 25630	1. 29683
1¼—11½	. 4200	. 70678	1. 55713	1. 59766	1. 58338	1. 62391	1. 60130	1. 64183
1½—11½	. 4200	. 72348	1. 79609	1. 83662	1. 82234	1. 86287	1. 84130	1. 88183
2—11½	. 4360	. 75652	2. 26902	2. 30955	2. 29627	2. 33680	2. 31630	2. 35683
2½—8	. 6820	1. 13750	2. 71953	2. 77778	2. 76216	2. 82041	2. 79062	2. 84887
3—8	. 7660	1. 20000	3. 34062	3. 39887	3. 38850	3. 44675	3. 41562	3. 47387

[a] Major diameter is based upon crest minimum truncation of 0.20p.

[b] This dimension has been revised. For the superseded dimension see subsection 9, appendix 7, p. 109.

Table VIII.17.—*Basic dimensions of Dryseal American Standard taper pipe thread (L_3) basic-notch plug gages, NPTF*

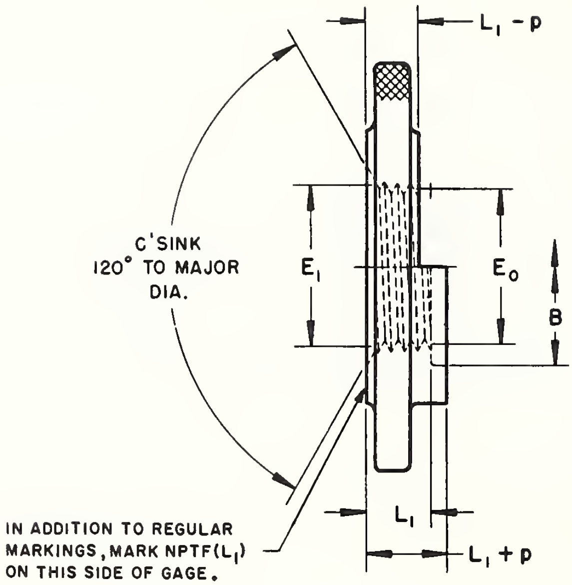


Size	Small end		Relief diameter (E_3+0.0625×4p−sharp-V thd hgt−0.020 to 0.025 below sharp root); F+0.005, −0.000	Four threads, G, (L_3+p)	Standard notch+3 threads, (L_3+L_1)	Blank length, B	Notch depth, J +0.005, −0.000
	Pitch diameter, E_3	Major[a] diameter, D_3					
1	2	3	4	5	6	7	8
	in.	*in.*	*in.*	*in.*	*in.*	*in.*	*in.*
1/16—27	0.2642	0.2815	0.216	0.1482	0.2711	3/8	0.030
1/8—27	.3566	.3738	.309	.1482	[b].2726	13/32	.030
1/4—18	.4670	.4928	.409	.2222	[b].3945	1/2	.030
3/8—18	.6016	.6275	.542	.2222	.4067	9/16	.030
1/2—14	.7451	.7783	.676	.2857	.5343	11/16	.040
3/4—14	.9543	.9876	.886	.2857	.5533	23/32	.040
1—11½	1.1973	1.2379	1.118	.3478	.6609	7/8	.050
1¼—11½	1.5408	1.5814	1.462	.3478	.6809	7/8	.050
1½—11½	1.7798	1.8203	1.701	.3478	.6809	7/8	.050
2—11½	2.2527	2.2932	2.174	.3478	.6969	7/8	.050
2½—8	2.6961	2.7543	2.590	.5000	1.0570	1½	.050
3—8	3.3172	3.3754	3.214	.5000	1.1410	1½	.050

[a] Major diameter is based upon crest minimum truncation of 0.20p.

[b] This dimension has been revised. For the superseded dimension see subsection 9, appendix 7, p. 109.

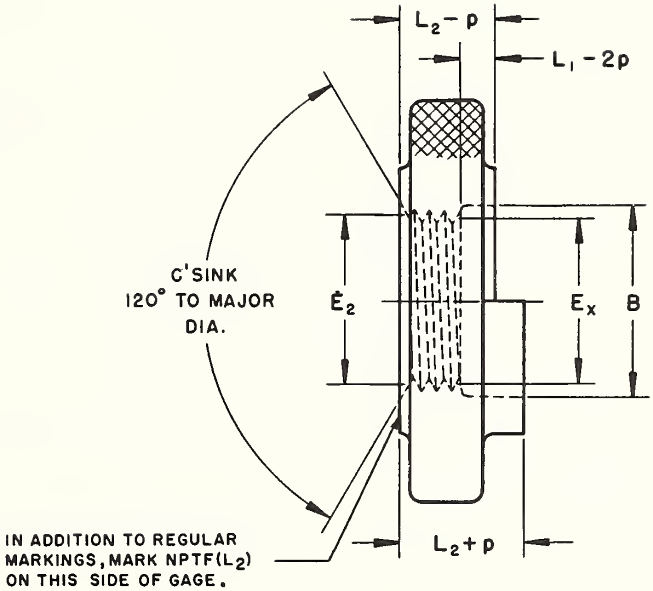
Table VIII.18.—*Basic dimensions of Dryseal American Standard taper pipe thread (L_1) step-limit thin ring gages, NPTF*



Size	(L_1) step-limit thin-ring gages							
	L_1	Max pitch diameter gaging step, L_1-p	Min pitch diameter gaging step, L_1+p	Pitch diameter, E_1	Minor diameter [a] at large end	Pitch diameter at small end c'bore, E_0	Minor diameter [a] at small end c'bore	C'bore diameter, B
1	2	3	4	5	6	7	8	9
	in.	*in.*	*in.*	*in.*	*in.*	*in.*	*in.*	*in.*
1/16—27	0.1600	0.12296	0.19704	0.28118	0.26392	0.27118	0.25392	3/8
1/8—27	.1615	.12446	.19854	.37360	.35634	.36351	.34625	15/32
1/4—18	.2278	.17224	.28336	.49163	.46574	.47739	.45150	19/32
3/8—18	.2400	.18444	.29556	.62701	.60112	.61201	.58712	23/32
1/2—14	.3200	.24857	.39143	.77843	.74514	.75843	.72514	7/8
3/4—14	.3390	.26757	.41043	.98887	.95558	.96768	.93439	1 3/32
1—11½	.4000	.31304	.48696	1.23863	1.19810	1.21363	1.17310	1 11/32
1¼—11½	.4200	.33304	.50696	1.58338	1.54285	1.55713	1.51660	1 11/16
1½—11½	.4200	.33304	.50696	1.82234	1.78181	1.79609	1.75556	1 15/16
2—11½	.4360	.34904	.52296	2.29627	2.25574	2.26902	2.22849	2½
2½—8	.6820	.55700	.80700	2.76216	2.70391	2.71953	2.66128	2 15/16
3—8	.7660	.64100	.89100	3.38850	3.33025	3.34062	3.28237	3 9/16

[a] Minor diameter is based on crest minimum truncation of $0.20p$.

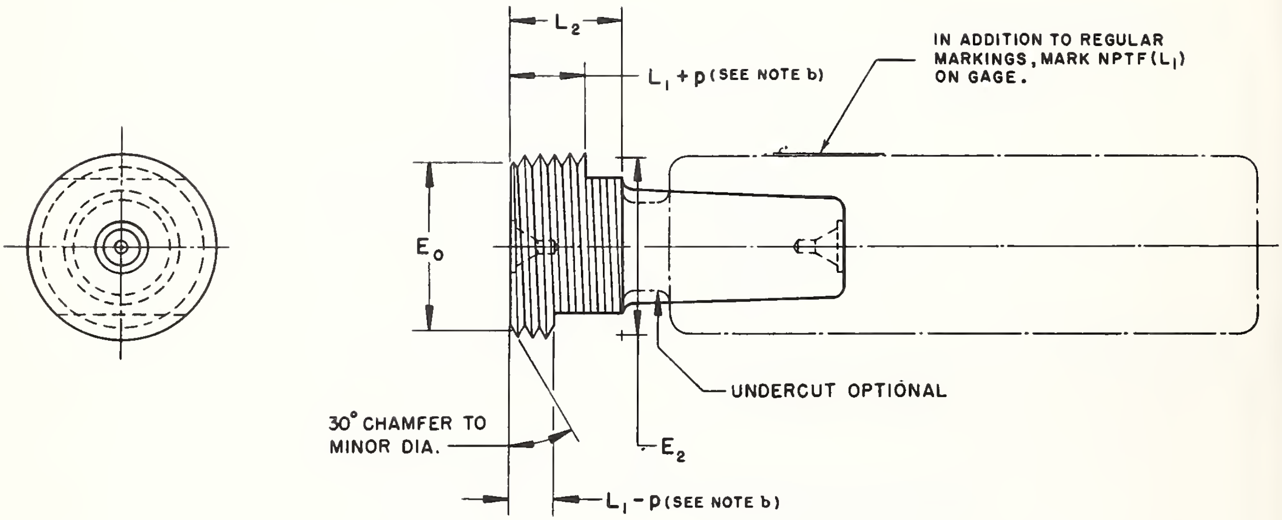
TABLE VIII.19.—*Basic dimensions of Dryseal American Standard taper pipe thread (L_2) step-limit full-ring gages, NPTF*



Size	(L_2) step-limit full-ring gages								
	L_2	Max pitch diameter gaging step, L_2-p	Min pitch diameter gaging step, L_2+p	Pitch diameter, E_2	Minor diameter [a] at large end	Pitch diameter at L_1 from min PD gaging step, E_x	Minor diameter [a] at small end c'bore	L_1-2p	C'bore diameter, B
1	2	3	4	5	6	7	8	9	10
	in.	*in.*	*in.*	*in.*	*in.*	*in.*	*in.*	*in.*	*in.*
1/16—27	0.26113	0.22409	0.29817	0.28750	0.27024	0.27886	0.26160	0.08592	3/8
1/8—27	.26385	.22681	.30089	.38000	.36274	.37129	.35403	.08742	15/32
1/4—18	.40178	.34622	.45734	.50250	.47661	.48816	.46227	.11668	19/32
3/8—18	.40778	.35222	.46334	.63750	.61161	.62354	.59765	.12888	23/32
1/2—14	.53371	.46228	.60514	.79179	.75850	.77396	.74067	.17714	7/8
3/4—14	.54571	.47428	.61714	1.00179	.96850	.98440	.95111	.19614	1 3/32
1—11 1/2	.68278	.59582	.76974	1.25630	1.21577	1.23320	1.19267	.22608	1 11/32
1 1/4—11 1/2	.70678	.61982	.79374	1.60130	1.56077	1.57794	1.53741	.24608	1 11/16
1 1/2—11 1/2	.72348	.63652	.81044	1.84130	1.80077	1.81690	1.77637	.24608	1 15/16
2—11 1/2	.75652	.66956	.84348	2.31630	2.27577	2.29084	2.25031	.26208	2 1/2
2 1/2—8	1.13750	1.01250	1.26250	2.79062	2.73237	2.75434	2.69609	.43200	2 15/16
3—8	1.20000	1.07500	1.32500	3.41562	3.35737	3.38068	3.32243	.51600	3 9/16

[a] Minor diameter is based on crest minimum truncation of 0.20p.

Table VIII.20.—*Basic dimensions of Dryseal American Standard taper pipe thread* (L_1) *step-limit plug gages, NPTF*

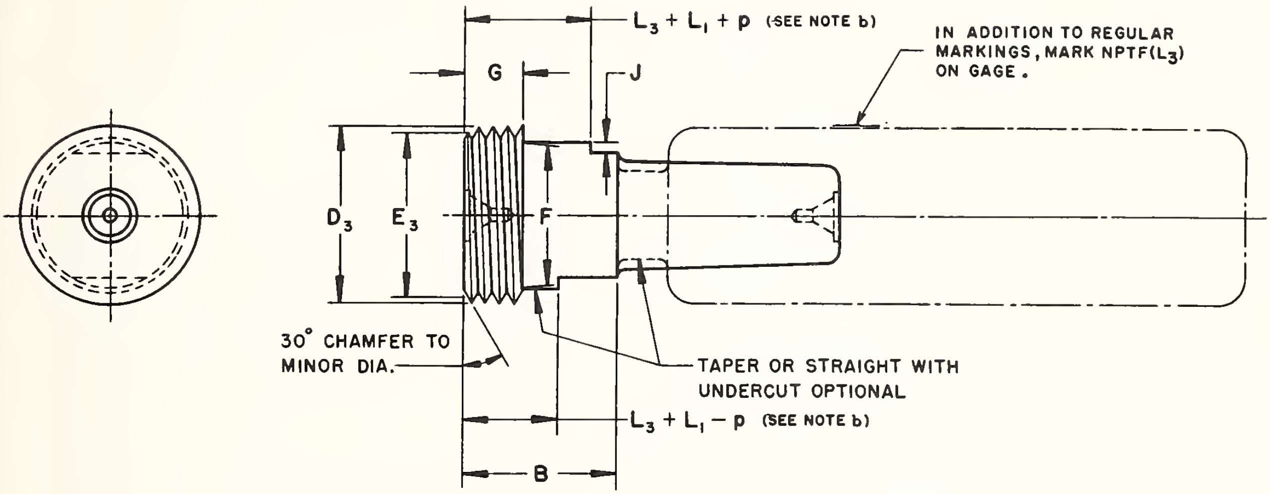


Size	L_1	L_2	Small end		Min PD gaging step		Max PD gaging step		Large end	
			Pitch diameter, E_0	Major [a] diameter	L_1-p	Pitch diameter	L_1+p	Pitch diameter	Pitch diameter, E_2	Major [a] diameter
1	2	3	4	5	6	7	8	9	10	11
	in.	*in.*	*in.*	*in.*	*in.*	*in.*	*in.*	*in.*	*in.*	*in.*
1/16—27	0. 1600	0. 26113	0. 27118	0. 28844	0. 12296	0. 27887	0. 19704	0. 28350	0. 28750	0. 30476
1/8—27	. 1615	. 26385	. 36351	. 38077	. 12446	. 37129	. 19854	. 37592	. 38000	. 39726
1/4—18	. 2278	. 40178	. 47739	. 50328	. 17224	. 48816	. 28336	. 49510	. 50250	. 52839
3/8—18	. 2400	. 40778	. 61201	. 63790	. 18444	. 62354	. 29556	. 63048	. 63750	. 66339
1/2—14	. 3200	. 53371	. 75843	. 79172	. 24857	. 77397	. 39143	. 78289	. 79179	. 82508
3/4—14	. 3390	. 54571	. 96768	1. 00097	. 26757	. 98441	. 41043	. 99333	1. 00179	1. 03508
1—11 1/2	. 4000	. 68278	1. 21363	1. 25416	. 31304	1. 23320	. 48696	1. 24406	1. 25630	1. 29683
1 1/4—11 1/2	. 4200	. 70678	1. 55713	1. 59766	. 33304	1. 57795	. 50696	1. 58882	1. 60130	1. 64183
1 1/2—11 1/2	. 4200	. 72348	1. 79609	1. 83662	. 33304	1. 81691	. 50696	1. 82778	1. 84130	1. 88183
2—11 1/2	. 4360	. 75652	2. 26902	2. 30955	. 34904	2. 29084	. 52296	2. 30170	2. 31630	2. 35683
2 1/2—8	. 6820	1. 13750	2. 71953	2. 77778	. 55700	2. 75435	. 80700	2. 76997	2. 79062	2. 84887
3—8	. 7660	1. 20000	3. 34062	3. 39887	. 64100	3. 38069	. 89100	3. 39631	3. 41562	3. 47387

[a] Major diameter is based upon crest minimum truncation of $0.20p$.

[b] Maximum and minimum pitch-diameter steps are gaging limits. Notch formulas on drawing apply to all sizes.

TABLE VIII.21.—*Basic dimensions of Dryseal American Standard taper pipe thread (L_3) step-limit plug gages, NPTF*

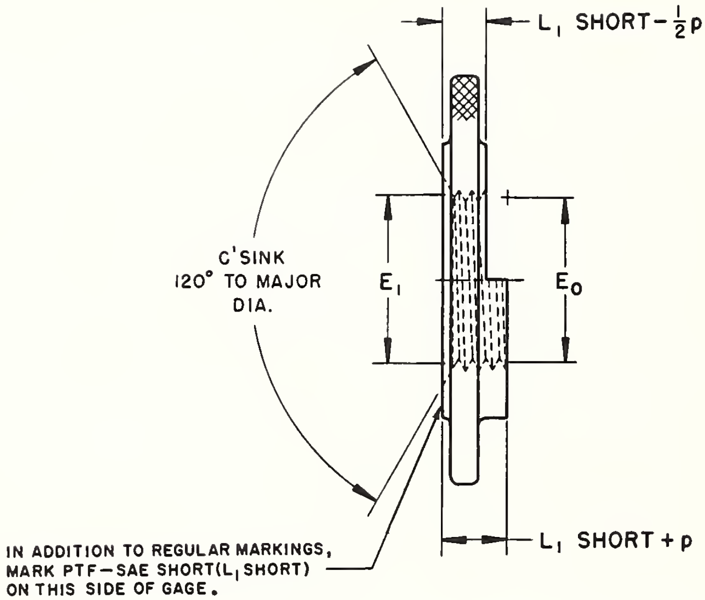


Size	Small end		Relief diameter (E_3+0.0625×4p−sharp-V thd hgt −0.020 to 0.025 below sharp root); F+0.005, −0.000	Four threads, G, (L_3+p)	Min pitch diameter gaging step+3 thds, (L_3+L_1−p)	Max pitch diameter gaging step+3 thds, (L_3+L_1+p)	Blank length, B	Notch depth, J +0.005, −0.000
	Pitch diameter, E_3	Major [a] diameter, D_3						
1	2	3	4	5	6	7	8	9
	in.	*in.*	*in.*	*in.*	*in.*	*in.*	*in.*	*in.*
1/16—27	0.2642	0.2815	0.216	0.1482	0.2341	0.3082	3/8	0.030
1/8—27	.3566	.3738	.309	.1482	.2356	.3097	13/32	.030
1/4—18	.4670	.4928	.409	.2222	.3389	.4500	1/2	.030
3/8—18	.6016	.6275	.542	.2222	.3511	.4622	9/16	.030
1/2—14	.7451	.7783	.676	.2857	.4628	.6057	11/16	.040
3/4—14	.9543	.9876	.886	.2857	.4818	.6247	23/32	.040
1—11½	1.1973	1.2379	1.118	.3478	.5739	.7478	7/8	.050
1¼—11½	1.5408	1.5814	1.462	.3478	.5939	.7678	7/8	.050
1½—11½	1.7798	1.8203	1.701	.3478	.5939	.7678	7/8	.050
2—11½	2.2527	2.2932	2.174	.3478	.6099	.7838	7/8	.050
2½—8	2.6961	2.7543	2.590	.5000	.9320	1.1820	1½	.050
3—8	3.3172	3.3754	3.214	.5000	1.0160	1.2660	1½	.050

[a] Major diameter is based on crest minimum truncation of 0.20p.

[b] Maximum and minimum pitch-diameter steps are gaging limits. Notch formulas on drawing apply to all sizes.

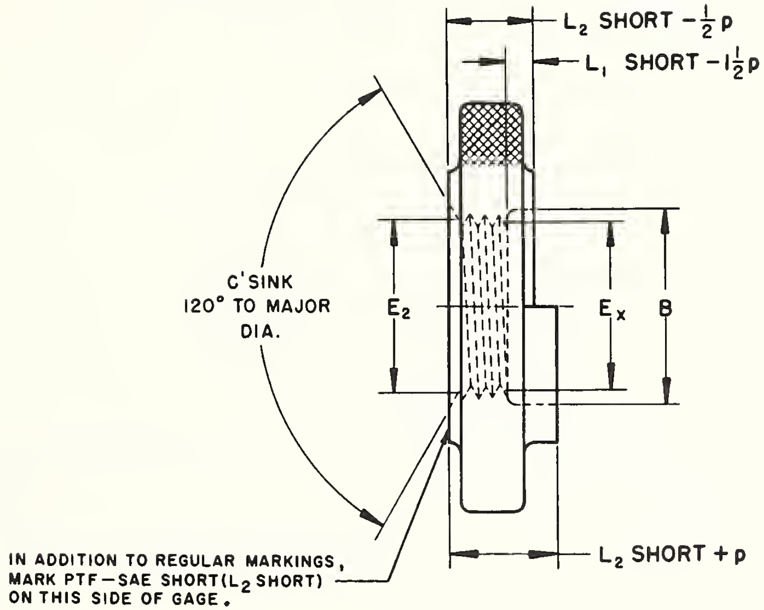
Table VIII.22.—*Basic dimensions of Dryseal SAE short taper pipe thread (L_1 short) step-limit thin-ring gages, PTF–SAE SHORT*



Size	(L_1 short) step-limit thin-ring gages						
	(L_1 short)	Max pitch diameter gaging step, (L_1 short−½p)	Min pitch diameter gaging step, (L_1 short+p)	Pitch diameter, E_1	Minor diameter [a] at large end	Pitch diameter at min pitch diameter gaging step, E_0	Minor diameter [a] at small end
1	2	3	4	5	6	7	8
	in.	*in.*	*in.*	*in.*	*in.*	*in.*	*in.*
1/16—27	0.12296	0.10444	0.1600	0.28118	0.26392	0.27118	0.25392
⅛—27	.12446	.10594	.1615	.37360	.35634	.36351	.34625
¼—18	.17224	.14446	.2278	.49163	.46574	.47739	.45150
⅜—18	.18444	.15666	.2400	.62701	.60112	.61201	.58712
½—14	.24857	.21286	.3200	.77843	.74514	.75843	.72514
¾—14	.26757	.23186	.3390	.98887	.95558	.96768	.93439
1—11½	.31304	.26956	.4000	1.23863	1.19810	1.21363	1.17310
1¼—11½	.33304	.28956	.4200	1.58338	1.54285	1.55713	1.51660
1½—11½	.33304	.28956	.4200	1.82234	1.78181	1.79609	1.75556
2—11½	.34904	.30556	.4360	2.29627	2.25574	2.26902	2.22849
2½—8	.55700	.49450	.6820	2.76216	2.70391	2.71953	2.66128
3—8	.64100	.57850	.7660	3.38850	3.33025	3.34062	3.28237

[a] Minor diameter is based on crest minimum truncation of $0.20p$.

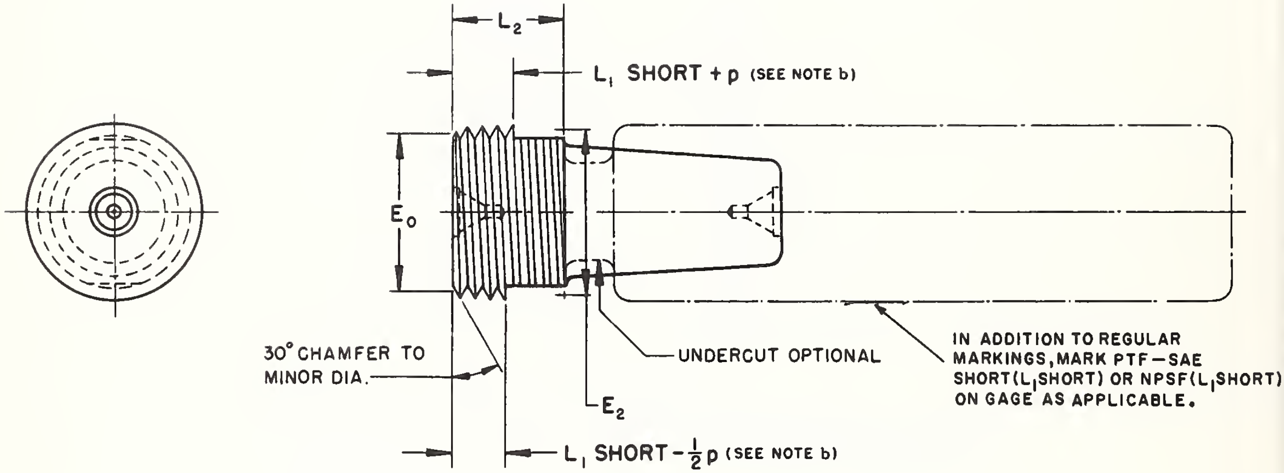
Table VIII.23.—*Basic dimensions of Dryseal SAE short taper pipe thread (L_2 short) step-limit full-ring gages, PTF–SAE SHORT*



Size	(L_2 short)	(L_2 short) step-limit full-ring gages							
		Max pitch diameter gaging step, (L_2 short−½p)	Min pitch diameter gaging step, (L_2 short+p)	Pitch diameter, E_2	Minor [a] diameter at large end	Pitch diameter at (L_1 short−3p/2) from min pitch diameter gaging step, E_x	Minor [a] diameter at small end of c'bore	(L_1 short−3p/2)	C'bore diameter, B
1	2	3	4	5	6	7	8	9	10
	in.	*in.*	*in.*	*in.*	*in.*	*in.*	*in.*	*in.*	*in.*
1/16—27	0. 2241	0. 20557	0. 26113	0. 28750	0. 27024	0. 27886	0. 26160	0. 06740	3/8
1/8—27	. 2268	. 20829	. 26385	. 38000	. 36274	. 37129	. 35403	. 06890	15/32
1/4—18	. 3462	. 31845	. 40178	. 50250	. 47661	. 48816	. 46227	. 08891	19/32
3/8—18	. 3522	. 32445	. 40778	. 63750	. 61161	. 62354	. 59765	. 10111	23/32
1/2—14	. 4623	. 42657	. 53371	. 79179	. 75850	. 77396	. 74067	. 14143	7/8
3/4—14	. 4743	. 43857	. 54571	1. 00179	. 96850	. 98440	. 95111	. 16043	1 3/32
1—11½	. 5958	. 55235	. 68278	1. 25630	1. 21577	1. 23320	1. 19267	. 18260	1 11/32
1¼—11½	. 6198	. 57635	. 70678	1. 60130	1. 56077	1. 57794	1. 53741	. 20260	1 11/16
1½—11½	. 6365	. 59305	. 72348	1. 84130	1. 80077	1. 81690	1. 77637	. 20260	1 15/16
2—11½	. 6695	. 62609	. 75652	2. 31630	2. 27577	2. 29084	2. 25031	. 21860	2½
2½—8	1. 0125	. 95000	1. 13750	2. 79062	2. 73237	2. 75434	2. 69609	. 36950	2 15/16
3—8	1. 0750	1. 01250	1. 20000	3. 41562	3. 35737	3. 38068	3. 32243	. 45350	3 9/16

[a] Minor diameter is based on crest minimum truncation of 0.20p.

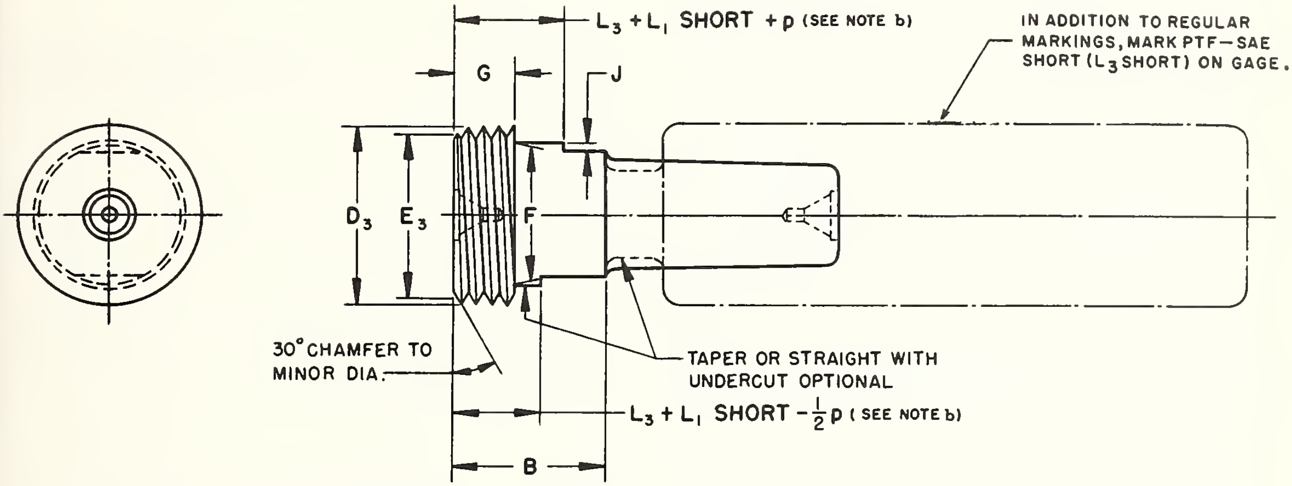
TABLE VIII. 24.—*Basic dimensions of Dryseal SAE short taper pipe thread and Dryseal American Standard fuel internal straight pipe thread (L_1 short) step-limit plug gages, PTF–SAE SHORT and NPSF*



Size	(L_1 Short)	L_2	Small end		Min PD gaging step		Max PD gaging step		Large end	
			Pitch diameter, E_0	Major diameter [a]	(L_1 Short $-\frac{1}{2}p$)	Pitch diameter	(L_1 Short $+p$)	Pitch diameter	Pitch diameter, E_2	Major diameter [a]
1	2	3	4	5	6	7	8	9	10	11
	in.	*in.*	*in.*	*in.*	*in.*	*in.*	*in.*	*in.*	*in.*	*in.*
1/16—27	0. 12296	0. 26113	0. 27118	0. 28844	0. 10444	0. 27771	0. 1600	0. 28118	0. 28750	0. 30476
1/8—27	. 12446	. 26385	. 36351	. 38077	. 10594	. 37013	. 1615	. 37360	. 38000	. 39726
1/4—18	. 17224	. 40178	. 47739	. 50328	. 14446	. 48642	. 2278	. 49163	. 50250	. 52839
3/8—18	. 18444	. 40778	. 61201	. 63790	. 15666	. 62180	. 2400	. 62701	. 63750	. 66339
1/2—14	. 24857	. 53371	. 75843	. 79170	. 21286	. 77174	. 3200	. 77843	. 79179	. 82506
3/4—14	. 26757	. 54571	. 96768	1. 00095	. 23186	. 98218	. 3390	. 98887	1. 00179	1. 03506
1—11½	. 31304	. 68278	1. 21363	1. 25416	. 26956	1. 23048	. 4000	1. 23863	1. 25630	1. 29683
1¼—11½ [c]	. 33304	. 70678	1. 55713	1. 59766	. 28956	1. 57523	. 4200	1. 58338	1. 60130	1. 64183
1½—11½ [c]	. 33304	. 72348	1. 79609	1. 83662	. 28956	1. 81419	. 4200	1. 82234	1. 84130	1. 88183
2—11½ [c]	. 34904	. 75652	2. 26902	2. 30955	. 30556	2. 28812	. 4360	2. 29627	2. 31630	2. 35683
2½—8 [c]	. 55700	1. 13750	2. 71953	2. 77778	. 49450	2. 75044	. 6820	2. 76216	2. 79062	2. 84887
3—8 [c]	. 64100	1. 20000	3. 34062	3. 39887	. 57850	3. 37678	. 7660	3. 38850	3. 41562	3. 47387

[a] Major diameter is based on crest minimum truncation of $0.20p$.
[b] Maximum and minimum pitch-diameter steps are gaging limits. Notch formulas on drawing apply to all sizes.
[c] For reference only above 1—11½ size.

Table VIII.25.—*Basic dimensions of Dryseal SAE short taper pipe thread (L_3 short) step-limit plug gages, PTF–SAE SHORT*

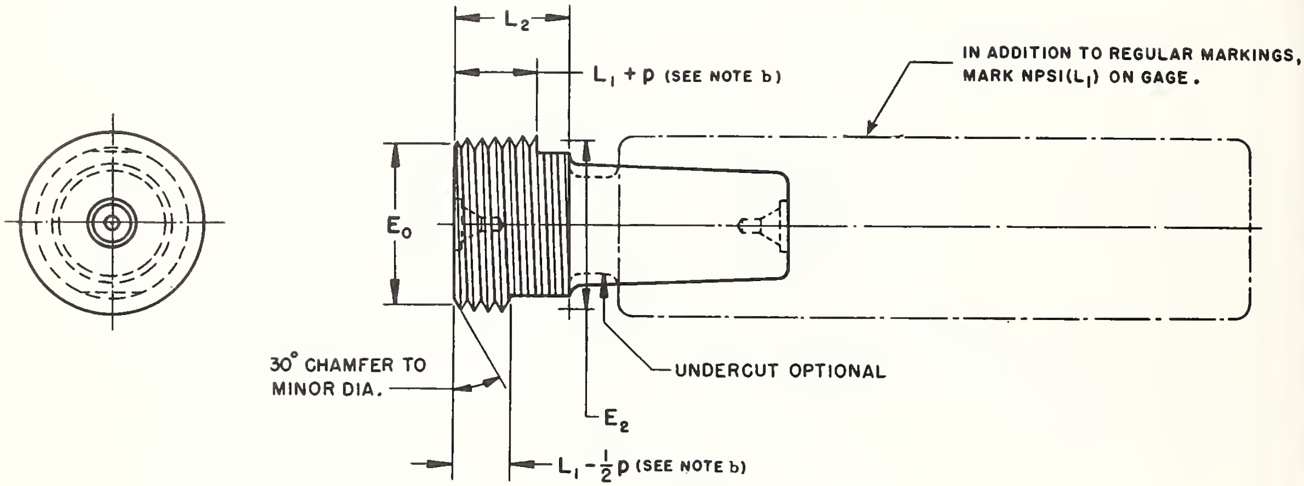


Size	Small end: Pitch diameter, E_3	Small end: Major diameter,[a] D_3	Relief diameter ($E_3+0.0625\times4p-$sharp-V thd hgt -0.020 to 0.025 below sharp root); $F+0.005, -0.000$	Four threads, G, (L_3+p)	Min PD gaging step+3 thds, (L_3+L_1 short $-p/2$)	Max PD gaging step+3 thds, (L_3+L_1 short $+p$)	Blank length, B	Notch depth, $J+0.005, -0.000$
1	2	3	4	5	6	7	8	9
	in.	*in.*	*in.*	*in.*	*in.*	*in.*	*in.*	*in.*
1/16—27	0. 2642	0. 2815	0. 216	0. 1482	0. 2156	0. 2711	3/8	0. 030
1/8—27	. 3566	. 3738	. 309	. 1482	. 2171	. 2726	13/32	. 030
1/4—18	. 4670	. 4928	. 409	. 2222	. 3111	. 3945	1/2	. 030
3/8—18	. 6016	. 6275	. 542	. 2222	. 3233	. 4067	9/16	. 030
1/2—14	. 7451	. 7783	. 676	. 2857	. 4271	. 5343	11/16	. 040
3/4—14	. 9543	. 9876	. 886	. 2857	. 4462	. 5533	23/32	. 040
1—11½	1. 1973	1. 2379	1. 118	. 3478	. 5304	. 6609	7/8	. 050
1¼—11½	1. 5408	1. 5814	1. 462	. 3478	. 5504	. 6809	7/8	. 050
1½—11½	1. 7798	1. 8203	1. 701	. 3478	. 5504	. 6809	7/8	. 050
2—11½	2. 2527	2. 2932	2. 174	. 3478	. 5664	. 6969	7/8	. 050
2½—8	2. 6961	2. 7543	2. 590	. 5000	. 8695	1. 0570	1½	. 050
3—8	3. 3172	3. 3754	3. 214	. 5000	. 9535	1. 1410	1½	. 050

[a] Major diameter is based upon crest minimum truncation of $0.20p$.

[b] Maximum and minimum pitch-diameter steps are gaging limits. Notch formulas on drawing apply to all sizes.

Table VIII.26.—*Basic dimensions of Dryseal American Standard intermediate internal straight pipe thread (L_1) step-limit plug gages, NPSI*



Size	L_1	L_2	Small end		Min PD gaging step		Max PD gaging step		Large end	
			Pitch diameter, E_0	Major diameter [a]	$(L_1-p/2)$	Pitch diameter	(L_1+p)	Pitch diameter	Pitch diameter, E_2	Major diameter [a]
1	2	3	4	5	6	7	8	9	10	11
	in.	*in.*	*in.*	*in.*	*in.*	*in.*	*in.*	*in.*	*in.*	*in.*
1/16—27	0.1600	0.26113	0.27118	0.28844	0.14148	0.28002	0.19704	0.28350	0.28750	0.30476
1/8—27	.1615	.26385	.36351	.38077	.14298	.37245	.19854	.37592	.38000	.39726
1/4—18	.2278	.40178	.47739	.50328	.20002	.48989	.28336	.49510	.50250	.52839
3/8—18	.2400	.40778	.61201	.63790	.21222	.62527	.29556	.63048	.63750	.66339
1/2—14	.3200	.53371	.75843	.79170	.28428	.77620	.39143	.78289	.79179	.82506
3/4—14	.3390	.54571	.96768	1.00095	.30328	.98664	.41043	.99333	1.00179	1.03506
1—11½	.4000	.68278	1.21363	1.25416	.35652	1.23592	.48696	1.24406	1.25630	1.29683
1¼—11½ [c]	.4200	.70678	1.55713	1.59766	.37652	1.58066	.50696	1.58882	1.60130	1.64183
1½—11½ [c]	.4200	.72348	1.79609	1.83662	.37652	1.81962	.50696	1.82778	1.84130	1.88183
2—11½ [c]	.4360	.75652	2.26902	2.30955	.39252	2.29355	.52296	2.30170	2.31630	2.35683
2½—8 [c]	.6820	1.13750	2.71953	2.77778	.61950	2.75825	.80700	2.76997	2.79062	2.84887
3—8 [c]	.7660	1.20000	3.34062	3.39887	.70350	3.38459	.89100	3.39631	3.41562	3.47387

[a] Major diameter is based on crest minimum truncation of $0.20p$.
[b] Maximum and minimum pitch-diameter steps are gaging limits. Notch formulas on drawing apply to all sizes.
[c] For reference only above 1—11½ size.

SECTION IX. GAS CYLINDER VALVE OUTLET AND INLET THREADS[7]

1. INTRODUCTION

1. General.—The first efforts to develop standards for compressed gas cylinder valve threads followed immediately after World War I, and were inspired by the difficulties encountered both by industry and the military services because of the multiplicity of connections that were then in use.

Through the activity of the Gas Cylinder Valve Thread Committee of the Compressed Gas Manufacturers' Association, Inc., material progress was made through the years that followed, with the result that, when the United States became involved in World War II, the gas industries themselves had materially improved this situation. Several of the compressed gas industries had achieved virtual standardization at tremendous cost for replacement of valve equipment. Their standards, however, were not completely formalized nor fully coordinated with other related standards. Much of the progress between World War I and World War II was the re ult of interest in the problem by the Federal Specifications Board.

The circumstances surrounding industrial and military users of compressed gases during World War II brought into clear focus the need for acceleration of the standardizing project for cylinder valve threads. They created not only the necessity but also a splendid opportunity for the compressed gas industry, the Military services, and other Federal agencies to study cooperatively the standardizing problems of valve outlet threads. These studies resulted in closer definition and appreciation of each valve outlet and in a more balanced relationship between the many types and sizes.

When the Standards Associations representing Great Britain, Canada, and the United States met in Ottawa in October 1945 to consider unification of screw threads, a fairly well developed plan for standardization of compressed gas cylinder valve threads was presented to the Conference by the Valve Thread Standardization Committee of the Compressed Gas Manufacturers' Association, Inc. (CGMA). These proposed standards represented the experience and knowledge of compressed gas manufacturers, valve manufacturers, and the needs and requirements of varied users of gas cylinder valves, including the military services and other Federal agencies. Approval of these standards to the extent to which they were then developed was given by the U S Department of Commerce, the U.S. Army, and the U.S. Navy through the Interdepartmental Screw Thread Committee following a joint meeting with the representatives of CGMA in August 1945. Much progress was made later in that year at the Canadian Section Meeting of CGMA tending to unify United States and Canadian practices. During January 1946 through conference between representatives of the CGMA Valve Thread Standardization Committee[8] and the Interdepartmental Screw Thread Committee in Washington, agreements were reached that resulted in final approval of considerable additional gas cylinder valve thread data. These data were included in the 1950 supplement to Handbook H28. This issue of H28 includes more detailed data on the outlet and inlet connections than were previously shown.

2. Medical Gas Cylinder Valve Connections.—As early as 1940 it was evident to various medical societies, as well as to the manufacturers of medical gases that a system should be devised to prevent the interchangeability of medical gas cylinders equipped with flush-type valves when used with medical gas administering apparatus. Various means for accomplishing this were studied. The most difficult obstacle to be overcome was that of devising a system that would permit the adjustment of existing apparatus without interfering with its use and without requiring that it be returned to the manufacturer for conversion. The system contained in these standards, and known as "The Pin-Index Safety System for Flush-Type Cylinder Valves" is the result of the concerted efforts of the companies and organizations concerned. This standard has been submitted to Technical Committee No. 58 of the International Organization for Standardization as a proposed International Standard.

3. Scope.—The valves for cylinders containing compressed gases embody several screw threads, namely: (1) The outlet connection, (2) the inlet, neck, or valve to cylinder connection, (3) the safety device cap or plug, and (4) the various threads associated with the valve mechanism. While the practice for all of these threads is fairly well established, only the outlet threads (1) and the inlet threads (2) have been fully standardized.

2. OUTLET CONNECTIONS

Figures IX.1 through IX.34 show the details of the valve outlet connections included in this section. The outlet connections are designated by their commercial designations and are arranged in numerical sequence. On each figure are listed the gases with which the valve outlet connection shown on that figure is to be used. Table IX.1 consists of an alphabetical list of gases cross-referenced with the valve outlet connection numbers and figure numbers.

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[7] This section is substantially in agreement with the present issue of ASA B57.1, "American Standard Compressed Gas Cylinder Valve Outlet and Inlet Connections," which is published by the Compressed Gas Association, Inc., 11 West 42d Street, New York 36, N.Y. The latest revision should be consulted when referring to this ASA standard.

[8] The Compressed Gas Manufacturers' Association, Inc. changed its name in January 1949 and its Valve Thread Standardization Committee became the Valve Thread Standards Committee of Compressed Gas Association, Inc.

TABLE IX.1.—*Alphabetical list of gases with valve outlet connection numbers*

Gas	Standard connection		Alternate connection [a]	
	Valve outlet connection number	Figure	Valve outlet connection number	Figure
Acetylene	510	IX. 14	300	IX. 7
Acetylene, small valve series	200	IX. 3	520	IX. 15
Air, water-pumped	580	IX. 17		
Air, oil-pumped	590	IX. 18		
Ammonia, anhydrous [b]	240, 380	IX. 4, IX. 13	260	IX. 5
Ammonia, anhydrous, yoke connection	800	IX. 23		
Argon, water-pumped	580	IX. 17		
Argon, oil-pumped	590	IX. 18		
Boron trifluoride	330	IX. 9		
Bromochloromethane	620	IX. 19		
Butadiene	510	IX. 14		
Butane	510	IX. 14	350, 300	IX. 11, IX. 7
Carbon dioxide	320	IX. 8		
Carbon dioxide, medical, yoke connection	940	IX. 34		
Carbon dioxide-ethylene oxide mixtures	350	IX. 11		
Carbon dioxide-oxygen mixture (CO_2 over 7%), medical, yoke connection	940	IX. 34		
Carbon monoxide	350	IX. 11		
Chlorine	660	IX. 21		
Chlorine, yoke connection, washer on outer face	820	IX. 24		
Chlorine, yoke connection, washer inside of recess	840	IX. 25		
Chlorine trifluoride	670	IX. 22		
Cyclopropane, medical, yoke connection	920	IX. 32		
Cyclopropane, industrial	510	IX. 14		
Dichlorodifluoromethane	620	IX. 19		
Dichlorodifluoromethane-difluoroethane mixture	620	IX. 19		
Difluorodibromoethane	620	IX. 19		
Difluoroethane	660	IX. 21		
Difluoromonochloroethane	660	IX. 21		
Dimethylamine, anhydrous	240	IX. 4		
Dimethyl ether	510	IX. 14		
Ethane	350	IX. 11		
Ethyl chloride	300	IX. 7		
Ethylene, industrial and medical	350	IX. 11		
Ethylene, medical, yoke connection	900	IX. 30		
Ethylene oxide	510	IX. 14	350	IX. 11
Fluorine	670	IX. 22		
Helium, water-pumped	580	IX. 17		
Helium, medical, yoke connection	930	IX. 33		
Helium, oil-pumped	590	IX. 18	350	IX. 11
Helium-oxygen mixture (O_2 less than 20%), medical, yoke connection	930	IX. 33		
Hydrogen	350	IX. 11		
Hydrogen chloride, anhydrous	330	IX. 9		
Hydrogen cyanide, anhydrous	160	IX. 2		
Hydrogen fluoride, anhydrous	670	IX. 22		
Hydrogen sulphide	330	IX. 9		
Isobutane	510	IX. 14	350	IX. 11
Krypton, water-pumped	580	IX. 17		
Krypton, water-pumped, small valve series	120	IX. 1		
Krypton, oil-pumped	590	IX. 18		
Methane	350	IX. 11		
Methyl bromide	620	IX. 19	340	IX. 10
Methyl chloride	620	IX. 19	360	IX. 12
Methyl mercaptan	330	IX. 9		
Monochlorodifluoromethane	620	IX. 19		
Monochlorotetrafluoroethane	620	IX. 19		
Monochlorotrifluoromethane	620	IX. 19		
Monomethylamine, anhydrous	240	IX. 4		
Neon, water-pumped	580	IX. 17		
Neon, water-pumped, small valve series	120	IX. 1		
Neon, oil-pumped	590	IX. 18		
Nitrogen, water-pumped	580	IX. 17		
Nitrogen, oil-pumped	590	IX. 18		
Nitrous oxide	320	IX. 8		
Nitrous oxide, medical, yoke connection	910	IX. 31		
Oxygen, industrial and medical	540	IX. 16		
Oxygen, medical, yoke connection	870	IX. 27		
Oxygen-carbon dioxide mixture (CO_2 not over 7%), medical, yoke connection	880	IX. 28		
Oxygen-helium mixture (helium not over 80%), medical, yoke connection	890	IX. 29		
Phosgene	640	IX. 20		
Phosgene, small valve series	160	IX. 2		
Propane	510	IX. 14	350, 300	IX. 11, IX. 7
Propylene	510	IX. 14	350	IX. 11
Sulphur dioxide	620	IX. 19	360	IX. 12
Sulphur hexafluoride	590	IX. 18		
Tetrafluoroethylene	620	IX. 19		
Trifluorobromomethane	620	IX. 19		
Trifluorochloroethylene, inhibited	620	IX. 19		
Trimethylamine, anhydrous	240	IX. 4		
Vinyl chloride, inhibited	290	IX. 6		
Vinyl methyl ether, inhibited	290	IX. 6		
Xenon, water-pumped	580	IX. 17		
Xenon, water-pumped, small valve series	120	IX. 1		
Xenon, oil-pumped	590	IX. 18		

[a] Alternate valve outlet connections are shown to indicate valve outlet connections widely used by industry in addition to the approved standards. The Federal services shall not specify alternate outlet connections. In areas where gases cannot be readily procured commercially in cylinders equipped with valves complying with these standards, cylinders equipped with valves complying with the alternate standards may be accepted, provided authority to do so is specifically granted by the Government department concerned. Alternates may be used only during a limited transition period.

[b] Co-standards 240 and 380 have been established for anhydrous ammonia. Connection No. 240 is standard for the Federal services while No. 380 is the commercial standard.

1. THREADS AND GAGING.—Table IX.2 consists of a numerical listing of the valve outlet connections showing the connecting threads.

The threads on the outlets are separated into four basic divisions—internal and external (INT and EXT), as well as right-hand and left-hand (RH and LH). Within each of the four divisions, further separation is made by varying the pitch and diameter of the threads. The diameters within each division are so spaced that adjoining sizes either will not enter or will not engage.

As far as practicable, the design of connections and assignment of the connections to gases has been made so as to prevent the interchange of connections which may result in a hazard. With the exception of outlets having taper pipe threads which seal at the threads, each outlet provides for screw threads which do not seal but merely hold the nipple against its seat. These screw threads have the Unified form, but are not in the regular series.

Past practice has firmly established many outlet connections for specific gases or groups of gases and in many cases these connections were retained. Small differences in the threads and other elements of the same connection were reconciled into one form and size, properly recorded and defined. By adhering to existing outlets where practicable, it was possible to put the new standard system into effect without the inconvenience and expense of a cumbersome and costly changeover. Alternate and co-standards have been established for some gases.

Keeping the established practice in mind when classifying and assigning the gases to their outlets, an effort was made to follow a plan whereby right-hand threads would be used for non-fuel gases and for water-pumped gases, whereas left-hand threads would be used for fuel gases and for oil-pumped gases. These left-hand threads are identified by a groove on the hexagon nut. An external thread is used on the valve in most cases, but some important groups of gases have an internal thread on the valve.

In general, as indicated by table IX.2, most of the connecting threads are of the National Gas Outlet (NGO) type. This symbol was suggested and designated by the Interdepartmental Screw Thread Committee to provide for the peculiar needs of the industry.

For the NGO thread an allowance (minimum clearance) of from 0.0020 to 0.0050 in. between the mating parts is established to provide the desired looseness of fit at the threads, and to assure interchangeability between products of different manufacturers, who lacked a common standard in the past. The tolerances are in the direction of greater looseness and are determined on the basis of NS-3 data, except for the major

TABLE IX.2.—*Numerical listing of valve outlet connections showing the connecting threads*

Valve outlet connection number	Figure No.	Valve outlet		Mating assembly		Nipple or pipe No.	Nut or converter No.	Washer No.
		No.	Thread	No.	Thread			
1	2	3	4	5	6	7	8	9
120	IX. 1	121	.373—24NGO-RH-EXT	122	.375—24NGO-RH-INT	123	124	
160	IX. 2	161	⅛—27NGT-RH-INT	162	⅛—27NGT-RH-EXT	163		
200	IX. 3	201	.625—20NGO-RH-EXT	202	.628—20NGO-RH-INT	203	204	
240	IX. 4	241	⅜—18NGT-RH-INT	242	⅜—18NPT-RH-EXT	243	244	245
260	IX. 5	261	⅜—18NGT-RH-INT (with 1" nut)	262	⅜—18NPT-RH-EXT (with 1" nut)	263	264	265
290	IX. 6	291	.745—14NGO-LH-EXT	292	.750—14NGO-LH-INT	293	294	
300	IX. 7	301	.825—14NGO-RH-EXT (for conical nipple).	302	.830—14NGO-RH-INT (conical nipple).	303	304	
320	IX. 8	321	.825—14NGO-RH-EXT (for flat nipple).	322	.830—14NGO-RH-INT (flat nipple).	323	324	325
330	IX. 9	331	.825—14NGO-LH-EXT (for flat nipple).	332	.830—14NGO-LH-INT (flat nipple)	333	334	335
340	IX. 10	341	½—14NGT-RH-EXT	342	½—14NGT-RH-INT	343	344	
350	IX. 11	351	.825—14NGO-LH-EXT (for round nipple).	352	.830—14NGO-LH-INT (round nipple).	353	354	
360	IX. 12	361	½—14NGT-RH-EXT	362	½—14NGT-RH-INT		364	365
380	IX. 13	381	½—14NGT-RH-INT	382	½—14NPT-RH-EXT	383	384	385
510	IX. 14	511	.885—14NGO-LH-INT	512	.880—14NGO-LH-EXT	513	514	
520	IX. 15	521	.895—18NGO-RH-EXT	522	.899—18NGO-RH-INT	523	524	
540	IX. 16	541	.903—14NGO-RH-EXT	542	.908—14NGO-RH-INT	543	544	
580	IX. 17	581	.965—14NGO-RH-INT	582	.960—14NGO-RH-EXT	583	584	
590	IX. 18	591	.965—14NGO-LH-INT	592	.960—14NGO-LH-EXT	593	594	
620	IX. 19	621	1.030—14NGO-RH-EXT (with groove).	622	1.035—14NGO-RH-INT (with flare converter).		624	625
640	IX. 20	641	1.030—14NGO-RH-EXT (with ⅛—27NGT-RH-INT).	642	1.035—14NGO-RH-INT (with ⅜—18NGT-RH-EXT converter).		644	645
660	IX. 21	661	1.030—14NGO-RH-EXT (without groove).	662	1.035—14NGO-RH-INT (with nut and nipple).	663	664	665
670	IX. 22	671	1.030—14NGO-LH-EXT	672	1.035—14NGO-LH-INT	673	674	675
			Yoke outlet for:					
800	IX. 23	801	Ammonia, anhydrous	802	Yoke connection	803		805
820	IX. 24	821	Chlorine	822	Yoke connection (with washer on outer face).	823		825
840	IX. 25	841	Chlorine	842	Yoke connection (with washer inside of recess).	843		845
870	IX. 27	871	Oxygen, medical	872	Yoke connection	873		875
880	IX. 28	881	O_2–CO_2 mixture (CO_2 not over 7%), medical.	882	Yoke connection	883		875
890	IX. 29	891	Oxygen-helium mixtures (helium not over 80%), medical.	892	Yoke connection	893		875
900	IX. 30	901	Ethylene, medical	902	Yoke connection	903		875
910	IX. 31	911	Nitrous oxide, medical	912	Yoke connection	913		875
920	IX. 32	921	Cyclopropane, medical	922	Yoke connection	923		875
930	IX. 33	931	Helium, medical; and helium-oxygen mixture (O_2 less than 20%), medical.	932	Yoke connection	933		875
940	IX. 34	941	CO_2, medical; and CO_2—oxygen mixture (CO_2 over 7%), medical.	942	Yoke connection	943		875

Each complete outlet connection is different. However, one or more of its components may be the same as those used on other connections, as follows:

Valve outlets: 241 and 801 are identical. 661, 821, and 841 are identical. 621 and 641 are similar.

Nipples: 243 (Plain pipe connection) and 263 are identical. 323 and 333 are identical. 513, 583, and 593 are identical. 663 and 673 are identieal.

Nuts: 304 and 324 are identical. 334 and 354 are identical.

Washers: 325 and 335 are identical. 625 and 645 are identical.

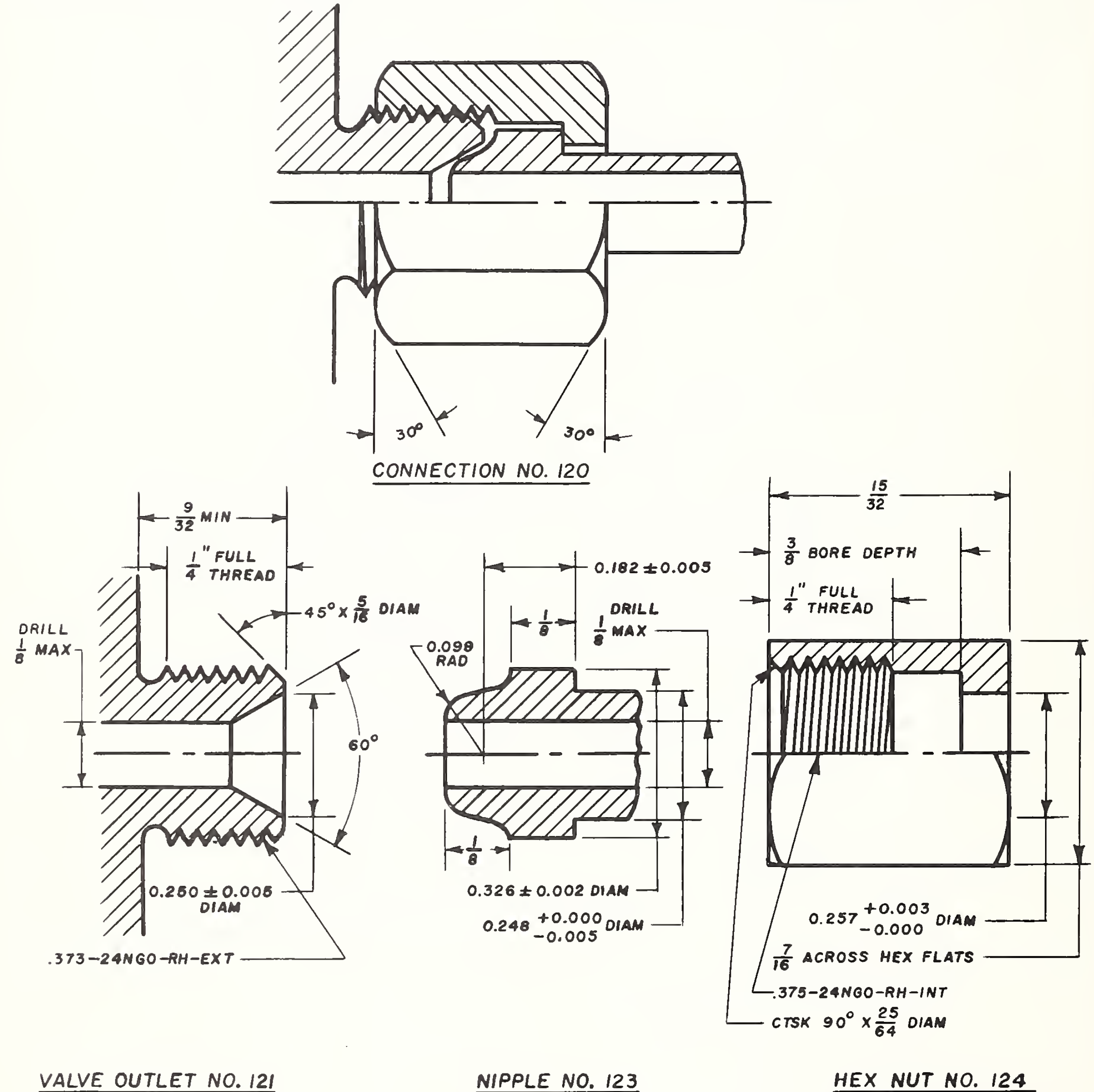
diameter of the external threads for which the tolerance is limited to 0.0050 in. instead of 0.0098 in.

In addition to the NGO threads, other types of threads are used on the outlet connections as connecting threads or in the valve body. The types of threads specified on figures IX.1 through IX.34 are listed in table IX.3 along with references as to where information on limits of size and gaging of these threads may be found.

TABLE IX.3.—*Types of threads used in valve outlet connections cross-referenced with limits of size and gaging information for the threads*

Type of thread	Limits of size of thread [a]	Gages and gaging [a]
NGO	Table IX.4, p. 76	Section VI of Part I.
NGT	Table IX. 5, p. 76	Par. 1(b), p. 77.
NPSM	Table VII.6, p. 9	Section VII, par. 8, p. 11.
NPT	Tables VII.1 and VII.2, pp. 4 and 5.	Section VII, par. 8, p. 11.
1—14NS	Table I.9, p. 136 of Part I	Table I.16, p. 152 of Part I.
UNF	Table III.10, p. 27 of Part I	Table III.12, p. 39 of Part I.

[a] See also par. 1, threads and gaging, p. 44.



Standard outlet connection for:
Krypton, water-pumped, small valve series
Neon, water-pumped, small valve series
Xenon, water-pumped, small valve series

Dimensions in inches unless otherwise specified.

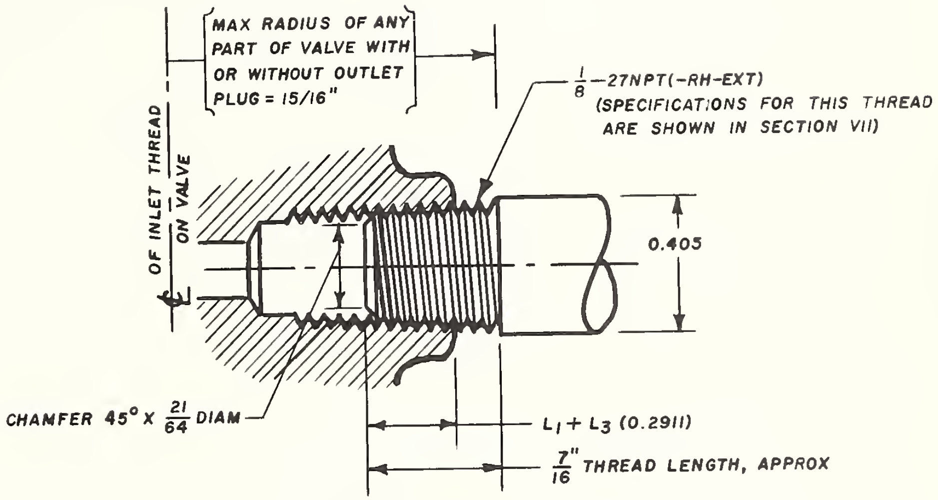
FIGURE IX.1.—*No. 120 valve outlet connection, .373—24NGO-RH-EXT thread.*

For purposes of clarity and consistency, all threads shown on figures IX.1 through IX.34 have RH–EXT(INT) in the thread designation even though it may not be required for proper thread identification.

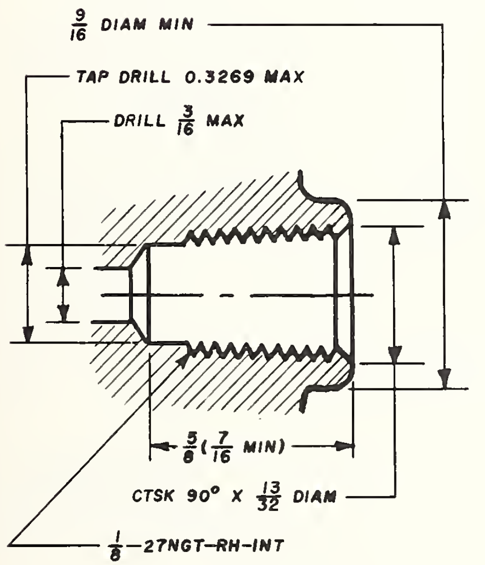
2. Clearance.—The maximum radius of any part of the valve from its centerline has been specified to insure clearance for the smallest (3⅛-in.) standard cylinder valve protecting cap.

3. Numbering System.—The last digit of the designating numbers for the outlet connections and components shown in figures IX.1 through IX.34 has the following significance:

0—complete outlet connection,
1—valve outlet,
2—mating assembly (see table IX.2),
3—nipple or pipe,
4—nut or converter,
5—washer,
9—plug.

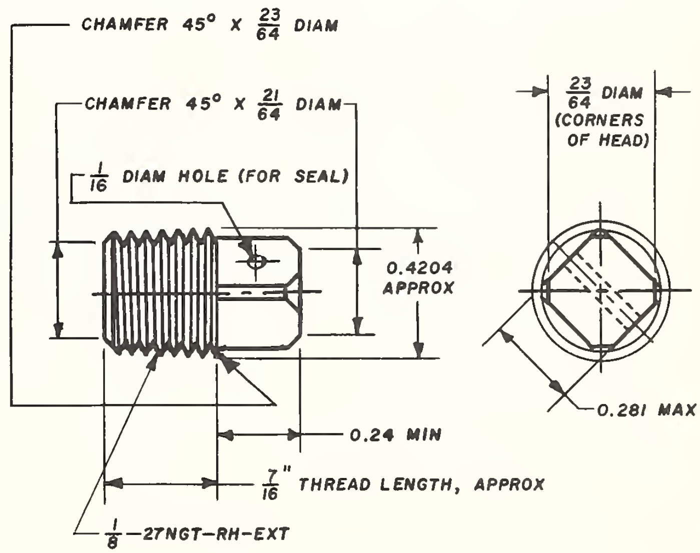


PIPE CONNECTION NO. 163



VALVE OUTLET NO. 161

(USED WITH SEALED TRANSIT CAP WITH 2⅜" DIAM THREAD, MIN)



PLUG NO. 169

Standard outlet connection for:
Hydrogen cyanide, anhydrous
Phosgene, small valve series

Dimensions in inches unless otherwise specified.

Figure IX.2.—*No. 160 valve outlet connection, ⅛—27NGT–RH–INT thread.*

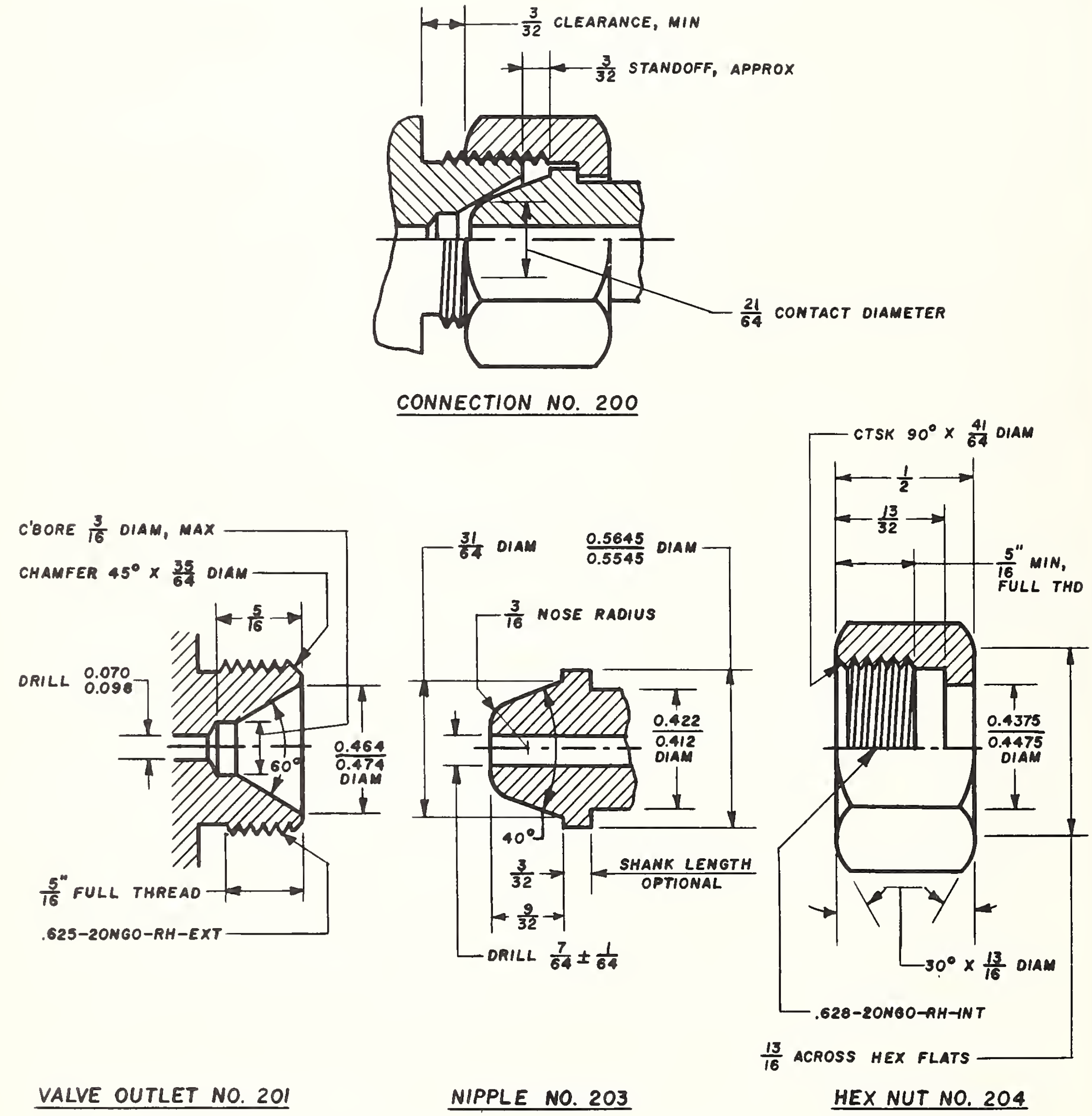
4. Adapters.—In the standardization of compressed gas valve outlet connections, more than one outlet is provided for some gases. To provide interchangeability of equipment for the same gas, adapters may be required.

The appendix to ASA B57.1 (see footnote 7) lists detailed information on adapters which are designed to connect a cylinder valve outlet to a regulator, charging connection, or other mating part having a different connection for the same gas. These adapters are limited to make the following connections (see footnote *a*, table IX.1.):

(a) From standards to alternate standards for the same gas.

(b) From alternate standards to standards for the same gas.

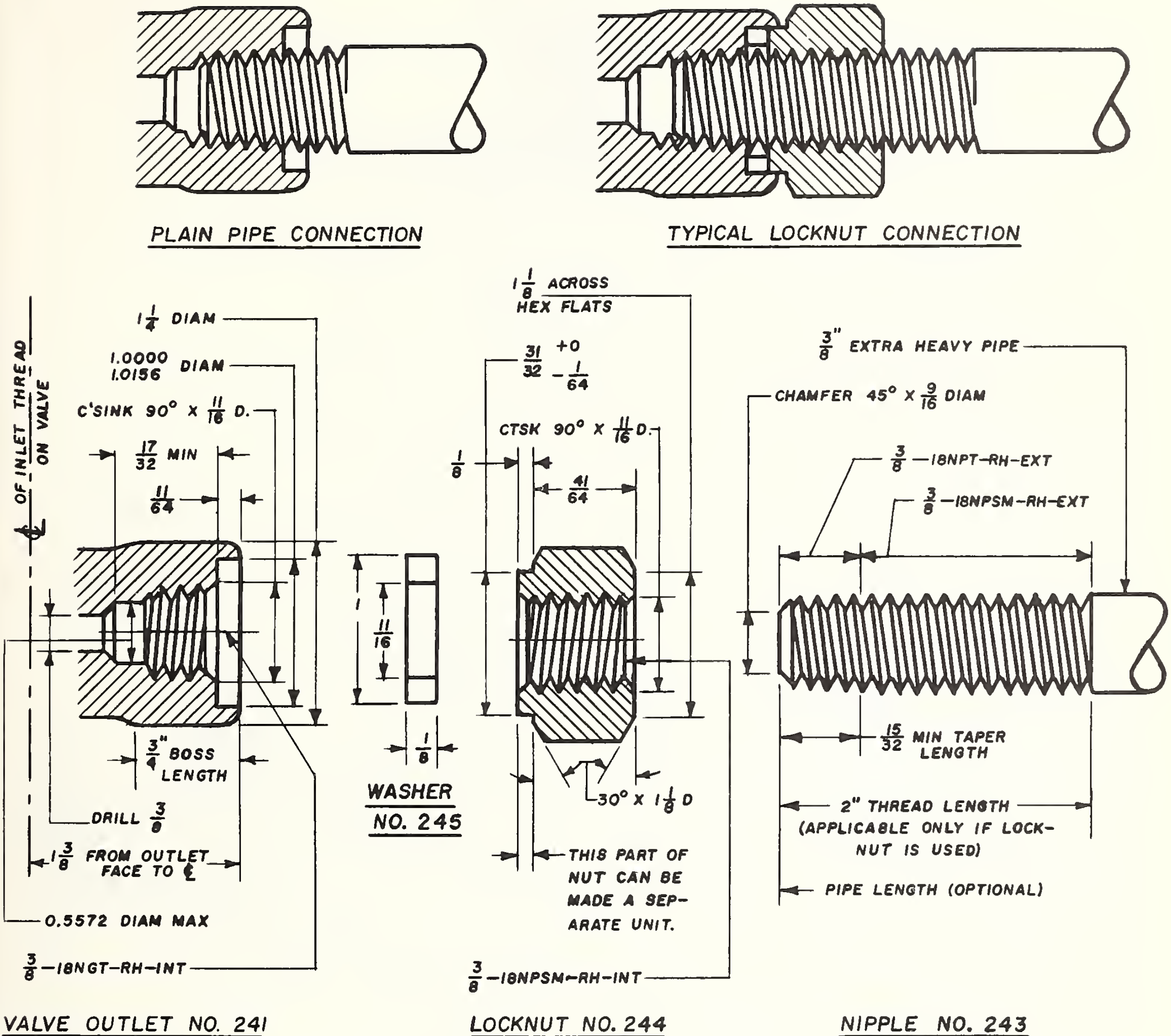
(c) From one alternate standard to another alternate standard for the same gas.



Standard outlet connection for: Acetylene, small valve series

Dimensions in inches unless otherwise specified.

Figure IX.3.—*No. 200 valve outlet connection, .625—20NGO-RH-EXT thread.*

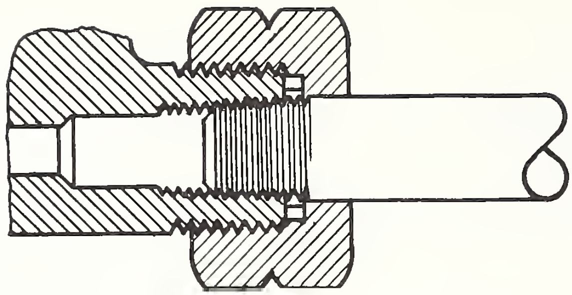


Dimensions for boss length and distance from outlet face to centerline of inlet thread on valve applicable only if right-angle outlet is used.

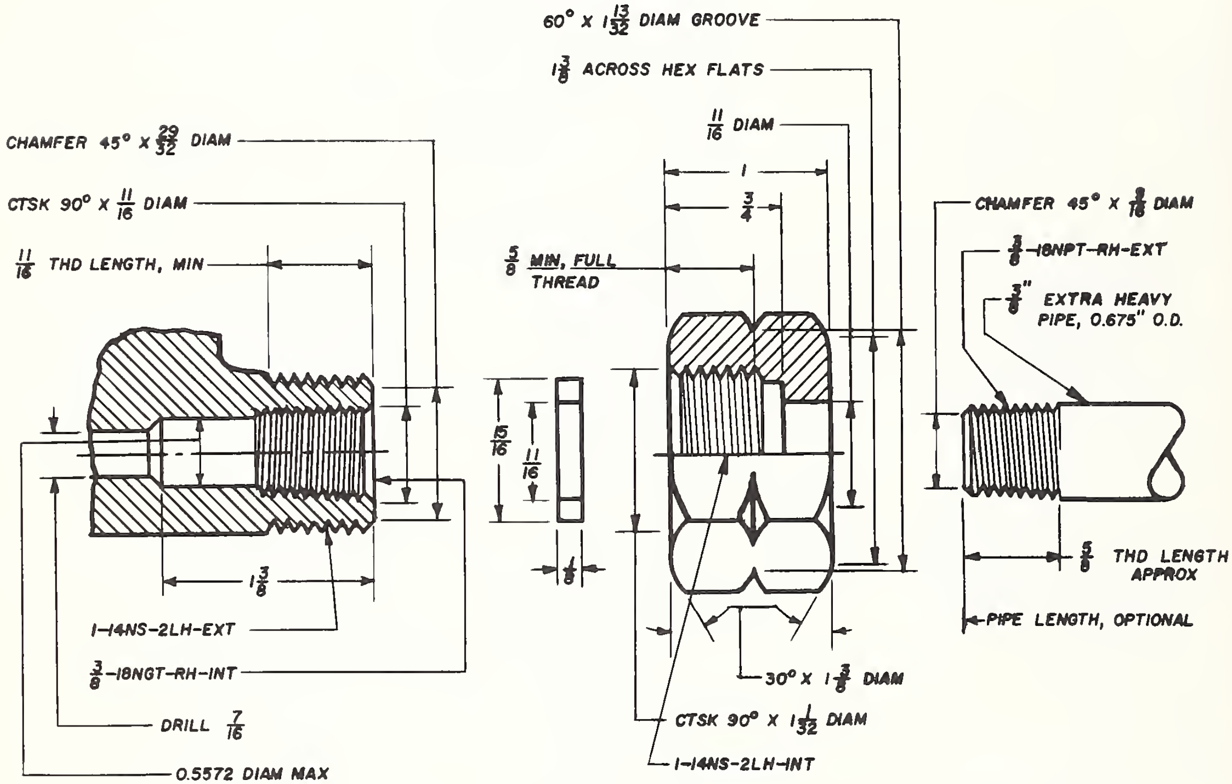
Standard outlet connection for:
- Ammonia, anhydrous (co-standards 240 and 380 have been established for anhydrous ammonia. Connection No. 240 is standard for the Federal Services while No. 380 is the commercial standard.)
- Dimethylamine, anhydrous
- Monomethylamine, anhydrous
- Trimethylamine, anhydrous

Dimensions in inches unless otherwise specified.

FIGURE IX.4.—*No. 240 valve outlet connection, 3/8—18NGT–RH–INT thread.*



CONNECTION NO. 260

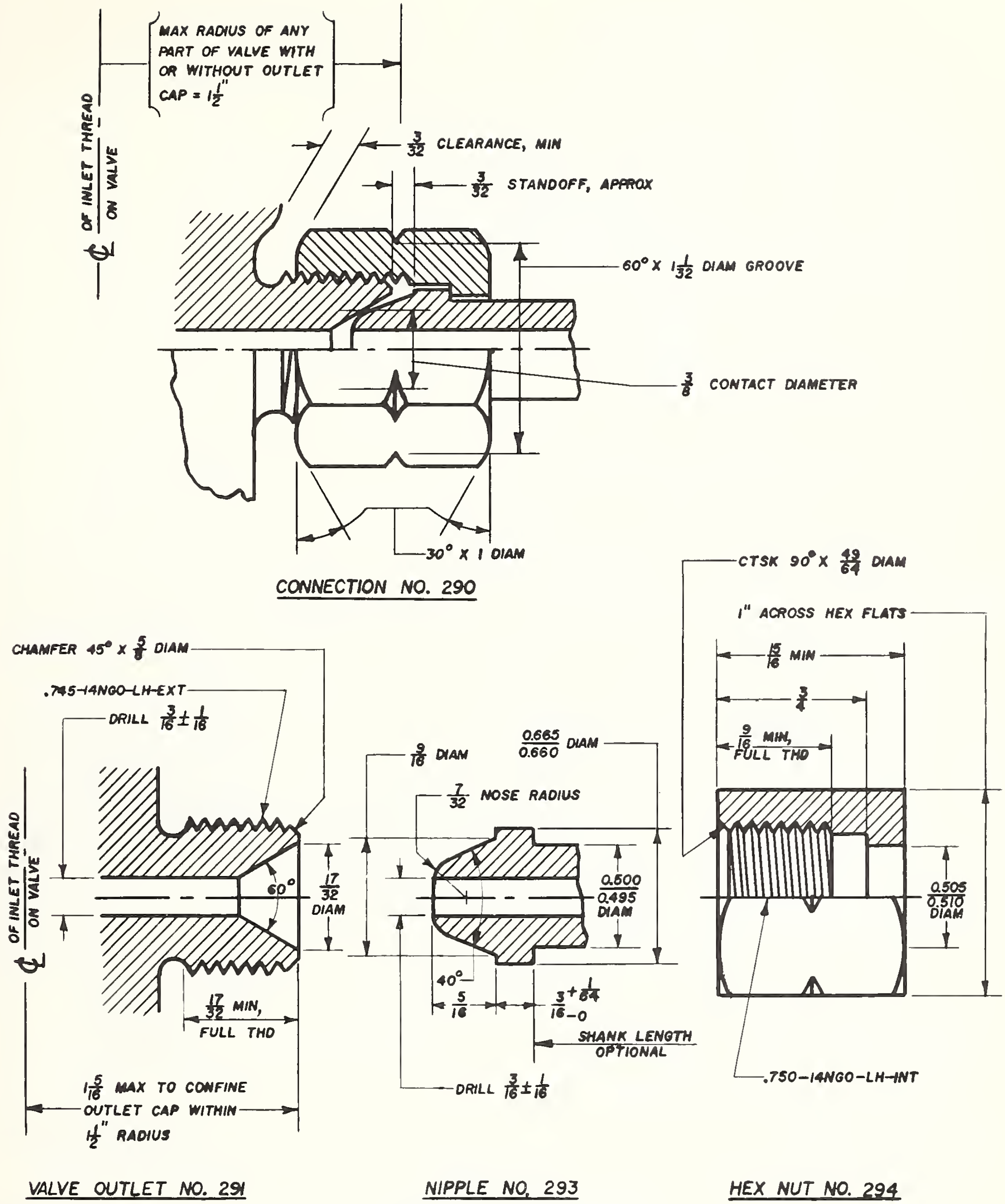


VALVE OUTLET NO. 261 | WASHER NO. 265 | HEX NUT NO. 264 | NIPPLE NO. 263

Alternate Standard outlet connection for: Ammonia, anhydrous (see footnote *a* to table IX.1.)

Dimensions in inches unless otherwise specified.

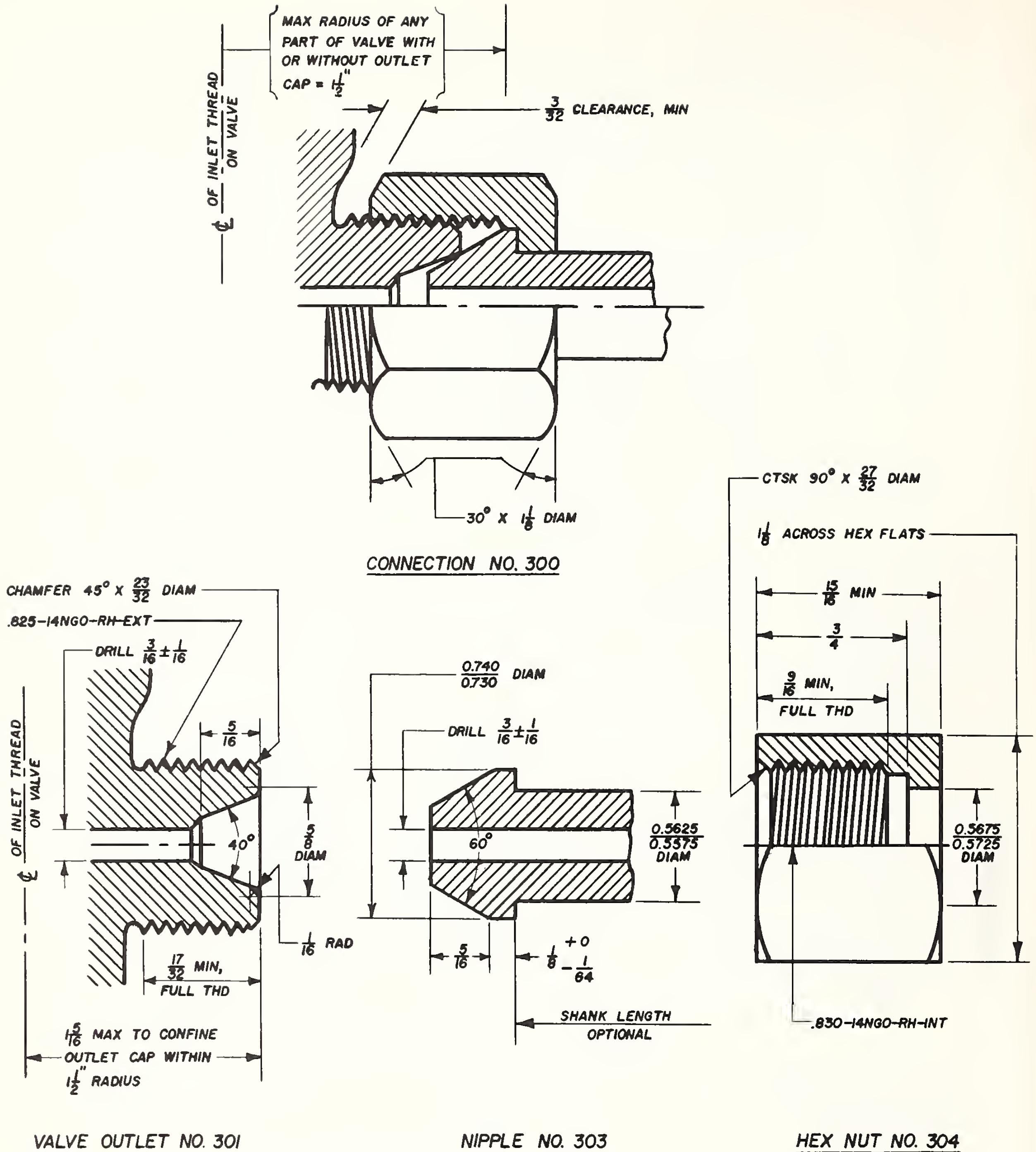
FIGURE IX.5.—*No. 260 valve outlet connection, ⅜—18NGT–RH–INT thread with nut with 1—14NS-2LH–INT thread.*



Standard outlet connection for:
Vinyl chloride, inhibited
Vinyl methyl ether, inhibited

Dimensions in inches unless otherwise specified.

FIGURE IX.6.—*No. 290 valve outlet connection, .745—14NGO-LH-EXT thread.*

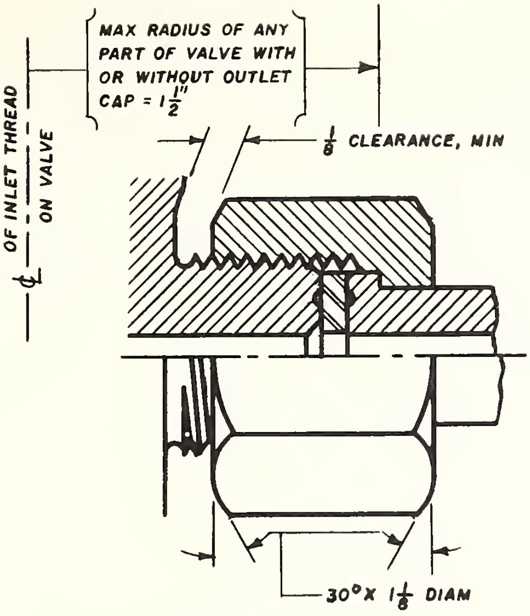


Standard outlet connection for: Ethyl chloride
Alternate standard outlet connection for: [a]
- Acetylene
- Butane (No. 2 alternate)
- Propane (No. 2 alternate)

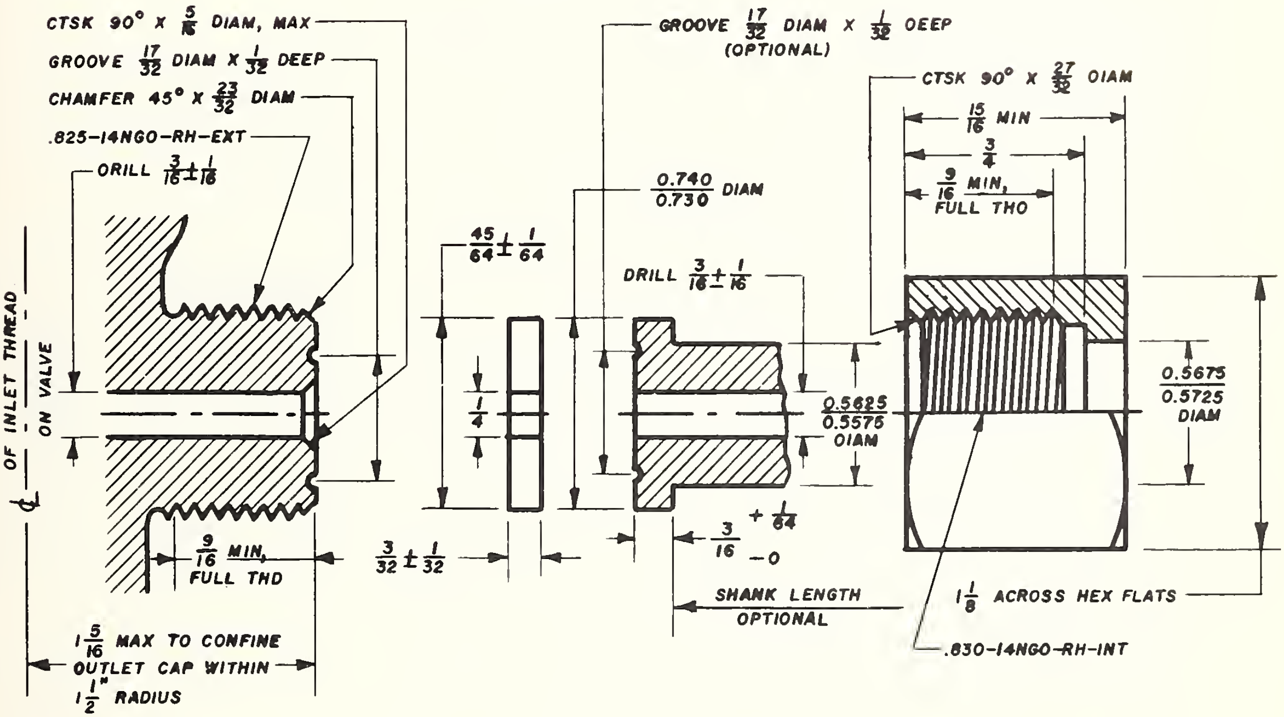
Dimensions in inches unless otherwise specified.

FIGURE IX.7.—*No. 300 valve outlet connection, .825—14NGO–RH–EXT thread with conical nipple.*

[a] See footnote *a* to table IX.1.



CONNECTION NO. 320

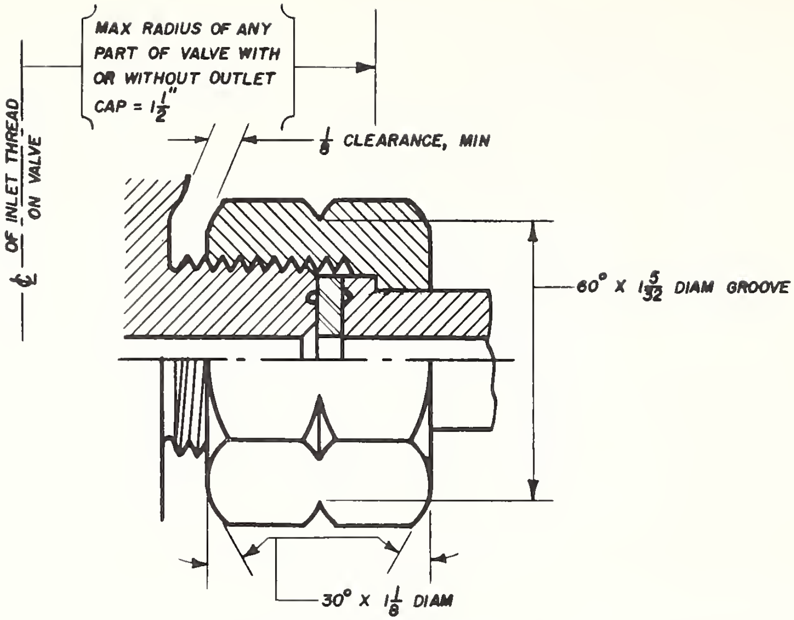


VALVE OUTLET NO. 321 | WASHER NO. 325 | NIPPLE NO. 323 | HEX NUT NO. 324

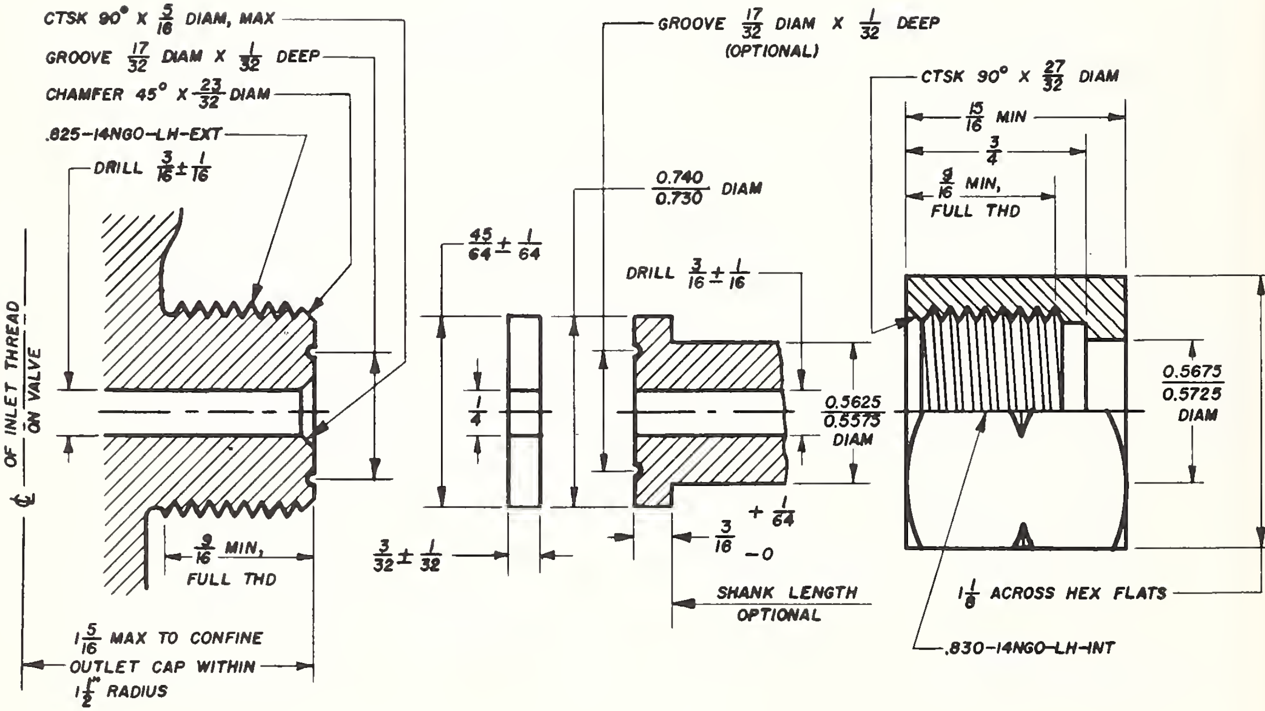
Standard outlet connection for:
Carbon dioxide
Nitrous oxide

Dimensions in inches unless otherwise specified.

FIGURE IX.8.—*No. 320 valve outlet connection, .825—14NGO-RH-EXT thread with flat nipple.*



CONNECTION NO. 330

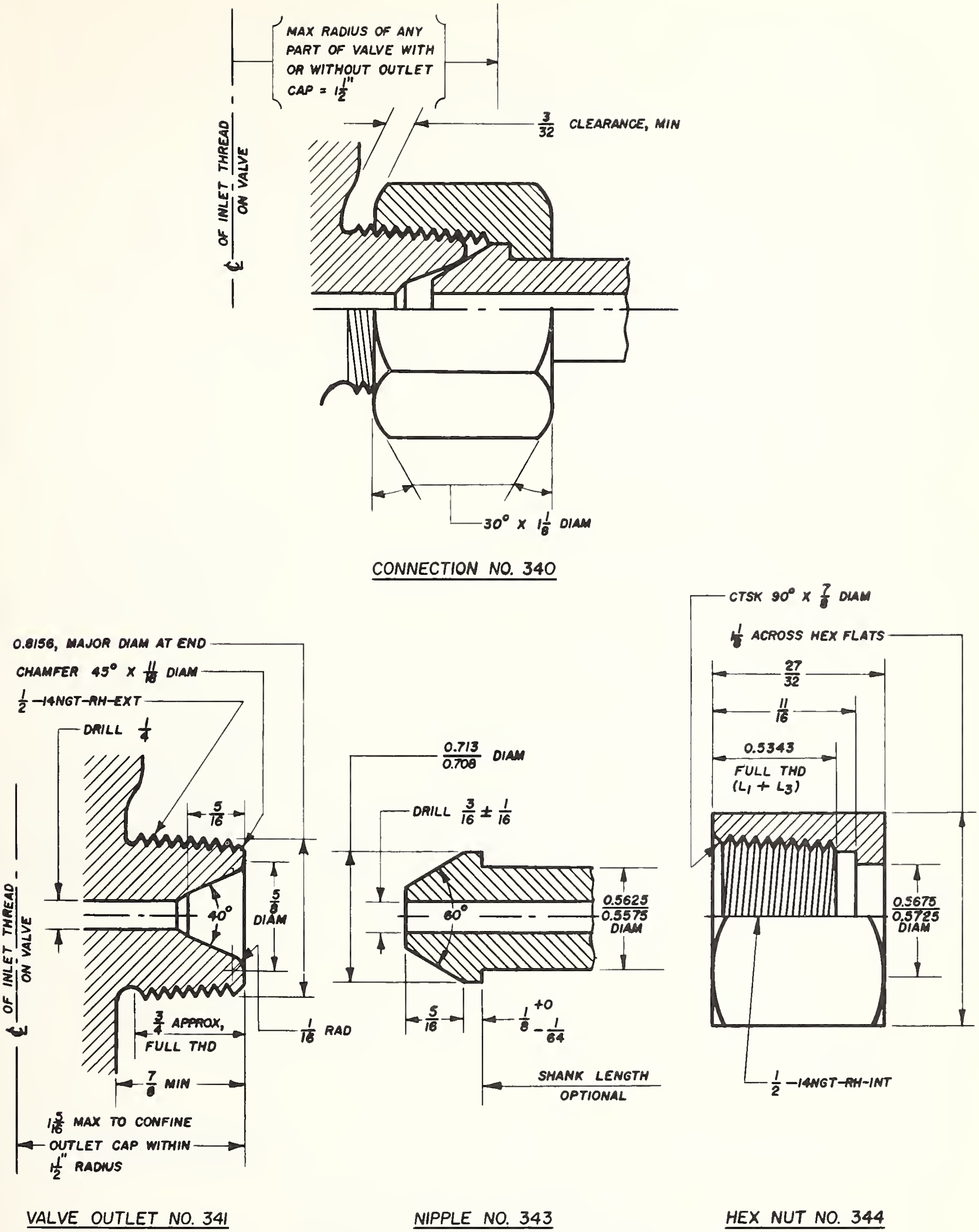


VALVE OUTLET NO. 331 | WASHER NO. 335 | NIPPLE NO. 333 | HEX NUT NO. 334

Standard outlet connection for:
- Boron trifluoride
- Hydrogen chloride, anhydrous
- Hydrogen sulphide
- Methyl mercaptan

Dimensions in inches unless otherwise specified.

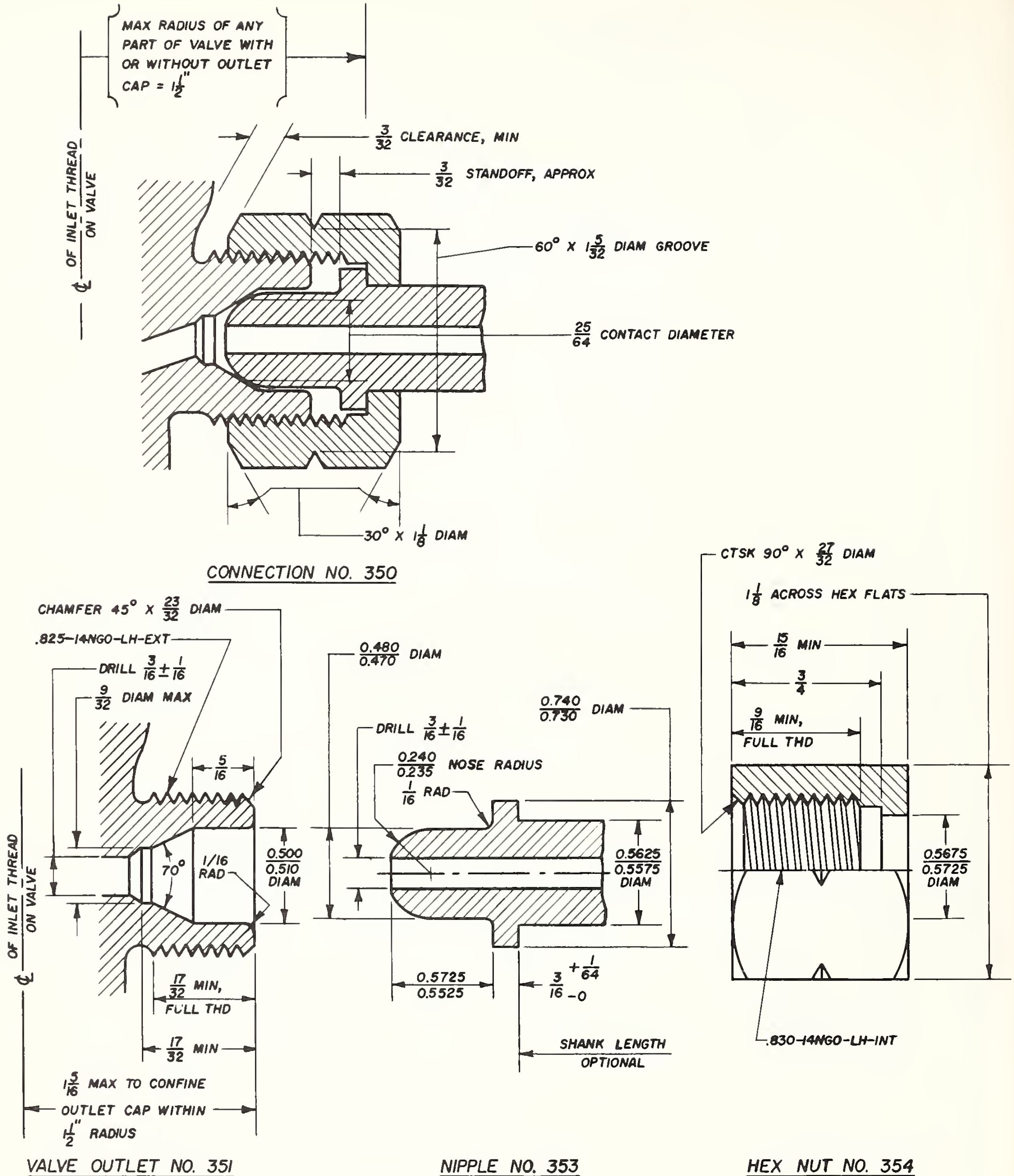
FIGURE IX.9.—*No. 330 valve outlet connection, .825—14NGO-LH-EXT thread with flat nipple.*



Alternate standard outlet connection for: Methyl bromide (see footnote *a* to table IX.1.)

Dimensions in inches unless otherwise specified.

FIGURE IX.10.—*No. 340 valve outlet connection, ½—14NGT–RH–EXT thread with conical nipple.*



Standard outlet connection for:

Carbon dioxide-ethylene oxide mixtures	Ethane
Carbon monoxide	Hydrogen
Ethylene, industrial and medical	Methane

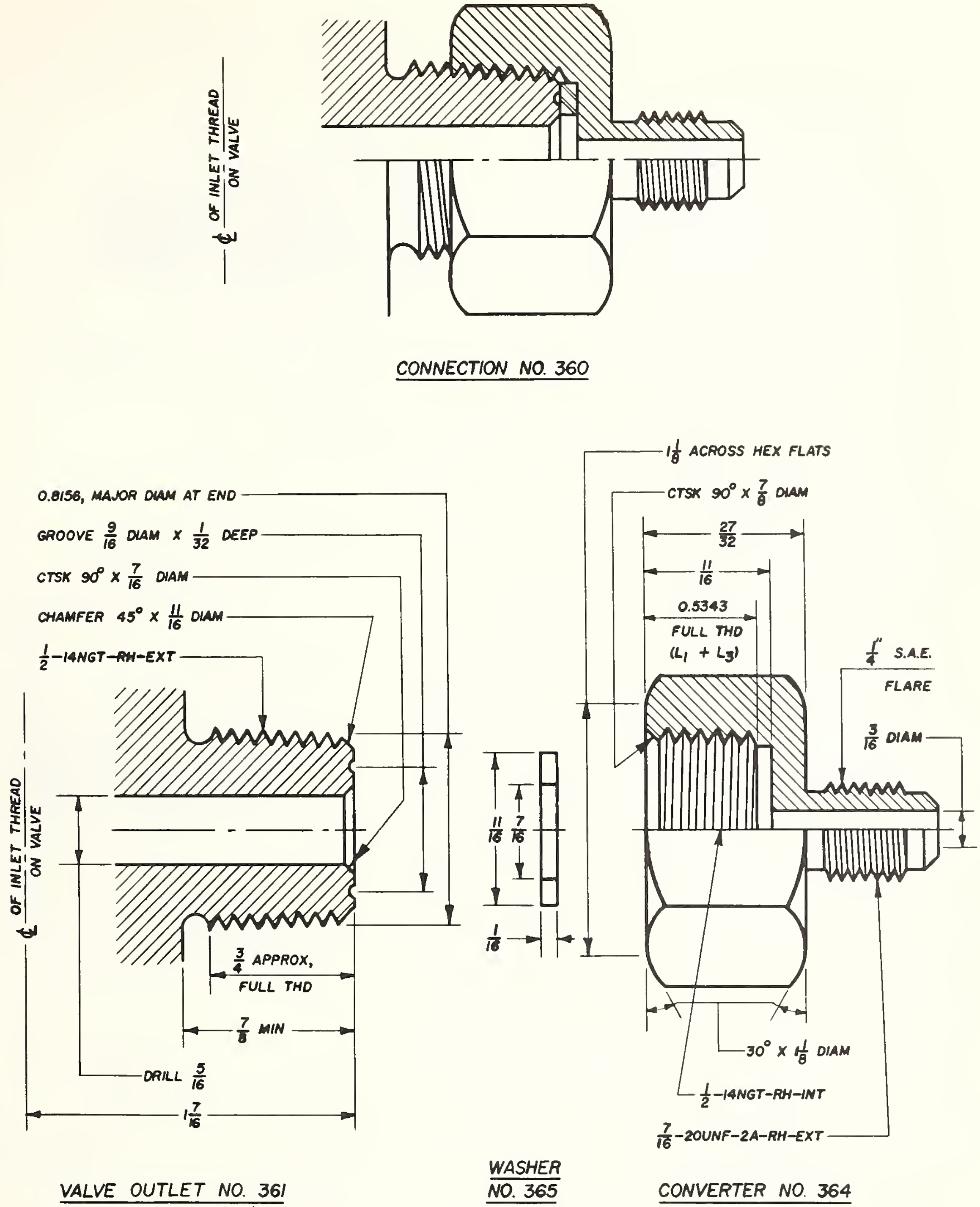
Alternate standard outlet connection [a] for:

Butane (No. 1 alternate)	Isobutane
Ethylene oxide	Propane (No. 1 alternate)
Helium, oil-pumped	Propylene

Dimensions in inches unless otherwise specified.

FIGURE IX.11.—*No. 350 valve outlet connection, .825—14NGO–LH–EXT thread with round nipple.*

[a] See footnote *a* to table IX.1.

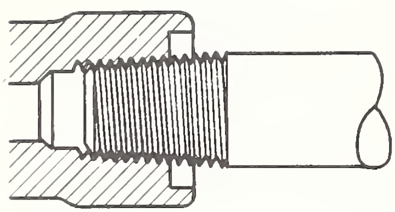


Alternate standard outlet connection [a] for:
Methyl chloride
Sulphur dioxide

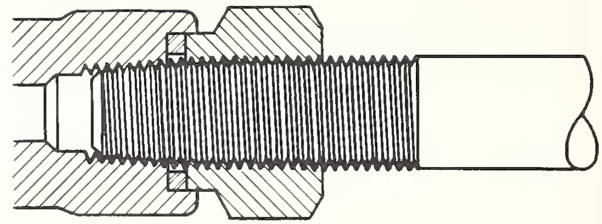
Dimensions in inches unless otherwise specified.

FIGURE IX.12.—*No. 360 valve outlet connection, ½—14NGT–RH–EXT thread.*

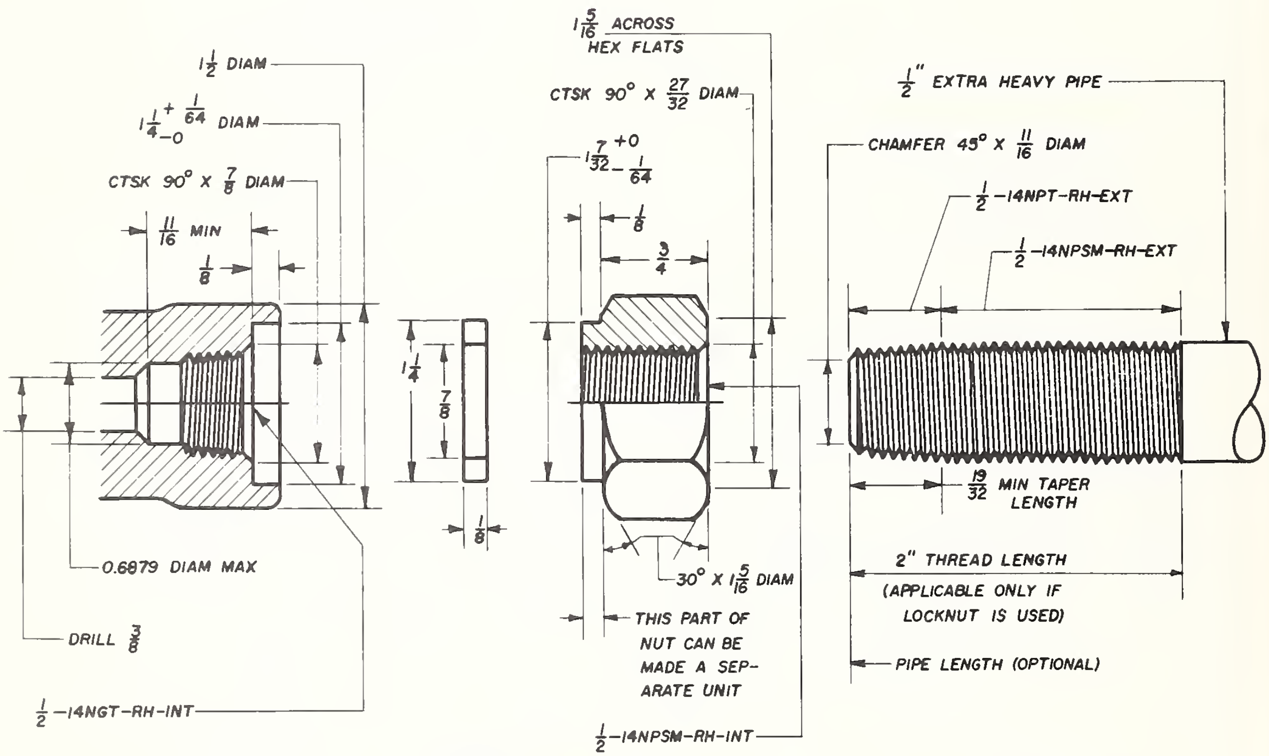
[a] See footnote *a* to table IX.1.



PLAIN PIPE CONNECTION



TYPICAL LOCKNUT CONNECTION



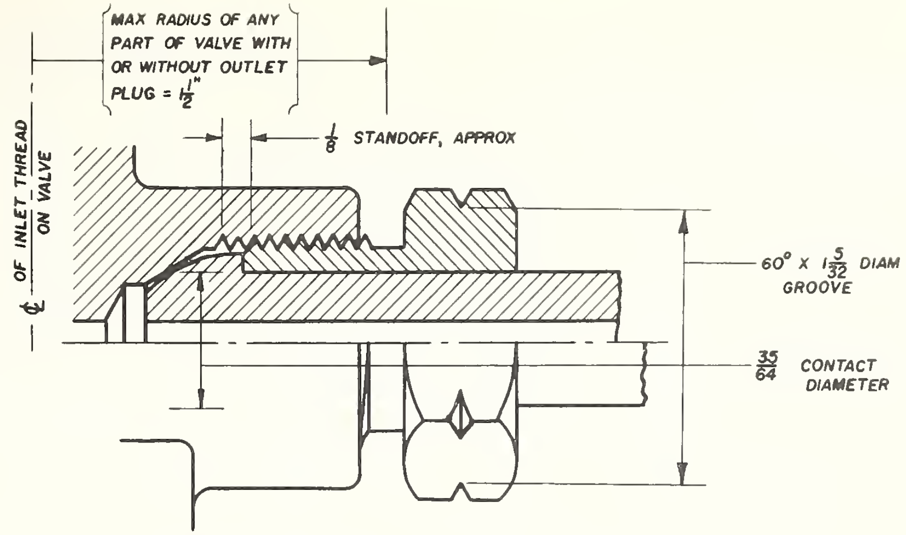
VALVE OUTLET NO. 381 | WASHER NO. 385 | LOCKNUT NO. 384 | NIPPLE NO. 383

Standard outlet connection for:

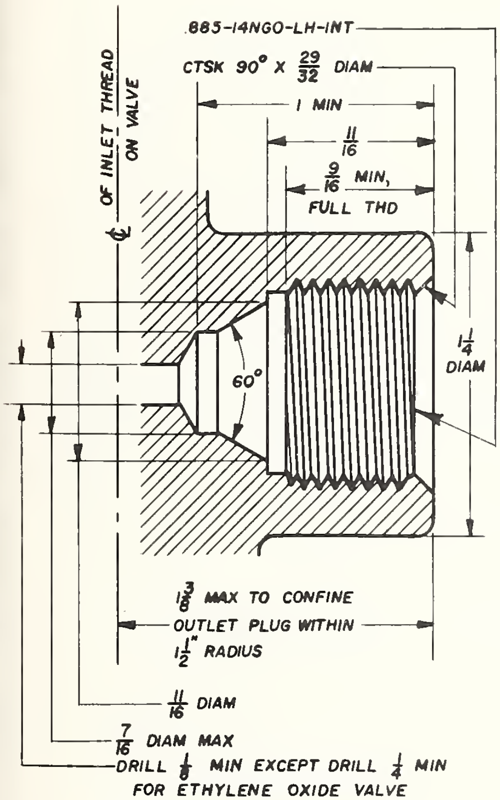
Ammonia, anhydrous (co-standards 240 and 380 have been established for anhydrous ammonia. Connection No. 240 is standard for the Federal Services while No. 380 is the commercial standard).

Dimensions in inches unless otherwise specified.

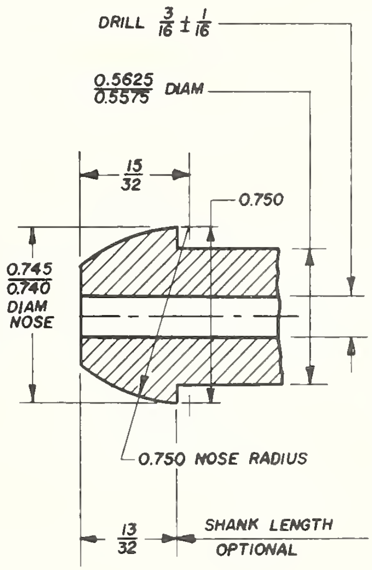
FIGURE IX.13.—*No. 380 valve outlet connection, ½—14NGT–RH–INT thread.*



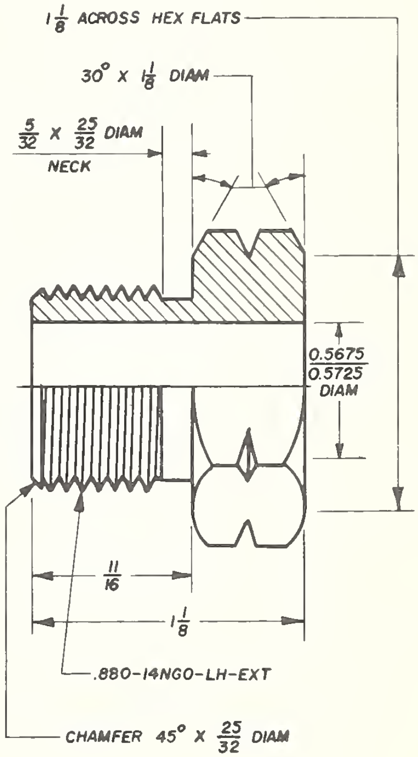
CONNECTION NO. 510



VALVE OUTLET NO. 511



NIPPLE NO. 513



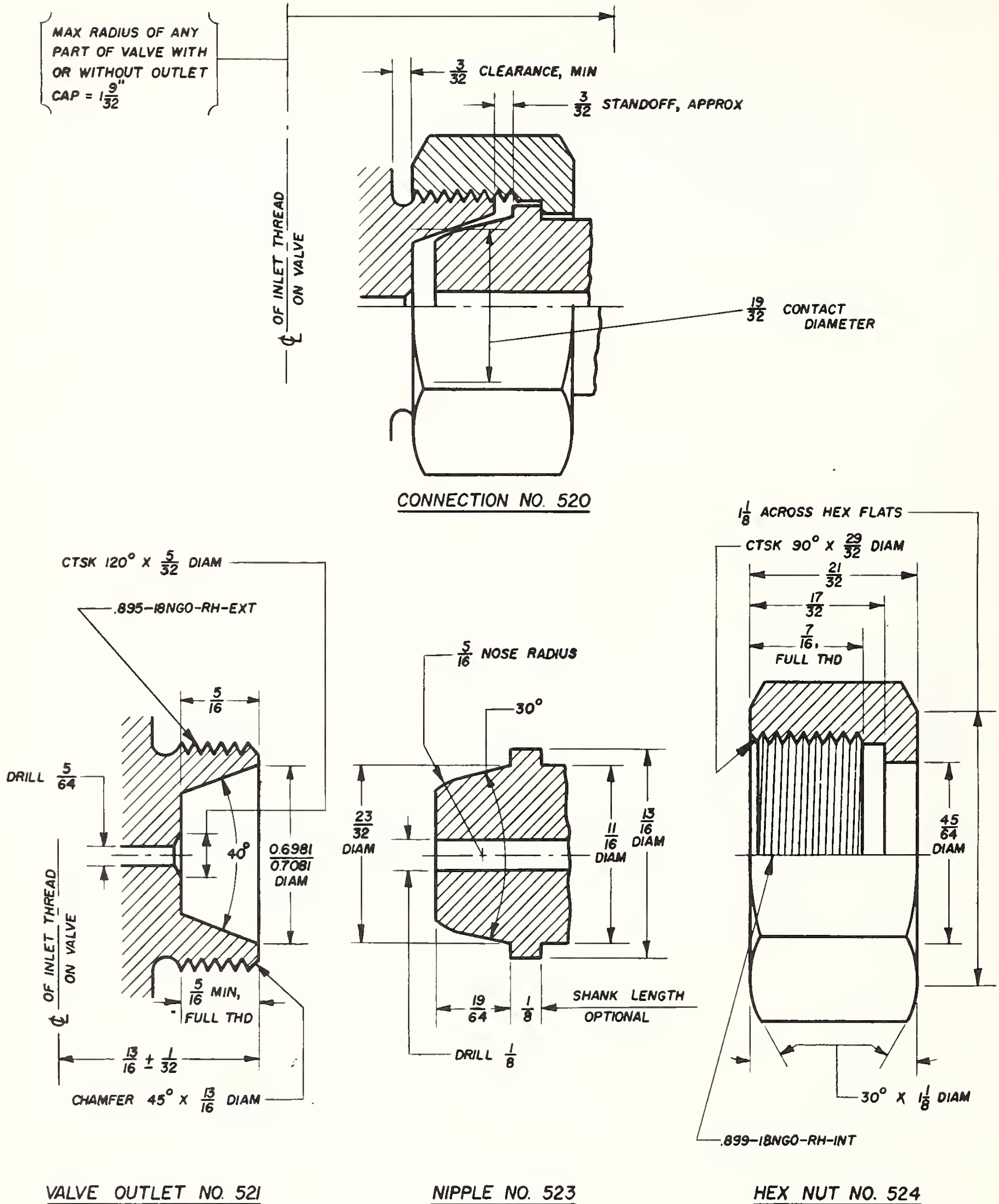
HEX NUT NO. 514

Standard outlet connection for:

Acetylene	Cyclopropane, industrial	Isobutane
Butadiene	Dimethyl ether	Propane
Butane	Ethylene oxide	Propylene

Dimensions in inches unless otherwise specified.

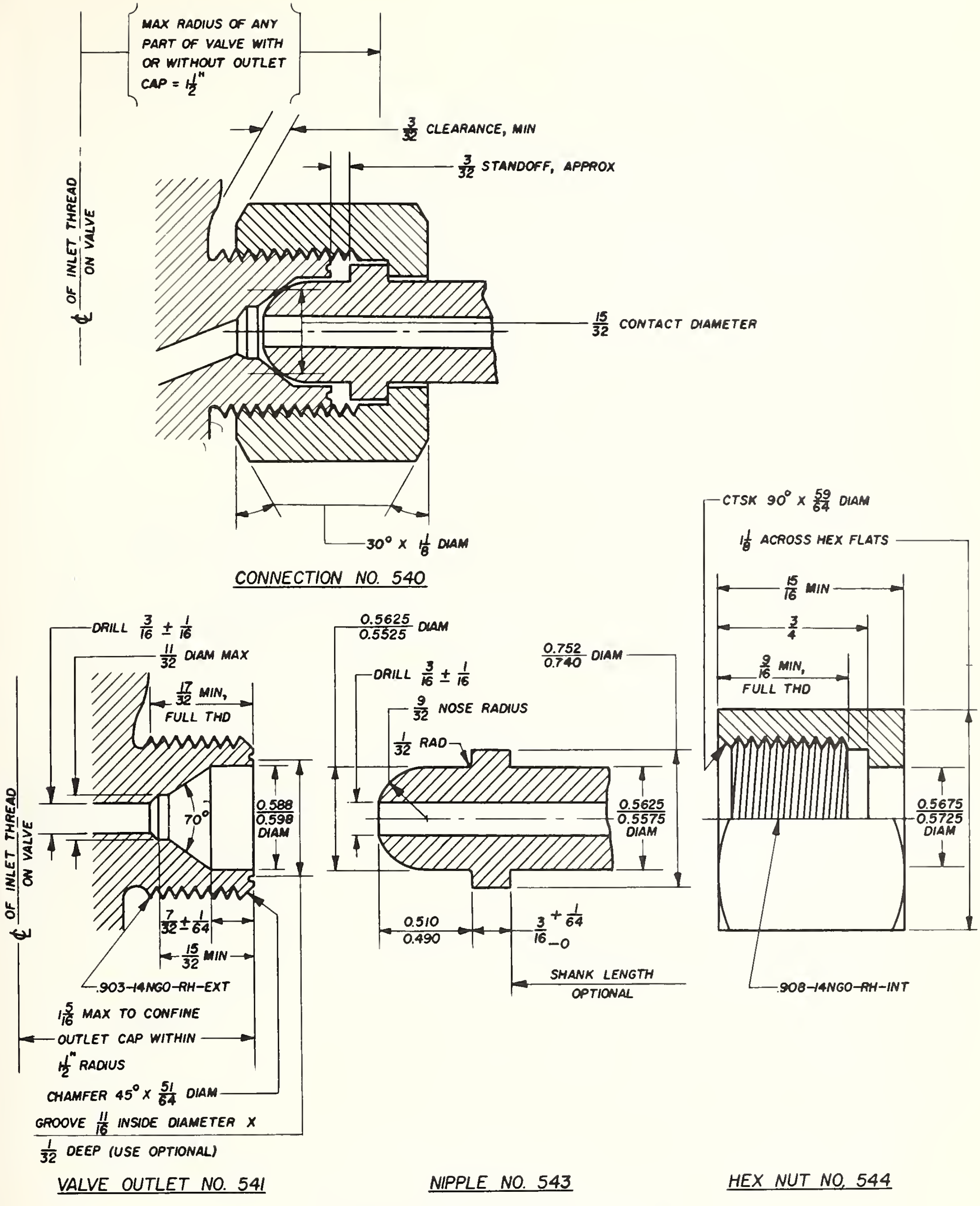
FIGURE IX.14.—*No. 510 valve outlet connection, .885—14NGO–LH–INT thread.*



Alternate standard outlet connection for: Acetylene, small valve series (see footnote *a* to table IX.1.)

Dimensions in inches unless otherwise specified.

FIGURE IX.15.—*No. 520 valve outlet connection, .895—18NGO-RH-EXT thread.*

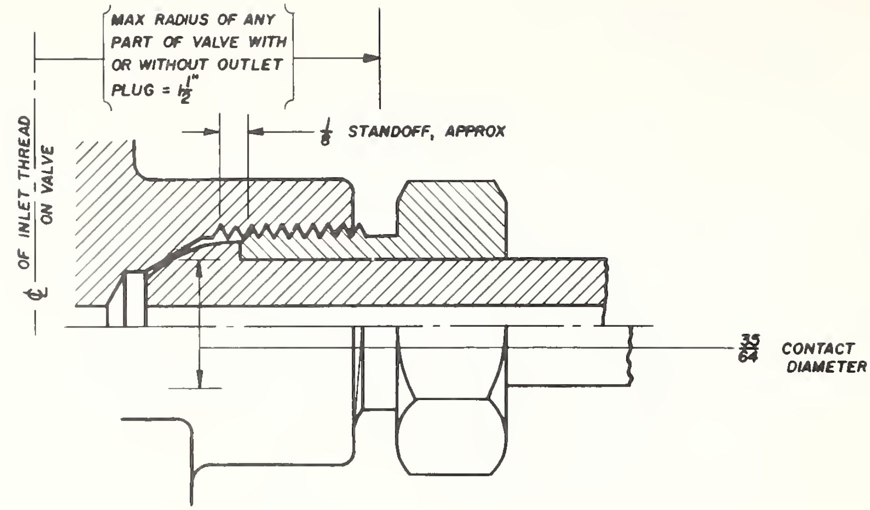


Standard outlet connection for: Oxygen, industrial and medical

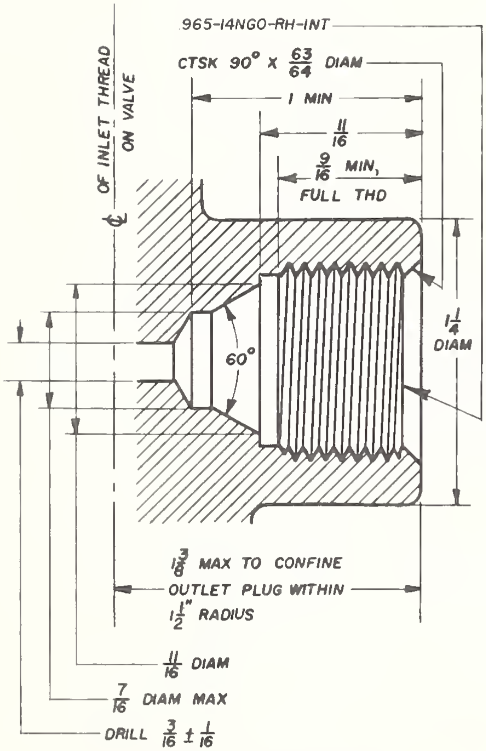
Dimensions in inches unless otherwise specified.

WARNING: DO NOT USE THIS CONNECTION FOR ANY OTHER GAS OR FOR ANY GAS MIXTURE.

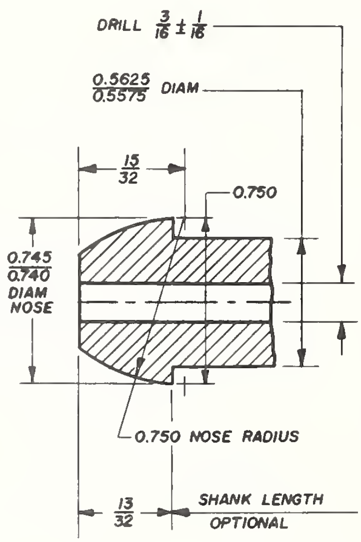
FIGURE IX.16.—*No. 540 valve outlet connection, .903—14NGO–RH–EXT thread with round nipple.*



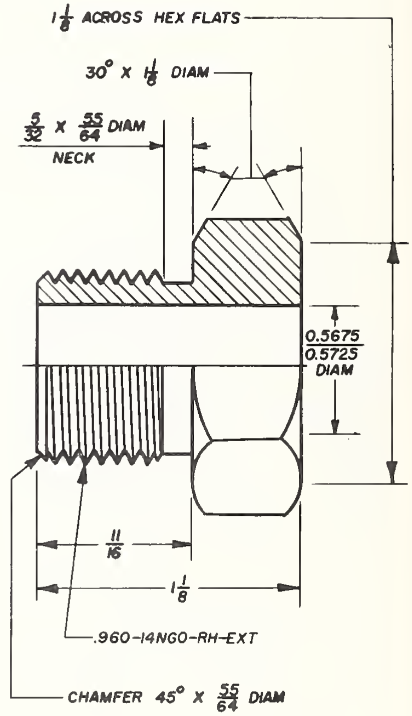
CONNECTION NO. 580



VALVE OUTLET NO. 581



NIPPLE NO. 583



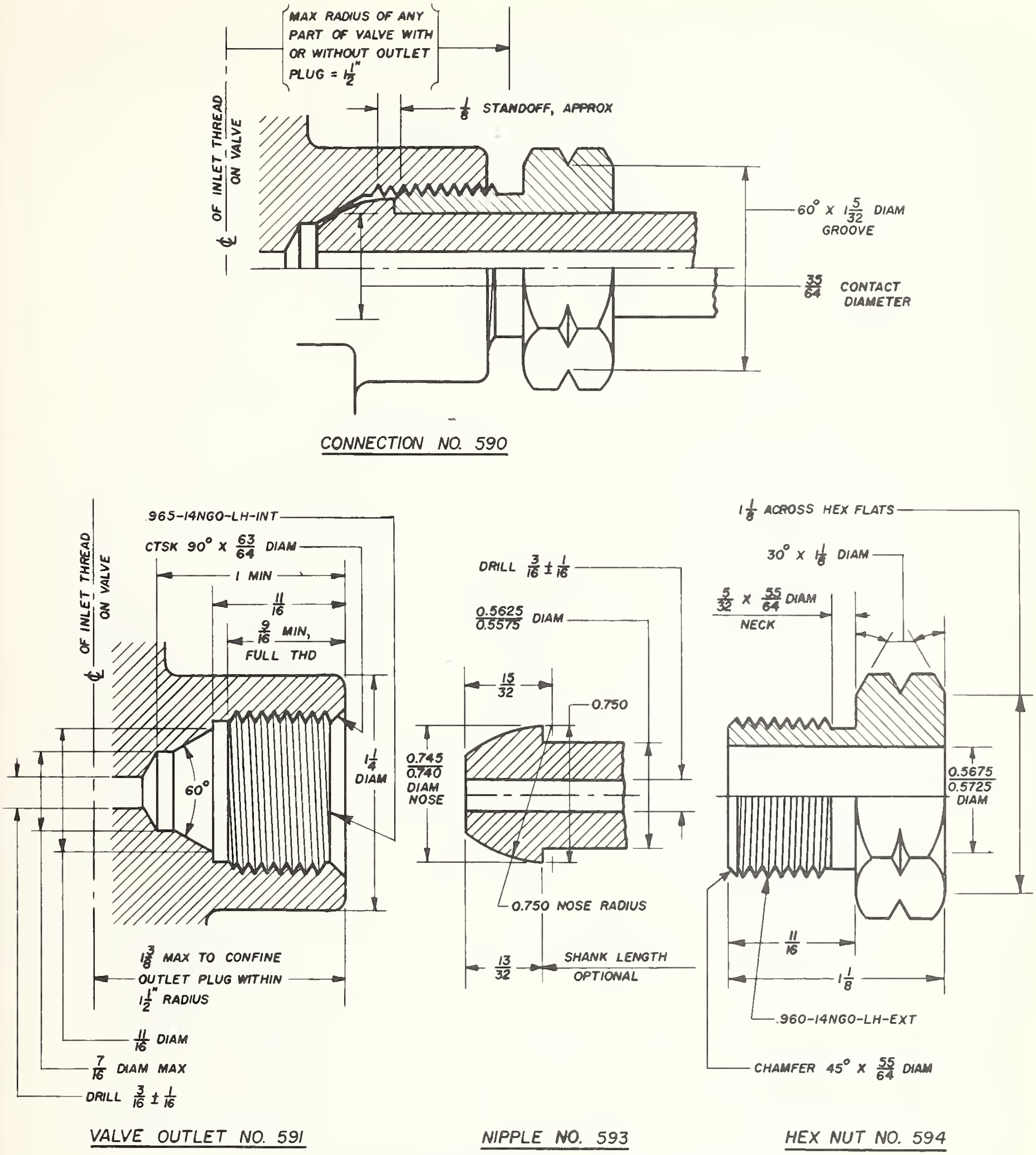
HEX NUT NO. 584

Standard outlet connection for:

Air, water-pumped	Neon, water-pumped
Argon, water-pumped	Nitrogen, water-pumped
Helium, water-pumped	Xenon, water-pumped
Krypton, water-pumped	

Dimensions in inches unless otherwise specified.

FIGURE IX.17.—*No. 580 valve outlet connection, .965—14NGO–RH–INT thread.*

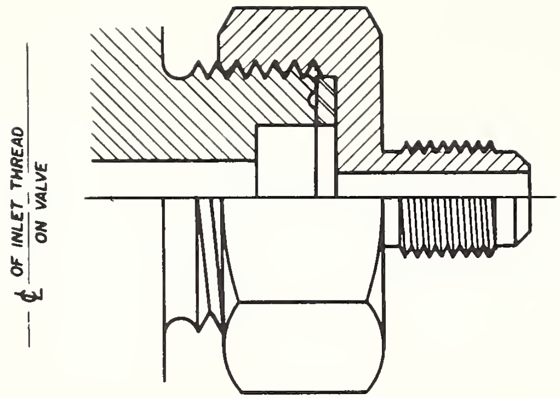


Standard outlet connection for:

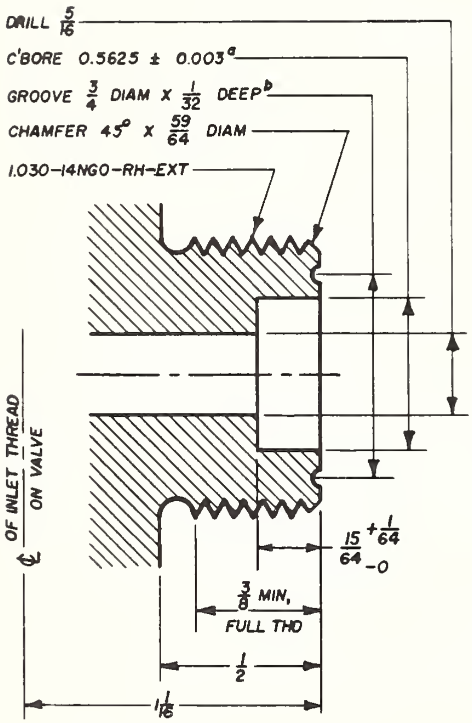
Air, oil-pumped	Neon, oil-pumped
Argon, oil-pumped	Nitrogen, oil-pumped
Helium, oil-pumped	Sulphur hexafluoride
Krypton, oil-pumped	Xenon, oil-pumped

Dimensions in inches unless otherwise specified.

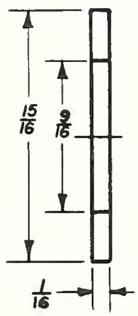
FIGURE IX.18.—*No. 590 valve outlet connection, .965—14NGO-LH-INT thread.*



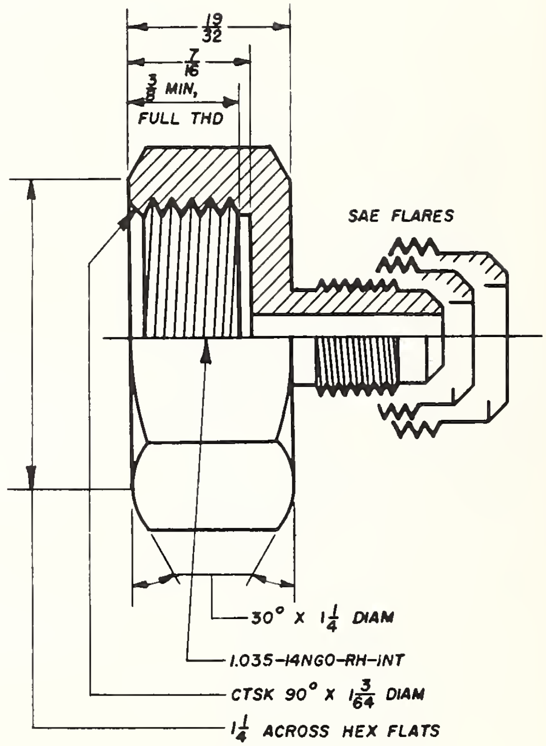
CONNECTION NO. 620



VALVE OUTLET NO. 621



WASHER NO. 625



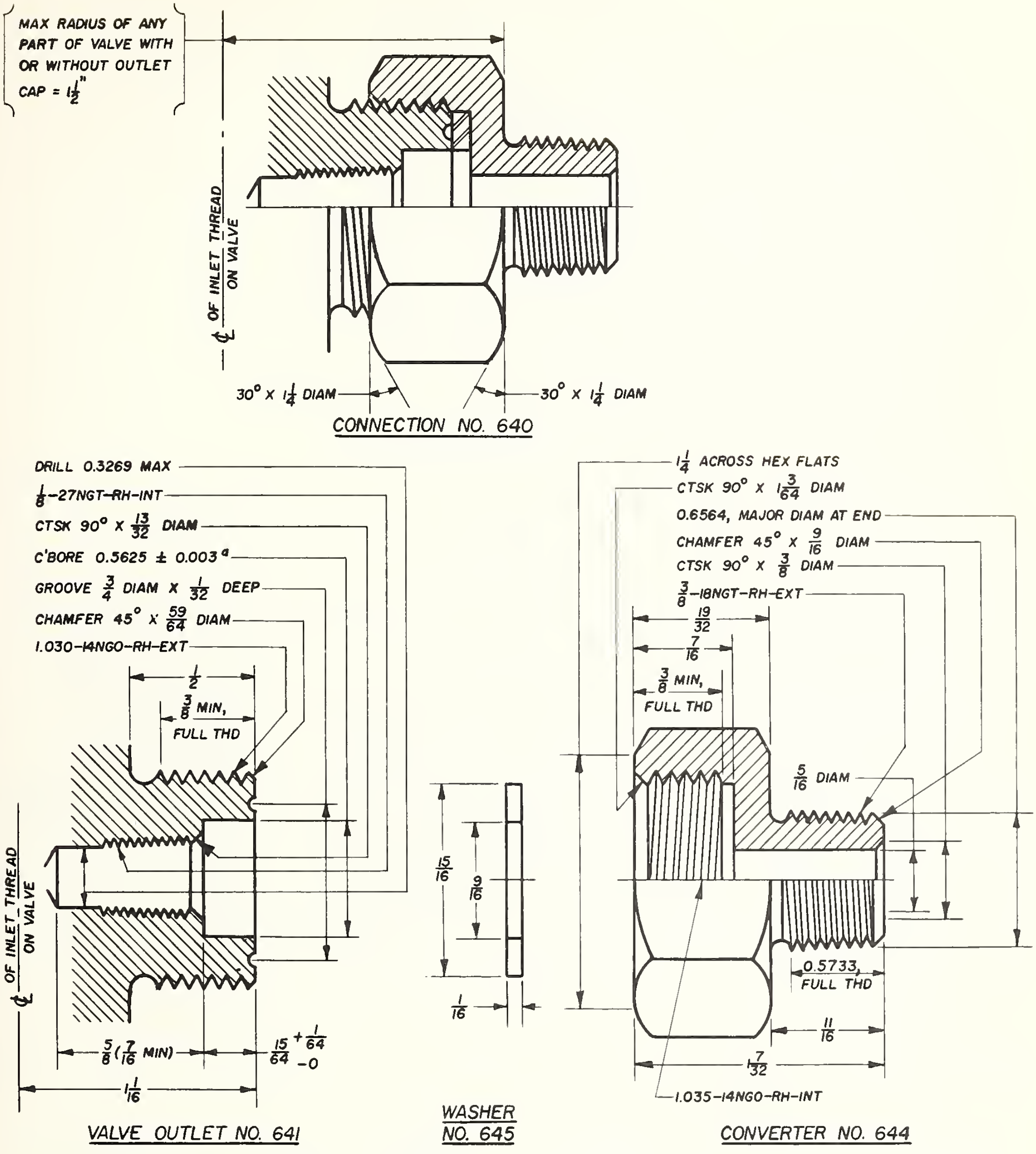
CONVERTER NO. 624

[a] Counterbore may be omitted when so specified.
[b] If groove is not required, use valve outlet No. 661, figure IX.21.

Standard outlet connection for:
- Bromochloromethane
- Dichlorodifluoromethane
- Dichlorodifluoromethane-difluoroethane mixture
- Difluorodibromoethane
- Methyl bromide
- Methyl chloride
- Monochlorodifluoromethane
- Monochlorotetrafluoroethane
- Monochlorotrifluoromethane
- Sulphur dioxide
- Tetrafluoroethylene
- Trifluorobromomethane
- Trifluorochloroethylene, inhibited

Dimensions in inches unless otherwise specified.

FIGURE IX.19.—*No. 620 valve outlet connection, 1.030—14NGO-RH-EXT thread with flare converters.*

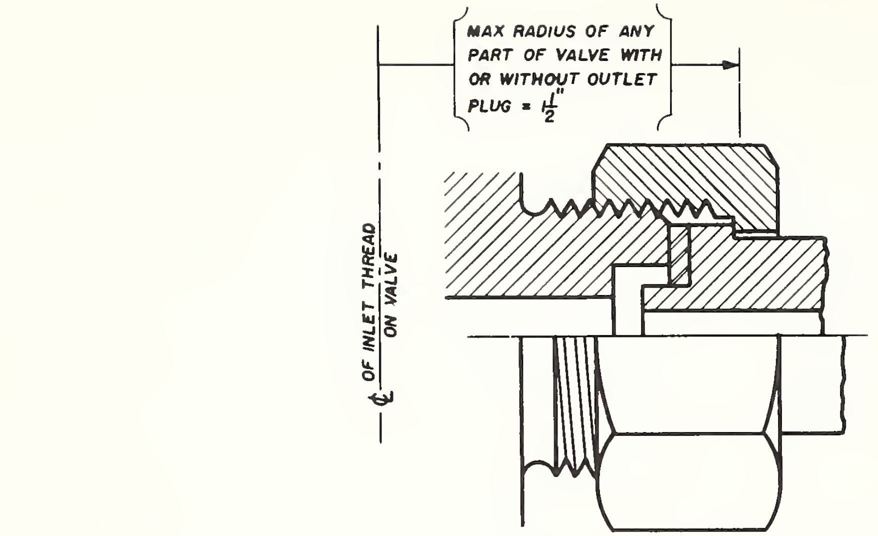


[a] Counterbore may be omitted when so specified.

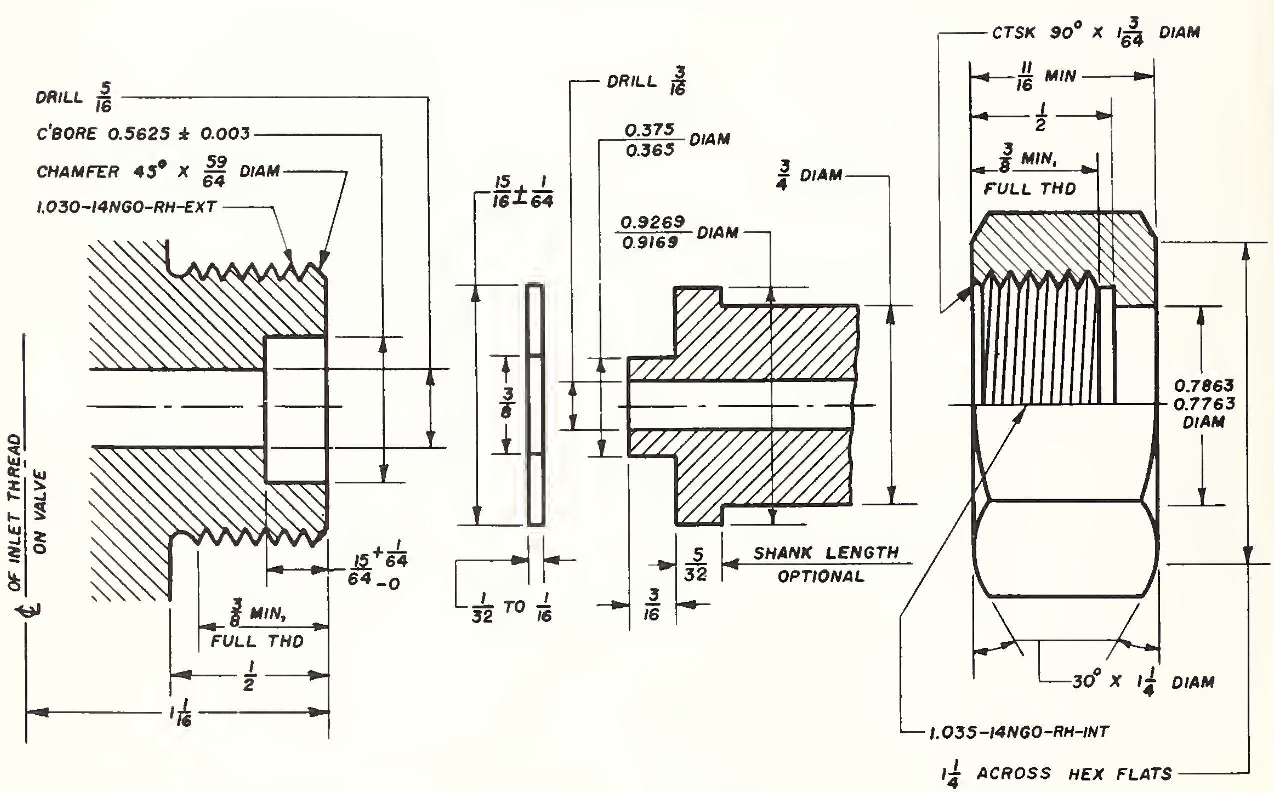
Standard outlet connection for: Phosgene

Dimensions in inches unless otherwise specified.

FIGURE IX.20.—*No. 640 valve outlet connection, 1.030—14NGO–RH–EXT thread with 3/8—18NGT–RH–EXT converter.*



CONNECTION NO. 660



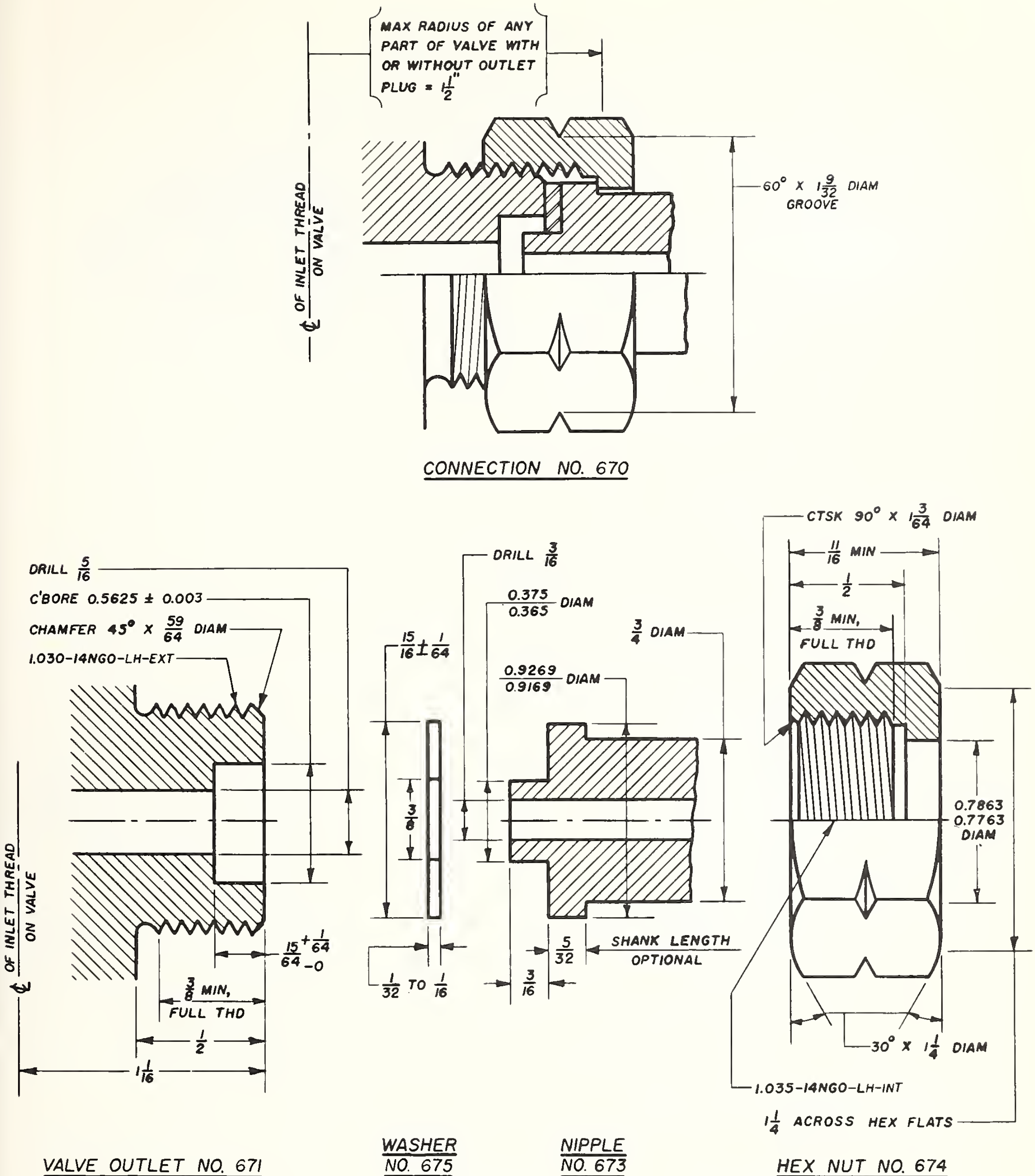
VALVE OUTLET NO. 661[a] | WASHER NO. 665 | NIPPLE NO. 663 | HEX NUT NO. 664

[a] If groove is required, use valve outlet No. 621, figure IX.19.

Standard outlet connection for:
Chlorine
Difluoroethane
Difluoromonochloroethane

Dimensions in inches unless otherwise specified.

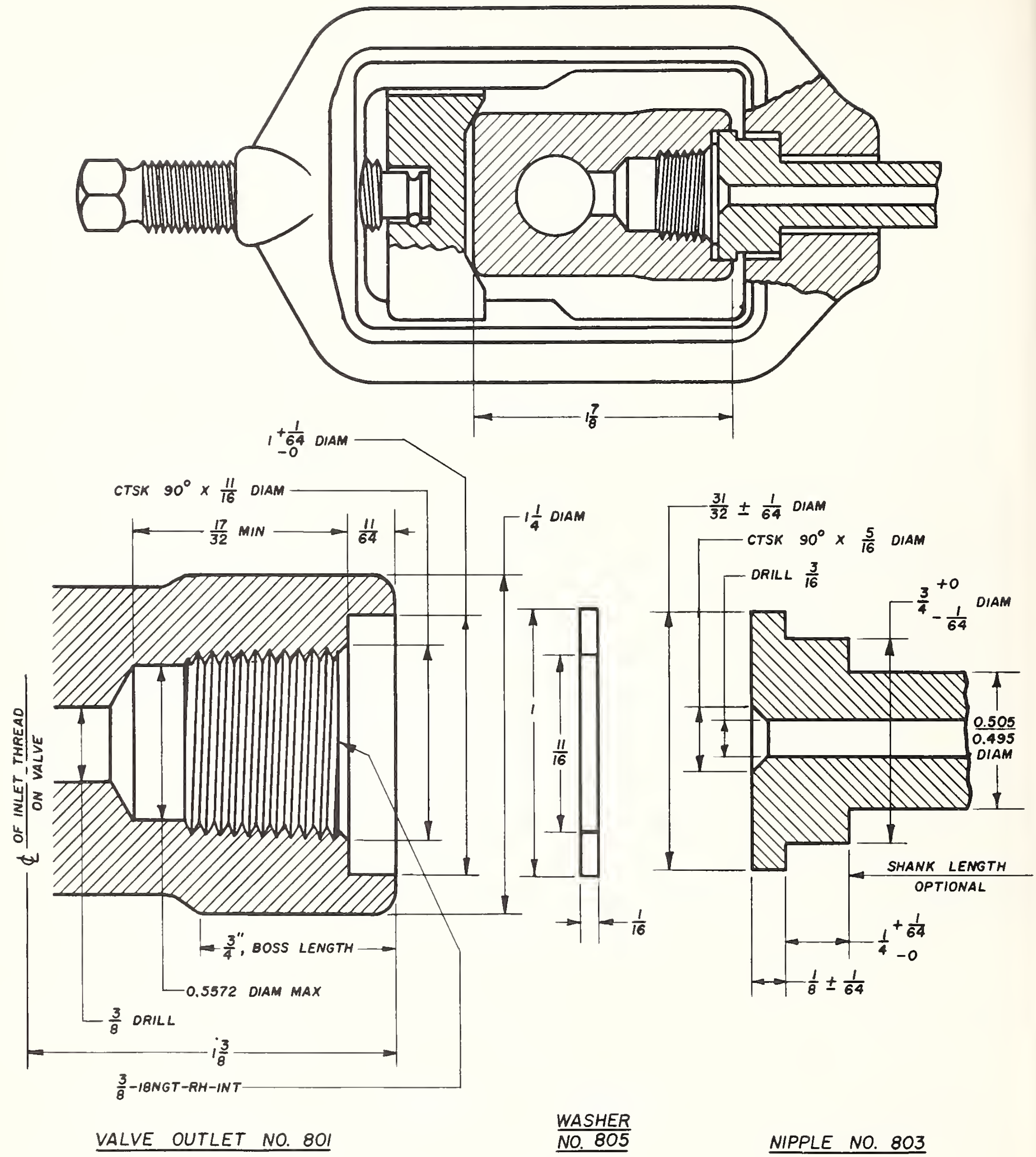
FIGURE IX.21.—*No. 660 valve outlet connection, 1.030—14NGO–RH–EXT thread with nut and nipple.*



Standard outlet connection for:
Chlorine trifluoride
Fluorine
Hydrogen fluoride, anhydrous

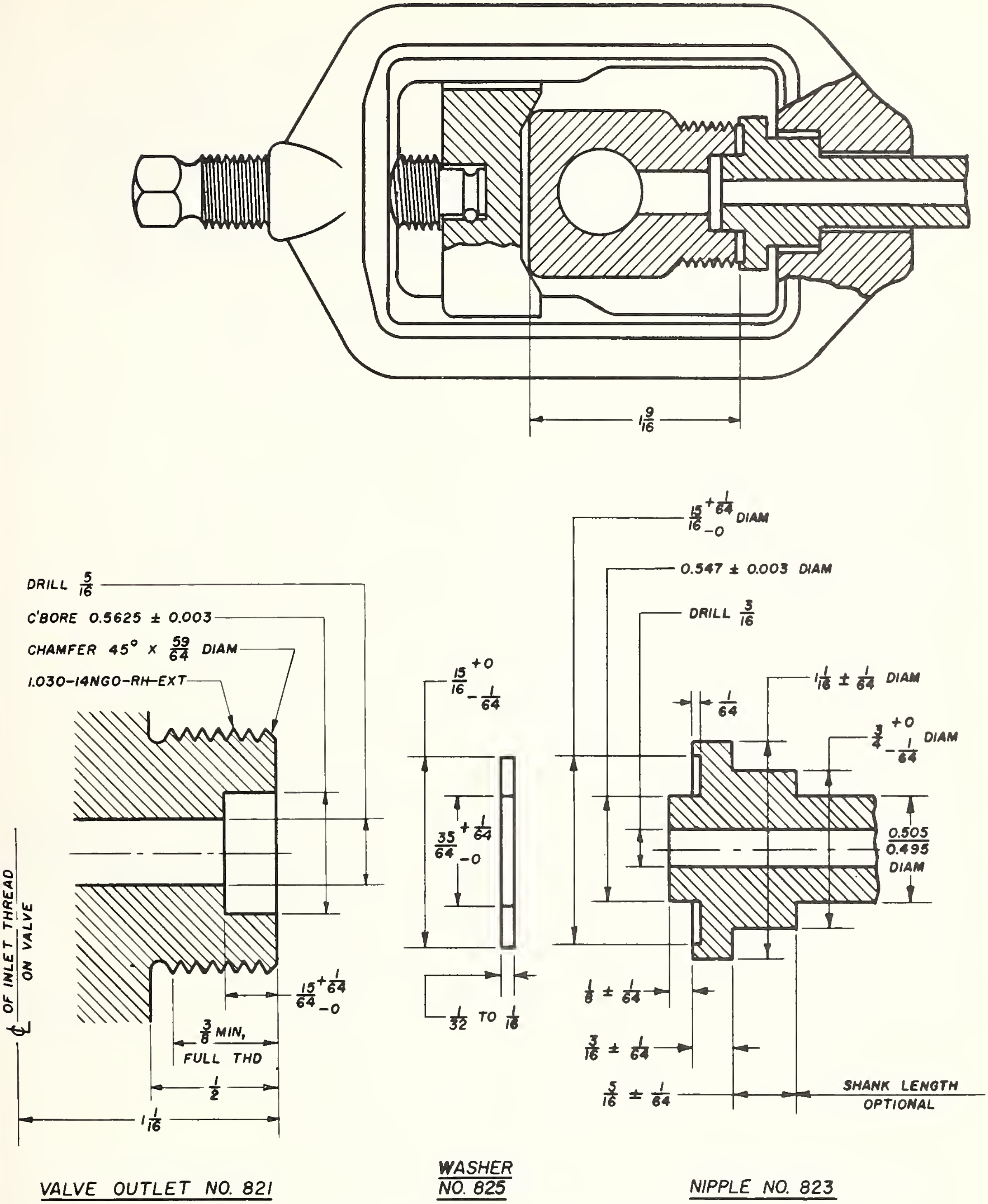
Dimensions in inches unless otherwise specified.

FIGURE IX.22.—*No. 670 valve outlet connection, 1.030–14NGO–LH–EXT thread.*



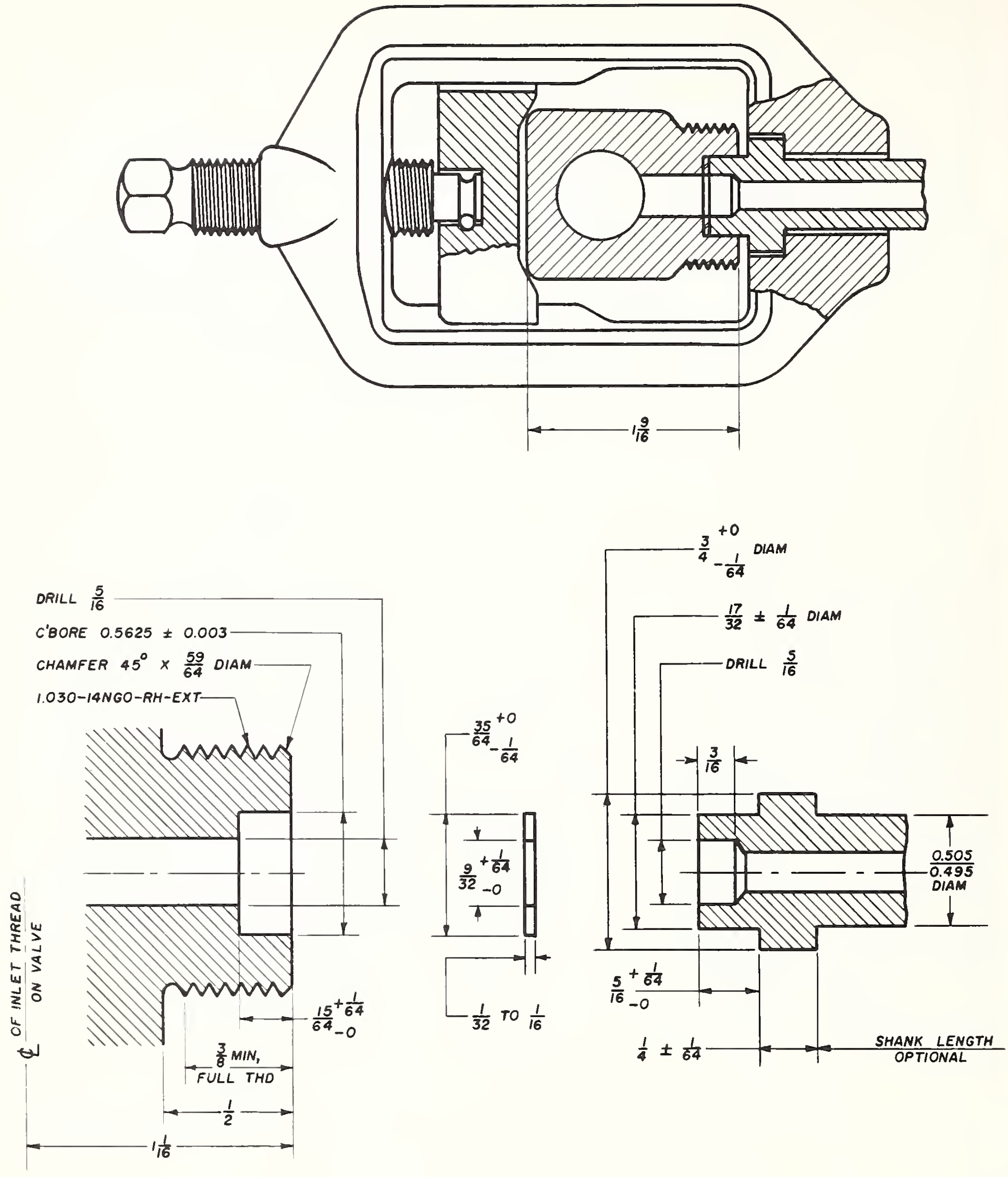
Dimensions in inches unless otherwise specified

FIGURE IX.23.—*No. 800 standard valve outlet connection, yoke type, for ammonia, anhydrous.*



Dimensions in inches unless otherwise specified.

FIGURE IX.24.— *No. 820 standard valve outlet connection, yoke type, for chlorine (with washer on outer face).*



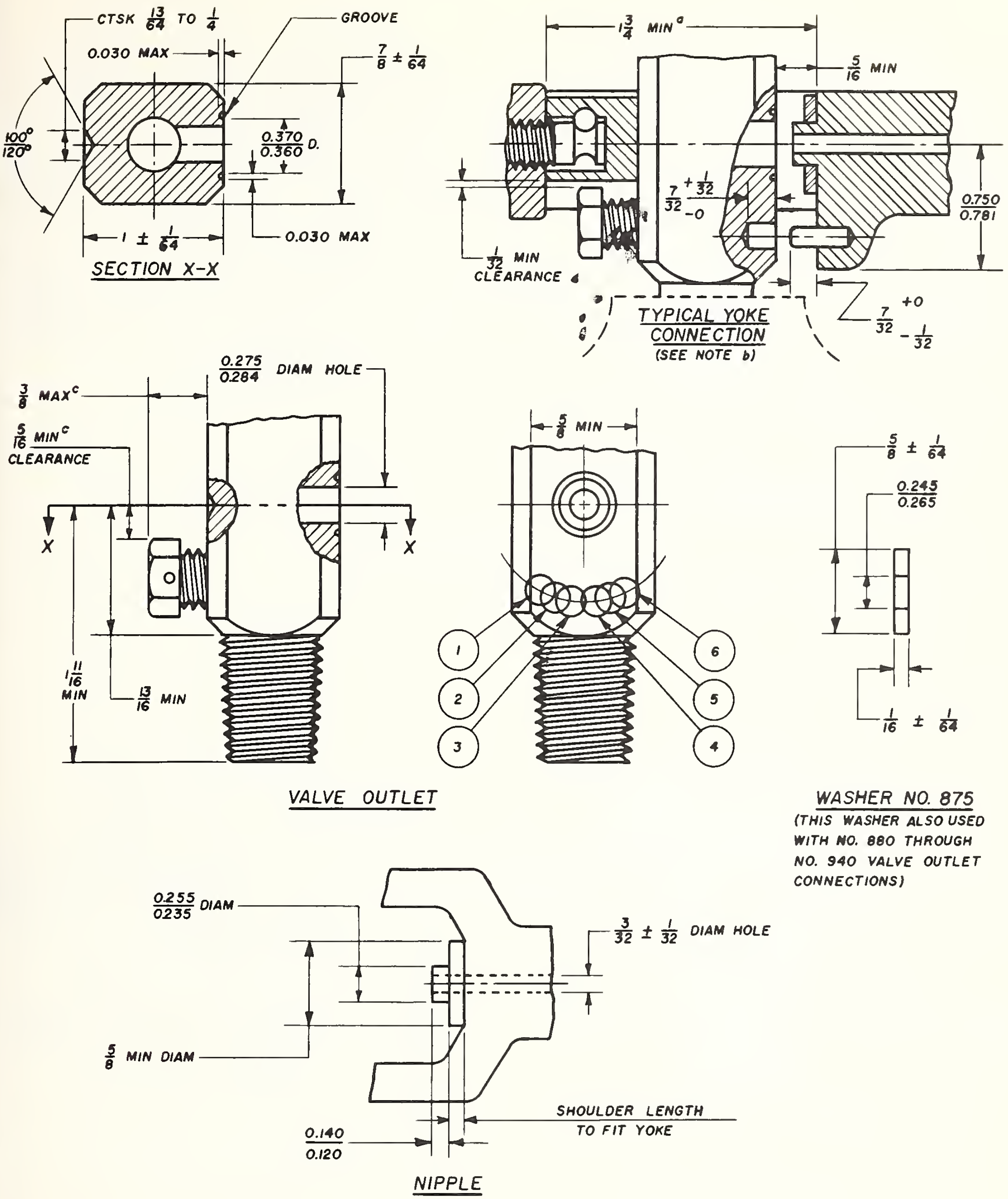
VALVE OUTLET NO. 841

WASHER NO. 845

NIPPLE NO. 843

Dimensions in inches unless otherwise specified.

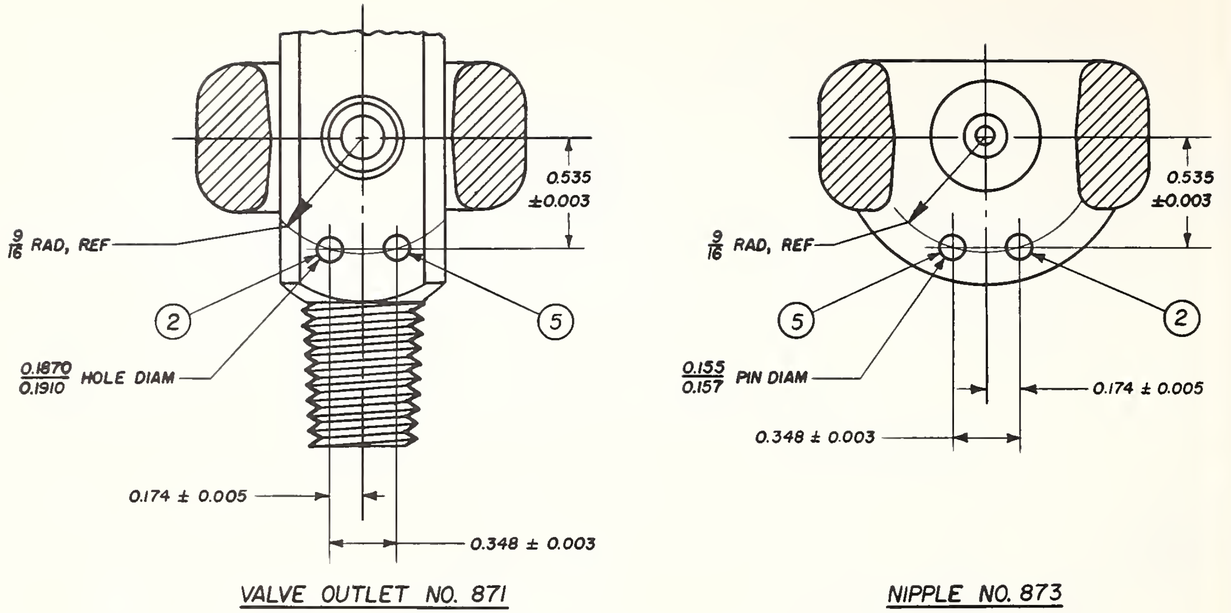
FIGURE IX.25.—*No. 840 standard valve outlet connection, yoke type, for chlorine (with washer inside of recess).*



[a] 1¾" may be reduced to 1⅜" if clearance is provided for projecting safety nut.
[b] Yoke or stabilizer shall be so dimensioned as to limit its rotation on the valve to ±6 degrees.
[c] Applicable only if projecting type safety is used.

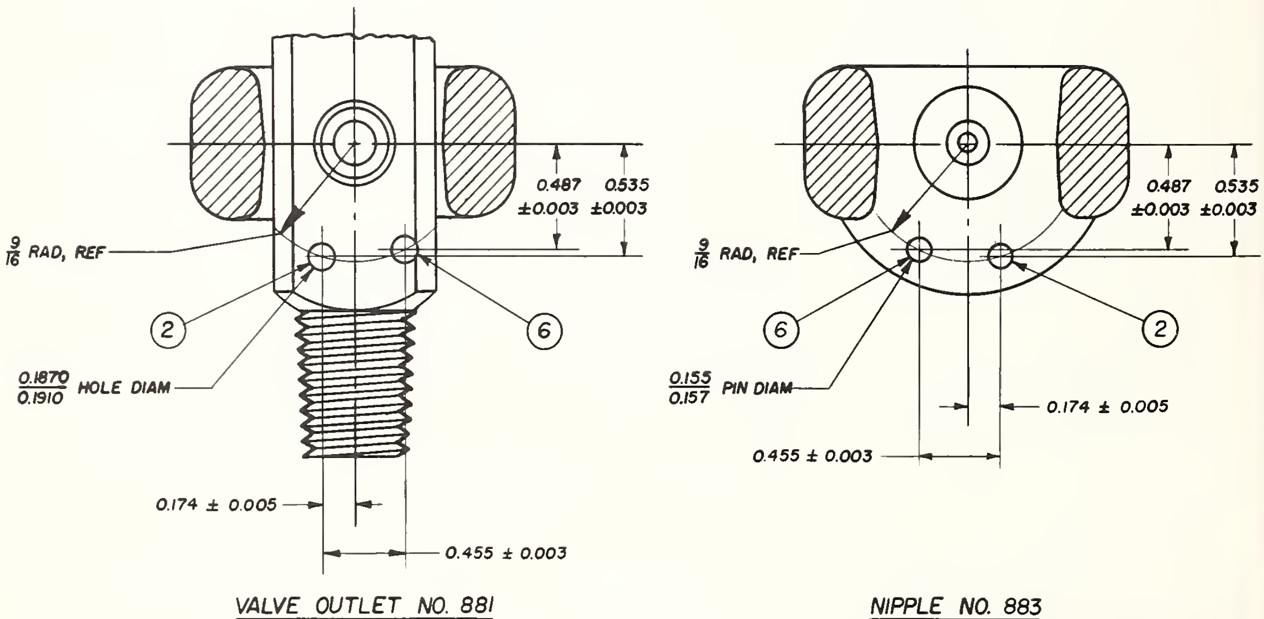
Dimensions in inches unless otherwise specified.

FIGURE IX.26.—*No. 870 through No. 940 valve outlet connections, yoke type, basic dimensions.*



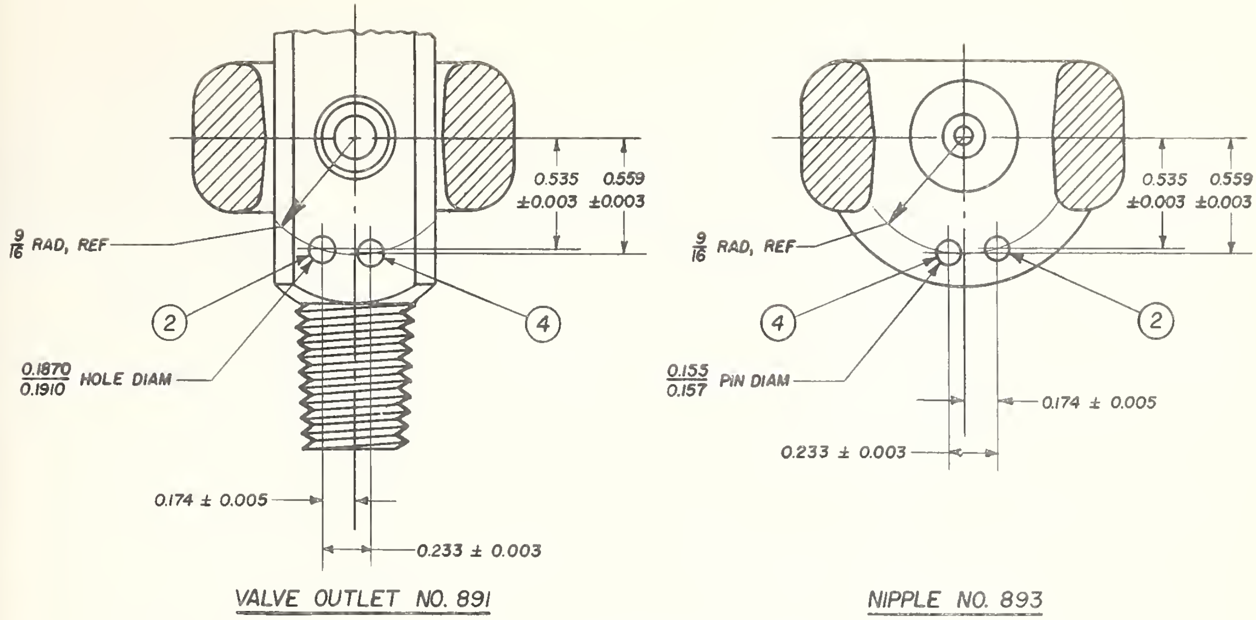
For basic dimensions see figure IX.26.
Dimensions in inches unless otherwise specified.

FIGURE IX.27.—*No. 870 standard valve outlet connection, yoke type, for oxygen, medical.*



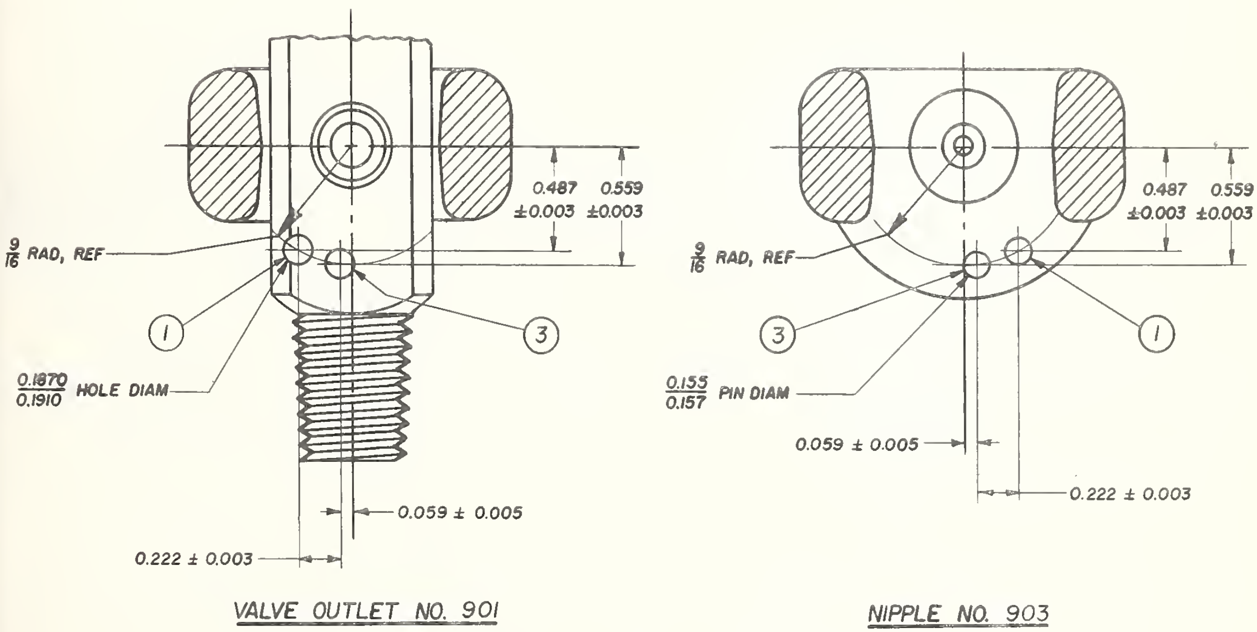
For basic dimensions see figure IX.26.
Dimensions in inches unless otherwise specified.

FIGURE IX.28.—*No. 880 standard valve outlet connection, yoke type, for oxygen-carbon dioxide mixture (CO_2 not over 7 percent), medical.*



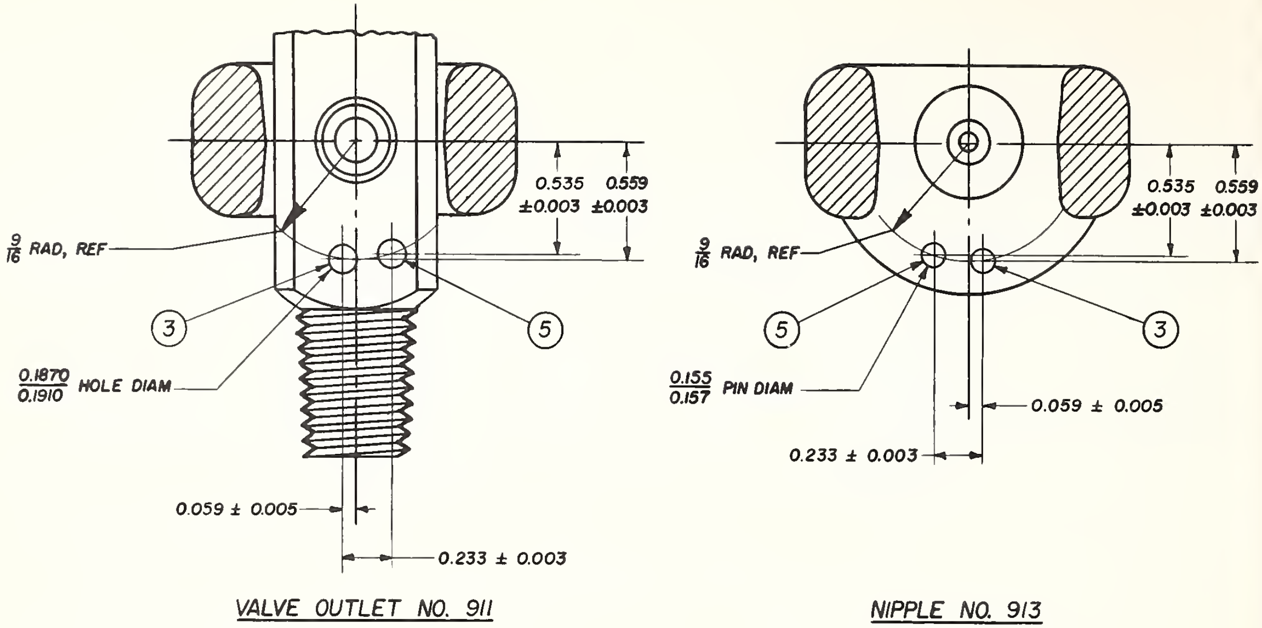
For basic dimensions see figure IX.26.
Dimensions in inches unless otherwise specified.

FIGURE IX.29.—*No. 890 standard valve outlet connection, yoke type, for oxygen-helium mixtures (helium not over 80 percent), medicol.*



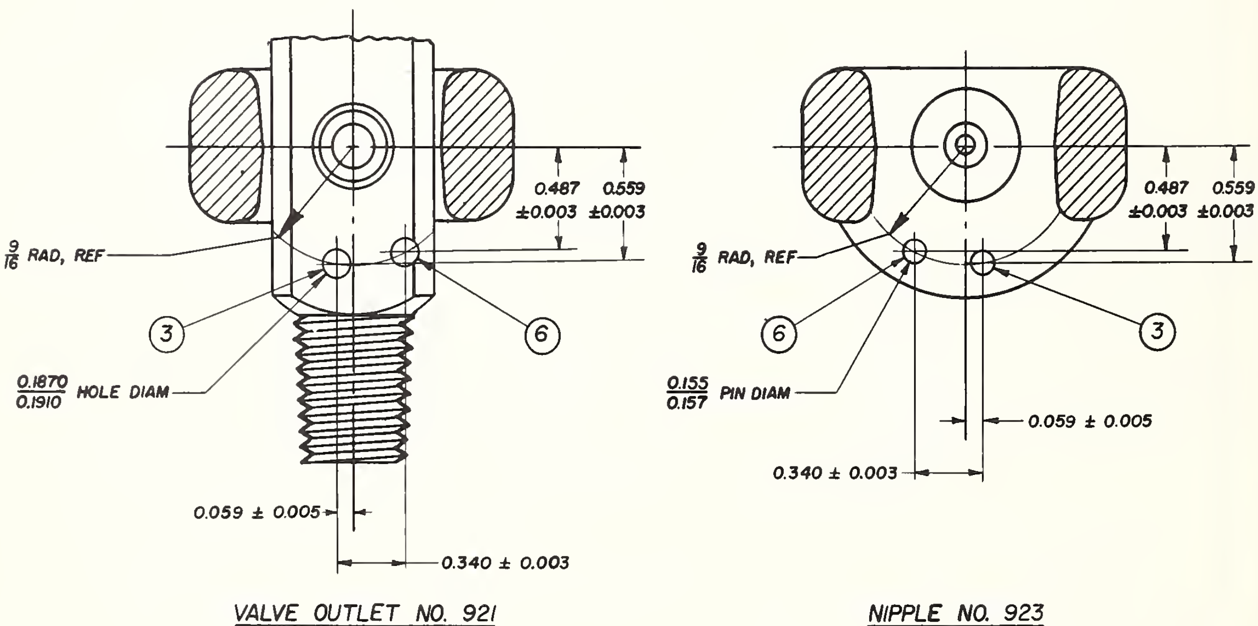
For basic dimensions see figure IX.26.
Dimensions in inches unless otherwise specified.

FIGURE IX.30.—*No. 900 standord volve outlet connection, yoke type, for ethylene, medicol.*



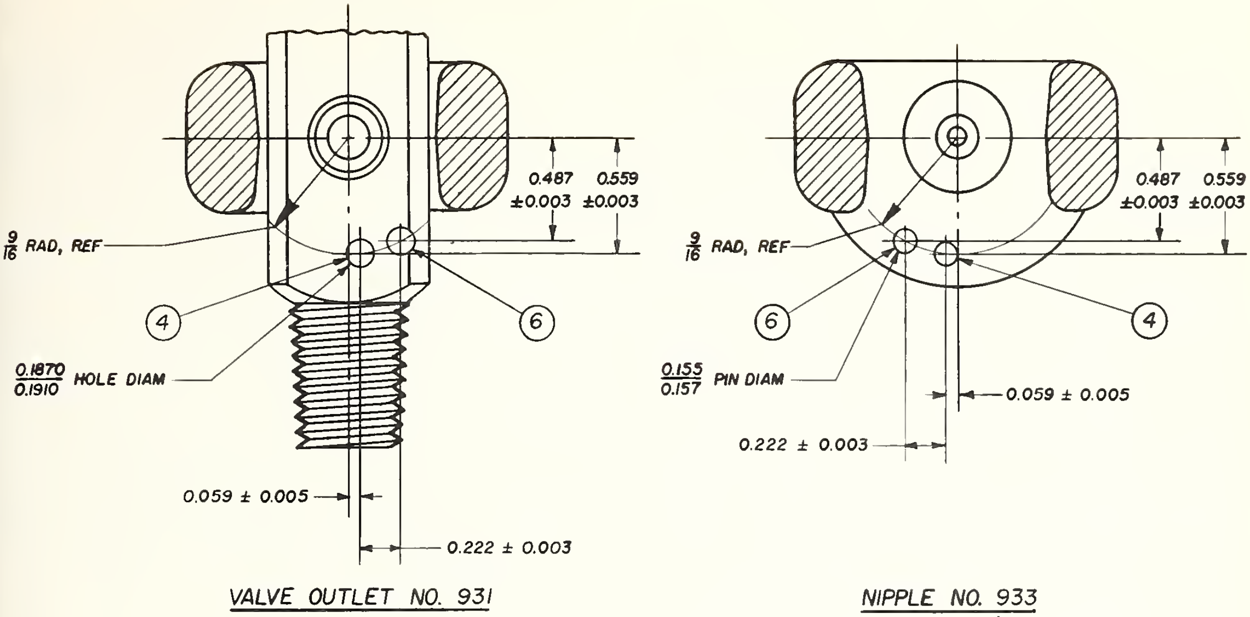
For basic dimensions see figure IX.26.
Dimensions in inches unless otherwise specified.

FIGURE IX.31.—*No. 910 standard valve outlet connection, yoke type, for nitrous oxide, medical.*



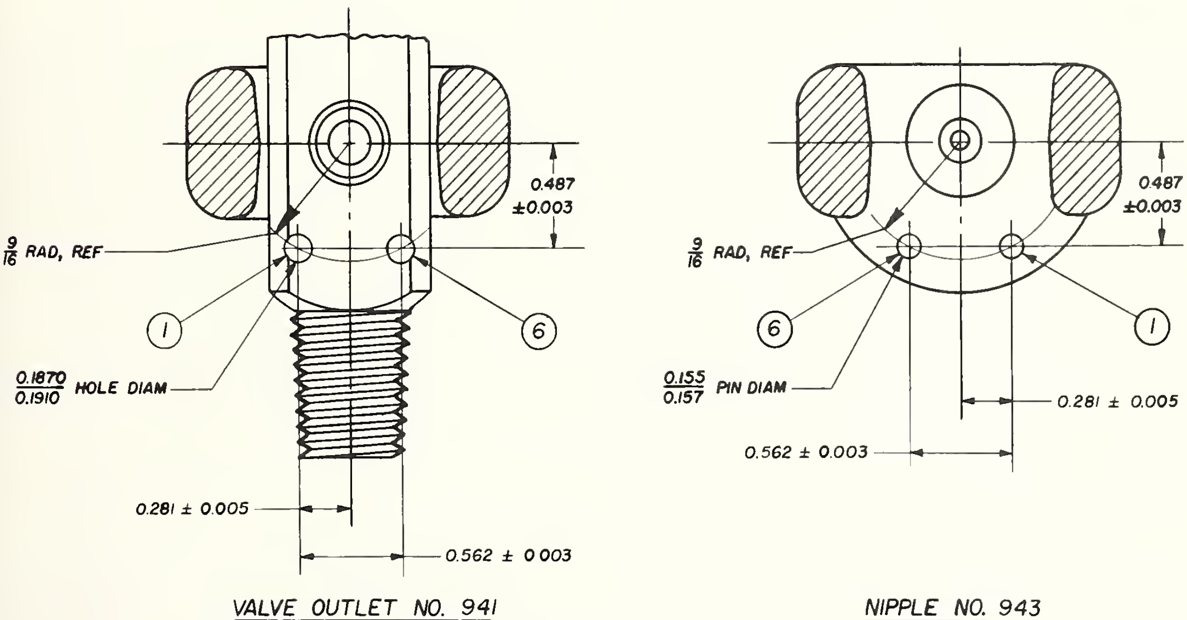
For basic dimensions see figure IX.26.
Dimensions in inches unless otherwise specified.

FIGURE IX.32.—*No. 920 standard valve outlet connection, yoke type, for cyclopropane, medical.*



For basic dimensions see figure IX.26.
Dimensions in inches unless otherwise specified.

FIGURE IX.33.—*No. 930 standard valve outlet connection, yoke type, for helium, medical; and helium-oxygen mixture (O_2 less than 20 percent), medical.*



For basic dimensions see figure IX.26.
Dimensions in inches unless otherwise specified.

FIGURE IX.34.—*No. 940 standard valve outlet connection, yoke type, for carbon dioxide, medical; and carbon dioxide-oxygen mixture (CO_2 over 7 percent), medical.*

Table IX.4.—*Limits of size of U.S. compressed gas cylinder valve outlet threads, NGO*

Thread designation	External thread					Internal thread				
	Major diameter		Pitch diameter		Minor diameter	Minor diameter		Pitch diameter		Major diameter
	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min
1	2	3	4	5	6	7	8	9	10	11
	in.	*in.*	*in.*	*in.*	*in.*	*in.*	*in.*	*in.*	*in.*	*in.*
.373—24NGO-RH-EXT	0.3730	0.3680	0.3459	0.3435	0.3219					
.375—24NGO-RH-INT						0.3299	0.3344	0.3479	0.3503	0.3750
.625—20NGO-RH-EXT	.6250	.6200	.5925	.5895	.5637					
.628—20NGO-RH-INT						.5739	.5793	.5955	.5985	.6280
.745—14NGO{-RH / -LH}-EXT	.7450	.7400	.6986	.6950	.6574					
.750—14NGO{-RH / -LH}-INT						.6727	.6804	.7036	.7072	.7500
.825—14NGO{-RH / -LH}-EXT	.8250	.8200	.7786	.7750	.7374					
.830—14NGO{-RH / -LH}-INT						.7527	.7604	.7836	.7872	.8300
.880—14NGO-LH-EXT	.8800	.8750	.8336	.8300	.7924					
.885—14NGO-LH-INT						.8077	.8154	.8386	.8422	.8850
.895—18NGO-RH-EXT	.8950	.8900	.8589	.8553	.8268					
.899—18NGO-RH-INT						.8389	.8449	.8629	.8665	.8900
.903—14NGO-RH-EXT	.9030	.8980	.8566	.8530	.8154					
.908—14NGO-RH-INT						.8307	.8384	.8616	.8652	.9080
.960—14NGO{-RH / -LH}-EXT	.9600	.9550	.9136	.9100	.8724					
.965—14NGO{-RH / -LH}-INT						.8877	.8954	.9186	.9222	.9650
1.030—14NGO{-RH / -LH}-EXT	1.0300	1.0250	.9836	.9796	.9424					
1.035—14NGO{-RH / -LH}-INT						.9577	.9654	.9886	.9926	1.0350

Table IX.5.—*Limits of size, National Gas Taper, Special Gas Taper threads; NGT, NGT(Cl), SGT*

Thread designation[a]	Hand-tight engagement,[c] L_1	External							Internal						
		Small end			Full threads		Large end		Neck radius, min, G	Pitch diameter at face, E_1	C'sink 90° x max. diameter	Full threads			
		Major diameter, D_0	Pitch diameter, E_0	Chamfer 45° x min. diameter	Pitch diameter, E_8	Length,[d] L_8	Major diameter, approx., D_{10}	Over-all length, approx., L_{10}				Bore, max., K_3	Pitch diameter, E_3	Length, (L_1+L_3)	Length of full root, min.,[e] L_9
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.*
1/8—27NGT	0.1800	0.3931	0.3635	21/64	0.3886	0.4022	0.4204	7/16	9/32	0.3748	13/32	0.3269	0.3566	0.2911	0.3652
1/4—18NGT	.2000	.5218	.4774	27/64	.5107	.5333	.5530	5/8	3/8	.4899	9/16	.4225	.4670	.3667	.4778
3/8—18NGT	.2400	.6564	.6120	9/16	.6479	.5733	.6915	11/16	7/16	.6270	11/16	5572	.6016	.4067	.5178
1/2—14NGT	.3200	.8156	.7584	11/16	.8052	.7486	.8625	3/4	9/16	.7784	7/8	.6879	.7450	.5343	.6771
3/4—14NGT	.3390	1.0248	.9677	29/32	1.0157	.7676	1.0795	7/8	11/16	.9889	1 1/16	.8972	.9543	.5533	.6961
3/4—14NGT (Cl)-1	.3390	1.0248	.9677	29/32	1.0268	.9461	1.0951	1 1/8	11/16	.9889	1 1/16	.8972	.9543	.5533	.9461
3/4—14NGT (Cl)-2	.3390	1.0427	.9856	59/64	1.0447	.9461	1.1130	1 1/8	1 1/16	.9889	1 1/16	.8972	.9543	.5533	9461
3/4—14NGT (Cl)-3	.3390	1.0628	1.0057	15/16	1.0648	.9461	1.1331	1 1/8	1 1/16	.9889	1 1/16	.8972	.9543	.5533	.9461
3/4—14NGT (Cl)-4	.3390	1.0873	1.0302	31/32	1.0893	.9461	1.1576	1 1/8	11/16	.9889	1 1/16	.8972	.9543	.5533	.9461
3/4—14SGT[b]	4008	1.047	0.9852	59/64	1.0731	.7030	1.1564	7/8	11/16	1.0353	1 7/64	.8556	.9474	.5714	.7030
1—11½NGT	.4000	1.2832	1.2136	1 1/8	1.2712	.9217	1.3457	1	13/16	1.2386	1 5/16	1.1278	1.1973	.6609	.8348
1¼—11½NGT	.4200	1.6267	1.5571	1 15/32	1.6160	.9417	1.6931	1 1/16	1	1.5834	1 43/64	1.4713	1.5408	.6809	.8548
1½—11½NGT	.4200	1.8657	1.7961	1 45/64	1.8550	.9417	1.9360	1 1/8	1 5/32	1.8223	1 29/32	1.7102	1.7798	.6809	.8548

All dimensions are basic. See figure IX.35 for relationship of dimensions.

[a] For uses other than chlorine, oversize threads for revalving are generally specified at 4 or 7 turns oversize. For chlorine, the ¾—14NGT(Cl)—1 size is standard; the —2 is 4 turns oversize; the —3 is 8½ turns oversize; and the —4 is 14 turns oversize.

[b] The ¾—14SGT (Special Gas Taper) thread is a standard having a taper of 1/8 (=1½ inches per foot on diameter) with a 60° thread normal to the axis and 0.0618 inch deep. For this thread col. 13, 14 and 15 are based on gages 0.7030 inch long. Cylinders are held to final inspection limits from basic to 1½ turns small, and valves to plus or minus 1 turn.

[c] The basic condition of fit is that the external thread with a pitch diameter of E_0 at the end (reference plane for gaging external thread) shall enter by hand engagement to a distance L_1 into the internal thread with a pitch diameter of E_1 at the opening (reference plane for gaging internal thread).

[d] External threads shall be threaded the approximate length L_{10} but gaged up to L_8. Dimension L_8 is equal to L_1 plus six (6) threads for all NGT threads and L_1 plus eight and a half (8½) threads for the NGT(Cl) threads. Dimension E_8 is measured at distance L_8 from E_0, and dimension D_{10} is measured at distance L_{10} from E_0. These longer external threads are desirable if further tightening should be necessary. To facilitate gaging, provision should be made to allow the L_8 ring gage to advance a distance of two full threads beyond the L_8 length (one turn for allowable variation in pitch diameter and one turn for allowable variation in taper).

[e] Full internal threads at the crests and roots shall extend throughout lengths L_1+L_3 (L_3=3 threads). This dimension determines the minimum metal on the inside of the neck to produce maximum bore K_3. Any metal below L_3 shall have tapped threads with full roots to a minimum length L_9 (L_1+5 threads for all NGT threads and L_1+8½ threads for the NGT(Cl) threads).

3. INLET CONNECTIONS

The threads on the inlet, neck, or valve to cylinder connection are right hand of the following types:

(a) National gas taper threads, NGT or NGT (Cl) for chlorine.

(b) Special gas taper threads, SGT.

(c) National gas straight threads, NGS.

1. NGT, NGT(Cl), AND SGT THREADS.—The NGT and NGT(Cl) threads are based on the American Standard for taper pipe threads but are longer to provide fresh threads if further tightening is necessary. Manufacturing tolerances for the taper of these threads are as follows:

The taper on the pitch elements of *external* threads is 1/16 on diameter, (=3/4 in./ft.) with a minus tolerance of one turn but with no plus tolerance in gaging.

The taper on the pitch elements of *internal* threads is 1/16 on diameter, with a plus tolerance of one turn but with no minus tolerance in gaging.

The limits on crest and root truncation are the same as for the American National taper pipe threads as shown in table VII.1, p. 4.

The SGT threads are similar to the NGT threads except that the taper is 1/8 (=1 1/2 in./ft.) on diameter instead of 1/16.

(*a*). *Limits of size for the NGT, NGT(Cl), and SGT threads.*—Limits of size for these threads are given in table IX.5. (See footnote b of that table.) Figure IX.35 indicates the relationship of these dimensions.

(*b*). *Gaging of the NGT, NGT(Cl), and SGT threads.*—Special gages are required for the gaging of these threads because of their length and the rigid requirements for sealing the compressed gas against leakage. The working or inspection gages described in this section are called *ramp* gages. Ramp gages are similar to conventional taper pipe thread gages but provide more positive control of the thread elements; however, other gages acceptable to the procuring agency may be used.

1. Pitch diameter of external thread.—To check the pitch diameter of the external thread, the threaded ring gages shown on figure IX.36 are used. The L_1 ring gage is known as a *primary* gage since the reading taken on the ramp will be needed for use when additional gaging is done.

The L_8 ring is screwed onto the valve, flat face first. The L_1 ring is then screwed onto the valve. Both rings should be engaged to about the same tightness. For the thread to be acceptable, the rim of the L_8 ring should not project above the L_1 ring or below the bottom of the gaging notch on the L_1 ring.

The numbers on the ramp ring indicate the quarters of a turn the thread varies from basic. While the L_1 and L_8 rings are screwed onto the valve, the plunger should be pushed down against the end of the valve. The reading on the ramp should then be taken. The reading will be the number within the division where the helical scale or ramp intersects the edge of the collar on the body.

The threads are to be within one turn in either direction from basic but preferably within 1/2 turn from basic. Therefore the product should gage preferably between −2 and +2 on the scale with readings between −4 and +4 being acceptable. This reading will be needed as a reference for gaging the crest and root truncation of the external thread.

2. Crest truncation of external thread.—To check the crest truncation of the external thread, the gage shown in figure IX.37 is used. The gage should be placed over the threads lightly and rocked in different directions to detect out-of-roundness or off-taper. If the rock is not excessive, the plunger should be pushed down and a reading taken. If the edge of the collar on the body lies within the helical ramp at the same reading as was shown on the ramp of the pitch diameter ring gage (fig. IX.36), the crest truncation of the external thread is acceptable

3. Root truncation of external thread.—To check the root truncation of the external thread, the gage shown in figure IX.38 is used. The gage is screwed delicately onto the valve. After reaching full engagement, the gage is backed off one-half to one full turn, and the degree of looseness is compared with that of generally accepted threads. Slight looseness indicates that the gage and product bear along the length of a full and continuous or cleared thread. Considerable looseness indicates that the gage has seated or stopped on the last incomplete thread.

If the thread appears to be satisfactory after the above preliminary check, the gage is screwed onto the valve fingertight. The plunger is then pushed down and a reading taken. If the edge of the collar on the body lies within the helical ramp at the same reading as was shown on the ramp of the pitch diameter ring gage (fig. IX.36), the root truncation of the external thread is acceptable.

4. Pitch diameter of internal thread.—To check the pitch diameter of the internal thread, the threaded plug gage shown on figure IX.39 is used. This gage is known as a *primary* gage since the reading taken on the ramp will be needed for use when additional gaging is done.

Both heads are screwed in simultaneously, with the precaution that the L_9 section advances with some clearance ahead of the L_1 section to prevent locking. Both sections should be screwed in to about the same tightness. For the pitch diameter of the tapped hole to be acceptable, the upper band should not be above or below the edge of the gaging ring.

To measure the effective pitch diameter of the thread at the L_1 length, with the gage screwed into the cylinder, the hexagonal sleeve is pushed down to the face of the cylinder. A reading is then taken on the ramp at the point where it intersects the edge of the hexagonal sleeve.

The threads are to be within one turn in either direction from basic but preferably within ½ turn from basic. Therefore the product should gage preferably between −2 and +2 on the scale, with readings between −4 and +4 being acceptable. This reading will be needed as a reference for gaging the crest and root truncation and the maximum bore of the internal thread on the cylinder.

5. *Crest truncation of internal thread.*—To check the crest truncation of the internal thread, the plain plug gage shown in figure IX.40 is used.

The plug is slipped lightly into the hole and rocked in different directions to detect out-of-roundness or off-taper. If either of these conditions appears excessive, the crest should be examined visually for roughness, chips, and variations in truncation.

After this inspection, the plug is seated into the hole and the hexagonal sleeve pushed down to the face of the cylinder. If the upper edge of the hexagonal sleeve lies within the helical ramp at the same reading as was shown on the ramp of the pitch diameter plug gage (fig. IX.39), the crest truncation of the internal thread is acceptable.

6. *Maximum bore of internal thread.*—To check the maximum bore of the internal thread, the gage shown in figure IX.41 is used.

The plug is seated into the hole and the hexagonal sleeve pushed down to the face of the cylinder. If the upper edge of the hexagonal sleeve lies within the helical ramp at the same reading as was shown on the ramp of the pitch diameter plug gage (fig. IX.39), the maximum bore of the internal thread is acceptable.

7. *Root truncation of internal thread.*—To check the root truncation of the internal thread, the threaded plug gage shown on figure IX.42 is used. The gage is screwed delicately into the tapped hole of the cylinder. After reaching full engagement, the gage is backed off one-half to one full turn and the degree of looseness compared with that of generally accepted threads. Slight looseness indicates that the gage and cylinder bear along the length of a full and continuous or cleared thread. Considerable looseness indicates that the plug has seated or stopped on the last incomplete thread.

If the thread appears to be satisfactory after the above preliminary check, the gage is screwed into the cylinder fingertight. The hexagonal sleeve is then pushed down to the face of the cylinder. If the upper edge of the hexagonal sleeve lies within the helical ramp at the same reading as was shown on the ramp of the pitch diameter plug gage (fig. IX.39), the root truncation of the internal thread is acceptable.

(*c*) *Checking of the NGT, NGT(Cl), and SGT working or inspection gages with master gages.*—The sketches of the master gages are shown on figures IX.43, IX.44, and IX.45. Gaging information is given in the notes on these figures.

2. National Gas Straight Threads, NGS.—All straight threads for inlet connections shall be NGS threads. The diameters and the form for both the external and internal threads shall conform to those for NPSM American Standard straight pipe threads for free-fitting mechanical joints (without clearance) (see table VII.6, p. 9). The length of engagement shall be (L_1+L_3). The seal for tightness shall be at or close to the end face of the cylinder whether it incorporates the external or the internal threads.

4. SAFETY DEVICE THREADS

The safety devices on high pressure gas cylinder valves shall be provided with right hand threads of the Unified form, 19 threads per inch. The minimum length of engagement shall be ½ in. The thread dimensions shall be as follows:

	Boss (external thread)		Cap (internal thread)	
	Max	Min	Min	Max
	in.	*in.*	*in.*	*in.*
Major diameter	0.6500	0.6423	0.6500	-------
Pitch diameter	.6157	.6116	.6157	0.6198
Minor diameter	.5852	----------	.5929	.5986

The safety device threads shall be designated as follows:

Boss (external thread):
0.6500–19NS–2
PD 0.6157–0.6116
Length of engagement 0.5

Cap (internal thread):
0.6500–19NS–2
PD 0.6198–0.6157
Length of engagement 0.5

Table IX.6.—*Dimensions of master setting plug gages; NGT, SGT*

	1/8—27NGT	1/4—18NGT	3/8—18NGT	1/2—14NGT	3/4—14NGT	3/4—14NGT(Cl)-1	3/4—14NGT(Cl)-2	3/4—14NGT(Cl)-3	3/4—14NGT(Cl)-4	3/4—14SGT	1—11½NGT	1¼—11½NGT	1½—11½NGT
1	2	3	4	5	6	7	8	9	10	11	12	13	14
	in.	*in.*	*in.*	*in.*	*in.*	*in.*	*in.*	*in.*	*in.*	*in.*	*in.*	*in.*	*in.*
D_0	0.3931	0.5218	0.6564	0.8156	1.0248	1.0248	1.0427	1.0628	1.0873	1.0470	1.2832	1.6267	1.8657
D_1	.4044	.5343	.6714	.8356	1.0460	1.0460	1.0639	1.0840	1.1085	1.0971	1.3082	1.6530	1.8920
$D_{(8-p)}$	.4160	.5517	.6888	.8579	1.0683	1.0683	1.0862	1.1063	1.1308	1.1417	1.3354	1.6802	1.9192
D_{10}, approx	.4204	.5530	.6915	.8625	1.0795	1.0951	1.1130	1.1331	1.1576	1.1564	1.3457	1.6931	1.9360
E_0	.3635	.4774	.6120	.7584	.9677	.9677	.9856	1.0057	1.0302	.9852	1.2136	1.5571	1.7961
E_0—½ thd height	.3475	.4534	.5880	.7275	.9368	.9368	.9547	.9748	.9993	.9543	1.1760	1.5195	1.7585
E_1	.3748	.4899	.6270	.7784	.9889	.9889	1.0068	1.0269	1.0514	1.0353	1.2386	1.5834	1.8223
$E_{(1+p)}$	.3771	.4934	.6305	.7829	.9934	.9934	1.0113	1.0314	1.0559	1.0443	1.2440	1.5888	1.8277
E_8	.3886	.5107	.6479	.8052	1.0157	1.0268	1.0447	1.0648	1.0893	1.0731	1.2712	1.6160	1.8550
E_8—½ thd height	.3726	.4867	.6239	.7743	.9848	.9959	1.0138	1.0339	1.0584	1.0422	1.2336	1.5784	1.8174
K_0	.3315	.4329	.5676	.7013	.9106	.9106	.9285	.9486	.9731	.8824	1.1441	1.4876	1.7265
$K_{(8-p)}$	.3544	.4628	.6000	.7436	.9541	.9541	.9720	.9921	1.0166	.9771	1.1963	1.5411	1.7800
L_1	.1800	.2000	.2400	.3200	.3390	.3390	.3390	.3390	.3390	.4008	.4000	.4200	.4200
L_8	.4022	.5333	.5733	.7486	.7676	.9461	.9461	.9461	.9461	.7030	.9217	.9417	.9417
$L_{(8-p)}$	.3652	.4777	.5177	.6772	.6962	.8747	.8747	.8747	.8747	.6316	.8347	.8547	.8547
L_{10}, approx	7/16	5/8	11/16	13/16	7/8	1 1/8	1 1/8	1 1/8	1 1/8	7/8	1	1 1/16	1 1/8
P	.0370	.0556	.0556	.0714	.0714	.0714	.0714	.0714	.0714	.0714	.0870	.0870	.0870
Chamfer 45° x min. dia	21/64	27/64	9/16	11/16	29/32	29/32	59/64	15/16	31/32	59/64	1 1/8	1 15/32	1 45/64
H	.2912	.3824	.3824	.4912	.4912	.6688	.6688	.6688	.6688	.5208	.5968	.5968	.5984
M	.6564	.8601	.9001	1.1684	1.1874	1.5435	1.5435	1.5435	1.5435	1.1524	1.4315	1.4515	1.4531

See figure IX.35, p. 81, for the explanation of all letter symbols except H and M, which are identified on figure IX.45, p. 90.

Table IX.7.—*Dimensions of master setting ring gages; NGT, SGT*

	1/8—27NGT	1/4—18NGT	3/8—18NGT	1/2—14NGT	3/4—14NGT	3/4—14NGT(Cl)-1	3/4—14NGT(Cl)-2	3/4—14NGT(Cl)-3	3/4—14NGT(Cl)-4	3/4—14SGT	1—11½NGT	1¼—11½NGT	1½—11½NGT
1	2	3	4	5	6	7	8	9	10	11	12	13	14
	in.	*in.*	*in.*	*in.*	*in.*	*in.*	*in.*	*in.*	*in.*	*in.*	*in.*	*in.*	*in.*
D_0	0.3931	0.5218	0.6564	0.8156	1.0248	1.0248	1.0427	1.0628	1.0873	1.0470	1.2832	1.6267	1.8657
D_1	.4044	.5343	.6714	.8356	1.0460	1.0460	1.0639	1.0840	1.1085	1.0971	1.3082	1.6530	1.8920
$D_{(8-p)}$	.4160	.5517	.6888	.8579	1.0683	1.0683	1.0862	1.1063	1.1308	1.1417	1.3354	1.6802	1.9192
D_9	.3815	.5044	.6390	.7933	1.0025	1.0025	1.0204	1.0405	1.0650	1.0024	1.2560	1.5995	1.8385
E_0	.3635	.4774	.6120	.7584	.9677	.9677	.9856	1.0057	1.0302	.9852	1.2136	1.5571	1.7961
E_1	.3748	.4899	.6270	.7784	.9889	.9889	1.0068	1.0269	1.0514	1.0353	1.2386	1.5834	1.8223
E_3	.3566	.4670	.6016	.7450	.9543	.9543	.9722	.9923	1.0168	.9474	1.1973	1.5408	1.7798
E_9	.3520	.4601	.5947	.7361	.9454	.9454	.9633	.9834	1.0079	.9295	1.1864	1.5299	1.7689
E_9+½ thd height	.3680	.4841	.6187	.7670	.9763	.9763	.9942	1.0143	1.0388	.9604	1.2240	1.5675	1.8065
$E_{(9-3½p)}$	.3601	.4723	.6069	.7517	.9610	.9610	.9789	.9990	1.0235	.9607	1.2054	1.5489	1.7879
K_1	.3451	.4454	.5826	.7213	.9318	.9318	.9497	.9698	.9943	.9325	1.1691	1.5139	1.7528
K_3	.3269	.4225	.5572	.6879	.8972	.8972	.9151	.9352	.9597	.8556	1.1278	1.4713	1.7102
K_9	.3223	.4156	.5503	.6790	.8883	.8883	.9062	.9263	.9508	.8377	1.1169	1.4604	1.6993
L_1	.1800	.2000	.2400	.3200	.3390	.3390	.3390	.3390	.3390	.4008	.4000	.4200	.4200
L_1+L_3	.2911	.3667	.4067	.5343	.5533	.5533	.5533	.5533	.5533	.5714	.6609	.6809	.6809
L_8	.4022	.5333	.5733	.7486	.7676	.9461	.9461	.9461	.9461	.7030	.9217	.9417	.9417
$L_{(8-p)}$	.3652	.4777	.5177	.6772	.6962	.8747	.8747	.8747	.8747	.6316	.8347	.8547	.8547
L_9	.3652	.4778	.5178	.6771	.6961	.9461	.9461	.9461	.9461	.7030	.8348	.8548	.8548
$3½p$	.1296	.1944	.1944	.2500	.2500	.2500	.2500	.2500	.2500	.2500	.3043	.3043	.3043
$1½p$	.0556	.0833	.0833	.1071	.1071	.1071	.1071	.1071	.1071	.1071	.1304	.1304	.1304
P	.0370	.0556	.0556	.0714	.0714	.0714	.0714	.0714	.0714	.0714	.0870	.0870	.0870
C'sink 90° x max. dia	13/32	9/16	11/16	7/8	1 1/16	1 1/16	1 5/64	1 3/32	1 1/8	1 7/64	1 5/16	1 43/64	1 29/32
G	9/32	3/8	7/16	9/16	11/16	11/16	11/16	11/16	11/16	11/16	13/16	1	1 5/32
A	.5812	.8026	.8426	1.0979	1.1153	1.3653	1.3653	1.3653	1.3653	1.0390	1.3468	1.3668	1.3668
B	.2160	.3248	.3248	.4208	.4192	.4192	.4192	.4192	.4192	.3360	.5120	.5120	.5120

See figure IX.35, p. 81, for the explanation of all letter symbols except A and B, which are identified on figure IX.44, p. 89.

TABLE IX.8.—*Master setting gage tolerances; NGT, SGT*

Thread designation	Tolerance on pitch diameter at gaging notch of plug gage	Tolerance [a] on lead in L_1 length of gage		Tolerance [b] on half angle		Tolerance [a] on taper in L_1 length of gage		Tolerance on major diameter of plug gage at gaging notch	Tolerance on minor diameter of ring gage at large end
		Plugs	Rings	Plugs	Rings	Plugs	Rings		
1	2	3	4	5	6	7	8	9	10
	in. ±	*in.* ±	*in.* ±	*min* ±	*min* ±	*in.* +	*in.* −	*in.* −	*in.* +
1/8—27NGT	0.0002	0.0002	0.0003	15	20	0.0003	0.0006	0.0004	0.0004
1/4—18NGT	.0002	.0002	.0003	15	20	.0004	.0007	.0006	.0006
3/8—18NGT	.0002	.0002	.0003	15	20	.0004	.0007	.0006	.0006
1/2—14NGT	.0003	.0002	.0003	10	15	.0006	.0009	.0010	.0010
3/4—14NGT	.0003	.0002	.0003	10	15	.0006	.0009	.0010	.0010
3/4—14NGT(Cl)	.0003	.0002	.0003	10	15	.0006	.0009	.0010	.0010
3/4—14SGT	.0003	.0002	.0003	10	15	.0006	.0009	.0010	.0010
1—11½NGT	.0003	.0003	.0004	10	15	.0008	.0012	.0010	.0010
1¼—11½NGT	.0003	.0003	.0004	10	15	.0008	.0012	.0010	.0010
1½—11½NGT	.0003	.0003	.0004	10	15	.0008	.0012	.0010	.0010

[a] The lead and taper on plug and ring gages shall be measured along the pitch line, omitting the imperfect threads at each end.

[b] In solving for the correction in diameter for angle deviations, the average deviation in half angle for the two sides of thread regardless of their signs should be taken.

NOTES.—Maximum possible interchange standoff, any ring against any plug other than its master plug, may occur when taper deviations are zero and all other dimensions are at opposite extreme tolerance limits.

Interchange standoff, any ring against any plug other than its master plug, may occur when all dimensions including taper are midway between opposite tolerance limits.

The large end of the ring gage shall be flush with the gaging notch of its master plug gage within ±0.002 in. when assembled handtight.

The tolerance for the length L_1 from small end to gaging notch of the plug gage shall be +0.000, −0.001 in.

The tolerance for the overall thread length L_2 of the plug gage shall be +0.005, −0.000 in.

The tolerance for the thickness L_1 of the ring gage shall be +0.001, −0.000 in.

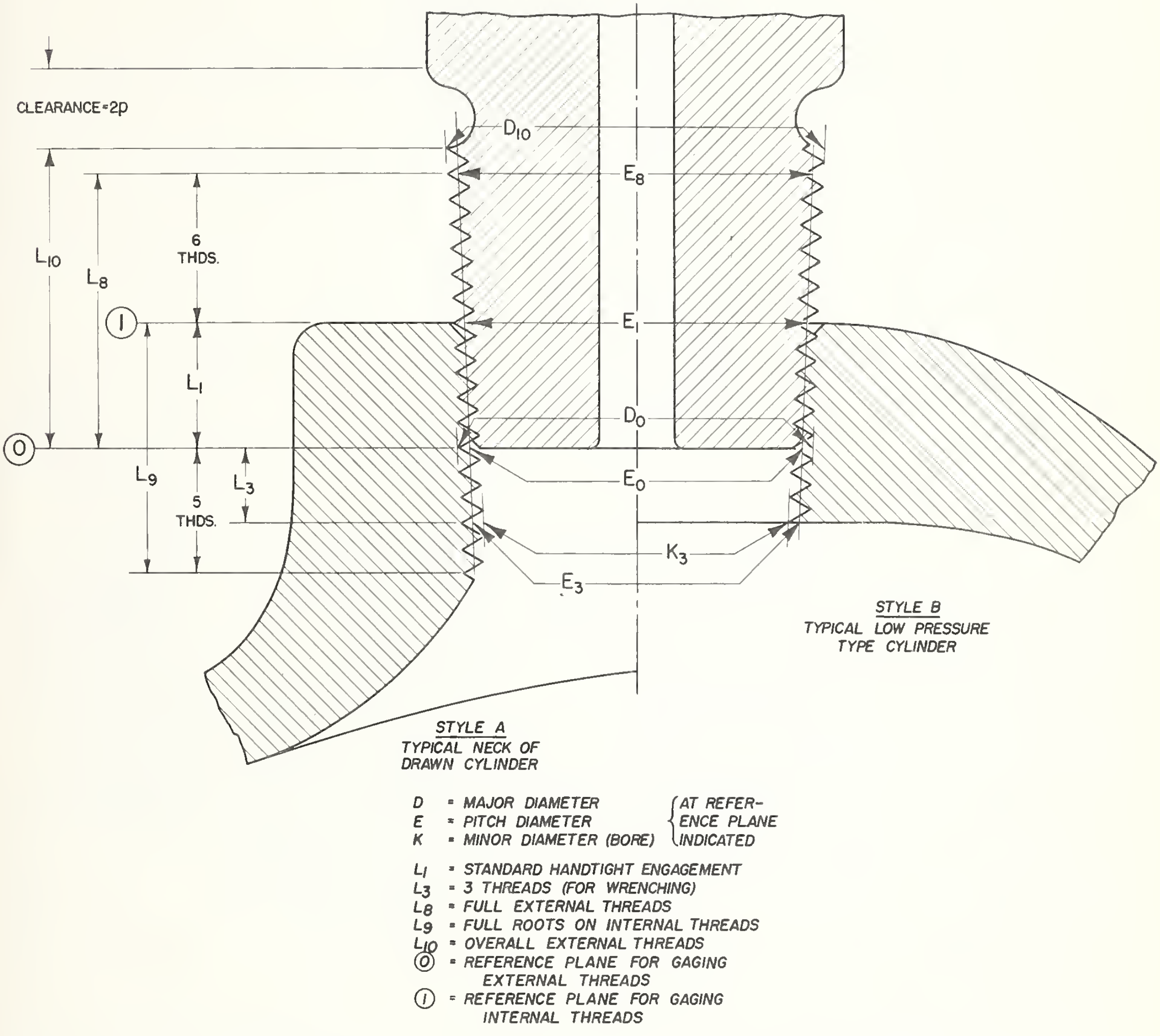


FIGURE IX.35.—*Relationship between internal and external thread dimensions of NGT, NGT(Cl), and SGT threads.*

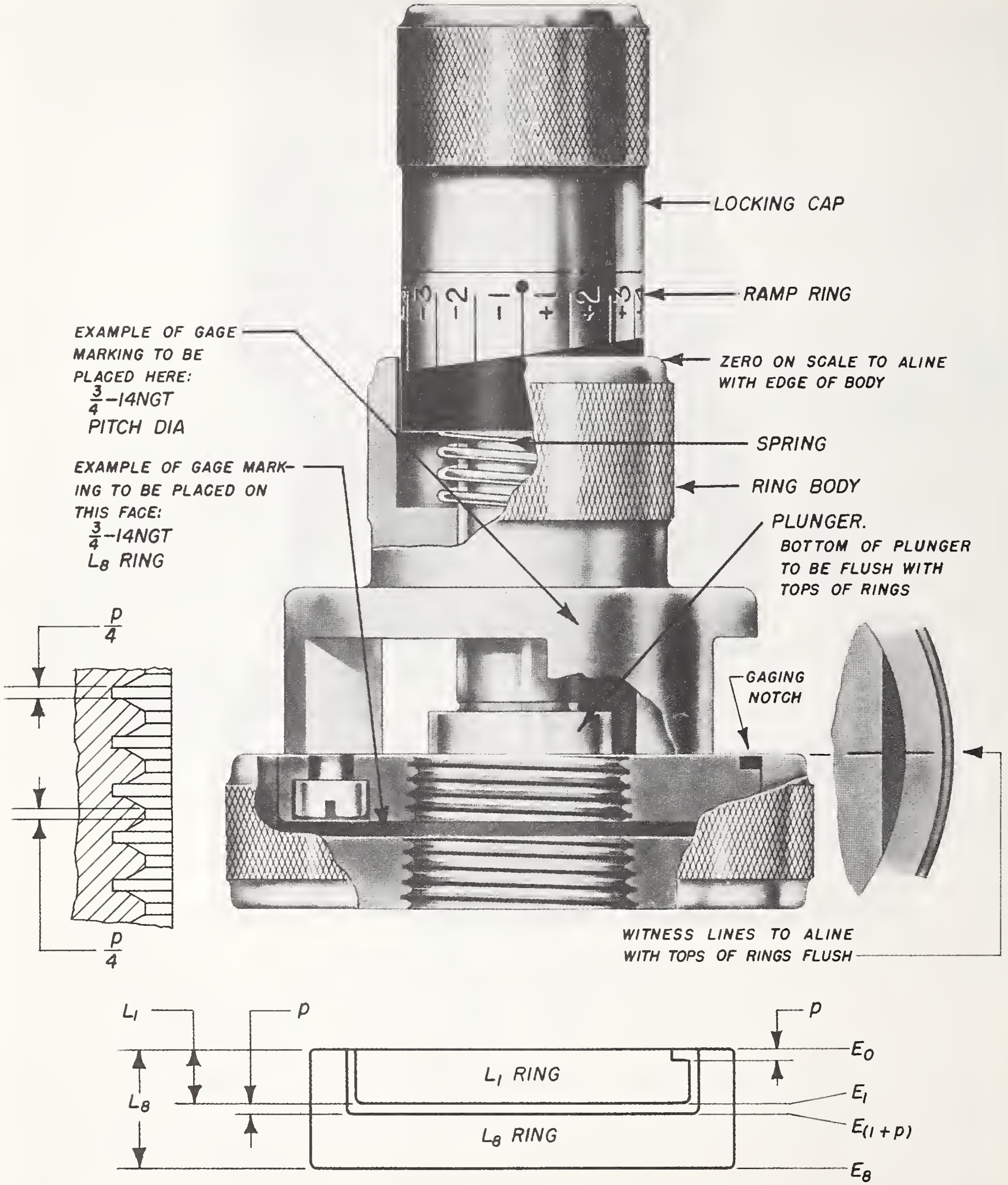
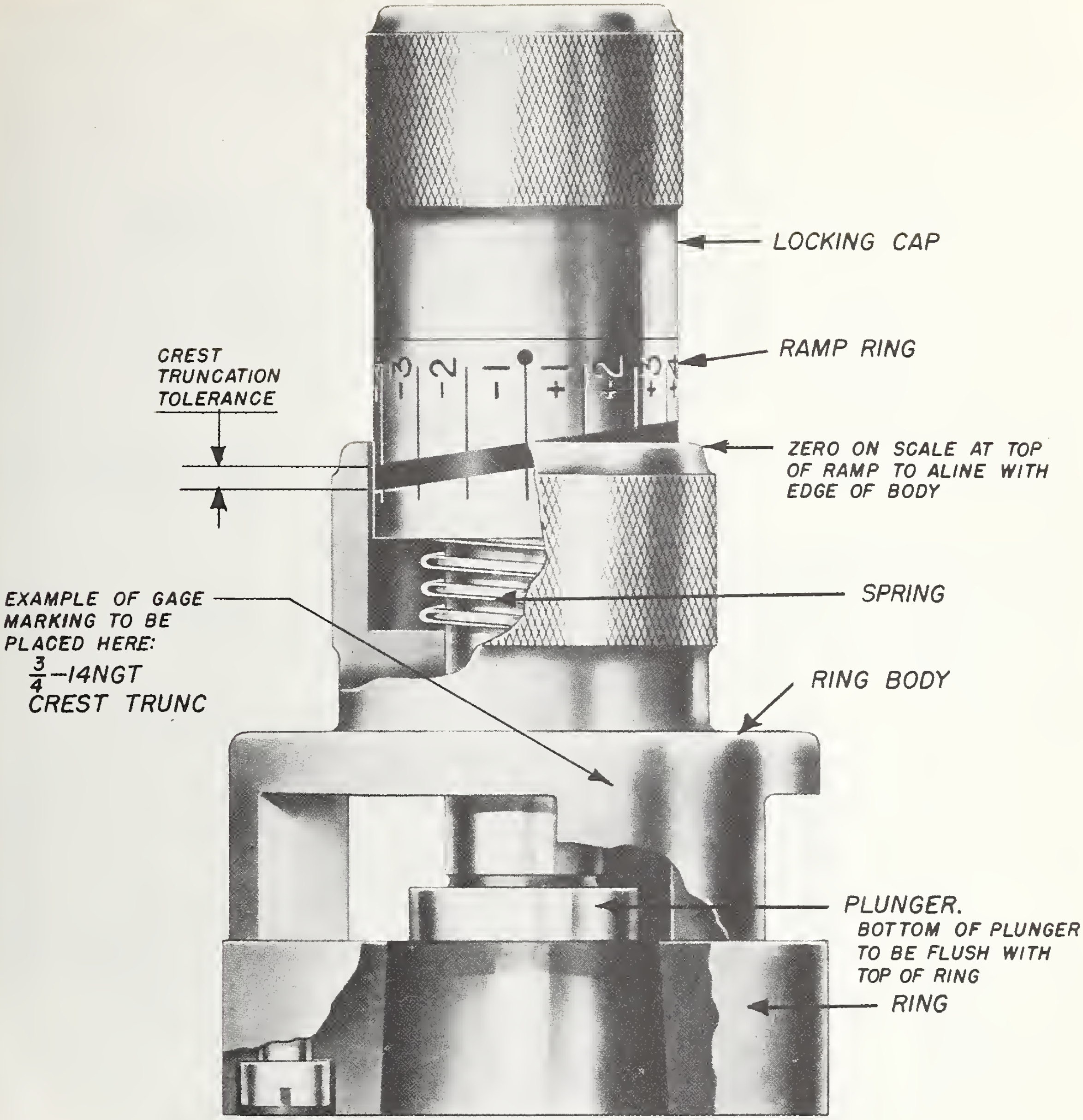


FIGURE IX.36.—*Pitch diameter ring gages; NGT, SGT.*



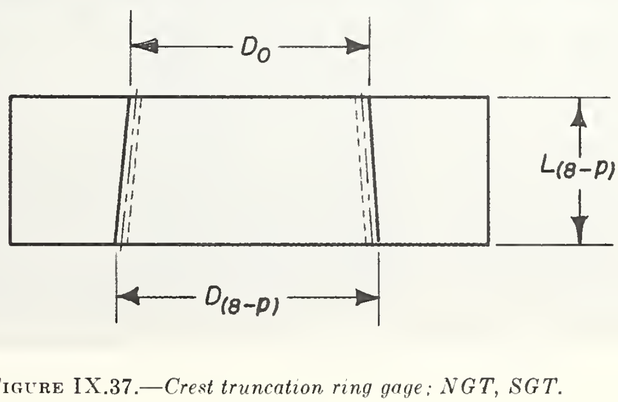


FIGURE IX.37.—*Crest truncation ring gage; NGT, SGT.*

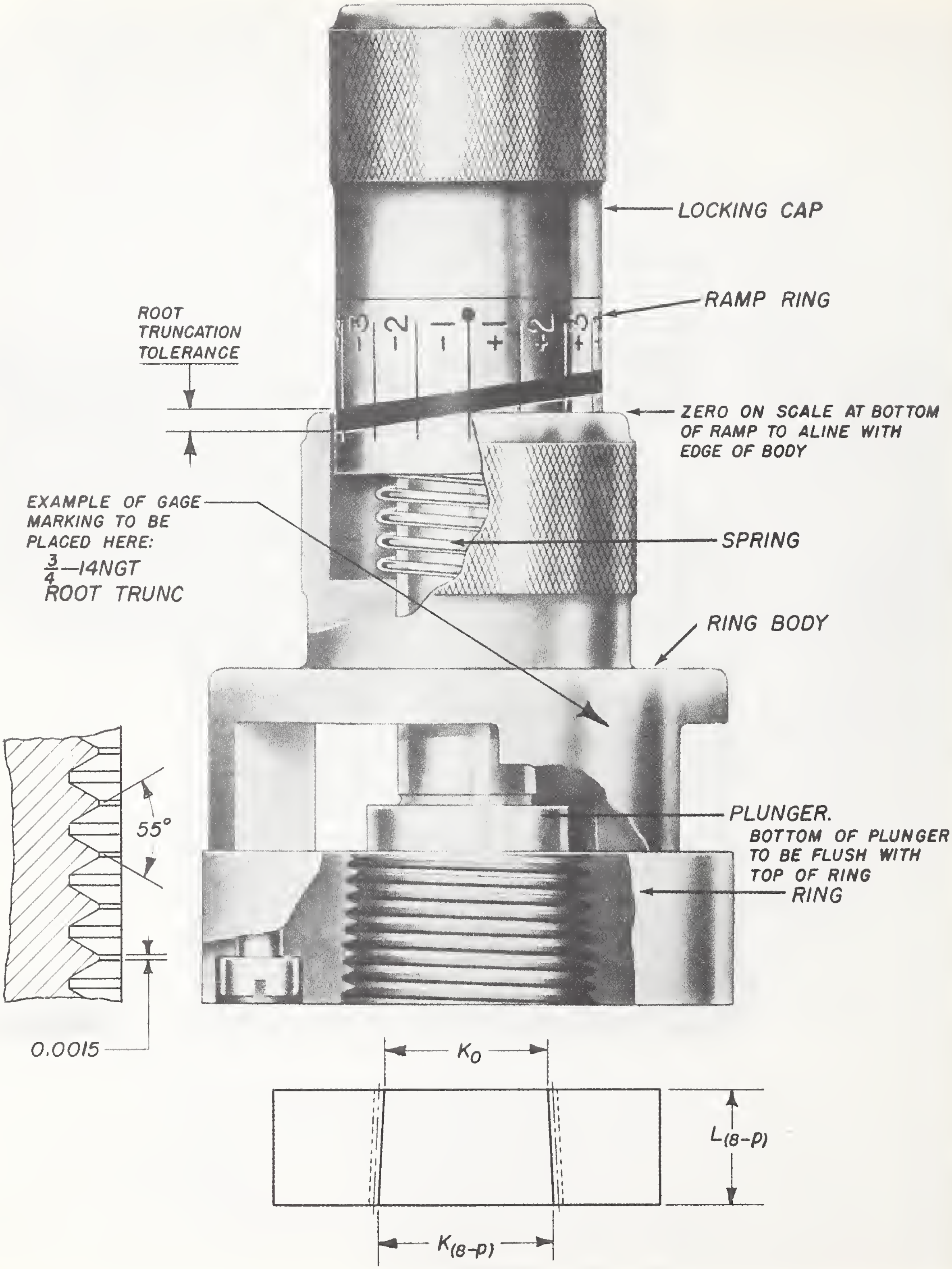


FIGURE IX.38.—*Root truncation ring gage; NGT, SGT.*

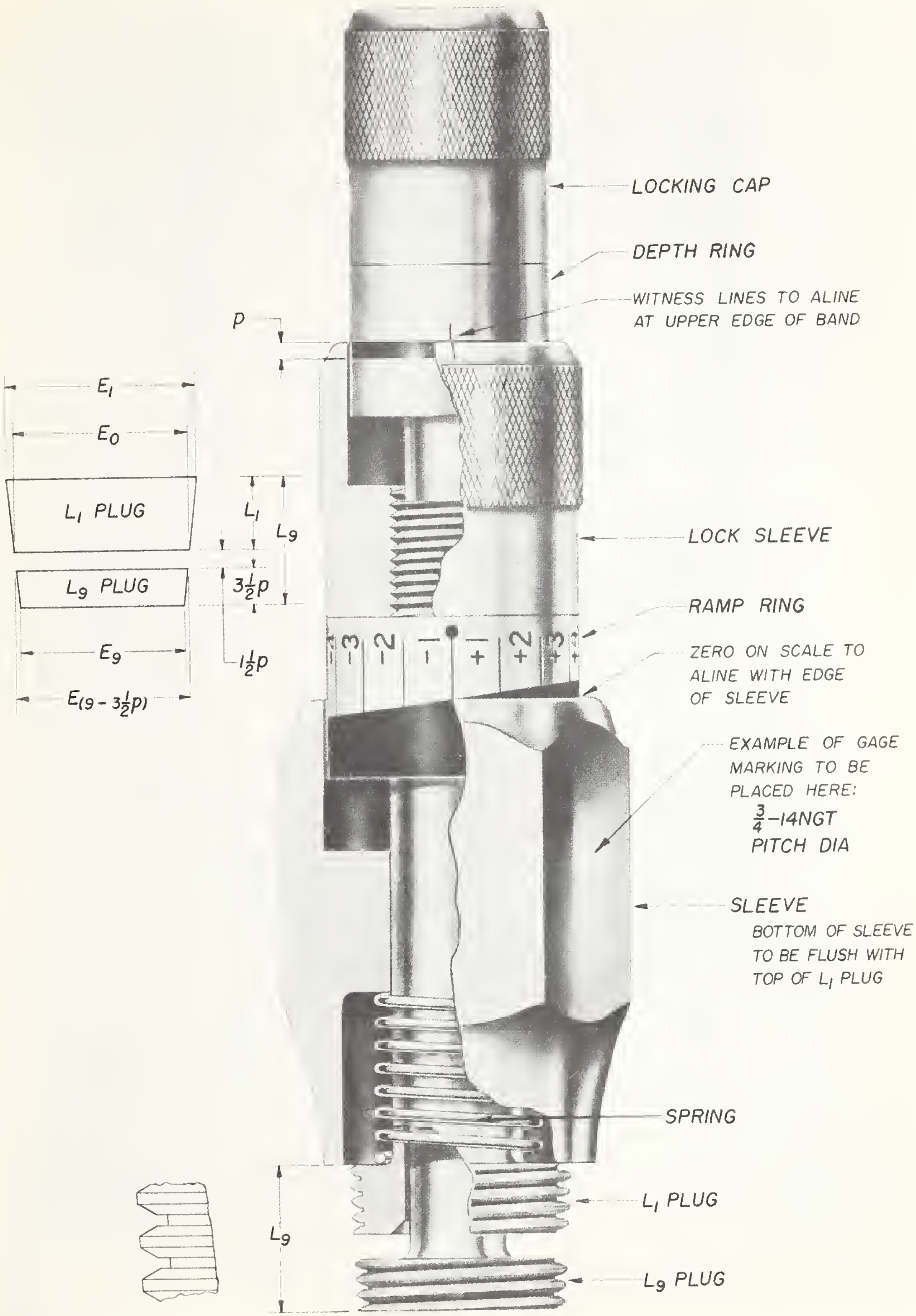


FIGURE IX.39.—*Pitch diameter plug gage; NGT, SGT.*

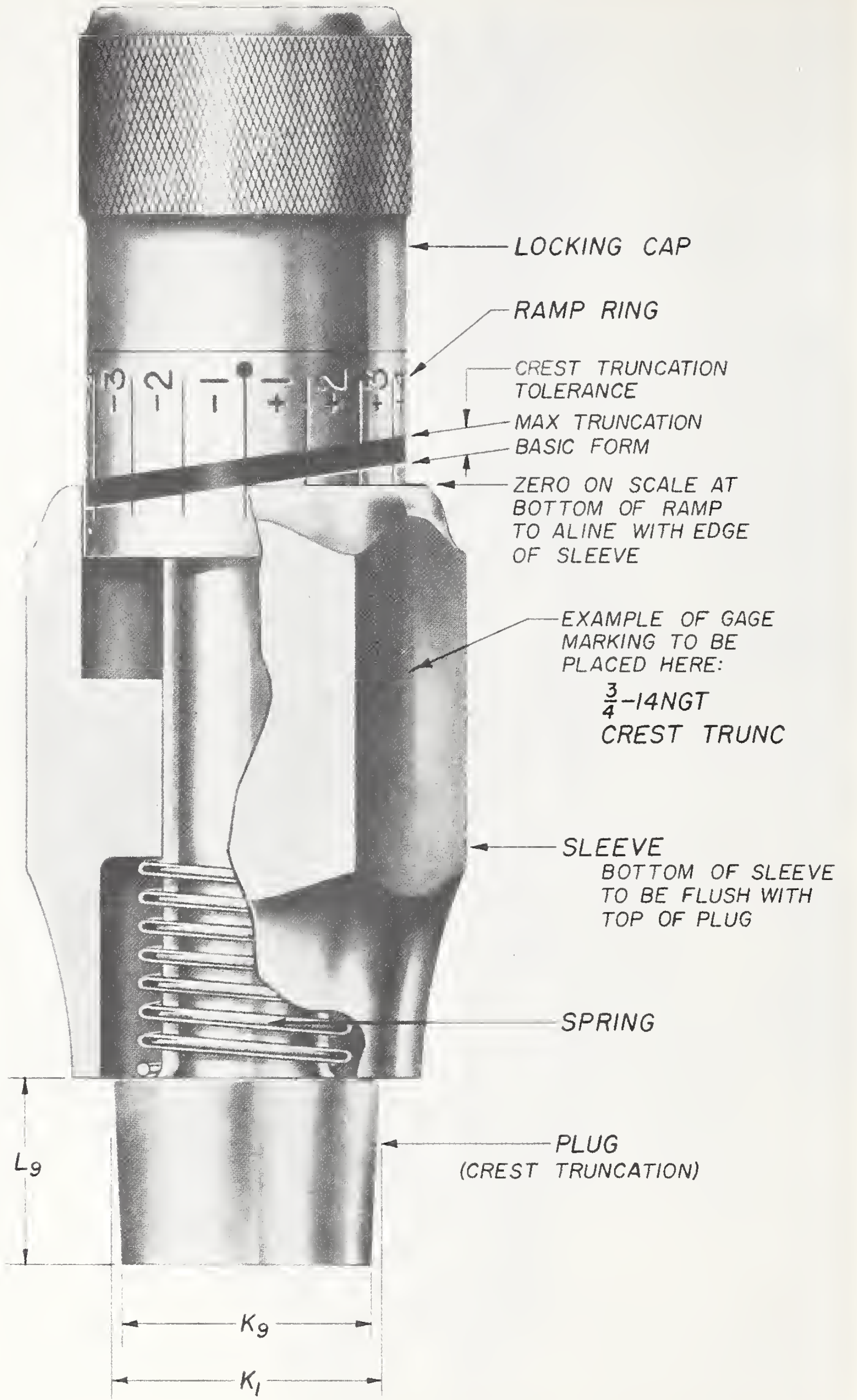


FIGURE IX.40.—*Crest truncation plug gage; NGT, SGT.*

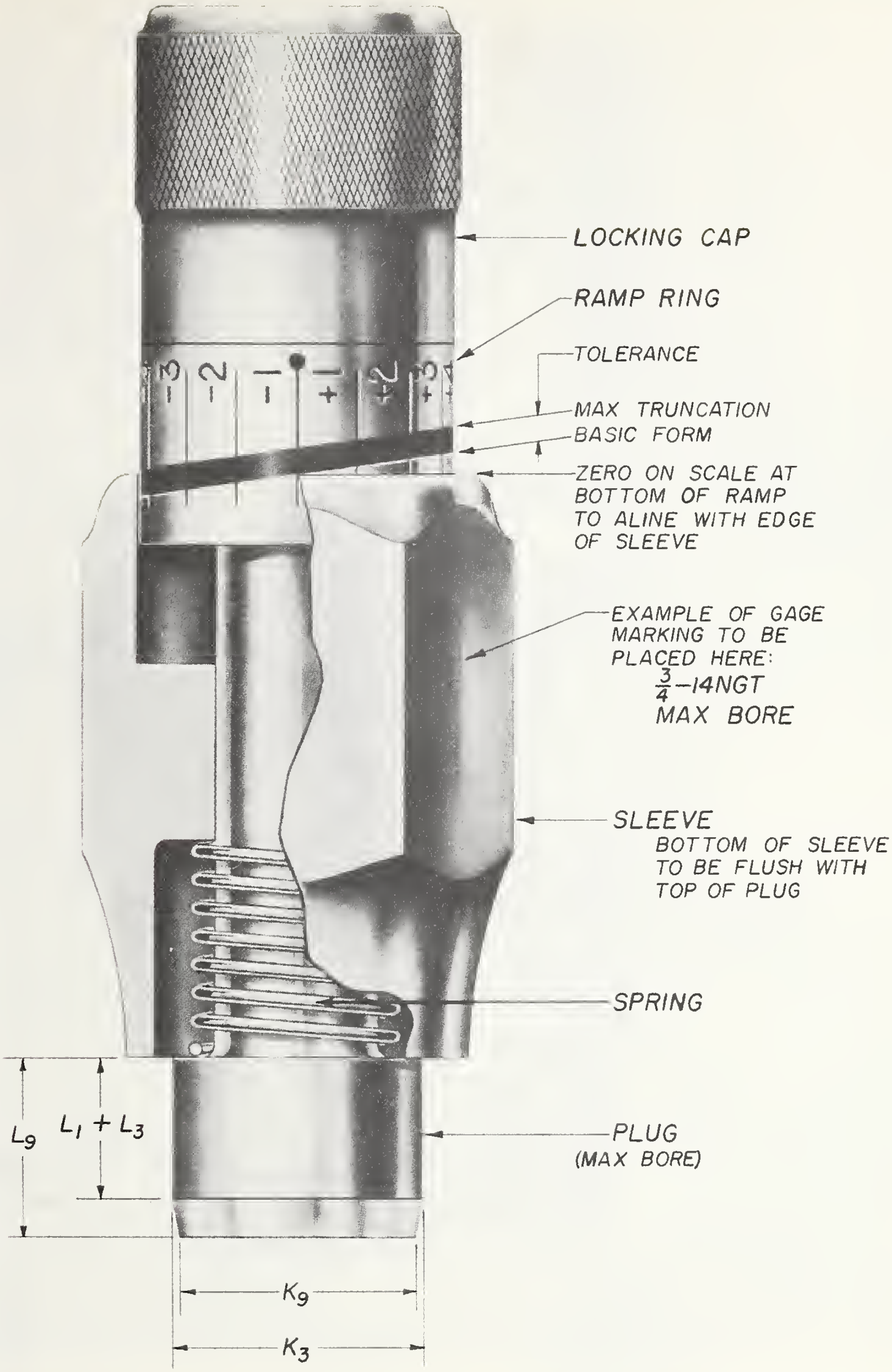


FIGURE IX.41.—*Maximum bore plug gage; NGT, SGT.*

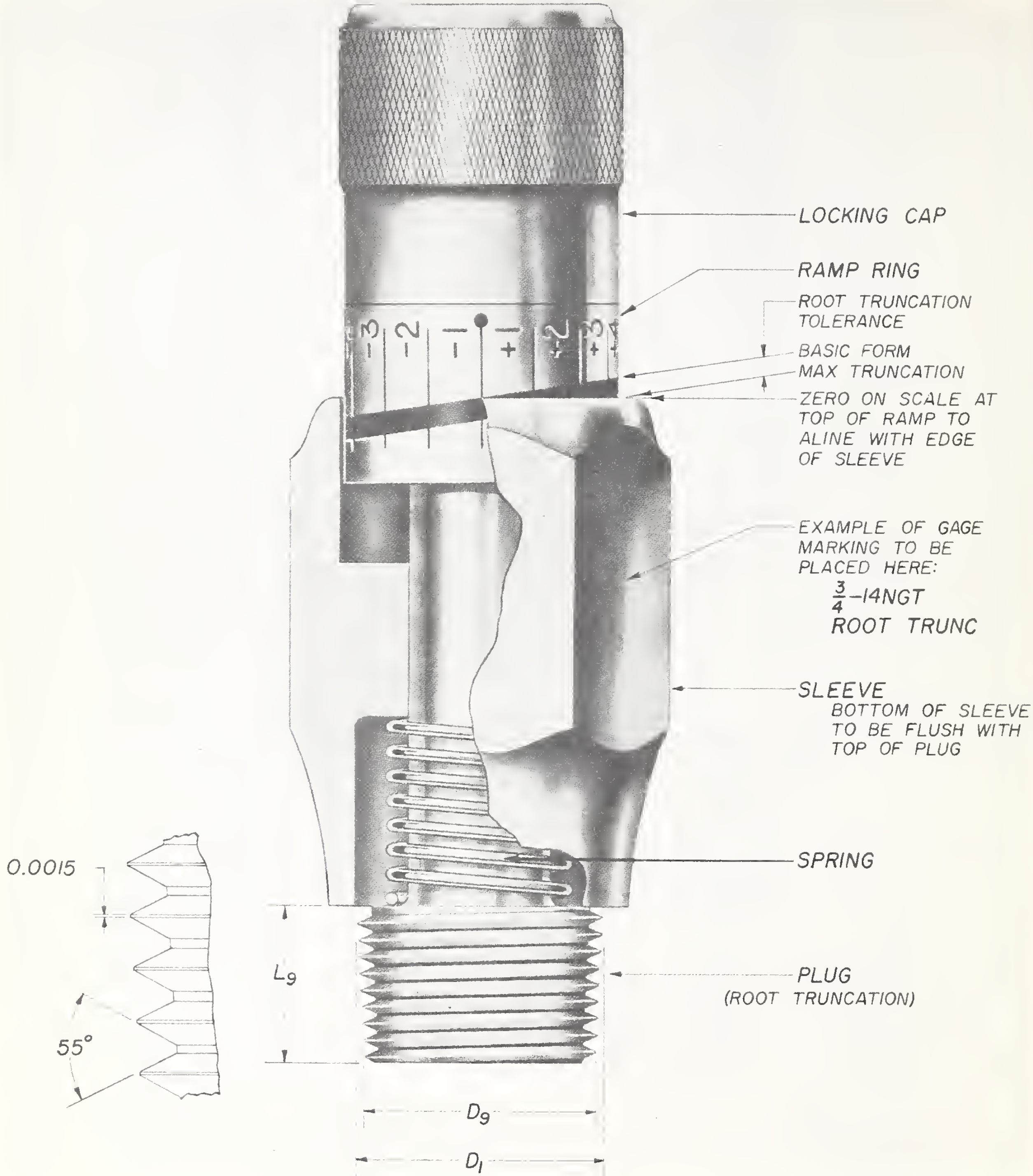
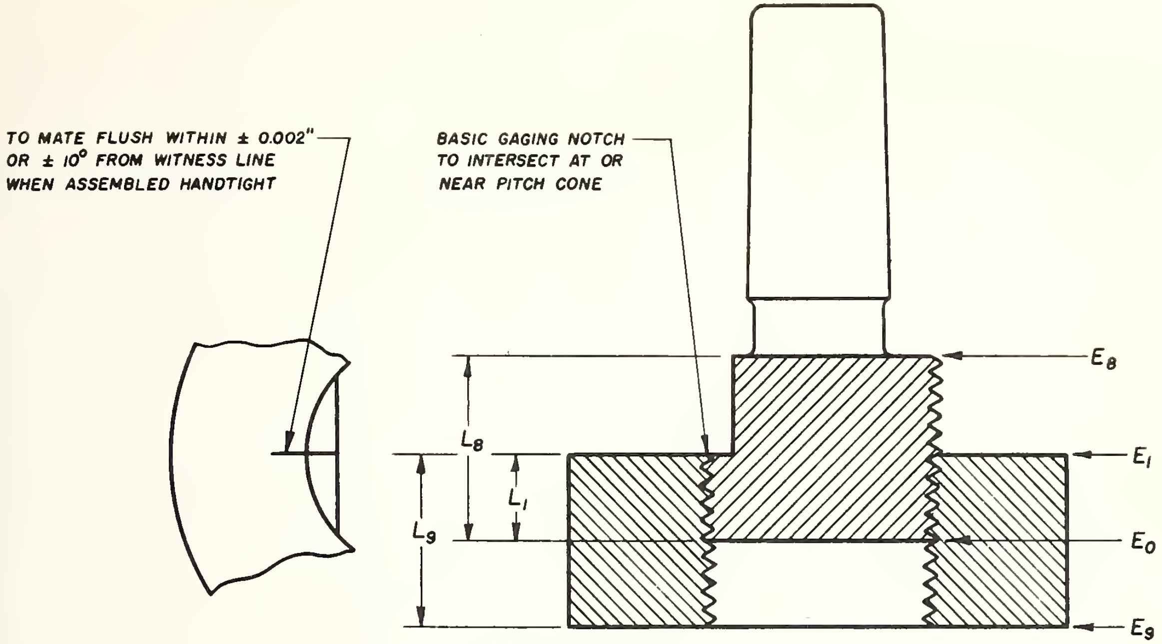
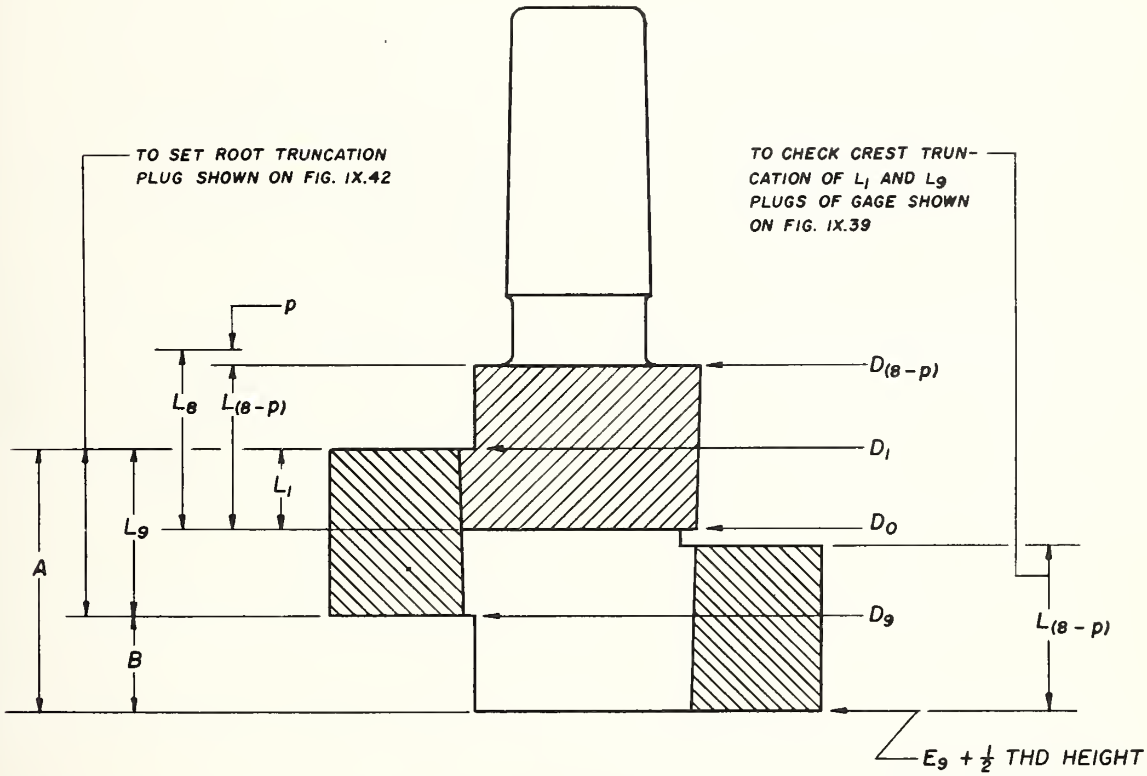


Figure IX.42.—*Root truncation plug gage; NGT, SGT.*



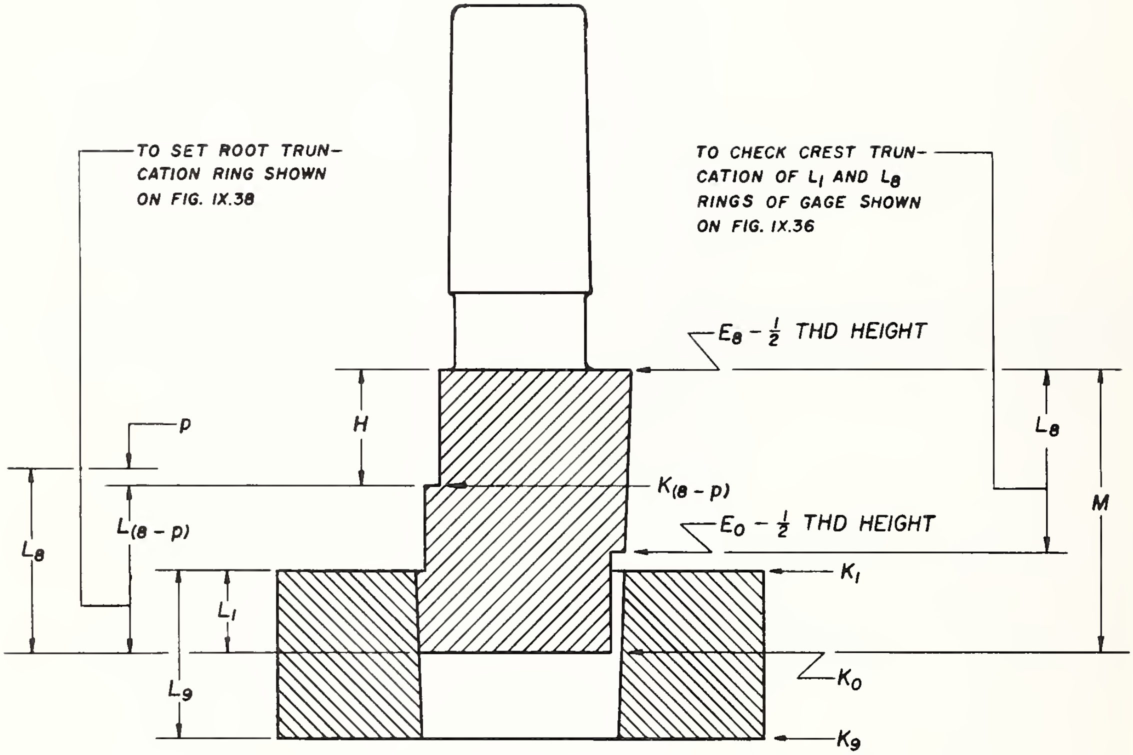
Roots of threads on plug and ring to be undercut to $p/4$ max to clear sharp V 60° thread.
Gages to be calibrated to allow for deviations in flank angle, taper, lead, and pitch diameter. Maximum cumulative tolerance from true basic=1/16 turn.
Master setting plug is for setting L_1 and L_8 ring gages shown on figure IX.36. Master setting ring is for setting L_1 and L_9 plug gages shown on figure IX.39.
See tables IX.6 and IX.7 for dimensions, table IX.8 for tolerances.

FIGURE IX.43.—*Master setting plug and ring gages for setting pitch diameter of threaded plug and ring gages; NGT, SGT.*



Master setting plug is for setting crest truncation ring shown on figure IX.37. Master setting ring is for setting root truncation plug shown on figure IX.42 and to check crest truncation of L_1 and L_9 plugs of gage shown on figure IX.39.
See tables IX.6 and IX.7 for dimensions, table IX.8 for tolerances.

FIGURE IX.44.—*Master setting plug and ring gages for setting and checking major diameters of plug and ring gages; NGT, SGT.*



Master setting plug is for setting root truncation ring shown on figure IX.38 and to check crest truncation of L_1 and L_8 rings of gage shown on figure IX.36. Master setting ring is for setting crest truncation plug shown on figure IX.40 and maximum bore plug shown on figure IX.41.
See tables IX.6 and IX.7 for dimensions, table IX.8 for tolerances.

FIGURE IX.45.—*Master setting plug and ring gages for setting and checking minor diameters of plug and ring gages; NGT, SGT.*

SECTION X. AMERICAN NATIONAL HOSE COUPLING AND FIRE-HOSE COUPLING THREADS [9]

1. INTRODUCTION

1. American National Hose Coupling Threads, NPSH.—The purpose of this specification is to provide a standard which will be recognized and adopted at once by a majority of manufacturers and consumers and toward which the minority may be brought, thus eliminating many threads which have been in use and the confusion and misunderstandings that have prevailed.

As in other lines of work, current practice in use and manufacture must be recognized as well as the specific advantages of certain thread proportions for specific uses. This prevents the adoption of a single specification for each one of the nominal sizes.

These standards apply to the threaded parts of hose couplings, valves, nozzles, and all other fittings used in direct connection with hose intended for fire protection or for domestic, industrial, and general service in nominal sizes of ½, ⅝, ¾, 1, 1¼, 1½, and 2 in. In Federal specification ZZ–H–466, Hose; Gasoline, Rubber-Metal, data are given on special hose coupling threads based on American National pipe threads, NPT, in nominal sizes of 2½, 3, 3½, and 4 in., 8 threads per inch.

2. American National Fire-hose Coupling Threads, NH.—Some years ago specifications for American National fire-hose coupling threads were approved by the National Board of Fire Underwriters, National Fire Protection Association, American Society of Mechanical Engineers, American Society of Municipal Improvements, New England Water Works Association, American Water Works Association, the National Bureau of Standards, and other interested organizations. These specifications were published in 1911 as the Specifications of the National Board of Fire Underwriters, recommended by the National Fire Protection Association and approved by the various other organizations. They were also published in 1914 as Circular C50 of the National Bureau of Standards. This circular was revised and republished in 1917.

When the National Screw Thread Commission took up its work on the standardization of screw threads, the specifications for fire-hose coupling threads above referred to were accepted as the basis of its work on fire-hose coupling threads. It was found, however, that the specifications as originally drawn were inadequate in that they specified nominal dimensions only, with no maximum and minimum limits. The limits of size herein specified have met with general approval and correspond in all details with those recommended by the National Fire Protection Association and by the National Bureau of Standards.

3. Threading Tools.—In ordering threading tools [10] for producing American National hose coupling and fire-hose coupling threads, it should be pointed out that new taps should be near the maximum permissible size of the coupling, and new dies near the minimum permissible size of the nipple, in order that reasonable wear may be provided. As the threading tools wear by use, the couplings will become smaller and the nipples larger until the limits of size are reached. These must not be exceeded. When the product reaches, or comes dangerously close to the limiting size, the threading tools should be readjusted or replaced.

2. FORM OF THREAD

Figure X.1 illustrates the thread form.

1. Angle of Thread.—The basic angle of thread, A, between the sides of the thread measured in an axial plane is 60°. The line bisecting this 60° angle, is perpendicular to the axis of the thread.

2. Flat at Crest and Root.—The flat at the crest and root of the basic thread form is $\frac{1}{8}p$ or $0.125p$.

3. Height of Thread.—The height of the basic thread form is

$$h=0.649519p, \text{ or } h=\frac{0.649519}{n},$$

where

p=pitch in inches,
n=number of threads per inch,
h=basic height of thread.

3. THREAD SERIES

1. American National Hose Coupling and Fire-Hose Coupling Threads, NPSH and NH.—In table X.1 are specified the basic dimensions of these threads. In tables X.2 and X.3 are specified the limits of size and tolerances. In tables X.4 and X.5 are specified the thread lengths and other thread details for these threads.

2. Thread Designation.—These threads are designated by specifying in sequence the nominal size of hose, number of threads per inch, and the thread symbol as shown in the following examples:

¾—8NH
1¼—11½NPSH
3—6NH
6—4NH

[9] This section, with the exception of table X.7, is substantially in agreement with the present issues of ASA B26, "National (American) Standard Fire-Hose Coupling Screw Thread," and ASA B33.1, "American Standard Hose Coupling Screw Threads," which are published by the ASME, 29 West 39th Street, New York 18, N.Y. The latest revisions should be consulted when referring to these ASA standards.

[10] In the interest of the universal adoption of the American National fire-hose coupling threads throughout the United States, attention is directed to the fact that sets of tools for rethreading existing hydrants and hose couplings are commercially available. Such sets comprise roughing and finishing taps, roughing and finishing dies, expanders for expanding undersize externally threaded fittings preparatory to rethreading, gages, and various accessories. The tools are applicable where existing threaded fittings do not differ so widely from the American National threads as to leave insufficient stock for the new thread. By the use of such tools a considerable number of municipalities have at small expense converted their existing equipment and thus availed themselves of the important advantages which standardization affords.

4. TOLERANCES AND ALLOWANCES

The tolerances and allowances for the American National hose coupling and fire-hose coupling threads are specified in table X.6. The tolerances represent the extreme variations permitted on the threads. Figure X.1, below, shows the relationship between nipple and coupling dimensions, and thread form.

(*a*) The tolerance on the coupling (internal) thread is plus, and is applied from the minimum coupling dimension to above the minimum coupling dimension.

(*b*) The tolerance on the nipple (external) thread is minus, and is applied from the maximum nipple dimension to below the maximum nipple dimension.

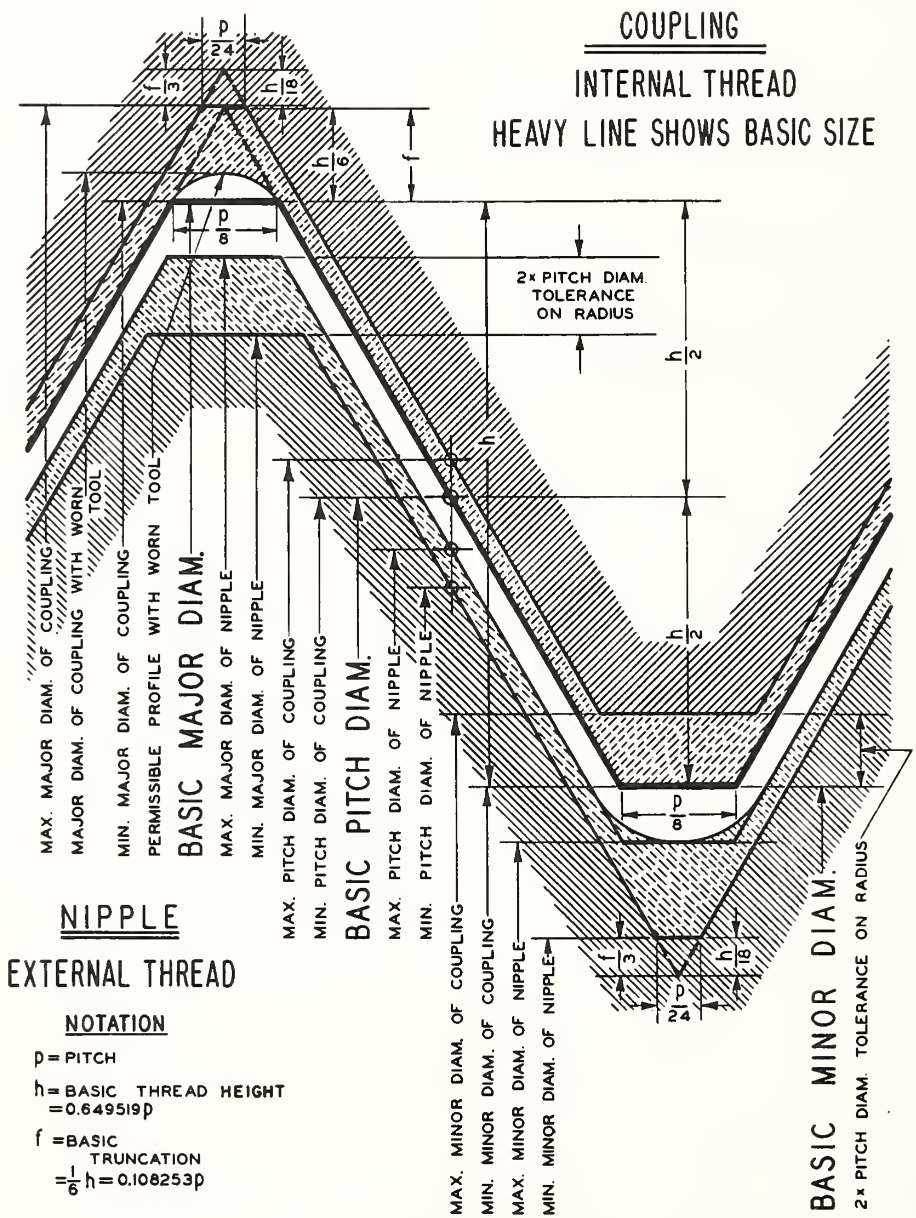


FIGURE X.1.—*American National hose coupling and fire-hose coupling form of thread, NPSH and NH.*

(*c*) The pitch diameter tolerances provided for a mating nipple and coupling are the same.

(*d*) Pitch diameter tolerances include lead and angle variations (see footnote *a*, table X.6).

(*e*) The tolerance on the major diameter is twice the tolerance on the pitch diameter.

(*f*) The tolerance on the minor diameter of the nipple (external) thread is equal to the tolerance on the pitch diameter plus two-ninths of the basic thread height. The minimum minor diameter of a nipple (external) thread is such as to result in a flat equal to one-third of the basic flat, $p/24$, at the root when the pitch diameter of the nipple (external) thread is at its minimum value. The maximum minor diameter is basic, but may be such as results from the use of a worn or rounded threading tool.

(*g*) The tolerance on the major diameter of the coupling (internal) thread is equal to the tolerance on the pitch diameter plus two-ninths of the basic thread height. The minimum major diameter of the coupling (internal) thread is such as to result in a basic flat, $p/8$, when the pitch diameter of the coupling is at its minimum value. The maximum major diameter of the coupling is that corresponding to a flat equal to one-third the basic flat, $p/24$.

(*h*) The tolerance on the minor diameter of the coupling (internal) thread is twice the tolerance on the pitch diameter of the coupling. The minimum minor diameter of a coupling is such as to result in a basic flat, $p/8$, at the crest when the pitch diameter of the coupling is at its minimum value.

5. GAGES

1. Gages for American National Hose Coupling Threads.—Limits of size of gages for American National hose coupling threads are given in table X.7 and are based on the specifications and tolerances for gages given in section VI of part I.

2. Gages for American National Fire-hose Coupling Threads.—It is recommended that American National fire-hose coupling threads be inspected in the field by means of gages made within the tolerances given in table X.8. Limits of size for these gages are given in tables X.9 and X.10.

It is further recommended that American National fire-hose coupling threads be given final inspection by the manufacturer by means of gages made within the limits given in tables X.9 and X.10 in order to avoid, as far as possible, disagreements which might otherwise arise as the result of slight differences in the sizes of gages.

6. EXTENT OF USAGE OF THE AMERICAN NATIONAL FIRE-HOSE COUPLING THREADS

In appendix 9 is a listing of the cities in the United States which had a population of 25,000 or more in accordance with the 1950 census, and which have not standardized on the American National fire-hose coupling threads on hydrants, couplings, and nipples used with 2½ in. nominal size fire hose.

Table X.1.—*Basic dimensions of American National hose coupling and fire-hose coupling threads, NPSH and NH*

Nominal size of hose	Symbol	Service	Thds per inch	Pitch	Height of thread	Maximum nipple dimensions (external thread)				Minimum (basic) coupling dimensions (internal thread)		
						Allowance	Major diameter	Pitch diameter	Minor diameter	Minor diameter	Pitch diameter	Major diameter
1	2	3	4	5	6	7	8	9	10	11	12	13
in.				*in.*	*in.*	*in.*	*in.*	*in.*	*in.*	*in.*	*in.*	*in.*
½, ⅝, ¾	NH	Garden hose	11½	0.08696	0.05648	0.0100	1.0625	1.0060	0.9495	0.9595	1.0160	1.0725
¾, 1	NH	Chemical engine and booster hose.	8	.12500	.08119	.0120	1.3750	1.2938	1.2126	1.2246	1.3058	1.3870
1½	NH	Fire hose	9	.11111	.07217	.0120	1.9900	1.9178	1.8457	1.8577	1.9298	2.0020
½	NPSH	Steam, air, water, and all other hose connections to be made up with standard pipe threads.	14	.07143	.04639	.0075	.8248	.7784	.7320	.7395	.7859	.8323
¾	NPSH		14	.07143	.04639	.0075	1.0353	.9889	.9425	.9500	.9964	1.0428
1	NPSH		11½	.08696	.05648	.0100	1.2951	1.2386	1.1821	1.1921	1.2486	1.3051
1¼	NPSH		11½	.08696	.05648	.0100	1.6399	1.5834	1.5269	1.5369	1.5934	1.6499
1½	NPSH		11½	.08696	.05648	.0100	1.8788	1.8223	1.7658	1.7758	1.8323	1.8888
2	NPSH		11½	.08696	.05648	.0100	2.3528	2.2963	2.2398	2.2498	2.3063	2.3628
2½	NH	Fire hose	7½	.13333	.08660	.0150	3.0686	2.9820	2.8954	2.9104	2.9970	3.0836
3	NH		6	.16667	.10825	.0150	3.6239	3.5156	3.4073	3.4223	3.5306	3.6389
3½	NH		6	.16667	.10825	.0200	4.2439	4.1356	4.0273	4.0473	4.1556	4.2639
4 [a]	NH(SPL)		6	.16667	.10825	.0201	4.9082	4.7999	4.6916	4.7117	4.8200	4.9283
4	NH		4	.25000	.16238	.0250	5.0109	4.8485	4.6861	4.7111	4.8735	5.0359
4½	NH		4	.25000	.16238	.0250	5.7609	5.5985	5.4361	5.4611	5.6235	5.7859
5	NH		4	.25000	.16238	.0250	6.2600	6.0976	5.9352	5.9602	6.1226	6.2850
6	NH		4	.25000	.16238	.0250	7.0250	6.8626	6.7002	6.7252	6.8876	7.0500

[a] Data on the 4–6NH(SPL) thread are included since this thread is used extensively by the Navy Department.

Table X.2.—*Limits of size and tolerances for American National hose coupling and fire-hose coupling external threads, NPSH and NH nipples*

Nominal size of hose	Symbol	Service	Thds per inch	Pitch	Height of thread	Nipple (external) thread						
						Major diameter			Pitch diameter			Minor [a] diameter
						Max	Min	Tol.	Max	Min	Tol.	Max
1	2	3	4	5	6	7	8	9	10	11	12	13
in.				*in.*	*in.*	*in.*	*in.*	*in.*	*in.*	*in.*	*in.*	*in.*
½, ⅝, ¾	NH	Garden hose	11½	0.08696	0.05648	1.0625	1.0455	0.0170	1.0060	0.9975	0.0085	0.9495
¾, 1	NH	Chemical engine and booster hose.	8	.12500	.08119	1.3750	1.3528	.0222	1.2938	1.2827	.0111	1.2126
1½	NH	Fire hose	9	.11111	.07217	1.9900	1.9678	.0222	1.9178	1.9067	.0111	1.8457
½	NPSH	Steam, air, water, and all other hose connections to be made up with standard pipe threads.	14	.07143	.04639	.8248	.8108	.0140	.7784	.7714	.0070	.7320
¾	NPSH		14	.07143	.04639	1.0353	1.0213	.0140	.9889	.9819	.0070	.9425
1	NPSH		11½	.08696	.05648	1.2951	1.2781	.0170	1.2386	1.2301	.0085	1.1821
1¼	NPSH		11½	.08696	.05648	1.6399	1.6229	.0170	1.5834	1.5749	.0085	1.5269
1½	NPSH		11½	.08696	.05648	1.8788	1.8618	.0170	1.8223	1.8138	.0085	1.7658
2	NPSH		11½	.08696	.05648	2.3528	2.3358	.0170	2.2963	2.2878	.0085	2.2398
2½	NH	Fire hose	7½	.13333	.08660	3.0686	3.0366	.0320	2.9820	2.9660	.0160	2.8954
3	NH		6	.16667	.10825	3.6239	3.5879	.0360	3.5156	3.4976	.0180	3.4073
3½	NH		6	.16667	.10825	4.2439	4.2079	.0360	4.1356	4.1176	.0180	4.0273
4[b]	NH(SPL)		6	.16667	.10825	4.9082	4.8722	.0360	4.7999	4.7819	.0180	4.6916
4	NH		4	.25000	.16238	5.0109	4.9609	.0500	4.8485	4.8235	.0250	4.6861
4½	NH		4	.25000	.16238	5.7609	5.7109	.0500	5.5985	5.5735	.0250	5.4361
5	NH		4	.25000	.16238	6.2600	6.2100	.0500	6.0976	6.0726	.0250	5.9352
6	NH		4	.25000	.16238	7.0250	6.9750	.0500	6.8626	6.8376	.0250	6.7002

[a] Dimensions given for the maximum minor diameter of the nipple are figured to the intersection of the worn tool arc with a centerline through crest and root. The minimum minor diameter of the nipple shall be that corresponding to a flat at the minor diameter of the minimum nipple equal to $\frac{1}{24}\times p$, and may be determined by subtracting $1\frac{2}{9}\times h$ (or $0.7939p$) from the minimum pitch diameter of the nipple.

[b] Data on the 4–6NH(SPL) thread are included since this thread is used extensively by the Navy Department.

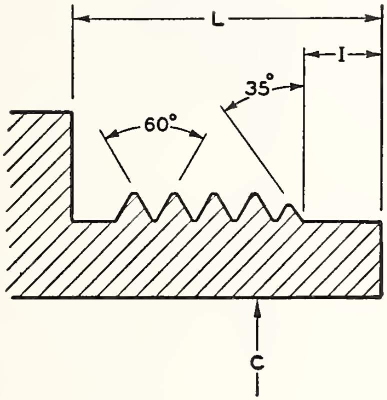
Table X.3.—*Limits of size and tolerances for American National hose coupling and fire-hose coupling internal threads, NPSH and NH couplings*

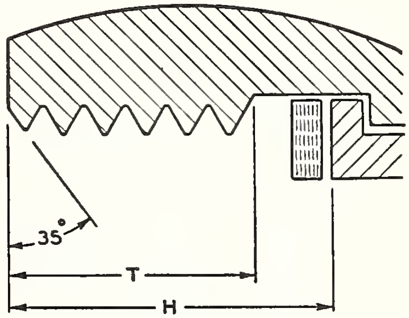
Nominal size of hose	Symbol	Service	Thds per inch	Pitch	Height of thread	Coupling (internal) thread						
						Minor diameter			Pitch diameter			Major [a] diameter
						Min	Max	Tol.	Min	Max	Tol.	Min
1	2	3	4	5	6	7	8	9	10	11	12	13
in.				*in.*	*in.*	*in.*	*in.*	*in.*	*in.*	*in.*	*in.*	*in.*
½, ⅝, ¾	NH	Garden hose	11½	0.08696	0.05648	0.9595	0.9765	0.0170	1.0160	1.0245	0.0085	1.0725
¾, 1	NH	Chemical engine and booster hose.	8	.12500	.08119	1.2246	1.2468	.0222	1.3058	1.3169	.0111	1.3870
1½	NH	Fire hose	9	.11111	.07217	1.8577	1.8799	.0222	1.9298	1.9409	.0111	2.0020
½	NPSH	Steam, air, water, and all other hose connections to be made up with standard pipe threads.	14	.07143	.04639	.7395	.7535	.0140	.7859	.7929	.0070	.8323
¾	NPSH		14	.07143	.04639	.9500	.9640	.0140	.9964	1.0034	.0070	1.0428
1	NPSH		11½	.08696	.05648	1.1921	1.2091	.0170	1.2486	1.2571	.0085	1.3051
1¼	NPSH		11½	.08696	.05648	1.5369	1.5539	.0170	1.5934	1.6019	.0085	1.6499
1½	NPSH		11½	.08696	.05648	1.7758	1.7928	.0170	1.8323	1.8408	.0085	1.8888
2	NPSH		11½	.08696	.05648	2.2498	2.2668	.0170	2.3063	2.3148	.0085	2.3628
2½	NH	Fire hose	7½	.13333	.08660	2.9104	2.9424	.0320	2.9970	3.0130	.0160	3.0836
3	NH		6	.16667	.10825	3.4223	3.4583	.0360	3.5306	3.5486	.0180	3.6389
3½	NH		6	.16667	.10825	4.0473	4.0833	.0360	4.1556	4.1736	.0180	4.2639
4[b]	NH(SPL)		6	.16667	.10825	4.7117	4.7477	.0360	4.8200	4.8380	.0180	4.9283
4	NH		4	.25000	.16238	4.7111	4.7611	.0500	4.8735	4.8985	.0250	5.0359
4½	NH		4	.25000	.16238	5.4611	5.5111	.0500	5.6235	5.6485	.0250	5.7859
5	NH		4	.25000	.16238	5.9602	6.0102	.0500	6.1226	6.1476	.0250	6.2850
6	NH		4	.25000	.16238	6.7252	6.7752	.0500	6.8876	6.9126	.0250	7.0500

[a] Dimensions for the minimum major diameter of the coupling correspond to the basic flat ($\frac{1}{8}\times p$), and the profile at the major diameter produced by a worn tool must not fall below the basic outline. The maximum major diameter of the coupling shall be that corresponding to a flat at the major diameter of the maximum coupling equal to $\frac{1}{24}\times p$, and may be determined by adding $1\frac{2}{9}\times h$ (or $0.7939p$) to the maximum pitch diameter of the coupling.

[b] Data on the 4-6NH(SPL) thread are included since this thread is used extensively by the Navy Department.

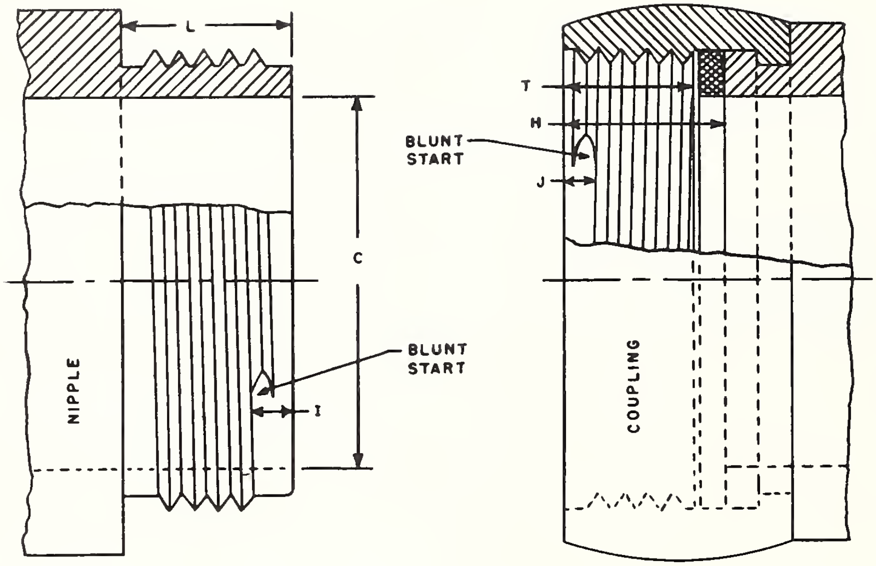
Table X.4.—*Lengths of threads for American National hose coupling threads, NPSH (all sizes), and for American National fire-hose coupling threads, NH (up to and including the 1 inch size)*





Nominal size of hose	Symbol	Service	Threads per inch, *n*	Inside diameter of nipple, *C*	Approximate outside diameter of external thread	Length of nipple, *L*	Length of pilot, *I*	Depth of coupling, *H*	Thread length for coupling, *T*	Approximate number of threads in length, *T*
1	2	3	4	5	6	7	8	9	10	11
in.				*in.*	*in.*	*in.*	*in.*	*in.*	*in.*	
½, ⅝, ¾	NH	Garden hose	11½	25/32	1 1/16	9/16	⅛	17/32	⅜	4¼
¾, 1	NH	Chemical engine and booster hose.	8	1 1/32	1⅜	⅝	5/32	19/32	15/32	3¾
½	NPSH	Steam, air, water, and all other hose connections to be made up with standard pipe threads.	14	17/32	13/16	½	⅛	15/32	5/16	4¼
¾	NPSH		14	25/32	1 1/32	9/16	⅛	17/32	⅜	5¼
1	NPSH		11½	1 1/32	1 9/32	9/16	5/32	17/32	⅜	4¼
1¼	NPSH		11½	1 9/32	1⅝	⅝	5/32	19/32	15/32	5½
1½	NPSH		11½	1 17/32	1⅞	⅝	5/32	19/32	15/32	5½
2	NPSH		11½	2 1/32	2 11/32	¾	3/16	23/32	19/32	6¾

Table X.5.—*Lengths of threads for American National fire-hose coupling threads, NH (1½ in. size and larger)*



Nominal size of hose	Symbol	Service	Threads per inch, *n*	Inside diameter of nipple or coupling, *C*	Approximate outside diameter of external thread	Length of nipple, *L*	Length of pilot to start of second thread, *I*	Depth of coupling, *H*	Thread length for coupling, *T*	From face of coupling to start of second thread, *J*
1	2	3	4	5	6	7	8	9	10	11
in.				*in.*	*in.*	*in.*	*in.*	*in.*	*in.*	*in.*
1½	NH	Fire hose	9	1½	2	⅝	5/32	19/32	15/32	----------
2½	NH		7½	2½	3 1/16	1	¼	1 5/16	11/16	3/16
3	NH		6	3	3⅝	1⅛	5/16	1 1/16	¾	¼
3½	NH		6	3½	4¼	1⅛	5/16	1 1/16	¾	¼
4 [a]	NH(SPL)		6	4	4 29/32	1⅛	5/16	1 1/16	¾	¼
4	NH		4	4	5	1¼	7/16	1 3/16	⅞	⅜
4½	NH		4	4½	5¾	1¼	7/16	1 3/16	⅞	⅜
5	NH		4	5	6¼	1⅜	7/16	1 5/16	1	⅜
6	NH		4	6	7 1/32	1⅜	7/16	1 5/16	1	⅜

[a] Data on the 4—6NH(SPL) thread are included since this thread is used extensively by the Navy Department.

Table X.6.—*Tolerances and allowances for American National hose coupling and American National fire-hose coupling threads, NPSH and NH*

Nominal size of hose	Symbol	Service	Threads per inch	Allowance	Tolerance [a] on pitch diameter	Lead [b] deviation consuming one-half of pitch-diameter tolerance	Deviation in half angle consuming one-half of pitch-diameter tolerance	
1	2	3	4	5	6	7	8	
in.				*in.*	*in.*	*in.*	*deg.*	*min.*
½, ⅝, ¾	NH	Garden hose	11½	0.0100	0.0085	0.0025	1	52
¾, 1	NH	Chemical engine and booster hose	8	.0120	.0111	.0032	1	42
1½	NH	Fire hose	9	.0120	.0111	.0032	1	54
½	NPSH	Steam, air, water, and all other hose connections to be made up with standard pipe threads.	14	.0075	.0070	.0020	1	52
¾	NPSH		14	.0075	.0070	.0020	1	52
1	NPSH		11½	.0100	.0085	.0025	1	52
1¼	NPSH		11½	.0100	.0085	.0025	1	52
1½	NPSH		11½	.0100	.0085	.0025	1	52
2	NPSH		11½	.0100	.0085	.0025	1	52
2½	NH	Fire hose	7½	.0150	.0160	.0046	2	17
3	NH		6	.0150	.0180	.0052	2	4
3½	NH		6	.0200	.0180	.0052	2	4
4 [c]	NH(SPL)		6	.0201	.0180	.0052	2	4
4	NH		4	.0250	.0250	.0072	1	55
4½	NH		4	.0250	.0250	.0072	1	55
5	NH		4	.0250	.0250	.0072	1	55
6	NH		4	.0250	.0250	.0072	1	55

[a] The tolerances specified for pitch diameter include all deviations of pitch diameter, lead, and angle. The full tolerance cannot, therefore, be used on pitch diameter unless the lead and angle of the thread are perfect. Columns 7 and 8 give, for information, the deviations in lead (per length of thread engaged) and in angle, each of which can be compensated for by half the tolerance on the pitch diameter given in column 6. If lead and angle deviations both exist to the amount tabulated, the pitch diameter of a nipple, for example, must be reduced by the full tolerance or it will not enter the "go" gage.

[b] Between any two threads not farther apart than the length of engagement.

[c] Data on the 4–6NH(SPL) thread are included since this thread is used extensively by the Navy Department.

Table X.7.—*Limits of size of gages for American National hose-coupling threads, NPSH (all sizes), and for American National fire-hose coupling threads, NH (up to and including the 1½ in. size)*

Limits of size		Service								
		Garden hose, NH	Chemical engine and booster hose, NH	Fire protection hose, NH	Steam, air, water, and all other hose connections to be made up with standard pipe threads, NPSH					
		Size								
		½, ⅝, ¾	¾, 1	1½	½	¾	1	1¼	1½	2
		Threads per inch								
		11½	8	9	14	14	11½	11½	11½	11½
		Limits of size								
Nipple (external) thread										
"Go" Thread Gages for Nipples		*in.*	*in.*	*in.*	*in.*	*in.*	*in.*	*in.*	*in.*	*in.*
Major diameter of basic-form setting plug, and full portion of truncated setting plug	Max	1.0625	1.3750	1.9900	0.8248	1.0353	1.2951	1.6399	1.8788	2.3528
	Min	1.0619	1.3743	1.9893	.8242	1.0347	1.2945	1.6393	1.8782	2.3522
Major diameter of truncated portion of truncated setting plug	Max	1.0455	1.3528	1.9678	.8108	1.0213	1.2781	1.6229	1.8618	2.3358
	Min	1.0449	1.3521	1.9671	.8102	1.0207	1.2775	1.6223	1.8612	2.3352
Pitch diameter of setting plug or ring gage	Max X	1.0060	1.2938	1.9178	.7784	.9889	1.2386	1.5834	1.8223	2.2963
	Min X	1.0057	1.2934	1.9175	.7781	.9886	1.2383	1.5831	1.8220	2.2959
	Max Y	1.0058	1.2936	1.9176	.7782	.9887	1.2384	1.5832	1.8221	2.2961
	Min Y	1.0054	1.2931	1.9171	.7778	.9883	1.2380	1.5828	1.8217	2.2955
Minor diameter of ring gage	Max	.9595	1.2246	1.8577	.7395	.9500	1.1921	1.5369	1.7758	2.2498
	Min	.9589	1.2239	1.8570	.7389	.9494	1.1915	1.5363	1.7752	2.2492
"Not Go" Thread Gages for Nipples										
Major diameter of basic-form setting plug, and full portion of truncated setting plug	Min	1.0619	1.3743	1.9893	.8242	1.0347	1.2945	1.6393	1.8782	2.3522
	Max	1.0625	1.3750	1.9900	.8248	1.0353	1.2951	1.6399	1.8788	2.3528
Major diameter of truncated portion of truncated setting plug	Min	1.0346	1.3361	1.9541	.8017	1.0122	1.2672	1.6120	1.8509	2.3249
	Max	1.0352	1.3368	1.9548	.8023	1.0128	1.2678	1.6126	1.8515	2.3255
Pitch diameter of setting plug or ring gage	Min	.9975	1.2827	1.9067	.7714	.9819	1.2301	1.5749	1.8138	2.2878
	Max	.9978	1.2831	1.9070	.7717	.9822	1.2304	1.5752	1.8141	2.2882
Minor diameter of ring gage	Min	.9787	1.2556	1.8826	.7559	.9664	1.2113	1.5561	1.7950	2.2690
	Max	.9793	1.2563	1.8833	.7565	.9670	1.2119	1.5567	1.7956	2.2696
Plain Gages for Nipples										
"Go" gages for major diameter	Max	1.06250	1.37500	1.99000	.82480	1.03530	1.29510	1.63990	1.87880	2.35280
	Min	1.06241	1.37491	1.98988	.82473	1.03521	1.29501	1.63978	1.87868	2.35268
"Not go" gages for major diameter	Min	1.04550	1.35280	1.96780	.81080	1.02130	1.27810	1.62290	1.86180	2.33580
	Max	1.04559	1.35289	1.96792	.81087	1.02139	1.27819	1.62302	1.86192	2.33592
Coupling (internal) thread										
"Go" Thread Gages for Couplings										
Major diameter of plug gage	Min	1.0725	1.3870	2.0020	0.8323	1.0428	1.3051	1.6499	1.8888	2.3628
	Max	1.0731	1.3877	2.0027	.8329	1.0434	1.3057	1.6505	1.8894	2.3634
Pitch diameter of plug gage	Min	1.0160	1.3058	1.9298	.7859	.9964	1.2486	1.5934	1.8323	2.3063
	Max	1.0163	1.3062	1.9301	.7862	.9967	1.2489	1.5937	1.8326	2.3067
"Not Go" Thread Gages for Couplings										
Major diameter of plug gage	Max	1.0622	1.3710	1.9890	.8238	1.0343	1.2948	1.6396	1.8785	2.3525
	Min	1.0616	1.3703	1.9883	.8232	1.0337	1.2942	1.6390	1.8779	2.3519
Pitch diameter of plug gage	Max	1.0245	1.3169	1.9409	.7929	1.0034	1.2571	1.6019	1.8408	2.3148
	Min	1.0242	1.3165	1.9406	.7926	1.0031	1.2568	1.6016	1.8405	2.3144
Plain Gages for Couplings										
"Go" gages for minor diameter	Min	.95950	1.22460	1.85770	.73950	.95000	1.19210	1.53690	1.77580	2.24980
	Max	.95959	1.22469	1.85782	.73957	.95009	1.19219	1.53702	1.77592	2.24992
"Not go" gages for minor diameter	Max	.97650	1.24680	1.87990	.75350	.96400	1.20910	1.55390	1.79280	2.26680
	Min	.97641	1.24671	1.87978	.75343	.96391	1.20901	1.55378	1.79268	2.26668

TABLE X.8.—*Tolerances on gages for American National fire-hose coupling threads, NH (2½ in. size and larger)*

Allowable variation in lead between any two threads not farther apart than length of engagement	Allowable variation in one half angle of thread		Tolerance on diameter of minimum thread gage	Tolerance on diameter of maximum thread gage
1	2		3	4
in.	*deg*	*min*	*in.*	*in.*
±0.0005	±0	10	−0.000 +.001	+0.000 −.001

TABLE X.9.—*Limits of size of field inspection thread ring gages for American National fire-hose coupling external threads, NH nipples (2½ in. size and larger)* [a]

Nominal size of hose	Threads per inch	"Go" or maximum gage				"Not go" or minimum gage			
		Pitch diameter		Minor diameter		Pitch diameter		Minor diameter	
		Max	Min	Max	Min	Max	Min	Max	Min
1	2	3	4	5	6	7	8	9	10
in.		*in.*	*in.*	*in.*	*in.*	*in.*	*in.*	*in.*	*in.*
2.500	7½	2.9820	2.9810	2.9104	2.9094	2.9670	2.9660	2.9114	2.9104
3.000	6	3.5156	3.5146	3.4223	3.4213	3.4986	3.4976	3.4233	3.4223
3.500	6	4.1356	4.1346	4.0473	4.0463	4.1186	4.1176	4.0483	4.0473
4.000 [b]	6	4.7999	4.7989	4.7117	4.7107	4.7829	4.7819	4.7127	4.7117
4.000	4	4.8485	4.8475	4.7111	4.7101	4.8245	4.8235	4.7121	4.7111
4.500	4	5.5985	5.5975	5.4611	5.4601	5.5745	5.5735	5.4621	5.4611
5.000	4	6.0976	6.0966	5.9602	5.9592	6.0736	6.0726	5.9612	5.9602
6.000	4	6.8626	6.8616	6.7252	6.7242	6.8386	6.8376	6.7262	6.7252

[a] The minor diameters of plug gages and the major diameters of ring gages are undercut beyond the nominal diameters to give clearance for grinding or lapping. The allowable variation in lead between any two threads not farther apart than the length of engagement is ±0.0005 in. The allowable variation in one-half angle of thread is ±10 min.

[b] Data on the 4—6 thread are included since this thread is used extensively by the Navy Department. It is to be designated: 4—6NH(SPL).

TABLE X.10.—*Limits of size of field inspection thread plug gages for American National fire-hose coupling internal threads, NH couplings (2½ in. size and larger)* [a]

Nominal size of hose	Threads per inch	"Go" or minimum gage				"Not go" or maximum gage			
		Major diameter		Pitch diameter		Major diameter		Pitch diameter	
		Max	Min	Max	Min	Max	Min	Max	Min
1	2	3	4	5	6	7	8	9	10
in.		*in.*	*in.*	*in.*	*in.*	*in.*	*in.*	*in.*	*in.*
2.500	7½	3.0846	3.0836	2.9980	2.9970	3.0836	3.0826	3.0130	3.0120
3.000	6	3.6399	3.6389	3.5316	3.5306	3.6389	3.6379	3.5486	3.5476
3.500	6	4.2649	4.2639	4.1566	4.1556	4.2639	4.2629	4.1736	4.1726
4.000 [b]	6	4.9293	4.9283	4.8210	4.8200	4.9283	4.9273	4.8380	4.8370
4.000	4	5.0369	5.0359	4.8745	4.8735	5.0359	5.0349	4.8985	4.8975
4.500	4	5.7869	5.7859	5.6245	5.6235	5.7859	5.7849	5.6485	5.6475
5.000	4	6.2860	6.2850	6.1236	6.1226	6.2850	6.2840	6.1476	6.1466
6.000	4	7.0510	7.0500	6.8886	6.8876	7.0500	7.0490	6.9126	6.9116

[a] The minor diameters of plug gages and the major diameters of ring gages are undercut beyond the nominal diameters to give a clearance for grinding or lapping. The allowable variation in lead between any two threads not farther apart than the length of engagement is ±0.0005 in. The allowable variation in one-half angle of thread is ±10 min.

[b] Data on the 4—6 thread are included since this thread is used extensively by the Navy Department. It is to be designated: 4—6NH(SPL).

SECTION XI. HOSE CONNECTIONS FOR WELDING AND CUTTING EQUIPMENT

Specifications covering hose connections for welding and cutting equipment were formulated and adopted in 1925 by the International Acetylene Association, the Gas Products Association, and various manufacturers. Essentially the same specifications were adopted by the National Screw Thread Commission in 1926.

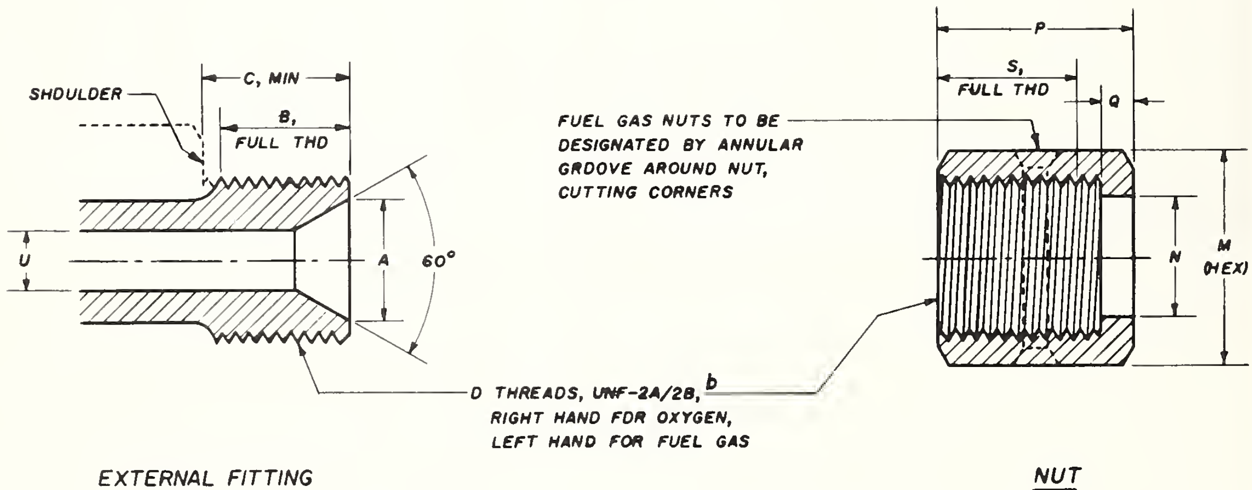
Revised specifications for these connections were adopted by the International Acetylene Association, March 9, 1939. These revised specifications were amended several times; the most recent amendment having been on April 1, 1957. These revised specifications, as amended, were adopted by the Interdepartmental Screw Thread Committee and are presented below.

Dimensions essential to the interchangeability of parts have been standardized. Other dimensions and details of design are optional, so that manufacturers may use their own judgment and follow their usual practice as much as possible.

The hose connection consists of an external fitting, nut, and shank. Dimensions for the type I hose connection external fittings and nuts for oxygen and fuel gas are shown in table XI.1. Dimensions for the type II hose connection external fittings and nuts for water and gases other than oxygen and fuel gas are shown in table XI.2.

The shanks are interchangeable for types I and II for any given class. Dimensions for the hose connection shanks are shown in table XI.3.

TABLE XI.1—*Dimensions for American National standard hose connection external fittings and nuts for oxygen and fuel gas* [a] *used with welding and cutting equipment, type I*



Thread size, *D*	Industry designation, class	For use with hose of inside diameter of—	External fitting					Nut					
			Large diameter of seat, *A*		Length of full thread, *B*	Length to shoulder, *C*	Bore, *U*	Width across hexagon flats, *M*	Diameter of hole, *N*		Over-all length, *P*	Length of hole, *Q*	Depth of full thread, *S*
			Max	Min		Min			Max	Min			
1	2	3	4	5	6	7	8	9	10	11	12	13	14
		in.	*in.*	*in.*	*in.*	*in.*	*in.*	*in.*	*in.*	*in.*	*in.*	*in.*	*in.*
3/8—24	A	1/8, 3/16	0.255	0.245	1/4	9/32	3/32	7/16	0.262	0.257	15/32	3/32	1/4
9/16—18	B	1/8, 3/16, 1/4, 5/16, 3/8	.438	.428	5/16	13/32	1/4	11/16	.4425	.4375	5/8	1/8	5/16
7/8—14	C	1/4, 5/16, 3/8, 1/2	.630	.620	11/16	23/32	21/64	1 1/8	.5997	.5907	1	5/32	11/16
1 1/4—12	D	3/8, 1/2, 3/4	.962	.946	7/8	31/32	9/16	1 1/2	.9122	.9042	1 11/32	7/32	15/16

[a] The hose connection consists of the external fitting and nut shown in this table and the shank shown in table XI.3.

[b] See section III for dimensions of threads and method of designating threads, and section VI for gaging of threads.

1. STANDARD DIMENSIONS [11]

Dimensions for the following have been standardized and should be met.

1. Size, type, and class of thread.
2. Angle and large diameter of internal seat.
3. Radius and distance of radius center of external seat from shank shoulder.
4. Diameter of shank shoulder.
5. Diameter of drilling through external fitting and shank.
6. Diameter of hole in nut.
7. Large diameter of hose shank.
8. Fuel gas nuts to be designated by an annular groove around the nut, cutting corners.

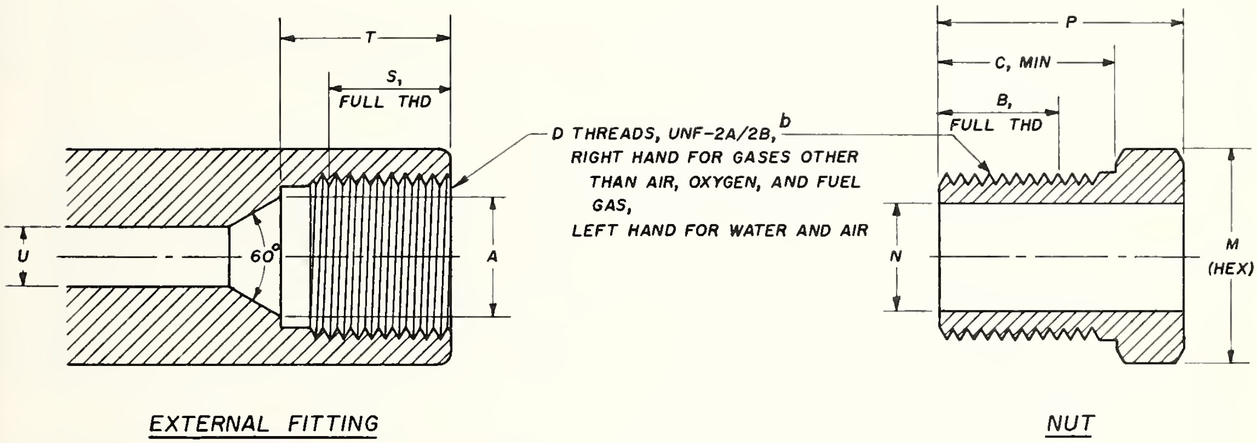
[11] Designs of gages for controlling dimensions other than thread dimensions of these connections were published in NBS Miscellaneous Publications M89 and M141, and Handbook H25.
The gaging of the threads is covered in section VI.

2. OPTIONAL FEATURES

The following features are optional.

1. Material, except that its strength shall be equal to or greater than that of free-turning high brass.
2. Form of end of shank except seating section as dimensioned.
3. Length of hose shank.
4. Type and number of serrations on hose shank.
5. A second shoulder, equal to the larger diameter of the largest shank to extend through the hole in the nut for appearance, may be used or omitted for smaller diameter shanks.
6. Length and location of hexagon wrench section on nut.

Table XI.2—*Dimensions for American National standard hose connection external fittings and nuts for water and gases [a] other than oxygen and fuel gas used with oxygen-fuel gas welding and cutting equipment, type II*

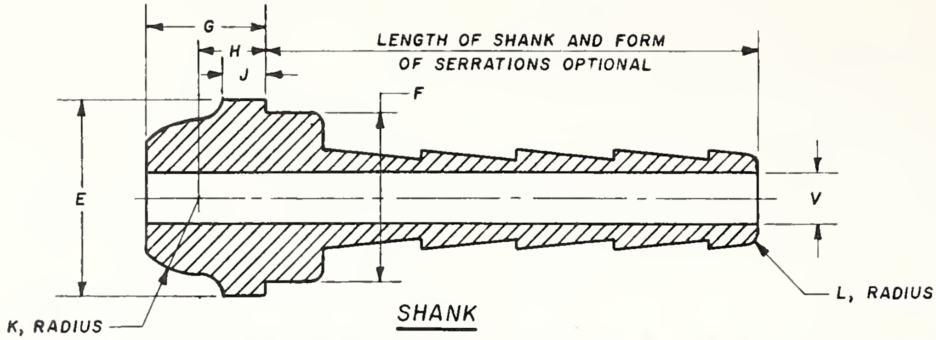


Thread size, *D*	Industry designation, class	For use with hose of inside diameter of—	External fitting: Large diameter of seat, *A*		Depth of full thread, *S*	Depth, *T*	Bore, *U*	Nut: Length of full thread, *B*	Length to shoulder, *C* (Min)	Width across hexagon flats, *M*	Diameter of hole, *N*		Over-all length, *P*
			Max	Min							Max	Min	
1	2	3	4	5	6	7	8	9	10	11	12	13	14
		in.	*in.*	*in.*	*in.*	*in.*	*in.*	*in.*	*in.*	*in.*	*in.*	*in.*	*in.*
3/8—24	A	1/8, 3/16	0.255	0.245	9/32	3/8	3/32	9/32	3/8	7/16	0.262	0.257	1/2
5/8—18	B	1/8, 3/16, 1/4, 5/16, 3/8	.438	.428	3/8	1/2	1/4	3/8	7/16	11/16	.4425	.4375	7/8
7/8—14	C	1/4, 5/16, 3/8, 1/2	.630	.620	11/16	27/32	21/64	11/16	23/32	1 1/8	.5997	.5907	1 1/4
1 1/4—12	D	3/8, 1/2, 3/4	.962	.946	15/16	1 1/8	9/16	7/8	31/32	1 1/2	.9122	.9042	1 1/2

[a] The hose connection consists of the external fitting and nut shown in this table and the shank shown in table XI.3.

[b] See section III for dimensions of threads and method of designating threads, and section VI for gaging of threads.

TABLE XI.3—*Dimensions for American National standard hose connection shanks for water, oxygen, fuel gas, and other gases used with welding and cutting equipment, types I and II* [a]



Thread [b] size, *D*	Industry designation, class	For use with hose of inside diameter of—	Diameter of hole, *V* (min)	Diameter of shoulder, *E*		Diameter of shank, *F*		Length to shoulder, *G*	Radius distance, *H*		Length of shoulder, *J*	Radius, *K*	Radius, *L* (min)
				Max	Min	Max	Min		Max	Min			
1	2	3	4	5	6	7	8	9	10	11	12	13	14
		in.	*in.*	*in.*	*in.*	*in.*	*in.*	*in.*	*in.*	*in.*	*in.*	*in.*	*in.*
3/8—24	A	1/8 3/16	1/16 3/32	0.328	0.324	0.248	0.243	1/4	0.187	0.177	1/8	0.099	1/32
9/16—18 [c] 5/8—18 [c]	B	1/8 3/16 1/4 5/16 3/8	1/16 3/32 9/64 3/16 1/4	.500	.496	.430	.425	5/16	.180	.170	1/8	.196	3/64
7/8—14	C	1/4 5/16 3/8 1/2	9/64 3/16 1/4 21/64	.754	.746	.578	.568	7/16	.255	.245	3/16	.280	1/32
1 1/4—12	D	3/8 1/2 3/4	1/4 21/64 9/16	1.140	1.132	.875	.865	5/8	.335	.319	3/16	.438	3/64

[a] The hose connection consists of the shank shown in this table and the external fitting and nut shown in tables XI.1 or XI.2, depending on the application.

[b] Shown for cross-reference purposes as regards the external fittings and nuts shown in tables XI.1 and XI.2.

[c] The 9/16—18 thread size is for the external fitting and nut shown in table XI.1; the 5/8—18 thread size is for the external fitting and nut shown in table XI.2.

APPENDIX 7. SUPPLEMENTARY PIPE-THREAD INFORMATION

The information contained herein supplements sections VII and VIII.

1. DEFINITIONS AND LETTER SYMBOLS PERTAINING TO PIPE THREADS

1. DEFINITIONS.—Terms relating only to taper pipe threads are defined as follows:

1. *Pitch cone.*—The pitch cone is a cone, the surface of which would pass through the thread profiles at such points as to make the width of the groove equal to one half of the basic pitch. On a perfect thread this occurs at the point where the widths of the thread and groove are equal.

2. *Major cone.*—The major cone is a cone having an apex angle equal to that of the pitch cone, the surface of which would bound the crest of an external thread or the root of an internal thread.

3. *Sharp major cone.*—The sharp major cone is a cone having an apex angle equal to that of the pitch cone, the surface of which would pass through the sharp crest of an external thread or the sharp root of an internal thread.

4. *Minor cone.*—The minor cone is a cone having an apex angle equal to that of the pitch cone, the surface of which would bound the root of an external thread or the crest of an internal thread.

5. *Sharp minor cone.*—The sharp minor cone is a cone having an apex angle equal to that of the pitch cone, the surface of which would pass through the sharp root of an external thread or the sharp crest of an internal thread.

6. *Standoff.*—The standoff is the axial distance between specified reference points on external and internal taper threaded members or gages, when assembled with a specified torque or under other specified conditions.

7. *Bottom of chamfer.*—On a chamfered internal taper thread the bottom of the chamfer is defined as the intersection of the chamfer cone and the pitch cone of the thread.

2. LETTER SYMBOLS.—Standard letter symbols used to designate the dimensions of taper pipe threads are given in table 7.1. The applications of the symbols are shown in figure 7.1.

2. SUGGESTED TWIST DRILL DIAMETERS FOR DRILLED HOLE SIZES FOR PIPE THREADS OF SECTION VII

The drill diameters given in table 7.2 for the drilled holes for taper and straight internal pipe threads are the diameters of the standard and stock drills which are the closest to the minimum minor diameters shown in table VII.2, column 22.

They represent the diameters of the holes which would be cut with a twist drill correctly ground when drilling a material without tearing or flow of metal. This is approximately the condition that exists when a correctly sharpened twist drill is cutting a hole in a homogeneous block of cast iron.

When flat drills are used, the width of the cutting edge may have to be adjusted to produce a hole of the required diameter.

When nonferrous metals and other similar materials are to be drilled and tapped, it may be found necessary to use a drill of slightly larger or smaller diameter to produce a

Table 7.1.—*Pipe thread symbols (see fig. 7.1)*

Symbols	Dimensions	Remarks
D	Outside diameter of pipe	Subscript 4 is used for dimensions in plane of vanish point when these differ from D, d, or t, respectively.
d	Inside diameter of pipe	
t	Wall thickness of pipe	
D_x	Major diameter	Subscript x denotes plane containing the diameter. For axial positions of planes see foot of this table. Subscripts s or n designating screw or nut may also be used if necessary.
E_x	Pitch diameter	
K_x	Minor diameter	
L_x	Length of thread from plane of pipe end to plane containing basic diameter D_x, E_x, or K_x.	For axial position of plane containing basic diameter, see foot of this table.
V	Length of washout (vanish cone) threads.	
β (beta)	Half apex angle of pitch cone of taper thread.	
γ (gamma)	Angle of chamfer at end of pipe measured from a plane normal to the axis.	
A	Handtight standoff of face of coupling from plane containing vanish point on pipe.	
M	Length from plane of handtight engagement to the face of coupling on internally threaded member.	
S	Distance of gaging step of plug gage from face of ring gage for handtight engagement.	
L_n	Length from center line of coupling, face of flange, or bottom of internal thread chamber to face of fitting.	
b	Width of bearing face on coupling.	
τ (tau)	Angle of chamfer at bottom of recess or counterbore measured from the axis.	
ϵ (epsilon)	Half apex angle of vanish cone	
J	Length from center line of coupling, face of flange, or bottom of internal thread chamber to end of pipe, wrenched engagement.	

Table 7.1.—*Pipe thread symbols*—Continued

Symbols	Dimensions	Remarks
L_t	(1) Length of straight full thread. (2) Length from plane of handtight engagement to small end of full internal taper thread.	
Q	Diameter of recess or counterbore in fitting.	
q	Depth of recess or counterbore in fitting.	
W	Outside diameter of coupling or hub of fitting.	
DEFINITION OF PLANES DENOTED BY SUBSCRIPT x		
$x=0$	Plane of pipe end	
$x=1$	Plane of handtight engagement or plane at mouth of coupling (excluding recess, if present). On British pipe threads this is designated the "gauge plane," and the major diameter in this plane is designated the "gauge diameter."	
$x=2$	Plane at which washout threads on pipe commence.	
$x=3$	Plane in coupling reached by end of pipe in wrenched condition. (L_3 is measured from plane containing pipe end in position of handtight engagement.)	
$x=4$	Plane containing vanish point of thread on pipe.	
$x=5$	Plane at which major diameter cone of thread intersects outside diameter of pipe.	

Note.—Additional special subscripts are as follows: Plane $x=6$ is the plane of the pipe end for railing joints. Plane $x=7$ is the plane of the API gage point at a specified length from the plane of vanish point. Plane $x=8$ is the plane of the large end of the "L_8 thread ring gage" for the compressed-gas cylinder valve inlet connection thread. Plane $x=9$ is the plane of the small end of the "L_9 thread plug gage" for the compressed-gas cylinder inlet thread.

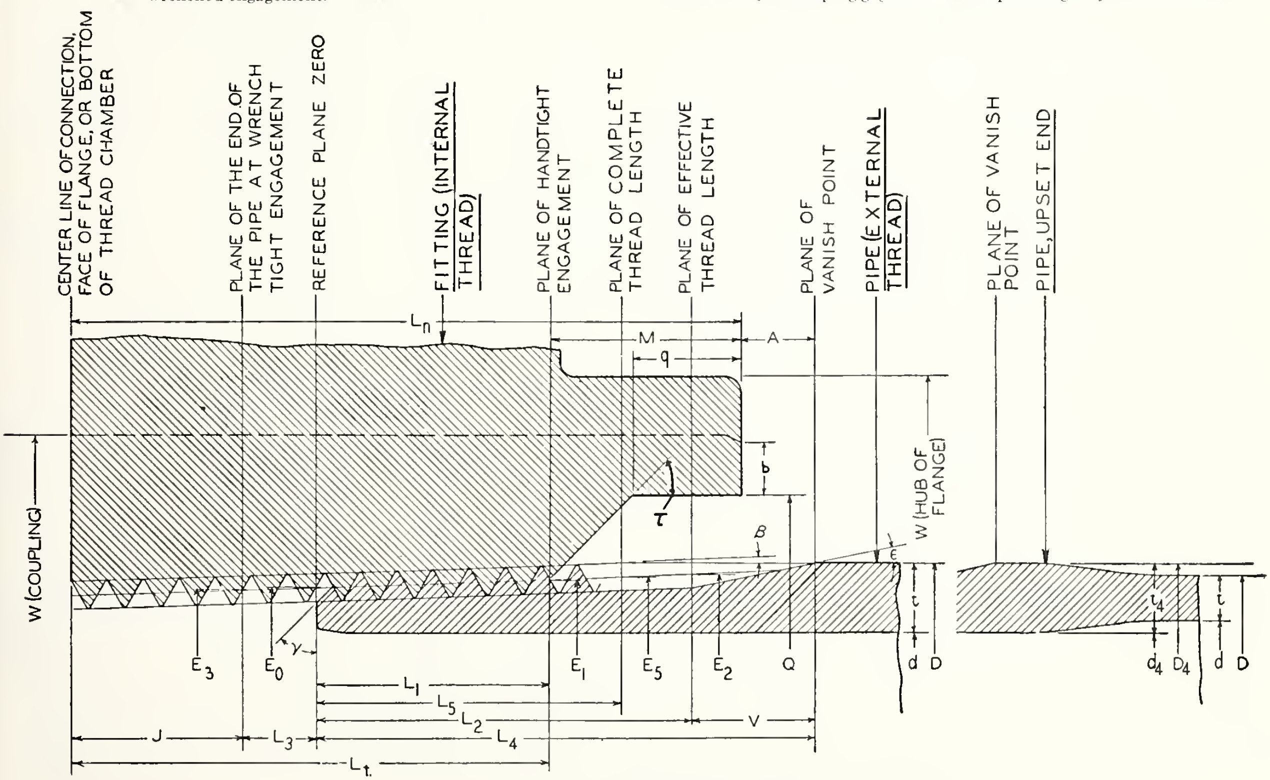


Figure 7.1—*Pipe thread symbols.*

Table 7.2.—*Suggested twist drill diameters for drilled hole sizes for pipe threads*

Nominal pipe size	Taper thread				Straight pipe thread	
	With use of reamer		Without use of reamer			
1	2		3		4	
in.	*in.*	*in.*	*in.*	*in.*	*in.*	*in.*
1/16		[a] 0.240		[a] 0.246	1/4	[a] 0.250
1/8	21/64	[a] .328		[a] .332	11/32	[a] .344
1/4	27/64	[a] .422	7/16	[a] .438	7/16	[a] .438
3/8	9/16	[a] .562	9/16	[a] .562	37/64	[a] .578
1/2	11/16	[a] .688	45/64	[a] .703	23/32	[a] .719
3/4	57/64	[a] .891	29/32	[a] .906	59/64	[a] .922
1	1 1/8	[a] 1.125	1 9/64	[a] 1.141	1 5/32	[a] 1.156
1 1/4	1 15/32	1.469	1 31/64	1.484	1 1/2	1.500
1 1/2	1 23/32	1.719	1 47/64	1.734	1 3/4	1.750
2	2 3/16	2.188	2 13/64	2.203	2 7/32	2.219
2 1/2	2 19/32	2.594	2 5/8	2.625	2 21/32	2.656

[a] American Standard twist drill sizes.

hole of a size that will make it possible for the tap to cut an acceptable pipe thread with the required thread height.

It should be understood that this table of twist drill diameters is intended to help only the occasional user of drills in the application of this standard. When internal pipe threads are produced in larger quantities in a particular type of material and with specially designed machinery it may be found to be more advantageous to use a drill size not given in the table, even one having a nonstandard diameter.

3. SUGGESTED TWIST DRILL DIAMETERS FOR DRILLED HOLE SIZES FOR DRYSEAL PIPE THREADS OF SECTION VIII

The drill diameters given in table 7.3 are for taper and straight internal pipe threads and will usually permit the tapping of acceptable threads in free-machining brass or steel provided the drill is correctly sharpened. When hard metals or other similar materials are to be drilled and tapped, it may be necessary to use a drill of slightly smaller diameter whereas soft materials may require a larger size.

Table 7.3.—*Suggested twist drill diameters for drilled hole sizes for Dryseal pipe threads*

Nominal pipe size	Taper thread				Straight thread	
	With use of reamer		Without use of reamer			
1	2		3		4	
in.	*in.*	*in.*	*in.*	*in.*	*in.*	*in.*
1/16		[a] 0.234		[a] 0.246	1/4	[a] 0.250
1/8	21/64	[a] .328		[a] .339	11/32	[a] .344
1/4	27/64	[a] .422	7/16	[a] .438		.444
3/8	9/16	[a] .562	37/64	[a] .578	37/64	[a] .578
1/2	11/16	[a] .688	45/64	[a] .703	23/32	[a] .719
3/4	57/64	[a] .891	59/64	[a] .922		.955
1	1 1/8	[a] 1.125	1 5/32	[a] 1.156	1 5/32	[a] 1.156
1 1/4	1 15/32	1.469	1 1/2	1.500		
1 1/2	1 45/64	1.703	1 47/64	1.734		
2	2 3/16	2.188	2 7/32	2.219		
2 1/2	2 19/32	2.594	2 41/64	2.641		
3	3 7/32	3.219	3 17/64	3.266		

[a] American Standard twist drill sizes.

Taper pipe threads of improved quality are obtained when the holes are taper reamed after drilling and before tapping. Standard taper pipe reamers are used and, as in drilling, the actual size of the hole depends upon the material and is best determined by trial.

4. THREADING OF PIPE FOR AMERICAN STANDARD THREADED STEEL FLANGES

The length of the effective external taper thread of the American Standard pipe thread provides a sufficient number of threads on the pipe to insure a satisfactory joint with the ordinary weight of fitting or flange. The

Table 7.4.—*Projection of threaded end through ring gage, standard threaded steel flanges*

Nominal pipe size	150, 300 lb.	400 lb.	600 lb.		900 lb.		1,500 lb.		2,500 lb.	
	Number of turns	Number of turns	Number of turns	Inches	Number of turns	Inches	Number of turns	Inches	Number of turns	Inches
1	2	3	4	5	6	7	8	9	10	11
1/2	([a])		([a])	([a])			3 1/2	0.250	7	0.500
3/4	([a])		([a])	([a])			5	.357	7	.500
1	([a])		([a])	([a])			5	.435	7 1/2	.650
1 1/4	([a])		([a])	([a])			5	.435	7 1/2	.650
1 1/2	([a])		([a])	([a])			5	.435	7 1/2	.650
2	([a])		([a])	([a])			5	.435	7 1/2	.650
2 1/2	([a])		([a])	([a])			5	.625	8	1.000
3	([a])		1	0.125	3	0.375	6	.750	10	1.250
3 1/2	([a])		1	.125						
4	([a])	([a])	1 1/2	.187	3 1/2	.437	6 1/2	.812	10 1/2	1.312
5	([a])	([a])	1 1/2	.187	3 1/2	.437	6 1/2	.812	10 1/2	1.312
6	([a])	([a])	1 1/2	.187	3 1/2	.437	7 1/2	.937	11 1/2	1.437
8	([a])	([a])	2	.250	4	.500	8	1.000	14	1.750
10	([a])	([a])	3	.375	5	.625	9	1.125	16	2.000
12	([a])	([a])	3	.375	5	.625	10	1.250	19	2.375
14 OD	([a])	([a])	3	.375	6	.750				
16 OD	([a])	([a])	3	.375	6	.750				
18 OD	([a])	([a])	3	.375	6	.750				
20 OD	([a])	([a])	3	.375	6	.750				
24 OD	([a])	([a])	3	.375	6	.750				

[a] Regular American Standard pipe thread is used for this size.

American Standard Steel Flanges for high pressure-temperature service (ASA B16.5) calls for thread lengths in the flanges in proportion to the thickness of the flange. This means that the thread lengths in the flanges intended for higher pressures in a given size are longer than the thread lengths in the flanges intended for the lower pressures.

Table 7.4 provides for a length of effective thread on pipe for sizes and weights of flanges where the regular American Standard length of effective thread is too short to bring the end of the pipe reasonably close to the face of the flange when both parts are assembled by power. As the threads in all flanges as well as on the pipe are gaged with a tolerance of one thread large and one thread small there will naturally be some difference in distance between the end of the pipe and face of the flange in the various assemblies for the different sizes and weights of flanges.

In table 7.4 the additional number of threads are added to the small end of the standard pipe thread. The pitch diameter at the end of the external thread is, therefore, smaller than that of the regular standard pipe. In other words, the small end of the ring gage will pass over the end of the pipe the number of turns or the length in inches equal to the values given in table 7.4.

5. INTERNAL STRAIGHT PIPE THREADS IN FINISHED DRUMS AND EXTERNAL THREADS ON PLUGS

The screw threads which have been used for some years to hold the bung plugs in steel barrels or drums are another application of straight pipe threads.[12]

The flanges of the bung and vent are tapped respectively with 2 in. and ¾ in. American Standard form straight pipe thread having dimensions in accordance with table 7.5.

TABLE 7.5.—*Drum plug and flange thread limits of size and tolerances*

Item	Size	Threads per inch	Major diameter		
			Maximum	Tolerance	Minimum
	in.		*in.*	*in.*	*in.*
Flange	¾	14	----------	----------	1.0324
Plug	¾	14	1.0274	0.0200	1.0074
Flange	2	11½	----------	----------	2.3495
Plug	2	11½	2.3395	.0200	2.3195

Item	Pitch diameter			Minor diameter		
	Maximum	Tolerance	Minimum	Maximum	Tolerance	Minimum
	in.	*in.*	*in.*	*in.*	*in.*	*in.*
Flange	1.0045	.0185	.9860	0.9648	0.0200	0.9448
Plug	.9810	.0180	.9630	.9398	----------	----------
Flange	2.3150	.0220	2.2930	2.2628	.0200	2.2428
Plug	2.2830	.0220	2.2610	2.2328	----------	----------

[12] Some types of explosives and other dangerous materials are transported in containers having a special form of flange and plug. The dimensions of the straight screw threads of these parts are established by the Interstate Commerce Commission. The thread form is that developed by the Manufacturing Chemists Association of the United States. Its principal dimensions are:

Form of Thread: Angle, 60°; depth of thread, 0.0933 in.; and radius of crest and root, 0.0075 in.

Internal Screw Thread in Flange: threads per inch, 8; pitch diameter, 2.2067 in.; maximum major diameter, 2.305; minimum major diameter, 2.295 in.; maximum minor diameter, 2.1184 in.; and minimum minor diameter, 2.1084 in.; length of thread, 1$\frac{1}{16}$ in.

External Screw Thread on Plug: Pitch diameter, 2.1887 in.; maximum major diameter, 2.287 in.; minimum major diameter, 2.277 in.; maximum minor diameter, 2.1004 in.; minimum minor diameter, 2.0904 in.; length of thread, 1$\frac{1}{16}$ plus ⅛ in. recess.

Large tolerances in addition to the allowance have been provided to ensure easy seating of the plug in the flange when making up the joint with a proper gasket.

6. TAPER AND STRAIGHT THREADS FOR RIGID STEEL ELECTRICAL CONDUIT AND FITTINGS

1. GENERAL.—Tables 7.6 and 7.7 give the principal thread data used in the production of rigid steel electrical conduit and fittings. These data were taken from the publications of the conduit manufacturers, the Underwriters Laboratories, and the National Electrical Manufacturers Association. In certain places slight adjustments have been made to bring the dimensions in line with the long established pipe thread practice. In every case these adjustments have been discussed with the interested group. The sole purpose of the printing of these data is to show their relation to the original standard and to make them generally available.

2. TAPER THREADS FOR CONDUIT.—The taper threads on rigid steel conduit shown in table 7.6 are generally made in accordance with table VII.2. Table 7.6 records the dimensions commonly referred to for the conduit thread. When screw threads are cut by hand on rigid-steel conduit at the job, regular pipe fitter's stocks and dies (pipe threading tools) are used.

3. STRAIGHT EXTERNAL RUNNING THREADS.—The straight external running threads for conduit as used for fixture stems and conduit fittings are made in accordance with the dimensions given in table 7.7, columns 3 and 4.

4. STRAIGHT INTERNAL THREADS.—The straight internal threads used in conduit fittings are shown in table 7.7. These threads are made with the American Standard pipe thread form.

7. PITCH DIAMETERS OF TAPER PIPE THREADS SHOWN IN THEIR RELATION TO E_1

Pitch diameters of taper pipe threads are shown in their relation to E_1, basic pitch diameter, in table 7.8.

8. SPECIAL SHORT, PTF-SPL SHORT; SPECIAL EXTRA SHORT, PTF-SPL EXTRA SHORT; FINE THREAD, F-PTF; AND SPECIAL DIAMETER-PITCH COMBINATION, SPL-PTF, DRYSEAL PIPE THREADS

1. GENERAL.—Included in this portion of the appendix are data on the following threads:

DRYSEAL SPECIAL SHORT TAPER PIPE THREAD, PTF-SPL SHORT. (Par. 2)
DRYSEAL SPECIAL EXTRA SHORT TAPER PIPE THREAD, PTF-SPL EXTRA SHORT (Par. 3)
DRYSEAL FINE THREAD SERIES, F-PTF (Par. 6)
DRYSEAL SPECIAL DIAMETER-PITCH COMBINATION SERIES, 27 threads per inch, SPL-PTF (Par. 7)

The SAE Dryseal pipe thread series are based on thread length. Full thread lengths and clearances for Dryseal standard and SAE SHORT series are shown in tables VIII.4, VIII.5, and VIII.6. These full thread lengths and clearances should be used in design applications wherever possible.

Design limitations, economy of material, permanent installation, or other limiting conditions may not permit the use of either of the full thread lengths and shoulder lengths in the preceding tables for the above thread series. To meet these conditions two special thread series have been established as shown in figure 7.2. The deviations from standard practice are described below.

2. DRYSEAL SPECIAL SHORT TAPER PIPE THREAD, PTF-SPL SHORT.—Threads of this series conform in all respects to the PTF-SAE SHORT threads except that the full thread length has been further shortened by eliminating one thread at the large end of external threads or eliminating one thread at the small end of internal threads.

TABLE 7.6.—*Dimensions of taper external and internal threads for rigid steel electrical conduit and conduit fittings (taper: ¾ inch per foot on the diameter)*

Nominal or trade size of conduit	Threads per inch	External threads			Internal threads	
		Pitch diameter at beginning of external thread, E_0	Length of thread		Gaged with American Standard taper pipe thread (NPT) plug gage (See table VII. 9)	
			Effective, L_2	Over-all, L_4	Min turns	Max turns
1	2	3	4	5	6	7
in.		*in.*	*in.*	*in.*		
⅛	27	0.3635	0.26	0.39	5½	8½
¼	18	.4774	.40	.59	5½	8½
⅜	18	.6120	.41	.60	6	9
½	14	.7584	.53	.78	6	9
¾	14	.9677	.55	.79	6	9
1	11½	1.2136	.68	.98	6	9
1¼	11½	1.5571	.71	1.01	6	10
1½	11½	1.7961	.72	1.03	6	10
2	11½	2.2690	.76	1.06	6	10
2½	8	2.7195	1.14	1.57	6	10
3	8	3.3406	1.20	1.63	6	10
3½	8	3.8375	1.25	1.68	7	11
4	8	4.3344	1.30	1.73	7	11
5	8	5.3907	1.41	1.84	7	11
6	8	6.4461	1.51	1.95	7	11

NOTES.—Tolerance on pitch diameter of taper thread and over-all thread length, L_4: The maximum allowable variation in the commercial product is one turn large and one turn small from the gaging notch on plug and gaging face of ring when using working gages. This is equivalent to a maximum allowable variation of the product of one and one-half turns large or small from the basic dimensions. The extra half turn is due to the permissible allowance of one-half turn large or small on working gages.

The dimensions shown in columns 3, 4, and 5 agree with those shown in columns 5, 9, and 17 of table VII.2, p. 5.

TABLE 7.7.—*Dimensions of straight external and internal threads for rigid steel electrical conduit, conduit bushings and other fittings, and locknuts*

Nominal or trade size of conduit	Threads per inch	External threads, pitch diameter		Internal threads, pitch diameter			
				Bushings and other fittings		Locknuts	
		Max	Min	Min	Max	Min	Max
1	2	3	4	5	6	7	8
in.		*in.*	*in.*	*in.*	*in.*	*in.*	*in.*
½	14	0.776	0.770	0.781	0.788	0.801	0.808
¾	14	.987	.981	.992	.999	1.011	1.018
1	11½	1.236	1.228	1.244	1.252	1.266	1.274
1¼	11½	1.581	1.573	1.588	1.596	1.611	1.619
1½	11½	1.820	1.812	1.827	1.835	1.850	1.858
2	11½	2.294	2.286	2.301	2.309	2.323	2.332
2½	8	2.758	2.748	2.769	2.781	2.801	2.813
3	8	3.385	3.375	3.396	3.408	3.428	3.439
3½	8	3.885	3.875	3.896	3.908	3.928	3.940
4	8	4.383	4.373	4.394	4.406	4.426	4.438
5	8	5.445	5.435	5.456	5.468	5.488	5.500
6	8	6.502	6.492	6.513	6.525	6.545	6.557

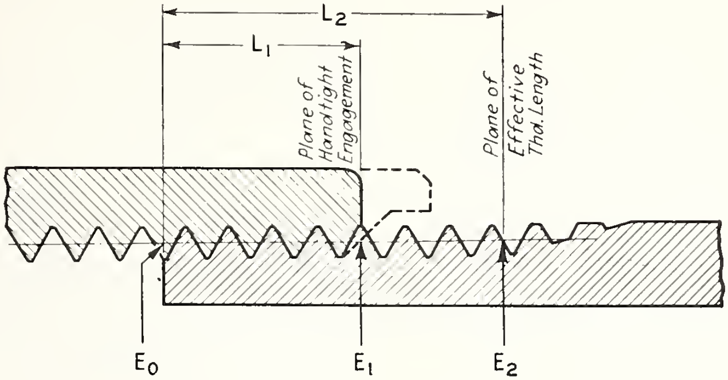
All dimensions are after plating.

The column 3 values are the column 8 values of table VII.2, p. 5, minus 0.0022 for the 14 tpi threads, minus 0.0026 for the 11½ tpi threads, and minus 0.0039 for the 8 tpi threads, rounded to three decimal places.

The column 5 values are the same as the column 8 values of table VII.2, p. 5, plus 0.003 for the 14 tpi threads, plus 0.005 for the 11½ tpi threads, and plus 0.007 for the 8 tpi threads, rounded to three decimal places.

The column 7 and 8 values are the column 7 and 8 values of table VII.7, p. 10, rounded to three decimal places.

TABLE 7.8.—*Pitch diameters of taper pipe threads shown in their relation to E_1*



Nominal pipe size	Length L_1 in turns	Pitch diameter at E_0	Number of turns—small: 7	6	5	4	3	2	1½	1	Basic pitch diameter, E_1
			Pitch diameter								
1	2	3	4	5	6	7	8	9	10	11	12
in.		*in.*	*in.*	*in.*	*in.*	*in.*	*in.*	*in.*	*in.*	*in.*	*in.*
1/16	4.32	0.27118	--------	--------	--------	0.27194	0.27425	0.27656	0.27772	0.27887	0.28118
1/8	4.36	.36351	--------	--------	--------	.36436	.36667	.36898	.37014	.37129	.37360
1/4	4.10	.47739	--------	--------	--------	--------	.48122	.48469	.48642	.48816	.49163
3/8	4.32	.61201	--------	--------	--------	.61313	.61660	.62007	.62180	.62354	.62701
1/2	4.48	.75843	--------	--------	--------	.76059	.76505	.76951	.77174	.77397	.77843
3/4	4.75	.96768	--------	--------	--------	.97103	.97549	.97995	.98218	.98441	.99887
1	4.60	1.21363	--------	--------	--------	1.21691	1.22234	1.22777	1.23049	1.23320	1.23863
1¼	4.83	1.55713	--------	--------	--------	1.56166	1.56709	1.57252	1.57524	1.57795	1.58338
1½	4.83	1.79609	--------	--------	--------	1.80062	1.80605	1.81148	1.81420	1.81691	1.82234
2	5.01	2.26902	--------	--------	2.26912	2.27455	2.27998	2.28541	2.28813	2.29084	2.29627
2½	5.45	2.71953	--------	--------	2.72311	2.73092	2.73873	2.74654	2.75045	2.75435	2.76216
3	6.12	3.34063	--------	3.34164	3.34945	3.35726	3.36507	3.37288	3.37679	3.38069	3.38850
3½	6.56	3.83750	--------	3.38195	3.84976	3.85757	3.86538	3.87319	3.87710	3.88100	3.88881
4	6.76	4.33438	--------	4.34027	4.34808	4.35589	4.36370	4.37151	4.37542	4.37932	4.38713
5	7.50	5.39073	5.39462	5.40243	5.41024	5.41805	5.42586	5.43367	5.43758	5.44148	5.44929
6	7.67	6.44609	6.45130	6.45911	6.46692	6.47473	6.48254	6.49035	6.49426	6.49816	6.50597

Basic pitch diameter, E_1	Number of turns—large: 1	1½	2	3	4	Pitch diameter at E_2	Length L_2-L_1 in turns	Increase in pitch diameter per turn	Pitch of thread	Nominal pipe size
	Pitch diameter									
13	14	15	16	17	18	19	20	21	22	23
in.	*in.*	*in.*	*in.*	*in.*	*in.*	*in.*		*in.*	*in.*	*in.*
0.28118	0.28349	0.28464	0.28580	--------	--------	0.28750	2.73	0.00231	0.03704	1/16
0.37360	.37591	.37707	.37822	--------	--------	.38000	2.76	.00231	.03704	1/8
0.49163	.49510	.49684	.49857	0.50204	--------	.50250	3.13	.00347	.05556	1/4
0.62701	.63048	.63222	.63395	.63742	--------	.63750	3.02	.00347	.05556	3/8
0.77843	.78289	.78512	.78735	--------	--------	.79179	2.99	.00446	.07143	1/2
0.99887	.99333	.99556	.99779	--------	--------	1.00179	2.89	.00446	.07143	3/4
1.23863	1.24406	1.24678	1.24949	1.25492	--------	1.25630	3.25	.00543	.08696	1
1.58338	1.58881	1.59153	1.59424	1.59967	--------	1.60130	3.30	.00543	.08696	1¼
1.82234	1.82777	1.83049	1.83320	1.83863	--------	1.84130	3.49	.00543	.08696	1½
2.29627	2.30170	2.30442	2.30713	2.31256	--------	2.31630	3.69	.00543	.08696	2
2.76216	2.76997	2.77388	2.77778	2.78559	--------	2.79062	3.64	.00781	.12500	2½
3.38850	3.39631	3.40022	3.40412	3.41193	--------	3.41562	3.47	.00781	.12500	3
3.88881	3.89662	3.90053	3.90443	3.91224	--------	3.91562	3.43	.00781	.12500	3½
4.38713	4.39494	4.39885	4.40275	4.41056	--------	4.41562	3.64	.00781	.12500	4
5.44929	5.45710	5.46101	5.46491	5.47272	--------	5.47862	3.76	.00781	.12500	5
6.50597	6.51378	6.51769	6.52159	6.52940	6.53721	6.54062	4.44	.00781	.12500	6

Gaging is the same as for PTF–SAE SHORT except the L_2 ring thread gage for external thread length and taper or the L_3 plug thread gage for internal thread length and taper cannot be used. The tolerance must be altered as described in paragraph 4 below on Limitations of Assembly. For interchangeability, see table 7.9. This thread shall be designated as follows:

⅛—27 DRYSEAL PTF–SPL SHORT.

3. Dryseal Special Extra Short Taper Pipe Thread, PTF–SPL EXTRA SHORT.—Threads of this series conform in all respects to the PTF–SAE SHORT threads except that the full thread length has been further shortened by eliminating two threads at the large end of external threads or eliminating two threads at the small end of internal threads. Gaging is the same as for PTF–SAE SHORT except the L_2 ring thread gage for external thread length and taper or the L_3 plug thread gage for internal thread length and taper cannot be used. The tolerance must be altered as described in paragraph 4 below on Limitations of Assembly. For interchangeability, see table 7.9. This thread shall be designated as follows:

⅛—27 DRYSEAL PTF–SPL EXTRA SHORT.

4. Limitations of Assembly for Dryseal PTF–SPL SHORT and PTF–SPL EXTRA SHORT Threads.—Combinations of the standard Dryseal pipe threads are given in table VIII.3, page 21. However, where special combinations are used, additional considerations must be observed. In addition to "SPL" in the designation, the gaging tolerance should be specified.

5. Interchangeability Between Dryseal Special and Dryseal Standard Threads.—Interchangeability between Dryseal special and Dryseal standard threads of section VIII, is given in table 7.9.

6. Dryseal Fine Thread Series, F–PTF.—The need for finer pitches for nominal pipe sizes has brought into use applications of 27 threads per inch to ¼ and ⅜ in. pipe sizes. There may be other needs which require finer pitches for larger pipe sizes. It is recommended that the existing threads per inch be applied to next size larger pipe size for a fine thread series such as are shown in table 7.10. This series applies to external and internal threads of full length and is suitable for applications where threads finer than NPTF are required. The designation for this thread should include the letter F and omit the letter N as follows:

¼–27 DRYSEAL F–PTF

7. Dryseal Special Diameter-Pitch Combination Series, SPL–PTF.—Other applications of diameter-pitch combinations have also come into use where taper pipe threads are applied to nominal size thin wall tubing such as are shown in table 7.11. This series applies to external and internal threads of full length and is applicable to thin wall nominal outside diameter tubing. The number of threads is uniform at 27 per inch. The designation for this special series should include the abbreviation SPL for special and omit the letter N. Also, the outside diameter of the tubing should be given as follows:

½–27 DRYSEAL SPL–PTF, O.D. 0.500

8. Formulas for Diameter and Length of Thread.—Basic diameter and length of thread for sizes of Dryseal fine taper pipe thread, F–PTF, and Dryseal special taper pipe thread, SPL–PTF, given in tables 7.10 and 7.11 are based on the following formulas:

D=outside diameter of pipe or tubing in inches
p=pitch of thread in inches
Diametral taper=0.75 in. per 12.00 in. of length

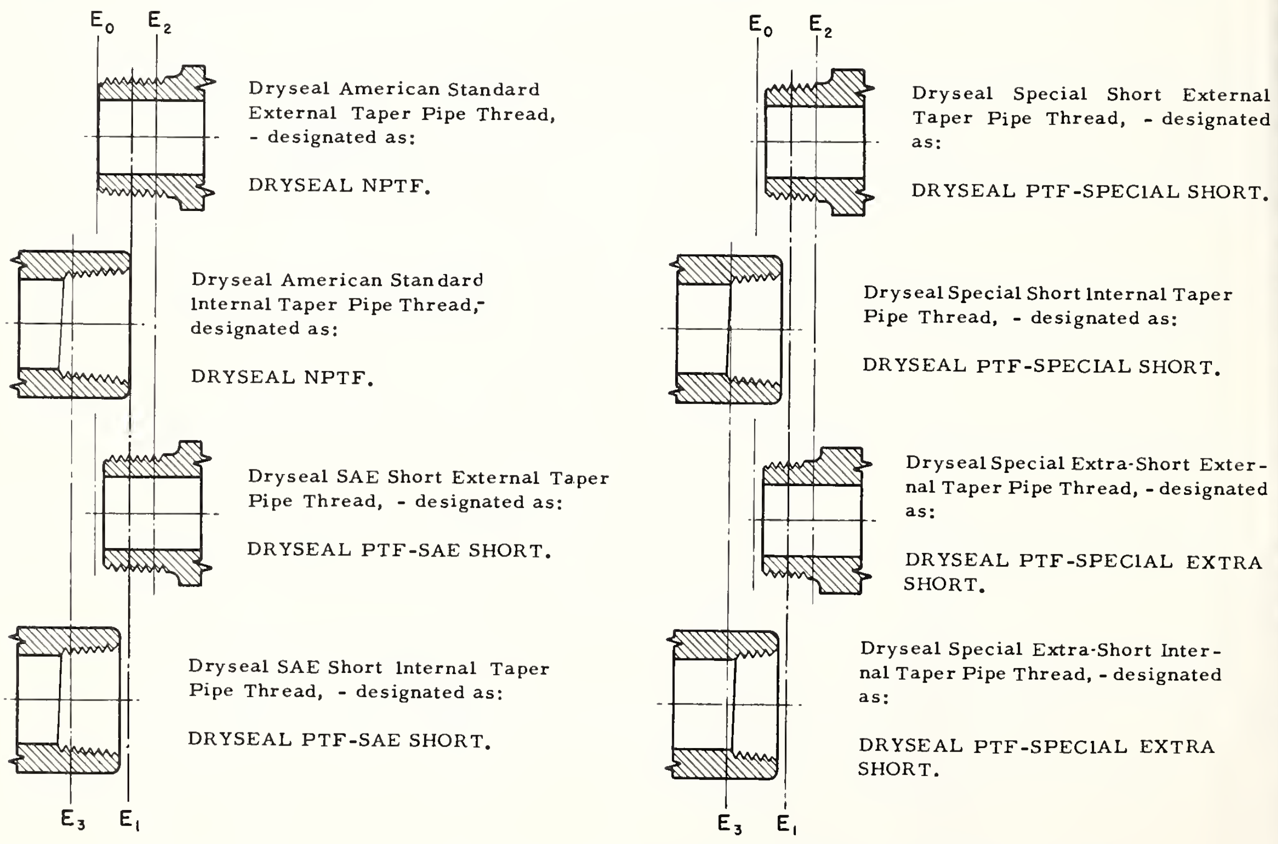


Figure 7.2.—*Comparison of special length Dryseal threads with standard length Dryseal threads.*

Table 7.9.—*Interchangeability between Dryseal special and Dryseal standard threads*

PTF-SPL SHORT, external. PTF-SPL EXTRA SHORT, external.	May [a] assemble with—	PTF-SAE SHORT, internal. NPSF, internal. PTF-SPL SHORT, internal. PTF-SPL EXTRA SHORT, internal.
PTF-SPL SHORT, internal. PTF-SPL EXTRA SHORT, internal.	May [a] assemble with—	PTF-SAE SHORT, external.
PTF-SPL SHORT, external. PTF-SPL EXTRA SHORT, external.	May [b] assemble with—	NPTF, internal. NPSI, internal.
PTF-SPL SHORT, internal. PTF-SPL EXTRA SHORT, internal.	May [b] assemble with—	NPTF, external.

[a] Only when the external thread or the internal thread or both are held closer than the standard tolerance, the external toward the minimum and the internal toward the maximum pitch diameter to provide a minimum of one turn hand engagement. At extreme tolerance limits the shortened full thread lengths reduce hand engagement and the threads may not start.

[b] Only when both the internal thread and the external thread are held closer than the standard tolerance, the internal toward the minimum and the external toward the maximum pitch diameter to provide a minimum of two turns for wrench makeup and sealing. At extreme tolerance limits the shortened full thread lengths reduce wrench makeup and the threads may not seal.

Basic pitch diameter at small end of external thread:

$$E_0 = D - (0.05D + 1.1)p.$$

Basic pitch diameter at large end of internal thread:

$$E_1 = E_0 + 0.0625L_1 = D - 0.8625p.$$

Basic pitch diameter at large end of external thread:

$$E_2 = E_0 + 0.0625L_2 = D - 0.675p.$$

Basic pitch diameter at small end of internal thread:

$$E_3 = E_0 - 0.0625L_3 = D - (0.05D + 1.2875)p.$$

Basic length of thread for hand engagement:

$$L_1 = (0.8D + 3.8)p.$$

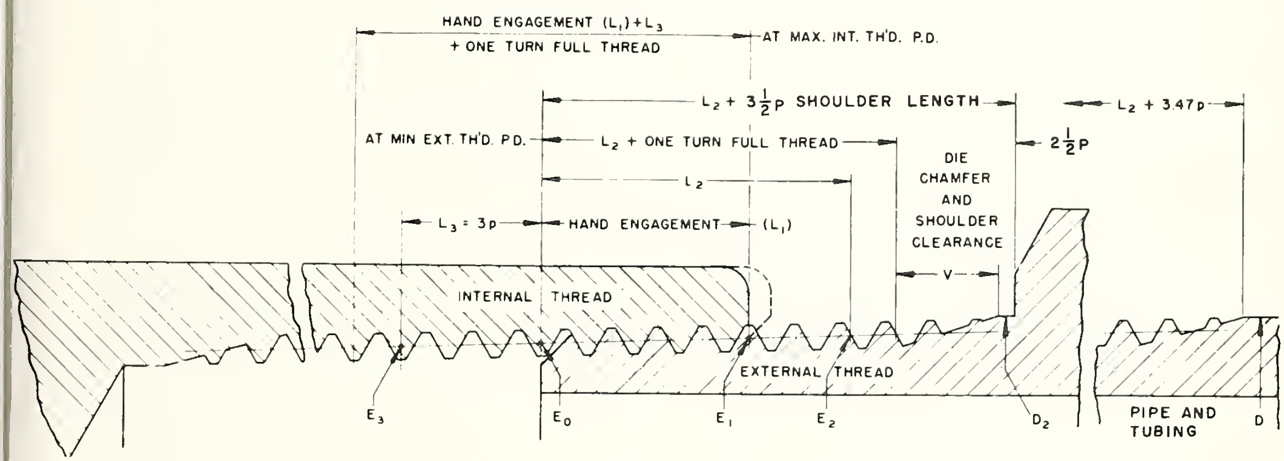
Basic length of full and effective thread:

$$L_2 = (0.8D + 6.8)p.$$

Basic length of internal thread from end of hand engagement, E_0, to small end of internal thread, E_3:

$$L_3 = 3p.$$

Table 7.10.—*Basic dimensions of Dryseal fine taper pipe thread, F-PTF*



Size	Pitch, p	Pitch diameter at small end of external thread, E_0	Pitch diameter at large end of internal thread, E_1	Pitch diameter at large end of external thread, E_2	Pitch diameter at small end of internal thread, E_3	Hand engagement, L_1		Internal basic [a], [b] full thread length, (L_1+L_3), and external basic full thread length, L_2		Vanish thds, V, plus full thd. tol. plus shoulder clearance, $(V+3/2p)$		Shoulder length, $(L_2+3\frac{1}{2}p)$	Thread for draw		Outside diameter of fitting, D_2	Outside diameter of pipe, D
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
	in.	*in.*	*in.*	*in.*	*in.*	*in.*	*thds*	*in.*	*thds*	*in.*	*thds*	*in.*	*in.*	*thds*	*in.*	*in.*
¼—27	0.03704	0.49826	0.50807	0.51501	0.49132	0.157	4.23	0.268	7.23	0.1296	3.5	0.3975	0.1111	3.0	0.546	0.540
⅜—27	.03704	.63301	.64307	.65001	.62607	.161	4.34	.272	7.34	.1296	3.5	.4015	.1111	3.0	.681	.675
½—18	.05556	.77655	.79205	.80249	.76613	.248	4.47	.415	7.47	.1944	3.5	.6096	.1667	3.0	.850	.840
¾—18	.05556	.98597	1.00210	1.01247	.97555	.258	4.64	.424	7.64	.1944	3.5	.6189	.1667	3.0	1.060	1.050
1—14	.07143	1.23173	1.25342	1.26679	1.21834	.347	4.85	.561	7.85	.2500	3.5	.8109	.2143	3.0	1.327	1.315
1¼—14	.07143	1.57550	1.59837	1.61181	1.56211	.366	5.13	.581	8.13	.2500	3.5	.8306	.2143	3.0	1.672	1.660
1½—14	.07143	1.81464	1.83839	1.85176	1.80125	.380	5.32	.594	8.32	.2500	3.5	.8443	.2143	3.0	1.912	1.900
2—14	.07143	2.28794	2.31338	2.32675	2.27455	.407	5.70	.621	8.70	.2500	3.5	.8714	.2143	3.0	2.387	2.375

[a] Tabulated external basic full thread lengths include chamfers not exceeding one pitch (thread) length. Design size full thread length should equal the external basic full thread length plus one pitch.

[b] Tabulated internal basic full thread lengths do not include countersink beyond the intersection of the pitch line and the chamfer cone (gaging reference point). Design size full thread length should equal the internal basic full thread length plus one pitch.

Tolerance shall be equal to plus or minus the taper of one thread on the diameter.

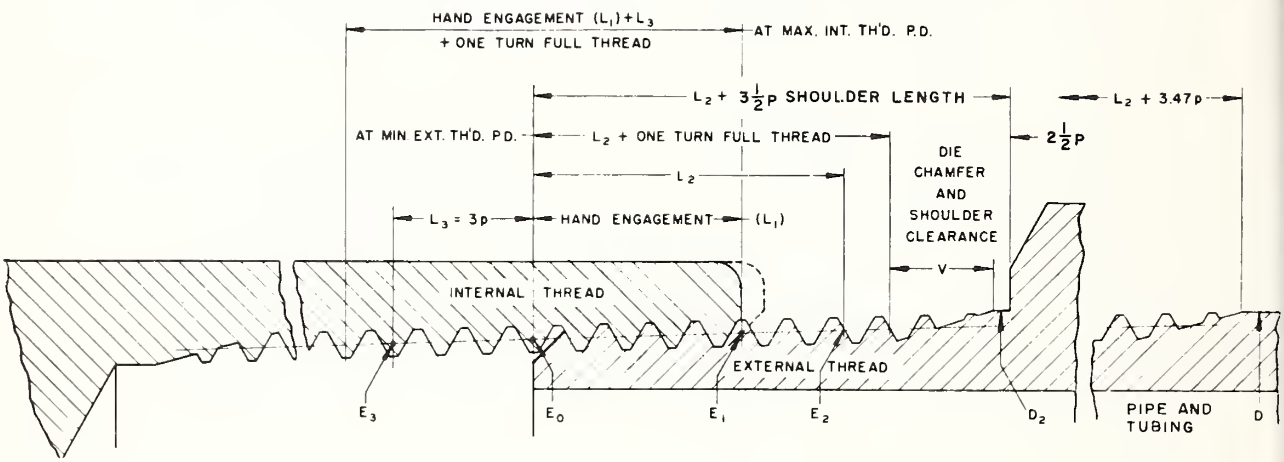
9. DRYSEAL DIMENSIONS DERIVED FROM SUPERSEDED DIMENSIONS OF L_1 EQUALS 0.1800 IN. FOR THE 1/8—27 SIZE AND 0.2000 IN. FOR THE 1/4—18 SIZE

Table 7.12 lists the dimensions derived from the superseded dimensions of L_1 handtight engagement of 0.1800 in. for the 1/8—27 size and 0.2000 in. for the 1/4—18 size. These changes are pertinent to tables VIII.15, VIII.16, and VIII.17.[13]

The L_1 dimensions for these two sizes were revised in this standard to correct for a disproportionate number of threads for handtight engagement.

[13] Tables VIII.15 through VIII.26 relating to gages for Dryseal threads are based on standards of the Automotive Industry. Only the automotive standards of this series, on which tables VIII.15, VIII.16, and VIII.17 are based, had dimensions derived from an L_1 of 0.1800 for the 1/8—27 size and 0.2000 for the 1/4—18 size.

Table 7.11.—*Basic dimensions of Dryseal special taper pipe thread, SPL–PTF (for thin wall nominal size OD tubing)*



Tubing [a] diameter, D	Threads per inch	Pitch, p	Pitch diameter at small end of external thd, E_0	Pitch diameter at large end of internal thd, E_1	Pitch diameter at large end of external thd, E_2	Pitch diameter at small end of internal thd, E_3	Hand engagement, L_1		Internal basic [b, c] full thread length, (L_1+L_3), and external basic full thread length, L_2		Thread for draw	
1	2	3	4	5	6	7	8	9	10	11	12	13
in.		*in.*	*in.*	*in.*	*in.*	*in.*	*in.*	*thds*	*in.*	*thds*	*in.*	*thds*
1/2	27	0.03704	0.45833	0.46806	0.47500	0.45139	0.1556	4.2	0.2667	7.2	0.1111	3.0
5/8	27	.03704	.58310	.59306	.60000	.57616	.1593	4.3	.2704	7.3	.1111	3.0
3/4	27	.03704	.70787	.71806	.72500	.70093	.1630	4.4	.2741	7.4	.1111	3.0
7/8	27	.03704	.83264	.84306	.85000	.82570	.1667	4.5	.2778	7.5	.1111	3.0
1	27	.03704	.95740	.96805	.97500	.95046	.1704	4.6	.2815	7.6	.1111	3.0

Note—Dimensions of other combinations of diameter and pitch, in addition to those listed above, may be developed by use of the formulas.

[a] This denotes nominal outside diameter of tubing and should not be confused with nominal pipe diameter and thread designations.

[b] Tabulated external basic full thread lengths include chamfers not exceeding one pitch (thread) length. Design size full thread length should equal the external basic full thread length plus one pitch.

[c] Tabulated internal basic full thread lengths do not include countersink beyond the intersection of the pitch line and the chamfer cone (gaging reference point). Design size full thread length should equal the internal basic full thread length plus one pitch.

TABLE 7.12.—*Dryseal dimensions derived from superseded dimensions of L_1 equals 0.1800 for the 1/8—27 size and 0.2000 for the 1/4—18 size*

Size	Pitch diameter at L_1-p, E_x	Minor diameter at L_1-p	L_1-p	Handtight engagement, L_1	Pitch diameter, E_1	Minor diameter at L_1	Major diameter at L_1	L_3+L_1
1	2	3	4	5	6	7	8	9
	in.	*in.*	*in.*	*in.*	*in.*	*in.*	*in.*	*in.*
1/8—27	0.37244	0.35518	0.14296	0.1800	0.37476	0.35750	0.39202	0.2911
1/4—18	.48642	.46053	.14444	.2000	.48989	.46400	.51578	.3667

APPENDIX 8. GEOMETRY OF TAPER SCREW THREADS

1. INTRODUCTION

This appendix presents several geometrical relationships relative to the conical spiral, which is the curve of generation of the taper screw thread, and also briefly discusses the conical helix. With reference to these curves, the formulas include the parametric equations, the projection, the development, the lead angle, and length of an arc.

The geometry of taper screw threads has, in practice, developed by modification of the geometry of straight screw threads, with the result that formulas commonly used for taper screw threads are often approximations instead of being exact. That such approximations have been satisfactory in practice arises from the fact that the angle of taper, or cone angle, of standard taper threads has been small. The more recent use of larger taper angles together with the higher precision of measurement of screw thread gages now demanded, sometimes requires the availability of exact, or more nearly exact, formulas to be substituted for the approximate formulas or used to determine the magnitude of errors introduced by the usual approximations.

It is convenient to approach the subject by considering the nature of the curves of generation of straight screw threads and of taper screw threads, respectively, namely the cylindrical helix and the conical spiral.

A cylindrical helix may be defined in various ways. First it is a curve on the surface of a circular cylinder which cuts the elements of the cylinder at a constant angle. The same curve may also be defined as the curve generated by a point moving at a uniform rate along a straight line while the line revolves uniformly about an axis parallel to itself, so that successive intersections of the curve and an element of the cylinder are equally spaced. These definitions establish the fact that the cylindrical helix is both loxodromic and isometric.

There is no corresponding curve on the surface of a cone which simultaneously answers to both methods of generation. Thus there are two different spiral-shaped curves lying on the surface of a cone which are analagous to the circular helix, one of which is loxodromic and the other isometric. Mathematicians have agreed [6] [13] that the loxodromic curve corresponds to the definition of a general helix, and that it should properly be termed a conical helix. The isometric curve has been called the conical spiral. Loria [6] gives a brief history of this curve, stating that it is found in a work by B. Pascal and citing several 18th century references, one of which points out that the curve was known to ancient Greek geometricians. Thus there are the following definitions:

A *conical spiral* is generated if a point travels on the surface of a right circular cone so as to combine a uniform angular motion around the axis of the cone with a uniform linear motion along a generator toward or from the vertex. It is characterized by uniformity of pitch, that is, successive intersections of the curve and an element of the cone are equally spaced, and by the fact that it passes through the vertex of the cone. The conical spiral occurs in such mechanical applications as the taper screw thread, the spiral bevel gear [11], and the conical spring [12].

A *conical helix* is generated if a point travels on the surface of a right circular cone in such a way that the curve produced intersects the elements of the cone at a constant angle. The pitch of this curve varies from point to point and it approaches the vertex of the cone as an asymptote. It is applied mechanically in the conical spring [1, 7, 9] as sometimes made. (For conical springs with coils of constant slope it is desirable that the projection of the neutral axis of the spring be an Archimedes' spiral. Such a spring is not truly conical but is wound on a paraboloid of revolution.) [10]

The cylindrical helix is the curve of intersection of a helicoid and a coaxial cylinder, and the conical spiral is the intersection of a helicoid and a coaxial cone. Accordingly, although the geometry of the conical spiral differs from that of the helix, there is but one geometry of helicoids. A screw helicoid, for example, remains a screw helicoid, whether the ends of its generatrix are determined by coaxial cylinders, as in straight screw threads, or by coaxial cones, as in taper screw threads. These different boundary conditions give rise, however, to certain different geometrical relations.

2. PARAMETRIC EQUATIONS OF THE CONICAL SPIRAL; THE PROJECTION, DEVELOPMENT, LEAD ANGLE, AND LENGTH OF AN ARC

The parametric equations of the conical spiral, with the vertex of the cone at the origin and the axis of the cone coinciding with the z-axis, as shown in figure 8.1, are:

$$\left.\begin{aligned} x&=\frac{L}{2\pi}\theta\tan\alpha\cos\theta\\ y&=\frac{L}{2\pi}\theta\tan\alpha\sin\theta\\ z&=\frac{L}{2\pi}\theta, \end{aligned}\right\}\qquad(1)$$

where

α=1/2 included angle between opposite elements of the cone,

θ=the variable parameter, and is the angle which the projection of the radius vector of the point on the conical spiral makes with the x-axis on the xy-plane,

L=lead of spiral, or advance, parallel to the axis, in one revolution.

The length, r, of the radius vector at any point on the conical spiral is given by the relation:

$$r=\frac{L}{2\pi}\theta\sec\alpha.\qquad(2)$$

[13] Numbers in brackets refer to similarly numbered items in the bibliography at the end of this appendix.

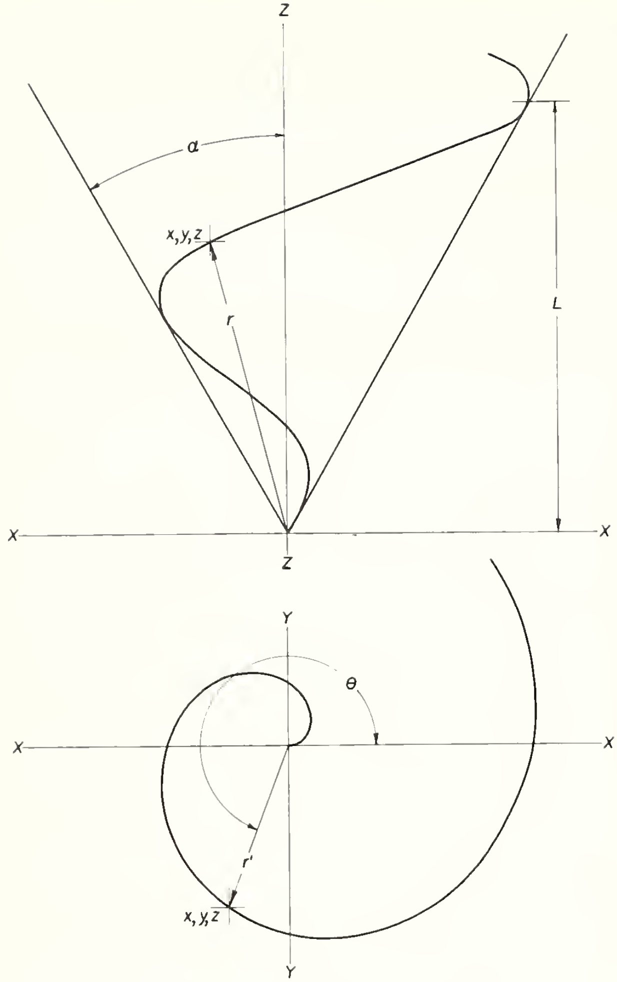


FIGURE 8.1.—*The conical spiral.*

The projection, r', of the radius vector, r, on the xy-plane is given by the relation:

$$r'=\frac{L}{2\pi}\,\theta\tan\alpha. \tag{3}$$

This is the equation of a spiral of Archimedes, which is the projection of the conical spiral on the xy-plane.

The developed cylindrical helix is a straight line, which makes an angle, s, with the line perpendicular to the axis, such that,

$$\tan s=\frac{L}{2\pi r}. \tag{4}$$

The developed conical spiral is an Archimedes' spiral, derived from the equations for the conical spiral and represented by the equation:

$$\rho=\frac{L\phi}{\pi}\,csc\;2\alpha \tag{5}$$

where

ρ = radius vector $= z \sec\alpha = \frac{L}{2\pi}\,\theta\sec\alpha$

ϕ = vectorial angle $=\theta\sin\alpha$.

The lead angle, s, defined as the angle made by the conical spiral at a given point with a plane perpendicular to the axis, is determined from the formula for the tangent line:

$$\tan s=\frac{\cot\alpha}{\sqrt{\theta^2+1}}. \tag{6}$$

This expression is of interest because the lead, L, is not directly involved. It shows that all isometric conical spirals at a given number of revolutions from the apex cut an element of the cone at the same angle, regardless of the pitch. Also, a conical spiral is tangent to an element of the cone at the apex.

The exact length, S_a, of the arc of a conical spiral subtended by the vectorial angle $(\theta_2-\theta_1)$, is given by the expression:

$$S_a=\frac{L}{4\pi}\,tan\;\alpha\left\{\theta_2\sqrt{\theta_2^2+csc^2\alpha}-\theta_1\sqrt{\theta_1^2+csc^2\alpha}\right.$$
$$\left.+csc^2\alpha\,\log\frac{\theta_2+\sqrt{\theta_2^2+csc^2\alpha}}{\theta_1+\sqrt{\theta_1^2+csc^2\alpha}}\right\}. \tag{7}$$

An approximation of the value of S_a, which is exact for the cylindrical helix and sufficiently close to the exact value for the conical spiral for most practical purposes, is given by the relation:

$$S_a=\sqrt{\pi^2(r'_1+r'_2)^2+L^2} \tag{8}$$

where r'_1 and r'_2 are the projections of the radii vectores corresponding to θ_1 and θ_2.

3. PARAMETRIC EQUATIONS OF THE CONICAL HELIX; THE PROJECTION, DEVELOPMENT, LEAD ANGLE, AND LENGTH OF AN ARC

The properties of the conical helix, which is defined above, have been discussed by Dieu [5], Resal [8], and others [1, 2, 6]. Some of the more important analytical relations are here presented.

Taking, as for the conical spiral, the vertex of the cone as the origin, and the axis of the cone as the z-axis, figure 8.2, the general parametric equations, and the equation of the radius vector, of the conical helix, are:

$$\left.\begin{aligned} x&=c\,e^{a\theta}\cos\theta\\ y&=c\,e^{a\theta}\sin\theta\\ z&=b\,e^{a\theta}\end{aligned}\right\} \tag{9}$$

$$r=\sqrt{b^2+c^2}\,e^{a\theta} \tag{10}$$

where a, b, and c are constants, e is the natural logarithmic base, 2.71828, θ is the variable parameter, and r is the radius vector.

This curve, unlike the conical spiral, approaches the origin as an asymptotic point, the successive turns about the cone being closer together toward the vertex.

To simplify the mathematics involved in dealing with this curve, it is convenient so to locate the curve with respect to the origin that $\theta=0$ when $y=0$ and $r=1$. Under these conditions,

$$b=\cos\alpha$$

$$c=\sin\alpha$$

where

$\alpha=\frac{1}{2}$ included angle between opposite elements of cone.

Also

$a=\sin\alpha\cot\beta$, where $\beta<90°$,

= the constant angle with which the curve intersects the elements of the cone.

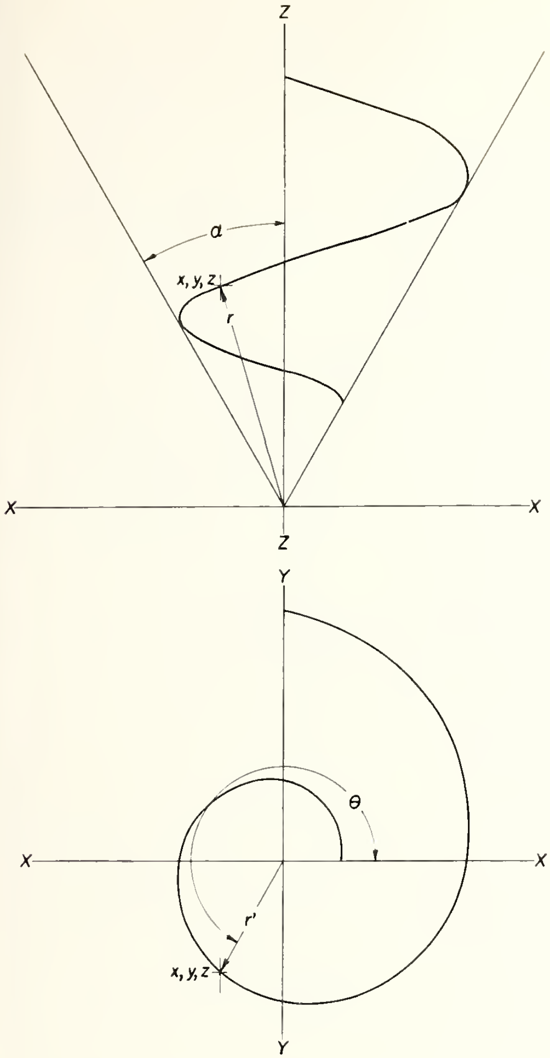


FIGURE 8.2.—*The conical helix.*

Thus

$$\left.\begin{aligned} x&=\sin\alpha\cos\theta\, e^{\theta\sin\alpha\cot\beta}\\ y&=\sin\alpha\sin\theta\, e^{\theta\sin\alpha\cot\beta}\\ z&=\cos\alpha\, e^{\theta\sin\alpha\cot\beta}\end{aligned}\right\} \tag{11}$$

$$r=e^{\theta\sin\alpha\cot\beta} \tag{12}$$

when

$r>1$, θ is plus, and when $r<1$, θ is minus.

The expression for r, equation (12), completely represents the curve in polar coordinates, a third coordinate being unnecessary because the radius vector makes a constant angle α with the z axis.

If, instead of β, the angle γ which the curve makes with the xy-plane is given, $\cot\beta=\sec\alpha\tan\gamma$, and the above exponent $\theta\sin\alpha\cot\beta$ is replaced by $\theta\tan\alpha\tan\gamma$.

The lead angle $s(=\gamma)$, is accordingly given by

$$\tan s=\cos\alpha\cot\beta$$
$$=a\cot\alpha$$

The projection r' of the radius vector, r, on the xy-plane is given by

$$r'=\sin\alpha\, e^{\theta\sin\alpha\cot\beta}. \tag{13}$$

This is a logarithmic spiral, and the equation represents the projection of the conical helix on the xy-plane.

The developed conical helix is a logarithmic spiral, derived from the parametric equations of the curve, which is represented by

$$\rho=e^{\phi\cot\beta} \tag{14}$$

where

$$\rho=\text{radius vector}=z\sec\alpha$$
$$=\cos\alpha\, e^{\theta\sin\alpha\cot\beta}\sec\alpha$$
$$\phi=\text{vectorial angle}=\theta\sin\alpha.$$

The length, S_a, of the arc of a conical helix subtended by the vectorial angle, $\theta_2-\theta_1$, is:

$$S_a=\sin\alpha\csc\beta\, e^{\theta\sin\alpha\cot\beta}(\theta_2-\theta_1) \tag{15}$$

4. GEOMETRICAL PROPERTIES OF TAPER SCREW THREADS

Taper screw threads are generally produced commercially with the bisector of the thread angle perpendicular to the axis of the thread. The pitch, p, is the distance, measured parallel to the axis of the thread, between any two corresponding points in an axial plane on parallel sides of adjacent threads. If p_c is the length of the line joining the two points, then,

$$p=p_c\cos y \tag{16}$$

where

$$y=\text{half-angle of taper.}$$

The same is true of any taper thread, the sides of which are unsymmetrical with respect to a line which is perpendicular to the axis and passes through a vertex of the thread.

The lead or pitch of the generatrix of the helicoid forming the side of a taper thread differs from the lead or pitch of the thread [3, 4]. The lead of the generatrix of the following side of the thread is (see fig. 8.3):

$$L_f=(p+n)=L(1+\tan\alpha_1\tan y). \tag{17}$$

The lead of the generatrix of the leading side of the thread is:

$$L_r=(p-m)=L(1-\tan\alpha_2\tan y) \tag{18}$$

where

L = lead of thread

α_1 = angle between line perpendicular to axis of thread and the following side of thread

α_2 = angle between line perpendicular to axis of thread and the leading side of thread.

For a symmetrical thread, $\alpha_1=\alpha_2=\alpha$, and

$$L_f=L(1+\tan y\tan\alpha) \tag{19}$$

$$L_r=L(1-\tan y\tan\alpha). \tag{20}$$

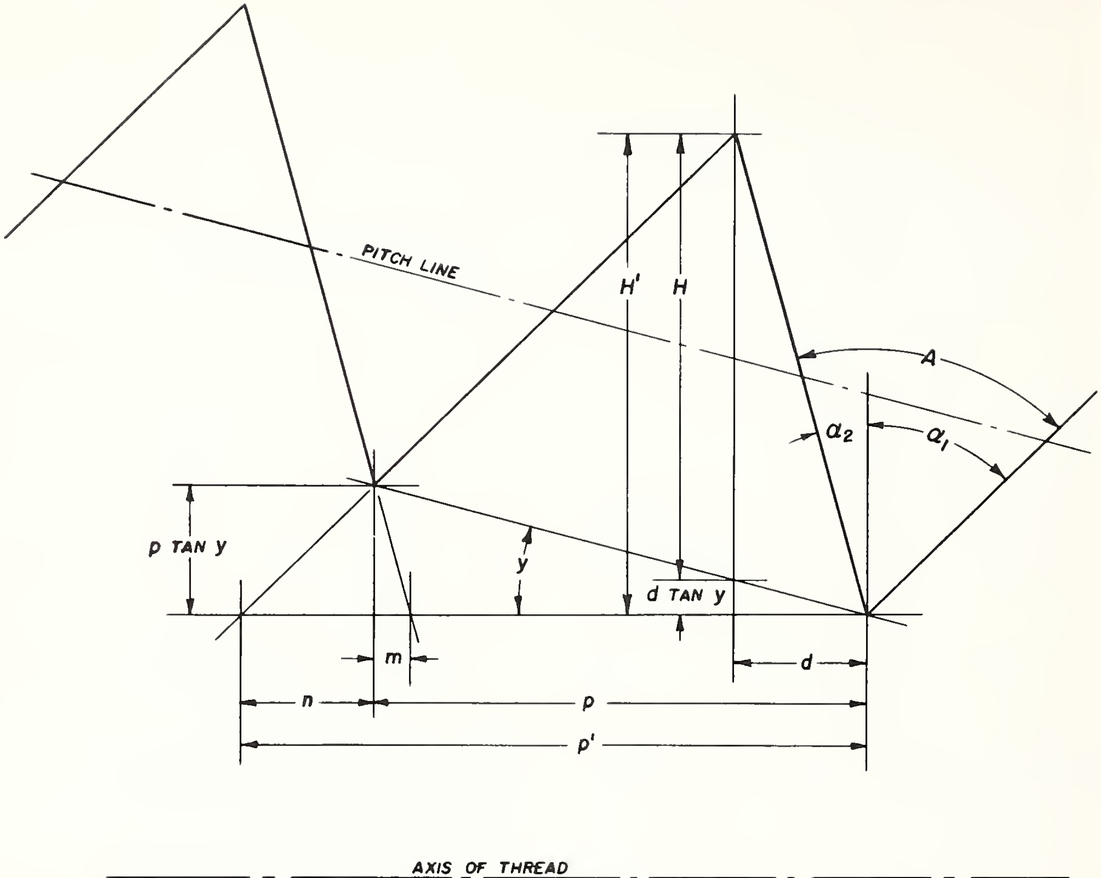


FIGURE 8.3.—*Geometry of unsymmetrical taper screw thread.*

The depth, H, of an unsymmetrical sharp-V taper thread is the distance, perpendicular to the axis, between the cones enveloping the thread at crest and root, and is given by the relation:

$$H = p \sec^2 y \csc A \cos (\alpha_2 + y) \cos (\alpha_1 - y) \qquad (21)$$

where

$$A = \alpha_1 + \alpha_2.$$

If a thread is symmetrical about the perpendicular to the axis,

$$\alpha_1 = \alpha_2 = \alpha,$$

and

$$H = \frac{p}{2} (\cot \alpha - \tan^2 y \tan \alpha). \qquad (22)$$

In a taper screw thread the crest of a thread is not exactly opposite the root of the thread at points located 180° apart, as in a straight thread, but there is an axial displacement between these positions. This displacement is given by the formula:

$$\delta = \frac{L}{2} (1 - 2 \sec y \csc A \cos (\alpha_1 - y) \sin \alpha_2) \qquad (23)$$

for an unsymmetrical thread. For a symmetrical thread this formula reduces to [3]:

$$\delta = \frac{L}{2} \tan \alpha \tan y. \qquad (24)$$

For an unsymmetrical thread having the bisector of the thread angle perpendicular to the element of the cone [3],

$$\delta = \frac{L}{2} \cot \alpha \tan y. \qquad (25)$$

5. DIAMETER OF AN ARCHIMEDES' SPIRAL AS MEASURED BETWEEN FLAT, PARALLEL SURFACES

As previously stated, the projection of the pitch line of a taper thread gage on a plane perpendicular to the axis of the gage is an Archimedes' spiral. If parallel lines are drawn tangent to opposite sides of a segment of such a spiral, figure 8.4, the radii vectores to the points of contact subtend an angle of slightly more than 180°, and the distance between the lines is slightly greater than the length of the line, intercepted by the spiral, which is drawn perpendicular to these tangents through the axis of the spiral. In measuring the diameter of a taper thread gage between flat parallel anvils AA and BB, figure 8.4, the measurement obtained corresponds to the distance between the parallel lines, whereas the true diameter corresponds to the length of the intercepted perpendicular line. For commercial taper screw threads the difference, ΔM, between these lengths is given very nearly by the formula:

$$\Delta M = E (\cos \phi - 1) + \frac{L}{\pi} \phi \tan \alpha \cos \phi \qquad (26)$$

where

E = true diameter, or length of intercepted line

θ = approximate mean vectorial angle at points of measurement

$\phi = \cot^{-1} \theta$.

Example: Solve for ΔM for presumably the worst case encountered in commercial practice, namely the A.P.I. standard 2⅜ in. rotary joint thread.

$L = 0.20$ in.

$E = 2.36537$ in.

taper = 0.25 in./in.

$$\theta = \frac{2.36537}{0.25 \times 0.20} \times 2\pi + \pi$$

$$= 300.38276 \text{ radians}$$

$$\cot \phi = \theta = 300.38276$$

$$\phi = 0°11'28''$$

$$= 0.00334 \text{ radians}$$

$$\Delta M = 2.36537\ (0.9999944 - 1) + \frac{0.20}{\pi} \times 0.125 \times 0.00334 \times 0.9999944$$

$$= +0.000013 \text{ in.}$$

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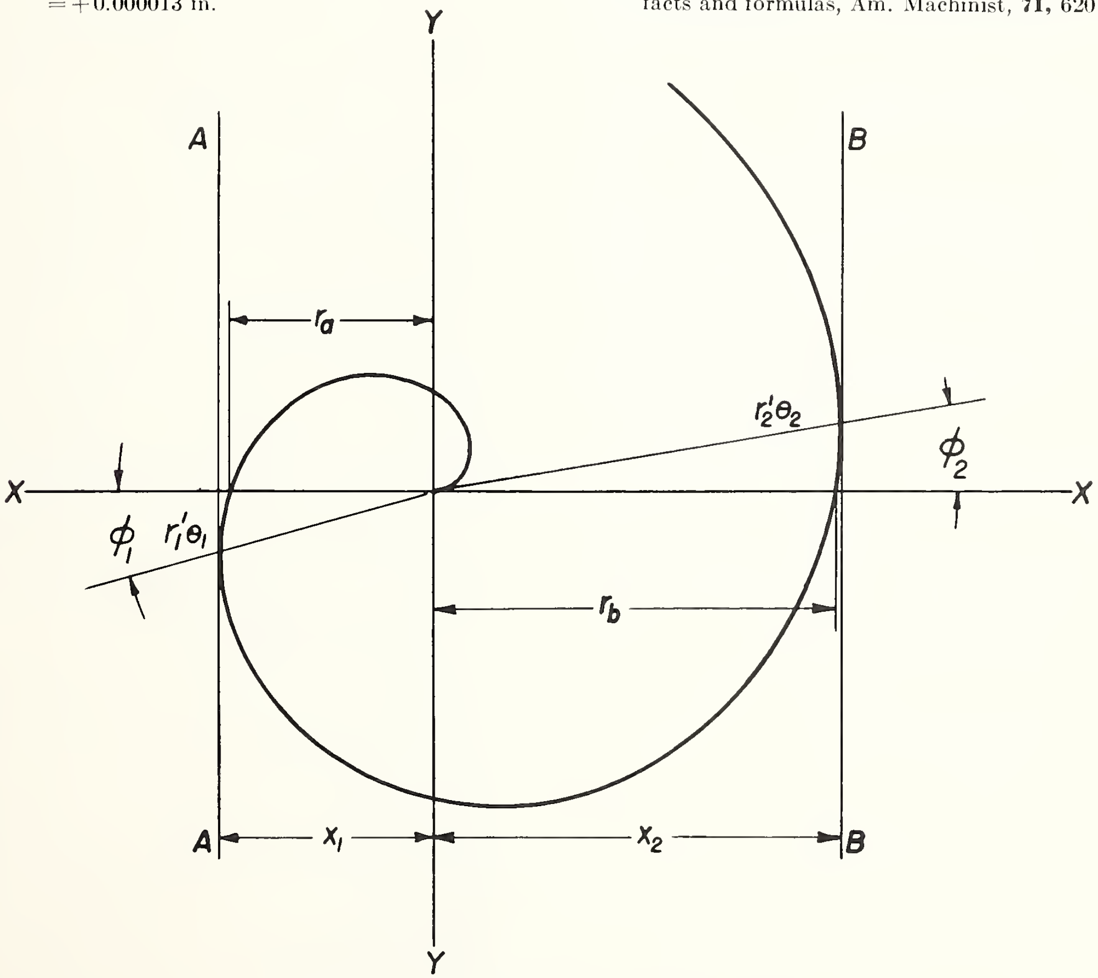

FIGURE 8.4.—*Measurement of Archimedes' spiral.*

APPENDIX 9. EXTENT OF USAGE OF THE AMERICAN NATIONAL FIRE-HOSE COUPLING THREADS ON COUPLINGS AND NIPPLES USED WITH 2½ INCH NOMINAL SIZE FIRE HOSE

Listed below are the cities in the United States which had a population of 25,000 or more according to the 1950 census, and which have not standardized on the American National fire-hose coupling thread on hydrants, couplings, and nipples used with 2½ in. nominal size fire hose. The outside diameter of the nipple (external) thread is 3$^{1}\!/_{16}$ in. and the pitch is 7½ threads per inch for this American National thread. If all cities of 25,000 population or over in a state have adopted the American National standard for the 2½ in. fire hose, that state is shown in the tabulation as being 100 percent Standard.

The tabulation shows the outside diameter of the nipple (external) thread in inches and the number of threads per inch, the number preceding the dash being the outside diameter and the number following being the pitch. (Outside diameters are given to the nearest $^{1}\!/_{64}$ in.).

Special types of snap, clutch, or other patent couplings are designated by their trade names.

In some instances, the dimensions were not available and were left blank.

Where there are differences in pitch of more than one-half a thread between the mating parts, or differences in pitch diameter in excess of $^{1}\!/_{32}$ in., there will not be washer tight fits. Coupling parts more than $^{1}\!/_{16}$ in. larger in pitch diameter than the nipple will blow off when subjected to high pressures.

Alabama (100% Standard)
Arizona
- Phoenix (Adapters), 2$^{1}\!/_{16}$ to 2$^{3}\!/_{32}$—6

Arkansas (100% Standard)
California
- Burbank

Colorado
- Colorado Springs, 3 & 3$^{1}\!/_{32}$—7½
  - Note: Colorado Springs is in the process of changing over to the National Standard.
- Denver, 3$^{3}\!/_{32}$—8
- Pueblo, 3¼—6

Connecticut
- Bridgeport, 3$^{11}\!/_{64}$ & 3$^{5}\!/_{32}$—8
- Norwich, 3$^{3}\!/_{64}$—7½ and National Standard

Delaware (100% Standard)
District of Columbia (100% Standard)
Florida
- Gainesville
- Key West, 2$^{31}\!/_{32}$ to 3—8
- Lakeland, 3$^{1}\!/_{16}$—6
- Tallahassee, 3—6

Georgia
- Macon, 3—8
- Rome, 3$^{3}\!/_{16}$—7

Idaho (100% Standard)
Illinois
- Alton, 3$^{1}\!/_{32}$ and 3$^{5}\!/_{64}$—7
- Aurora, 3$^{1}\!/_{32}$—7 and National Standard
- Berwyn, 3—7½
- Bloomington
- Champaign, 3$^{1}\!/_{32}$ and 3$^{1}\!/_{16}$—8
- Chicago, 3$^{1}\!/_{64}$—7½
- Cicero, 3$^{1}\!/_{32}$ to 3$^{5}\!/_{64}$—7½
- Danville, 3$^{1}\!/_{16}$—8
- Decatur, 3$^{3}\!/_{32}$—7
- East St. Louis, 3$^{3}\!/_{64}$ & 3⅛—6
- Elgin, 3$^{1}\!/_{32}$—7
- Galesburg, 3$^{1}\!/_{16}$—7
- Granite City, 3$^{3}\!/_{32}$—6
- Joliet, 3—8
- Kankakee, 2$^{31}\!/_{32}$ to 3—7½
- Maywood, 3—7½
- Moline, 3$^{1}\!/_{16}$—7

Illinois—Continued
- Oak Park, 3$^{1}\!/_{16}$—7
- Peoria, 3$^{1}\!/_{16}$—7
- Rock Island, 3$^{3}\!/_{64}$ & 3$^{1}\!/_{16}$—7
- Springfield, 3$^{1}\!/_{16}$—7
- Waukegan, 3$^{1}\!/_{16}$—7

Indiana
- Bloomington
- Marion, 3$^{7}\!/_{32}$—6

Iowa
- Burlington, 3¼—6
- Cedar Rapids, 3$^{1}\!/_{16}$—6
- Clinton
- Council Bluffs, 3$^{3}\!/_{32}$—8
- Fort Dodge, 3¼—6
- Sioux City, 3$^{19}\!/_{64}$—6

Kansas (100% Standard)
Kentucky
- Covington, 3$^{5}\!/_{64}$ & 3$^{3}\!/_{32}$—6
- Louisville, 3⅛—6
- Newport
- Paducah, 3$^{7}\!/_{32}$—6

Louisiana
- Alexandria, 3$^{3}\!/_{32}$—8
- Baton Rouge, 3$^{1}\!/_{16}$—8
- Lafayette, 3$^{3}\!/_{32}$—8
- Lake Charles, 3$^{1}\!/_{16}$—8
- Monroe, 3$^{1}\!/_{16}$—8
- New Orleans
  - Hose, 3$^{1}\!/_{64}$—7½
  - Hydrants, 3$^{5}\!/_{32}$—6

Maine (100% Standard)
Maryland
- Hagerstown
  - Hose, 3$^{1}\!/_{16}$—6
  - Hydrants, 3⅛—7

Massachusetts (100% Standard)
Michigan
- Dearborn, 3⅛—7½
- Detroit, 3⅛—7½
- Ferndale, 3⅛—7½
- Hamtramck, 3⅛—7½
- Highland Park, 3⅛—7½
- Lincoln Park, 3$^{3}\!/_{16}$—7
- Muskegon, 3$^{7}\!/_{32}$—6
- Pontiac, 3⅛—7½
- Royal Oak, 3$^{3}\!/_{16}$—9
- Wyandotte, 3⅛—7½

Minnesota (100% Standard)
Mississippi
- Biloxi
- Greenville
- Laurel, Iron pipe threads—8
- Meridian, 3$^{1}\!/_{16}$—8 and National Standard

Missouri
- Joplin, "Anderson" & 3$^{7}\!/_{32}$—6
- St. Joseph, 3$^{7}\!/_{32}$—6

Montana (100% Standard)
Nebraska
- Lincoln, 3$^{1}\!/_{32}$—8 and National Standard
- Omaha, 3$^{1}\!/_{16}$—8

Nevada (100% Standard)
New Hampshire (100% Standard)
New Jersey
- Bayonne, 3—8
- Belleville, 3—8
- Bloomfield, 2$^{15}\!/_{16}$ to 3—8
- Camden
  - Hose, "Jones"
  - Hydrants, 3$^{1}\!/_{32}$—6
- Clifton, 3—8
- East Orange, 3—8
- Elizabeth, 3—8
- Garfield
- Hoboken, 3—8
- Irvington, 3 & 3$^{1}\!/_{64}$—8
- Jersey City, 3—8
- Kearny, 3—8

New Jersey—Continued
Linden, $3\frac{1}{32}$—8
Montclair, 3—8
Newark, 3—8
Orange
Passaic, $3\frac{1}{16}$—8
Paterson, 3—8
Plainfield, 3—8
West Orange, 3—8

New Mexico
Roswell
Santa Fe, $3\frac{1}{16}$—6

New York
Amsterdam, $3\frac{1}{32}$ & $3\frac{1}{16}$—6
Auburn, $3\frac{3}{32}$—$7\frac{1}{2}$ and National Standard
Buffalo, $3\frac{1}{16}$—8
Elmira, $3\frac{3}{32}$—8
Hempstead, $3\frac{1}{32}$—8
Ithaca, $3\frac{1}{64}$—$7\frac{1}{2}$
Jamestown, $3\frac{1}{16}$—8
Lockport, $3\frac{1}{16}$—8
Mount Vernon, 3—8
New Rochelle, $3\frac{1}{32}$—8
New York City, $3\frac{1}{32}$—8
Rochester, $3\frac{1}{32}$—7
Rome, $3\frac{3}{16}$—8
Schenectady, Dbl. $3\frac{1}{8}$—6
Syracuse, $3\frac{9}{64}$—8
Utica, $3\frac{11}{64}$—8
Valley Stream, $3\frac{1}{32}$—6
Yonkers, Adapters & 3—8

North Carolina
Asheville, $3\frac{1}{16}$—6
Raleigh, $3\frac{5}{16}$—6
Wilmington, $3\frac{1}{4}$—6
Winston-Salem, $2\frac{59}{64}$ & $2\frac{31}{32}$—$7\frac{1}{2}$

North Dakota (100% Standard)

Ohio
Akron, $3\frac{1}{4}$—6
Alliance, $3\frac{15}{64}$—6
Barberton, $3\frac{15}{64}$—6
Cincinnati
Cleveland, $3\frac{5}{64}$—8
Cleveland Heights, $3\frac{1}{16}$—8
Cuyahoga Falls, $3\frac{1}{4}$—6
Dayton, $3\frac{15}{64}$—6
East Cleveland, $3\frac{1}{16}$—8
Euclid
Hamilton, $3\frac{3}{16}$—7
Lakewood, $3\frac{1}{16}$—8
Middletown, $3\frac{1}{4}$—6
Parma, $3\frac{5}{64}$—8
Shaker Heights
Springfield, $3\frac{5}{16}$—6
Steubenville, $3\frac{1}{16}$—6
Toledo, 3 & $3\frac{1}{64}$—8

Oklahoma
Muskogee
Oklahoma City, $3\frac{5}{32}$—6
Okmulgee

Oregon (100% Standard)

Pennsylvania
Aliquippa, 3—8
Allentown, $3\frac{1}{4}$—6 & 3—8
Altoona, $3\frac{1}{16}$—6
Bethlehem, $3\frac{3}{16}$—6
Chester, "Jones" & $2\frac{15}{16}$ & $2\frac{61}{64}$—$7\frac{1}{2}$
Easton, 3 & $3\frac{1}{32}$—6
Erie
Harrisburg, $3\frac{1}{32}$—8
Hazelton, $3\frac{3}{32}$—6
Johnstown, $3\frac{1}{16}$—7
Lancaster, $3\frac{1}{16}$—7
Lebanon, 3—8
McKeesport, $3\frac{5}{32}$—6
New Kensington
Norristown, "Jones Snap"
Philadelphia, "Jones Snap"
Pittsburgh, $3\frac{1}{16}$—6
Reading, $3\frac{7}{32}$—6
Scranton
Sharon
Washington, $3\frac{5}{64}$—6
Wilkes-Barre, $3\frac{1}{16}$—6
Wilkinsburg, $3\frac{1}{8}$—6
Williamsport, $3\frac{1}{16}$—6
York, $3\frac{9}{64}$—7

Rhode Island
Newport, $3\frac{11}{64}$—6

South Carolina (100% Standard)

South Dakota
Aberdeen, $3\frac{13}{64}$—6
Rapid City, 3—8

Tennessee (100% Standard)

Texas
San Angelo
Temple

Utah
Salt Lake City, $3\frac{15}{64}$—6

Vermont
Burlington, $3\frac{1}{8}$—6

Virginia
Charlottesville, $3\frac{5}{16}$—8
Petersburg, $2\frac{15}{16}$—8
Richmond, $3\frac{5}{16}$—8
Roanoke, "Clay Snap"

Washington (100% Standard)

West Virginia
Clarksburg, $3\frac{5}{64}$—6
Fairmont, 3—8
Huntington, $3\frac{1}{16}$ & $3\frac{3}{32}$—6
Morgantown, $3\frac{1}{16}$—6
Wheeling, $3\frac{1}{16}$—6

Wisconsin (100% Standard)

Wyoming
Casper, $3\frac{5}{16}$—7 and National Standard
Cheyenne, $3\frac{1}{4}$—6

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