

Greenslade & Company, Inc.

Fastener Inspection Equipment - Innovative Gage Design

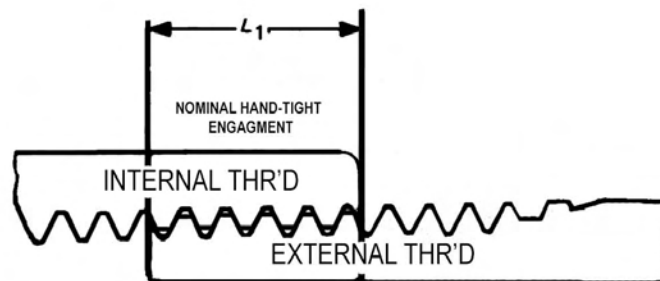
Dimensional Calibration

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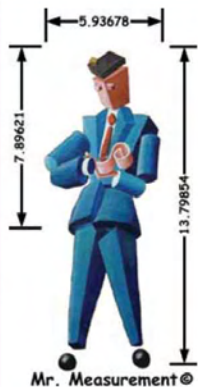
NPT TAPER PIPE THREAD GAGES

Although there are many types of both taper pipe and straight pipe threads, the most common in general usage is NPT (National Pipe Taper). This thread has 3/4" taper per foot (1/16" taper per inch) and a 60° included angle of thread, perpendicular to the axis. NPT threads have a maximum height of thread equal to .8 x pitch which is much sharper at the crest and root than conventional UNS straight threads.



Note on the above diagram that the nominal length of engagement when external and internal threads are assembled "hand tight" is designated as the L-1 length. The actual length of engagement between any two parts can vary appreciably due to allowable tolerances. Bringing the parts together "wrench tight" will, of course, increase the length of engagement to some extent. A sealing compound is normally used to provide a leak proof connection

The table on the next page lists the NPT thread sizes up to 2". (Standards are actually established for sizes as large as 24".) This table shows L-1 lengths and also the nominal pitch diameters at the small end of external threads (designated E0) and at the large end of internal threads (designated E1), plus additional information that may be of interest.

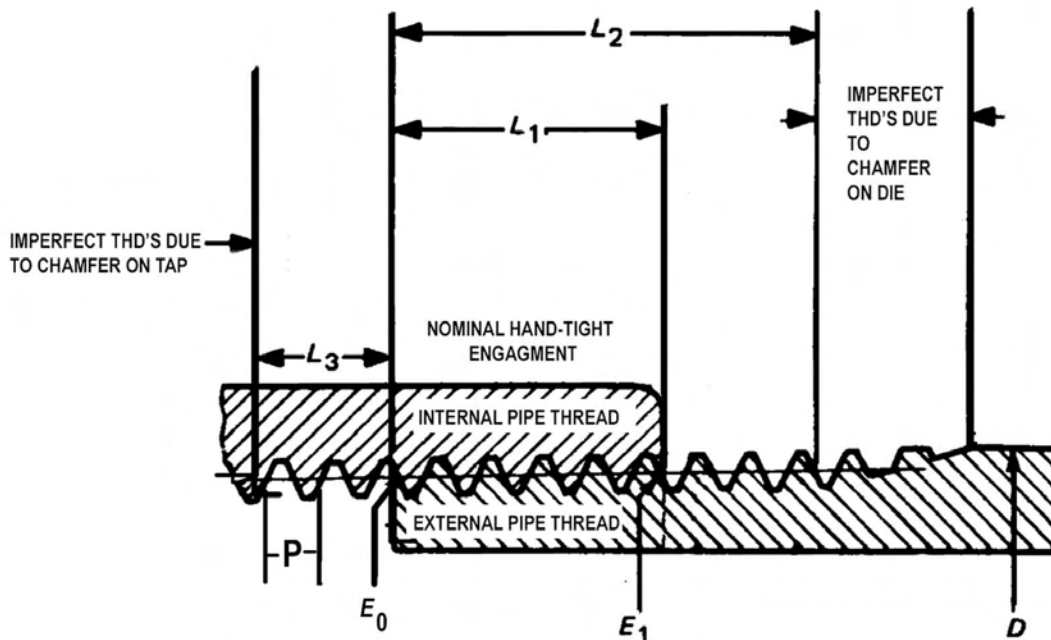


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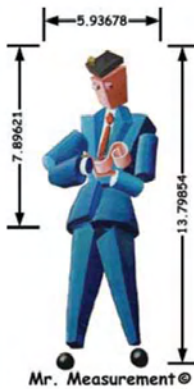
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Nominal Size	Pitch P	Increase in in dia. per thrd	L - 1		P.D. at E ₀	P.D. at E ₁	Nominal Dia. of pipe D
			LENGTH	NO. OF THREADS			
1/16-27	.03704	.00231	.160	4.32	.27118	.28118	.3125
1/8-27	.03704	.00231	.1615	4.36	.36351	.37360	.405
1/4-18	.05556	.00347	.2278	4.10	.47739	.49163	.540
3/8-18	.05556	.00347	.240	4.32	.61201	.62701	.675
1/2-14	.07143	.00446	.320	4.48	.75843	.77843	.840
3/4-14	.07143	.00446	.339	4.75	.96768	.98887	1.050
1" - 11 ¹ / ₂	.08696	.00543	.400	4.60	1.21363	1.23863	1.315
1 ¹ / ₄ - 11 ¹ / ₂	.08696	.00543	.420	4.83	1.55713	1.58338	1.660
1 ¹ / ₂ - 11 ¹ / ₂	.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



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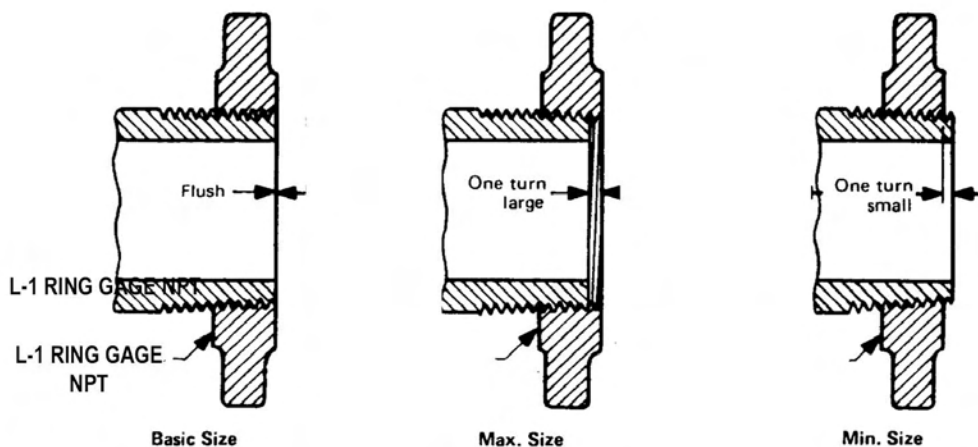
Gaging of NPT threads is relatively simple. The only gages normally used, as pictured below, are as follows:

Taper Pipe Thread *ring* Gage (L-1) for checking external threads.

Taper Pipe Thread *plug* Gage (L-1) for checking internal threads.



The taper pipe thread ring gage has a thickness equal to the L-1 length and a pitch diameter at the small end equal to the E_o dimension in the previous table. This gage is turned onto the external pipe thread until it stops (hand tight). The small end of the ring is required to be flushed with the small end of the pipe within a tolerance of plus or minus one turn. (see following diagram)



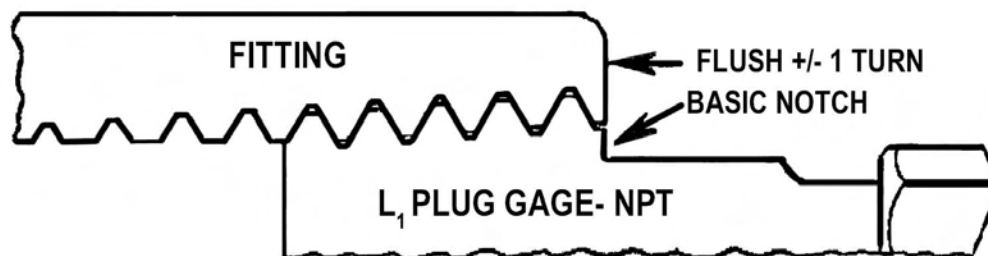
The taper pipe thread plug has a notch at the L-1 distance from the its small end. The pitch diameter at the notch corresponds to the E_1 dimension in the table. The plug gage is turned hand tight into the fittings or coupling (internal pipe thread). The notch on the gage is required to be flush with the large end of the product thread within a tolerance of plus or minus one turn. If the large end of the fitting is chamfered or recessed the gaging point versus the notch is generally considered to be at the bottom of the chamfer or recess. (See following diagram)



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If both the plug gage and the ring gage check respective parts as flush (basic size) then the assembly of those particular parts should be approximately the L-1 length. However, as mentioned previously, the actual assemble length can vary longer or shorter because of the permissible plus or minus one turn tolerance on both parts. Product threads must be free of dirt and chips before gaging. In fact, both gage and product threads must be reasonably clean. Some have questioned how much the thread gages should be tightened when gaging the product. There is no standard torque values established. The documents describe it only as "hand tight". Some inspectors turn the gage finger tight and then tap the gage or the part with a rubber hammer or on a bench and then increase the tightness. This practice causes rapid wear of gages and chipping of end threads. It can also make some difference in gaging results. Therefore, the Quality Control Manager or person in similar authority should establish the gaging guidelines and these should be agreed upon with manufacturing and inspection departments and with other companies if they are also involved with the acceptance of the parts.

Thread plug and thread ring gages are "functional type" gages and, therefore, are affected by lead, angle, and taper errors in addition to the actual size of the part. They are also affected by surface roughness, poor thread form, burrs, stop lines from tooling or other imperfections on product threads. For successful control of accuracy of pipe threads, it is necessary to make sure the correct threading tools are selected and are operating properly, maintaining their sharpness and form. It is also advisable to include an optical or visual inspection of the quality of product threads being produced.

Greenslade has additional information relating to various styles of pipe taps, recommended drill sizes, taper pipe reaming, and acorn dies and pipe dies.

Greenslade also can be of service in providing means for checking wear on pipe gages. The recommended limit for wear on working taper pipe thread gages is $\frac{1}{2}$ turn beyond basic size. Masters or Reference gages can be furnished, that offer a convenient and simple method of checking the extent of wear