INSTRUCTIONS FOR THE CORRECT USE OF THE BM BROACHING HEAD

Made in Italy

BM BROACHING HEAD

The BM Broaching head is a device that, thanks to the oscillating movement of the broach itself, allows for the creation of any polygonal shape (square, hexagon, Torx, splined shafts, etc.) within a blind or through cavity.

With the addition of the adapter, external profiles can also be created using the same broaching head. Its functionality is based on the principle that the thrust force required to penetrate inside the metal is extremely limited, as it is sequentially concentrated upon a small part of the broach, and not the entire profile.

In order to facilitate the penetration of the broach and the consequent removal of the shavings, a hole slightly larger than the diameter of the profile of the broach must be pre-drilled.

BROACH

For internal profiles, the broach is a tool with one end featuring the figure to be created, and the other comprising the shank to be connected to the broaching head.

This type of broach is made from specially treated HSS steel.

The broaches are produced in five different sizes, each of which is associated with a relative shank diameter (G).

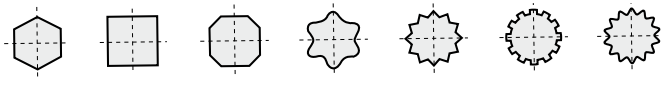
Specifically:

G5 = Ø 5mm - G8 = Ø 8mm - G12 = Ø 12mm

G16 = Ø 16mm - G25 = Ø 25mm

The broaches for external profiles are comprised of steel discs, which feature a shaped hole with the appropriate profile at the centre. There is an extensive range of possible profiles, each of which is produced based on the Customer's technical specifications.

A number of sample broach profiles are listed below:



BROACHING HEAD - CHARACTERISTICS AND DIMENSIONS

CHARACTERISTICS

TYPE OF BROACHING HEAD:		BR-G5-..	BR-G8S-..	BR-G8M-..	BR-G8-..	BR-G12B-..	BR-G12-..	BR-G16-..	BR-GL16-..	BR-G25-..
BROACH SHANK	Ø	5	8	8	8	12	12	16	16	25
HEXAGONAL CAVITY CAPACITY	mm	1 - 6	1 - 8	1 - 8	1 - 10	1 - 14	1 - 14	1 - 24	5 - 28	10 - 40
SQUARE CAVITY CAPACITY	mm	1 - 4	1 - 6	1 - 6	1 - 8	1 - 10	1 - 12	1 - 16	5 - 22	10 - 25
TORX® CAVITY CAPACITY	T		T5-T15	T5-T15	T5-T20	T5-T30	T5-T50	T5-T60		
MAX. WORKING DEPTH ("L1" fig. 2)	mm	7,5	15	15	15	21	21	21	40	65
ACTUAL CUTTING DEPTH ("L" fig. 2)	mm	≤ 6	≤ 12	≤ 12	≤ 12	≤ 16	≤ 16	≤ 20	≤ 35	≤ 60

TYPE OF ATTACHMENT

TYPE OF BROACHING HEAD:		BR-G5-C..	BR-G8S-C..	BR-G8M-C..	BR-G8-C..	BR-G12B-C..	BR-G12-C..	BR-G16-C..	BR-GL16-C..	BR-G25-C..
CYLINDRICAL ATTACHMENT	Ø	8	10	10	12	19,05	25	25	32	32
	Ø	10	12	12	16	20	32	32	40	40
	Ø	12	15,875	16	19,05	22				
	Ø	15,875	16	19,05	20	25				
	Ø	16	19,05	20	22	25,40				
	Ø	19,05	20	25	25					
	Ø	20	25	25,40	25,40					
	Ø	22	25,40							

TYPE OF BROACHING HEAD:		BR-G5-CM..	BR-G8S-CM..	BR-G8M-CM..	BR-G8-CM..	BR-G12B-CM..	BR-G12-CM..	BR-G16-CM..	BR-GL16-CM..	BR-G25-CM..
MORSE TAPER ATTACHMENT							2 - 3	3	4	4

TYPE OF BROACHING HEAD:		BR-G5-ISO..	BR-G8S-ISO..	BR-G8M-ISO..	BR-G8-ISO..	BR-G12B-ISO..	BR-G12-ISO..	BR-G16-ISO..	BR-GL16-ISO..	BR-G25-ISO..
ISO - DIN 69871 / DIN 2080 ATTACHMENT							30-40	40	40-50	40-50

TYPE OF BROACHING HEAD:		BR-G5-VDI..	BR-G8S-VDI..	BR-G8M-VDI..	BR-G8-VDI..	BR-G12B-VDI..	BR-G12-VDI..	BR-G16-VDI..	BR-GL16-VDI..	BR-G25-VDI..
VDI ATTACHMENT							20	30	40	40
							30	40		

TYPE OF BROACHING HEAD:		BR-G5-HSK..	BR-G8S-HSK..	BR-G8M-HSK..	BR-G8-HSK..	BR-G12B-HSK..	BR-G12-HSK..	BR-G16-HSK..	BR-GL16-HSK..	BR-G25-HSK..
HSK ATTACHMENT							40			
							50	50	50	50
							63	63	63	63

DIMENSIONS AND WEIGHT

TYPE OF BROACHING HEAD:		BR-G5-..	BR-G8S-..	BR-G8M-..	BR-G8-..	BR-G12B-..	BR-G12-..	BR-G16-..	BR-GL16-..	BR-G25-..
BODY DIMENSIONS ("HxD" fig. 1)	mm	35x22	36x35	48x28	46x35	65x45	78x57	95x70	105x90	105x98
WEIGHT	gr/g	110	410	225	470	750	1460	2550	4400	5100

OPERATING PARAMETERS

Pre-drilling diameter

For blind and through-hole broaching operations, a hole with a diameter slightly larger than the cross-section of the broach itself must first be drilled in order to facilitate the removal of the material. As a general guideline, this diameter increase will vary from +0.03 to +0.3 mm for hexagonal and Torx cross-sections.

For square cross-sections, it is necessary to pre-drill a hole with a significantly increased diameter, as the material to be removed is more considerable.

The operating limits vary from +0.20 to +0.60 mm.

For particularly hard materials to be broached, it is recommended to further increase the diameter in order to avoid compromising the requirements of the part to be created.

Pre-drilling depth

When drilling blind cavities, it is essential to apply a pre-drilling depth that is slightly greater than the actual depth required, in order to collect the shavings produced by the machining process.
In our experience, for hexagonal cross-sections the depth must be increased by 1.15 times with respect to the required broaching depth.
For square cross-sections, this ratio is equal to 1.25. If the structural design does not provide for this collection area, or if it is insufficient, the broaching operation can not be performed without causing serious damage to the broach, thus resulting in poor final results.

Working depth

It is necessary to distinguish between:

Max. working depth: this is given by the total projection of the profile of the broach, and varies based on the diameter of the shank of the broach (G). Specifically:
G5 = ≤7mm G8 = ≤15mm G12 = ≤21mm G16 = ≤21mm GL16 = ≤40mm G25 = ≤65mm

Actual cutting depth

This depth is strictly dependent upon:
- The type of broach
- The type and cross-section of the broach
- The hardness of the material to be processed

Using a broach with a hexagonal cross-section (E15) and steel of average hardness (C40 steel) as a reference, the following table indicates the actual broaching depth in relation to the various types of broaching heads:

BR-G5	BR-G8S	BR-G8M	BR-G8	BR-G12B	BR-G12	BR-G16	BR-GL16	BR-G25
≤6	≤12	≤12	≤12	≤16	≤16	≤18	≤35	≤60

In the case of broaches with a square cross-section, the depth is reduced by 25-30%.

Machine RPMs and feed

The variables that determine the machine RPMs and feed are the following:
- The cross-section of the broach
- The mechanical characteristics of the material
- The required finishing level

A broaching operation is defined as “normal” when the steel to be broached is of a medium hardness (Rm: 500H/sq. mm) and the profile is hexagonal at 15 mm. The recommended parameters are the following:
- Rotation speed: 1200-1300 RPM
- Feed: 0,07-0,08 mm/revolution

Having established the standard rule, it is also possible to add the following:
- If the dimensions of the profile of the broach are increased, it is recommended to moderately reduce the two parameters;
- With materials of greater hardness, it is recommended to significantly reduce the rotation speed and to moderately reduce the feed;
- For higher finishing levels, it is recommended to use faster rotation speeds and to moderately increase the feed.

For square profiles, with the hexagonal equivalents being equal, it is necessary to reduce the two parameters by 20-30%.

ADVANCEMENT BAR

During broaching operations on parallel lathes, milling machines, drilling machines, and machining centres, situations requiring the use of the advancement bar may arise.

The advancement bar can be useful in the following cases:

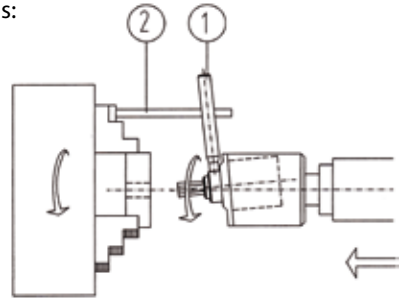
1. Whenever the figure needs to be aligned with a particular reference point on the piece to be broached.
   Suppose you need to create a square shape inside a cavity, and that one of the square's edges needs to be aligned with a specific point on the piece to be broached.
   In this case we proceed as follows:
   a. Apply the broach to the broaching head;
   b. Screw the advancement bar into the axial hole on the broaching head;
   c. Secure the broaching head to the machine tool so that the advancement bar rests against the bracket attached to the machine;
   d. Position the piece to be broached so that the precise reference point is aligned with the edge of the broach itself.

2. It is also recommended to use the advancement bar in the case of deep broaching involving particularly hard materials. The broach is subjected to significant stress under these conditions, which in turn can result in a screwing phenomenon that can severely damage the broach itself and compromise the finish.

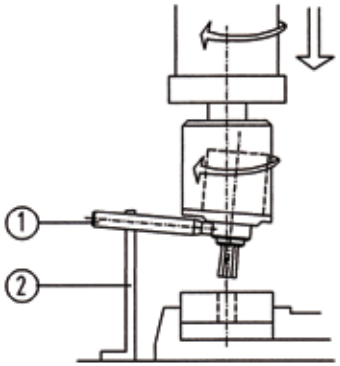
<u>Preparing the machine for broaching operations</u>
<u>using the advancement bar</u>

It is necessary to distinguish between two different situations:

a. Broaching on horizontal machine tools
   (traditional lathes).
   The bracket (2) is secured to the lathe's mandrel. The advancement bar (1) is applied to the broaching head, taking care to make sure that it is resting against the bracket. During the rotary movement, the perfect coupling with the two bodies (the broach and the piece to be broached) is ensured, while the body of the broaching head remains stationary.



b. Broaching on vertical machines
   (drills, milling machines, and machining centres).
   The advancement bar (1) mounted on the broaching head is aligned with the bracket (2) fixed to the work surface of the machine tool. During the machining process, the broach and the piece to be broached remain stationary and in contact with one another while the body of the broaching head turns.



In both cases, the complete and integral coupling of the broach with the piece to be broched is guaranteed, thus resulting in optimal working conditions.

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