FIXED-TURNING® pilots are centered with precision within the machining head of the machine owing to a hydraulic centering system and separate driving mechanism with flat at the tip of the pilot.

This distinctive NEWEN® feature is one of the precision characteristics of the centering of the NEWEN® machines, and this precision allows to work with minimum plays between guides and pilots.

Note: only "C2" type solid carbide pilots may be used on a FIXED-TURNING® machine under penalty of permanently destroying the machining head.

How to select a pilot for a given cylinder head type.

Metric size cylinder heads:

In metric sizes, valve guides usually have round dimensions, for example 7, 8, 9, 10mm, but there also exist intermediate sizes such as 5.5mm, 6.5mm, etc...
In all cases, the "round" dimension is called the nominal size and is subject to an ISO system tolerance. The most common tolerance is H7, sometimes H6 (tighter) or H8 (broader).

For example (most common case), a 7mm valve guide with an H7 tolerance will measure 7.00mm + 0.018mm, hence from 7.00mm to 7.018mm (as an information, ISO tolerance tables are available on the Internet).
In this specific case, one cannot use a 7.00mm pilot, for if the valve guide is at its minimum tolerance, hence 7.00mm, the pilot will not fit in. The pilot that will fit within all the valve guides shall measure 7.00mm minus 0.01mm, hence 6.99mm. A 7.00mm pilot will be perfect for engines that have already run.

We can therefore recommend two pilots per nominal size, and the minus 0.01mm dimension for new engines. For a 7.00mm nominal dimension, two pilots are recommended, a 7.00mm pilot and a 6.99mm pilot.

Nominal hole sizes (mm)				
over	3	6	10	18
inc.	6	10	18	30
micrometers (10^{-6}m)				
H6	+8 0	+9 0	+11 0	+13 0
H7	+12 0	+15 0	+18 0	+21 0
H8	+18 0	+22 0	+27 0	+33 0
H9	+30 0	+36 0	+43 0	+52 0

Cylinder heads with Imperial dimensions (in inches):

The principle is the same, one must take the smallest diameter defined by the tolerance as the nominal dimension, for example 3/8, hence .375" + or - .001". The smallest diameter shall be .375"-.001" = .374". The pilot that will fit all the valve guides will measure .374" less .0004'' =.3736".

For engines that have already run, a .374" pilot can be used for optimum precision.

In summary, one needs to determine the smallest diameter of the nominal dimension to subtract .01mm or .0004" for the smallest pilot and add the same value for an engine that has already run (second pilot). Then one can take stronger pilots in increments of .01mm or .0004", as long as the pilot fits within the valve guide without pressure.

Never use pilots that jam within the valve guides, they must always fall under their own weight, otherwise the risk of seizing up shall be important, with all the consequences that we know.

Minimum play between the valve guide and the pilot.

If one can measure with precision the dimention of the valve guide, which is diffi cult without precision measuring equipment, indeed in addition to measuring the diameter in various parts of the bore in order to fi nd out the smallest diameter, one must also check the shape of the axis of the valve guide, which often is "banana shaped" and will therefore result in a pilot being able to enter at either end without being able to go through the guide.

In this case, the dimension of the bore is not enough to determine a pilot dimension.

Only trial and error with different pilot diameters, will allow, little by little, to determine the pilot that is capable of going through the valve guide with a minimum play. The strongest pilot that is going through the guide without seizing up within it is the best possible pilot.

Maximum play between the valve guide and the pilot.

For one same cylinder head with identical size pilots between intake and exhaust, the smallest acceptable pilot does not have the same size for exhaust and intake.

Explanation:

The machining spindle of the machine centers with more precision if the pilot has minimum play within the valve guide. The valve that will in that valve guide will have a stem diameter inferior to that of the pilot diameter. Indeed, the functional play of the valve is determined by the dilations and flexing of the valve while the engine is running.
The play between the valve stem and the valve guide varies from .003mm (.0001”) to nearly .10mm (.0039”) depending upon the stem sizes and the nature of the valve (intake or exhaust).

With an equipment like a FIXED-TURNING® machine, that guaranties very precise centering with respect to the play between the valve guide and the pilot, the tilt of the spindle shall always be less that the tilt of the valve could have with a stem diameter inferior to one thousands of an inch or more, in that case the valve shall yield a perfect seal with its seat.

What needs to be noted, is that the valve stem diameters are not identical between intake valves and exhaust valves. Intake valve heat up less than exhaust valves and they require less functional play to work.

As a result, it is necessary to select the pilot for one same cylinder head, in function to the intake valve which exhibits a stem approximately one thousand stronger than that of the exhaust valve stem.

The dimension of the smallest acceptable pilot for one same cylinder head shall be equivalent to the precise dimension of the intake valve stem + one hundredth of mm (.01mm) or four thenth of a thousand (.0004”).
With this pilot, the centering will not be perfect but all the valves will be able to have an angle superior to that which will have been authorized to the Fixed-Turning machining spindle, and the four valves shall seat properly on their respective seats and shall yield a good seal to the cylinder.

Summary:

Optimum diameter of a pilot = diameter of the strongest pilot capable of going through the valve guide without getting stuck within the bore.

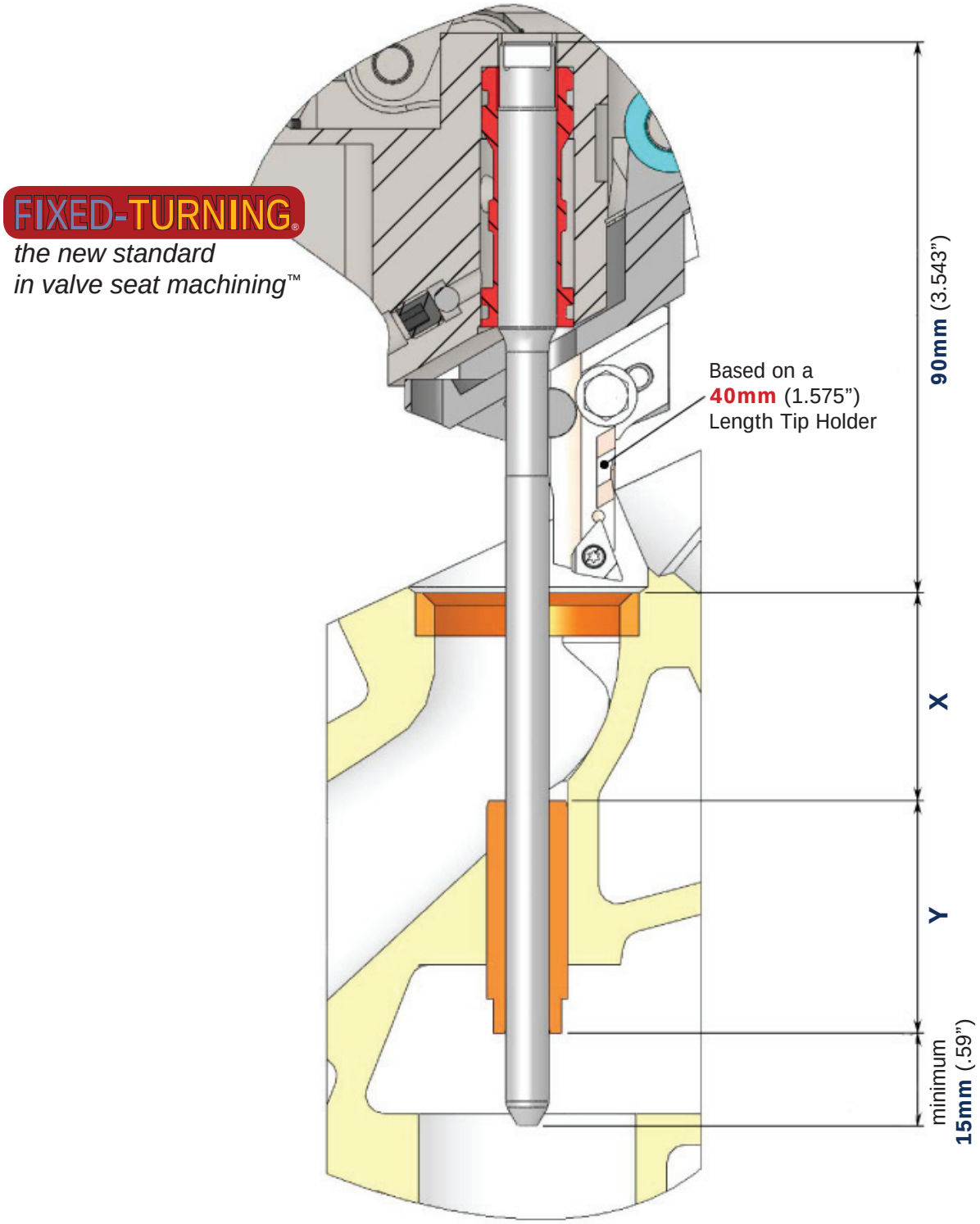
Minimum pilot diameter (maximum acceptable play) = diameter of the intake valve stem + .01mm or .0004”

In all cases, the length of the pilot must allow it to go through the guide during the auto-centering process, just like the valve goes completely through the valve guide while it is working and centers according to the entire length of the valve guide. If you are not sure on how to select the appropriate pilot length, please refer to chart on following page.

FIXED-TURNING®
the new standard
in valve seat machining™

HOW TO SELECT THE APPROPRIATE PILOT LENGTH

90mm (3.54”) + X + Y + 15mm (.59”) = Correct Pilot Length



NEVEN®

Legend: • Stock

mm	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm	inch
3.96	0.1559	4.64	0.1827	5.32	0.2094	5.985	0.2356	6.67	0.2626	7.35	0.2894
3.97	0.1563	4.65	0.1831	5.33	0.2098	5.99	0.2358	6.68	0.2630	7.36	0.2898
3.98	0.1567	4.66	0.1835	5.34	0.2102	5.995	0.2360	6.69	0.2634	7.37	0.2902
3.99	0.1571	4.67	0.1839	5.35	0.2106	6.00	0.2362	6.70	0.2638	7.38	0.2906
4.00	0.1575	4.68	0.1843	5.36	0.2110	6.01	0.2366	6.71	0.2642	7.39	0.2909
4.01	0.1579	4.69	0.1846	5.37	0.2114	6.02	0.2370	6.72	0.2646	7.40	0.2913
4.02	0.1583	4.70	0.1850	5.38	0.2118	6.03	0.2374	6.73	0.2650	7.41	0.2917
4.03	0.1587	4.71	0.1854	5.39	0.2122	6.04	0.2378	6.74	0.2654	7.42	0.2921
4.04	0.1591	4.72	0.1858	5.40	0.2126	6.05	0.2382	6.75	0.2657	7.43	0.2925
4.05	0.1595	4.73	0.1862	5.41	0.2130	6.06	0.2386	6.76	0.2661	7.44	0.2929
4.06	0.1599	4.74	0.1866	5.42	0.2134	6.07	0.2339	6.77	0.2665	7.45	0.2933
4.07	0.1602	4.75	0.1870	5.43	0.2138	6.08	0.2394	6.78	0.2669	7.46	0.2937
4.08	0.1606	4.76	0.1874	5.44	0.2142	6.09	0.2398	6.79	0.2673	7.47	0.2941
4.09	0.1610	4.77	0.1878	5.45	0.2146	6.10	0.2402	6.80	0.2677	7.48	0.2945
4.10	0.1614	4.78	0.1882	5.46	0.2150	6.11	0.2406	6.81	0.2681	7.49	0.2949
4.11	0.1618	4.79	0.1886	5.47	0.2154	6.12	0.2409	6.82	0.2685	7.50	0.2953
4.12	0.1622	4.80	0.1890	5.48	0.2157	6.13	0.2413	6.83	0.2689	7.51	0.2957
4.13	0.1626	4.81	0.1894	5.49	0.2161	6.14	0.2417	6.84	0.2693	7.52	0.2961
4.14	0.1630	4.82	0.1898	5.50	0.2165	6.15	0.2421	6.85	0.2697	...	...
4.15	0.1634	4.83	0.1902	5.51	0.2169	6.16	0.2425	6.86	0.2701	7.56	0.2976
4.16	0.1638	4.84	0.1906	5.52	0.2173	6.17	0.2429	6.87	0.2705	7.57	0.2980
4.17	0.1642	4.85	0.1909	5.53	0.2177	6.18	0.2433	6.88	0.2709	7.58	0.2984
4.18	0.1646	4.86	0.1913	5.54	0.2181	6.19	0.2437	6.89	0.2713	7.59	0.2988
4.19	0.1650	4.87	0.1917	5.55	0.2185	6.20	0.2441	6.90	0.2717	7.60	0.2992
4.20	0.1654	4.88	0.1921	5.56	0.2189	...	...	6.91	0.2720	7.61	0.2996
4.21	0.1657	4.89	0.1925	5.57	0.2193	6.24	0.2457	6.92	0.2724	7.62	0.3000
4.22	0.1661	4.90	0.1929	5.58	0.2197	6.25	0.2461	6.93	0.2728	7.63	0.3004
4.23	0.1665	4.91	0.1933	5.59	0.2201	6.26	0.2465	6.94	0.2732	7.64	0.3008
4.24	0.1669	4.92	0.1937	5.60	0.2205	6.27	0.2469	6.95	0.2736	7.65	0.3012
4.25	0.1673	4.93	0.1941	5.61	0.2209	6.28	0.2472	6.96	0.2740	7.66	0.3016
4.26	0.1677	4.94	0.1945	5.62	0.2213	6.29	0.2476	6.97	0.2744	7.67	0.3020
4.27	0.1681	4.95	0.1949	5.63	0.2217	6.30	0.2480	6.98	0.2748	7.68	0.3024
4.28	0.1685	4.96	0.1953	5.64	0.2220	6.31	0.2484	6.99	0.2752	7.69	0.3028
4.29	0.1689	4.97	0.1957	5.65	0.2224	6.32	0.2488	7.00	0.2756	7.70	0.3031
4.30	0.1693	4.98	0.1961	5.66	0.2228	6.33	0.2492	7.005	0.2758	7.71	0.3035
4.31	0.1697	4.99	0.1965	5.67	0.2232	6.34	0.2496	7.01	0.2760	7.72	0.3039
4.32	0.1701	5.00	0.1969	5.68	0.2236	6.35	0.2500	7.02	0.2764	7.73	0.3043
4.33	0.1705	5.01	0.1972	5.69	0.2240	6.36	0.2504	7.03	0.2768	7.74	0.3047
4.34	0.1709	5.02	0.1976	5.70	0.2244	6.37	0.2508	7.04	0.2772	7.75	0.3051
4.35	0.1713	5.03	0.1980	5.71	0.2248	6.38	0.2512	7.05	0.2776	7.76	0.3055
4.36	0.1717	5.04	0.1984	5.72	0.2252	6.39	0.2516	7.06	0.2780	7.77	0.3059
4.37	0.1720	5.05	0.1988	5.73	0.2256	6.40	0.2520	7.07	0.2783	7.78	0.3063
4.38	0.1724	5.06	0.1992	5.74	0.2260	6.41	0.2524	7.08	0.2787	7.79	0.3067
4.39	0.1728	5.07	0.1996	5.75	0.2264	6.42	0.2528	7.09	0.2791	7.80	0.3071
4.40	0.1732	5.08	0.2000	5.76	0.2268	6.43	0.2531	7.10	0.2795	7.81	0.3075
4.41	0.1736	5.09	0.2004	5.77	0.2272	6.44	0.2535	...	...	7.82	0.3079
4.42	0.1740	5.10	0.2008	5.78	0.2276	6.45	0.2539	7.13	0.2807	7.83	0.3083
4.43	0.1744	5.11	0.2012	5.79	0.2280	6.46	0.2543	7.14	0.2811	7.84	0.3087
4.44	0.1748	5.12	0.2016	5.80	0.2283	6.47	0.2547	7.15	0.2815	7.85	0.3091
4.45	0.1752	5.13	0.2020	5.81	0.2287	6.48	0.2551	7.16	0.2819	7.86	0.3094
4.46	0.1756	5.14	0.2024	5.82	0.2291	6.49	0.2555	7.17	0.2823	7.87	0.3098
4.47	0.1760	5.15	0.2028	5.83	0.2295	6.50	0.2559	7.18	0.2827	7.88	0.3102
4.48	0.1764	5.16	0.2031	5.84	0.2299	6.51	0.2563	7.19	0.2831	7.885	0.3104
4.49	0.1768	5.17	0.2035	5.85	0.2303	6.52	0.2567	7.20	0.2835	7.89	0.3106
4.50	0.1772	5.18	0.2039	5.86	0.2307	6.53	0.2571	7.21	0.2839	7.895	0.3108
4.51	0.1776	5.19	0.2043	5.87	0.2311	6.54	0.2575	7.22	0.2843	7.90	0.3110
4.52	0.1780	5.20	0.2047	5.88	0.2315	6.55	0.2579	7.23	0.2846	7.91	0.3114
4.53	0.1783	5.21	0.2051	5.89	0.2319	6.56	0.2583	7.24	0.2850	7.92	0.3118
4.54	0.1787	5.22	0.2055	5.90	0.2323	6.57	0.2587	7.25	0.2854	7.93	0.3122
4.55	0.1791	5.23	0.2059	5.91	0.2327	6.58	0.2591	7.26	0.2858	7.94	0.3126
4.56	0.1795	5.24	0.2063	5.92	0.2331	6.59	0.2594	7.27	0.2862	7.95	0.3130
4.57	0.1799	5.25	0.2067	5.93	0.2335	6.60	0.2598	7.28	0.2866	7.96	0.3134
4.58	0.1803	5.26	0.2071	5.94	0.2339	6.61	0.2602	7.29	0.2870	7.97	0.3138
4.59	0.1807	5.27	0.2075	5.95	0.2343	6.62	0.2606	7.30	0.2874	7.98	0.3142
4.60	0.1811	5.28	0.2079	5.96	0.2346	6.63	0.2610	7.31	0.2878	7.99	0.3146
4.61	0.1815	5.29	0.2083	5.97	0.2350	6.64	0.2614	7.32	0.2882	8.00	0.3150
4.62	0.1819	5.30	0.2087	5.98	0.2354	6.65	0.2318	7.33	0.2886	8.01	0.3154
4.63	0.1823	5.31	0.2091			6.66	0.2622	7.34	0.2890	8.02	0.3157

NEWEN®

Legend: • Stock

mm	inch
8.03	0.3161
8.04	0.3165
8.05	0.3169
8.06	0.3173
8.07	0.3177
8.08	0.3181
8.09	0.3185
8.10	0.3189
8.11	0.3193
8.12	0.3197
8.13	0.3201
...	...
8.17	0.3217
8.18	0.3220
8.19	0.3224
8.20	0.3228
8.21	0.3232
8.22	0.3236
8.23	0.3240
8.24	0.3244
8.25	0.3248
8.26	0.3252
8.27	0.3256
8.28	0.3260
8.29	0.3264
8.30	0.3268
8.31	0.3272
8.32	0.3276
8.33	0.3280
8.34	0.3283
8.35	0.3287
8.36	0.3291
8.37	0.3295
8.38	0.3299
8.39	0.3303
8.40	0.3307
8.41	0.3311
8.42	0.3315
8.43	0.3319
8.44	0.3323
8.45	0.3327
8.46	0.3331
8.47	0.3335
8.48	0.3339
8.49	0.3343
8.50	0.3346
8.51	0.3350
8.52	0.3354
8.53	0.3358
8.54	0.3362
8.55	0.3366
8.56	0.3370
8.57	0.3374
8.58	0.3378
8.59	0.3382
8.60	0.3386
8.61	0.3390
8.62	0.3394
8.63	0.3398
8.64	0.3402
8.65	0.3406
8.66	0.3409
8.67	0.3413
8.68	0.3417
8.685	0.3419
8.69	0.3421
8.695	0.3423
8.70	0.3425

mm	inch
8.71	0.3429
8.715	0.3431
8.72	0.3433
8.73	0.3437
8.74	0.3441
8.75	0.3445
8.76	0.3449
8.77	0.3453
8.78	0.3457
8.79	0.3461
8.80	0.3465
...	...
8.83	0.3476
8.84	0.3480
8.85	0.3484
8.86	0.3488
8.87	0.3492
8.88	0.3496
8.89	0.3500
8.90	0.3504
8.91	0.3508
8.92	0.3512
8.93	0.3516
8.94	0.3520
8.95	0.3524
8.96	0.3528
8.97	0.3531
8.98	0.3535
8.99	0.3539
9.00	0.3543
9.01	0.3547
9.02	0.3551
9.03	0.3555
9.04	0.3559
9.05	0.3563
9.06	0.3567
9.07	0.3571
9.08	0.3575
9.09	0.3579
9.10	0.3583
9.11	0.3587
9.12	0.3591
9.13	0.3594
9.14	0.3598
9.15	0.3602
9.16	0.3606
9.17	0.3610
9.18	0.3614
9.19	0.3618
9.20	0.3622
9.21	0.3626
9.22	0.3630
9.23	0.3634
9.24	0.3638
9.25	0.3642
9.26	0.3646
9.27	0.3650
9.28	0.3654
9.29	0.3657
9.30	0.3661
9.31	0.3665
9.32	0.3669
9.33	0.3673
9.34	0.3677
9.35	0.3681
9.36	0.3685
9.37	0.3689
9.38	0.3693

mm	inch
9.39	0.3697
9.40	0.3701
9.41	0.3705
9.42	0.3709
9.43	0.3713
9.44	0.3717
9.45	0.3720
9.46	0.3724
9.47	0.3728
9.48	0.3732
9.49	0.3736
9.50	0.3740
9.51	0.3744
9.52	0.3748
9.53	0.3752
9.54	0.3756
9.55	0.3760
9.56	0.3764
9.57	0.3768
9.58	0.3772
9.59	0.3776
9.60	0.3780
9.61	0.3783
9.62	0.3787
9.63	0.3791
9.64	0.3795
9.65	0.3799
9.66	0.3803
9.67	0.3807
9.68	0.3811
9.69	0.3815
9.70	0.3819
9.71	0.3823
9.72	0.3827
9.73	0.3831
9.74	0.3835
9.75	0.3839
9.76	0.3843
9.77	0.3846
9.78	0.3850
9.79	0.3854
9.80	0.3858
9.81	0.3862
9.82	0.3866
9.83	0.3870
9.84	0.3874
9.85	0.3878
9.86	0.3882
9.87	0.3886
9.88	0.3890
9.89	0.3894
9.90	0.3898
9.91	0.3902
9.92	0.3906
9.93	0.3909
9.94	0.3913
9.95	0.3917
9.96	0.3921
9.97	0.3925
9.98	0.3929
9.99	0.3933
10.00	0.3937
10.01	0.3941
10.02	0.3945
10.03	0.3949
10.04	0.3953
10.05	0.3957
10.06	0.3961

mm	inch
10.07	0.3965
...	...
10.25	0.4035
10.26	0.4039
10.27	0.4043
10.28	0.4047
10.29	0.4051
10.30	0.4055
10.31	0.4059
10.32	0.4063
10.33	0.4067
10.34	0.4071
10.35	0.4075
10.36	0.4079
10.37	0.4083
10.38	0.4087
10.39	0.4091
10.40	0.4094
10.41	0.4098
10.42	0.4102
10.43	0.4106
10.44	0.4110
10.45	0.4114
10.46	0.4118
...	...
10.96	0.4315
10.97	0.4319
10.98	0.4323
10.99	0.4327
11.00	0.4331
11.01	0.4335
11.02	0.4339
11.03	0.4343
11.04	0.4346
11.05	0.4350
11.06	0.4354
11.07	0.4358
11.08	0.4362
11.09	0.4366
11.10	0.4370
11.11	0.4374
...	...
11.45	0.4508
11.46	0.4512
11.47	0.4516
11.48	0.4520
11.49	0.4524
11.50	0.4528
11.51	0.4531
11.52	0.4535
...	...
11.98	0.4717
11.99	0.4720
12.00	0.4724
12.01	0.4728
12.02	0.4732
...	...
12.48	0.4913
12.49	0.4917
12.50	0.4921
12.51	0.4925
12.52	0.4929
12.53	0.4933
12.54	0.4937
12.55	0.4941
12.56	0.4945
12.57	0.4949
12.58	0.4953

mm	inch
12.59	0.4957
12.60	0.4961
12.61	0.4965
12.62	0.4969
12.63	0.4972
12.64	0.4976
12.65	0.4980
12.66	0.4984
12.67	0.4988
12.68	0.4992
12.69	0.4996
12.70	0.5000
12.71	0.5004
12.72	0.5008
12.73	0.5012
12.74	0.5016
12.75	0.5020
12.76	0.5024
12.77	0.5028
12.78	0.5031
12.79	0.5035
12.80	0.5039
...	...
14.20	0.5591
14.21	0.5594
14.22	0.5598
14.23	0.5602
14.24	0.5606
14.25	0.5610
14.26	0.5614
14.27	0.5618
14.28	0.5622
14.29	0.5626
14.30	0.5630
14.31	0.5634
14.32	0.5638
14.33	0.5642
14.34	0.5646
14.35	0.5650
14.36	0.5654
14.37	0.5657
14.38	0.5661
14.39	0.5665
14.40	0.5669
...	...
15.75	0.6201
15.76	0.6205
15.77	0.6209
15.78	0.6213
15.79	0.6217
15.80	0.6220
15.81	0.6224
15.82	0.6228

How to order a FIXED-TURNING® Pilot depending on its Overall Length (OAL):

OAL = 210mm (8.27”)
STANDARD LENGTH
NWN-C2-pilot Ø-**1**

OAL = 236mm (9.29”)
NWN-C2-Pilot Ø

FIXED-TURNING®
the new standard in valve seat machining™