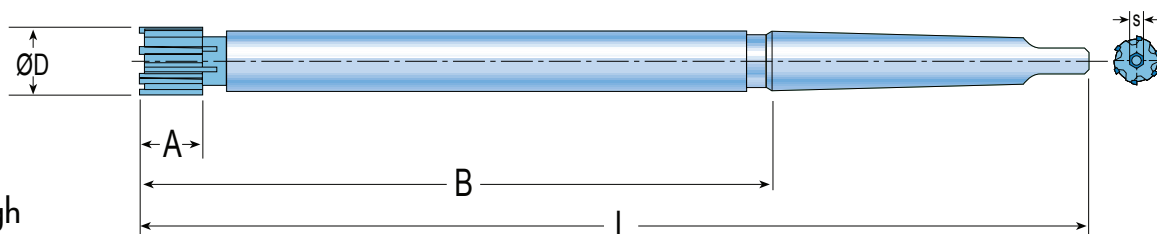


INTEGRAL EXPANDING REAMERS

MT shank - LONG SERIES - Brazed carbide

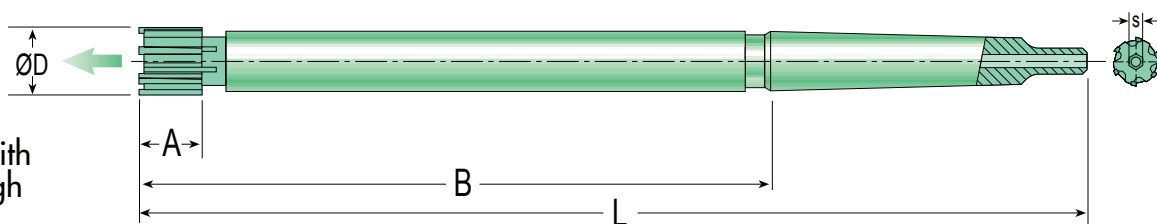
Series 2400

- through and blind holes without through tool coolant



Series 2401

- blind holes with central through tool coolant



ØD mm	B mm	A mm	L mm	MT shank	Number of teeth	S
5,80 - 6,60	72	8	138	1	4	2
6,61 - 7,60	84	8	150	1	4	2
7,61 - 8,60	90	10	156	1	4	2,5
8,61 - 9,60	96	10	162	1	4	2,5
9,61 - 10,60	103	10	168	1	6	3
10,61 - 11,60	110	10	175	1	6	3
11,61 - 12,60	117	10	182	1	6	3
12,61 - 13,60	117	10	182	1	6	4
13,61 - 14,60	123	10	189	1	6	4
14,61 - 15,60	124	10	204	2	6	4
15,61 - 16,60	130	10	210	2	6	4
16,61 - 17,60	134	10	213	2	6	5
17,61 - 18,60	139	12	219	2	6	5
18,61 - 19,10	143	12	223	2	6	5
19,11 - 20,10	148	12	228	2	6	5
20,11 - 21,10	152	12	232	2	6	5
21,11 - 22,10	157	12	237	2	6	6
22,11 - 23,10	161	12	241	2	6	6
23,11 - 24,10	169	12	268	3	6	6
24,11 - 25,10	169	12	268	3	6	6
25,11 - 26,10	174	12	273	3	6	6
26,11 - 27,10	178	14	277	3	6	6
27,11 - 28,10	178	14	277	3	6	8
28,11 - 29,10	182	14	281	3	6	8
29,11 - 30,10	182	14	281	3	6	8
30,11 - 31,10	186	14	285	3	6	8
31,11 - 32,10	193	14	317	4	6	8

TECHNICAL INFORMATION AND CUTTING PARAMETERS STANDARD SPEED REAMING

Hard metal brazed carbide (our ref. H.M.)

MATERIAL TO WORK	N / mm ²	Reamer Ø mm	STOCK ALLOWANCE Ø mm	SURFACE SPEED m / min	FEED mm / rev	LUBRICANT
Mild Steel Unalloyed Low alloyed Structural steel Fused Metal	Up to 600 Greater than 600	Up to 10 10 - 22 22 - 40 40 - 50 50 - 70 70 - 100	0,10 - 0,20 0,15 - 0,25 0,20 - 0,40 0,30 - 0,40 0,35 - 0,50 0,40 - 0,50	7 - 15 6 - 10	0,15 - 0,30 0,25 - 0,50 0,30 - 0,80 0,60 - 1,00 0,60 - 1,20 0,80 - 1,50 0,10 - 0,30 0,20 - 0,40 0,30 - 0,60 0,40 - 0,80 0,50 - 0,90 0,60 - 1,20	Emulsible oil Cutting oil Emulsible oil Cutting oil
Alloy steel Stainless steel	400 - 1000	Up to 10 10 - 22 22 - 40 40 - 50 50 - 70 70 - 100	0,10 - 0,20 0,15 - 0,25 0,20 - 0,30 0,30 - 0,40 0,35 - 0,50 0,40 - 0,50	4 - 8	0,10 - 0,30 0,20 - 0,40 0,30 - 0,60 0,40 - 0,80 0,50 - 0,90 0,60 - 1,20	Emulsible oil Cutting oil
Strongly alloy steel Steel with manganese	800 - 1500	Up to 10 10 - 22 22 - 40 40 - 50 50 - 70 70 - 100	0,10 - 0,20 0,15 - 0,25 0,20 - 0,30 0,30 - 0,40 0,35 - 0,50 0,40 - 0,50	3 - 6	0,10 - 0,20 0,15 - 0,40 0,30 - 0,50 0,30 - 0,70 0,40 - 0,80 0,50 - 1,00	Emulsible oil Cutting oil
Grey cast iron Spheroidal cast iron (pearlitic) Malleable cast iron	Up to 200HB Greater than 200 HB	Up to 10 10 - 22 22 - 40 40 - 50 50 - 70 70 - 100	0,10 - 0,20 0,15 - 0,30 0,30 - 0,40 0,30 - 0,40 0,35 - 0,50 0,40 - 0,50	≤ 200 HB 15 - 30 > 200 HB 10 - 20	0,20 - 0,50 0,40 - 0,60 0,60 - 1,20 0,75 - 1,50 0,80 - 1,60 1,00 - 1,80	Oil Emulsible oil Cutting oil
Spheroidal cast iron (ferritic)	300 - 700	Up to 10 10 - 22 22 - 40 40 - 50 50 - 70 70 - 100	0,10 - 0,20 0,15 - 0,25 0,20 - 0,30 0,30 - 0,40 0,35 - 0,50 0,40 - 0,50	8 - 12	0,15 - 0,30 0,40 - 0,60 0,50 - 1,00 0,75 - 1,50 0,80 - 1,60 1,00 - 1,80	Emulsible oil Cutting oil
Copper and alloys Brass	Up to 500	Up to 10 10 - 22 22 - 40 40 - 50 50 - 70 70 - 100	0,10 - 0,25 0,15 - 0,25 0,25 - 0,40 0,30 - 0,40 0,35 - 0,50 0,40 - 0,50	10 - 18	0,15 - 0,40 0,20 - 0,60 0,25 - 0,90 0,40 - 1,10 0,50 - 1,20 0,60 - 1,50	Emulsible oil
Bronze Bronze phosphorous	Up to 600	Up to 10 10 - 22 22 - 40 40 - 50 50 - 70 70 - 100	0,10 - 0,25 0,15 - 0,25 0,25 - 0,40 0,30 - 0,40 0,35 - 0,50 0,40 - 0,50	10 - 20	0,15 - 0,40 0,25 - 0,60 0,50 - 0,80 0,60 - 1,00 0,70 - 1,10 0,80 - 1,20	Emulsible oil Cutting oil
Alluminium and light alloys	Up to 500	Up to 10 10 - 22 22 - 40 40 - 50 50 - 70 70 - 100	0,10 - 0,2 0,15 - 0,3 0,20 - 0,4 0,30 - 0,4 0,35 - 0,5 0,40 - 0,5	15 - 30	0,20 - 0,40 0,30 - 0,60 0,40 - 1,00 0,75 - 1,50 0,80 - 1,60 0,90 - 1,80	Emulsible oil Oil Cutting oil
Titanium and alloys		Up to 10 10 - 22 22 - 40 40 - 50 50 - 70 70 - 100	0,10 - 0,20 0,15 - 0,25 0,20 - 0,30 0,30 - 0,40 0,35 - 0,50 0,40 - 0,50	5 - 8	0,15 - 0,30 0,20 - 0,40 0,30 - 0,50 0,40 - 0,60 0,60 - 0,80 0,80 - 1,20	Emulsible oil Cutting oil
Syntetic materials		Up to 10 10 - 22 22 - 40 40 - 50 50 - 70 70 - 100	0,10 - 0,20 0,15 - 0,25 0,20 - 0,30 0,30 - 0,40 0,35 - 0,50 0,40 - 0,50	15 - 30	0,20 - 0,50 0,40 - 0,80 0,50 - 1,40 0,80 - 1,50 0,90 - 1,60 1,00 - 1,80	Compressed air Dry Emulsible oil

TECHNICAL INFORMATION AND CUTTING PARAMETERS HIGH SPEED & HIGH FEED REAMING

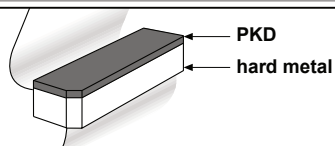
Hard metal brazed carbide coated TiN - TiCN - TiAlN (our ref. TIN - TIC - TIA)
Cermet brazed carbide (our ref. AVC)

*AVC reamers are available coated TiN, TiCN or TiAlN

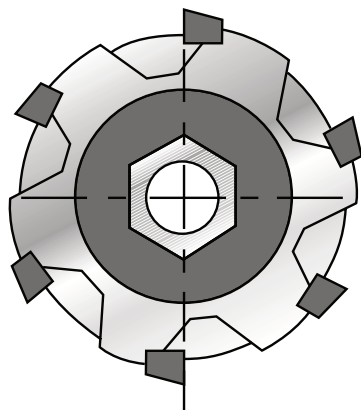
MATERIAL TO WORK	N / mm ²	Reamer Ø mm	STOCK ALLOWANCE Ø mm	H.M. coated TiN - TiCN TiAlN	CERMET AVC *	Lead-in A,G	Lead-in E,N,M
				SURFACE SPEED m / min	SURFACE SPEED m / min	FEED mm / rev	FEED mm / rev
Mild Steel	Up to 600	up to 10	0,08 - 0,15	60 - 80	90 - 300	0,20 - 0,40	0,30 - 0,60
Unalloyed		10 - 18	0,15 - 0,25			0,40 - 0,60	0,40 - 1,00
Low alloyed		18 - 40	0,15 - 0,30			0,50 - 0,80	0,60 - 1,20
Structural steel		40 - 80	0,20 - 0,40			0,50 - 1,00	0,80 - 1,60
Fused Metal	Greater than 600	over 80	0,25 - 0,50	40 - 70	80 - 200	0,80 - 1,50	1,00 - 2,20
		up to 10	0,08 - 0,15			0,20 - 0,40	0,30 - 0,50
		10 - 18	0,15 - 0,25			0,30 - 0,60	0,30 - 0,80
		18 - 40	0,15 - 0,30			0,40 - 0,70	0,40 - 1,00
	400 - 1000	40 - 80	0,20 - 0,40	30 - 50	60 - 150	0,50 - 0,80	0,60 - 1,40
		over 80	0,25 - 0,50			0,80 - 1,20	1,00 - 2,00
		up to 10	0,08 - 0,15			0,20 - 0,40	0,30 - 0,50
		10 - 18	0,15 - 0,25			0,30 - 0,60	0,30 - 0,80
	800 - 1500	18 - 40	0,15 - 0,30	15 - 30	60 - 120	0,40 - 0,70	0,40 - 1,00
		40 - 80	0,20 - 0,40			0,50 - 0,80	0,60 - 1,40
		over 80	0,25 - 0,50			0,80 - 1,20	1,00 - 2,00
		up to 10	0,08 - 0,15			0,20 - 0,40	0,30 - 0,50
	Up to 200HB	10 - 18	0,15 - 0,25	50 - 70		0,30 - 0,60	0,30 - 0,80
		18 - 40	0,15 - 0,30			0,40 - 0,70	0,40 - 1,00
		40 - 80	0,20 - 0,40			0,50 - 0,80	0,60 - 1,40
		over 80	0,25 - 0,50			0,80 - 1,20	1,00 - 2,00
	Greater than 200 HB	up to 10	0,08 - 0,15			0,20 - 0,40	0,30 - 0,50
		10 - 18	0,15 - 0,25			0,30 - 0,60	0,30 - 0,80
		18 - 40	0,15 - 0,30			0,40 - 0,70	0,40 - 1,00
		40 - 80	0,20 - 0,40			0,50 - 0,80	0,60 - 1,40
	300 - 700	over 80	0,25 - 0,50	30 - 50	60 - 120	0,80 - 1,20	1,00 - 2,00
		up to 10	0,08 - 0,15			0,20 - 0,40	0,30 - 0,50
		10 - 18	0,15 - 0,25			0,30 - 0,60	0,30 - 0,80
		18 - 40	0,15 - 0,30			0,40 - 0,70	0,40 - 1,00
	Up to 500	40 - 80	0,20 - 0,40	100 - 200		0,50 - 0,80	0,60 - 1,40
		over 80	0,25 - 0,50			0,80 - 1,20	1,00 - 2,00
		up to 10	0,08 - 0,15			0,20 - 0,40	0,30 - 0,50
		10 - 18	0,15 - 0,25			0,30 - 0,60	0,30 - 0,80
	Up to 600	18 - 40	0,15 - 0,30	80 - 160	100 - 300	0,40 - 0,70	0,40 - 1,00
		40 - 80	0,20 - 0,40			0,50 - 0,80	0,60 - 1,40
		over 80	0,25 - 0,50			0,80 - 1,20	1,00 - 2,00
		up to 10	0,08 - 0,15			0,20 - 0,40	0,30 - 0,50
	Up to 500	10 - 18	0,15 - 0,25	100 - 200		0,30 - 0,60	0,30 - 0,80
		18 - 40	0,15 - 0,30			0,40 - 0,70	0,40 - 1,00
		40 - 80	0,20 - 0,40			0,50 - 0,80	0,60 - 1,40
		over 80	0,25 - 0,50			0,80 - 1,20	1,00 - 2,00
	Up to 600	up to 10	0,08 - 0,15	20-60		0,20 - 0,40	0,30 - 0,50
		10 - 18	0,15 - 0,25			0,30 - 0,60	0,30 - 0,80
		18 - 40	0,15 - 0,30			0,40 - 0,70	0,40 - 1,00
		40 - 80	0,20 - 0,40			0,50 - 0,80	0,60 - 1,40
	Up to 500	over 80	0,25 - 0,50			0,80 - 1,20	1,00 - 2,00
		up to 10	0,08 - 0,15			0,20 - 0,40	0,30 - 0,50
		10 - 18	0,15 - 0,25			0,30 - 0,60	0,30 - 0,80
		18 - 40	0,15 - 0,30			0,40 - 0,70	0,40 - 1,00
	Up to 600	40 - 80	0,20 - 0,40			0,50 - 0,80	0,60 - 1,40
		over 80	0,25 - 0,50			0,80 - 1,20	1,00 - 2,00
		up to 10	0,08 - 0,15			0,20 - 0,40	0,30 - 0,50
		10 - 18	0,15 - 0,25			0,30 - 0,60	0,30 - 0,80
	Up to 600	18 - 40	0,15 - 0,30			0,40 - 0,70	0,40 - 1,00
		40 - 80	0,20 - 0,40			0,50 - 0,80	0,60 - 1,40
		over 80	0,25 - 0,50			0,80 - 1,20	1,00 - 2,00
		up to 10	0,08 - 0,15			0,20 - 0,40	0,30 - 0,50
	Up to 600	10 - 18	0,15 - 0,25			0,30 - 0,60	0,30 - 0,80
		18 - 40	0,15 - 0,30			0,40 - 0,70	0,40 - 1,00
		40 - 80	0,20 - 0,40			0,50 - 0,80	0,60 - 1,40
		over 80	0,25 - 0,50			0,80 - 1,20	1,00 - 2,00

HIGH SPEED FOR ALUMINIUM REAMING

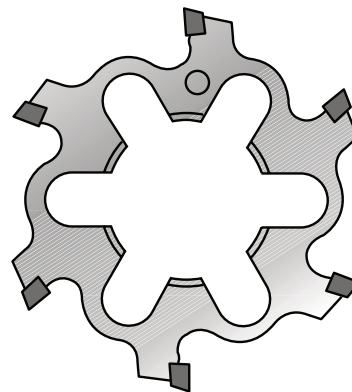
Aluminium with silicon greater than 10% - brazed carbide with PKD



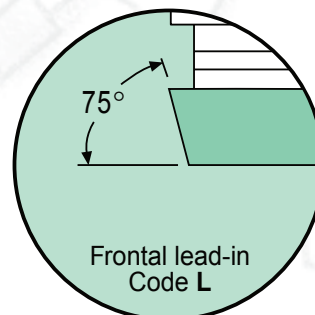
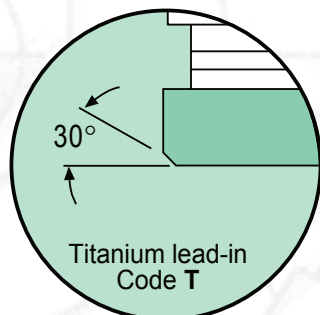
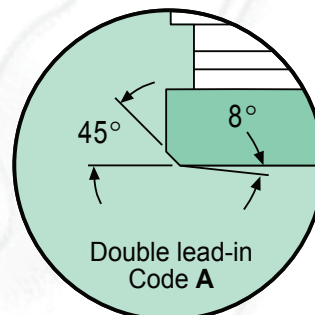
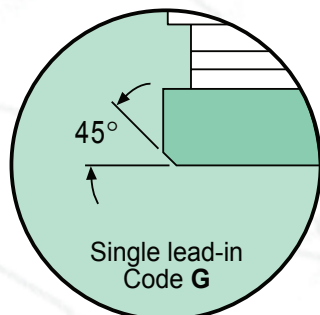
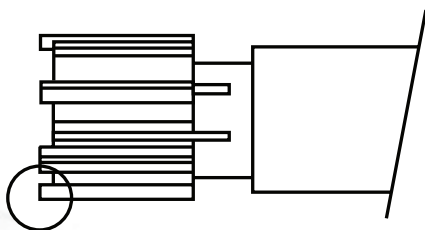
- Surface speed up to 1500 m/min.
- When using PKD reamers a machine tool with high rigidity and absolute precision is a minimum requirement.
- Each application must be assessed by our technical department.



Integral expanding reamer

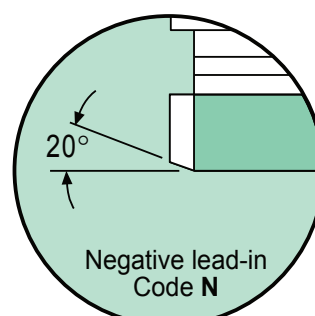
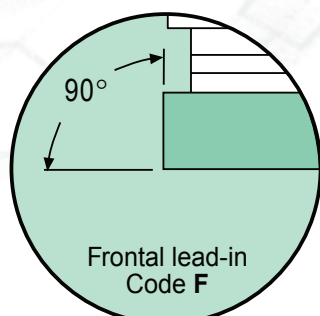


Cutting ring



"L" lead-in
to reduce the feed
of 40% compared
with the values
on pages 6-7

"F" lead-in
to reduce the feed
of 40% compared
with the values
on pages 6-7



"N" lead-in
ideal for through hole.
It is possible
to increase
the feed up to 100%
of the values
indicated
on pages 6-7

Approach angles

MATERIAL TO WORK	TENSILE STRENGTH	APPROACH ANGLE*
Iron and mild steel (C < 0,2%)	50 Kg / mm ²	G - A - E
Mild steel (C 0,2 < 0,3%)	60 Kg / mm ²	N - A - E
Mild steel (C 0,3 < 0,4%)	70 Kg / mm ²	N - A - E
Mild steel (C 0,4 < 0,5%)	80 Kg / mm ²	N - A - E
Alloy steel	≤ 80 Kg / mm ²	G - N - A - E
Alloy steel	90 Kg / mm ²	G - N - E
Alloy steel	100 Kg / mm ²	G - N - M
Alloy steel	> 100 Kg / mm ²	G - N - M
Stainless and refractory steel	from 50 Kg / mm ² to 90 Kg / mm ²	G - N - M
Grey, spheroidal and malleable cast iron	from 150 HB to 320 HB	G - N - E
Titanium and titanium alloy		T - E
Tempered steel	48 - 64 HRc	G - N - M
Pure copper		G - N - E
Electrolytic copper		G - N - E
Brass / Bronze		G - N - E
Aluminium alloy < 10% Si		G - A - E
Aluminium alloy > 11% Si		G - E
Magnesium alloy		G - A - E
Thermoplastic material		G - E
Thermosetting resins		G - E
Stiffened synthetic material		G - E

* Do not use negative lead-in on blind holes

Negative lead-in "N" can be used on large range of materials: please apply to our technical department.

Usually ex-stock: - single lead-in G

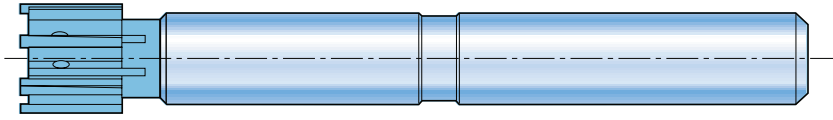
Approach angles

MATERIAL TO WORK	TENSILE STRENGTH	APPROACH ANGLE*
Iron and mild steel (C < 0,2%)	50 Kg / mm ²	G - A - E
Mild steel (C 0,2 < 0,3%)	60 Kg / mm ²	N - A - E
Mild steel (C 0,3 < 0,4%)	70 Kg / mm ²	N - A - E
Mild steel (C 0,4 < 0,5%)	80 Kg / mm ²	N - A - E
Alloy steel	≤ 80 Kg / mm ²	G - N - A - E
Alloy steel	90 Kg / mm ²	G - N - E
Alloy steel	100 Kg / mm ²	G - N - M
Alloy steel	> 100 Kg / mm ²	G - N - M
Stainless and refractory steel	from 50 Kg / mm ² to 90 Kg / mm ²	G - N - M
Grey, spheroidal and malleable cast iron	from 150 HB to 320 HB	G - N - E
Titanium and titanium alloy		T - E
Tempered steel	48 - 64 HRc	G - N - M
Pure copper		G - N - E
Electrolytic copper		G - N - E
Brass / Bronze		G - N - E
Aluminium alloy < 10% Si		G - A - E
Aluminium alloy > 11% Si		G - E
Magnesium alloy		G - A - E
Thermoplastic material		G - E
Thermosetting resins		G - E
Stiffened synthetic material		G - E

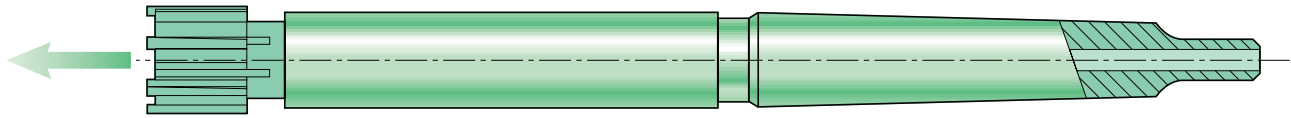
* Do not use negative lead-in on blind holes

Negative lead-in "N" can be used on large range of materials: please apply to our technical department.

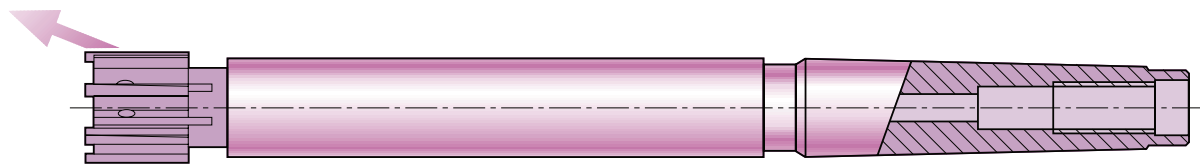
Usually ex-stock: - single lead-in G



Expanding reamers without through tool coolant

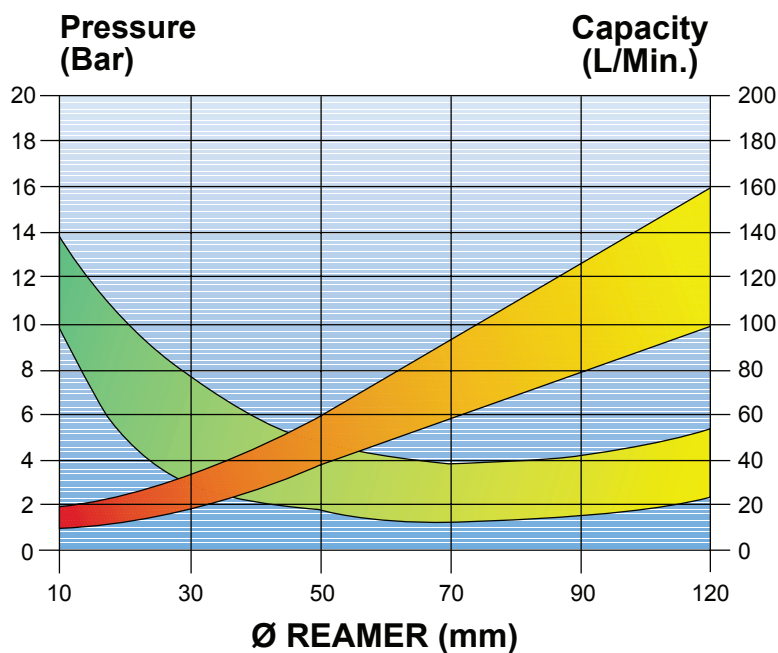


Expanding reamers with central through tool coolant



Expanding reamers with radial through tool coolant

Recommended values for lubricants



It is important to use a good quality lubricant.



The reamers can be expanded for recovering the starting diameter.

EXPANDING & FIXED REAMERS INSTRUCTIONS

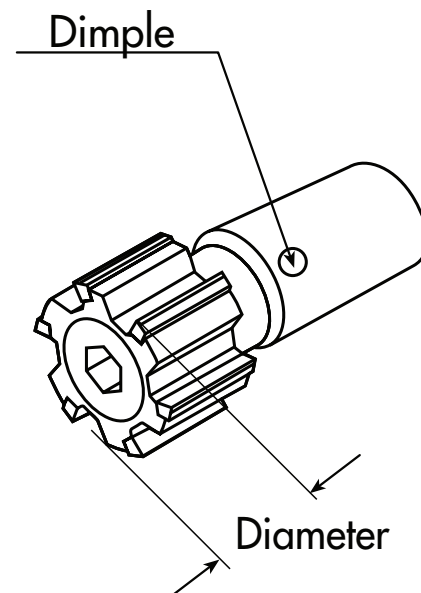
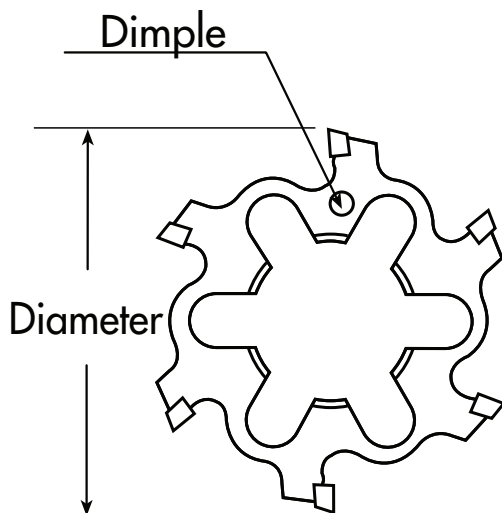
1) Diameter measurement

The diameter of the reamers and of the cutting rings is measured with a micrometer. We recommend the use of a comparator style micrometer with at least a $2\mu\text{m}$ resolution to avoid micro chipping of the cutting edges.

To allow setting of the reamer, two cutting edges are exactly 180° opposed. These are marked with a coloured dimple (see diagram below).

Measurement must be taken from the front of the cutting edges only.

The red dimple indicates that the tool has been ground with a single lead-in angle (code G), the blue dimple indicates a double lead-in angle (code A).



2) Tolerance

All the reamers are ground to the requested diameter and set to nominal tolerance for expanding reamers and $3/4$ of minimum tolerance for fixed reamers.

3) Expanding reamers adjustment

The adjustment must be made to compensate for wear to the cutting edges when the size reaches its lower tolerance.

This operation can be repeated several times until the surface finish of the hole deteriorates to an unacceptable level, then the reamer must be reground. The maximum expansion is about 1% of the diameter for the integral reamers and about 4% of the diameter for the cutting rings.