Metric Keyway Broaches

2mm thru 45mm

Applications: **Short Run Production** | **General Maintenance**

Stock Keyway Broaches / Optional Metric Keyway Broaches

Broaches are supplied with necessary Shims unless otherwise noted. For extra or replacement Shims see the table below.

Broach Size (mm)	Tolerances (Decimal Equiv.)	Broach Dimensions (inches)	Standard Millimeter Keys	Shims Req'd	Length of Cut (inches) Min.	Length of Cut (inches) Max.	Pressure Required. for Max. L/C (lbs.)*	EDP No duMONT Std.	EDP No duMONT TiN	EDP No duMONT TiAlN	EDP No Hassay Savage
2-A / I	0.0782 – 0.0791	1/8 x 5	2 x 2	0	13/64	1-1/8	720	44401	44301	44801	11102
3-A / I	0.1176 – 0.1185		3 x 3	1			650	44402	44302	44802	11103
4-B1 / II	0.1569 – 0.1579	1/4 x 6-3/4	4 x 4	1	19/64	1-11/16	1,140	44403	44303	44803	11204
5-B1 / II	0.1963 – 0.1972		5 x 5				1,860	44404	44304	44804	11205
5-C / III	0.1963 – 0.1972	3/8 x 11-3/4	5 x 5	1	25/64	2-1/2	1,470	44405	44305	44805	11305
6-C / III	0.2356 – 0.2366		6 x 6	1			2,100	44406	44306	44806	11308
7-C / III	0.2749 – 0.2763		7 x 6	1			2,900	10232	10332	10832	11307
8-C / III	0.3143 – 0.3155		8 x 7	2			3,680	44407	44307	44807	-
10-D / IV	0.3930 – 0.3942	9/16 x 13-7/8	10 x 8	2	1	6	6,500	44408	44308	44808	11410
12-D / IV	0.4716 – 0.4730		12 x 8				8,400	44409	44309	44809	11412
14-D / IV	0.5503 – 0.5517		14 x 9				11,100	44410	44310	44810	11414
16-E / V	0.6290 – 0.6304	3/4 x 15-1/2	16 x 10	3	1	6	9,400	44411	44311	44811	11516
18-E / V	0.7078 – 0.7092		18 x 11				10,600	44412	44312	44812	11518
20-F / VI	0.7864 – 0.7880	1 x 20-1/4	20 x 12	3	1	6	8,800	44413	44313	44813	11620
22-F / VI	0.8651 – 0.8667		22 x 14	4			9,400	44414	44314	44814	11622
24-F / VI	0.9439 – 0.9455		24 x 14	4			10,600	44415	44315	44815	11624
25-F / VI	0.9832 – 0.9848		25 x 14	4			12,300	44494	44394	44894	11625
28	1.1025 – 1.1035	1-1/8 x 20-1/4	28 x 16	5	1	6	12,000	10233	-	-	11628
32	1.2600 – 1.2610	1-1/4 x 20-1/4	32 x 18	5	1-1/2	8	20,600	10234	-	-	11632
36	1.4175 – 1.4185	1-7/16 x 20-1/4	36 x 20	**	1-1/2	8	24,200	10235	-	-	11636
40	1.5753 – 1.5760	1-9/16 x 20-1/4	40 x 22	**	1-1/2	8	22,500	10236	-	-	-
45	1.7718 – 1.7728	1-3/4 x 20-1/4	45 x 25	**	1-1/2	8	27,200	10237	-	-	-

*Based on mild steel **Shims are not supplied with these broaches, sold as Progressive Shims only, see below

Extra Shims

Extra Shims are provided in necessary Shim Sets only. Shims are available as special items for Broaches larger than 32mm progressive. Please specify EDP No. when ordering extra or replacement Shims. Shims correspond to Broach size, not to Bushing type.

Broach Size (mm)	# / Set	Shim Thickness	EDP No. duMONT
3-A / I	1	0.0310	44480
4-B1 / II	1	0.0380	44481
5-B1 / II		0.0500	44482
5-C / III	1	0.0470	44483
6-C / III	1	0.0625	44484
7-C / III	1	0.0625	44577
8-C / III	2	0.0500	44485

Broach Size (mm)	# / Set	Shim Thickness	EDP No. duMONT
10-D / IV	2	0.0560	44486
12-D / IV		0.0560	44487
14-D / IV		0.0625	44488
16-E / V	3	0.0560	44489
18-E / V		0.0560	44490

Broach Size (mm)	# / Set	Shim Thickness	EDP No. duMONT
20-F	3	0.0625	44491
22-F	4	0.0560	44492
24-F	5	0.0625	44493
25-F	4	0.0560	44496
28	5	0.0560	44478
32		0.0625	44479

Progressive Shims

Broach Size (mm)	# / Set	Shim Thickness	EDP No. duMONT
36	3	.062, .125, .250	44578
40	3	.062, .125, .250	44579
45	4	.062 (2pcs), .125, .250	44580

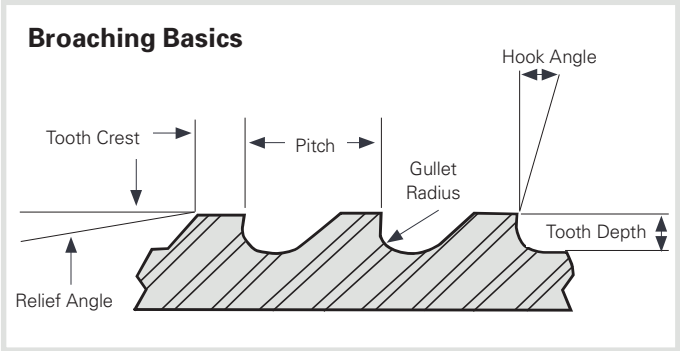
SPECIAL ORDERS: We are fully equipped to manufacture Special Keyway Broaches not listed above. TiN or TiAlN coatings are available. Please contact Pilot Precision Products for details.

Engineering Section

Applications: **Standard Push Broaching Procedures** | **Broaching Basics**

Standard Broaching Procedures

duMONT Minute Man® and Hassay Savage Broaches are designed for fast, accurate, and convenient broaching with arbor or hydraulic presses. A study of the Broaching Procedures presented in this section will familiarize the operator with proper broaching procedures and troubleshooting practices. Following proper broaching fundamentals, paying attention to technique and Broach maintenance will help prevent drifting, deflection and even breakage while providing greater efficiencies in the cutting of your parts. If you have a specific question or problem, contact our Engineering Department at 413-350-5200 or by email at info@pilotprecision.com.



Warning Information

Cutting tools may shatter or break, therefore **eye protection should be worn wherever and whenever cutting tools are being used**. Government Regulations require use of safety glasses and other appropriate safety equipment at all times in the vicinity of cutting tool use.

Workpiece Material

duMONT Minute Man® and Hassay Savage stock Broaches can be used on a variety of workpiece materials. It is not practical to Broach material having a Rockwell hardness higher than Rc35. When broaching **Iron** or **Steel**, use the standard Broach as supplied. **Brass** and **Free Machining Bronze** may require stoning of a slight land on the top of the teeth to prevent drifting (pulling into the work). Custom Broaches are designed and engineered to provide the correct tooth form, pitch and rake angles for the material specified.

Length of Cut

Our Broaches are designed to be used in operations where a minimum of two teeth are engaged at all times. Tooth engagement is required to maintain a smooth cutting action promoting a clean finish. The chip generated during the cutting process must be contained within the gullet of the tooth to avoid binding of the tool. This could cause potential damage to the Broach, the workpiece and injury to the operator. Appropriate chip load allows for smooth cutting, and improved tool life. All individual stock Broaches have recommended Minimum and Maximum Length of Cut guidelines which should be followed. The required force necessary to achieve the Maximum Length of Cut is also provided with the individual Broach specifications. Workpieces may be stacked to establish the Minimum Length of Cut, or to improve the efficiencies of the operation as long as Maximum Length of Cut is not exceeded. Proper nesting and clamping of stacked parts is vital when this approach is taken. The Maximum Length of Cut with Push-type Keyway Broaches should not exceed the length of the Bushing being used. **Reminder:** "A/I" Style Broaches are used with "A/I" Style Bushings, "B/II" Style Broaches with "B/II" Style Bushings, etc. Pilot Precision Products Push-type and Pull-type Broaches often can be designed to accommodate your specific length of cut requirements.

Set-Up and Alignment

Successful broaching begins with proper set-up, and alignment of the Broach, workpiece and ram. Attention to these details will provide a stable workpiece, and prevent drifting, deflection or even breakage caused by misalignment. The workpiece must be solidly fixed or nested perfectly square with the baseplate and ram face. Make sure all square and parallel surfaces on the face of the ram and baseplate remain true. It is essential to maintain a rigid set-up at all times and caution should be taken when stacking parts to maintain the integrity of the set-up. Never attempt to exceed the Broach's specified Maximum Length of Cut. At the beginning of a cut, be sure the Broach is centered under the ram. Proper alignment is important. After the Broach starts to cut, back off pressure on the ram to allow the Broach to center itself, if not in perfect alignment. If Broach moves out of alignment after starting cut, back off the pressure on the ram and align the broach itself. Repeat this procedure during successive cuts. This will assure a perfectly straight broached hole.

Suggestions for a drifting or "hogging" Push-type Keyway Broach:

1. Reverse workpiece or turn Broach so teeth face toward the back of the press.
2. Let the Bushing protrude above the workpiece to give more support to the back of the Broach, thereby helping to keep it aligned. If a collared Bushing is used, place it upside down under the workpiece.

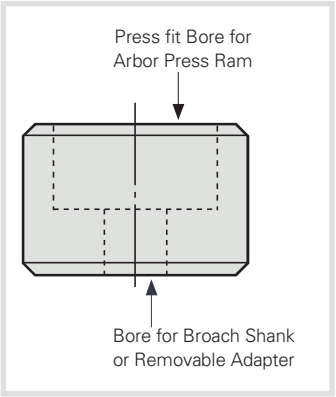
Ram Adapter Use

Ram Adapters are used for broaching applications that require Round, Custom Shapes such as Rectangular as well as Square, and Hexagon Broaches 1/4" and 6mm or smaller. A Ram Adapter would also be recommended in situations where an extraordinary high degree of accuracy is required.

Engineering Section

How to Use Broaches

Applications: **Standard Push Broaching Procedures** | **Broach Re-Sharpening**



These Adapters are also referred to as rear guides and provide support and guidance for the Broach at the shank end, minimizing the possibility of deflection or breakage. When an Adapter is used as a rear guide for the Broach, the hole in the Ram Adapter must be in alignment with the pilot hole in the workpiece. It is important a Ram Adapter provides a tight, true fit to both the press ram and to the Broach shank. An adapter may also be used to allow the shanks of smaller Internal Hole Broaches to be gripped to avoid deflection and breakage.

Cutting Fluids and Lubrication

Broach lubrication is crucial to tool life and the quality of the finish produced. Lubrication enables chips to slide freely and curl in the tooth gullets minimizing frictional heat. This cuts down on Broach wear and prevents build up on the cutting edge of the teeth. Push-type Keyway Broaches, regardless of the material to be broached, require lubrication on the back side of the Broach in order to reduce friction. Proper lubrication will increase Broach life and produce a cleaner finish. Various materials require different lubricants.

Mild Steel – A good quality cutting oil or water-soluble coolant brushed on the teeth and back side of the Broach.

Tough Steels such as Nickel Alloys – A good grade of a sulfur-based cutting oil.

Brass – Typically is broached dry.

Bronze – Works well with an oil or soluble oil.

Cast Iron – Is almost always broached dry but requires lubrication for the backside of the Broach.

Aluminum – Straight kerosene may be used but special lubricants are available.

You may wish to contact your cutting fluid dealer for additional recommendations and availability.

Coatings Available

duMONT Minute Man® and Hassay Savage Broaches are available with TiN, and TiAlN coatings. The coatings provide enhanced performance for specific applications, delivering greater value and tool life on your more challenging materials.

TiN – provides increased lubricity and wear resistance when broaching abrasive materials such as fiberglass and some aluminum alloys.

TiAlN – offers significant increase in surface hardness (Rc low 90s). Applications would include broaching in most stainless steels, alloy steels and harder materials.

Broaching with Keyway Sets or Individual Broaches

Use of Individual Push-type Keyway Broaches or Keyway Broaches from a Broach Set requires the use of a Bushing and Shim(s). The Bushing size and style are determined by the bore diameter of the workpiece as well as the Style of Broach to be used. "A / I" Style Broaches are used with "A / I" Style Bushings, "B / II" style Broaches with "B / II" Style Bushings, etc. The smallest Broaches cut in one pass and require no Shim. Multiple pass Keyway Broaches are furnished with all necessary Shim(s) unless otherwise noted. A Shim is required to compensate for the thickness removed following a Keyway Broach's cutting pass. The addition of a Shim to the bottom of the bushing's slot serves to move the Broach forward toward its standard finished cutting depth. Subsequent passes require the stacking of Shims.

1. Select the right Broach for the bore (sizes are plainly marked).
2. Insert Broach (which is also plainly marked for size) and check alignment.
3. Place this assembly in the press.
4. Lubricate.
5. Apply pressure to the Broach—back off pressure on Ram to allow the Broach to center itself if not in perfect alignment—reapply pressure to push Broach through the work.
6. Clean Broach using a stiff brush to remove chips from cutting section.
7. Insert shim and repeat steps 3 through 6 as required to obtain exact keyway depth.