Gaging NPTF Threads

NPTF (DRYSEAL) TAPER PIPE GAGES

Dryseal pipe threads are generally used in more critical applications than NPT and therefore a greater variety of gages and/or measuring equipment is used to more adequately check size, taper and thread form. NPT product threads and gages are covered by our Technical Bulletin, "NPT Taper Pipe Thread Gages", which may be consulted for basic taper pipe gaging principles and to make comparisons to NPTF.

NPTF (National Pipe Taper Fuel) threads have the same taper (3/4" per foot) and 60º thread angle as NPT but differ significantly in the crest and root truncation requirements. Closer control of all elements is necessary for a satisfactory "dryseal" assembly of mating parts. This control starts with selection of the proper threading tools specifically made to produce an NPTF profile.

Figure #1 illustrates the normal product thread condition wherein the crests (major diameter of external threads and minor diameter of internal threads) are sharper than the roots of the mating parts.

Figure #1

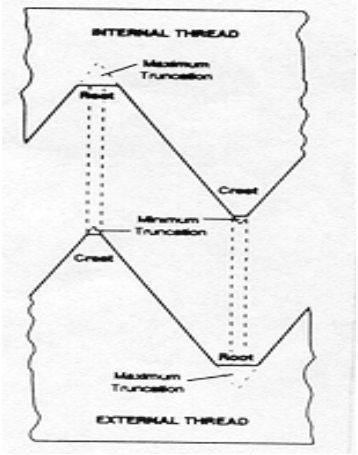


Figure #2 illustrates that when the NPTF parts are assembled hand-tight there normally will be contact or interference at crest and root first while the flanks are still separated.

Figure #2

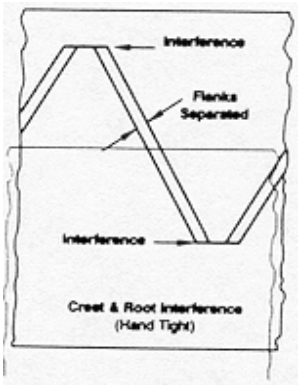
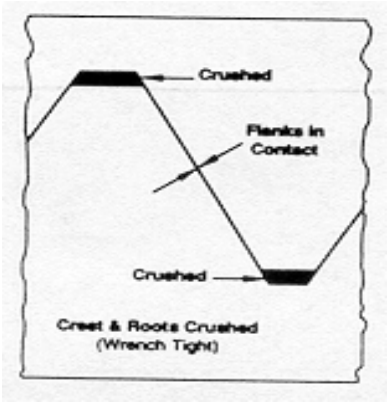


Figure #3 illustrates the results when mating parts are brought to a wrench-tight condition. Now, the sharper crests are crushed into the opposing roots while the thread flanks are drawn together. Thus, there is complete mating profile making a leak-proof connection without the necessity of sealing compound. Hence, the term "dryseal" is used. (There are applications particularly where high pressures are involved when a sealant may still be applied).

Figure #3



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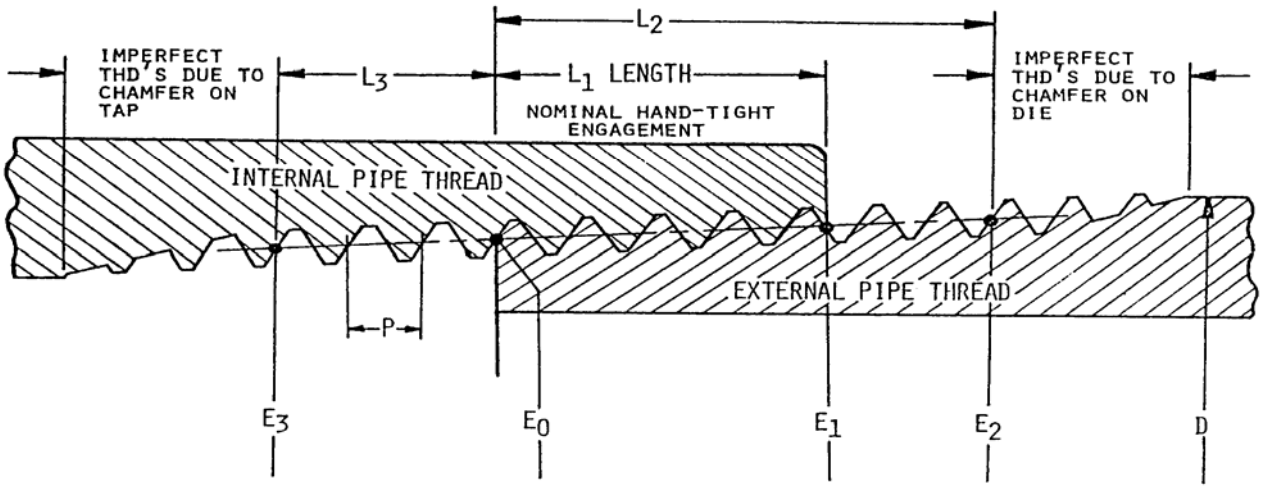
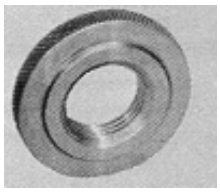


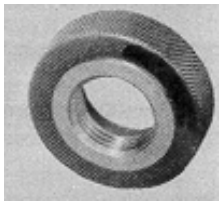
Nominal Size	Pitch P	Increase in Dia. Per Thrd	L-1		P.D. At E0	P.D. At E1	Nominal Dia. Of Pipe D
			Length	No of Threads			
1/16 – 27	.03704	.00231	.160	4.32	.27118	.28118	.3125
1/8 - 27	.03704	.00231	.1615	4.36	.36351	.37360	.405
¼ - 18	.05556	.00347	.2278	4.10	.47739	.49163	.540
3/8-18	.05556	.00347	.240	4.32	.61201	.62701	.675
½-14	.07143	.00543	.320	4.48	.75843	.77843	.840
¾ - 14	.07143	.00543	.339	4.75	.96768	.98887	1.050
1 – 11 ½	.08696	.00543	.400	4.60	1.21363	1.23863	1.315
1 ¼ - 11 1/2	.08696	.00543	.420	4.83	1.55713	1.58338	1.660
1 ½ - 11 ½	.08696	.00543	.420	4.83	1.79609	1.82234	1.900
2 – 11 1/2	.08696	.00543	.436	5.01	2.26902	2.29627	2.375

Technical Bulletin, #16 *NPT Taper Pipe Thread Gages*, defines the L-1 basic hand tight engagement on NPT product threads. This same L-1 length applies to NPTF threads. It is the theoretical length of assembly (hand-tight) if both parts had perfect thread form and taper and were exactly at the nominal size. The diagram and table above show standard L-1 lengths for pipe thread sizes up to 2" and also other length dimensions known as L-2 and L-3.

Because of allowable tolerances on both parts the actual length of assembly often uses threads in these other sections and particularly so when drawn together wrench-tight. The full L-2 and L-3 threads should have satisfactory sizes and profiles to permit this assembly and therefore additional thread gages are used. Figure #4 shows the four thread gages required for checking NPTF parts.

FIGURE 4





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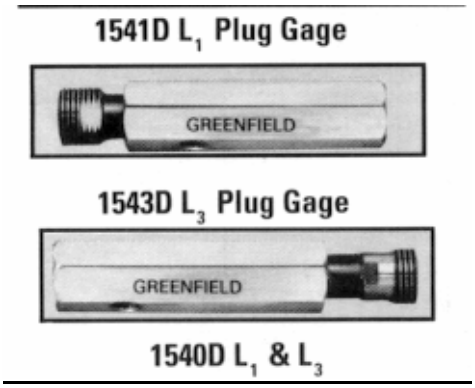
Gaging NPTF Threads

Thin Ring
For gaging L1 thread length (hand tight engagement) of pipe.

Thick Ring
For gaging L 2 thread length (effective threads) of pipe

The ANSI B1.20.5-1991 standard (and corresponding FED-STD H28/8) has established two classes of NPTF product threads. On class 1 threads the acceptability is determined by the coordinated use of L-1 and L-3 thread plug gages for internal product threads and L-1 and L-2 thread ring gages for external product threads. Crest and root truncations are generally considered adequately controlled by the tooling used to produce the product threads. Class 2 NPTF requirement is described later.



GAGING INTERNAL THREADS

The L-1 taper pipe thread plug gage is used first. This gage has a notch at a distance of L-1 from its small end. The pitch diameter at the notch is equal to the E1 dimension in the Table. This gage is turned "hand-tight" into the product and the notch must then be flush with the large end of the internal thread within a tolerance of plus or minus one turn. (See Figure #5). It also must be noted on each part as to the approximate position within this maximum and minimum that limits the gaging point stopped.

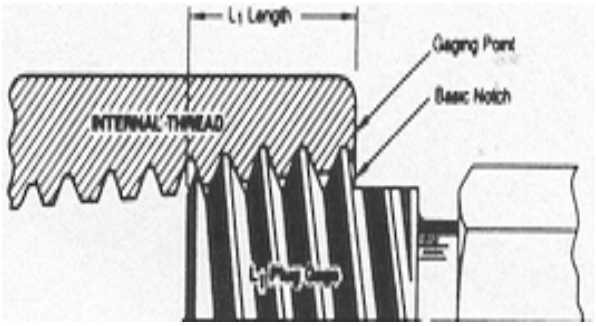
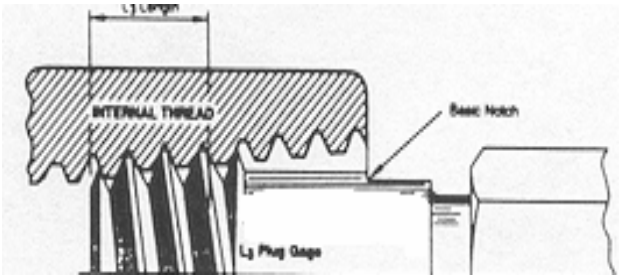


FIGURE 5

After removing the L-1 gage the L-3 taper pipe thread plug gage is fully engaged into the part. This gage checks threads in the L-3 section (beyond those checked by the L-1 gage). Threads on this gage near the large end have been removed but the basic notch is at the same theoretical position as the notch on the L-1 gage.

Figure 6



This notch must stop within plus or minus 1/2 turn of the same position found in using the L-1 gage on that particular part. The L-3 gage thus checks the assembleability and functional size of threads in the L-3 region, and the correlation of results with the L-1 gage provides an indication of excessive steep or shallow taper deviations in the product threads.

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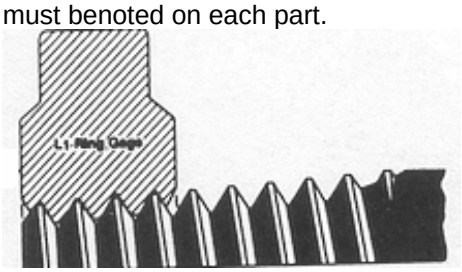
Gaging NPTF Threads

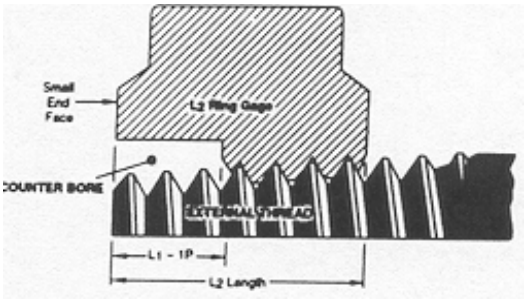
GAGING EXTERNAL THREADS

The L-1 taper pipe threads ring gage is used first. This gage has a pitch diameter at small end equal to the Eo dimension in the table and a thickness equal to the L-1 length. When this ring gage is turned hand-tight onto the external pipe thread the small end faces of each must be flush within a tolerance of plus or minus one turn. See Figure #7 Again, the appropriate position within these limits must benoted on each part.



L1 Length

The L-2 taper pipe thread ring gage is then used. The small end of this gage must correlate within plus or minus 1/2 turn of the same position as noted when the L-1 ring was used on that same part. The L-2 ring has a thickness equal to the standard L-2 thread length per the table, but threads near the small end of the gage are omitted.
See Figure #8.



This gage checks the assembleability and functional size of threads further up on the pipe beyond those checked by the L-1 ring. The coordinated use of both L-1 and L-2 thread rings also gives an indication of taper deviations.

CLASS 2 NPTF PRODUCT THREADS

For class 2 NPTF threads the use of L-1, L-2 and L-3 thread gages is still required for acceptability, but beyond that the measurement of gaging of crests and roots is also required. Direct measurements or optical projection (on a sampling basis) of the truncations or equivalent widths of flat is generally considered more accurate and is the referee method in the event of a dispute. (For internal threads this would involve sectioning or making a cast.)

Crest and root truncation gages are used as alternate methods. The 6 step plain taper plug and ring gages provide a rapid, simplified method of checking crest truncations and we will discuss their usage.

The six step root truncatgion gages are not as common. They have threads with 50o included angles made to clear the 60o product thread flanks and contact only at the roots of the product threads. Gaging results would be affected by the inaccuracy of flank angles, lead, and taper also by dirt, chips and surface imperfections.

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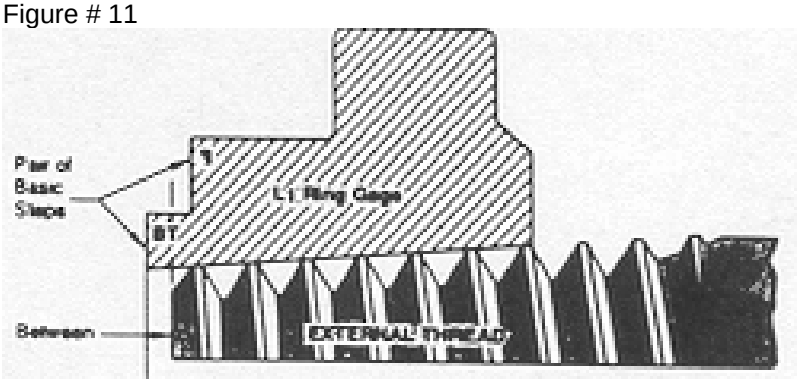
FIGURE 11 shows a 6 step plain taper ring gage checking
the crest (major diameter) of an external thread. The small end face of the part falls within the B and Bt steps as this part was judged by the L1 thread ring gage to be within the “basic” thread size category.

Figure # 11



Root truncation gages also have 3 pairs of steps which would be used in the same manner as plain taper gages i.e. coordinating with the size category established by the L1 thread gage.

Turns Engagement Method

Another gaging technique described in H-28 and ANSI documents is called the “turns engagement” method. In this method the thread plug or thread ring gage is fully assembled into or onto the product thread and then the exact number of turns and decimal part thereof is counted as the gage is removed until it becomes a disengaged. The documents list the “basic” number of turns for L-1, L-2 and L-3 gages in each pipe size. The product limits are still plus or minus 1 turn from the “basic” turns and there is still a correlation required between the results of L-1 versus L-2 or L-3 gaging of plus or minus ½ turn. The “turns engagement” method is particularly useful if the gaging point on the product is not an accurate or perpendicular face.

The NPT Technical Bulletin, #16, on ”NPT Taper Pipe Thread Gages” contains additional comments relating to tightness or torque in using pipe thread gages. Greenfield can also supply information on master pipe gages for verifying functional size and wear on working pipe gages. Information on various styles of pipe taps (Interrupted thread, “easy start”, “high hook”, “spiral flute”, etc.) and other threading tools can also be supplied.

The Technical Bulletin #24 “ NPSF, NPSI and PTF-SAE Short Gages” deals with short dryseal pipe threads.

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