Carbide reamers

The carbide reamers, which are the cutting edges in sintered carbides, are heavily used in the production of large series, where it is absolutely necessary that the diameters obtained are all within very close tolerances.
Its main characteristic of this material is a very high hardness which limit the wear in all those processes where the material being worked makes it difficult for chip removal process.
Just think of the holes in the parts of a car engine: the cylinder head or crankcase, respectively, made in aluminum alloys (very abrasive) and iron (very hard and abrasive), their need precision and uniformity of the diameters in order to ensure the absolute interchangeability of parts.
In almost all of the holes is not possible to use other systems if you do not finish by reaming.
The carbide reamers can be built with brazed plates on the body, mechanically clamped inserts (for larger diameters), or up to around 12 mm diameter, solid carbide.
The construction of solid carbide reamers has the advantage, compared to those with brazed plate, which does not have limitation in the number of teeth and in the helix angle.
Normally one uses a hard metal of the group K, in practice almost always a K10, which is the group that has the higher hardness and higher abrasion resistance.
This category combines the high hardness of sintered carbides with a high fragility, but, unless special cases, a reamer is not subject to shocks during processing and therefore this feature has no negative effect on performance.
In figures from # 1 to # 5 are summarized the construction characteristics of some typical reamer with tungsten carbide brazed to a steel body with high strength.
All the characteristic angles of these reamers are practically identical to those on high-speed steel reamers. Only the rake angle may be slightly less.

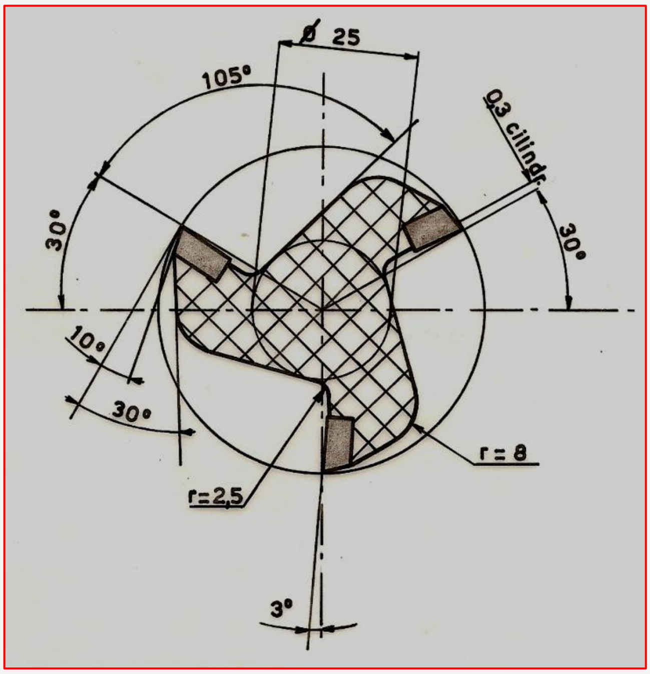

Figure N°1- *Reamer with 3 cutting edges, Ø = 50 to 60 mm for steel, helix angle 5° positive*

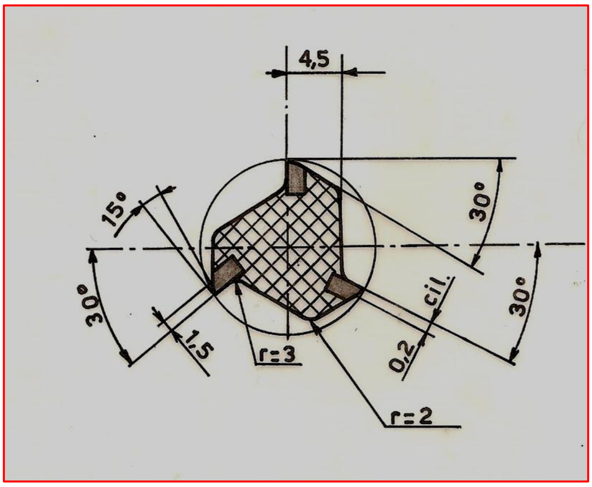

Figure N°2- *Reamer with 3 cutting edges, Ø = 15 mm for aluminum, helix angle 12° positive*

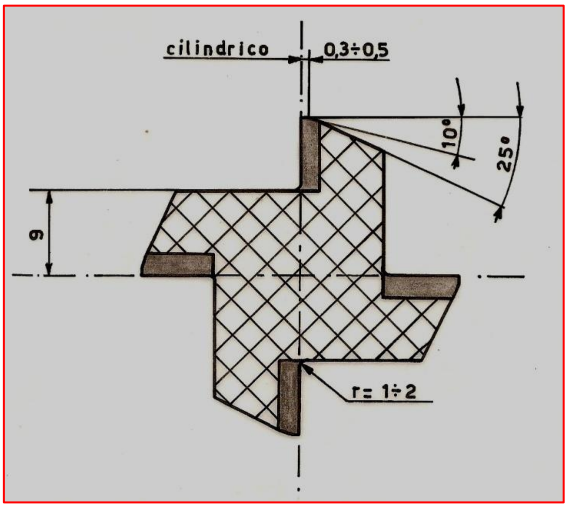

Figure N° 3 – *Reamer with 4 cutting edges, Ø = 35 to 40 mm for cast iron, helix angle 5 ° positive*

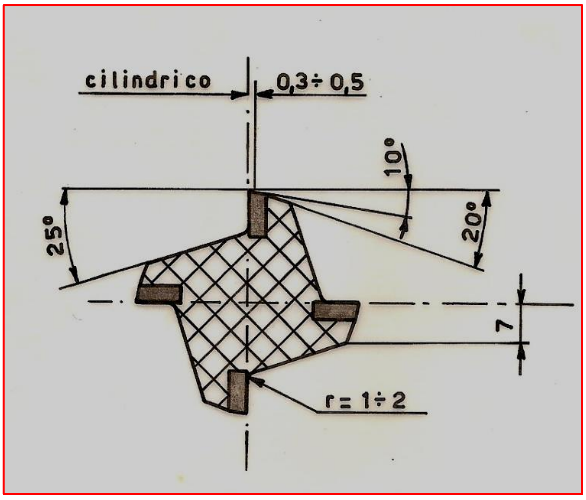

Figure N° 4 - *Reamer with 4 cutting edges, Ø = 35 to 40 mm for cast iron, helix angle 8° positive*

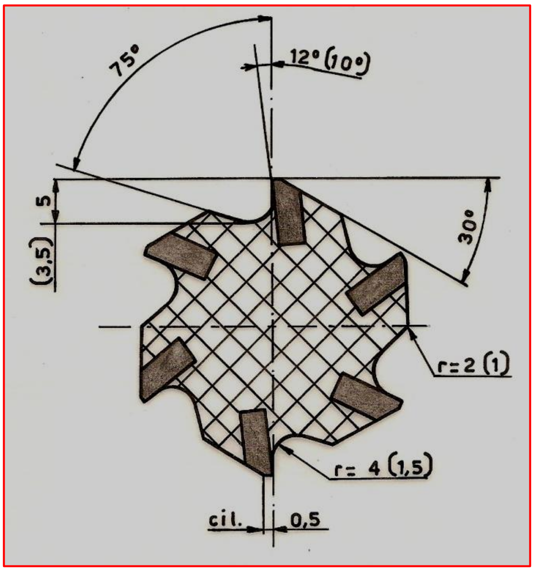

Figure N° 5 – *Reamer with 6 cutting edges, Ø = 30 mm, for aluminum, helix angle 12°positive (values in brackets refer to a reamer with 6 cutting edges, Ø = 15 mm, for malleable iron, with helix angle 8°)*

The manufacturing tolerances

Given the importance of construction characteristics of the reamers, these are made of steel or carbide, in order to obtain the desired dimensions on the piece, it will be appropriate to say a few words about the construction tolerance of reamers.

The information below is taken from the catalog of the company Cerin (Affi - Verona), specialized in manufacturing carbide reamers (and other tools).

The manufacturing tolerances refer to the unification DIN 1420. They are related to the tolerance ranges of bore holes and ensure, in general, that the hole bored within this zone of tolerance, while maintaining the opportunity to use a economically cost.

It must however consider that the diameter of the reamed hole depends on a number of factors independent from the precision reamer, such as:

¬ *Angle of the cutting edges*
¬ *Type of chamfer of the reamer*
¬ *Locking the piece*
¬ *Type of tool holder*
¬ *State of the operating machine*
¬ *Lubrication*
¬ *Material of workpiece*

Practically then you may be times when the reamer manufacturing tolerance must be different from the requirements.

Determination of maximum and minimum diameters of reamer

The maximum permitted diameter of the reamer d_{1max} is offset 15% of the value of the tolerance of the hole (0.15 IT) below the maximum permissible diameter of the hole (see Figure No. 6). The value 0.15IT is rounded off to the next micrometer or half micrometer.

The permissible minimum diameter D_{1min} of the reamer has a 35% deviation for the corresponding tolerance values of the hole (0,35IT) below the maximum diameter of the reamer d_{1max} .

Example

¬ *Nominal diameter d_1 = 20.000 mm*
¬ *Maximum diameter of hole = 20.033 mm*
¬ *Bore tolerance IT8 = 0.033 mm*
¬ *15% of the hole tolerance = 0.0049 mm (rounded to 0.005 mm)*

Simplified determination of the diameters of the reamers d_{1max} and d_{1min}

To simplify the calculation are shown in Table # 1, the most common areas of tolerance for boring holes and the corresponding deviations above and below the nominal diameter d_1 of the reamers.

With the deviations can be given quickly calculate the maximum and minimum of the reamer diameter.

Table N°1

Nominal ∅ of reamer d_1 in mm	*max e min deviation of the nominal ∅ of the reamer in μm per hole tolerance*													
	H6	***H7***	***H8***	***H9***	***H10***	***H11***	***H12***	***J6***	***J7***	***J8***	***JS6***	***JS7***	***JS8***	***JS9***
over 1 up to 3	*+5 +2*	*+8 +4*	*+11 +6*	*+21 +12*	*+34 +20*	*+51 +30*	*+85 +50*	*+1 -2*	*+2 -2*	*+3 -2*	*+2 -1*	*+3 -1*	*+4 -1*	*+8 -1*
over 3 up to 6	*+6 +3*	*+10 +5*	*+15 +8*	*+25 +14*	*+40 +23*	*+63 +36*	*+102 +60*	*+3 0*	*+4 -1*	*+7 0*	*+2 -1*	*+4 -1*	*+6 -1*	*+10 -1*
over 6 up to 10	*+7 +3*	*+12 +6*	*+18 +10*	*+30 +17*	*+49 +28*	*+76 +44*	*+127 +74*	*+3 -1*	*+5 -1*	*+8 0*	*+3 -1*	*+5 -1*	*+7 -1*	*+12 -1*
over 10 uo to 18	*+9 +5*	*+15 +8*	*+22 +12*	*+36 +20*	*+59 +34*	*+93 +54*	*+153 +90*	*+4 0*	*+7 0*	*+10 0*	*+3 -1*	*+6 -1*	*+9 -1*	*+15 -1*
over 18 up to 30	*+11 +6*	*+17 +9*	*+28 +16*	*+44 +25*	*+71 +41*	*+110 +64*	*+178 +104*	*+6 -1*	*+8 0*	*+15 -3*	*+4 -1*	*+7 -1*	*+11 -1*	*+18 -1*

Example: Ø 20 H8 Reamer

--Nominal diameter d1 = 20.000 mm

-- Upper deviation (from table) = +28 μm = 20.028 mm = d1max

-- Lower deviation (from table) = +16 μm = 20.016 mm = d1min

-- The same results would be achieved as shown in Figure # 6

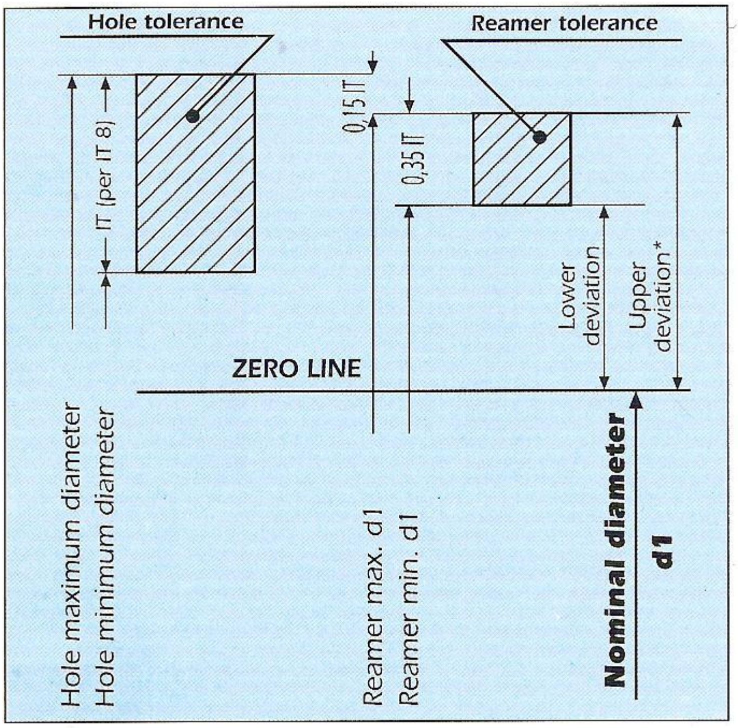

Figure N°6 – *Determination of reamers max and min diameters*