Date of Issue: April 9, 1998
Affected Publication: API Specification 5B, Threading, Gauging, and Thread Inspection of Casing, Tubing, and Line Pipe Threads, Fourteenth Edition, August 1996,
Effective: December 1, 1996

ERRATA

Page 4, Table 2: Change the tolerance for Lead per inch to read:
Lead
per Inch. . . . . ±0.003 in.

Page 4, Table 2: Change the tolerance for Standoff A to read:
Standoff A: . . . . See Par. 6.1.4

Page 4, Table 2:
Footnote *a, 2nd sentence should read*: See Table 21 for g dimensions.

Page 6, Figure 3:
Note 1 should read: . . .grades H, J, and K casing a $^3/_8$ in. equilateral . . .

Page 6, Table 5: Change the tolerance for Standoff A to read:
Standoff A: . . . . See Par. 6.1.4

Page 6, Table 5:
Footnote a, 2nd sentence should read: See Table 22 for g dimensions.

Page 7, Table 6; Page 8, Table 7; Page 13, Table 12; Page 14, Table 13; Page 15, Table 14; and Page 16, Table 15:
The heading for column 1 should read:

Size
Designation
D

Page 8, Table 7:

The dimensions for Diameter of Coupling Recess, Q, for sizes 7 5/8, 8 5/8, 9 5/8, and 20 should read as follows:

Size Designation, D	Diameter of Coupling Recess, Q
7 5/8	7 23/32
8 5/8	8 23/32
9 5/8	9 23/32
9 5/8	9 23/32
20	20 3/32
20	20 3/32

Page 9, Figure 6:

Replace Figure 6 with the following:

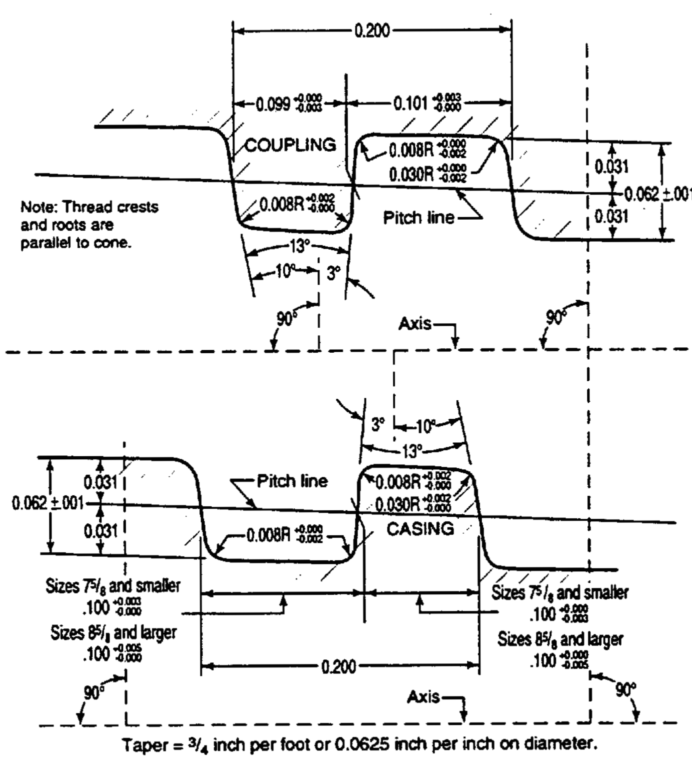

Figure 6—Buttress Casing Thread Form and Dimensions—for Casing Sizes 4 1/2 through 13 3/8 in.

Page 10, Table 8: Change the tolerance for Standoff A to read:
Standoff A: . . . . See Par. 6.1.4

Page 10, Table 8:
Footnote b, 3rd sentence should read: . . . paragraph 5.1.4.

Page 11, Table 9:
Heading for Column 1 should read: Size Designation

Heading for Column 10 should read:

Length:
Face of
Coupling to
Plane E_7

Page 12, Table 10:
Value of h_s *for 10 threads per inch should read:* 0.05560

Page 12, Table 11: Change the tolerance for Standoff A to read:
Length, L_4 (external thread):
10-Thread per in.
External-Upset . . . . $+1^1/_2$

Page 12, Table 11: Change the tolerance for Standoff A to read:
Standoff A: . . . . See Par. 6.1.4

Page 18, Figure 10:
References to Figure 7.1 should be changed to: Figure 10

References to Figure 7.3 should be changed to: Figure 12

Page 21, Figure 11:
References to Figure 7.2 should be changed to: Figure 11

References to Figure 7.5 should be changed to: Figure 14

Page 25, Paragraph 5.1.5.b.1 should read:
. . . having 11 threads per inch. Measurement of full perfect thread length may require an overlap of the thread measuring interval. At no time shall taper, height or lead measurements be taken with a contact point beyond the last perfect thread location except on buttress threads. Buttress . . .

Page 31, Paragraph 5.1.9 heading should read: Procedure (Taper Gauge)

Page 31, Paragraph 5.1.9:
The phrase in parentheses "(as specified in Table 9, Column 6 (L_4))" *should be deleted.*

Page 31, Paragraph 5.1.11 heading should read: Procedure (Runout)

Page 31, Paragraph 5.1.11: the last sentence should be deleted.

Page 31, Paragraph 5.1.13 heading should be: Procedure (Taper Gauge)

Page 32, Paragraph 5.1.19:
Referenced paragraph in parentheses should read: (see Par. 5.1.5.b)

Page 33, Paragraph 5.1.23 should read:
For V-groove check block . . ., within a tolerance of ±0.0002.:

Page 38, Paragraph 6.1.1, the last sentence should read:
. . . of Sect. 7 and certified as required in Sect. 8.

Page 38, Paragraph 6.1.1, Note 1, last sentence should read: See Par. 6.1.9 . . .

Page 38, Paragraph 6.1.1, Note 2, delete last sentence

Page 51, Figure 38: 3 items are missing from this figure.

1. *Dimension* D_0 *is missing from the right side of the drawing.*
2. *The designation for a* 90° angle *on the right side of the* "U" dimension.
3. *References to the* "Gaging Notch" *location.*

Refer to Figure 4.2 in the 13th edition for correct version of drawing.

Page 57, Table 24:
For 1.050 OD, column 11 should read: 1.0938

Page 59, Table 28: Column 2, third line of heading should read: p=0.1000

Page 60, Table 29:
Diameter of Collar, D_4, $11\frac{1}{2}$ Threads per Inch *should read:* ±0.010

Page 61, Table 30:
Ring Gauge
Taper . . . . –0.0002
–0.0012

Page 61, Table 31: Change Taper values to read:

Ring Gauge			
	Taper	$13\frac{3}{8}$ and smaller	–0.0002 –0.0012
		16 and larger	–0.0002 –0.0017

Page 62, Table 32; and Page 63, Table 33:
Add the words "for Extreme Line Casing" *to the end of the title.*

Page 78, Change the API Monogram logo shown in the License Agreement to the following:

Specification for Threading, Gauging, and Thread Inspection of Casing, Tubing, and Line Pipe Threads (U.S. Customary Units)

API SPECIFICATION STANDARD 5B
FOURTEENTH EDITION, AUGUST 1996

EFFECTIVE DATE: DECEMBER 1, 1996

American
Petroleum
Institute

Specification for Threading, Gauging, and Thread Inspection of Casing, Tubing, and Line Pipe Threads (U.S. Customary Units)

Exploration and Production Department

API SPECIFICATION STANDARD 5B
FOURTEENTH EDITION, AUGUST 1996

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American Petroleum Institute

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FOREWORD

This standard is under the jurisdiction of the API Subcommittee on Standardization of Tubular Goods and includes items approved by letter ballot through 1994.

This specification was originally issued in 1939 as Standard 5B, *Specification for Inspection of External and Internal Pipe Threads*. The 4th edition, issued in 1962, was expanded to include, in addition to thread inspection, dimensional requirements on threads and thread gauges, stipulations on gauging practice, gauge specifications, and gauge certification, for casing, tubing, and line pipe, including couplings, as covered by API Standard 5A, 5AC, 5AX, and 5L. The title of Standard 5B was changed with the 4th edition to *Specification for Threading, Gauging, and Thread Inspection of Casing, Tubing, and Line Pipe Threads*.

Acknowledgment is hereby given to United States Steel Corporation for dedicating to the public all patents covering buttress casing, and to Armco Division, Armco Steel Corporation for dedicating to the public all patents covering extreme-line casing.

API Exploration and Production publications usually contain a bar notation in the margin to identify parts of the publication that have been changed from the previous edition. This publication has been completely reformatted, and therefore all text section and paragraph references have been changed. Users are advised to review this new edition carefully.

This standard shall become effective on the date printed on the cover but may be used voluntarily from the date of distribution.

Suggested revisions are invited and should be submitted to the director of the Exploration and Production Department, American Petroleum Institute, 1220 L Street, N.W., Washington, D.C. 20005.

CONTENTS

Tables

Specification for Threading, Gauging, and Thread Inspection of Casing, Tubing, and Line Pipe Threads (U.S. Customary Units)

1 Scope

1.1 COVERAGE

This specification covers dimensions and marking requirements for API Master thread gauges. Additional product threads and thread gauges as well as instruments and methods for the inspection of threads for line pipe, round thread casing, buttress casing, and extreme line casing connections are included. It is applicable when so stipulated in the API standard governing the product. The inspection procedures for measurements of taper, lead, height, and angle of thread are applicable to threads having $11^1/_2$ or less turns per inch. All thread dimensions shown without tolerances are related to the basis for connection design and are not subject to measurement to determine acceptance or rejection of product.

1.2 INSPECTION

Thread inspection applies at the point of manufacture prior to shipment, to inspection at any intermediate point, to inspection subsequent to delivery at destination, and to inspection by inspectors representing the purchaser or the manufacturer. The manufacturer may, at his option, use other instruments or methods to control manufacturing operations; but acceptance and rejection of the product shall be governed solely by the results of inspection made in accordance with the requirements of this specification.

1.3 OTHER REQUIREMENTS

The applicable product specification should be consulted for requirements not given herein.

1.4 METRIC CONVERSIONS

Metric conversions of U.S. customary units are provided in the metric version of this specification.

2 References

2.1 GENERAL

This specification includes by reference, either in total or in part, the most recent editions of the following standards:

API

RP 5A3	*Recommended Practice on Thread Compounds*
RP 5C1	*Recommended Practice for the Care an Use of Casing and Tubing*
Spec 5CT	*Specification for Casing and Tubing*
Spec 5L	*Specification for Line Pipe*

2.2 REQUIREMENTS

Requirements of other standards included by reference in this specification are essential to the safety and interchangeability of the equipment produced.

2.3 EQUIVALENT STANDARDS

Other nationally or internationally recognized standards shall be submitted to and approved by API for inclusion in this specification prior to their use as equivalent standards.

3 Definitions

3.1 *Shall* is used to indicate that a provision is mandatory.

3.2 *Should* is used to indicate that a provision is not mandatory, but recommended as good practice.

3.3 *May* is used to indicate that a provision is optional.

3.4 *Imperfection.* An imperfection is a discontinuity or irregularity in the product detected by methods outlined in the applicable specification.

3.5 *Defect.* A defect is an imperfection of sufficient magnitude to warrant rejection of the product based on the stipulations of the applicable specification.

4 Thread Dimensions and Tolerances

4.1 LINE PIPE, ROUND-THREAD CASING AND TUBING, AND BUTTRESS THREAD CASING

4.1.1 Thread Measurement

Thread length shall be measured parallel to the thread axis; thread height and Taper diameter shall be measured approximately normal to the thread axis; lead of line pipe and round threads shall be measured parallel to the axis along the pitch cone and, for buttress threads, parallel to the thread axis, approximately along the pitch cone, for both the external and the internal thread. On line pipe and round threads, the included taper shall be measured on the diameter along the pitch cone and, for buttress threads, on the diameter along the minor cone for the external thread and the major cone for the internal thread. For gauging procedure, see Section 5.

4.1.2 Visual Inspection

Threads shall be free from visible tears, cuts, grinds, shoulders, or any other imperfections which break the continuity of the threads, within the minimum length of full crest threads from the end of pipe (L_c) and within the interval from the recess or counterbore to a plane located at distance

J + one thread turn from the center of the coupling, or from the small end of the thread in the box of integral-joint tubing. Superficial scratches, minor dings and surface irregularities that do not affect the continuity of thread surfaces are occasionally encountered and may not necessarily be detrimental. Because of the difficulty in defining superficial scratches, minor dings and surface irregularities, and the degree to which they affect thread performance, no blanket waiver of such imperfections can be established. As a guide to acceptance, the most critical consideration is to ensure that there are no detectable protrusions on the threads that can peel off the protective coating on the coupling threads or score mating surfaces. Cosmetic repair of thread surfaces by hand is permitted. Imperfections between the L_c length and the vanish point are permissible providing their depth does not extend below the root cone of the thread; or extend beyond 12½% of specified pipe wall thickness (measured from the projected pipe surface) whichever is greater. Grinding to probe imperfections or to eliminate defects is also permitted in this area, with the depth of grind having the same limits as imperfections in this area. Imperfections include such other discontinuities as seams, laps, pits, tool marks, dents, handling damage, etc. Minor pitting and thread discoloration may also be encountered in any part of the threaded area and may not necessarily be detrimental. Because of the difficulty in defining pitting and discoloration and the degree to which they affect thread performance, no blanket waiver of such imperfections can be established. As a guide to acceptance, the most critical considerations are that any corrosion products protruding above the surface of the threads be removed and that no leak path exists. Filing or grinding to remove pits is not permitted.

Imperfections within the above described permissible limits shall be permitted under the following conditions:

a. If imperfections are detected at the mill, the pipe end with imperfections must be the end with the exposed pipe threads. No imperfections detected at the mill are permitted on the coupling end of the pipe, except as otherwise provided in Par. 4.1.2c.

b. Imperfections within the above limits are acceptable on the end with the exposed pipe threads. Imperfections running under the coupling, which are detected after shipment from the mill, are not acceptable unless it can be demonstrated that the imperfection is within the above described permissible limit. If the imperfection is within the permissible limits the coupling may be reapplied and the length of pipe is an acceptable product. If the imperfection exceeds permissible limits, it shall be considered a defect and the length of pipe is rejectable, or it may be reconditioned by cutting the threads off, rethreading and reapplying the coupling.

c. Imperfections that would run under the coupling shall be removed by grinding prior to threading, provided the grind is well contoured with the circumference of the pipe and displays a high degree of workmanship. Such grinding shall not be considered an imperfection. Because of the difficulty in defining acceptable contours and a high degree of workmanship, user discretion shall govern.

Note: User discretion applies only to the contour of the grind.

4.1.3 Thread Precision

Threads shall be cut with such precision of form and dimensions and with such finish as to make a tight connection when properly made up power-tight using a high-grade thread compound. On casing and tubing, the thread compound shall meet or exceed the performance requirements of the latest edition of Recommended Practice 5A3, Thread Compounds for Casing, Tubing and Line Pipe. For tubing the connection shall be capable of being made up power-tight and unscrewed four times without injury to the threads by galling. It should not be expected that threaded connections will gauge properly after being made up power tight, therefore minor deviations from the specified tolerances should be accepted. Subsequent use of tubing is reviewed in the latest edition of API Recommended Practice 5C1, Care and Use of Casing and Tubing (paragraphs applicable to threads).

A ⅜ in. high equilateral triangle die stamp shall be placed at a distance of L_4 + 1/16 in. from each end of size 16, 18⅝ and 20 8-round thread casing in Grades H40, J55, and K55. However, the position of the coupling with respect to the base of the triangle shall not be a basis for acceptance or rejection. For buttress casing a triangle stamp shall be applied as indicated in Figure 5 and shall be used as a means of make-up acceptance or rejection. Unless otherwise specified on the Purchase Order, the triangle mark may be replaced with a transverse white paint band ⅜ inch wide by 3 inches long.

Note: A tight connection is one which, when properly made up power-tight using a high-grade thread compound, shows no leaks at ambient temperature at any pressure up to and including the specified hydrostatic test pressure.

4.1.4 Thread Design

Threads shall be right-hand and shall conform to the dimensions and tolerances specified herein.

Note: In the design of round thread casing connections, values for total thread length L_4 are derived from calculations based on providing a theoretical wall thickness at the root of the thread at the end of the pipe as determined by the following formula:

t_0 = 0.009D + 0.040 in. or 0.090 in., whichever is greater.
t_0 = basic wall thickness at the root of the thread at the end of the pipe, in inches;
D = specified outside diameter of casing, in inches.

The theoretical wall thickness t_0 is related to a basis of connection design only and is not a specification value. It is not subject to measurement or application of tolerances.

"p" is defined as the distance from a point on a nominal thread form to a corresponding point on the next thread, measured parallel to the axis. This value can be calculated by dividing one inch by the number of threads per inch.

4.1.5 Chamfer

The angle (65 degrees) of the outside chamfer at the end of the pipe shall be as shown in Fig. 1, 3, 5 and 8 and must extend a full 360 degrees around the face of the pipe. The diameter of the chamfer shall be such that the thread root shall run out on the chamfer and not on the face of the pipe and shall not produce a feather edge.

4.1.6 Coupling Thread

The root of the coupling thread shall start within the area of the ID chamfer and extend to the center of the coupling. The length of thread in the box end of integral-joint tubing shall not be less than $L_4 + J$ from the face of the box. The internal threads within the interval from the recess or counterbore to a place located at distance J + one thread turn from the center of the coupling, or from the small end of the thread in the box of integral-joint tubing, shall conform to the requirements of Sect. 4. The threads in steel couplings for line pipe nominal sizes 2 and larger, in all sizes of casing and tubing couplings, and in the box or on the pipe male end of integral-joint tubing shall be zinc or tin electroplated or phosphatized to minimize galling and develop the maximum leak resistance characteristics of the connection. Where tin, or other ductile coating in excess of 0.001 in. are used, the thread tolerance and standoff apply only to the uncoated threads. In some instances coatings in excess of 0.001 in. thickness are being used and accurate gauging is impractical. The maximum thickness of electroplated tin coatings shall not exceed 0.006 in. Taper, standoff and OD dimensions may be affected by power tight makeup. Deviations from the specified tolerances for these dimensions may be expected after power tight makeup.

4.1.7 Thread Control

All threads shall be controlled by API gauges in accordance with the gauging practice requirements in Sect. 6.

4.1.8 Thread elements

Thread elements for all threads except line pipe threads finer than 11½ threads per inch shall be subject to inspection in accordance with Sect. 5.

Note: With respect to thread elements, line pipe threads finer than 11½ threads per inch (nominal pipe sizes smaller than 1), only the requirements on thread length and stand-off are subject to inspection.

4.1.9 Misalignment

The maximum misalignment of the axis of coupling threads measured in the plane of the coupling face shall not exceed 0.031 in. for casing and tubing couplings. The maximum angular misalignment in line pipe couplings nominal size 6 and larger and in all sizes of couplings for casing and tubing shall not exceed ¾ in. per 20 ft of projected axis. Concentricity and alignment tests may be made in accordance with the requirements in Sect. 5 or any other method giving an equal degree of accuracy may be used.

4.1.10 Misalignment Tests (Options)

If so requested by the inspector representing the purchaser, either of the methods of misalignment tests as defined in Section 5, Coupling Thread Alignment, shall be made on one coupling from each lot of 100 couplings or less of each size. If any coupling fails, two additional couplings from the same lot may be tested, both of which shall conform with the specified requirements; otherwise, the lot shall be rejected. The manufacturer may elect to test each coupling in the rejected lot. The term lot as used in this paragraph is defined as 100 consecutive pieces manufactured on the same piece of equipment.

4.1.11 Misalignment Rejects (Purchaser Option)

The purchaser shall have the right to reject pipe on which he considers the pin threads to be out of alignment to a degree which would adversely effect the performance of the pipe. The criteria for rejection shall be some demonstration that axial misalignment exceeds 0.031 in., or the angular misalignment exceeds ¾ in. per 20 feet of projected axis, or by a check of whether the minimum length of full crest threads (L_c) is present.

4.1.12 Full Crested Thread Length

The required minimum length of full crest threads is defined by L_c in Tables 3, 6, 7, 9, 12, 13, 14 and 15.

Threads that are not fully crested have historically been and continue to be referred to as "black crest threads" because the original mill surface has not been removed. The term "black crest thread" is a useful descriptive term; however, it should be pointed out that there can also be non-full crested threads that are not black crested. Threads within the L_c area that are not full crested or still show the original outside diameter of the pipe or upset surface shall not be made to appear full-crested either mechanically or by hand.

4.1.13 Hand Tight Connection

A hand tight connection is defined as a threaded connection that has been made up by hand without the aid of excessive force. Hand tight standoff "A" is the nominal makeup position of two nominal parts which is achieved at initial mechanical interference.

4.1.14 Rounded Nose

In lieu of the conventional corner breaks on the ends of threaded tubing, the "Round" or "Bullet-nose" profile, specified on Table 16 may be supplied at the manufacturer's option or may be specified by the purchaser. The modified

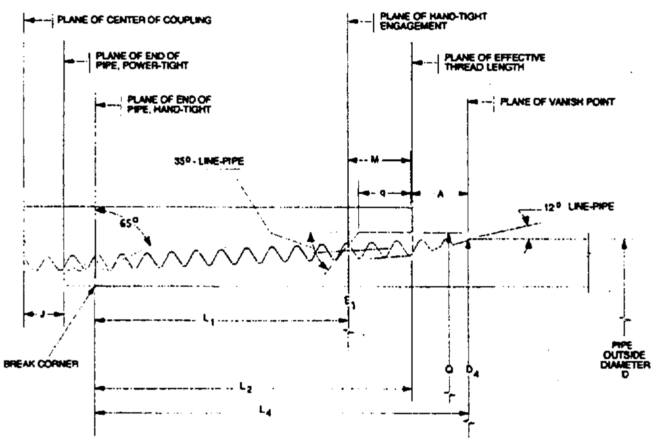
Continued on Page 17

Table 1—Line-Pipe Thread Height Dimensions

All dimensions in inches. See Figure 2.

(1) Thread Element		(2) 27 Threads Per Inch p = 0.0370	(3) 18 Threads Per Inch p = 0.0556	(4) 14 Threads Per Inch p = 0.0714	(5) $11^1/_2$ Threads Per Inch p = 0.0870	(6) 8 Threads Per Inch p = 0.1250
H =	0.866p	0.0321	0.0481	0.0619	0.0753	0.1082
$h_s = h_n =$	0.760p	0.0281	0.0422	0.0543	0.0661	0.0950
$f_{rs} = f_{rn} =$	0.033p	0.0012	0.0018	0.0024	0.0029	0.0041
$f_{cs} = f_{cn} =$	0.073p	0.0027	0.0041	0.0052	0.0063	0.0091

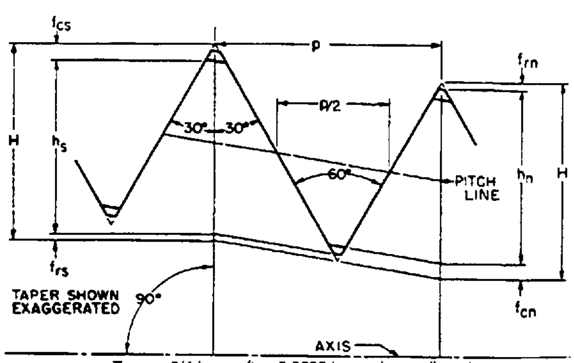
Note: Calculations for H, h_s, and h_n are based on formulas for a symmetrical straight screw thread rather than a symmetrical tapered thread. The resulting differences are deemed to be insignificant for threads with 0.125 in. pitch and $^3/_4$ in. per foot taper or less.



For basic power-tight make-up the face of coupling or box advances to plane of vanish point

The vanish cone angle applies to the roots of the incomplete threads produced by either multiple point or single point tools

Figure 1—Basic Dimensions of Line Pipe Threads Hand-Tight Make-Up



Taper = 3/4 in. per ft or 0.0625 in. per in. on diameter

Figure 2—Line-Pipe Thread Form (See Table 1 for Dimensions)

Table 2—Tolerances on Line-Pipe Thread Dimensions[c]

(1) Element	(2) Tolerances
Taper:[d]	
per Foot on Diameter (0.750 in.)	+0.0625 in. −0.0312 in.
per Inch on Diameter (0.0625 in.)	+0.0052 in. −0.0026 in.
Lead:[a,d]	
per Inch	±0.003 in.
cumulative	±0.006 in.
Height:[d]	
h_s and h_n	+0.002 in. −0.006 in.
Angle, Included	$\pm 1^1/_2$ deg.
Length, L_4 (external thread):[b]	±1 p
Chamfer:[d]	+5 deg. −0 deg.
Standoff A:	See Par. 4.4

[a]For pipe (external threads) the lead tolerance per inch is the maximum allowable error in any inch within the length L_4–g. See Sect. 5 for g dimensions. The cumulative lead tolerance is the maximum allowable error over the entire length L_4–g. For internal threads, lead measurements shall be made within the length from the recess to a plane located at a distance J + one thread turn from the center of the coupling.

[b]L_4 is acceptable: a, if the distance from the end of the pipe to the vanish plane (at the point where the outside diameter of the pipe is a maximum) is within the above minus tolerance; or b, if the distance from the end of the pipe to the vanish plane (where the outside diameter of the pipe is a minimum) is within the above plus tolerance.

[c]Tolerances apply to both external and internal threads except where otherwise indicated.

[d]Not applicable to line pipe smaller than nominal size 1.

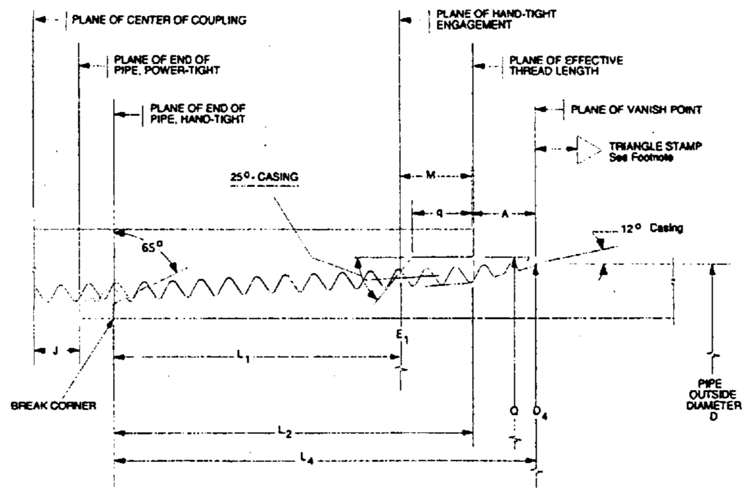
Table 3—Line-Pipe Thread Dimensions

All dimensions in inches, except as indicated. See Figure 1.

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
Nominal Size	Major Diameter D_4	No. of Threads per Inch	Length: End of Pipe to Hand-Tight Plane L_1	Length: Effective Threads L_2	Total Length: End of Pipe to Vanish Point L_4	Pitch Diameter at Hand-Tight Plane E_1	End of Pipe to Center of Coupling, Power-Tight Make-Up J	Length: Face of Coupling, to Hand-Tight Plane M	Diameter of Coupling Recess Q	Depth of Coupling Recess q	Hand-Tight Standoff Thread Turns A	Minimum Length, Full Crest Threads From End of Pipe L_c*
1/8	0.405	27	0.1615	0.2639	0.3924	0.37360	0.1389	0.1198	0.468	0.0524	3	—
1/4	0.540	18	0.2278	0.4018	0.5946	0.49163	0.2179	0.2001	0.603	0.1206	3	—
3/8	0.675	18	0.240	0.4078	0.6006	0.62701	0.2119	0.1938	0.738	0.1147	3	—
1/2	0.840	14	0.320	0.5337	0.7815	0.77843	0.2810	0.2473	0.903	0.1582	3	—
3/4	1.050	14	0.339	0.5457	0.7935	0.98887	0.2690	0.2403	1.113	0.1516	3	—
1	1.315	11 1/2	0.400	0.6828	0.9845	1.23863	0.3280	0.3235	1.378	0.2241	3	0.3325
1 1/4	1.660	11 1/2	0.420	0.7068	1.0085	1.58338	0.3665	0.3275	1.723	0.2279	3	0.3565
1 1/2	1.900	11 1/2	0.420	0.7235	1.0252	1.82234	0.3498	0.3442	1.963	0.2439	3	0.3732
2	2.375	11 1/2	0.436	0.7565	1.0582	2.29627	0.3793	0.3611	2.469	0.2379	3	0.4062
2 1/2	2.875	8	0.682	1.1375	1.5712	2.76216	0.4913	0.6392	2.969	0.4915	2	0.6342
3	3.500	8	0.766	1.2000	1.6337	3.38850	0.4913	0.6177	3.594	0.4710	2	0.6967
3 1/2	4.000	8	0.821	1.2500	1.6837	3.88881	0.5038	0.6127	4.094	0.4662	2	0.7467
4	4.500	8	0.844	1.3000	1.7337	4.38712	0.5163	0.6397	4.594	0.4920	2	0.7967
5	5.563	8	0.937	1.4063	1.8400	5.44929	0.4725	0.6530	5.657	0.5047	2	0.9030
6	6.625	8	0.958	1.5125	1.9462	6.50597	0.4913	0.7382	6.719	0.5861	2	1.0092
8	8.625	8	1.063	1.7125	2.1462	8.50003	0.4788	0.8332	8.719	0.6768	2	1.2092
10	10.750	8	1.210	1.9250	2.3587	10.62094	0.5163	0.8987	10.844	0.7394	2	1.4217
12	12.750	8	1.360	2.1250	2.5587	12.61781	0.5038	0.9487	12.844	0.7872	2	1.6217
14 D	14.000	8	1.562	2.2500	2.6837	13.87263	0.5038	0.8717	14.094	0.7136	2	1.7467
16 D	16.000	8	1.812	2.4500	2.8837	15.87575	0.4913	0.8217	16.094	0.6658	2	1.9467
18 D	18.000	8	2.000	2.6500	3.0837	17.87500	0.4788	0.8337	18.094	0.6773	2	2.1467
20 D	20.000	8	2.125	2.8500	3.2837	19.87031	0.5288	0.9087	20.094	0.7490	2	2.3467

Included taper on diameter, all sizes, 0.0625 in. per in.

Note: Hand tight Standoff "A" is the basic allowance for basic power makeup of the joint as shown in Figure 1.
*$L_c = L_4 - 0.652$ in. for 11 1/2 thread line pipe.
$L_c = L_4 - 0.937$ in. for 8 thread line pipe.



Notes:
1. For sizes 16, 18 5/8 and 20 grades H, J and K casing a 5/8 in. equilateral triangle shall be die stamped at a distance of L_4 + 1/16 in. from each end.
2. The vanish cone angle is optional for round threads on downhole tools.
3. For basic power-tight make-up, the face of coupling or box advances to plane of vanish point.
4. The vanish cone angle applies to the roots of the incomplete threads produced by either multiple point or single point tools.
5. TECL (Thread Element Control Length) is a measured dimension (actual total thread length - 0.500"), therefore, not a basic design measurement.

Figure 3—Basic Dimensions of Casing Round Threads Hand-Tight Make-Up

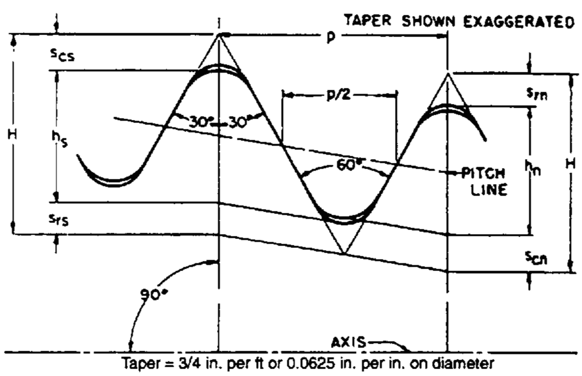


Figure 4—Casing Round Thread Form
(See Table 4 for dimensions)

Table 4—Casing Round Thread Height Dimensions

All dimensions in inches. See Figure 3.

Thread Element	8 Threads per Inch $p = 0.1250$
$H = 0.866p$	0.10825
$h_s = h_n = 0.626p - 0.007$	0.07125
$s_{rs} = s_{rn} = 0.120p + 0.002$	0.01700
$s_{cs} = s_{cn} = 0.120p + 0.005$	0.02000

Note: Calculations for H, h_s, and h_n are based on formulas for a symmetrical straight screw thread rather than a symmetrical tapered thread. The resulting differences are deemed to be insignificant for threads with 0.125 in. pitch and 3/4 in. per foot taper or less.

Table 5—Tolerances on Casing Round Thread Dimensions[c]

Element	Tolerances
Taper:	
per Foot on Diameter (0.750 in.)	+0.0625 in. −0.0312 in.
per Inch on Diameter (0.0625 in.)	+0.0052 in. −0.0026 in.
Lead:[a]	
per Inch	±0.003 in.
cumulative	±0.006 in.
Height:	
h_s and h_n	+0.002 in. −0.004 in.
Angle, Included	±1 1/2 deg.
Length, L^4 (external thread):[b]	±1 p
Chamfer:	+5 deg. −0 deg.
Standoff A:	See Par. 4.4
Casing coupling dia Q, and depth q	+0.031 in. −0

[a]For pipe (external threads) the lead tolerance per inch is the maximum allowable error in any inch within the length L_4–g. See Sect. 5 for g dimensions. The cumulative lead tolerance is the maximum allowable error over the entire length L_4–g. For internal threads, lead measurements shall be made within the length from the recess to a plane located at a distance J + one thread turn from the center of the coupling.
[b]L_4 is acceptable: a, if the distance from the end of the pipe to the vanish plane (at the point where the outside diameter of the pipe is a maximum) is within the above minus tolerance; or b, if the distance from the end of the pipe to the vanish plane (where the outside diameter of the pipe is a minimum) is within the above plus tolerance.
[c]Tolerances apply to both external and internal threads except where otherwise indicated.

Table 6—Casing Short-Thread Dimensions

All dimensions in inches, except as indicated. See Figure 3.

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
Size Designation	Major Diameter D_4	Nominal Weight: Thread and Coupling lb. per ft.	No. of Threads per Inch	Length: End of Pipe to Hand-Tight Plane L_1	Length: Effective Threads L_2	Total Length: End of Pipe to Vanish Point L_4	Pitch Diameter at Hand-Tight Plane E_1	End of Pipe to Center of Coupling, Power-Tight Make-Up J	Length: Face of Coupling to Hand-Tight Plane M	Diameter of Coupling Recess Q	Depth of Coupling Recess q	Hand-Tight Standoff, Thread Turns A	Minimum Length, Full Crest Threads From End of Pipe L_c*
4½	4.500	9.50	8	0.921	1.715	2.000	4.40337	1.125	0.704	4 19/32	.500	3	0.875
4½	4.500	Others	8	1.546	2.340	2.625	4.40337	0.500	0.704	4 19/32	.500	3	1.500
5	5.000	11.50	8	1.421	2.215	2.500	4.90337	0.750	0.704	5 3/32	.500	3	1.375
5	5.000	Others	8	1.671	2.465	2.750	4.90337	0.500	0.704	5 3/32	.500	3	1.625
5½	5.500	All	8	1.796	2.590	2.875	5.40337	0.500	0.704	5 19/32	.500	3	1.750
6⅝	6.625	All	8	2.046	2.840	3.125	6.52837	0.500	0.704	6 23/32	.500	3	2.000
7	7.000	17.00	8	1.296	2.090	2.375	6.90337	1.250	0.704	7 3/32	.500	3	1.250
7	7.000	Others	8	2.046	2.840	3.125	6.90337	0.500	0.704	7 3/32	.500	3	2.000
7⅝	7.625	All	8	2.104	2.965	3.250	7.52418	0.500	0.709	7 25/32	.433	3½	2.125
8⅝	8.625	24.00	8	1.854	2.715	3.000	8.52418	0.875	0.709	8 25/32	.433	3½	1.875
8⅝	8.625	Others	8	2.229	3.090	3.375	8.52418	0.500	0.709	8 25/32	.433	3½	2.250
9⅝	9.625	All	8	2.229	3.090	3.375	9.52418	0.500	0.709	9 25/32	.433	3½	2.250[a]
9⅝	9.625	All	8	2.162	3.090	3.375	9.51999	0.500	0.713	9 25/32	.433	4	2.250[b]
10¾	10.750	32.75	8	1.604	2.465	2.750	10.64918	1.250	0.709	10 29/32	.433	3½	1.625[a]
10¾	10.750	Others	8	2.354	3.215	3.500	10.64918	0.500	0.709	10 29/32	.433	3½	2.375[a]
10¾	10.750	Others	8	2.287	3.215	3.500	10.64499	0.500	0.713	10 29/32	.433	4	2.375[b]
11¾	11.750	All	8	2.354	3.215	3.500	11.64918	0.500	0.709	11 29/32	.433	3½	2.375[a]
11¾	11.750	All	8	2.287	3.215	3.500	11.64499	0.500	0.713	11 29/32	.433	4	2.375[b]
13⅜	13.375	All	8	2.354	3.215	3.500	13.27418	0.500	0.709	13 17/32	.433	3½	2.375[a]
13⅜	13.375	All	8	2.287	3.215	3.500	13.26999	0.500	0.713	13 17/32	.433	4	2.375[b]
16	16.000	All	8	2.854	3.715	4.000	15.89918	0.500	0.709	16 7/32	.366	3½	2.875
18⅝	18.625	87.50	8	2.854	3.715	4.000	18.52418	0.500	0.709	18 27/32	.366	3½	2.875
20	20.000	All	8	2.854	3.715	4.000	19.89918	0.500	0.709	20 7/32	.366	3½	2.875[c]
20	20.000	All	8	2.787	3.715	4.000	19.89499	0.500	0.713	20 7/32	.366	4	2.875[d]

Included taper on diameter, all sizes, 0.0625 in. per in.

Note: Hand tight Standoff "A" is the basic allowance for basic power makeup of the joint as shown in Figure 3.
*$L_c = L_4 - 1.125$ in. for 8 Round Thread Casing.
[a]Applicable to coupling grades lower than P110.
[b]Applicable to coupling grades P110 and higher.
[c]Applicable to coupling grades lower than J55 and K55.
[d]Applicable to coupling grades J55 and K55 and higher.

Table 7—Casing Long-Thread Dimensions

All dimensions in inches, except as indicated. See Figure 3.

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
Size Designation	Major Diameter D_4	No. of Threads per Inch	Length: End of Pipe to Hand-Tight Plane L_1	Length: Effective Threads L_2	Total Length: End of Pipe to Vanish Point L_4	Pitch Diameter at Hand-Tight Plane E_1	End of Pipe to Center of Coupling, Power-Tight Make-Up J	Length: Face of Coupling to Hand-Tight Plane M	Diameter of Coupling Recess Q	Depth of Coupling Recess q	Hand-Tight Standoff, Thread Turns A	Minimum Length, Full Crest Threads From End of Pipe L_c*
4 1/2	4.500	8	1.921	2.715	3.000	4.40337	0.500	0.704	4 19/32	.500	3	1.875
5	5.000	8	2.296	3.090	3.375	4.90337	0.500	0.704	5 3/32	.500	3	2.250
5 1/2	5.500	8	2.421	3.215	3.500	5.40337	0.500	0.704	5 19/32	.500	3	2.375
6 5/8	6.625	8	2.796	3.590	3.875	6.52837	0.500	0.704	6 23/32	.500	3	2.750
7	7.000	8	2.921	3.715	4.000	6.90337	0.500	0.704	7 3/32	.500	3	2.875
7 5/8	7.625	8	2.979	3.840	4.125	7.52418	0.500	0.709	7 25/32	.433	3 1/2	3.000
8 5/8	8.625	8	3.354	4.215	4.500	8.52418	0.500	0.709	8 25/32	.433	3 1/2	3.375
9 5/8	9.625	8	3.604	4.465	4.750	9.52418	0.500	0.709	9 25/32	.433	3 1/2	3.625[a]
9 5/8	9.625	8	3.537	4.465	4.750	9.51999	0.500	0.713	9 25/32	.433	4	3.625[b]
20	20.000	8	4.104	4.965	5.250	19.89918	0.500	0.709	20 7/32	.366	3 1/2	4.125[c]
20	20.000	8	4.037	4.965	5.250	19.89499	0.500	0.713	20 7/32	.366	4	4.125[d]

Included taper on diameter, all sizes, 0.0625 in. per in.

Note: Hand tight Standoff "A" is the basic allowance for basic power makeup of the joint as shown in Figure 3.
*$L_c = L_4 - 1.125$ in. for 8 Round Thread Casing.
[a]Applicable to coupling grades lower than P110.
[b]Applicable to coupling grades P110 and higher.
[c]Applicable to coupling grades lower than J55 and K55.
[d]Applicable to coupling grades J55 and K55 and higher.

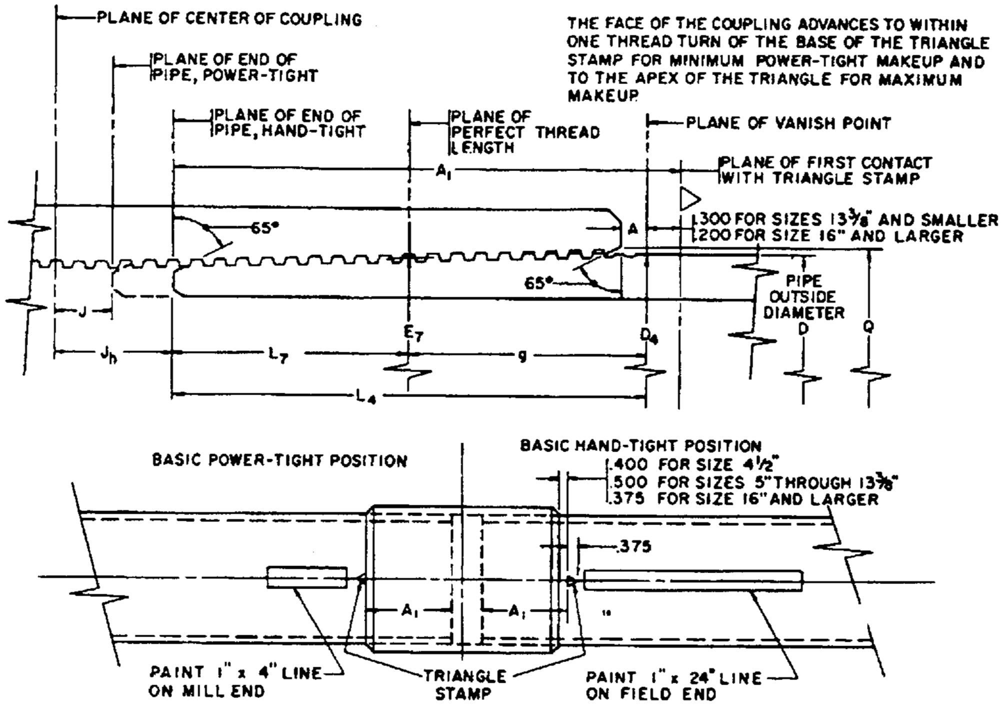
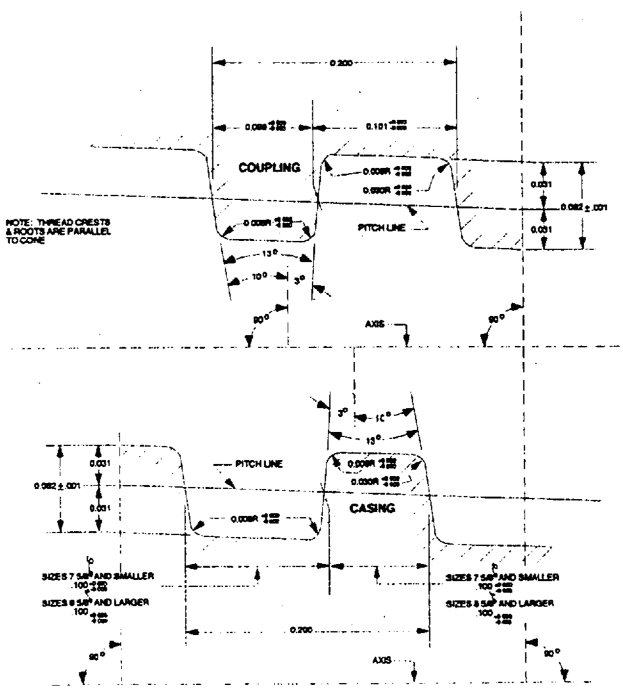
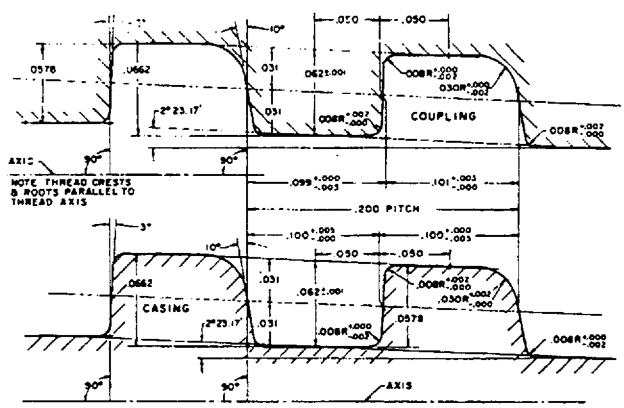


Figure 5—Basic Dimensions of Buttress Casing Threads Hand-Tight Make-Up
(See Figures 6 and 7 for detail of thread form and dimensions.)



TAPER = 3/4 IN. PER FT. OR 0.0625 IN. PER IN. ON DIAM.

Figure 6—Buttress Casing Thread Form and Dimensions—For Casing Sizes 4 1/2 through 13 3/8 in.



TAPER = 1 IN. PER FT. OR 0.0833 IN. PER IN. ON DIAM.

Figure 7—Buttress Casing Thread Form and Dimensions—For Casing Sizes 16 in. and Larger

Table 8—Tolerances on Buttress Casing Thread Dimensions[c]

(1) Element	(2) Tolerances
Taper:	
Coupling:	
per Foot on Diameter	+0.054 in. –0.030 in.
0.0625 in. per Inch on Diameter (4 1/2 in. through 13 3/8 in.)	+0.0045 in. –0.0025 in.
0.0833 in. per Inch on Diameter (16 in. and Larger)	+0.0045 in. –0.0025 in.
Pipe (In perfect thread length):	
per Foot on Diameter	+0.042 in. –0.018 in.
0.0625 in. per Inch on Diameter (4 1/2 in. through 13 3/8 in.)	+0.0035 in. –0.0015 in.
0.0833 in. per Inch on Diameter (16 in. and Larger)	+0.0035 in. –0.0015 in.
Pipe (In imperfect thread length):[a]	
per Foot on Diameter	+0.054 in. –0.018 in.
0.0625 in. per Inch on Diameter (4 1/2 in. through 13 3/8 in.)	+0.0045 in. –0.0015 in.
0.0833 in. per Inch on Diameter (16 in. and Larger)	+0.0045 in. –0.0015 in.
Lead:[b]	
Per Inch	
13 3/8 in. and smaller	±0.002 in.
16 in. and larger	±0.003 in.
Cumulative	±0.004 in.
Thread Height:	0.062 ± .001
Angle, included:	±1 deg.
Length, L_4 (external thread):	
Tolerance not specified because of type of thread	
Length A_1:	±1/32 in.
Chamfer:	
On outside end of threaded pipe and coupling	+5 deg. –0 deg.
Standoff A:	See Par. 4.4

[a]Taper of the thread root (or "minor") cone should not increase over the maximum tolerance at the point of intersection with the pipe outside diameter.
[b]The lead tolerance per inch is the maximum allowable error in any inch within the perfect thread length. The cumulative tolerance is the maximum allowable error over the full perfect thread length. The perfect thread length for (external and internal) threads is defined by paragraph 5.14.
[c]Tolerances apply to both external and internal threads except where otherwise indicated.

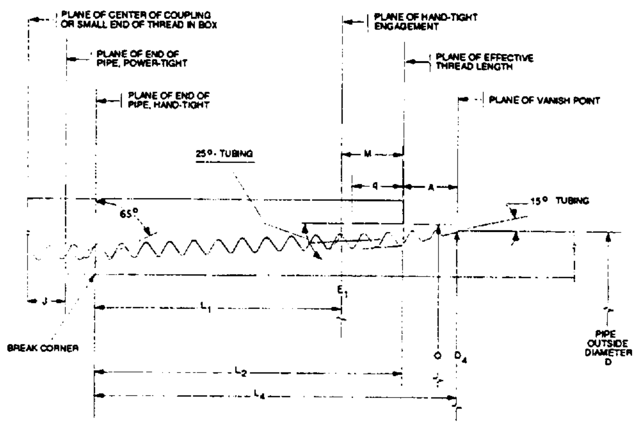
Table 9—Buttress Casing Thread Dimensions

All dimensions in inches, except as indicated. See Figure 5.

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
Size: Outside Diameter D	Major Diameter D_4	No. of Threads per Inch	Length: Imperfect Threads g	Length: Perfect Threads L_7	Total Length: End of Pipe to Vanish Point L_4	Pitch Diameter[a] E_7	End of Pipe to Center of Coupling, Power-Tight Make-Up J	End of Pipe to Center of Coupling, Hand-Tight Make-Up J_n	Length: Face of Coupling to Plane E_7	Length: End of Pipe to Triangle Stamp A_1	Hand-Tight Standoff Threads Turns A	Diameter of Counterbore in Coupling Q	Minimum Length, Full Crest Threads From End of Pipe L_c*
4 1/2	4.516	5	1.984	1.6535	3.6375	4.454	0.500	0.900	1.884	3 15/16	1/2	4.640	1.2535
5	5.016	5	1.984	1.7785	3.7625	4.954	0.500	1.000	1.784	4 1/16	1	5.140	1.3785
5 1/2	5.516	5	1.984	1.8410	3.8250	5.454	0.500	1.000	1.784	4 1/8	1	5.640	1.4410
6 5/8	6.641	5	1.984	2.0285	4.0125	6.579	0.500	1.000	1.784	4 5/16	1	6.765	1.6285
7	7.016	5	1.984	2.2160	4.2000	6.954	0.500	1.000	1.784	4 1/2	1	7.140	1.8160
7 5/8	7.641	5	1.984	2.4035	4.3875	7.579	0.500	1.000	1.784	4 11/16	1	7.765	2.0035
8 5/8	8.641	5	1.984	2.5285	4.5125	8.579	0.500	1.000	1.784	4 13/16	1	8.765	2.1285
9 5/8	9.641	5	1.984	2.5285	4.5125	9.579	0.500	1.000	1.784	4 13/16	1	9.765	2.1285
10 3/4	10.766	5	1.984	2.5285	4.5125	10.704	0.500	1.000	1.784	4 13/16	1	10.890	2.1285
11 3/4	11.766	5	1.984	2.5285	4.5125	11.704	0.500	1.000	1.784	4 13/16	1	11.890	2.1285
13 3/8	13.391	5	1.984	2.5285	4.5125	13.329	0.500	1.000	1.784	4 13/16	1	13.515	2.1285
16	16.000	5	1.488	3.1245	4.6125	15.938	0.500	0.875	1.313	4 13/16	7/8	16.154	2.7245
18 5/8	18.625	5	1.488	3.1245	4.6125	18.563	0.500	0.875	1.313	4 13/16	7/8	18.779	2.7245
20	20.000	5	1.488	3.1245	4.6125	19.938	0.500	0.875	1.313	4 13/16	7/8	20.154	2.7245

Included taper on diameter: Sizes 13 3/8 and smaller - 0.0625 in. per in.
Sizes 16 and larger - 0.0833 in. per in.

Notes:
1. At plane of perfect thread length L_7, the basic major diameter of the pipe thread and plug gage thread is 0.016 in. greater than specified pipe diameter D for sizes 13 3/8 and smaller, and is equal to the specified pipe diameter for sizes 16 and larger
2. Hand tight Standoff "A" is the basic allowance for basic power makeup of the joint as shown in Figure 5. The 3/8 in. equilateral triangle stamp located on the pipe at the length A_1 from the end of the pipe facilitates obtaining the power makeup provided for by the Hand tight Standoff "A".
[a]Pitch diameter on buttress casing thread is defined as being midway between the major and minor diameters.
*$L_c = L_7 - 0.400$ in. for buttress thread casing. Within the L_c length, as many as 2 threads showing the original outside surface of the pipe on their crests for a circumferential distance not exceeding 25% of the pipe circumference is permissible. The remaining threads in the L_c thread length shall be full crested threads.



Notes:
1. The vanish cone angle is optional for round threads on downhole tools.
2. The vanish cone angle applies to the roots of the incomplete threads produced by either multiple point or single point tools.
3. For basic power-tight make-up, the face of coupling or box advances to plane of vanish point.

Figure 8—Basic Dimensions of Tubing Round Threads Hand-Tight Make-Up

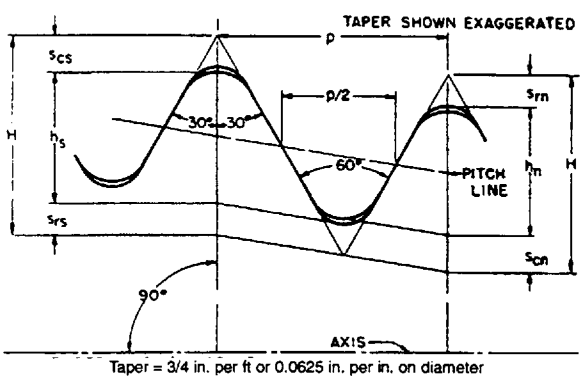


Figure 9—Tubing Round Thread Form (See Table 10 for dimensions)

Table 10—Tubing Round Thread Height Dimensions

All dimensions in inches. See Figure 8.

Thread Element	10 Threads per inch $p = 0.1000$	8 Threads per inch $p = 0.1250$
$H = 0.866p$	0.08660	0.10825
$h_s = h_n = 0.626p - 0.007$	0.05580	0.07125
$s_{rs} = s_{rn} = 0.120p + 0.002$	0.01400	0.01700
$s_{cs} = s_{cn} = 0.120p + 0.005$	0.01700	0.02000

Note: Calculations for H, h_s, and h_n are based on formulas for a symmetrical straight screw thread rather than a symmetrical tapered thread. The resulting differences are deemed to be insignificant for threads with 0.125 in. pitch and 3/4 in. per foot taper or less.

Table 11—Tolerances on Tubing Round-Thread Dimensions[c]

(1) Element	(2) Tolerances
Taper:	
Per Foot on Diameter:	
Non-Upset tubing and regular thread external-upset tubing	+0.0625 in. −0.0312 in.
Per Inch on Diameter:	
Non-Upset tubing and regular thread external-upset tubing	+0.0052 in. −0.0026 in.
Lead:[a]	
per Inch:	
Non-Upset tubing and regular thread external-upset tubing	±0.003 in.
cumulative	
Non-Upset tubing and regular thread external-upset tubing	±0.006 in.
Height, h_s and h_n:	
Non-Upset tubing and regular thread external-upset tubing	+0.002 in. −0.004 in.
Angle, included ±1 1/2 deg.	
Length, L_4 (external thread):[b]	
8-Thread per in.	±1 p
10-Thread per in.	
External-Upset	±1 1/2p −3/4p
Non-Upset	±1 1/2p
Chamfer: (On outside end of threaded pipe)	+5 deg. −0 deg.
Standoff A:	See Par. 4.4

[a]For pipe (external threads) the lead tolerance per inch is the maximum allowable error in any inch within the length L_4–g. See Sect. 5 for g dimensions. The cumulative lead tolerance is the maximum allowable error over the entire length L_4–g. For internal threads, lead measurements shall be made within the length from the recess to a plane located at a distance J + one thread turn from the center of the coupling or from the small end of the thread in the box of integral joint tubing.
[b]L_4 is acceptable: a, if the distance from the end of the pipe to the vanish plane (at the point where the outside diameter of the pipe is a maximum) is within the above minus tolerance; or b, if the distance from the end of the pipe to the vanish plane (where the outside diameter of the pipe is a minimum) is within the above plus tolerance.
[c]Tolerances apply to both external and internal threads except where otherwise indicated.
[d]For tolerances on fiberglass long round pipe threads, see applicable fiberglass pipe standards.

Table 12—Non-Upset Tubing Thread Dimensions

All dimensions in inches, except as indicated. See Figure 8.

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
Size: Designation	Major Diameter D_4	No. of Threads per Inch	Length: End of Pipe to Hand-Tight Plane L_1	Length: Effective Threads L_2	Total Length: End of Pipe to Vanish Point L_4	Pitch Diameter at Hand-Tight Plane E_1	End of Pipe to Center of Coupling, Power-Tight Make-Up J	Length: Face of Coupling to Hand-Tight Plane M	Diameter of Coupling Recess Q	Depth of Coupling Recess q	Hand-Tight Standoff, Thread Turns A	Minimum Length, Full Crest Threads From End of Pipe L_c*
1.050	1.050	10	0.448	0.925	1.094	0.98826	0.500	0.446	1.113	5/16	2	0.300
1.315	1.315	10	0.479	0.956	1.125	1.25328	0.500	0.446	1.378	5/16	2	0.300
1.660	1.660	10	0.604	1.081	1.250	1.59826	0.500	0.446	1.723	5/16	2	0.350
1.900	1.900	10	0.729	1.206	1.375	1.83826	0.500	0.446	1.963	5/16	2	0.475
2 3/8	2.375	10	0.979	1.456	1.625	2.31326	0.500	0.446	2.438	5/16	2	0.725
2 7/8	2.875	10	1.417	1.894	2.063	2.81326	0.500	0.446	2.938	5/16	2	1.163
3 1/2	3.500	10	1.667	2.144	2.313	3.43826	0.500	0.446	3.563	5/16	2	1.413
4	4.000	8	1.591	2.140	2.375	3.91395	0.500	0.534	4.063	3/8	2	1.375
4 1/2	4.500	8	1.779	2.328	2.563	4.41395	0.500	0.534	4.563	3/8	2	1.563

Included taper on diameter, all sizes, 0.0625 in. per in.

Note: Hand tight Standoff "A" is the basic allowance for basic power makeup of the joint as shown in Figure 8.
*$L_c = L_4 - 0.900$ in. for 10 thread tubing, but not less than 0.300 in.
$L_c = L_4 - 1.000$ in. for 8 thread tubing.

Table 13—External-Upset Tubing Thread Dimensions

All dimensions in inches, except as indicated. See Figure 8.

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
Size: Designation	Major Diameter D_4	No. of Threads per Inch	Length: End of Pipe to Hand-Tight Plane L_1	Length: Effective Threads L_2	Total Length: End of Pipe to Vanish Point L_4	Pitch Diameter at Hand-Tight Plane E_1	End of Pipe to Center of Coupling, Power-Tight Make-Up J	Length: Face of Coupling to Hand-Tight Plane M	Diameter of Coupling Recess Q	Depth of Coupling Recess q	Hand-Tight Standoff, Thread Turns A	Minimum Length, Full Crest Threads From End of Pipe L_c*
1.050	1.315	10	0.479	0.956	1.125	1.25328	0.500	0.446	1.378	5/16	2	0.300
1.315	1.469	10	0.604	1.081	1.250	1.40706	0.500	0.446	1.531	5/16	2	0.350
1.660	1.812	10	0.729	1.206	1.375	1.75079	0.500	0.446	1.875	5/16	2	0.475
1.900	2.094	10	0.792	1.269	1.438	2.03206	0.500	0.446	2.156	5/16	2	0.538
2 3/8	2.594	8	1.154	1.703	1.938	2.50775	0.500	0.534	2.656	3/8	2	0.938
2 7/8	3.094	8	1.341	1.890	2.125	3.00775	0.500	0.534	3.156	3/8	2	1.125
3 1/2	3.750	8	1.591	2.140	2.375	3.66395	0.500	0.534	3.813	3/8	2	1.375
4	4.250	8	1.716	2.265	2.500	4.16395	0.500	0.534	4.313	3/8	2	1.500
4 1/2	4.750	8	1.841	2.390	2.625	4.66395	0.500	0.534	4.813	3/8	2	1.625

Included taper on diameter, all sizes, 0.0625 in. per in.

Note: Hand tight Standoff "A" is the basic allowance for basic power makeup of the joint as shown in Figure 8.

*$L_c = L_4 - 0.900$ in. for 10 thread tubing, but not less than 0.300 in.

$L_c = L_4 - 1.000$ in. for 8 thread tubing.

Table 14—External-Upset Long Round Thread Dimensions for Fiberglass Pipe

All dimensions in inches, except as indicated. See Figure 8.

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
Size: Designation	Major Diameter D_4	No. of Threads per Inch	Length: End of Pipe to Hand-Tight Plane L_1	Length: Effective Threads L_2	Total Length: End of Pipe to Vanish Point L_4	Pitch Diameter at Hand-Tight Plane E_1	End of Pipe to Center of Coupling, Power-Tight Make-Up J	Length: Face of Coupling to Hand-Tight Plane M	Diameter of Coupling Recess Q	Depth of Coupling Recess q	Hand-Tight Standoff, Thread Turns A	Minimum Length, Full Crest Threads From End of Pipe L_c*
1.050	1.315	10	0.979	1.456	1.625	1.25328	0.500	0.446	1.378	5/16	2	0.725
1.315	1.469	10	1.104	1.581	1.750	1.40706	0.500	0.446	1.531	5/16	2	0.850
1.660	1.812	10	1.229	1.706	1.875	1.75079	0.500	0.446	1.875	5/16	2	0.975
1.900	2.094	10	1.417	1.894	2.063	2.03206	0.500	0.446	2.156	5/16	2	1.163
2 3/8	2.594	8	1.779	2.328	2.563	2.50775	0.500	0.534	2.656	3/8	2	1.563
2 7/8	3.094	8	2.091	2.640	2.875	3.00775	0.500	0.534	3.156	3/8	2	1.875
3 1/2	3.750	8	2.341	2.890	3.125	3.66395	0.500	0.534	3.813	3/8	2	2.125
4	4.250	8	2.591	3.140	3.375	4.16395	0.500	0.534	4.313	3/8	2	2.375
4 1/2	4.750	8	2.716	3.265	3.500	4.66395	0.500	0.534	4.813	3/8	2	2.500

Included taper on diameter, all sizes, 0.0625 in. per in.

Note: Hand-tight Standoff "A" is the basic allowance for basic power makeup of the joint as shown in Figure 8.
*$L_c = L_4 - 0.900$ in. for 10 thread tubing.
$L_c = L_4 - 1.000$ in. for 8 thread tubing.

Table 15—Integral-Joint Tubing Thread Dimensions

All dimensions in inches, except as indicated. See Figure 8.

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
Size: Designation	Major Diameter D_4	No. of Threads per Inch	Length: End of Pipe to Hand-Tight Plane L_1	Length: Effective Threads L_2	Total Length: End of Pipe to Vanish Point L_4	Pitch Diameter at Hand-Tight Plane E_1	End of Pipe to Center of Coupling, Power-Tight Make-Up J	Length: Face of Coupling to Hand-Tight Plane M	Diameter of Coupling Recess Q	Depth of Coupling Recess q	Hand-Tight Standoff, Thread Turns A	Minimum Length, Full Crest Threads From End of Pipe L_c*
1.315	1.315	10	0.479	0.956	1.125	1.25328	0.500	0.446	1.378	5/32	2	0.225
1.660	1.660	10	0.604	1.081	1.250	1.59826	0.500	0.446	1.723	5/16	2	0.350
1.900	1.900	10	0.729	1.206	1.375	1.83826	0.500	0.446	1.963	5/16	2	0.475
2.063	2.094	10	0.792	1.269	1.438	2.03206	0.500	0.446	2.156	5/16	2	0.538

Included taper on diameter, all sizes, 0.0625 in. per in.

Note: Hand tight Standoff "A" is the basic allowance for basic power makeup of the joint as shown in Figure 8.
*$L_c = L_4 - 0.900$ in. for 10 thread tubing.

profile shall be rounded to provide for coatable service and the radius transition shall be smooth with no sharp corners, burrs, or slivers on the ID or OD chamfer surfaces. The dimensions listed in Table 16 are recommended values but are not subject to measurement to determine acceptance or rejection of the product.

4.2 EXTREME-LINE CASING

4.2.1 Connection

Extreme-line casing shall be furnished with threaded external upset pin and box ends. The made-up casing joint shall be shoulder-tight. The shoulder provides the stop that positions the engaging members in their proper interference fit. The thread and seal elements shall conform to the specifications herein. The seal interference is that occurring in the fit of pin seal to box seal at the tangent point (see Figures 10 and 11, dimensions A and O).

4.2.2 Seals

The seals shall be finished in a manner to assure a pressure-tight connection when properly made up power-tight. The seals shall have a surface finish free of any defects which could cause surface galling of the mating members when connection is made up properly.

Note: A tight joint is one which, when properly made up power-tight using a suitable thread compound, shows no leaks at ambient temperature at any pressure up to and including the specified hydrostatic test pressure.

4.2.3 Thread Dimensions

Extreme-line casing threads shall conform to the dimensions specified in Figures 12 through 15 and the tolerances given in Table 19 and shown in Figures 12 through 15. The thread lengths and length tolerances shall be as specified in Figures 10 and 11. All thread lengths shall be measured parallel to the thread axis; all thread heights and diameters shall be measured normal to the thread axis; the lead shall be measured parallel to the thread axis along the reference dimension line in the perfect thread portion. The pin member entrance threads shall be as shown in Figures 12 and 14.

4.2.4 Thread Finish

The threads shall be free of any defects which break their continuity. The box and pin threads shall be of such form and finish and shall be machined uniformly within the specified limits to assure interchangeability and the ability to withstand power make-up and break-out without injury to the thread or seal elements of either member when using a thread compound meeting or exceeding the performance requirements of the latest edition of API Recommended Practice 5A3. The threads and seal in the box or on the pipe male end of extreme-line casing shall be electroplated, heat treated, or processed by some other acceptable method which will minimize galling and develop the maximum leak resistance characteristics of the connection.

4.2.5 Other Machined Elements

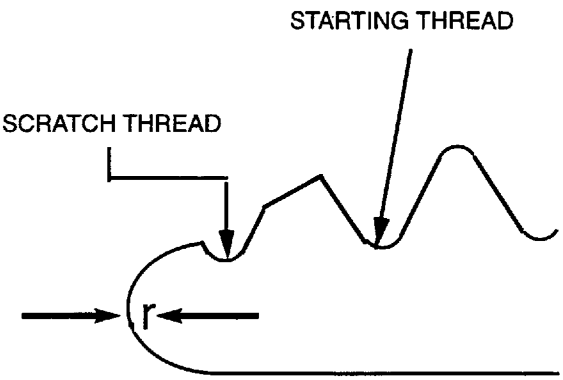
The pin shoulders and box faces shall be free of any defects which would cause a false standoff of the connection in the made-up position.

4.2.6 Gauging

The pin and box threads and seals shall be controlled by API certified reference master gauges in accordance with gauging practices in Sect. 6.2. All thread and seal elements shall be subject to inspection in accordance with Table 19 and Section 8.

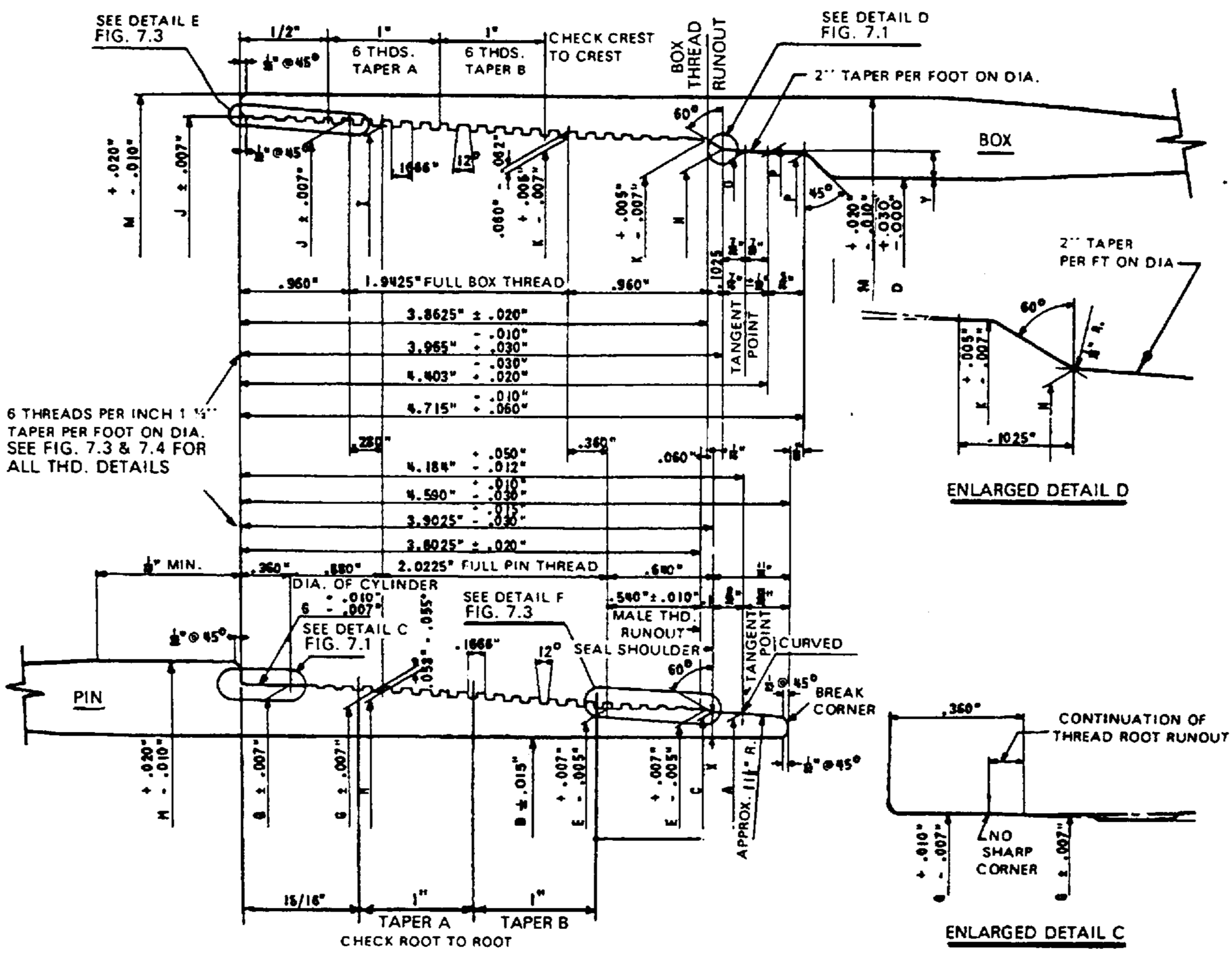
Continued on Page 25

Table 16—Round Nosed Ends



(1)	(2)
Size	Radius, r (in.)
2 3/8	3/32
2 7/8	3/32
3 1/2	1/8
4	1/8
4 1/2	1/8

Note: Radius transition shall be smooth with no sharp corners, burrs or slivers on ID or OD chamfer surfaces.



(See Table 17 for dimensions and standoff values.)
(See Figures 12 and 13 for thread details.)
(See Table 19 for thread and seal tolerances.)
(See Section 6.2 for gauging practice.)
(See Figure 11 and Table 18 for sizes over 7⅝ in.)

Figure 10—Machining Details—Sizes 5 Through 7⅝ In.

Table 17—Threading and Machining Dimensions—Sizes 5 Through 7⅝

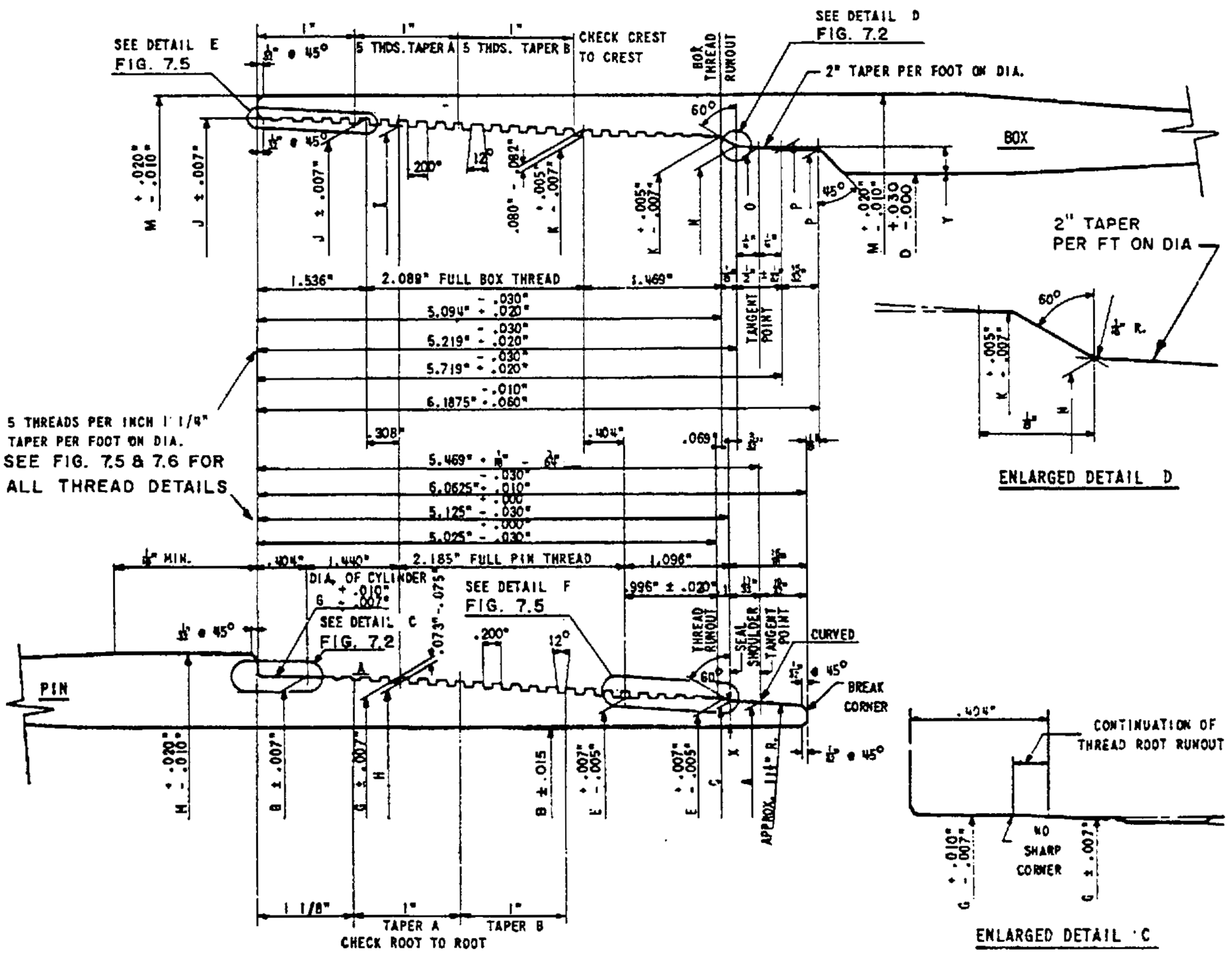
(See Figure 10 for illustration.)
(See Table 19 for thread and seal tolerances)
(See Sect. 6.2 for gauging practice)
(See Figure 11 and Table 18 for sizes over 7⅝ in.)
(All dimensions in inches, except as indicated)

(1)	(2)	(3)	(4)	(5)		(6)	(7)	(8)	(9)	(10)	(11)		(12)		(13)
		Threading and Machining Dimensions													
Size OD	Nom. Weight lb. per ft.	Made-Up Joint ID (Nom.)	Drift Dia. for Bored Upset	A Max.	A Min.	B	C	D	E	G	H Min.	H Max.	I Min.	I Max.	J
	15.00	4.198	4.183	4.504	4.506	4.208	4.545	4.235	4.575	4.938	4.827	4.829	4.819	4.821	4.975
5	18.00	4.198	4.183	4.504	4.506	4.208	4.545	4.235	4.575	4.938	4.827	4.829	4.819	4.821	4.975
	15.50	4.736	4.721	5.008	5.010	4.746	5.048	4.773	5.079	5.442	5.331	5.333	5.323	5.325	5.479
	17.00	4.701	4.686	5.008	5.010	4.711	5.048	4.738	5.079	5.442	5.331	5.333	5.323	5.325	5.479
5½	20.00	4.701	4.686	5.008	5.010	4.711	5.048	4.738	5.079	5.442	5.331	5.333	5.323	5.325	5.479
	23.00	4.610	4.595	5.007	5.009	4.619	5.048	4.647	5.079	5.441	5.330	5.332	5.323	5.325	5.479
	24.00	5.781	5.766	6.089	6.091	5.792	6.130	5.818	6.160	6.523	6.412	6.414	6.403	6.405	6.559
6⅝	28.00	5.731	5.716	6.088	6.090	5.741	6.129	5.768	6.160	6.522	6.411	6.413	6.403	6.405	6.559
	32.00	5.615	5.600	6.088	6.090	5.624	6.129	5.652	6.159	6.522	6.411	6.413	6.404	6.406	6.560
	23.00	6.171	6.156	6.477	6.479	6.182	6.518	6.208	6.549	6.912	6.801	6.803	6.792	6.794	6.948
	26.00	6.171	6.156	6.477	6.479	6.182	6.518	6.208	6.549	6.912	6.801	6.803	6.792	6.794	6.948
	29.00	6.123	6.108	6.477	6.479	6.134	6.518	6.160	6.549	6.912	6.801	6.803	6.792	6.794	6.948
7	32.00	6.032	6.017	6.477	6.479	6.042	6.518	6.069	6.548	6.911	6.800	6.802	6.792	6.794	6.948
	35.00	5.940	5.925	6.476	6.478	5.949	6.517	5.977	6.548	6.911	6.800	6.802	6.793	6.795	6.949
	38.00	5.860	5.845	6.476	6.478	5.869	6.517	5.897	6.548	6.911	6.800	6.802	6.793	6.795	6.949
	26.40	6.770	6.755	7.072	7.074	6.782	7.113	6.807	7.148	7.511	7.400	7.402	7.390	7.392	7.546
	29.70	6.770	6.755	7.072	7.074	6.782	7.113	6.807	7.148	7.511	7.400	7.402	7.390	7.392	7.546
7⅝	33.70	6.705	6.690	7.072	7.074	6.716	7.112	6.742	7.147	7.510	7.399	7.401	7.390	7.392	7.548
	39.00	6.565	6.550	7.071	7.073	6.575	7.112	6.602	7.147	7.510	7.399	7.401	7.391	7.393	7.549

Table 17—Threading and Machining Dimensions—Sizes 5 Through 7⅝ (Continued)

(See Figure 10 for illustration.)
(See Table 19 for thread and seal tolerances)
(See Sect. 6.2 for gauging practice)
(See Figure 11 and Table 18 for sizes over 7⅝ in.)
(All dimensions in inches, except as indicated)

(1)	(2)	(14)	(15)		(16)	(17)		(18)	(19)	(20)	(21)		(22)		(23)		(24)	
		Threading and Machining Dimensions									Gauge to Product Standoff							
											Ring to Pin				Plug to Box			
			M			O					Seal		Thread		Seal		Thread	
Size OD	Nom. Weight, lb. per ft.	K	Std. Jt.	Opt. Jt.	N	Min.	Max.	P	X Min.	Y Max.	j Min.	i Max.	h Min.	g Max.	b Min.	a Max.	d Min.	c Max.
	15.00	4.612	5.360	—	4.534	4.496	4.498	4.461	.151	.140	.144	.156	.326	.342	1.042	1.054	.072	.088
5	18.00	4.612	5.360	—	4.534	4.496	4.498	4.461	.151	.140	.144	.156	.326	.342	1.042	1.054	.072	.088
	15.50	5.116	5.860	5.780	5.037	5.000	5.002	4.964	.134	.122	.139	.151	.310	.326	1.039	1.051	.060	.076
	17.00	5.116	5.860	5.780	5.037	5.000	5.002	4.964	.151	.140	.139	.151	.310	.326	1.039	1.051	.060	.076
5½	20.00	5.116	5.860	5.780	5.037	5.000	5.002	4.964	.151	.140	.139	.151	.310	.326	1.039	1.051	.060	.076
	23.00	5.116	5.860	5.780	5.038	5.000	5.002	4.964	.197	.186	.136	.148	.306	.322	1.036	1.048	.056	.072
	24.00	6.196	7.000	6.930	6.117	6.080	6.082	6.044	.151	.140	.148	.160	.358	.374	1.048	1.060	.108	.124
6⅝	28.00	6.196	7.000	6.930	6.118	6.080	6.082	6.045	.177	.165	.145	.157	.354	.370	1.045	1.057	.104	.120
	32.00	6.197	7.000	6.930	6.118	6.081	6.083	6.045	.235	.223	.142	.154	.350	.366	1.042	1.054	.100	.116
	23.00	6.585	7.390	7.310	6.506	6.468	6.470	6.433	.151	.139	.151	.163	.364	.380	1.051	1.063	.112	.128
	26.00	6.585	7.390	7.310	6.506	6.468	6.470	6.433	.151	.139	.151	.163	.364	.380	1.051	1.063	.112	.128
	29.00	6.585	7.390	7.310	6.506	6.468	6.470	6.433	.175	.163	.151	.163	.364	.380	1.051	1.063	.112	.128
7	32.00	6.585	7.390	7.310	6.506	6.469	6.471	6.433	.220	.209	.148	.160	.360	.376	1.048	1.060	.108	.124
	35.00	6.586	7.530	7.390	6.507	6.469	6.471	6.434	.267	.255	.145	.157	.356	.372	1.045	1.057	.104	.120
	38.00	6.586	7.530	7.390	6.507	6.469	6.471	6.434	.307	.295	.145	.157	.356	.372	1.045	1.057	.104	.120
	26.40	7.183	8.010	7.920	7.100	7.062	7.064	7.026	.148	.137	.157	.169	.350	.366	1.057	1.069	.104	.120
	29.70	7.183	8.010	7.920	7.100	7.062	7.064	7.026	.148	.137	.157	.169	.350	.366	1.057	1.069	.104	.120
7⅝	33.70	7.183	8.010	7.920	7.100	7.062	7.064	7.027	.181	.169	.154	.166	.346	.362	1.054	1.066	.100	.116
	39.00	7.184	8.010	7.920	7.100	7.063	7.065	7.028	.251	.240	.151	.163	.342	.358	1.051	1.063	.096	.112



(See Table 18 for dimensions and standoff values.)
(See Figure 14 and 15 for thread details.)
(See Table 19 for thread and seal tolerances.)
(See Section 6.2 for gauging practice.)
(See Figure 10 and Table 17 for sizes under 8⁵/8.)

Figure 11—Machining Details—Sizes 8⁵/8 Through 10³/4

Table 18—Threading and Machining Dimensions—Sizes $8^5/_8$ Through $10^3/_4$

(See Figure 11 for illustration)
(See Table 17 for thread and seal tolerances)
(See Section 6.2 for gauging practice)
(See Figure 10 and Table 17 for sizes under $8^5/_8$)
(All dimensions in inches, except as indicated)

(1)	(2)	(3)	(4)	(5)		(6)	(7)	(8)	(9)	(10)	(11)		(12)		(13)
		Threading and Machining Dimensions													
Size OD	Nom. Weight lb. per ft.	Made-Up Joint ID (Nom.)	Drift Dia. for Bored Upset	A Max.	A Min.	B	C	D	E	G	H Min.	H Max.	I Min.	I Max.	J
	32.00	7.725	7.710	8.100	8.102	7.737	8.148	7.762	8.192	8.569	8.418	8.420	8.408	8.410	8.601
	36.00	7.725	7.710	8.100	8.102	7.737	8.148	7.762	8.192	8.569	8.418	8.420	8.408	8.410	8.601
$8^5/_8$	40.00	7.663	7.648	8.100	8.102	7.674	8.148	7.700	8.192	8.569	8.418	8.420	8.409	8.411	8.602
	44.00	7.565	7.550	8.100	8.102	7.575	8.147	7.602	8.191	8.568	8.417	8.419	8.409	8.411	8.602
	49.00	7.451	7.436	8.099	8.101	7.460	8.147	7.488	8.191	8.568	8.417	8.419	8.410	8.412	8.603
	40.00	8.665	8.650	9.041	9.043	8.677	9.089	8.702	9.134	9.512	9.361	9.363	9.351	9.353	9.544
	43.50	8.665	8.650	9.041	9.043	8.677	9.089	8.702	9.134	9.512	9.361	9.363	9.351	9.353	9.544
$9^5/_8$	47.00	8.621	8.606	9.041	9.043	8.633	9.089	8.658	9.134	9.512	9.361	9.363	9.351	9.353	9.544
	53.50	8.475	8.460	9.040	9.042	8.485	9.088	8.512	9.133	9.511	9.360	9.362	9.352	9.354	9.545
	45.50	9.819	9.804	10.286	10.288	9.829	10.334	9.854	10.378	10.756	10.605	10.607	10.597	10.599	10.790
	51.00	9.719	9.704	10.286	10.288	9.729	10.334	9.754	10.378	10.756	10.605	10.607	10.597	10.599	10.790
$10^3/_4$	55.50	9.629	9.614	10.286	10.288	9.639	10.334	9.664	10.378	10.756	10.605	10.607	10.597	10.599	10.790
	60.70	9.529	9.514	10.286	10.288	9.539	10.334	9.564	10.378	10.756	10.605	10.607	10.597	10.599	10.790

Table 18—Threading and Machining Dimensions—Sizes $8^5/_8$ Through $10^3/_4$ (Continued)

(See Figure 11 for illustration)
(See Table 17 for thread and seal tolerances)
(See Section 6.2 for gauging practice)
(See Figure 10 and Table 17 for sizes under $8^5/_8$)
(All dimensions in inches, except as indicated)

(1)	(2)	(14)	(15)		(16)	(17)		(18)	(19)	(20)	(21)		(22)		(23)		(24)	
		Threading and Machining Dimensions									Gauge to Product Standoff							
											Ring to Pin				Plug to Box			
			M			O					Seal		Thread		Seal		Thread	
Size OD	Nom. Weight, lb. per ft.	K	Std. Jt.	Opt. Jt.	N	Min.	Max.	P	X Min.	Y Max	j Min.	i Max.	h Min.	g Max.	b Min.	a Max.	d Min.	c Max.
	32.00	8.224	9.120	9.030	8.133	8.090	8.092	8.050	.188	.173	.160	.172	.355	.374	1.060	1.072	.106	.125
$8^5/_8$	36.00	8.224	9.120	9.030	8.133	8.090	8.092	8.050	.188	.173	.160	.172	.355	.374	1.060	1.072	.106	.125
	40.00	8.224	9.120	9.030	8.134	8.091	8.093	8.050	.219	.205	.157	.169	.350	.370	1.057	1.069	.101	.120
	44.00	8.225	9.120	9.030	8.134	8.092	8.094	8.051	.269	.253	.154	.166	.346	.365	1.054	1.066	.096	.115
	49.00	8.225	9.120	9.030	8.135	8.092	8.094	8.051	.326	.311	.151	.163	.341	.360	1.051	1.063	.091	.110
	40.00	9.167	10.100	10.020	9.074	9.031	9.033	8.991	.189	.174	.160	.172	.355	.374	1.060	1.072	.106	.125
	43.50	9.167	10.100	10.020	9.074	9.031	9.033	8.991	.189	.174	.160	.172	.355	.374	1.060	1.072	.106	.125
$9^5/_8$	47.00	9.167	10.100	10.020	9.074	9.031	9.033	8.991	.211	.196	.160	.172	.355	.374	1.060	1.072	.106	.125
	53.50	9.168	10.100	10.020	9.075	9.032	9.034	8.992	.284	.269	.154	.166	.346	.365	1.054	1.066	.096	.115
	45.50	10.413	11.460	—	10.321	10.278	10.280	10.237	.236	.220	.154	.166	.346	.365	1.054	1.066	.096	.115
$10^3/_4$	51.00	10.413	11.460	—	10.321	10.278	10.280	10.237	.286	.270	.154	.166	.346	.365	1.054	1.066	.096	.115
	55.50	10.413	11.460	—	10.321	10.278	10.280	10.237	.331	.315	.154	.166	.345	.365	1.054	1.066	.096	.115
	60.70	10.413	11.460	—	10.321	10.278	10.280	10.237	.381	.365	.154	.166	.346	.365	1.054	1.066	.096	.115

Table 19—Inspection of Extreme-Line Threads and Seals with Dimensions and Tolerances

THREAD TAPER

Taper shall be defined as the change in the cone diameter along the minor thread taper cone. The pin taper shall be measured in the thread roots; the box taper shall be measured on the thread crests. The box and pin tapers shall be measured through positions shown as taper A and taper B in Figures 10 and 11. The taper elements shall be as follows:

	Taper Limit on Diameter	
Position	Minimum in. per in.	Maximum in. per in.
Sizes 5 through $7^5/_8$ in.:		
Pin end taper A & B	0.123	0.127
Box end taper A	0.123	0.128
Box end taper B	0.123	0.127
Sizes $8^5/_8$ through $10^3/_4$ in.:		
Pin end taper A & B	0.102	0.106
Box end taper A	0.102	0.107
Box end taper	0.102	0.106

The thread of the pin member has two tapers as shown in detail F, Figures 12 and 14. The taper of the imperfect entrance thread adjacent to the seal is greater than that through positions shown as tapers A and B in Figures 10 and 11. The imperfect pin and box starting thread crests are normal while the roots of these threads are not, due to truncation—see details E and F, Figures 12 and 14 (see Note 1). The reverse condition occurs in the box mating threads adjacent to the box seal and on the male runout threads adjacent to the shoulder cylinder. These imperfect threads have normal roots on the same taper as the perfect threads while the crests are not normal due to truncation (see Figures 10 and 11).

Note 1: Strict conformance to profile details indicated for entrance threads is not mandatory. Modifications to facilitate generation of these threads in keeping with the various methods of manufacture, or to ease or simplify inspection, are permissible, provided such changes do not in any way impair the functioning of the joint with respect to handling, stabbing, makeup, interchangeability, performance properties, and service. Figures 12 and 14 show details of two entrance thread designs for both box and pin, representative of the two commonly used methods of machining.

Internal thread taper measurements shall be made on the thread crests. Three readings are required to cover tapers A and B. For measurements in taper area A, an internal taper gauge (see Note 2) fitted with the proper extension arm for the size of the thread to be inspected is required. The square contact point in the fixed end of the gauge shall be placed on the thread crest previously specified and the square contact point of the plunger is placed on the crest diametrically opposite.

Note 2: An internal micrometer fitted with flat contacts is also acceptable.

For pipe sizes 5 through $7^5/_8$, the inspection area shall start at a distance $^1/_2$ in. from the face of the box, which coincides with the fourth thread crest.

For pipe sizes $8^5/_8$ through $10^3/_4$, the inspection area shall start at a distance 1 in. from the face of the box, which coincides with the fifth thread crest.

The fixed point shall be held firmly in position, the plunger point oscillated through a small arc and the dial gauge set so that the zero position coincides with the maximum indication.

In a similar manner, the second reading of taper area A is made at the same radial position relative to the axis of the thread but at an additional 1 in. interval. This resulting reading is the actual taper for area A.

Measurement of taper area B commences with the last area A reading and concludes with the final reading taken at an additional 1 in. interval. The difference between these successive measurements shall be the taper of that interval of threads.

Contact Points

For all taper gauge points, all sizes, the point dimension shall be 0.060 in. in diameter. The recommended contact points for pin threads shall be of the ball type. The contact points for the box threads shall be flat bottomed square block type.

THREAD LEAD

Lead shall be measured through positions shown as follows:

Taper A and B (Figures 10 and 11)	Tolerance (in.)
Per inch	±0.003
Per meter	—
Cumulative	±0.006

Contact Points

Lead gauge contact points shall be of the truncated ball type (truncated 0.023 in. from the crest of the diameter).

Size	Ball-Point Diameter
5 through $7^5/_8$	0.087 in.
$8^5/_8$ through $10^3/_4$	0.105 in.

The standard templates shall be so constructed so as to compensate for the error in measuring lead parallel to the taper cone instead of parallel to the thread axis, according to the following values:

Length of Thread (Parallel to Thread Axis)	Compensated Length (Parallel to Taper Cone) For Threads having a Taper of: $1^1/_4$ in. per ft.	$1^1/_2$ in. per ft.
1	1.00136	1.00195
2	2.00271	2.00390

The distance between any two adjacent notches of the template shall be accurate within a tolerance of ±0.0001 in., and between any two non-adjacent notches within a tolerance of ±0.0002 in.

THREAD HEIGHT AND WIDTH

Height and width of threads shall be as shown in Figures 12 through 15. The height, width, and angle deviations appearing, as viewed and/or measured on an optical comparator relative to an imposed perfect thread profile template, constitute the applicable combined tolerances for these elements.

Note 3: Provided all other thread element dimensions are within the tolerances stipulated herein, an additional tolerance of + 0.001 in. on thread height is acceptable.

Contact Points

Thread height gauges shall be fitted with a conical point $^1/_8$ in. long. For 5 through $7^5/_8$, the point shall be tapered from 0.062 in. diameter to a 0.050 in. diameter at the tip. For $8^5/_8$ through $10^3/_4$, the point shall be tapered from 0.079 in. diameter to a 0.050 in. diameter at the tip.

Thread-Height Gauge and Check Block for All Sizes of Extreme-Line Casing

Extreme-line check blocks shall conform to the following dimensions within a tolerance of ±0.0002 in.:

	Pin (in.)	Box (in.)
Sizes 5 through $7^5/_8$		
Width of groove at base of 6" flanks	0.080	0.080
Depth of groove from 1st plateau	0.0488	0.0558
Depth of groove from 2nd plateau	0.0592	0.0662
Sizes $8^5/_8$ through $10^3/_4$		
Width of groove at base of 6" flanks	0.100	0.100
Depth of groove from 1st plateau	0.0688	0.0758
Depth of groove from 2nd plateau	0.0792	0.0862

Extreme-line thread height gauges having dials for determining the error in height of a thread shall be adjusted to register zero when applied to the proper 6 degree flank groove of the step-type check block.

Thread lengths shall be as shown in Figures 10 and 11.

The box member seal surface shall be conical at a taper of 2 in. per ft. on diameter, $\pm^1/_{16}$ in. per ft. The pin member seal surface shall be curved to a radius of $11^1/_2$ in. $\pm^1/_4$ in. centered as shown in Figures 12 and 14.

Thread and seal gauge standoff values shall be as shown in Tables 17 and 18.

5 Thread Inspection

5.1 LINE PIPE, ROUND THREAD CASING AND TUBING, AND BUTTRESS THREAD CASING

PRECAUTIONS

5.1.1 Temperature

All instruments shall be exposed to the same temperature conditions as the product to be inspected, for a time sufficient to eliminate temperature difference.

5.1.2 Care of Instruments

The instruments described herein are precision instruments and should be handled in a careful and intelligent manner, commensurate with the maintenance of the high accuracy and precision required for inspection under this specification. If any instrument is dropped or shocked, it shall not be used for inspection purposes until its accuracy has been re-established.

5.1.3 Cleaning the Threads

All threads shall be cleaned thoroughly before inspection.

LOCATION OF MEASUREMENTS

5.1.4 Locations of First and Last Perfect Threads

a. The first perfect thread location is the thread nearest the chamfer on the pin or face of the coupling with a root having a full crest on both sides.

b. The last perfect thread location on external threads shall be $L_4 - g$ for tubing and Line Pipe, L7 for buttress, and last scratch (Last Thread Groove) –0.500 in. for casing round threads. For casing, the distance from the end of the pipe to the Last Perfect Thread is called the Thread Element Control Length or TECL. The last perfect thread location on internal threads is $J + l_P$ measured from the physical center of the coupling or from the small end of the box for integral joint tubing.

5.1.5 Measuring Intervals

a. Thread Height. For the gauging of external or internal threads, measurements shall be made at the first and last perfect threads where full crested threads exist and continued from either in 1 in. intervals for products having a distance between the first and last perfect threads of more than 1 in.; ½ in. intervals for products having a distance between the first and last perfect threads of 1 in. to ½ in.; and intervals consisting of 4 threads for products having 11½ threads per inch.

b. Lead/Taper

1. Common Intervals. For the gauging of external or internal threads, lead and taper measurements shall be made starting at the first or last perfect thread and continued from either in 1 in. intervals for products having a distance between the first and last perfect threads of more than 1 in.; ½ in. intervals for products having a distance between the first and last perfect threads of ½ in. to 1 in.; and intervals consisting of 4 threads for products having 11½ threads per inch. Buttress thread taper shall also be checked in the Imperfect Thread Area.

2. Cumulative Lead Interval. The gauging of cumulative lead on external or internal threads shall be measured over an interval (between the first and last perfect threads) which has a length equal to the largest multiple of ½ in. for an even number of threads per inch or 1 in. for an odd number of threads per inch.

Note: The g values are given in Tables 21, 22, 24, 25 and 26. For round threads "g" was chosen as 0.625 inches for casing and 0.500 inches for tubing.

TAPER MEASUREMENT

5.1.6 Definition

For round threads and line pipe threads, taper shall be defined as the increase in the pitch diameter of the thread, in inches per inch of thread. For buttress threads, taper is defined as the change in diameter along the minor cone of the external threads and the major cone of the internal threads. On all threads, taper tolerances are expressed in terms of "inch per inch of thread" and taper deviation shall be determined accordingly. The measurements are made for the specific interval lengths and the observed deviation shall be calculated to the inches-per-inch basis.

5.1.7 Gauge Contact Points

The contact points of taper gauges shall be of the ball-point type with diameters in accordance with the following table. For line pipe and round threads, the diameter of the contact points are such that they contact the thread flanks at the pitch cone, approximately, rather than the minor cone. For buttress threads, the dimensions of the contact points are such that they contact the minor cone of the external thread and the major cone of the internal thread.

Contact Point Dimensions For Taper and Runout Gauges

Type Gauge	Threads per inch	Type Thread	Ball-Point* Diameter in.
Taper	8	Rd.	0.072
Taper	8	LP	0.072
Taper	10	Rd	0.057
Taper	10	LP	0.057
Taper	11½	LP	0.050
Taper	14	LP	0.041
Taper	18	LP	0.032
Taper	27	LP	0.021
Taper	5	Buttress	0.090
Runout	5	Buttress	0.057

*Tolerance is ±0.002 in.

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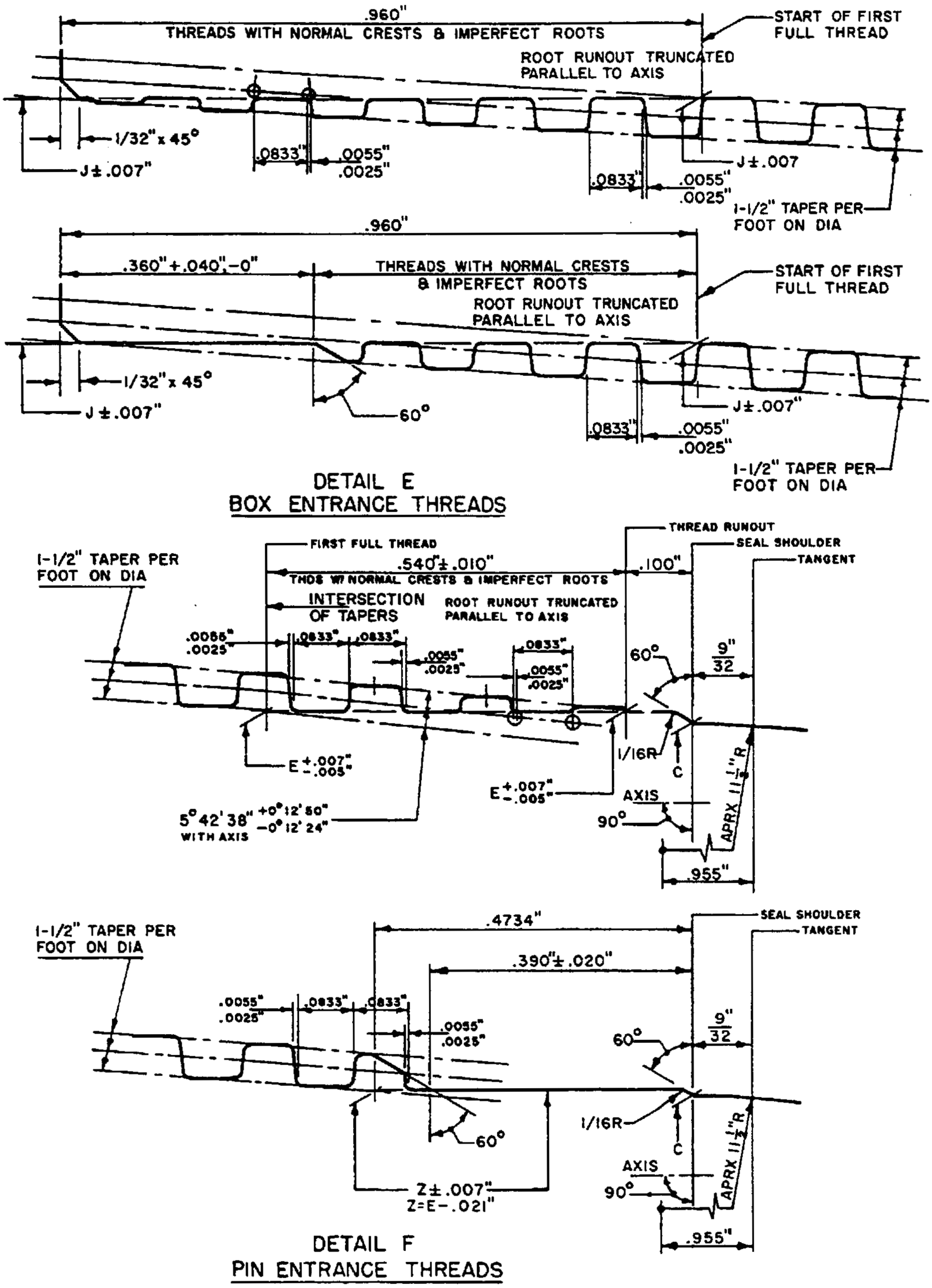


Figure 12—Box and Pin Entrance Threads—Sizes 5 Through 7⅝
(See Figure 10 and Table 17 for illustration and other dimensions)
(See Figure 13 for thread form and details)
(See Figure 14 for sizes over 7⅝)

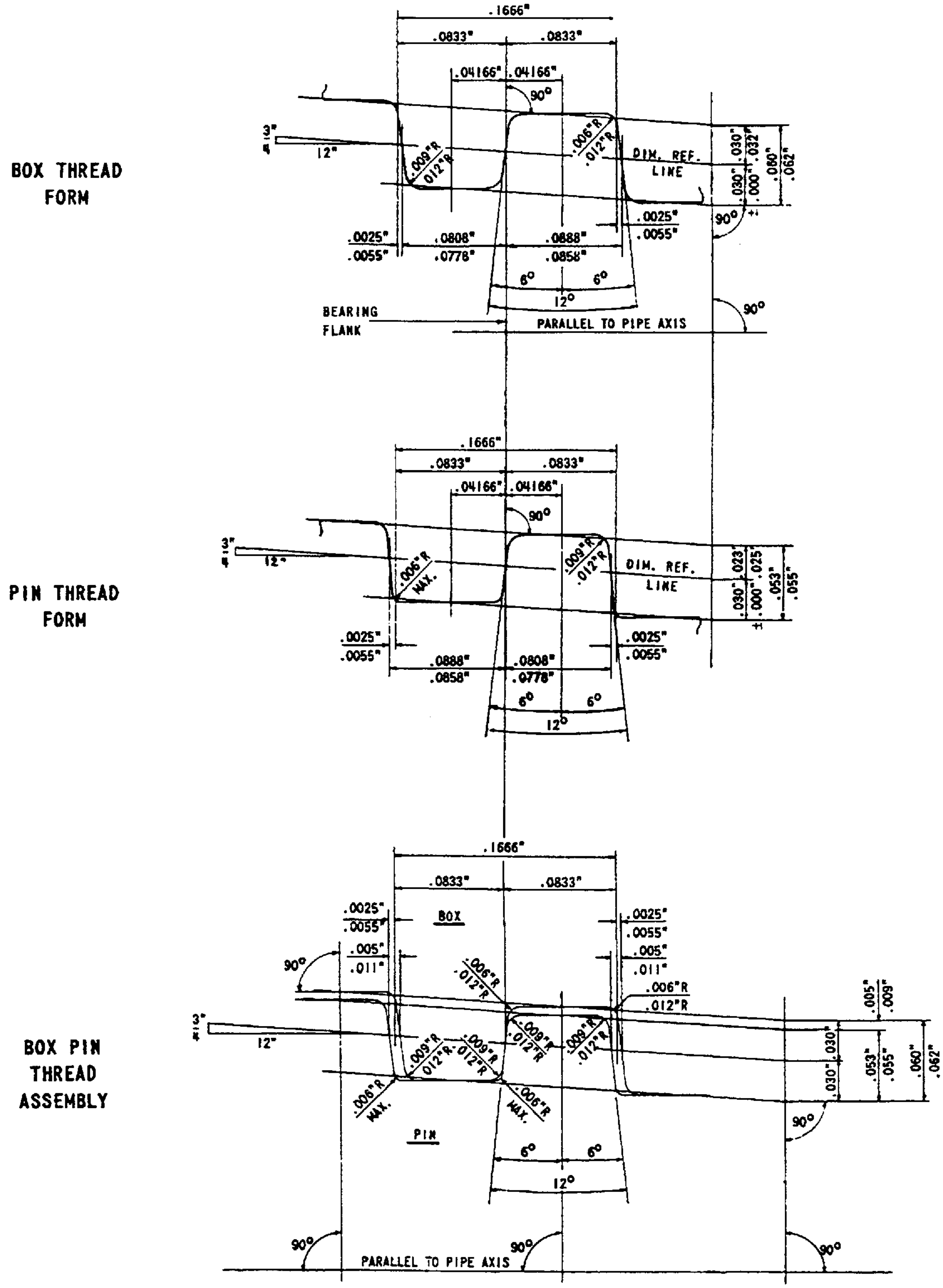
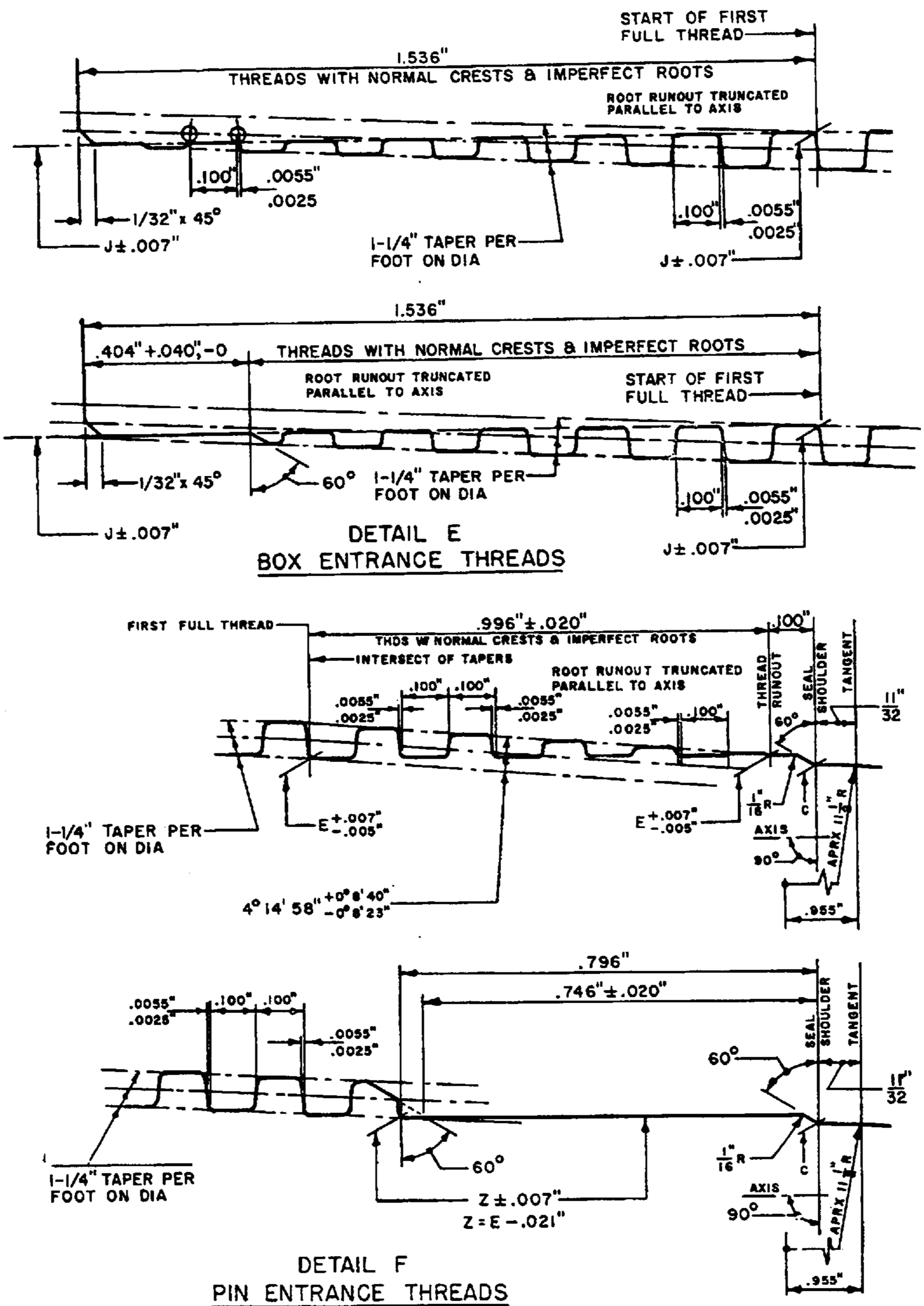
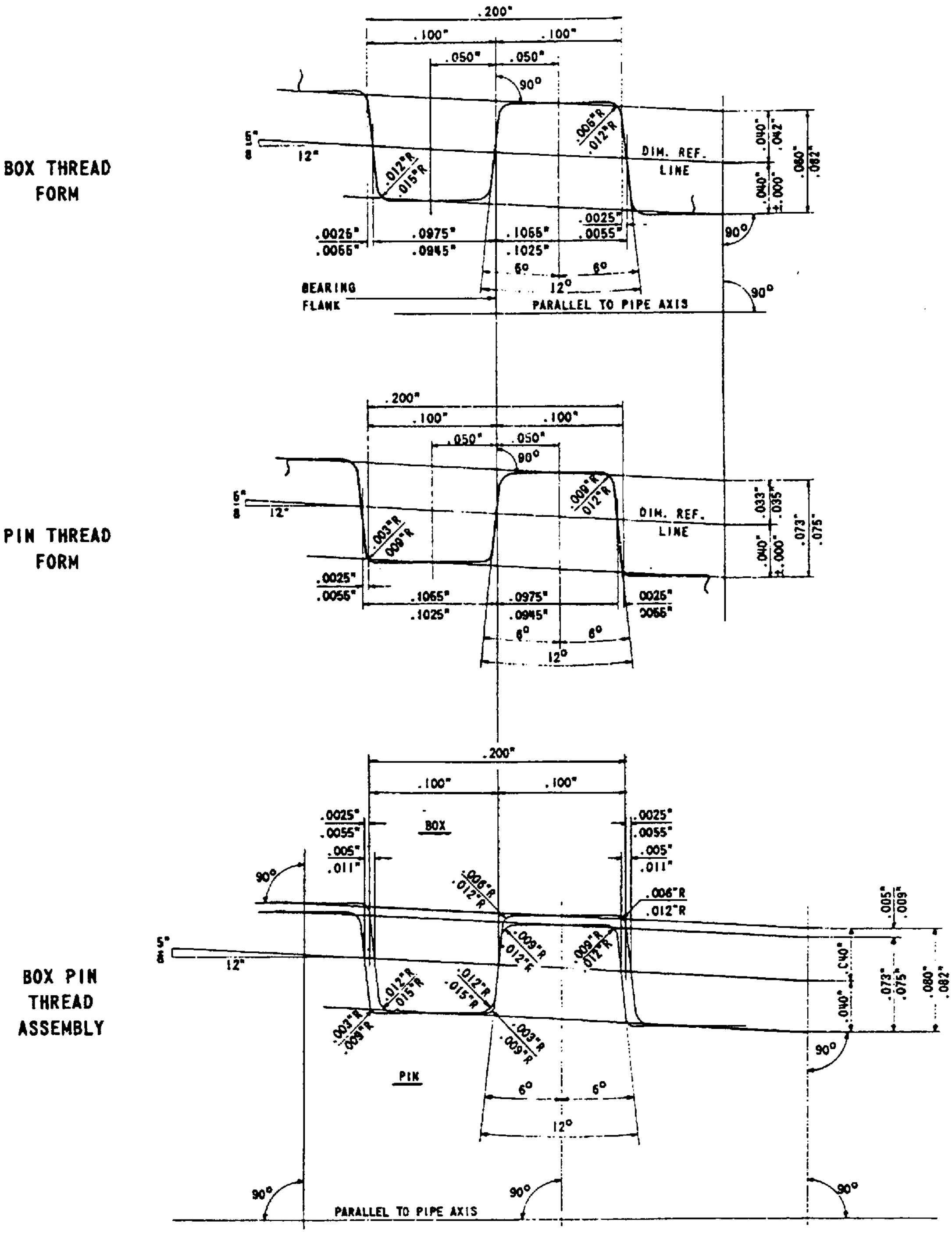


Figure 13—Product Thread Form—Sizes 5 Through 7⅝
6 Threads Per Inch—1½ In. Taper per Ft. on Dia.
(See Figure 10 for other threading details)
(See Figure 15 for thread form, sizes over 7⅝)



Note: See Figure 11 and Table 18 for illustration and other dimensions. See Figure 15 for thread form and details. See Figure 12 for sizes under $8^5/_8$.

Figure 14—Box and Pin Entrance Threads—Sizes $8^5/_8$ Through $10^3/_4$



Note: See Figure 11 for other threading details. See Figure 13 for thread form, sizes under 8⅝.

Figure 15—Product Thread Form—Sizes 8⅝ Through 10¾
5 Threads Per Inch—11/4 In. Taper Per Ft. on Dia.

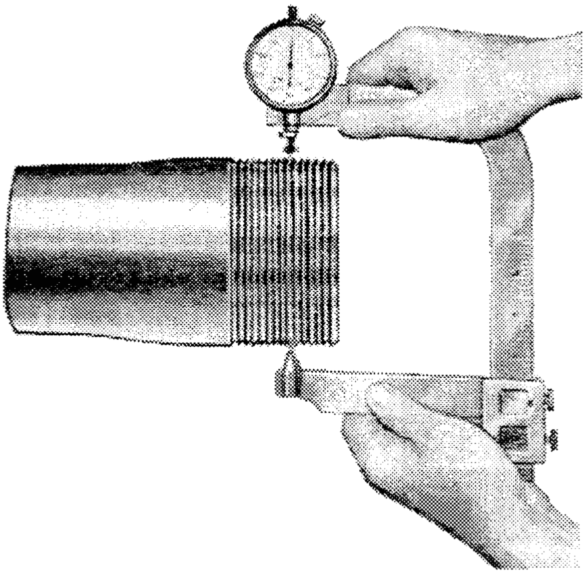


Figure 16—Typical External-Thread Taper Gauge

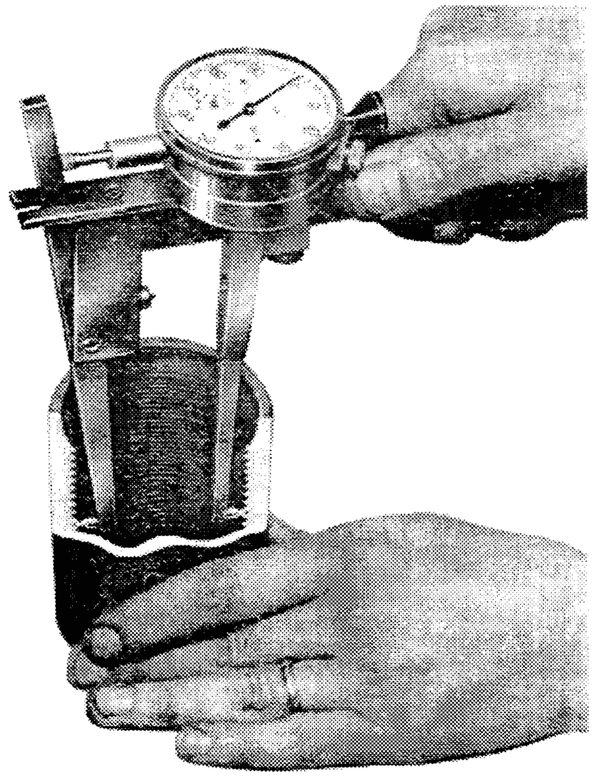


Figure 18—Typical Internal-Thread Taper Gauge for Threads in Sizes Smaller Than 4½

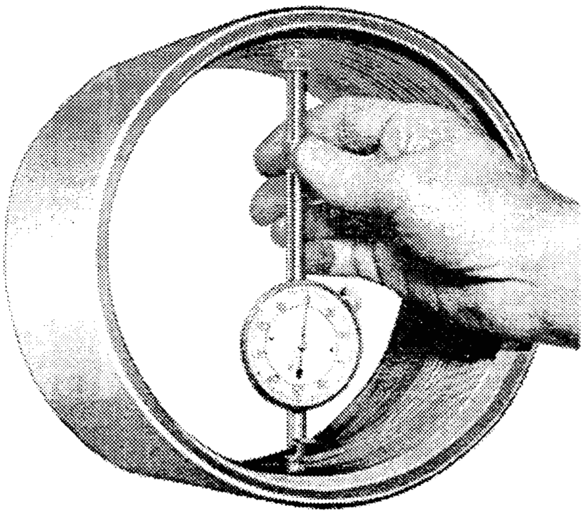


Figure 17—Typical Internal-Thread Taper Gauge for Threads in Sizes 4½ and Larger

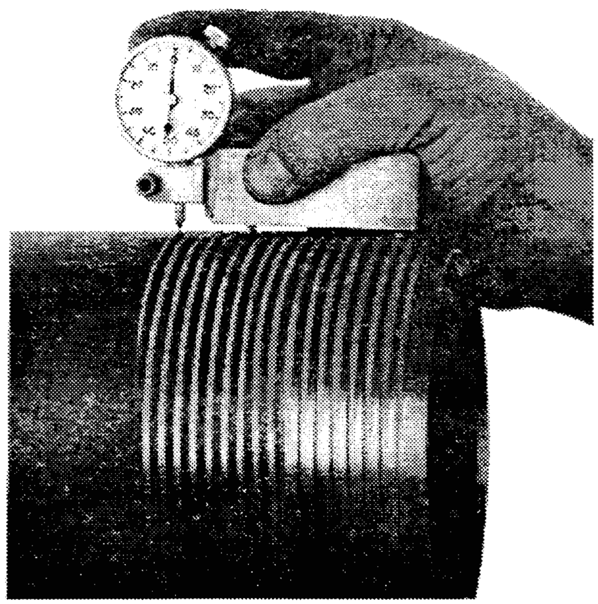


Figure 19—Typical Run-Out Gauge for Buttress Thread Casing

EXTERNAL THREADS

5.1.8 Taper Gauge

The taper of external threads shall be measured with a taper gauge (See Figure 16).

5.1.9 Procedure

The ball point on the fixed end of the gauge shall be placed in the groove at the first perfect thread position and the ball point on the plunger in the groove diametrically opposite. The fixed point shall be held firmly in position, the plunger point oscillated through a small arc, and the dial indicator set so that the zero position coincides with the maximum indication. Similarly, successive measurements at the same radial position relative to the axis of the thread, shall then be taken at the required intervals for the full length of threads for buttress threads (as specified in Table 9, Column 6 (L_4)) or the full length of perfect threads for tubing and line pipe threads and the TECL for round thread casing. The difference between successive measurements shall be the taper in that interval of threads. The taper in the last interval of perfect threads shall be measured.

5.1.10 Run-out (Buttress Only)

The run-out gauge (see Figure 19) shall be used to check the run-out thread root and insure that the external thread is sufficiently long and is a true runout thread. The run-out gauge indicator shall be set to zero using a flat surface as a setting standard for size 13³/₈ and smaller. For size 16 and larger casing, the run-out gauge indicator shall be set to zero using the perfect thread roots as a setting standard. These perfect thread roots shall be checked for acceptable taper prior to setting the run-out gauge.

5.1.11 Procedure

If the last thread groove is less than or equal to the distance from the end of the pipe to the apex of the make up triangle (A1 + .375 in.), the thread must be a true run-out thread. The thread run-out shall be measured where it terminates or at the apex of the make up triangle, whichever is the shortest length, by placing the run-out gauge contact point at 90 degrees prior to the thread termination or the apex of the triangle, and rotating the run-out gauge clockwise until the contact point is out of the thread groove or beyond the triangle apex. If the dial indicator reads +0.005 in. or less, the run-out is acceptable. At no time shall taper or lead measurements be taken with a contact point beyond the last perfect thread location defined in paragraph 5.1.4.

INTERNAL THREADS IN SIZES 4½ AND LARGER

5.1.12 Taper Gauge

The taper of internal threads in sizes 4½ and larger, shall be measured with an internal-taper gauge as illustrated in Figure 17.

5.1.13 Procedure

The ball point in the fixed end of the gauge shall be placed in the groove at the last perfect thread position and the ball point on the plunger in the groove diametrically opposite. The fixed point shall be held firmly in position, the plunger point oscillated through a small arc, and the dial indicator set so that the zero position coincides with the maximum indication. Similarly, successive measurements, at the same radial position relative to the axis of the thread, shall then be taken at the required intervals toward the large end of the internal thread for the full length of perfect threads. The taper in the first interval of perfect threads shall be measured. The difference between successive measurements shall be the taper in that interval of threads.

INTERNAL THREADS IN SIZES SMALLER THAN 4½

5.1.14 Taper Gauge

The taper of internal threads in sizes smaller than 4½ shall be measured with an internal-taper gauge as illustrated in Figure 18.

5.1.15 Procedure

The ball point on the adjustable arm of the gauge shall be placed in the groove at the last perfect thread position and the ball point on the pivoted arm of the gauge in the groove diametrically opposite. The fixed point shall be held firmly in position, the pivoted point oscillated through a small arc, and the dial indicator set so that the zero position coincides with the maximum indication. Similarly, successive measurements, at the same radial position relative to the axis of the thread, shall then be taken at the required intervals toward the large end of the internal thread for the length of perfect threads. The taper in the first interval of perfect threads shall be measured. The difference between successive measurements shall be the taper in that interval of threads.

LEAD MEASUREMENT

5.1.16 Definition

Lead shall be defined as the distance from a point on a thread to a corresponding point on the next thread turn, measured parallel to the thread axis. Lead tolerances are expressed in terms of "per inch" of threads and "cumulative," and lead errors must be determined accordingly. For interval measurements over lengths other than 1 in. the observed deviation should be calculated to the per-inch basis. For cumulative measurements, observed deviations represent the cumulative deviation.

5.1.17 Gauge Contact Points

The contact points of Lead Gauges shall be of the ball point type with diameters in accordance with the following table. For line pipe and round threads, the diameter of the contact points are such that they contact the thread flanks at the pitch cone, approximately, rather than the minor cone. For buttress threads, the dimensions of the contact points are such that they simultaneously touch the root and the 3-degree flank of the thread.

Contact Point Dimensions For Lead Gauge

Threads per inch	Type Thread	Ball-Point Diameter* in.
8	Rd	0.072
8	LP	0.072
10	Rd	0.057
10	LP	0.057
11½	LP	0.050
14	LP	0.041
18	LP	0.032
27	LP	0.021
5	Buttress	0.062

*Tolerance is ±0.002 in.

5.1.18 Lead Gauges

The lead of all external or internal threads in sizes 4½ and larger shall be measured with a lead gauge of the type illustrated in Figure 20, Detail A. The lead of all internal threads in sizes smaller than 4 shall be measured with a lead gauge of the type illustrated in Figure 20, Detail B. Lead gauges shall be so constructed that the measuring mechanism is under strain when the indicator is set to zero by means of the standard template (see Figure 20, Detail C). The standard template shall be so constructed as to compensate for the error in measuring lead parallel to the taper cone instead of parallel to the thread axis, according to the values shown in Table 20. The distance between any two adjacent notches of the template shall be accurate within a tolerance of ±0.0001 in., and between any two non-adjacent notches within a tolerance of ±0.0002 in.

5.1.19 Adjustment of Gauges

Before use, the fixed ball point shall be set to provide a distance between points equal to the interval of threads to be inspected (see Par. 8.1.5.b), and the indicator set to the zero position when the gauge is applied to the standard template. When applying the lead gauge to Buttress templates, care must be taken to insure the contact points engage the root and the 3 degree flank.

Table 20—Compensated Thread Lengths for Measurements Parallel to the Taper Cone

Length of Thread (Parallel to Thread Axis) In.	Compensated Length (Parallel to Taper Cone) For threads having a Taper of: ¾ in. per foot	1 in. per foot
.34783*	0.34800	—
½	0.50024	—
1	1.00049	1.00087
1½	1.50073	1.50130
2	2.00098	2.00174
2½	2.50122	2.50217
3	3.00146	3.00260
3½	3.50171	3.50304
4	4.00195	4.00347

*Equivalent to 4p for 11½ threads per inch.

5.1.20 Procedure

The ball points of the gauge shall be placed in the proper thread grooves and the gauge shall be pivoted upon the fixed ball point through a small arc on either side of the correct line of measurement. The minimum fast (+) or maximum slow (–) reading is the deviation in lead. On buttress casing threads, slight pressure shall be exerted on the gauge so that the fixed ball point remains simultaneously in contact with the 3-degree flank and root of the thread during the measurement. The pressure is applied toward the small end on external threads and toward the large end on couplings.

HEIGHT MEASUREMENT

5.1.21 Definition

Height of thread shall be defined as the distance between the crest and root, normal to the axis of the thread.

Note: A certain number of threads with imperfect crests are permissible on pipe under the requirements of Sect. 4. When threads with imperfect crests occur within the perfect-thread length on pipe, the last point of height measurement should be shifted to the last thread root having a full crest on each side.

5.1.22 Gauge Contact Points

The contact points for thread-height gauges for Line Pipe and Round Threads shall be conical in shape with a maximum included angle of 50 degrees and shall not contact the thread flank. Height gauges for buttress threads can use a cone point or a ball type point provided the contact point does not contact the thread flanks and does not exceed 0.092 in. diameter.

5.1.23 Height Gauges

Thread height shall be measured with gauges of the types illustrated in Figures 21 and 22. Such gauges for Line Pipe and Round threads may have indicators graduated to register the actual thread height or the deviation in thread height, as illustrated in Figure 21. Check blocks as shown in Figure 21 shall be provided for checking the height gauge. Buttress threads shall be measured with gauges of the type illustrated in Figure 21, registering error in thread height in .0005 in. increments. Gauges for size 16 and larger Buttress threads shall be provided with a step-type anvil. Check blocks of the step-type as shown in Figure 21, Detail B, shall be provided for checking the height gauge.

For the U-groove check block, the depths of the grooves shall conform to the following dimensions, within a tolerance of ±0.0002 in.:

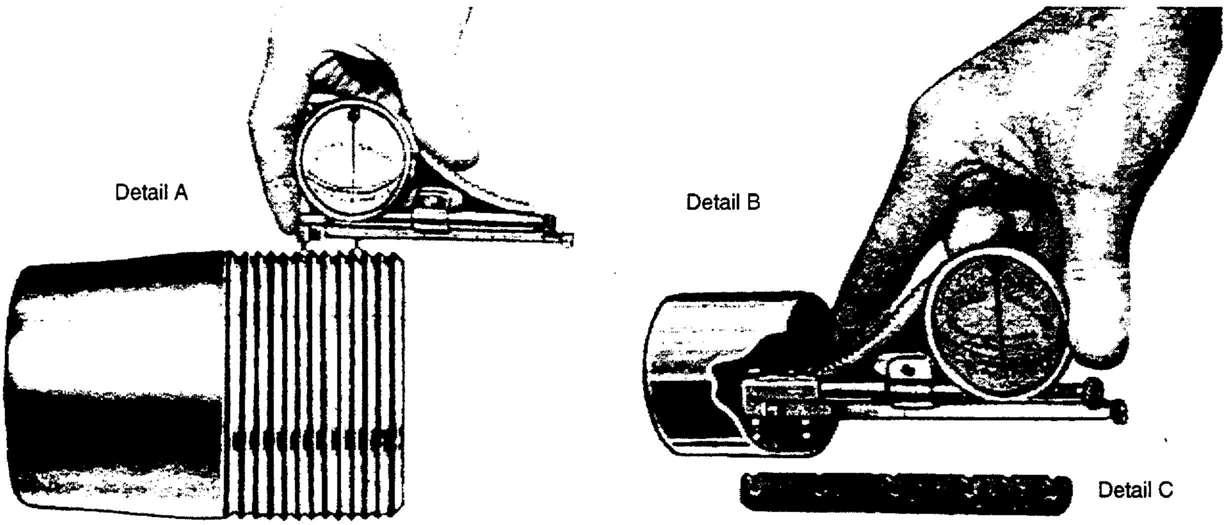


Figure 20—Typical Lead Gauges

8-V (line pipe) groove	0.0950 inch
$11^1/_2$-V (line pipe) groove	0.0661 inch
8-round (casing and tubing) groove	0.0712 inch
10-round (tubing) groove	0.0556 inch
Buttress thread groove, size $13^3/_8$ and smaller:	0.0620 inch

For the V-groove check block, the grooves shall have a maximum 60-deg. included angle and shall be truncated the following amounts, within a tolerance of + 0.0002 in.:

8-V (line pipe) groove	0.0031 inch
$11^1/_2$-V (line pipe) groove	0.0022 inch
8-round (casing and tubing) groove	0.0130 inch
10-round (tubing) groove	0.0100 inch

Buttress thread check blocks size 16 and larger:

Depth of groove to first plateau	0.0578 inch
Depth of groove to second plateau	0.0662 inch

5.1.24 Adjustments

Gauges shall be adjusted when applied to the U-groove (defined by Para. 5.1.23) for the type of thread to be measured. Gauges having indicators for determining the deviation in thread height shall be adjusted to register zero when applied to the applicable groove. Gauges having indicators for determining the actual thread height shall be adjusted to register the proper thread height when applied to the applicable groove. For V-threads and round threads, the gauge shall also be applied to the applicable V-groove for the threads to be measured. The gauge reading on the V-groove check block shall not vary more than 0.0005 in. from its reading on the U-groove check block. If it does not so register, the contact point has probably become worn or damaged and shall be replaced. For thread height gauges of the type illustrated in Figure 22, if the check block cannot be positioned flat on the anvil with the pressure arm applied, the arm shall be shifted out of the way to prevent contact with the check block during adjustments or checks.

PROCEDURE

5.1.25 External Threads and Internal Threads

The thread height gauges of the type illustrated in Figure 21 and Figure 22 shall be used for all external and all internal threads. The tip of the penetrator shall be placed in the proper thread groove with the anvil in a line parallel to the axis of the thread and resting on the crests of the adjacent threads, and the gauge oscillated through a small arc on each side of the position normal to the taper cone. For gauges graduated to measure the actual thread height, the minimum reading on the indicator shall be taken as the actual thread height.

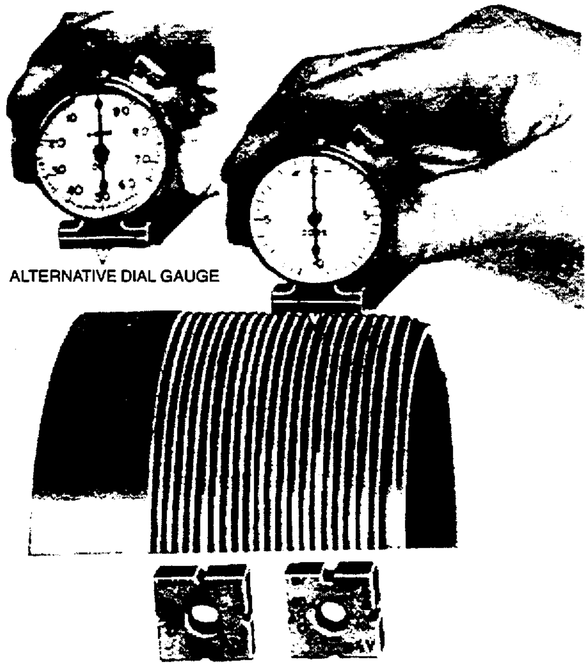
ANGLE MEASUREMENT

5.1.26 Definition

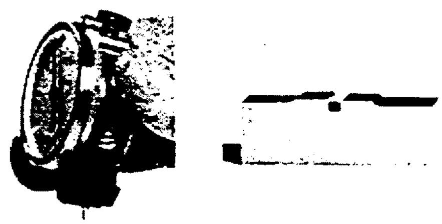
The angle of thread shall be defined as the included angle between the thread flanks. The flank angles of thread shall be defined as the angles between the flanks and are perpendicular to the thread axis. For 60 degree threads, the flank angles are half angles of the thread and therefore equal. For buttress threads, the leading flanks are 10 degrees and the following flanks are 3 degrees.

5.1.27 Angle Measurement Optical Comparator or Other Type

Thread angles shall be measured with a Optical Comparator or other type of precision angle measuring device, one type of which is illustrated in Figure 23. The recommended contact points for various thread types, except buttress, are the same as those shown in Par. 5.1.17 for the lead gauge. For



Detail A
Thread-height gauge for external threads and for internal threads in nominal size 3 and larger



Detail B
Thread-height gauge & check block for size 16 and larger buttress thread casing

Figure 21—Typical Thread Height Gauges

buttress casing threads, a ball point of 0.100 in. truncated 0.030 in. is recommended. This is to insure that the instrument seats properly into the thread flanks and to prevent rotational movement. When measuring the angle of coated threads, the measurement shall be taken prior to the application or after the coating has been chemically removed. As an alternative method, threads may be measured with a properly calibrated precision thread contour measuring machine equipped with master overlays of known accuracy and recording strip charts.

5.1.28 External Threads Procedure

Clean pipe threads to be inspected so that they are free from any particles that may impair viewing of the threads. Install the contact points, as described in Para. 5.1.27, into all four locations. Lock the stabilizer legs at the proper index mark, as shown in the manufacturer's instructions.

Note: This setting is a function of the thread helix angle and thus varies with pitch, taper and diameter.

a. Set the taper on the moveable contact arm to match that of the thread being inspected, e.g. 8 round would be set to the ³/₄ in. mark. Set the comparator on the pipe by first setting the moveable contact point into the thread flanks near the small end and then locating the central contact and the stabilizer leg contacts into the flanks near the last thread. The stabilizer legs should now be securely locked.

Rotate the diopter adjustment until the point of the arrow on the reticle is at its sharpest. This is an individual adjustment for each operator. The eye cup may be pushed down for eyeglass wearers. If you choose not to wear your glasses, return the cup to the extended position and readjust the diopter.

Rotate the reticle by using upper or lower knob until arrow points to the 0 line of the form you are inspecting. The upper reticle is for API and H90 rotary shouldered connections and the lower reticle is for API casing and tubing. Only one reticle at a time may be adjusted.

Note: To shift from one reticle to another, you must line up the two illustrated gauges over one another and turn reticle selection knob.

Rotate vertical micrometer clockwise until threads appear in the lower half of the green image field. Focus the unit so that both flanks of the actual thread are sharp.

The comparator is now adjusted for the particular diameter and thread form to be inspected. To inspect further connections, simply set it onto another pipe end. No more adjustments are necessary.

b. Using the rapid traverse knob along with the vertical micrometer, position a particular thread profile in close alignment with the reticle hairline form. Lock traverse movement

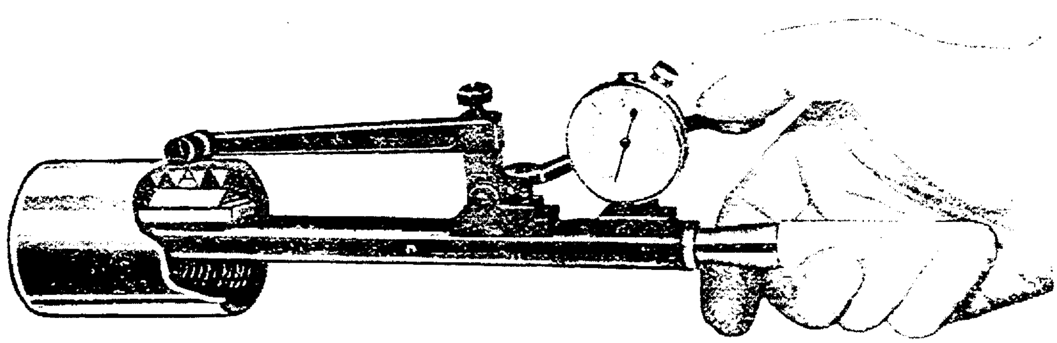


Figure 22—Typical Thread Height Gauge for Internal Threads in Nominal Sizes Smaller Than 3

by pushing lever downward and outward. Final alignment of the hairline and profile can now be made by using the horizontal and vertical micrometers.

Variation in dimensions of the actual thread can now be measured using the two micrometers.

c. Measurement of flank angle is done by rotating the reticle so that the flank angle of the reticle hairline matches that of the actual thread. Readjust image using both micrometers until a slight amount of green is seen between hairline and actual flank angle. The error in flank angle can now be read on the degree scale.

Note: Be sure to properly correlate the flank with the pipe-end as shown by upper arrow in reticle.

As an alternative method, threads may be measured with a properly calibrated precision thread contour measuring machine equipped with master overlays of known accuracy and recording strip charts to provide for a permanent documented record of the thread contour inspection.

INTERNAL THREADS

Note: In order to measure the flank angle of internal threads, it is first necessary to make a cast of the threads and then measure the flank angle of the threads on the cast. Therefore, a thread tooth on the cast represents a thread groove in the product and vice versa.

5.1.29 Procedure

The following procedure shall be followed in the measurement of flank angle of internal threads.

a. When thread coatings are present, remove electroplated or hot-dipped zinc coating from the threads by immersion in dilute hydrochloric acid (one volume of commercial hydrochloric acid to one volume of water) until violent evolution of gas ceases. Thoroughly rinse and dry the threads.

Note: Inhibited hydrochloric acid is to be preferred when available.

b. The casting of the internal thread must be made from a material which is stable and non-shrinking. It must be large enough to accommodate the Portable Optical Comparator or other type precision angle measuring device used in the same manner as described in Para. 5.1.27. Determine the angle of the threads on the cast in the same manner as specified for the measurement of the angle of external threads.

THREAD FORM

5.1.30 Definition

The form of thread is its profile in an axial plane for a length of one pitch.

5.1.31 Requirements

For 60 degree threads, there are no specific requirements on thread form except the limitations imposed by the requirements on height of thread and included flank angle. For buttress threads, the thread form must conform to the basic dimensions within the tolerances of Figures 6 and 7 including the requirements of thread height, included flank angles, and tooth thickness. The following are examples of acceptable methods of measuring tooth thickness: Single Dial Gauge as shown in Figure 24, Optical Comparator, Contour measuring Machine, or cast molds. The quality of workmanship required for acceptance under these specifications automatically prohibits the presence, to an objectionable degree, of such defects in thread form as torn threads, shaved threads, broken threads and distorted threads. Such imperfections may be detected, while at the same time measuring flank angles. Angular as well as linear measurements of the defects can be determined by comparing the thread-contour image with that of a toleranced thread outline. Rejection shall be made when such imperfections are present to an extent that there is a probability of galling or leakage when the connections are made up.

COUPLING THREAD ALIGNMENT

5.1.32 Definition

The opposing coupling thread cones are aligned through the bore.

a. Angular Misalignment. The measured angular deviation of one or both coupling thread cones to the center line thread cone axis.

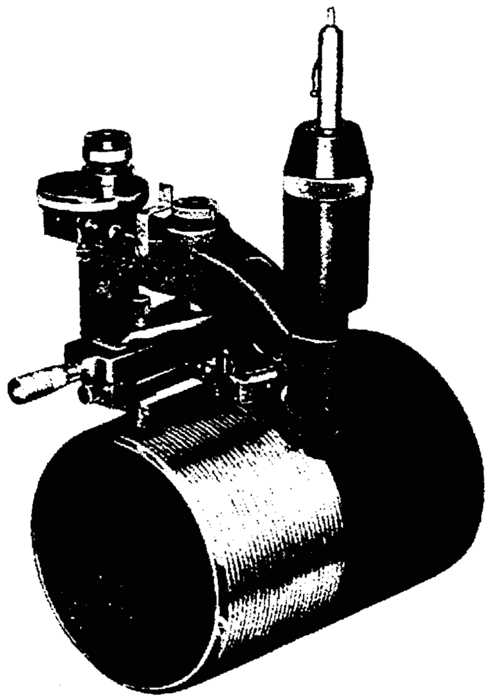


Figure 23—Typical Thread-Contour Microscope for Measuring Thread Angle and Checking Thread Form

b. Concentric Misalignment. The measured concentric deviation from the center line thread cone axis by one or both coupling thread cones.

5.1.33 Equipment

Concentricity and alignment of coupling threads may be measured with the following types of equipment:

a. Figure 26 is an example of equipment capable of measuring for concentricity and alignment of coupling threads. Concentricity and alignment tests for coupling threads (see Sect. 4) are made by screwing the coupling onto the threaded test mandrel which has been centered on the lathe type spindle, then screwing into the other end of the coupling a threaded plug provided with an axial extension of one foot and a disc attached as shown. While the assembly is rotated, concentricity of the coupling threads can be determined by means of a dial gauge bearing radially against the OD of the disc next to the coupling face (as shown). Angular misalignment can be determined by means of a dial gauge bearing radially against the plug extension, or axially against the side of the disc which is parallel to the coupling face.

b. Figure 27 is an example of a coupling thread alignment gauge. The contact points utilized on thread alignment gauges of this type shall be as follows: Line pipe, round thread casing and tubing shall be the same as those as shown in Par. 5.1.17 for the lead gauge. Ball point diameter of 0.100 in. truncated 0.030

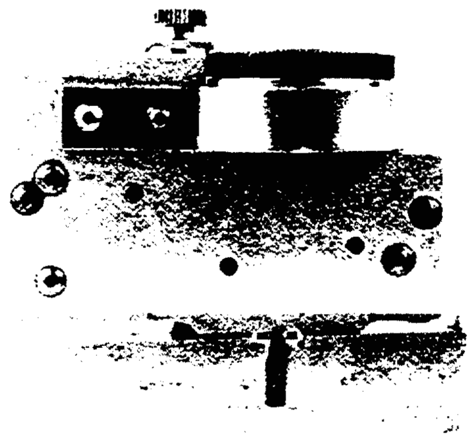


Figure 24—Typical Single Dial Gauge for Buttress Threads

Figure 25—Typical Check Pieces for Setting Dial Gauges

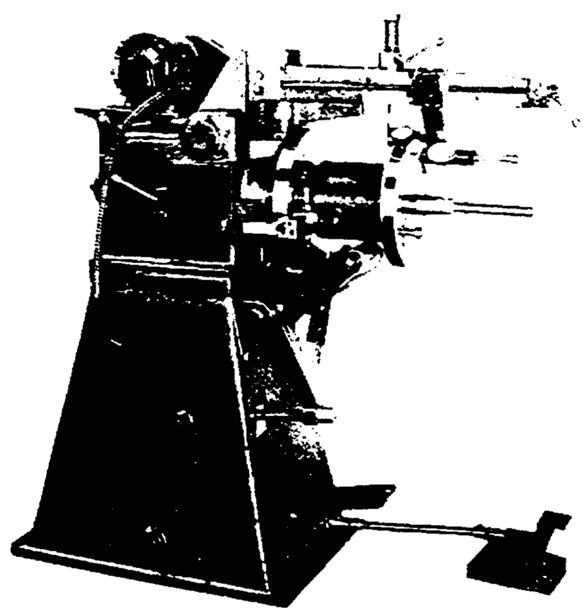


Figure 26—Typical Machine for Checking Coupling-Thread Alignment

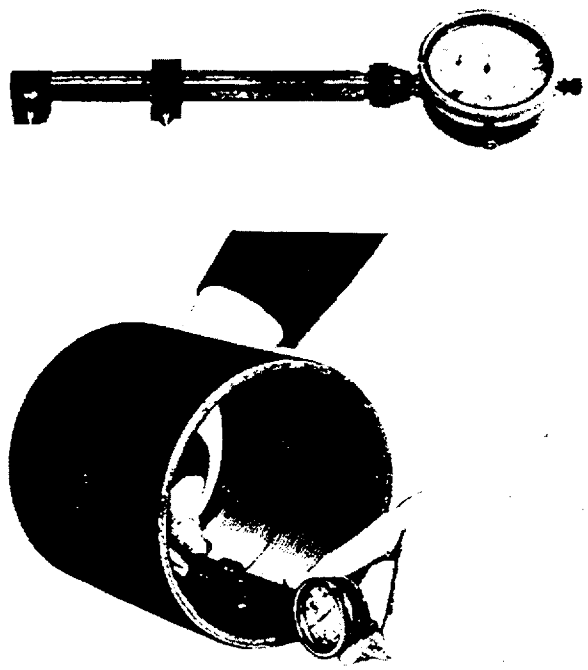


Figure 27—Typical Application of Coupling-Thread Alignment Gauge

in. shall be used for buttress casing threads. The ball points shall be inserted in the thread grooves, an equal distance on either side of the J area but not less than 2J plus two thread turns apart parallel along the center line axis of the coupling as shown in Figure 27, and rotated one turn while positioned in the thread grooves. The maximum sweep of the dial gauge indicator (space between the maximum and minimum indications) shall not exceed the amount determined by the following formula:

$$R = EA/240$$

Where:

R = maximum permissible sweep of the dial gauge indicator

E = pitch diameter of the coupling where the contact points on the gauge are located. This must be calculated for the coupling being inspected.

A = maximum allowable misalignment in 20 ft. (see Sect. 4, Par 4.1.9)

CALIBRATION OF INSTRUMENTS AND DIAL GAUGES

5.1.34 Use a lead-gauge calibrated to verify calibration of lead gauges through the entire range of scale for total lengths of threads up to 4 in. It is essential that calibrators of this type utilize a precision screw micrometer reading in increments of 0.0001 in. Determine the amount of movement of the micrometer screw (reading the micrometer to 0.0001 in., necessary to indicate an error of 0.001 in. by the lead gauge for each 0.001 in. of the lead-gauge scale. From these determinations prepare a table of accumulative error for the entire scale range of the lead gauge.

5.1.35 The accuracy of lead gauge standard templates and height gauge check blocks should be verified in a approximately 68 degree F (20 degree C) environment by a means that assures a measurement uncertainty no greater than 25% of the allowable tolerance for the dimension being measured. The required distances between notches on the lead gauge standard template are compensated for measurement parallel to the taper cone and are given in Table 20 and Par. 5.1.18. The groove dimensions for height check blocks are given in Par. 5.1.23.

5.1.36 Calibrate dial gauges by a method with a resolution of 0.0001. Following are some examples of acceptable calibration instruments:

a. Toolmakers microscope.
b. Universal measuring microscope.
c. A precision screw micrometer reading in increments of 0.0001.
d. Precision gauge blocks.
e. Precision linear-measuring machine.

5.1.37 Dial gauges shall be tested for accuracy on repeated readings and also of measuring intervals, over the full dial scale. The accuracy of repeated readings shall be within 0.0002 in. The accuracy of interval measurements shall be within the following values:

Range of Dial in.	Maximum Error in.
1.0000	0.0010
0.5000	0.0010
0.1000	0.0005
0.0200	0.0002

5.1.38 Frequency of Calibration

Verify calibration of dial gauges throughout the entire range of plunger travel when received, at frequent intervals (No less than once per year, however, if the dial gauge is not used in the 1 year period, calibration is not required until subsequent future usage.), and after they have been dropped, subjected to unusual shocks, or any other conditions which might affect the accuracy of precision measuring instruments.

5.2 EXTREME-LINE CASING

Inspection procedures for extreme-line casing threads and seals are included in Table 19.

6 Gauging Practice

6.1 LINE PIPE, ROUND THREAD CASING AND TUBING, AND BUTTRESS THREAD CASING

6.1.1 Coverage

All threads covered by this section shall comply with the gauging practice requirements specified herein. Accordingly, any manufacturer who produces products using any of the threads covered by this specification shall have access to master gauges for each size and type of thread produced.

Master gauges consists of a plug and mating ring conforming to the requirements of Sect. 5 and certified as required in Sect. 6.

Notes:
1. Gauges made under Standard 5A, 5AX or 5L prior to 1962 may be used provided proper allowance is made for deviations from the requirements of Section 5. See Par. 4.9 regarding line-pipe gauges made prior to 1940.
2. The use of master gauges in checking product threads should be minimized. Such use should be confined to cases of dispute which cannot be settled by rechecking the working gauge against the master. Good care should be exercised when the master gauge is assembled on a product thread. Good care is as indicated in Par. 4.2 and Par. 6.4.

6.1.2 Gauge Requirements

The manufacturer of product threads shall also provide working gauges conforming to the requirements of paragraph 7.1.2 for use in gauging the product threads, and shall maintain all working gauges in such condition as to ensure that product threads, gauged as required herein, are acceptable under this specification. The manufacturer shall establish and document a program of measuring the wear (interchange standoff of working gauges with master gauges) on each working ring and plug gauge that is used in the production of API threads. Included in this program shall be detailed procedures, frequency of measuring wear, and criteria of rejection that completely decommissions a working ring or plug gauge from any further use. The results of each required measurement for each working ring or plug gauge shall be documented. The records of procedures and measurements shall be maintained for not less than 3 years following the last usage of each gauge. The manufacturer shall also establish and document a frequency for inspecting product threads with working gauges based on his control of the manufacturing process.

6.1.3 The relationship between master gauges, working gauges, and product threads shall be as shown in Figures 28 and 29, wherein the master plug gauge is shown as the standard and the master ring gauge as the transfer standard. The standoff value S of master gauges is the distance from the plane of vanish point on the master plug gauge to the face of the master ring gauge. The standoff value P of master gauges is the difference between the tabulated L_4 dimension and the distance from the plane of vanish point on the master plug gauge to the small end of the master ring gauge. The master ring gauge is used to establish the standoff value S_1 of the working plug gauge. The master plug gauge is used to establish the standoff value P_1 of the working ring gauge. When calculating P_1 values, differences in ring gauge length (L_4 – S) between master and working ring gauges should be calculated as this will affect P_1 calculations.

Note: The mating standoff of the master ring gauge against the master plug gauge as marked on the ring gauge, is intended primarily as the basis for establishing the limits of wear or secular change in the gauges. Deviation from this initial S value should be taken into account in establishing working gauge standoff values.

6.1.4 Tolerances

Tolerance on standoff P and P_1 of the ring gauge against the end of the pipe, and on standoff A and A + (S_1 – S) of the plug gauge against the face of the coupling or box, shall be as follows:

	Tolerance	
	P and P_1	A and A + (S_1 – S)
Line pipe		
All sizes	±1p	±1p
8 threads per inch		
Round thread casing and tubing	±1p	±1p
10 threads per inch		
Round thread tubing	$\pm 1^1/_2$p	$\pm 1^1/_2$p
Buttress casing	$+^1/_2$p –0	+0 $-^1/_2$p

Note: The requirements given herein for line-pipe and round-thread gauges do not include mandatory provisions for a gauging notch. Therefore, the length A + M + (S_1 – S) cannot be measured readily with these gauges (see Detail D, Figure 16). This length may be measured by providing a suitable notch on the working plug gauge located at the Distance L_1 from the end-of-pipe plane (See Figure 37).

"p" is defined as the distance from a point on a nominal thread form to a corresponding point on the next thread, measured parallel to the axis. This value can be calculated by dividing one inch by the number of threads per inch.

6.1.5 Gauge Calibration Maintenance

The maintenance of master gauges within the standoff limits specified in Par. 6.1.6 shall be the responsibility of the gauge user. Gauges shall be periodically tested for mating standoff by the procedure stipulated in Par. 6.1.4, the interval between tests being dependent on the frequency of their use. The API monogram shall not be applied on products controlled by gauges which have not been so tested.

All records of mating stand-off of working gauges to master gauges shall indicate a traceable identification of the master utilized.

6.1.6 Gauge Acceptance

A pair of gauges (master plug and mating master ring) which have been tested as prescribed in Par. 8.1.4 may be considered acceptable for continued use provided the mating standoff remains equal to the original certified standoff S (as stamped on the ring gauge), or does not change from this original value more than that shown below.

a. For line-pipe gauges the mating standoff shall not increase from the original S value by more than the equivalent of $^1/_{10}$ thread turn for all pitches and sizes, and shall not decrease from this original value by more than $^1/_8$ thread turn for 27-thread and 18-thread (per inch) gauges, $^5/_{32}$ thread turn for 14-thread and 11$^1/_2$-thread gauges, or $^5/_{32}$ thread turn for 8-thread gauges for line pipe in nominal sizes 8 and smaller, and $^1/_5$ thread turn for 8-thread gauges for line pipe in nominal sizes 10 and larger.
b. For round-thread casing and tubing gauges, the mating standoff shall not increase from the original S value by more than the equivalent of $^1/_{10}$ thread turn for all pitches and sizes and shall not decrease from this original value for 8-thread gauges by more than $^5/_{32}$ thread turn for sizes 8$^5/_8$ and smaller, $^1/_5$ thread turn for sizes 9$^5/_8$ and larger, and $^1/_5$ thread turn for all 10-thread gauges.
c. For buttress-thread casing gauges the mating standoff shall not increase from the original S value by more than the equivalent of $^1/_{16}$ thread turn for all sizes and shall not decrease from this original value by more than $^1/_{10}$ thread turn for sizes 8$^5/_8$ and smaller, and $^1/_8$ thread turn for sizes 9$^5/_8$ and larger.

Note: The standoff in thread turns is converted to axial standoff by dividing the fractional turn by the number of threads per inch, or by multiplying the fractional turn by the pitch. The tolerances on standoff as given above in turns are equivalent to the following axial tolerances:

Number of Threads Per Inch	Axial Tolerance in.
Line Pipe Gauges	
27	+0.0037
	−0.0046
18	+0.0056
	−0.0070
14	+0.0071
	−0.0112
11$^1/_2$	+0.0087
	−0.0136
8 (Nominal pipe sizes 8 and smaller)	+0.0125
	−0.0195
8 (Nominal pipe sizes 10 and larger)	+0.0125
	−0.0250
Round thread casing and tubing gauges	
10	+0.0100
	−0.0200
8 (Pipe sizes 8$^5/_8$ and smaller)	+0.0125
	−0.0195
8 (Pipe sizes 9$^5/_8$ and larger)	+0.0125
	−0.0250
Buttress thread casing gauges	
5 (Pipe sizes 8$^5/_8$ and smaller)	+0.0125
	−0.0200
5 (Pipe sizes 9$^5/_8$ and larger)	+0.0125
	−0.0250

6.1.7 Change in S Value

A pair of master gauges showing at any time an increase or decrease in S value greater or less than given in Par. 6.1.6 shall be reconditioned or replaced.

Note: An increase in standoff usually indicates the presence of burrs, rough threads, some foreign substance, or possibly a secular change in dimensions. When an increase is observed, the gauges should be cleaned of burrs or foreign substances and rechecked. If the increase is still greater than that specified in Par. 6.1.6, the gauges shall be reconditioned or replaced.

6.1.8 Recertification

Before re-use, all reconditioned gauges shall be recertified by an official testing agency.

6.1.9 Line Pipe Gauges Prior to 1940

Master line-pipe gauges made prior to January 1, 1940, can be used in establishing working gauge standoff values, if proper corrections are applied. On line-pipe gauges made prior to 1940, gauge dimensions were referenced to a plane 5 thread turns from the E_7 plane. Under current gauge requirements, measurements are referred to the plane of vanish point, which is 5.47 thread turns from the E_7 plane (see Figure 30). Other gauge dimensions which affect how the gauges may be used were not changed; therefore, gauges made prior to 1940 may be used in current gauging practice, provided proper adjustment in standoff values is made for the shift in reference plane. These correction values, which are either negative or positive depending upon the standoff under consideration, are as follows:

Number of Threads Per Inch	Correction Difference in Values of g in.
27	0.017
18	0.026
14	0.034
11$^1/_2$	0.041
8	0.059

6.2 EXTREME-LINE CASING

6.2.1 Reference Master Gauges

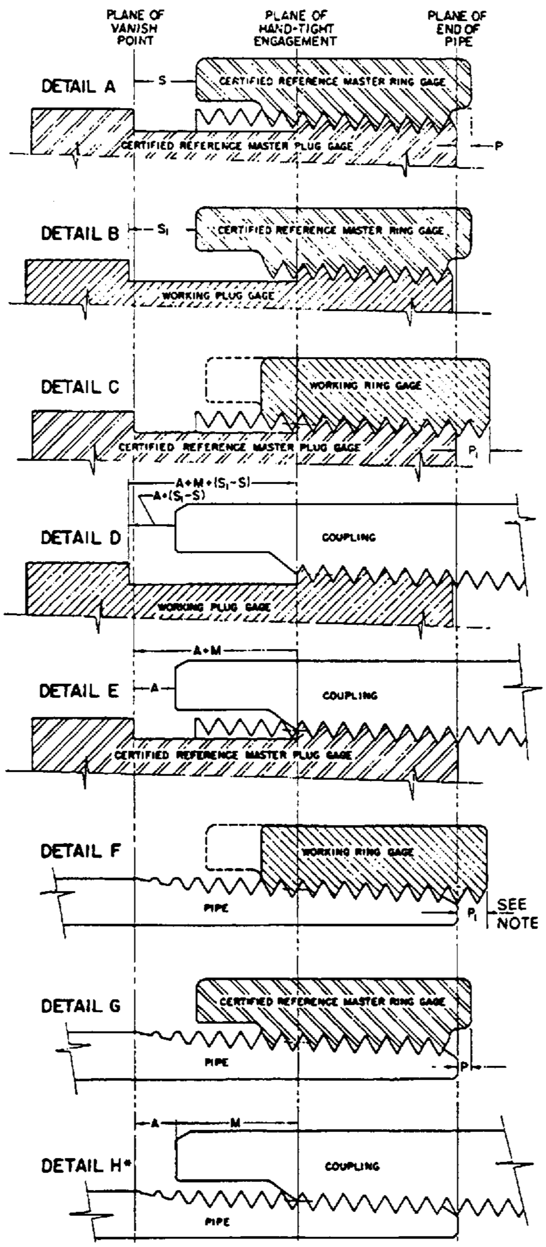
(See footnotes 1, 2, 3 and 6). All threads shall comply with the gauging practice requirements specified herein. Accordingly, any manufacturer who desires to produce API extreme-line casing shall have access to reference master gauges for each size and type of threads produced on products marked with the monogram. Reference Master gauges consist of a plug and mating ring conforming to the requirements of Sect. 7.2 and certified as specified in Sect. 8.2.

6.2.2 Working Gauges

(See footnotes 1, 3 and 5). The manufacturer shall also have in their possession working gauges for use in gauging the product threads and seals. The working gauges shall consist of a two-part seal and thread plug and a two-part seal and thread ring as illustrated in Figures 33 and 34, each conforming to the requirements of Sect. 7.2, or modifications thereof.

6.2.3 Standoff Limits

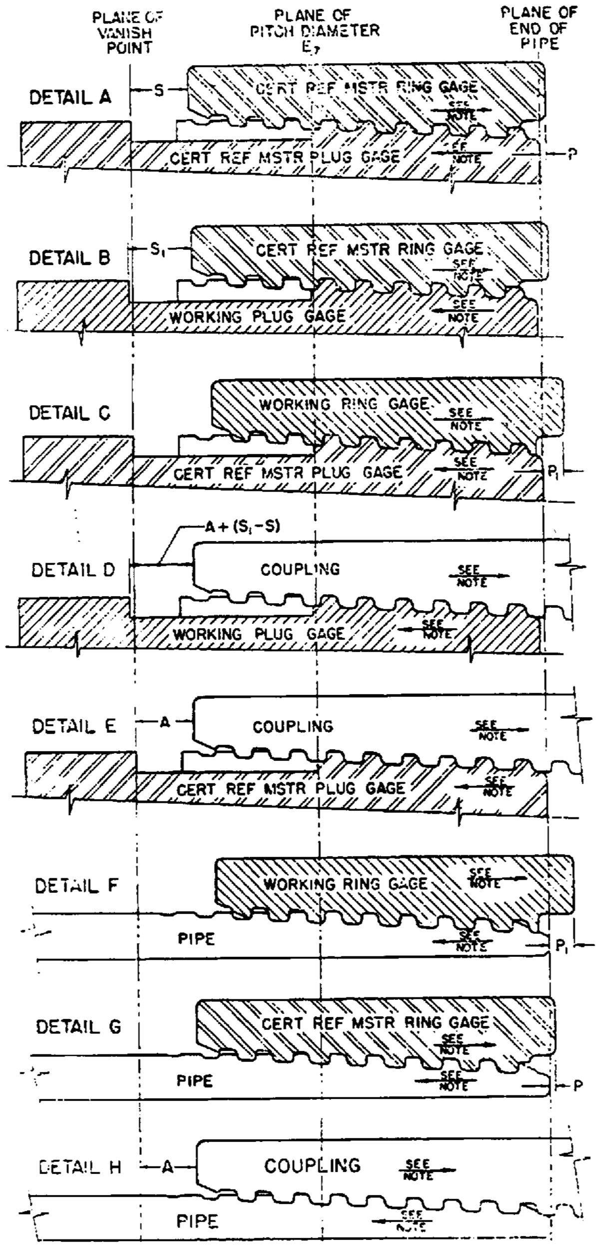
Tolerance limits for standoff of working plug gauge in



*Detail H is a nominal design illustration and the tolerances given in Par. 5.1.4 are not applicable to the standoff of coupling on pipe.

Note: When checking long thread casing with short thread ring gauges, the end of the pipe will extend beyond the small end of the ring gauge by an amount equal to (l1 long – L1 short) – P1.

Figure 28—Gauging Practice for Line-Pipe Threads and Casing and Tubing Round-Thread Hand-Tight Assembly



Note: To Obtain correct standoff on 16 in. and larger buttress casing thread gauges, the gauges should be advanced axially with back pressure in direction of arrows so that all clearance is removed between the make-up flanks of threads.

Figure 29—Gauging Practice for Buttress Casing Threads Hand-Tight Assembly

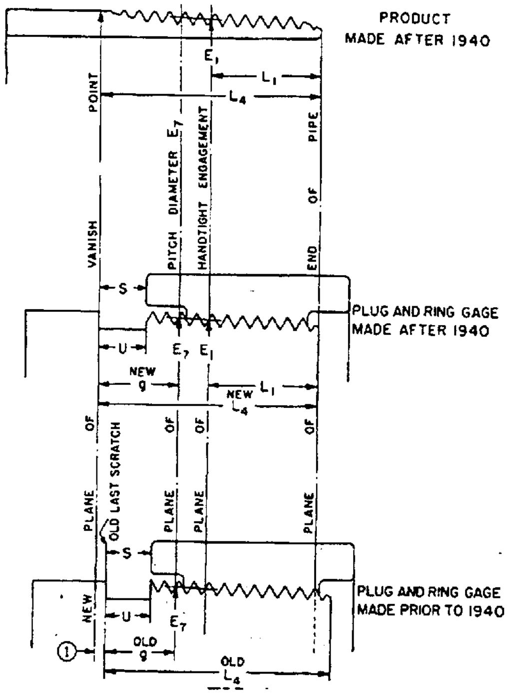


Figure 30—Comparison of Line-Pipe Gauges Made Subsequent to 1940 and Gauges Made Prior to 1940

product are shown as b and a (seal) and d and c (thread) in Tables 17 and 18. Tolerance limits for standoff of the working ring gauge on product are shown as j and i (seal) and h and g (thread) in Tables 17 and 18. New working gauges shall be made to standoff within ± 0.0015 in. tolerance on the thread element and ± 0.002 in. tolerance on the seal element, to the compensated reference master gauge standoff (see example in Par 7.2.5). A record of the deviation from the compensated standoff must accompany each working gauge when submitted to the user by the gauge maker.

The maintenance of working gauges shall be the responsibility of the gauge user. Working gauges shall be tested for mating standoff with reference master gauges by the procedure stipulated in Par. 8.2.3, the interval between tests being dependent upon the frequency of their use. A change of 0.002 in. in the recorded standoff is permissible before it is necessary to regrind and readjust the working gauge wear pads of the plug or ring element. A record of the adjustments shall be maintained, and regrinds totaling 0.032 in. deviation from the original standoff are allowable before the working gauge must be reconditioned or replaced. The API monogram shall not be applied on products controlled by gauges which have not been so tested, nor shall the letters API be used for identification of any pipe joints unless these requirements have been met.

6.2.4 Gauge Variations

(See footnotes 4 and 5). A pair of gauges (reference master plug and mating reference master ring) which have been tested according to the requirements of the applicable parts of Sect. 8 may be considered safe for continued use as long as the mating standoff does not vary from the original certified value marked on the master gauge by more than minus 0.012 in. on 5 pitch and minus 0.010 in. on 6 pitch thread, provided compensation is made for the amount of deviation from the original certified relationship. The mathematical adjustment for deviations is explained in Par 7.2.5. A pair of reference master gauges shall be reconditioned if at any time there is a change in relationship exceeding the limits given in the preceding statement.

Footnote 1. The function of reference master gauges is to check working gauges. The product box cannot be checked by the reference master plug, which has a fixed thread to seal relationship, with respect to allowable limits between the seal element and the thread element of the product. It is therefore necessary to control the amount of wear allowed in the working gauges before they must be reconditioned to comply with the prescribed working gauge to master gauge standoff value. The gauge user shall maintain all working gauges in such condition as to insure that product threads and seals, gauged as required herein, are acceptable under this specification. Cleanliness of product and gauge is imperative for satisfactory gauging of product. See Appendix A.

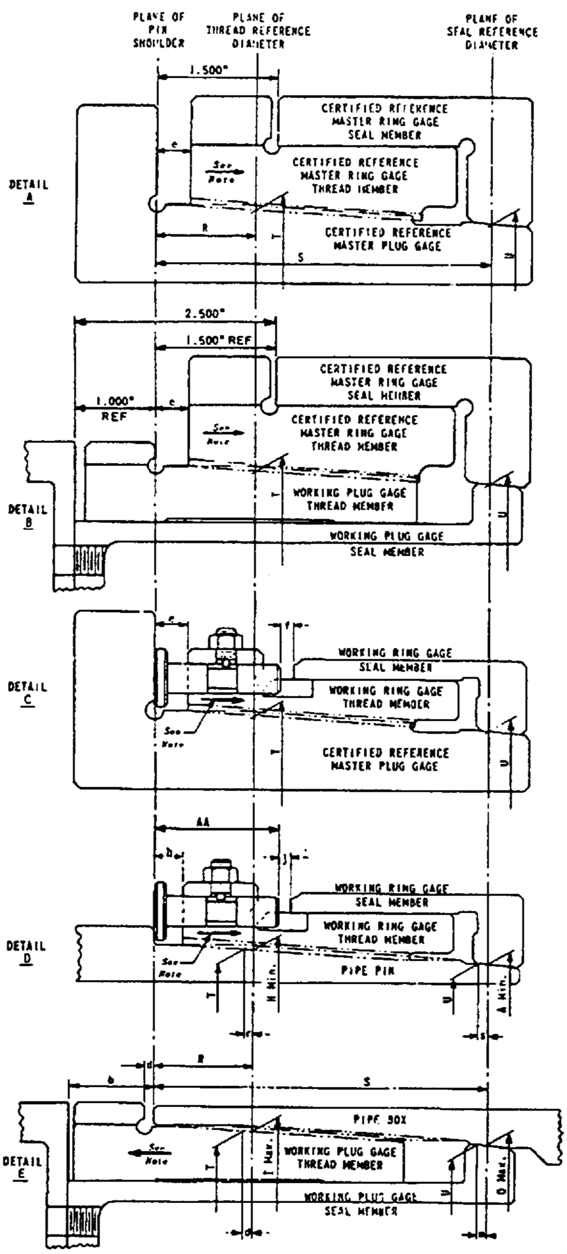
Footnote 2. It is not necessary that authority to use the API monogram on pipe be obtained in order to purchase certified reference master gauges, but the purchaser of such gauges must comply with all the stipulations on certification and retesting of such gauges as given in this specification.

Footnote 3. The relationships between the reference master gauges, working gauges and product threads and seals shall be as indicated in Fig. 31 wherein the certified reference master plug gauge is shown as the standard and the certified master ring gauge is the transfer standard. The thread standoff e of reference master plug gauge to the reference master ring gauge is the distance from the plug shoulder to the face of the ring thread member. The seal standoff (1.500 in. for all sizes) of the reference master plug gauge from the reference master ring gauge is the distance from the plug shoulder to the face of the ring seal member. To obtain correct standoff, the gauges should be advanced axially with back pressure in the direction indicated by the arrows (see Figure 31) so that all clearance is removed between the make-up flanks of the threads. The certified reference master ring gauge is used to establish the thread standoff e and seal standoff (2.500 in. for all sizes) of the working plug gauge. The certified reference master plug gauge is used to establish the thread standoff e and seal standoff f of the working ring gauge. Refer to Table 32 for standoff values.

Footnote 4. An increase in standoff usually indicates the presence of burrs, rough threads, some foreign substances or possible physical distortion of dimensions. When an increase is observed, the gauges should be cleaned of burrs or foreign substances and rechecked. If the standoff exceeds the permissible limits, the gauge shall be reconditioned. Before reuse, all reconditioned gauges shall be recertified by an authorized certification agency or testing agency as given in Par. 8.2.1.

Footnote 5. The manufacturer is not limited to the exact design of working gauges as prescribed herein. Modifications of his own choice, which would duplicate the functions and control the same limits in standoff, but not necessarily the same standoff values indicated for the working gauges shown in Sect. 7.2 are permissible.

Footnote 6. Reference Master extreme-line casing gauges made prior to 1962 are acceptable without certification provided the standoff has not changed more than the permissible amount shown in Par 6.2.4. Ring gauges shall be submitted to the National Institute of Standards and Technology for determination of interchange standoff with the Grand Master Gauges.



Notes:
1. See Figures 10 and 11 and Tables 17 and 18 for dimensions; see Figures 33 and 34 for gauge details; see Figures 7.11 and 7.12 for gauge thread form.
2. The letters j, h, d, and b constitute the minimum standoffs wherein the product is in the minimum metal condition. The corresponding standoffs for maximum metal conditions are identified in like sequence by letters i, g, c, and d as listed in Tables 7.2 and 7.3. For all other gauge dimensions, see Table 7.4.
3. To obtain correct standoff, gauges should be advanced axially with back pressure in direction of arrows so that all clearance is removed between the make-up flanks of threads.
thread form.

Figure 31—Gauging Practice for Extreme-Line Casing

7 Gauge Specification

7.1 LINE PIPE, ROUND THREAD CASING AND TUBING, AND BUTTRESS THREAD CASING

7.1.1 Master Gauges

Master plug and ring gauges, including fitting plates, shall be hardened within the limits of C60 to C63 Rockwell. They shall be ground gauges and shall conform to the dimensions and tolerances specified in Tables 21 through 31 and Figures 37 through 41. Imperfect threads at both ends of master gauges for line pipe, round thread casing, and tubing, and on the small end of master gauges for buttress casing, shall be convoluted to a full thread form. The lengths of thread for master plug gauges shall be $L_4 - U$.

7.1.2 Working Gauges

Working gauges shall conform to stipulations given herein with respect to lead, taper, and angle of thread. Working gauges shall conform to the dimensions and tolerances specified in Tables 21 through 31, but shall not be rejected for the non-compliance thereto of the miscellaneous elements D_4, D_u, U, Q, q, length of plug collar, and depth of ring counterbore unless interfering with the proper use of the gauge. The length of thread for working plug gauges shall be the basic L_1 dimension on line-pipe and round thread gauges, and the basic $L_4 - U$ dimension on buttress thread gauges. On buttress thread casing gauges, the plug gauges may be furnished with a gauging notch at the E_7 plane. The length from the plane of vanish point at to the end of the notch shall be equal to g, within the specified tolerances. It is permissible to provide a fitting plate on the small end face of the ring gauges. Working gauges should be hardened within the limits C60 to C63 Rockwell.

Note: The following relationships are the basis of gauge dimensions:

For line pipe thread gauges

a. The E_7 pitch diameter is equal to the basic outside diameter of the pipe, minus 0.8p.
b. The inside edge of the plug collar represents the basic plane of vanish point on the pipe.
c. The length g is equal to 5.47p.
d. The length of vanish threads is 3.47p.
e. The plug groove width U is equal to 3p.
f. The diameter of the plug collar D_4 is equal to the basic outside diameter of the pipe.
g. The basic diameter of the counterbore Q in the ring gauge is the same as the diameter of the recess in the coupling.
h. The basic diameter of the plug groove D_u is 0.060 in. smaller than the minor cone diameter of the product thread at the E_7 plane.

For round-thread casing and tubing gauges

a. The E_7 pitch diameter is equal to $D_4 - (h - 0.003$ in.).
b. The inside edge of the plug collar represents the basic plane of vanish point on the pipe.
c. The length g is equal to:
   5p – for casing and 10-thread tubing.
   4p – for 8-thread tubing.
d. The length of vanish threads is:
   2.28p for casing.
   1.69p for 10-thread tubing

1.88p for 8-thread tubing
e. The plug-groove width U is equal to 2p.
f. The diameter of the plug collar, D_4, is equal to the outside diameter of that portion of the pipe adjacent to the threads.
g. The basic diameter of the counterbore in the ring gauge is the same as the basic diameter of the recess in the coupling.
h. The basic diameter D_u of the plug groove is 0.060 in. smaller than the minor-cone diameter of the product thread at the plane of E_7.

For buttress-thread casing gauges

a. The major diameter at the end of the plug gauge D_0 is equal to $E_7 - 0.0625\ L_7 + 0.062$ in. for sizes $13^3/_8$ and smaller; for 16 and larger, D_0 is equal to $E_7 - 0.0833\ L7 + 0.062$ in.
b. At plane of perfect thread length L_7, the basic major diameter of pipe thread and plug gauge thread is 0.016 in. greater than specified outside diameter of the pipe D for sizes $13^3/_8$ and smaller, and is equal to the specified pipe diameter for sizes 16 and larger.
c. The pitch diameter E_7 is equal to $D_4 - 0.062$ inch. (The pitch diameter E_7 is for design purposes only and does not require certification.)
d. The inside edge of the plug collar represents the basic plane of vanish point on the pipe.
e. The length of imperfect threads, g, of the plug gauge is 1.984 in. for sizes $13^3/_8$ and smaller; for 16 and larger, g is 1.488 in.
f. The plug-groove width U is equal to $^3/_{16}$ in. for all sizes.
g. The diameter of the plug collar, D_4, is equal to the tabulated outside diameter of the pipe plus 0.016 in. for sizes $13^3/_8$ and smaller; for 16 and larger, D_4 is equal to the tabulated outside diameter of the pipe.
h. The basic diameter of the counterbore in the ring gauge is the same as the basic diameter of the counterbore in the coupling.
i. The basic diameter D_u of the plug gauge is $^3/_{16}$ in. smaller than the plug collar.
j. Thread crests and roots are parallel to cone for sizes $13^3/_8$ and smaller; crests and roots are parallel to the pipe axis for sizes 16 and larger.

7.1.3 Lead

The lead of line pipe and round thread plug and ring gauges shall be measured parallel to the thread axis along the pitch cone, over the full threaded length, less the end threads. The lead of buttress thread ring gauges shall be measured parallel to the thread axis, approximately along the pitch cone, over the full threaded length, less the end threads.

The lead of buttress thread plug gauge s shall be measured parallel to the thread axis, approximately along the pitch cone, in the perfect thread length, less the end thread at the small end. The lead error between any two threads shall not exceed the tolerance specified in Tables 29, 30 and 31.

7.1.4 Taper

The taper of both plug and ring gauges shall be determined from measurements of the diameter of the pitch cone for line pipe and round-thread gauges and of the major or the minor cones of buttress thread gauges, at a minimum of two positions covering the full threaded length less the end threads. The difference between the diameter at the large end of a gauge and the diameter at any position nearer the small end, less the end threads, shall not differ from the specified taper by more than the appropriate fraction of the total tolerance specified in Tables 29, 30, and 31. The applicable fraction of the tolerance shall be determined from the ratio of the axial distance between the positions where the diameter measurements are made to the $L_4 - g$ length for line pipe and round thread gauges and the $L_4 - S$ length for buttress thread gauges. In determining compliance with the specified tolerance, allowance should be made for the uncertainty of the diameter measurements, particularly in the case of small axial intervals where the taper tolerance is necessarily small.

7.1.5 Thread Height

For line-pipe gauges and round thread gauges, the thread height, h_g, is the distance from the crest of the thread on the plug to the crest of the thread on the ring at any given diameter assuming perfect thread form. It is a reference dimension used in determining the diameter of the ring gauge. It cannot be measured directly. Thread height, h_g, does not apply to buttress thread gauges. For buttress thread gauges, the thread height is measured directly and shall comply with the dimensions and tolerances given in Figures 40, 41 and Table 31.

7.1.6 Root Form

The roots of line-pipe and round-thread gauges shall be sharp or undercut to a width approximately the width of the product crest. The undercut shall be substantially symmetrical with respect to the adjoining thread flanks, and of such depth as to clear the basic sharp thread; otherwise, the shape of the undercut is optional with the gauge manufacturer.

7.1.7 Gauge Length

The length of thread in master and working ring gauges shall not be less than $L_4 - g - 1^1/_2p$ for line-pipe and round-thread gauges, and not less than $L_4 - 1$ in. for buttress thread casing gauges. If so specified or agreed to by the purchaser, the small end of the plug gauge shall be finished with a projection having a length approximately $1^1/_2p$ on line-pipe and round-thread gauges, and approximately $^3/_{16}$ in. on buttress thread casing gauges, and a gauging notch. The diameter at the end of the projection shall be such that the projection will not interfere with proper gauging (see Figures 37 and 38).

Note: Ring gauges made prior to 1979 having an extension on the small end to provide sockets for make-up may be used if the P_1 is determined and recorded so that the compensated values are known.

7.1.8 Master Plug Gauges—Centering Provisions

All API Master Plug Gauges (see note) up to and including $8^5/_8$ must have centers, arbors or handles with centers suitable for inspecting the gauge between centers. On gauges larger than $8^5/_8$ the following Bolt Circles and Back-up Plates are required for line pipe, buttress casing and short or long round casing gauges. Refer to Figure 42.

Note: Applies only to Master Casing and Line Pipe Plug Gauges made after May 31, 1988.

Size	Plate Diameter	Bolt Circle
$9^5/_8$	$9^5/_8$	$7^1/_4$
10		
$10^3/_4$	$10^3/_4$	$9^3/_8$
$11^3/_4$		
12		
$13^3/_8$	$13^3/_8$	$10^3/_4$
14		
16	16	$12^3/_8$
18	18	16
$18^5/_8$		
20	20	$17^3/_8$

The certifying agency can reject a plug gauge with inadequate centers or bolt circle.

7.1.9 Mating Standoff

The mating standoff S of the master ring gauge from the plane of vanish point on the master plug gauge shall conform to the values given in Tables 21 through 26. The initial mating standoff of the gauges shall conform to the specified value within the tolerance given in Tables 29, 30 and 31.

7.1.10 Marking

Master gauges shall be permanently marked by the gauge manufacturer with the marking given below. Plug gauges should preferably be marked on the body, although marking on the handle is acceptable on gauges in small sizes or when the handle is integral with the body. Any markings which are considered necessary by the gauge maker may be added. Both plug and ring shall be marked as follows:

a. Specification 5B (see note). "Spec 5B" may be used on master gauges produced by non-licensees and shall not be used on working gauges or gauges which do not meet all stipulations given herein, including determination of mating standoff. The API monogram shall be applied by authorized manufacturers in accordance with the regulations governing the use of the monogram described in Appendix B.

Note: Users of this specification should note that there is no longer a requirement for marking a product with the API monogram. The American Petroleum Institute continues to license use of the monogram on products covered by this specification but it is administered by the staff of the Institute separately from the specification. Licensees may mark products in conformance with Appendix B and non-licensees may mark in accordance with Section 7.1.10. The policy describing licensing and use of the monogram is contained in Appendix B, herein. No other use of the monogram is permitted.

b. Date of Manufacture.

c. Size of Gauge. For line pipe gauges the nominal sizes, as given in Table 21, and for casing and tubing gauges the outside diameter of the pipe as given in Tables 22 through 26, shall be marked on each new plug and ring gauge.

d. Type of Thread. Both plug and ring gauges shall be marked with the proper identifying terms or their abbreviations as follows:

Line Pipe	LINE PIPE or LP
Round-thread casing	CSG
Buttress-thread casing	BUTTRESS CSG
Non-upset tubing and integral joint tubing	TBG
External-upset tubing	UP TBG

e. Name or Identifying Mark of Gauge Maker. The name or identifying mark of the gauge maker shall be placed on both plug and ring gauge.

f. Year of Adoption (Line pipe gauges only). Gauge dimensions stipulated herein for new gauges were adopted in 1940. Plug gauges made prior to Jan. 1, 1940 may have g values at variance with such values as given herein. See Par. 6.1.9 for correction factors.

7.2 EXTREME-LINE CASING

7.2.1 Grand Master Gauges

The grand master gauges comply with the same limitations and tolerances as prescribed herein for the reference master plug gauges. Any deviation from nominal size shall be determined by the National Institute of Standards and Technology. Grand master gauges may not be used for checking working gauges, nor for checking reference master gauges not marked with the API monogram. Grand master gauges for all sizes of extreme-line casing are deposited with the National Institute of Standards and Technology, Gaithersburg, Maryland 20899, USA.

7.2.2 Reference Master Plug and Ring

The reference master plug and ring gauges as required in Sect. 6.2 shall be hardened within the limits of C60 to C63 Rockwell or equivalent hardness on a superficial scale. They shall be ground gauges and shall conform to the dimensions and tolerances specified herein. The master ring assembly shall consist of two sliding members, a threaded member and a seal member.

Note: The following relationships are the basis of gauge dimensions: (see Figure 31). The relationship, as defined herein, is to the product in the minimum metal condition.

a. (See Detail A). The root diameter T (as shown in Table 32) at R distance from the plane of the pin shoulder shall be the reference point for all thread dimensions.
b. (See Detail A). The tangent point U (as shown in Table 32) at S distance from the plane of the pin shoulder shall be the reference point for all seal dimensions.
c. (See Detail E). The crest diameter I max. at R distance from the box face shall be the reference point on the box thread member.
d. (See Detail E). The tangent point O max. at S distance from the box face shall be the reference point for the box seal member.
e. (See Detail D). The root diameter H min. at R distance from the pin shoulder shall be the reference point for the pin thread member.
f. (See Detail D). The tangent point A min. at S distance from the pin shoulder shall be the reference point for the pin seal member.
g. (See Detail D). The distance r between the reference point T and H min. equals the difference between the thread standoff e of the gauge to gauge and the thread standoff h of the gauge to product pin: $r = e - h$.
h. (See Detail D). The distance s between reference point U and A min. equals the difference between the seal standoff f of the master plug gauge to the working ring gauge and the seal standoff j of the working ring gauge to the product pin: $s = f - j$.

i. (See Detail E). The distance d between reference point T and I max. equals the standoff d of the working thread plug gauge to the product box.
j. (See Details B and E). The distance m between reference point U and O max. (see Detail E) equals the difference between the seal standoff b of the working plug gauge to the product box and the working seal plug shoulder to the shoulder base line distance of 1.000 in. (See Detail B): m = b – 1.000 in.

Note: m, r and s are not listed in the tables.

7.2.3 Reconditioning

The maintenance of reference master gauges within the standoff limits specified in Par. 6.2.4 shall be the responsibility of the gauge user. Reference master gauges in non-compliance with the standoff requirements of Par. 6.2.4 or otherwise unsuitable for further use, shall be promptly reconditioned (or replaced) and recertified in accordance with Par. 8.2.1.

7.2.4 Working Gauges

Working gauges shall conform to stipulations given herein. The length of thread for working plug gauges shall be as shown on Figures 33 and 34.

7.2.5 Standoff

Reference master and working gauges made to dimensions and tolerances, as prescribed in Sect. 4.2, will not be perfect. They will contain slight deviations (within allowable tolerances) from the nominal standoffs. Mathematical compensation in the form of adding or subtracting the amount of deviation from the nominal standoffs shall be carried through and accounted for in the gauge mating sequence of reference master plug to reference master ring to working plug and reference master plug to working ring, and thus the product can be maintained within the seal and thread diametral tolerances of ± 0.001 in. without accumulating gauge discrepancies. To further clarify, an example of the mathematical adjustment is as follows:

Example:

Subject: The size 5$^1/_2$ gauge sequence: Reference master plug gauge through working gauges on (a) the threaded element and on (b) the seal element.
Terms Used:
Nominal means the basic design or theoretical figure.
Actual means the actual physical measured dimensions.
Compensated means the mathematically adjusted figure.
Reference: Figure 31 and Table 32.

a. Thread Element. For the thread element on the reference master plug, the nominal distance from the plane of the pin shoulder to the gauge point T is R or 1.2400 in.; however, upon making the actual measurement, R of the plug was 1.2397 in. or a deviation of – 0.0003 in. from the nominal. This value is marked on the gauge by the authorized certifying agency, COMP R = 1.2397 in. When making a reference master thread ring element using the reference master plug as a measuring device, the nominal standoff e should be 0.3220 in., therefore, with this reference master plug the standoff to be produced will be 0.3217 in. (accounting for the – 0.0003 in.) When actually measured the standoff was 0.3206 in. or a deviation from the compensated reference master plug to the reference master ring element of – 0.0011 in. The actual standoff is marked on the threaded ring element by the certifying agency, ACT e = 0.3206 in. When making the working plug thread element gauge using the reference master ring as a measuring device, the nominal standoff e should be 0.3220 in.; however with this master ring the compensated e to be actually produced must be 0.3209 ± 0.0015 in. The reference master ring is marked with the compensated standoff by the certifying agency, COMP e = 0.3209 in. When making a working ring thread element using a reference master plug as a measuring device, the nominal standoff e should be 0.3220 in.; however with this reference master plug the compensated e to be actually produced must be 0.3217 ± 0.0015 in. This value is not marked on the plug.
b. Seal Element. For the seal element on the master plug, the nominal distance from the plane of the pin shoulder to the gauge point U is S or 4.1840 in.; however, upon making the actual measurement, S of the plug was 4.1858 in. or a deviation of + 0.0018 in. from the nominal. This value is marked on the gauge by the certifying agency, COMP S = 4.1858 in. When making the reference master seal ring element using the reference master plug as a measuring device, the nominal standoff should be the 1.5000 REF; therefore, with this reference master plug the standoff to be produced will be 1.5018 in. (accounting for the + 0.0018 in.). When actually measured, the standoff was 1.5024 in. or a deviation from the compensated reference master plug to the reference master ring element of + 0.0006 in. The actual and compensated standoff is marked on the ring by the certifying agency, ACT = 1.5024 in. and COMP = 1.5006 in. When making the working plug seal element gauge using the reference master ring as a measuring device, the nominal standoff should be 2.5000 in.; however, with this master ring, the standoff to be produced must be 2.5006 ± 0.002 in. When making the working ring seal element using a reference master plug as a measuring device, the nominal standoff f should be 0.1420 in.; however, with this reference master plug the compensated f to be actually produced must be 0.1438 ± 0.002 in.

7.2.6 Lead

The lead of plug and ring gauges shall be measured parallel to the thread axis along the dimensional reference line over the full thread length, omitting one full thread at each end. The lead error between any two threads shall not exceed the tolerances specified in Table 33.

7.2.7 Taper

On both thread plug and thread ring gauge the basic reference diameter shall be on the minor cone. On both plug and ring gauge the major cone may vary by the amount of thread depth tolerance. The taper of both plug and ring gauges shall be determined from measurements of the minor cone at a suitable number of positions covering the full thread length less one full thread at each end. The difference between the diameter at the large end of a gauge and the diameter at any position nearer the small end, neglecting end threads in all cases, shall not differ from the nominal taper by more than the appropriate fraction of the total tolerance specified in Table 33. The applicable fraction of the tolerance shall be determined from the ratio of the axial distance between the positions where diameter measurements are made to the gauge thread element length. In determining compliance with the specified tolerance, allowance should be made for the uncertainty of the diameter measurements, particularly in the case of small axial intervals where the taper tolerance is necessarily small.

On both seal plug and seal ring gauge member seal surface, the included taper over the full length of the seal cone surface elements of these gauge members shall be within the tolerances specified in Table 33.

7.2.8 Thread Height

The thread height on gauges shall conform to the thread height and tolerances as shown on the gauge thread dimensions of Figures 35 and 36.

7.2.9 Root and Crest Form

The roots and crests shall be parallel to the axis. The minor cone taper line shall bisect the root of the plug and the crest of the ring threads at a distance of $1/4$ pitch from the intersection of the bearing flank and the dimensional reference cone line.

7.2.10 Miscellaneous Elements

The dimensions as shown on Figures 33 and 34, Details C and D defining the outside diameters, pin lengths, etc., should conform to the dimensions given; but, gauges shall not be rejected for non-compliance thereto unless such non-compliance interferes with the proper use of the gauge. Refer to Figure 32 for dimensions of API removable Back-Up Plates for Extreme Line Casing Gauges. The certifying agency can reject a plug gauge with inadequate bolt circle.

7.2.11 Marking

The gauge manufacturer shall permanently mark the thread and seal gauge members with the markings given below. Any additional markings that are considered necessary by the gauge manufacturer may also be added.

a. API Monogram. The API monogram may be used only on certified reference master gauges and shall not be used on working gauges or gauges which do not meet all stipulations given herein, including determination of mating standoff. The API monogram shall be applied only as specified and only by authorized manufacturers.
b. Size of Gauge. The size as given in Tables 17 and 18 shall be marked on each plug and ring gauge.

Note: The size of the gauge is the same as the outside diameter of the pipe.

c. Type of Thread. Both plug and ring gauges shall be marked with the proper identification terms or their abbreviations as follows:

Extreme-Line Casing Ex. Li. Csg.

d. Gauge Set Identification. The gauge maker shall mark all gauge members for proper identification of matched ring and plug gauge sets.
e. Name or Identification Mark of Gauge Maker. The name or identification mark of the gauge maker shall be placed on both plug and ring gauges.
f. Dimensions and Standoffs. Dimensions and standoff determinations as indicated below shall be marked on master gauges by the certifying agency.

Plug Gauge Dimensions

Nom. R ________
Comp. R ________
Nom. S ________
Comp. S ________

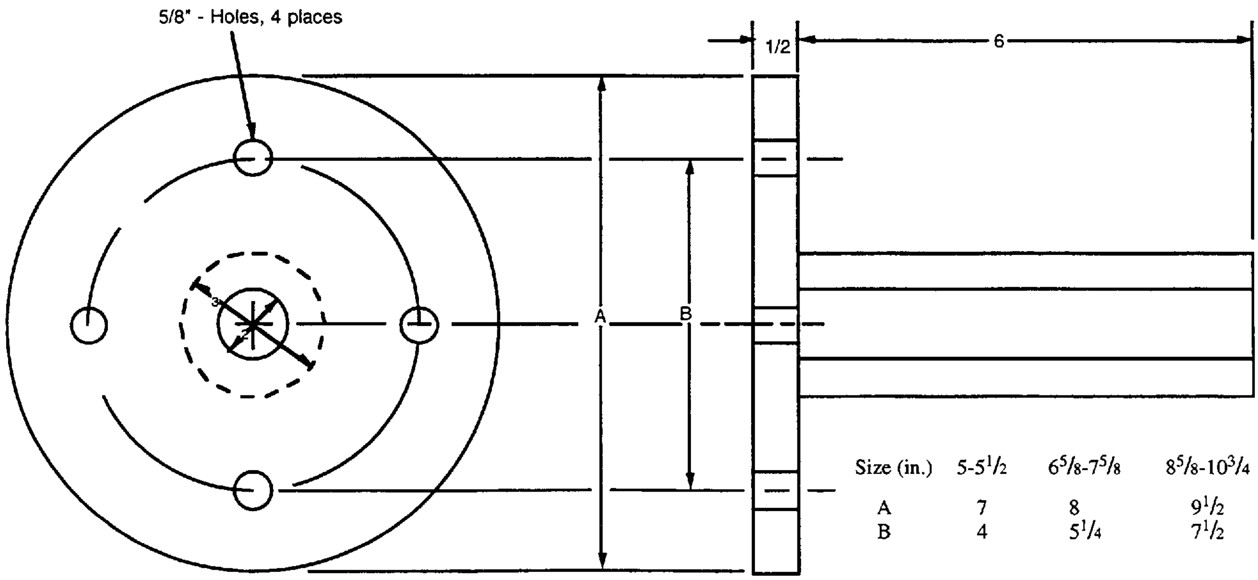
Ring Gauge Standoffs

Thread Member

Nom. e ________
Act. e ________
Comp. e ________

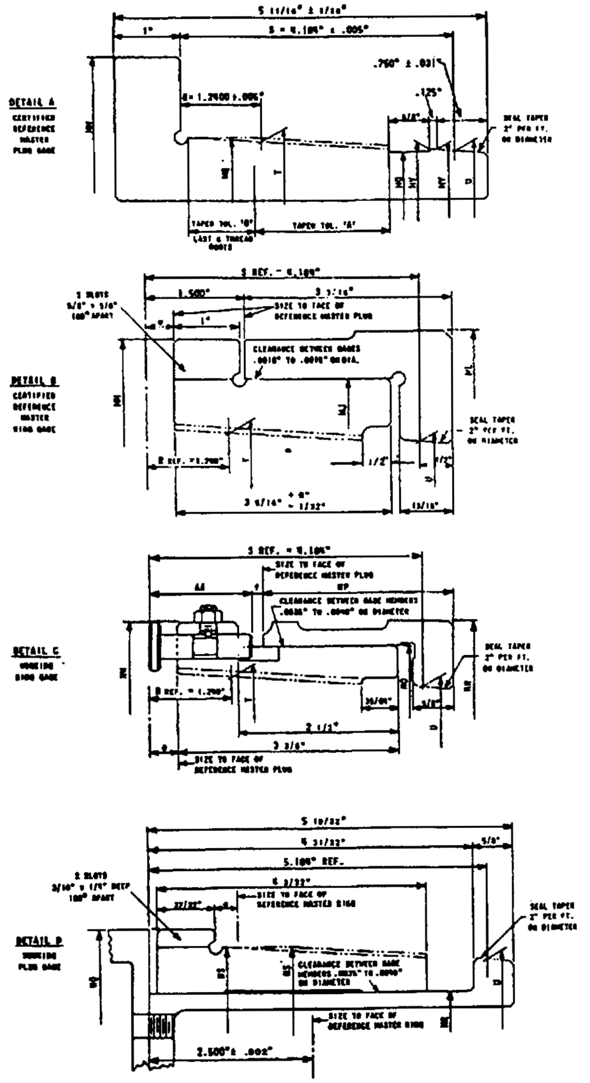
Seal Member

Nom. 1.5000 (for all sizes)
Act. ________________
Comp. ________________



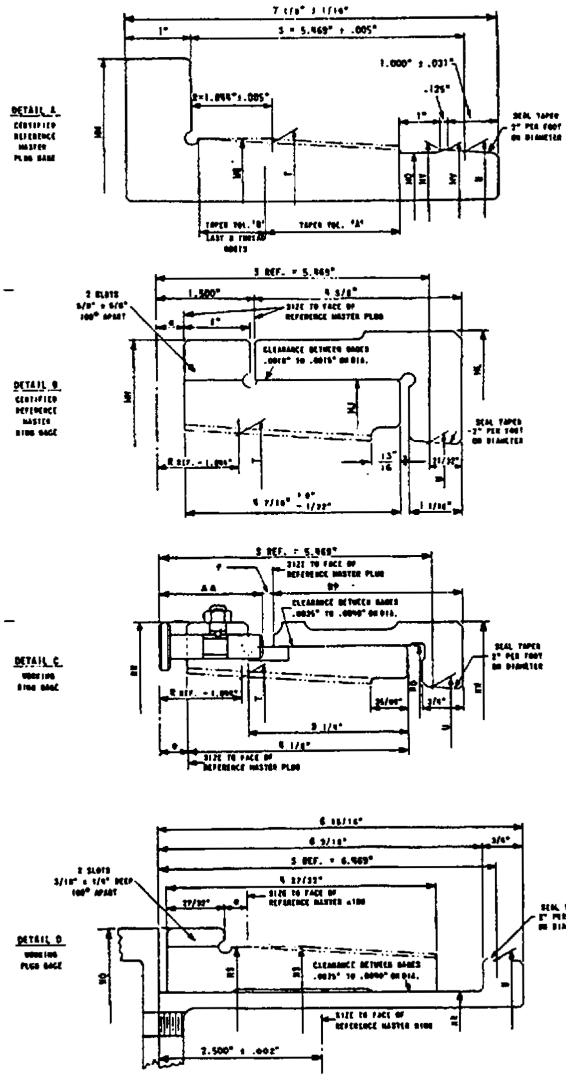
Size (in.)	5-5 1/2	6 5/8-7 5/8	8 5/8-10 3/4
A	7	8	9 1/2
B	4	5 1/4	7 1/2

Figure 32—Bolt Circles and Back-Up Plate Dimensions for Extreme-Line Casing Master Plus Gauges



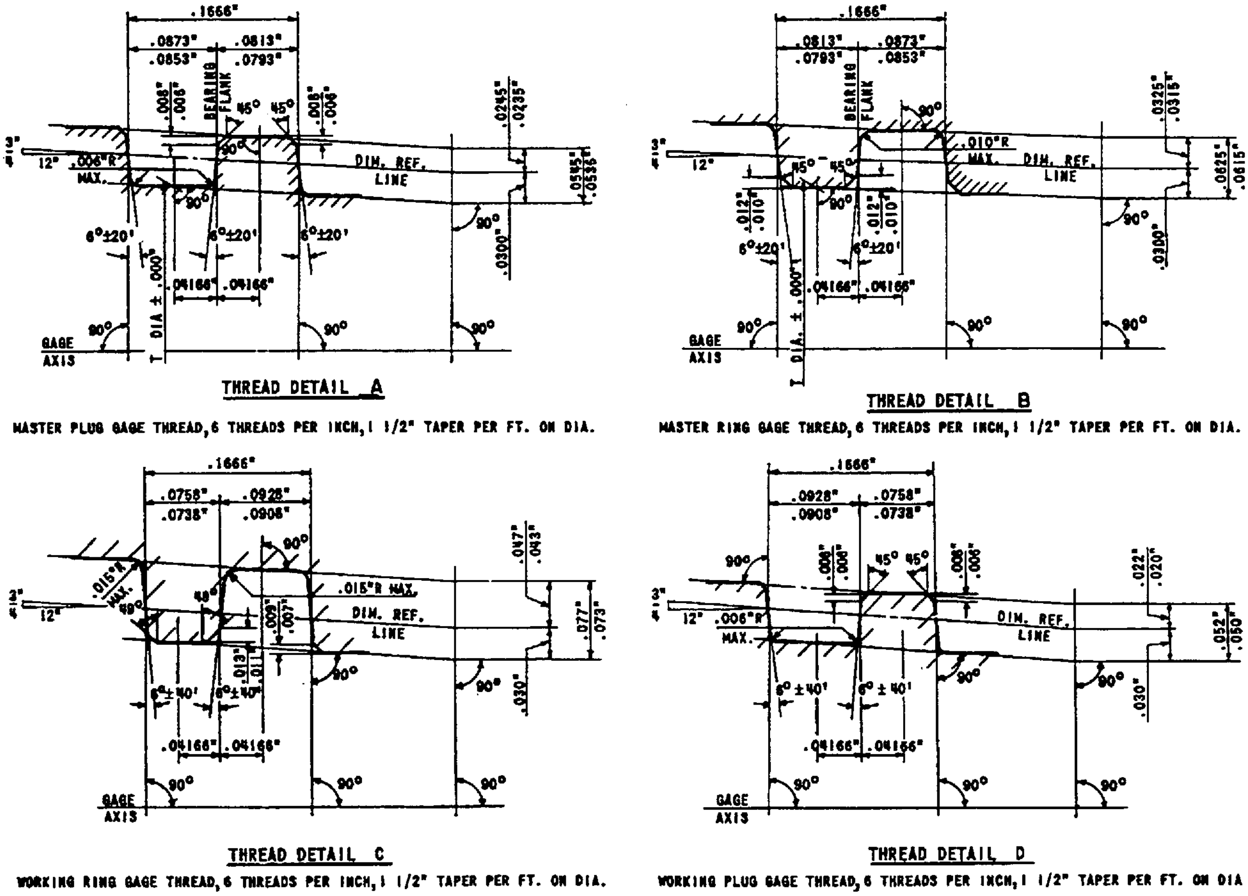
Notes:
1. End surfaces shall be ground normal to axis of the gauge within 0.0005 in. T.I.R.
2. See Table 32 for other dimensions; see Table 33 for thread and seal tolerances; see Figure 35 for thread form details; see Figure 31 for gauging practice; see Figure 34 for sizes over $7^5/_8$ in.

Figure 33—Gauge Details—Sizes 5 Through $7^5/_8$



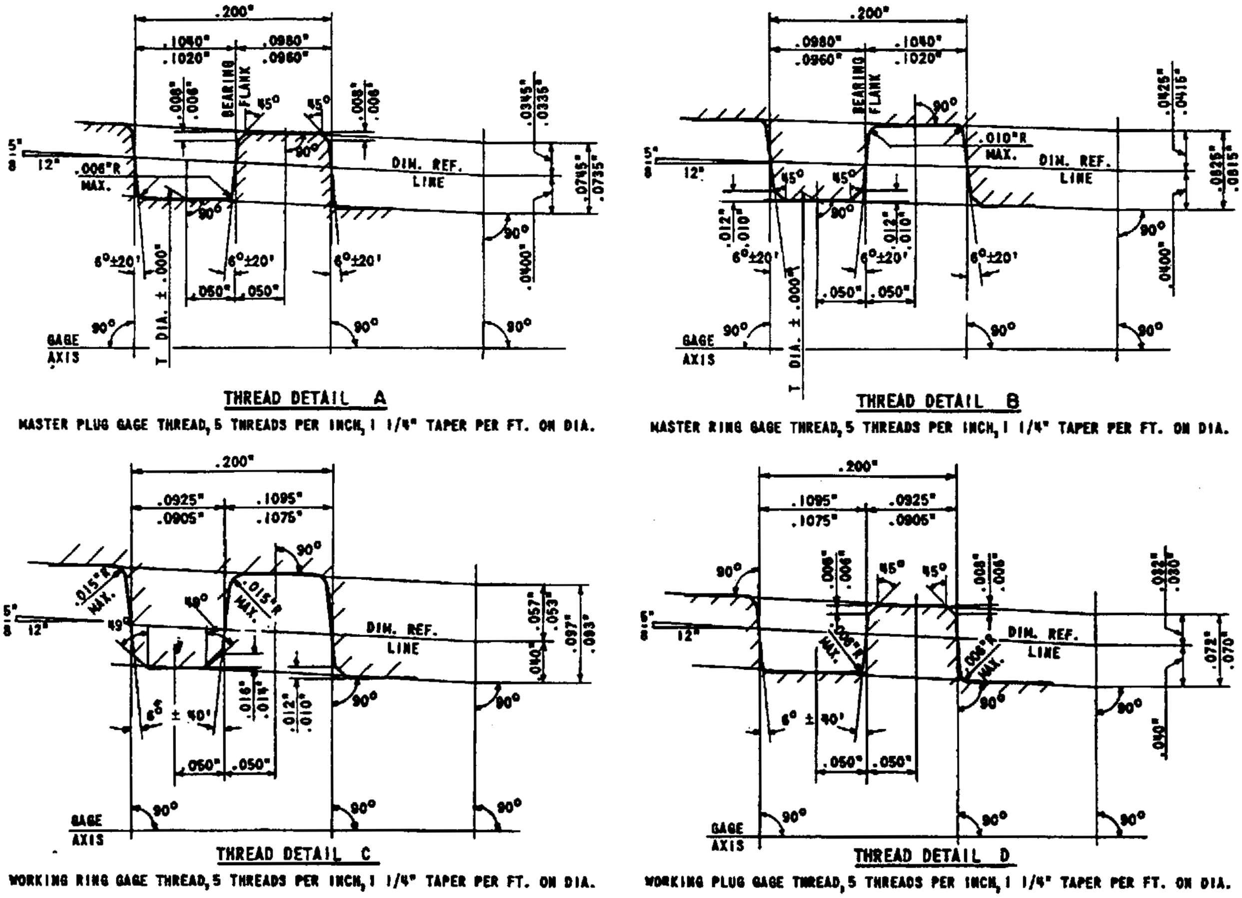
Notes:
1. End surfaces shall be ground normal to axis of the gauge within 0.0005 in. T.I.R.
2. See Table 32 for other dimensions; see Table 33 for thread and seal tolerances; see Figure 36 for thread form details; see Figure 31 for gauging practice; see Figure 33 for sizes over $7^5/_8$ in.

Figure 34—Gauge Details—Sizes $8^5/_8$ Through $10^3/_4$



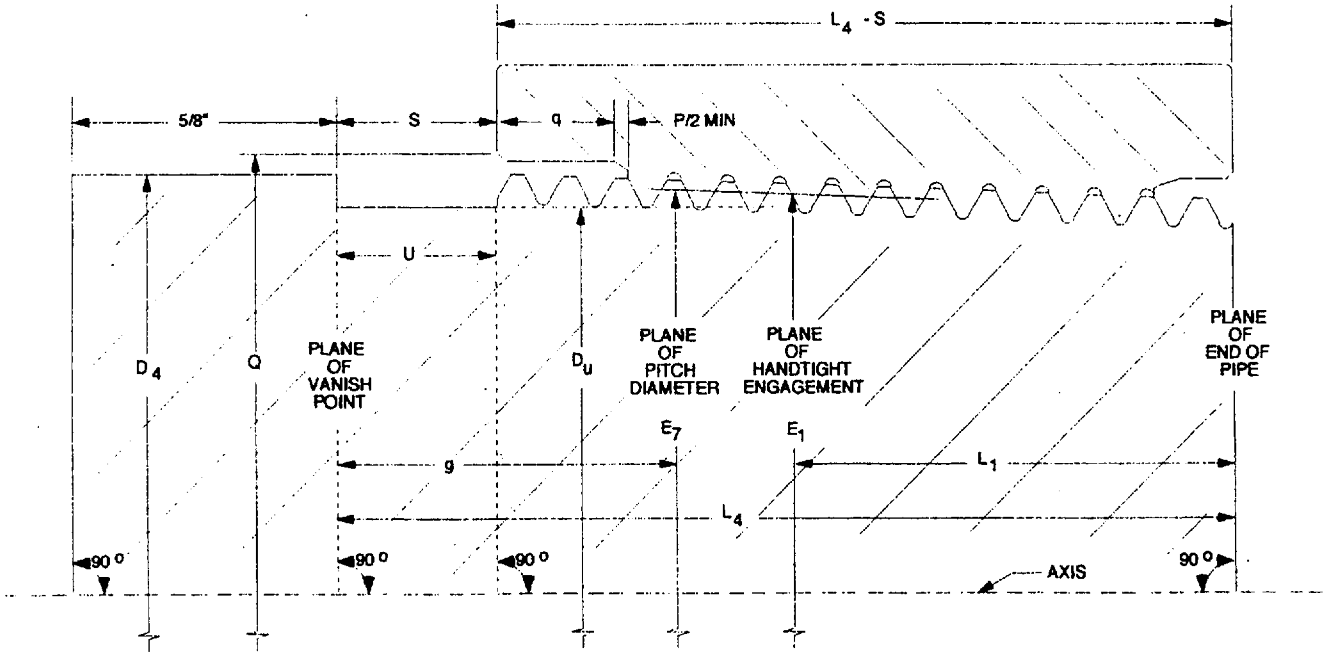
Note: See Figure 33 for other details; see Table 33 for other tolerances.

Figure 35—Gauge Thread Form—Sizes 5 Through $7^5/_8$



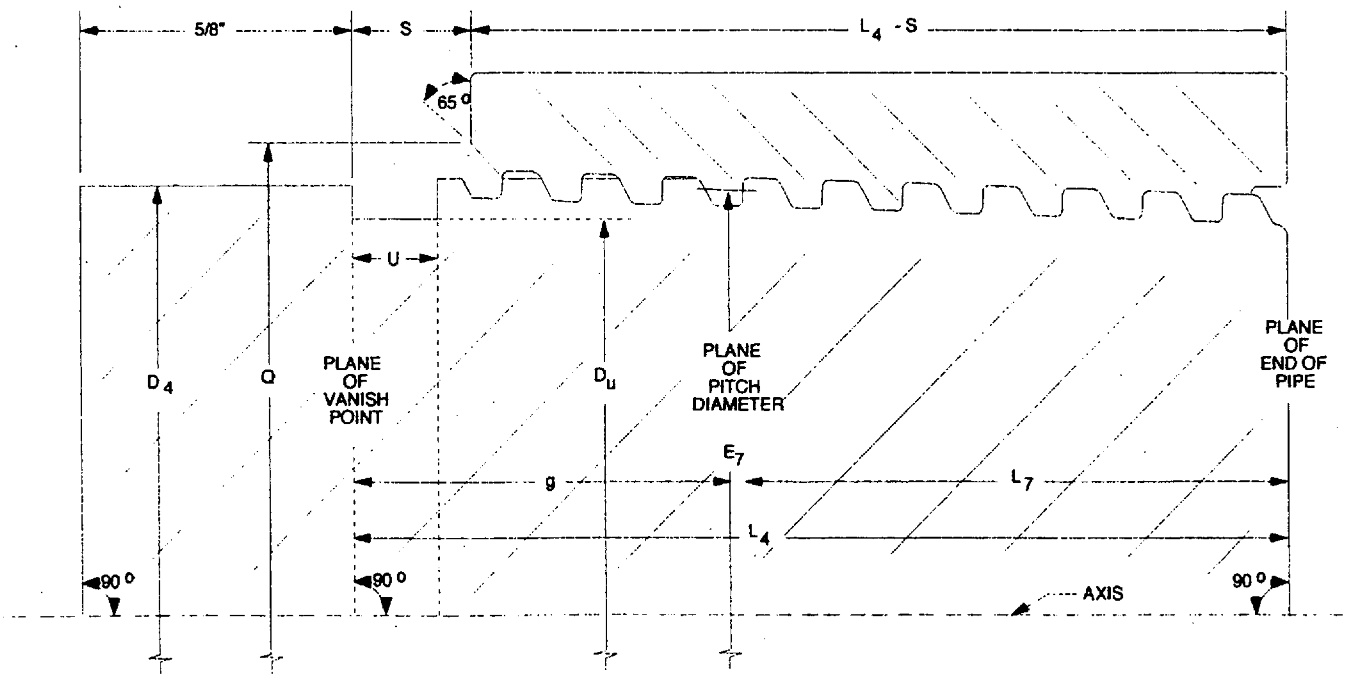
Note: See Figure 34 for other details; see Table 33 for other tolerances.

Figure 36—Gauge Thread Form—Sizes 8⅝ Through 10¾



Note: See Figure 39 for detail of thread form; see Tables 21, 22, and 24 through 28 for dimensions; see Par. 7.1.8 and Tables 29 and 30 for tolerances.

Figure 37—Thread Gauge for Line Pipe and Round-Thread Casing and Tubing



Note: See Figure 40 for detail of thread form; see Table 23 for dimensions; see Table 31 for tolerances.

Figure 38—Thread Gauge for Buttress Casing

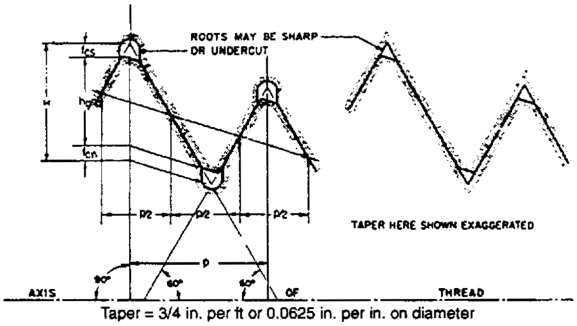


Figure 39—Gauge Thread Form for Line Pipe and Round Thread Casing and Tubing (See Tables 27 and 28 for dimensions)

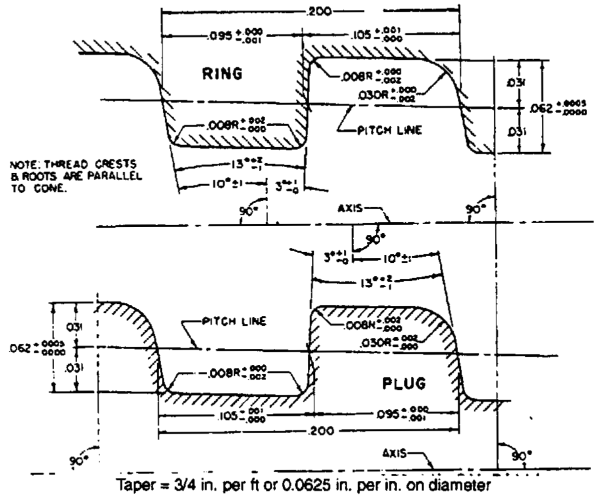


Figure 40—Gauge Thread Form and Dimensions for Buttress Casing (Sizes 4½ through 13⅜)

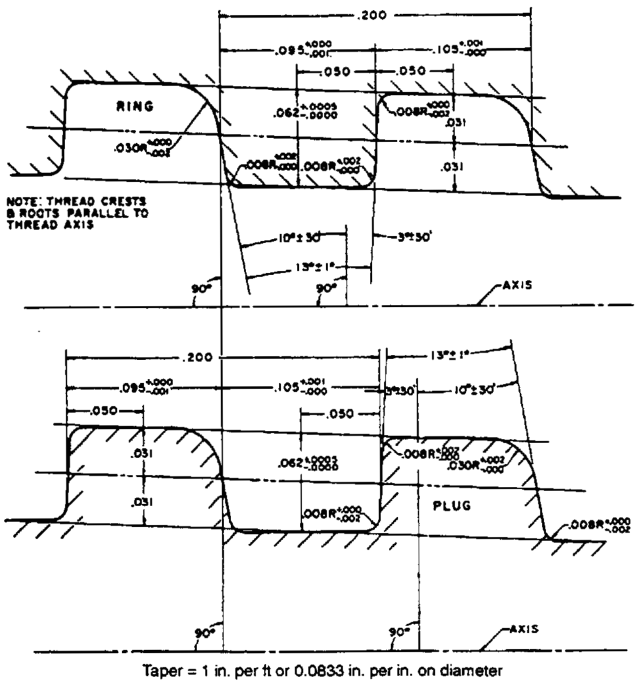
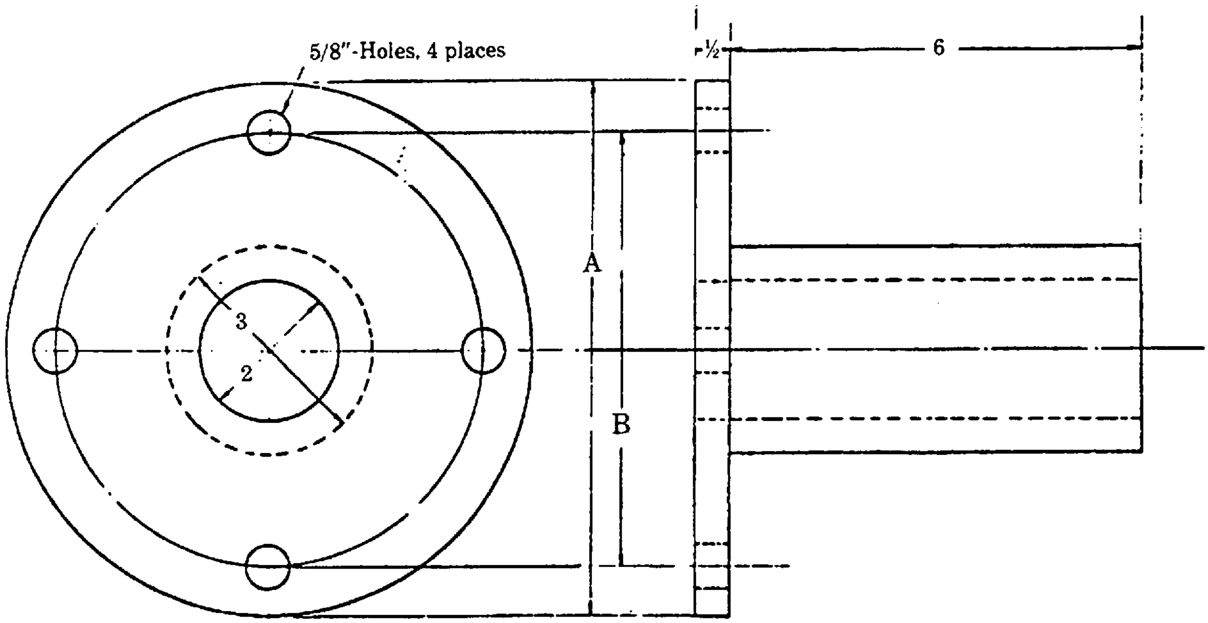


Figure 41—Gauge Thread Form and Dimensions for Buttress Casing (Sizes 16 and larger)



Size, in.	9⁵/₈	11/12	13³/₈/14	16	18/18⁵/₈	20
A	9⁵/₈	10³/₄	13³/₈	16	18	20
B	7¹/₄	9³/₈	10³/₄	12³/₈	16	17³/₈

Figure 42—Bolt Circles and Back-Up Plate Dimensions for Line Pipe, Buttress Casing and Short or Long Round Casing Master Plug Gauges

Table 21—Line Pipe Thread Gauge Dimensions

All dimensions in inches at 68 F, except as otherwise indicated. See Figure 37.

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
Nominal Size[a]	Outside Diameter of Plug Collar D_4	Diameter of Groove D_u	Diameter of Counter-bore Q	Depth of Counter-bore q	No. of Threads Per Inch	Pitch Diameter at Hand-Tight Plane E_1	Pitch Diameter at Length g from Vanish Point E_7	Length: Plane of E_7 to Vanish Point g	Length: End of Plug Gauge to Hand-Tight Plane L_1	Length: End of Plug Gauge to Vanish Point L_4	Width of Groove U	Stand-off S
1/8	0.405	0.286	0.468	0.092	27	0.37360	0.37537	0.2026	0.1615	0.3924	0.111	0.111
1/4	0.540	0.391	0.603	0.137	18	0.49163	0.49556	0.3039	0.2278	0.5946	0.167	0.167
3/8	0.675	0.526	0.738	0.137	18	0.62701	0.63056	0.3039	0.240	0.6006	0.167	0.167
1/2	0.840	0.666	0.903	0.177	14	0.77843	0.78286	0.3906	0.320	0.7815	0.214	0.214
3/4	1.050	0.876	1.113	0.177	14	0.98887	0.99286	0.3906	0.339	0.7935	0.214	0.214
1	1.315	1.116	1.378	0.215	11 1/2	1.23863	1.24543	0.4756	0.400	0.9845	0.261	0.261
1 1/4	1.660	1.461	1.723	0.215	11 1/2	1.58338	1.59043	0.4756	0.420	1.0085	0.261	0.261
1 1/2	1.900	1.701	1.963	0.215	11 1/2	1.82234	1.83043	0.4756	0.420	1.0252	0.261	0.261
2	2.375	2.176	2.469	0.215	11 1/2	2.29627	2.30543	0.4756	0.436	1.0582	0.261	0.261
2 1/2	2.875	2.615	2.969	0.309	8	2.76216	2.77500	0.6837	0.682	1.5712	0.375	0.375
3	3.500	3.240	3.594	0.309	8	3.38850	3.40000	0.6837	0.766	1.6337	0.375	0.375
3 1/2	4.000	3.740	4.094	0.309	8	3.88881	3.90000	0.6837	0.821	1.6837	0.375	0.375
4	4.500	4.240	4.594	0.309	8	4.38712	4.40000	0.6837	0.844	1.7337	0.375	0.375
5	5.563	5.303	5.657	0.309	8	5.44929	5.46300	0.6837	0.937	1.8400	0.375	0.375
6	6.625	6.365	6.719	0.309	8	6.50597	6.52500	0.6837	0.958	1.9462	0.375	0.375
8	8.625	8.365	8.719	0.309	8	8.50003	8.52500	0.6837	1.063	2.1462	0.375	0.375
10	10.750	10.490	10.844	0.309	8	10.62094	10.65000	0.6837	1.210	2.3587	0.375	0.375
12	12.750	12.490	12.844	0.309	8	12.61781	12.65000	0.6837	1.360	2.5587	0.375	0.375
14 D	14.000	13.740	14.094	0.309	8	13.87263	13.90000	0.6837	1.562	2.6837	0.375	0.375
16 D	16.000	15.740	16.094	0.309	8	15.87575	15.90000	0.6837	1.812	2.8837	0.375	0.375
18 D	18.000	17.740	18.094	0.309	8	17.87500	17.90000	0.6837	2.000	3.0837	0.375	0.375
20 D	20.000	19.740	20.094	0.309	8	19.87031	19.90000	0.6837	2.125	3.2837	0.375	0.375

Included taper on diameter, all sizes, 0.0625 in. per in.

[a]The gauge size is the same as nominal size of the pipe, and is not the outside diameter except for sizes 14 through 20.

Table 22—Casing Short and Long Round Thread Gauge Dimensions

All dimensions in inches at 68 F, except as otherwise indicated. See Figure 37.

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
Outside Diameter of Pipe Size Designation	Outside Diameter of Plug Collar D_4	Diameter of Groove D_u	Diameter of Counter-bore Q	Depth of Counter-bore q	No. of Threads Per Inch	Pitch Diameter at Hand-Tight Plane E_1	Pitch Diameter at Length g from Vanish Point E_7	Length: Plane of E_7 to Vanish Point g	Length: End of Plug Gauge to Hand-Tight Plane L_1	Length: End of Plug Gauge to Vanish Point L_4	Width of Groove U	Stand-off S
4 1/2	4.500	4.2975	4.594	0.250	8	4.40337	4.43175	0.625	0.921	2.000	0.250	0.375
5	5.000	4.7975	5.094	0.250	8	4.90337	4.93175	0.625	1.671	2.750	0.250	0.375
5 1/2	5.500	5.2975	5.594	0.250	8	5.40337	5.43175	0.625	1.796	2.875	0.250	0.375
6 5/8	6.625	6.4225	6.719	0.250	8	6.52837	6.55675	0.625	2.046	3.125	0.250	0.375
7	7.000	6.7975	7.094	0.250	8	6.90337	6.93175	0.625	2.046	3.125	0.250	0.375
7 5/8	7.625	7.4225	7.719	0.250	8	7.52418	7.55675	0.625	2.104	3.250	0.250	0.375
8 5/8	8.625	8.4225	8.719	0.250	8	8.52418	8.55675	0.625	2.229	3.375	0.250	0.375
9 5/8	9.625	9.4225	9.719	0.250	8	9.52418	9.55675	0.625	2.229	3.375	0.250	0.375
10 3/4	10.750	10.5475	10.844	0.250	8	10.64918	10.68175	0.625	2.354	3.500	0.250	0.375
11 3/4	11.750	11.5475	11.844	0.250	8	11.64918	11.68175	0.625	2.354	3.500	0.250	0.375
13 3/8	13.375	13.1725	13.469	0.250	8	13.27418	13.30675	0.625	2.354	3.500	0.250	0.375
16	16.000	15.7975	16.094	0.250	8	15.89918	15.93175	0.625	2.854	4.000	0.250	0.375
18 5/8	18.625	18.4225	18.719	0.250	8	18.52418	18.55675	0.625	2.854	4.000	0.250	0.375
20	20.000	19.7975	20.094	0.250	8	19.89918	19.93175	0.625	2.854	4.000	0.250	0.375

Included taper on diameter, all sizes, 0.0625 in. per in.

Table 23—Buttress Casing Thread Gauge Dimensions

All dimensions in inches at 68°F, except as otherwise indicated. See Figure 38.

(1) Outside Diameter of Pipe Size Designation	(2) Outside Diameter of Plug Collar D_4	(3) Diameter of Groove D_u	(4) Diameter of Counter-bore Q	(5) No. of Threads Per Inch	(6) Pitch Diameter[a] E_7	(7) Major Diameter at end-of Plug Gauge D_o	(8) Length Plane of E_7 to Vanish Point g	(9) Length: End of Plug Gauge to E_7 Plane L_7	(10) Length: End of Plug Gauge to Vanish Point L_4	(11) Width of Groove U	(12) Stand-off S
4 1/2	4.516	4.328	4.640	5	4.454	4.4127	1.984	1.6535	3.6375	3/16	0.100
5	5.016	4.828	5.140	5	4.954	4.9048	1.984	1.7785	3.7625	3/16	0.200
5 1/2	5.516	5.328	5.640	5	5.454	5.4009	1.984	1.8410	3.8250	3/16	0.200
6 5/8	6.641	6.453	6.765	5	6.579	6.5142	1.984	2.0285	4.0125	3/16	0.200
7	7.016	6.828	7.140	5	6.954	6.8775	1.984	2.2160	4.2000	3/16	0.200
7 5/8	7.641	7.453	7.765	5	7.579	7.4908	1.984	2.4035	4.3875	3/16	0.200
8 5/8	8.641	8.453	8.765	5	8.579	8.4830	1.984	2.5285	4.5125	3/16	0.200
9 5/8	9.641	9.453	9.765	5	9.579	9.4830	1.984	2.5285	4.5125	3/16	0.200
10 3/4	10.766	10.578	10.890	5	10.704	10.6080	1.984	2.5285	4.5125	3/16	0.200
11 3/4	11.766	11.578	11.890	5	11.704	11.6080	1.984	2.5285	4.5125	3/16	0.200
13 3/8	13.391	13.203	13.515	5	13.329	13.2330	1.984	2.5285	4.5125	3/16	0.200
16	16.000	15.812	16.154	5	15.938	15.7397	1.488	3.1245	4.6125	3/16	0.175
18 5/8	18.625	18.437	18.779	5	18.563	18.3647	1.488	3.1245	4.6125	3/16	0.175
20	20.000	19.812	20.154	5	19.938	19.7397	1.488	3.1245	4.6125	3/16	0.175

Included taper on diameter: Sizes 13 3/8 and smaller - 0.0625 in. per in.
Sizes 16 and larger - 0.0833 in. per in.

[a]Pitch diameter on buttress casing thread is defined as being midway between the major and minor diameters. The pitch diameter is for design purposes only and does not require certification.

Table 24—Non-Upset Tubing Thread Gauge Dimensions

All dimensions in inches at 68°F, except as otherwise indicated. See Figure 37.

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
Outside Diameter of Pipe Size Designation	Outside Diameter of Plug Collar D_4	Diameter of Groove D_u	Diameter of Counter-bore Q	Depth of Counter-bore q	No. of Threads Per Inch	Pitch Diameter at Hand-Tight Plane E_1	Pitch Diameter at Length g from Vanish Point E_7	Length: Plane of E_7 to Vanish Point g	Length: End of Plug Gauge to Hand-Tight Plane L_1	Length: End of Plug Gauge to Vanish Point L_4	Width of Groove U	Stand-off S
1.050	1.050	0.8788	1.113	0.200	10	0.98826	0.99740	0.500	0.448	1.9038	0.200	0.300
1.315	1.315	1.1438	1.378	0.200	10	1.25328	1.26240	0.500	0.479	1.1250	0.200	0.300
1.660	1.660	1.4888	1.723	0.200	10	1.59826	1.60740	0.500	0.604	1.2500	0.200	0.300
1.900	1.900	1.7288	1.963	0.200	10	1.83826	1.84740	0.500	0.729	1.3750	0.200	0.300
2 3/8	2.375	2.2038	2.438	0.200	10	2.31326	2.32240	0.500	0.979	1.6250	0.200	0.300
2 7/8	2.875	2.7038	2.938	0.200	10	2.81326	2.82240	0.500	1.417	2.0625	0.200	0.300
3 1/2	3.500	3.3288	3.563	0.200	10	3.43826	3.44740	0.500	1.667	2.3125	0.200	0.300
4	4.000	3.7975	4.063	0.125	8	3.91395	3.93175	0.500	1.591	2.3750	0.250	0.375
4 1/2	4.500	4.2975	4.563	0.125	8	4.41395	4.43175	0.500	1.779	2.5625	0.250	0.375

Included taper on diameter, all sizes, 0.0625 in. per in.

Note: See footnote Table 26 for interchangeability of gauges.

Table 25—External-Upset Tubing Thread Gauge Dimensions

All dimensions in inches at 68°F, except as otherwise indicated. See Figure 37.

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
Outside Diameter of Pipe Size Designation	Outside Diameter of Plug Collar D_4	Diameter of Groove D_u	Diameter of Counter-bore Q	Depth of Counter-bore q	No. of Threads Per Inch	Pitch Diameter at Hand-Tight Plane E_1	Pitch Diameter at Length g from Vanish Point E_7	Length: Plane of E_7 to Vanish Point g	Length: End of Plug Gauge to Hand-Tight Plane L_1	Length: End of Plug Gauge to Vanish Point L_4	Width of Groove U	Stand-off S
1.050	1.315	1.1438	1.378	0.200	10	1.25328	1.26240	0.500	0.479	1.1250	0.200	0.300
1.315	1.469	1.2976	1.531	0.200	10	1.40706	1.41615	0.500	0.604	1.2500	0.200	0.300
1.660	1.812	1.6413	1.875	0.200	10	1.75079	1.75990	0.500	0.729	1.3750	0.200	0.300
1.900	2.094	1.9226	2.156	0.200	10	2.03206	2.04115	0.500	0.792	1.4375	0.200	0.300
2 3/8	2.594	2.3912	2.656	0.125	8	2.50775	2.52550	0.500	1.154	1.9375	0.250	0.375
2 7/8	3.094	2.8912	3.156	0.125	8	3.00775	3.02550	0.500	1.341	2.1250	0.250	0.375
3 1/2	3.750	3.5475	3.813	0.125	8	3.66395	3.68175	0.500	1.591	2.3750	0.250	0.375
4	4.250	4.0475	4.313	0.125	8	4.16395	4.18175	0.500	1.716	2.5000	0.250	0.375
4 1/2	4.750	4.5475	4.813	0.125	8	4.66395	4.68175	0.500	1.841	2.6250	0.250	0.375

Included taper on diameter, all sizes, 0.0625 in. per in.

Note: See footnote Table 26 for interchangeability of gauges.

Table 26—Integral-Joint Tubing Thread Gauge Dimensions

All dimensions in inches at 68°F, except as otherwise indicated. See Figure 37.

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
Outside Diameter of Pipe Size Designation	Outside Diameter of Plug Collar D_4	Diameter of Groove D_u	Diameter of Counter-bore Q	Depth of Counter-bore q	No. of Threads Per Inch	Pitch Diameter at Hand-Tight Plane E_1	Pitch Diameter at Length g from Vanish Point E_7	Length: Plane of E_7 to Vanish Point g	Length: End of Plug Gauge to Hand-Tight Plane L_1	Length: End of Plug Gauge to Vanish Point L_4	Width of Groove U	Stand-off S
1.315	1.315	1.1438	1.378	0.200	10	1.25328	1.26240	0.500	0.479	1.1250	0.200	0.300
1.660	1.660	1.4888	1.723	0.200	10	1.59826	1.60740	0.500	0.604	1.2500	0.200	0.300
1.900	1.900	1.7288	1.963	0.200	10	1.83826	1.84740	0.500	0.729	1.3750	0.200	0.300
2.063	2.094	1.9226	2.156	0.200	10	2.03206	2.04115	0.500	0.792	1.4375	0.200	0.300

Included taper on diameter, all sizes, 0.0625 in. per in.

Note: The 1.315, 1.660, and 1.900 integral-joint tubing gauges are identical to non-upset tubing gauges of the same size and may be used interchangeably.
The 2.063 integral-joint tubing gauges are identical to 1.900 external-upset tubing gauges and may be used interchangeably.
The 1.050 external-upset tubing gauges, the 1.315 non-upset tubing gauges, and the 1.315 integral-joint tubing gauges are identical and may be used interchangeably.

Table 27—Gauge Thread Height Dimensions for Line Pipe

All dimensions in inches at 68°F. See Figure 39
See Table 29 for tolerances on crest truncation

(1)	(2)	(3)	(4)	(5)	(6)
Thread Element	27 Threads Per Inch p = 0.0370	18 Threads Per Inch p = 0.0556	14 Threads Per Inch p = 0.0714	$11^1/_2$ Threads Per Inch p = 0.0870	8 Threads Per Inch p = 0.1250
H = 0.866p	0.03204	0.04815	0.06183	0.07534	0.10825
h_g = 0.666p	0.02464	0.03703	0.04755	0.05794	0.08325
$f_{cs} = f_{cn}$ = 0.100p	0.00370	0.00556	0.00714	0.00870	0.01250

Table 28—Gauge Thread Height Dimensions for Round-Thread Casing and Tubing

All dimensions in inches at 68°F. See Figure 39
See Table 30 for tolerances on crest truncation

(1)	(2)	(3)
Thread Element	10 Threads per Inch *p* = 0.1250	8 Threads per Inch *p* = 0.1250
H = 0.866p	0.08660	0.10825
h_g = 0.356p	0.03560	—
h_g = 0.386p	—	0.04825
$f_{cs} = f_{cn}$ = 0.255p	0.02550	—
$f_{cs} = f_{cn}$ = 0.240p	—	0.03000

Table 29—Tolerances on Gauge Dimensions for Line Pipe

(All dimensions in inches at 68 F, except as otherwise indicated.
See Figure 37 and 39)

Element	Tolerances				
	Number of Threads per Inch				
	27	18	14	$11^1/_2$	8
			Plug Gauge		
Pitch diameter[a]	±0.0002	±0.0004	±0.0006	±0.0007	±0.0010
Taper[b]	+0.0003	+0.0004	+0.0006	+0.0008	+0.0010
	–0.0000	–0.0000	–0.0000	–0.0000	–0.0000
Lead[c]	±0.0002	±0.0002	±0.0003	±0.0004	±0.0005
Crest Truncation	+0.0015	+0.0015	+0.0015	+0.0025	+0.0025
	–0.0010	–0.0010	–0.0010	–0.0015	–0.0015
Half Angle of Thread	±15 min.	±15 min.	±10 min.	±10 min.	±10 min.
Width of Groove, U[d]	±0.037	±0.056	±0.071	±0.087	±0.125
Diameter of Groove, D_u[d]	±0.020	±0.020	±0.020	±0.020	±0.020
Diameter of Collar, D_4[d]	±0.010	±0.010	±0.010	±0.10	±0.010
Length, L_4[e]	±0.0010	±0.0010	±0.0010	±0.0010	±0.0010
			Ring Gauge		
Taper[b]	+0.0000	+0.0000	+0.0000	+0.0000	–0.0002
	–0.0006	–0.0007	–0.0009	–0.0012	–0.0014
Lead[c]	±0.0004	±0.0004	±0.0006	±0.0008	±0.0010
Crest Truncation	+0.0015	+0.0015	+0.0015	+0.0025	+0.0025
	–0.0010	–0.0010	–0.0010	- 0.0015	- 0.0015
Half Angle of Thread	±20 min.	±20 min.	±15 min.	±15 min.	±15 min.
Length of Ring, $L_4 - S$[e]	±.002	±.002	±.002	±.002	±.002
Diameter of Counterbore, Q[d]	+ 1/16	+ 1/16	+ 1/16	+ 1/16	+ 1/16
	–0.000	–0.000	–0.000	–0.000	–0.000
Mating Standoff, S	±0.037	±0.056	±0.071	±0.087	±0.100

[a]Helix angle correction shall be disregarded in pitch diameter determinations.
[b]The tolerance shown is the maximum allowable error in taper in the length of thread $L_4 - g$. See Par. 7.14. The pitch cone of the 8 threads per inch ring gauge is provided with a minus taper in order to minimize variations in interchange standoff due to lead errors.
[c]The tolerance shown is the maximum allowable error in lead between any two threads whether adjacent or separated by any amount not exceeding the full length of thread less one full thread at each end.
[d]See Par. 7.12 for permissible non-conformance.
[e]This requirement does not apply to gauges made prior to March, 1979.

Table 30—Tolerances on Gauge Dimensions for Round Thread Casing and Tubing

(All dimensions in inches at 68°F, except as otherwise indicated. See Figures 37 and 39.)

Element	Tolerances
Plug Gauge	
Pitch diameter[a]	±0.0010
Taper[b]	+0.0010 −0.0000
Lead[c]	±0.0005
Crest truncation	+0.0040 −0.0000
Half-angle of thread	±10 min.
Width of groove, U[d]:	
For casing and 8-thread non-upset tubing	±0.125
For 10-thread non-upset tubing and 8-thread and 10-thread upset tubing	±0.100
Diameter of groove, D_u[d]	±0.020
Diameter of collar, D_4[d]	±0.010
Length, L_4	±0.001
Length of gauging notch	+0.002 −0.000
Ring Gauge	
Taper[b]	+0.0002 −0.0012
Lead[c]	±0.0008
Crest truncation	+0.0040 −0.0000
Half-angle of thread	±15 min.
Diameter of counterbore, Q[d]	+0.062 −0.000
Length of ring, $L_4 - S$[f]	±0.002
Mating standoff, S[e]	±0.025

[a]Helix angle correction shall be disregarded in pitch diameter determinations.
[b]The tolerance shown is the maximum allowable error in taper in the length of thread $L_4 - g$. See Par. 7.1.4. The pitch cone of the ring gauge is provided with a minus taper in order to minimize variation in interchange standoff due to lead error.
[c]The tolerance shown is the maximum allowable error in lead between any two threads whether adjacent or separated by any amount not exceeding the full length of thread less one full thread at each end.
[d]See Par. 7.12 for permissible nonconformance.
[e]Master gauges made prior to March 1979 need not comply with the ±0.025 in. standoff tolerance. For gauges made prior to March 1979 a standoff tolerance of ±0.100 in. is acceptable.
[f]This requirement does not apply to gauges made prior to March, 1979.

Table 31—Tolerances on Gauge Dimensions for Buttress Casing

(All dimensions in inches at 68°F. See Figures 38, 40 and 41.)

Element		Tolerances
Plug Gauge		
Major Diameter, D_o, Per Specified Size:		
	4½ thru 7	±0.0005
	7⅝ thru 13⅜	±0.0007
	16 and larger	±0.0010
Taper[a]	13⅜ and smaller	+0.0010 −0.0000
	16 and larger	+0.0015 −0.0000
Lead[b]		±0.0005
Thread height		+0.0005 −0.0000
Diam. of collar, D_4[c]:		
	13⅜ and smaller	±0.001
	16 and larger	±0.002
Length, L_4		±0.001
Ring Gauge		
Taper[a]	13⅜ and smaller	+0.0002 −0.0012
	16 and larger	+0.0002 −0.0017
Lead[b]		±0.0008
Thread Height		+0.0005 −0.0000
Diameter of counterbore, Q[c]		+1/64 −0.000
Length of ring, $L_4 - S$[d]		±0.002
Mating standoff, S		±0.015

[a]The tolerance shown is the maximum allowable error in taper in the length $L_4 - S$. See Par. 7.1.4.
[b]See Par. 7.1.3 for measurement of lead.
[c]See Par. 7.1.2 for permissible non-conformance.
[d]This requirement does not apply to gauges made prior to March, 1979.

Table 32—Gauge Dimensions[a]

(Note: See Figures 31, 33 and 34 for illustrations and other dimensions; see Table 33 for other tolerances; all dimensions in inches at 68°F.)

(1) Size	(2) MM	(3) MG Tol. +.0020 −.0000	(4) MQ	(5) MV Tol. ±.0010	(6) MH	(7) ML	(8) AA Tol. ±.0001	(9) MJ	(10) NN	(11) NO
5	7 1/2	4.9501	4 7/16	4.5464	7 3/4	8	1.4060	6 1/2	6 5/8	5 7/8
5 1/2	8	5.4523	4 15/16	5.0491	8 1/4	8 1/2	1.4060	7	7 1/8	6 3/8
6 5/8	9	6.5383	6 1/32	6.1308	9 1/4	9 1/2	1.4375	8	8 1/8	7 3/8
7	9 7/16	6.9275	6 13/32	6.5200	9 11/16	9 15/16	1.4375	8 7/16	8 1/2	7 3/4
7 5/8	10	7.5248	7	7.1146	10 1/4	10 1/2	1.5000	9	9 1/8	8 1/4
8 5/8	11 3/16	8.5759	8 1/32	8.1598	11 7/16	11 11/16	1.5000	10 1/16	10 3/8	9 1/2
9 5/8	12 1/8	9.5181	8 31/32	9.1007	12 3/8	12 5/8	1.5000	11	11 1/4	10 3/8
10 3/4	13 3/8	10.7636	10 7/32	10.3463	13 5/8	13 7/8	1.5000	12 1/4	12 5/8	11 7/8

(1) Size	(12) NP Reference	(13) NQ	(14) NR	(15) NS Tol. +.002 −.000	(16) T	(17) U	(18) e Nominal, Reference	(19) f	(20) R Tol. ±.005	(21) S Tol. ±.005
5	3	5 17/32	3 7/8	4.932	4.8301	4.5053	.350	.150	1.240	4.184
5 1/2	3	6	4 1/4	5.434	5.3323	5.0080	.322	.142	1.240	4.184
6 5/8	2 31/32	7 1/8	5 3/8	6.520	6.4183	6.0897	.410	.154	1.240	4.184
7	2 31/32	7 1/2	5 1/2	6.909	6.8075	6.4789	.420	.160	1.240	4.184
7 5/8	2 57/64	8 3/32	5 3/4	7.507	7.4048	7.0735	.390	.166	1.240	4.184
8 5/8	4 1/4	9 7/32	6 3/4	8.563	8.4213	8.1025	.384	.172	1.844	5.469
9 5/8	4 1/4	10 7/32	7 5/8	9.505	9.3635	9.0434	.384	.172	1.844	5.469
10 3/4	4 1/4	11 21/32	9	10.751	10.6090	10.2890	.384	.172	1.844	5.469

[a]For product dimensions O max., A min., H min., I max. and product standoff values see Tables 17 and 18.

Table 33—Tolerances on Gauge Dimensions

See Figures 31, 33 and 34 for gauging practice and gauge details
See Table 32 for other dimensions and tolerances
See Figures 35 and 36 for thread form details
All dimensions in inches at 68 F, except as otherwise indicated

(1) Element	(2) Tolerance
Reference Master Plug Gauge	
Thread Element:	
R distance to nominal T	±0.005
Lead error between any two threads	0.0005
Taper of minor diameter, per inch	+.0002 −0.0000
Half angle of thread	±20 minutes
Squareness—face of thread member to thread axis	0.0005 T.I.R.
Seal Element:	
S distance to nominal U	±0.005
Taper, per inch	±0.00012
Concentricity—seal element to thread element	0.0004 T.I.R.
Reference Master Ring Gauge	
Thread Element:	
Taper of minor diameter, per inch	+0.0000 −0.00025
Lead error between any two threads	0.0005
Half angle of thread	±20 minutes
Squareness—face of thread member to thread axis	0.0005 T.I.R.
Concentricity—thread element to thread member shaft	0.0004 T.I.R.
Standoff of thread member from master plug	±0.003*
Seal Element:	
Taper over full seal length	±0.00012
Concentricity—seal element to seal member hub	0.0004 T.I.R.
Standoff of seal member from master plug (1.500)	±0.003*
Diametral clearance between seal ring hub and thread ring shaft	0.0010 to 0.0015
Working Plug Gauge	
Thread Element:	
Lead error between any two threads	0.0005
Taper of minor diameter, per inch	+.0003 −0.0000
Half angle of thread	±40 minutes
Squareness—face of gauge to thread axis	0.0005 T.I.R.
Concentricity—thread element to thread member hub	0.0004 T.I.R.
Standoff of thread member from master ring	±0.0015*
Seal Element:	
Taper, per inch	±0.00015
Concentricity—seal element to seal shaft	0.0004 T.I.R.
Standoff of seal member from master ring (2.500)	±0.002*
Diametral clearance between seal plug hub and thread plug shaft	0.0035 to 0.0040
Working Ring Gauge	
Thread Element:	
Taper of minor diameter, per inch	+0.0000 −0.0003
Lead error between any two threads	0.0005
Half angle of thread	±40 minutes
Squareness—face of gauge to thread axis	0.0005 T.I.R.
Concentricity—thread element to thread member shaft	0.0004 T.I.R.
Standoff of thread member master plug	±0.0015*
Seal Element:	
Taper over full seal length	±0.00015
Concentricity—seal element to seal member hub	0.0004 T.I.R.
Standoff of seal member from master plug (AA + f)	±0.002*
Diametral clearance between seal ring hub and thread ring shaft	0.0035 to 0.0040
Pin Element:	
Pin length AA	±0.0001

*Tolerances apply to compensated standoff.

8 Gauge Certification

8.1 LINE PIPE, ROUND THREAD CASING AND TUBING, AND BUTTRESS THREAD CASING

8.1.1 Certification Agencies

All master plug and mating ring gauges, prior to use, shall have been certified to be in accordance with the stipulations given in Section 7, by one of the following nationally recognized independent agencies (see note):

Note: Schedule of fees for tests may be obtained upon application to the testing agencies.

a. Instituto National de Technologia Industrial, Buenos Aires, Republic of Argentina.
b. Stabilimento Militare Materiali Elettronici e di Precisione, Rome, Italy.
c. National Institue of Metrology, Beijing, Peoples' Republic of China.
d. National Institute of Standards and Technology, Gaithersburg, Maryland, USA.
e. National Physical Laboratory, Teddington, Middlesex, England.
f. National Research Laboratory of Metrology, Ibaraki, Japan.
g. National Standards Laboratory, Chippendale, New South Wales, Australia (limited to gauges for sizes $8^5/_8$ and smaller).

Note: Application to become an API Gauge Certification Agency is open to any nationally recognized independent metrology laboratory capable of demonstrating compliance to API policy and specified requirements. Interested parties shall notify the API Exploration & Production Department. Appendix C of this specification outlines certification agency requirements.

8.1.2 Certification

The gauge certifying agency shall inspect new and reconditioned master gauges for conformance to the requirements of Sect. 5. Master gauges must be certified in complete sets, i.e., a master plug and a master ring gauge. A single master plug or a single master ring gauge may not be certified unless accompanied by a previously certified mating master gauge. For each gauge which complies with all requirements, the certifying agency shall issue a certificate to the gauge owner, with copy to the API office, showing the mating standoff measurement and stating that the gauge complies with this specification. For each gauge which does not comply with all requirements, the certifying agency shall issue a report to the gauge owner, with copy to the API office, stating the reason for rejection and showing the measured value for those dimensions which are outside the permissible limits. The certifying agency shall also report obvious defects and poor workmanship which, in the opinion of the certifying agency, may affect the future use of the gauge.

Master Gauges and Certificates of Compliance may be transferred. A copy of the Certificate shall be sent to the API office. If a Certificate is not available, the gauges shall be recertified and a new Certificate issued by an agency listed in Par. 8.1.1.

8.1.3 All used line pipe gauges made prior to Jan. 1, 1940, with g dimensions equal to 5p, when reconditioned, shall be checked for conformance to the dimensions given in the sixth edition of API Standard 5L (August, 1935) and recertified as provided herein.

8.1.4 The standoff S of ring gauges against the mating plug gauge shall be determined as follows:

a. The threads should be cleaned thoroughly and lubricated thoroughly with light high-grade mineral oil.
b. The temperature of the plug and of the ring should be identical.
c. The plug gauge should be rigidly held so as to prevent movement.
d. The mating gauge should be made up using a suitable lever arrangement which provides 2 hand holds equidistant on diametrically opposite sides of the gauge.
e. The mating plug and ring should be screwed up and unscrewed several times to permit uniform distribution of oil.
f. When checking gauges, it is permissible to strike lightly with a rubber hammer while screwing up. The hammer should not be used until the gauges become tight on the threads.
g. In the final tightening, the gauges should be screwed up snug by one man with a slow steady pull, care being exercised not to jerk them. The hammer is not used. With this procedure, the gauges should pull up freely to a full tight position with an abrupt stop, although further very slight advancement may be obtained by the application of a considerable additional force. It is believed that the actual force used to tighten in determining the S value is of secondary importance as compared with using the same force in screwing the master ring on to the working plug gauge, and in screwing the working gauges on the product.

8.1.5 Marking Verification

The certifying agency shall verify the markings required under Sect. 6, and shall mark all acceptable gauges (both plug and ring unless otherwise indicated herein) with the following markings (see note):

Note: The certifying agency may mark the gauges with any additional markings considered necessary for proper identification.

a. Date of Certification. The date of certification shall be marked on all gauges. In recertifying reconditioned gauges, the previous certification date shall be replaced with the date of recertification. Dates of retest, as required by Par. 6.1.5, shall not be marked on master gauges.
b. Name or Mark of Certifying Agency. The identification mark of the testing agency shall be marked on the plug gauge only.
c. Mating Standoff. The initial mating standoff shall be marked on the ring gauge only. Mating standoff values determined as specified in Par. 6.1.5 shall not be marked on master gauges.

d. API Monogram. If any gauge marked with the monogram is determined by the certifying agency to be in non-conformance to requirements, the monogram shall be removed.

8.2 EXTREME-LINE CASING

8.2.1 Certification Agencies

New and reconditioned reference master gauges shall be certified for accuracy of essential elements as specified in Sect. 7.2, including determination of mating standoff, by any of the agencies listed in Par. 8.1.1 possessing the appropriate grand master gauges.

8.2.2 Certification

The gauge certifying agency shall inspect all new and reconditioned reference master gauges for compliance with the requirements of Sect 7.2. Reference master gauges must be certified in complete sets, i.e., a reference master plug and a reference master ring gauge. A single reference master plug or a single reference master ring gauge may not be certified unless accompanied by a previously certified mating reference master gauge. For each pair of approved gauges the certifying agency shall issue a certificate to the gauge owner stating that the gauges meet all requirements of API Standard 5B and list the nominal and compensated values of the R and S dimensions of the reference master plug gauge and the nominal, actual, and compensated standoff values for both the thread and seal members of the reference ring gauge.

If any dimension of the gauges is outside the permissible limits the certifying agency shall issue a report to the gauge manufacturer showing the reason for rejection and the magnitude of the deviation.

In the case of a new or reconditioned reference master gauge submitted to the National Institute of Standards and Technology for measurement of standoff from the grand master gauges, the Institute shall issue a certificate to the owner of the gauges listing the actual standoff values for the thread and seal members of the reference ring gauge.

Copies of all reports and certificates shall be sent to the API Washington Office.

8.2.3 Standoff Determination Procedure

The thread and seal standoff of ring gauges against the mating plug gauge shall be determined as follows:

a. Cleaning. The thread and seal surfaces should be cleaned thoroughly and lubricated thoroughly with light high-grade mineral oil.

b. Temperature. The temperature of the plug and of the ring gauges should be identical.

c. Holding. The plug gauge should be rigidly held so as to prevent movement.

d. Make-Up. The mating gauge should be made up using a suitable lever arrangement which provides two hand holds equidistant on diametrically opposite sides of the gauge.

e. Tightening. In the final tightening, to obtain correct standoff, the gauges should be advanced axially with back pressure in the direction indicated by the arrows shown in Figure 31 so that all clearance is removed between the make-up flanks of the threads.

f. Seating Seal. After thread members of gauges are properly made-up, push forward on ring gauge seal member and turn clockwise one turn to seat on the mating seal plug gauge.

g. Checking. Check thread and seal member standoff values.

8.2.4 Marking

New and reconditioned reference master plug gauges shall be marked with the nominal and compensated values of the R and S dimensions (actual and compensated values of the R and S dimensions are identical). New and reconditioned reference master ring gauges shall be marked with the nominal, actual, and compensated standoffs of both thread and seal members from the mating reference master plug gauge. The nominal values shall be marked by the gauge manufacturer. The actual and compensated values shall be marked by the certifying agency. See Par. 7.2.11.

Thread standoffs shall be marked on the threaded part of the ring gauge and seal standoff on the seal part of the ring gauge.

The original actual standoff which shall be shown with the year of measurement shall never be removed from the reference master ring gauge unless the gauge is reconditioned. Subsequent values of actual standoff shall be marked separately with appropriate date. Only the latest value shall be retained.

Using the abbreviations suggested below the original actual standoff would be listed as AS-62 .xxx in. and a subsequent value as AS-65 .xxx in. This requirement applies to both the thread and seal members.

When only limited space is available on a gauge for marking, the following abbreviations may be used:

Nominal.................... N
Actual .... A
Compensated............... C
Standoff.................... S

Using these abbreviations, nominal R, for example, will be NR and compensated standoff, CS.

9 Thread Marking

Note: See Paragraphs 7.1.10 and 7.2.11 for gauge marking requirements.

9.1 Products having pipe threads which conform to the threading and gauging stipulation given in API Standard 5B may be identified by stamping or stenciling the product adjacent to such thread with the manufacturer's name or mark, the size, the letters Spec 5B (see note), and the thread symbol. The thread marking may be applied to products which do or do not bear the API monogram. For example, a product having size $2^1/_2$ line pipe threads may be marked:

AB CO $2^1/_2$ Spec 5B LP

Note: Users of this specification should note that there is no longer a requirement for marking a product with the API monogram. The American Petroleum Institute continues to license use of the monogram on products covered by this specification but it is administered by the staff of the Institute separately from the specification. The policy describing licensing and use of the monogram is contained in Appendix B, herein. No other use of the monogram is permitted. Licensees are to mark products in conformance with Appendix B and non-licensees are to mark products in conformance with Section 9.

If the product is clearly marked elsewhere with the manufacturer's identification, his name or mark may be omitted. Thread type marking symbols shall be as follows:

Casing (short round thread) . . . . CSG
Casing (long round thread) . . . . LCSG
Casing (buttress thread) . . . . BCSG
Casing (extreme-line). . . . . XCSG
Line Pipe . . . . LP
Tubing (non-upset). . . . . TBG
Tubing (external-upset) . . . . UPTBG

9.2 The use of the letters Spec 5B as provided in Par. 9.1 shall constitute a certification by the manufacturer that the threads so marked comply with the requirements stipulated in API Standard 5B, but should not be construed by the purchaser as a representation that the product so marked is in its entirety in accordance with any API specification. Manufacturers who use the letters Spec 5B for thread identification must have access to properly certified reference master pipe gauges and have in their possession working gauges with established values derived from API monogrammed master gauges.

APPENDIX A—INSTRUCTIONS FOR SHIPMENT OF MASTER GAUGES

A.1 Master gauges should ordinarily remain in good condition for years if properly cared for and used only for the purpose intended, namely, the checking of working gauges with smooth, clean threads. If the gauges become dirty they should be cleaned by the gauge owner before shipment to the custodian for standoff determination.

A.2 Burrs or small scored places on the threads may be stoned with a fine grade of stone. The stoning of scored places extending all the way around the gauge is not approved as the accuracy of the gauges may be seriously affected by extensive stoning. For severe cases of pitting or scoring, regrinding by the gauge manufacturer is advisable.

A.3 Shipping boxes should be securely made, and the material should be heavy enough to prevent damage of the gauges during shipment. The use of green lumber is to be avoided. Each mating pair of gauges should be boxed separately or separated by adequate separators, if contained in the same box. The use of waste or similar packaging to occupy voids and the wrapping of the gauge in a waterproof material is recommended. It is further recommended that the two-element master ring or plug gauges (extreme-line) should be locked and secured within itself to prevent in-transit damage.

A.4 The return address should be affixed securely on the box to aid the custodian for return shipment to the licensee.

A.5 All carriage charges must be prepaid. Shipment should preferably be by a fast system of transit. When returning gauges, custodians will ship collect. Owners should prescribe to the custodian the preferable method of transit for return of gauges.

A.6 Custodians are not permitted to assemble grand master gauges with reference master gauges which have dirty or damaged threads. If cleaning is required, other than that required to remove the protective coating, the testing agency will charge for the extra work. If the gauge is rusted or scored to such extent as to require reconditioning, the gauge owner will be so notified. Failure to recondition such gauges will be considered justification for cancellation of their status as authorized master gauges.

A.7 Owners of gauges which are to be transported by ship from outside the United States to the National Institute of Standards and Technology (NIST) for test must make prior arrangements with a customs broker either in the country of origin or in the United States for entry of the gauges into the United States, with or without bond as may be necessary, and prepaid transportation to and from the ports of entry and exit. Entry in bond is required for gauges made outside the United States; whereas gauges made in the United States may be entered without bond. If arrangements are made with a broker in the country of origin, that broker should, in turn, have a customs broker in or near the port of entry arrange for entry of the gauges and prepaid transportation to the National Institute of Standards and Technology, Gaithersburg, Maryland.

A.8 An alternative method of shipment which eliminates the need for the services of a customs broker is by air freight to NIST, via Dulles International Airport, Washington, D.C. When shipments are made by this method the NIST will pick up the gauges at the airport, arrange for entry in bond when necessary, and after test obtain release from bond if required and deliver the gauges to the airport for return shipment. The gauges will be returned collect with transportation charges payable at destination.

A.9 Transportation by air is much more expensive than by ship but the difference is largely offset by customs broker's charges. An added advantage of air transportation is the very great decrease in the time the gauges are away from the owner's factory.

A.10 NIST's charges for tests will be billed separately from those of a customs broker. Prepayment of all charges for tests is required.

Note: A list of customs brokers is available from the API Office, if desired by foreign gauge owners.

APPENDIX B—MARKING INSTRUCTIONS FOR API LICENSEES

B.1 Marking

Master gauges shall be permanently marked by the gauge manufacturer with the markings given below. Plug gauges should preferably be marked on the body, although marking on the handle is acceptable on gauges in small sizes or when the handle is integral with the body. Any markings which are considered necessary by the gauge maker may be added. Unless otherwise stated, both plug and ring shall be marked as follows:

a. API Monogram. The API monogram may be used only on master gauges and shall not be used on working gauges or gauges which do not meet all stipulations given herein, including determination of mating standoff. The API monogram shall be applied only as specified herein only by authorized manufacturers. The product shall be marked with the date of manufacture defined as the month and year when the monogram is applied. This marking shall be applied in a location adjacent to the monogram.

b. Size of Gauge. For line-pipe gauges the nominal sizes, as given in Table 21, and for casing and tubing gauges the size designation (outside diameter of the pipe), as given in Tables 22 through 26, shall be marked on each new plug and ring gauge.

Note: Existing tubing gauges marked with the nominal tubing size should be restamped to show the outside diameter size.

c. Type of Thread. Both plug and ring gauges shall be marked with the proper identifying terms or their abbreviations as follows:

Line pipe	LINE PIPE or LP
Round-thread casing	CSG
Buttress-thread casing	BUTTRESS CSG
Non-upset tubing and integral joint tubing	TBG
External-upset tubing	UP TBG

d. Name or Identifying Mark of Gauge Maker. The name or identifying mark of the gauge maker shall be placed on both plug and ring gauge.

e. Year of Adoption. (Line pipe gauges only.) All new gauges, and all used gauges which have been reconditioned to the dimensions given herein for new gauges, shall be marked with the numerals 1940. (Gauge dimensions stipulated herein for new gauges were adopted in 1940. Plug gauges made prior to Jan. 1, 1940 may have g values at variance with such values as given herein. See Par. 6.1.9 for correction factors.)

APPENDIX C—API GAUGE CERTIFICATION AGENCY REQUIREMENTS

All API Gauge Certification Agency applicants shall be required to demonstrate measurement capability in the following areas:

1. Facility Environment
2. Inspection Equipment
3. Standards and Calibration
4. Personnel Qualifications
5. Organizational Structure
6. Documentation
7. Storage and Handling

APPENDIX D—PUBLICATIONS LIST

The following publications are under the jurisdiction of the API Committee on Standardization of Tubular Goods and are available from the American Petroleum Institute, Publications and Distribution Section, 1220 L Street, Northwest, Washington, DC 20005, (202) 682-8375.

SPECIFICATIONS

Spec 5CT *Specification for Casing and Tubing.*

Covers seamless and welded casing and tubing, couplings, pup joints and connectors in all grades. Process of manufacture, chemical and mechanical property requirements, methods of test and dimensions.

Note: The first edition of Spec 5CT includes the requirements for casing and tubing previously detailed in last editions of discontinued Specifications 5A, 5AC, 5AX and 5AQ as well as items approved at the 1987 Standardization Conference.

Spec 5D *Specification for Drill Pipe.*

Covers all grades of seamless drill pipe. Process of manufacture, chemical and mechanical property requirements, methods of test and dimensions are included.

Note: The first edition of Specification 5D includes the requirements for drill pipe previously detailed in the last editions of discontinued Specifications 5A and 5AX as well as items approved at the 1987 Standardization Conference.

Spec 5L *Specification for Line Pipe.*

Covers seamless and welded steel line pipe in various grades. It includes standard-weight threaded line pipe, and standard-weight, regular-weight, special, extra-strong, and double-extra-strong plain-end line pipe. Processes of manufacture, chemical and physical requirements, and methods of test are included, as well as requirements on coupling and thread protectors.

Note: The thirty-third edition of Specification 5L includes the spiral weld process and grades X42 through X70 previously specified in Specifications 5LS and 5LX.

STANDARDS

Std 5B *Specification for Threading, Gauging, and Thread Inspection of Casing, Tubing, and Line Pipe Threads.*

Covers dimensional requirements on threads and thread gauges, stipulations on gauging practice, gauge specifications and certification, as well as instruments and methods for the inspection of threads of round-thread casing and tubing, buttress thread casing, and extreme-line casing, and drill pipe.

RECOMMENDED PRACTICES

RP 5A5 *Recommended Practice for Field Inspection of New Casing, Tubing, and Plain End Drill Pipe.*

Provides a uniform method of inspecting tubular goods.

RP 5B1 *Recommended Practice for Thread Inspection on Casing, Tubing and Line Pipe.*

The purpose of this recommended practice is to provide guidance and instructions on the correct use of thread inspection techniques and equipment.

RP 5C1 *Recommended Practice for Care and Use of Casing and Tubing.*

Covers use, transportation, storage, handling, and reconditioning of casing and tubing.

RP 5L1 *Recommended Practice for Railroad Transportation of Line Pipe.*

Provides a recommended procedure for loading line pipe on railroad cars.

RP 5L2 *Recommended Practice for Internal Coating of Line Pipe for Gas Transmission Services.*

Covers coating materials, application practices and inspection of internal coatings on new pipe.

RP 5L3 *Recommended Practice for Conducting Drop-Weight Tear Tests on Line Pipe.*

Describes a recommended method for conducting drop-weight tear tests on line pipe 20 in. OD and larger with wall thicknesses 0.750 in. and less.

RP 5L5 *Recommended Practice for Marine Transportation of Line Pipe.*

Provides recommendations for transportation of line pipe in sizes 10¾ in. OD and larger by seagoing vessels.

RP 5L6 *Recommended Practice for Transportation of Line Pipe on Inland Waterways.*

Provides recommendations for transportation of line pipe in sizes 10¾ in. OD and larger on inland waterways.

RP5L7 *Recommended Practices for Unprimed Internal Fusion Bonded Epoxy Coating of Line Pipe.*

Covers recommendations for coating materials, application, testing, and inspection of internal fusion bonded epoxy coatings on unused line pipe prior to installation.

BULLETINS

Bul 5A2 *Bulletin on Thread Compounds.*

Provides material requirements and performance tests for two grades of thread compound for use on oil-field tubular goods.

Bul 5C2 *Bulletin on Performance Properties of Casing and Tubing.*

Covers collapsing pressures, internal yield pressures, and joint strengths of casing and tubing and minimum yield load for drill pipe.

Bul 5C3 *Bulletin on Formulas and Calculations for Casing, Tubing, Drill Pipe, and Line Pipe Properties.*

Provides formulas used in the calculations of various pipe properties, also background information regarding their development and use.

Bul 5C4 *Bulletin on Round Thread Casing Joint Strength with Combined Internal Pressure and Bending.*

Provides joint strength of round thread casing when subject to combined bending and internal pressure.

Bul 5T1 *Bulletin on Imperfection Terminology.*

Provides definitions in English, French, German, Italian, Japanese, and Spanish for a number of imperfections which commonly occur in steel pipe.

APPLICATION FOR API LICENSE TO USE API MONOGRAM

General. The API license program to use the monogram on master gauges requires:

a. Manufacturer to have an approved functioning quality program, and
b. API to review manufacturer's quality manual and to survey manufacturer's facility to verify manufacturer's quality program meets API requirements including API Specification Q1.

If you are interested in obtaining the API license under this API Specification, please complete and submit an application package as shown in this section.

You may file an application with API as soon as you feel you meet the requirements of the licensing program. Your application package should include the following documents.

1. Completed Manufacturer's Application Form (Exhibit B)
2. Signed API License Agreement (Exhibit C)
3. Controlled Copy of Quality Manual (written in English)
4. Non-refundable Fee

Instructions. The policy and procedure on the use of the API Monogram are shown in the following section. API Specification Q1 is the specification for quality programs and may be ordered through the API Publications Department, Washington, DC. This API Specification sets the technical and quality control requirements for products you plan to monogram.

Review these API Standards and determine if you have a quality program in place and functioning at your facility that meets the requirements of these API Standards and that you have a quality manual that describes your quality program. Do not apply if you do not meet these requirements.

API Evaluation. There are two basic steps in the API evaluation of a manufacturer. First, the API staff will review the quality manual against API Specification Q1 and the requirements of this API Specification. If your program does not meet these requirements, your quality manual will be rejected, and you will be notified. You may submit a new application package after you correct any deficiencies. If your quality manual is accepted, you will be notified and given the name of the survey team leader and the time schedule for your survey.

The second step is based on the survey results. The survey team leader will contact the manufacturer and work out the detailed survey schedule, conduct his survey and submit his report to API (a copy will be left with the manufacturer at the time of the exit interview). The API staff will review the survey report to verify that the quality program described in the manufacturer's quality manual is in place and functioning.

The API takes action based on the above evaluations. Accredited manufacturers are issued a license and added to the licensee list.

EXHIBIT A—BOARD RESOLUTION

The original resolutions adopted by the Board of Directors of the American Petroleum Institute on Oct. 20, 1924, embodied the purpose and conditions under which such official monogram may be used.

The following restatement of the resolutions was adopted by the Board of Directors on November 14, 1977:

WHEREAS, The Board of Directors of the American Petroleum Institute has caused a review of the Institute's program for licensing the use of the API monogram and

WHEREAS, It now appears desirable to restate and clarify such licensing policy and to confirm and make explicitly clear that it is the licensees, not API, who make the representation and warranty that the equipment or material on which they have affixed the API monogram meets the applicable standards and specifications prescribed by the Institute;

NOW, THEREFORE, BE IT RESOLVED, That the purpose of the voluntary Standardization Program and the Monogram Program of the American Petroleum Institute is to establish a procedure by which purchasers of petroleum equipment and material may identify such equipment and materials as are represented and warranted by the manufacturers thereof to conform to applicable standards and specifications of the American Petroleum Institute; and be it further

RESOLVED, That the previous action under which the following monogram was adopted as the official monogram of the American Petroleum Institute is reaffirmed;

BE IT FURTHER RESOLVED, That the American Petroleum Institute's monogram and standardization programs have been beneficial to the general public as well as the petroleum industry and should be continued and the Secretary is hereby authorized to license the use of the monogram to anyone desiring to do so under such terms and conditions as may be authorized by the Board of Directors of the American Petroleum Institute, provided that the licensee shall agree that the use of the monogram by such licensee shall constitute the licensee's representation and warranty that equipment and materials bearing such monogram complies with the applicable standards and specifications of the American Petroleum Institute; and that licensee shall affix the monogram in the following manner;

BE IT FURTHER RESOLVED, That the words "Official Publication" shall be incorporated with said monogram on all such standards and specifications that may hereafter be adopted and published by the American Petroleum Institute, as follows:

OFFICIAL PUBLICATION

REG. U.S. PATENT OFFICE

EXHIBIT B

MANUFACTURER'S APPLICATION
FOR LICENSE TO USE API
MONOGRAM ON SPEC 5B MASTER GAUGES

Submit to: American Petroleum Institute
1220 L Street, N.W.
Washington, DC 20005

The information indicated below must be supplied as a part of all applications to use the API monogram. All such information is subject to investigation and applications may be rejected if the information supplied so warrants.

1. Do you now have a quality program in place at this facility? Yes _____ No _____
2. Do you now have a quality manual that describes your quality program? Yes _____ No _____

If answer to 1 or 2 is No do NOT submit application.

3. Product: ______________________________
   (List the products on which the monogram is to be applied)
4. Name of Manufacturer: ______________________________
5. Location of principal office: ______________________________
6. Location of manufacturing facility at which monogram is to be applied:
   ____
7. Manager of facility in (6) above: ______________________________
   Address: ______________________________
8. Name, address and telephone number of manufacturer's representative to whom API correspondence should be directed if other than facility manager: ______________________________
   ____
9. Are you actually producing this product now? ______________________________
   a. State the length of time you supplied the product to the oil industry:
   ____
   (Year and Months)
   b. If you are not now manufacturing this product, when do you expect to begin production? ______________
   c. State the approximate percentage of production of this product to this facility's total production:
   ____
10. Do you have an in-house process design group? Yes _____ No _____ Percent work done in-house _____
11. Do you have in-house machining equipment? Yes _____ No _____ Percent work done in-house _____
12. Do you have in-house inspection/test equipment? Yes _____ No _____ Percent work done in-house _____
13. Does your product require special processes? Yes _____ No _____
    Identify ______________________________
14. Size of plant: _______ Covered square footage. Number of employees at the plant _______ .
15. As a condition of this application being accepted by API, applicant agrees to submit quality program data requested, to participate in, and to pay the cost of an API survey of his facility whether or not he is granted a license to use the API monogram. API shall be the sole judge of whether an applicant meets the appropriate qualifications to become a Licensee.

______________________________ By ______________________________
(Applicant Company Name) (Signature and Title of Authorized Officer)

Date ____________________

Note: This application is to be accompanied by the original signed copy of the API License Agreement, a quality manual, and payment of a non-refundable application fee in amount of $2,500,* which covers the API administrative costs including API staff review of applicant's quality manual.)

*Application fee is $1500 if applicant is also licensed under another API Specification requiring a quality program evaluation and has one quality program and one quality manual covering all products to be monogrammed under both specifications.

EXHIBIT C—LICENSE AGREEMENT

No.____________

Use of the Official Monogram of the American Petroleum Institute

This agreement between the AMERICAN PETROLEUM INSTITUTE (hereinafter "API"), a corporation of the District of Columbia, having an office at 1220 L-Street, N.W., Washington, D.C., and ____,
(hereinafter "Licensee"), a corporation of ____,
having its principal place of business at ____ provides that:

WHEREAS, API is the owner of federal trademark and servicemark registrations including registration nos. 677,359; 679,642 and 840,642, as well as the owner of common law rights to such trademarks and servicemarks and various other trademarks and servicemarks;

WHEREAS, API through licensing, publications and other programs seeks to establish and promote standards and specifications for goods and services in the petroleum industry;

WHEREAS, Licensee desires a non-exclusive license from API for the purpose of promoting the standards and specifications of API by use of API trademarks or servicemarks on or in connection with the marketing of goods made in accordance with API standards and specifications.

NOW THEREFORE, in consideration of the mutual covenants hereinafter stated, the parties agree as follows:

1. API grants to Licensee a non-exclusive license to use the trademark/servicemark ⒶⓅ (the "monogram") on MASTER GAUGES ____ ("products") made at its facility located at ____ ("facility") in accordance with the official publications of API entitled Specification for Threading, Gauging and Thread Inspection of Casing, Tubing and Line Pipe Threads—Std. 5B ____________________ and Spec Q1 including any amendments, modifications or substitutions that may hereafter be adopted.

2. API grants to Licensee a non-exclusive license to use the monogram in connection with the marketing of the products; provided, however, that Licensee shall not use the monogram on letterheads or in any advertising without an express statement of fact describing the scope of Licensee's authorization, and further provided that Licensee shall not use the monogram or the name the AMERICAN PETROLEUM INSTITUTE or the description "API" in any advertising or otherwise to indicate API approval or endorsement of the products.

3. Licensee warrants that it has and will continue to have during the term of this license a quality program conforming to API Specification Q1. Copies of the Quality Manual describing said program and any amendments made thereto will be made available to API or its representatives upon request.

4. Licensee understands and agrees that Licensee's manufacturing facility will be surveyed periodically during the term of this license to determine whether or not Licensee may continue to qualify for authorization to use the Monogram. The frequency of the periodic surveys will be at the discretion of API. Licensee agrees to permit API, or an approved API surveyor to conduct such surveys. Periodic surveys will be at API's expense except every third year renewal survey shall be at Licensee's expense. In addition, Licensee agrees that it will do all other acts required of it by API to ensure that pertinent API standards and specifications are being met at all times in the manufacture of the products. API shall be the sole judge of whether Licensee meets the appropriate qualifications to remain a Licensee and whether the products meet the appropriate standard or specification.

5. Licensee agrees that use of the monogram on the products shall constitute a representation and warranty by Licensee to API and to the purchasers of the products that the products conform to the applicable standards and specifications of API; and Licensee agrees to hold harmless and indemnify API for any and all liability, loss, damage, costs and expense which API may suffer, incur, or be put to by reason of any claim, suit or proceeding, for personal injury, property damage or economic loss based on the failure or alleged failure of the Licensee's products to conform to such standards and specifications; and Licensee further agrees to defend API, at Licensee's expense, against any and all such suits, claims or proceedings.

6. This license shall be solely for the above listed products made by Licensee at its facility designated above and shall not be assignable or transferable by Licensee in any manner nor shall Licensee have the right to grant sublicenses.

7. This agreement may be terminated at any time and for any reason satisfactory to the API.
8. This license shall become effective and terminate upon the dates set forth below unless earlier terminated by API pursuant to paragraph 7 above.
9. Licensee agrees to pay an annual license fee when billed by API.

Date: ______________________ ______________________
(Licensee Company Name)

Effective
Date: ______________________ By ______________________
AMERICAN PETROLEUM INSTITUTE

Expiration
Date: ______________________ By ______________________

Additional copies available from API Publications and Distribution:
(202) 682-8375

Information about API Publications, Programs, and Services is
available on the World Wide Web at: http://www.api.org

American Petroleum Institute
1220 L Street, Northwest
Washington, D.C. 20005-4070
202-682-8000

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