AN AMERICAN NATIONAL STANDARD

PIPE THREADS, GENERAL PURPOSE (INCH)

1 INTRODUCTION

1.1 Scope

This American National Standard covers dimensions and gaging of pipe threads for general purpose applications.

1.2 Thread Designations

1.2.1 The types of pipe threads included in this Standard are designated by specifying in sequence the nominal pipe size,[1] number of threads per inch and the thread series symbol as follows:

3/8 - 18 NPT
1/8 - 27 NPSC
1/2 - 14 NPTR
1/8 - 27 NPSM
1/8 - 27 NPSL
1 - 11.5 NPSH

For left hand threads add LH to the designation, otherwise right hand threads will be understood. For example:

3/8 - 18 NPT - LH

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

N = National (American) Standard
P = Pipe
T = Taper
C = Coupling
S = Straight
M = Mechanical
L = Locknut
H = Hose Coupling
R = Railing Fittings

[1]Where it is necessary to use decimal notation for the size designation (as when inserting such in a computer or electronic accounting machine) the decimal equivalent of nominal pipe size may be substituted for fractional pipe sizes.

1.2.3 Coated or Plated Threads. The threaded product specifications covered in this Standard do not include an allowance for coatings or plating.

1.3 Sealing

1.3.1 Where pressure-tight joints are required, it is intended that taper pipe threads conforming to this Standard be made up wrench-tight with a sealant. To prevent galling on certain piping materials such as stainless steels, the sealant usually contains a lubricant.

1.3.2 Pipe threads designed for pressure-tight joints that may be used without sealing compounds (Dryseal Threads) are covered in ANSI B1.20.3 (Inch) and ANSI B1.20.4 (Metric Translation).

1.4 Inspection

A gaging method and tolerances are prescribed in this Standard to effect a functional inspection of the handtight L_1 engagement threads. However, conformance to this Standard requires that all basic design dimensions be met (within applicable tolerances) including extension of the thread elements to provide for wrench-tight makeup. Therefore, additional methods of gaging may be employed to evaluate conformance to the basic design dimensions. When additional methods of gaging are employed, they shall be agreed upon by the supplier and the purchaser.

1.5 Appendix

Useful and supplementary information which is not a part of this Standard is presented in the Appendix. Specifically, the Appendix gives Suggested Twist Drill Diameters for Drilled Hole Sizes for Pipe Threads.

1.6 Related Standard

Definitions of terms and symbols for thread dimensions are given in ANSI B1.7, Nomenclature, Definitions and Letter Symbols for Screw Threads.

larger end of the pipe thread. See Table 5. The dimensions of these external and internal threads are shown in Table 5. A recess in the fitting provides a covering for the last scratch or sharp edges of incomplete threads on the pipe.

5.1.1 Thread Designation. American National Standard Railing Joint Taper Pipe Threads are designated in accordance with 1.2.1 as follows:

1/2 - 14 NPTR

5.1.2 Form of Thread. The form of the thread is the same as the form of the American National Standard Taper Pipe Thread shown in Fig. 1.

5.1.3 Tolerances on Thread Elements. The gaging of these threads is specified in Table 5. The maximum allowable deviation in the external thread is no turns large and one turn small. The maximum allowable deviation in the internal thread is one turn large, no turns small.

6 SPECIFICATIONS FOR STRAIGHT PIPE THREADS FOR MECHANICAL JOINTS; NPSM, NPSL, NPSH

6.1 Straight Pipe Threads

In addition to pressure-tight pipe joints, for which taper external threads and either taper or straight internal threads are used, there are mechanical joints where straight pipe threads are used to advantage on both external and internal threads. Three of these straight pipe thread joints are covered by this Standard, all of which are based on the pitch diameter of the American National Standard Taper Pipe Thread at the gaging notch (dimension E_1 of Table 2) but have various truncations at crest and root as described below. These three types of joints are as follows:

(*a*) free-fitting mechanical joints for fixtures, Table 6, both external and internal, NPSM.

(*b*) loose-fitting mechanical joints with locknuts, Table 7, both external and internal, NPSL.

(*c*) loose-fitting mechanical joints for hose couplings (ANSI B2.4), NPSH.

6.1.1 Thread Designations. The above types of straight pipe threads for mechanical joints are designated in accordance with 1.2.1 as follows:

1/8 - 27 NPSM
1/8 - 27 NPSL
1 - 11.5 NPSH

6.1.2 Pitch and Flank Angle. The pitch and flank angle are the same as the corresponding dimensions of the taper pipe thread described in Section 3.

6.1.3 Diameter of Thread. The basic pitch diameter for both the external and internal straight pipe threads is equal to the pitch diameter of the American National Standard Taper Pipe Thread at the gaging notch (dimension E_1 of Table 2), which is the same as at the large end of the internal taper pipe thread.

6.2 Free-Fitting Mechanical Joints for Fixtures, NPSM

Pipe is often used for special applications where there are no internal pressures. Where straight thread joints are required for mechanical assemblies, straight pipe threads are often found more suited or convenient.

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

6.3 Loose-Fitting Mechanical Joints With Locknuts, NPSL

The American National Standard External Locknut thread is designed to produce a pipe thread having the largest diameter that it is possible to cut on standard pipe. Ordinarily Straight Internal Threads are used with these Straight External Threads, providing a loose fit. The dimensions of these threads are given in Table 7. It will be noted that the maximum major diameter of the external thread is slightly greater than the nominal outside diameter of the pipe. The normal manufacturer's variation in pipe diameter provides for this increase.

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

Gaging information for these threads is given in Section 7.

whether or not such truncations are within the limits specified, or particularly to see that maximum truncation is not exceeded, it is necessary to make further inspection. For this inspection, optics or optical projection is suggested.

7.3 Gage Tolerances

In the manufacture of gages, variations from basic dimensions are unavoidable. Furthermore, gages will wear in use. In order to fix the maximum allowable variations of gages, tolerances have been established. See Table 9 and 7.3.2.

7.3.1 Master Gage Tolerances. The set of master gages should be made to the basic dimensions as accurately as possible, but in no case shall the cumulative deviation exceed one-half of the total cumulative tolerance specified in cols. 13 and 14 of Table 9. Each master gage should be accompanied by a record of the measurements of all elements of the thread and the standoff of master plug to master ring (large end of ring gage to basic notch of plug gage).

7.3.2 Working Gage Tolerances. All gages applied to the product thread, whether in manufacture or inspection, are designated as working gages. All working gages should be made to the basic dimensions specified in Table 8 and within tolerances specified in Table 9. The maximum wear on a working gage shall not be more than the equivalent of one-quarter turn from its original dimensions.

7.4 Relation of Lead and Angle Deviations to Pitch Diameter Tolerances of Gages

When it is necessary to compute from measurements the decimal part of a turn that a gage varies from the basic dimensions, Tables 10 and 11 should be used. Table 10 gives the correction in diameter for angle deviations and Table 11 gives the correction in diameter for lead deviations. These corrections are always added to the pitch diameter in the case of external threads and subtracted in the case of internal threads regardless of whether the lead or angle deviations are either plus or minus.

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

8 GAGING OF TAPER PIPE THREADS

8.1 Gaging External Taper Threads

In gaging external taper threads, the L_1 ring gage, Fig. 6, is screwed handtight on the pipe or external thread. The thread is within the permissible tolerance when the gaging face of the working ring gage is not more than one turn, large or small, from being flush with the end of the thread, as indicated in Fig. 6.

8.2 Gaging Internal Taper Threads

In gaging internal taper threads, the L_1 plug gage, Fig. 4, is screwed handtight into the fitting or coupling. The thread is within the permissible tolerance when the gaging notch of the working plug gage is not more than 1 turn, large or small, from being flush with the end of the thread, as indicated in Fig. 7.

8.3 Gaging Practice

8.3.1 Precautions. In gaging pipe threads it is common practice to tap or rap the part to assure proper seating of the gage in or on the product thread. However, it is first necessary to clean both the gage and the product threads so that they are free of chips, burrs, abrasives, or other foreign materials.

8.3.2 Supplemental Gaging. Gaging of both internal and external threads by use of the L_1 plug and ring gages, illustrated by Figs. 6 and 7, serves to assure conformance to the L_1 elements of the design dimensions. However, conformance to this Standard requires that all basic design dimensions be met within applicable tolerances including extension of the thread elements to provide for wrench-tight make-up. Therefore, in controlling manufacturing practices or as otherwise required, additional methods of measuring or gaging may be employed to supplement L_1 gaging.

8.4 Gaging Chamfered, Countersunk, or Recessed Threads

The reference point for gaging internal product threads depends upon the chamfer diameter. When the internal chamfer diameter exceeds the major diameter of the internal thread, the reference point is the last thread scratch on the chamfer cone. See Fig. 8B. Otherwise, when the internal chamfer diameter does not exceed the major diameter of the internal thread, the reference point is the end of the

fitting. An allowance must be made for the depth of counterbore on counterbored fittings.

The reference point for gaging or measuring the length of external product threads is the end of the pipe.

8.4.1 Turns-Engagement Method of Gaging. The turns-engagement method of gaging taper threads with plug and ring pipe thread gages, determines that an adequate number of threads is available at hand, engagement, thus avoiding possible complications resulting from gage chamfer and product chamfer. See Table 2, col. 7, for the basic number of turns in the absence of chamfers (e.g., 4.32 turns for 27 tpi), the applicable tolerance being plus or minus one turn (or limits 3.32 to 5.32 turns for 27 tpi).

9 GAGING OF STRAIGHT PIPE THREADS

9.1 Types of Gages

Gages to properly control the production of these straight threads should be either straight GO and HI (Internal) and GO and LO (External) gages or the regular American National Standard Taper Pipe Thread gages as indicated below.

9.1.1 Use of Straight and Taper Gages. Straight GO and HI/LO gages should be used for all types of threaded joints where both the external and internal threads are straight. Taper plug gages should be used for the internal threads of all types of mechanical joints where the external thread is tapered and the internal thread is straight. Taper plug gages used for this purpose should be checked periodically by direct measurement.

9.1.2 Gaging Pressure-tight Joints. Taper thread gages shall be used to gage straight internal pipe threads forming part of pressure-tight joints where the external thread is tapered.

The plane of the gaging notch on the American National Standard Taper Pipe Thread plug gage shall come flush with the end of the American National Standard Coupling Straight Pipe Thread (NPSC) (Table 4) or flush with the last thread scratch on the chamfer cone if chamfered with an internal chamfer diameter in excess of the major diameter of the internal thread (see Fig. 8B). A tolerance of one and one-half turns large or small to gage shall be allowed.

CAUTION: When using a tapered thread plug gage, nonuniformity of gage wear is a particular problem; therefore, taper plug gages used for this application should be checked by direct measurement of thread form and size in addition to checking against a master.

9.2 Gage Dimensions

The straight GO and HI plug gages and the straight GO and LO ring gages used for checking mechanical joint threads, Tables 6 and 7, shall be made to the pitch diameter limits specified in the product tables in accordance with standard practice for straight thread gages as outlined in ANSI B1.2, Gages and Gaging for Unified Screw Threads.

The minimum major diameter of the GO thread plug gage shall be equal to the minimum pitch diameter of the internal thread plus an amount equal to 0.75H (0.649519p). The maximum major diameter of the HI thread plug gage shall be equal to the maximum pitch diameter of the internal thread plus an amount equal to 0.50H (0.433013p).

The maximum minor diameter of the GO thread ring gage shall be equal to the maximum pitch diameter of the external thread minus an amount equal to 0.50H (0.433013p). The minimum minor diameter of the LO thread ring gage shall be equal to the minimum pitch diameter of the external thread minus an amount equal to 0.25H (0.216506p).

See ANSI B1.2 for further details and tolerances for these straight thread gages.