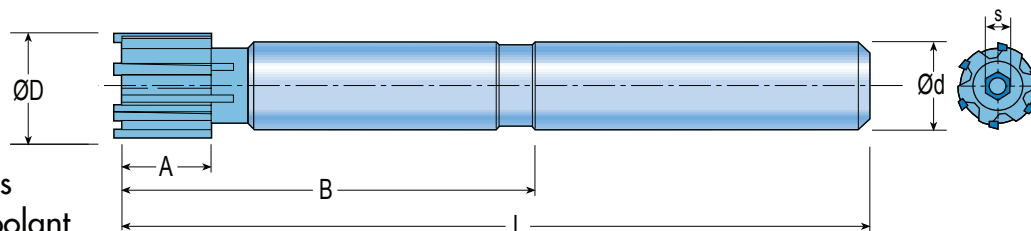


INTEGRAL EXPANDING REAMERS

Cylindrical shank - SHORT SERIES - Brazed carbide

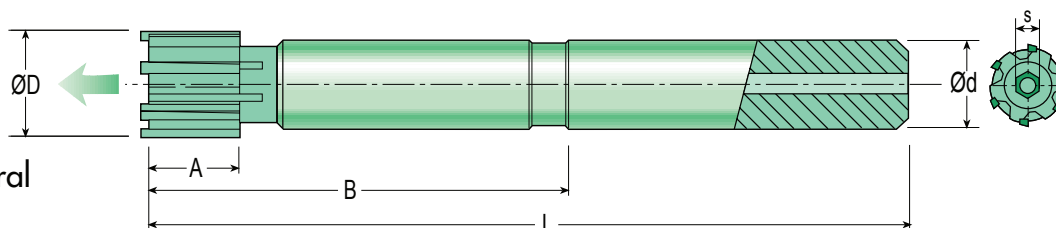
Series 2420 **Series 2440**

- through and blind holes without through tool coolant



Series 2421 **Series 2441**

- blind holes with central through tool coolant



Series 2420-2421					Series 2440-2441				Number of teeth	S
ØD mm	B mm	A mm	L mm	Ø d ^{h7} mm	B mm	A mm	L mm	Ø d ^{h7} mm		
5,80 - 6,60	40	8	80	10	40	8	80	12	4	2
6,61 - 7,60	40	8	80	10	40	8	80	12	4	2
7,61 - 8,60	40	10	80	10	40	10	80	12	4	2,5
8,61 - 9,60	40	10	80	10	50	10	90	12	4	2,5
9,61 - 10,60	40	10	80	10	50	10	95	12	6	3
10,61 - 11,60	40	10	80	12	60	10	105	12	6	3
11,61 - 12,60	40	10	80	12	60	10	105	12	6	3
12,61 - 13,60	40	10	80	12	60	10	105	12	6	4
13,61 - 14,60	40	10	80	12	70	10	115	12	6	4
14,61 - 15,60	40	10	80	12	70	10	115	12	6	4
15,61 - 16,60	50	10	90	16	80	10	130	16	6	4
16,61 - 17,60	50	10	90	16	80	10	130	16	6	5
17,61 - 18,60	50	12	90	16	90	12	140	16	6	5
18,61 - 19,10	50	12	90	16	90	12	150	20	6	5
19,11 - 20,10	50	12	90	16	100	12	160	20	6	5
20,11 - 21,10	-	-	-	-	100	12	160	20	6	5
21,11 - 22,10	-	-	-	-	100	12	160	20	6	6
22,11 - 23,10	-	-	-	-	100	12	160	20	6	6
23,11 - 24,10	-	-	-	-	100	12	160	20	6	6
24,11 - 25,10	-	-	-	-	100	12	160	20	6	6
25,11 - 26,10	-	-	-	-	110	12	170	25	6	6
26,11 - 27,10	-	-	-	-	110	14	170	25	6	6
27,11 - 28,10	-	-	-	-	110	14	170	25	6	8
28,11 - 29,10	-	-	-	-	110	14	170	25	6	8
29,11 - 30,10	-	-	-	-	110	14	170	25	6	8
30,11 - 31,10	-	-	-	-	110	14	170	25	6	8
31,11 - 32,10	-	-	-	-	110	14	170	25	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	Up to 600	Up to 10	0,10 - 0,20	7 - 15	0,15 - 0,30	Emulsible oil Cutting oil
Unalloyed		10 - 22	0,15 - 0,25		0,25 - 0,50	
Low alloyed		22 - 40	0,20 - 0,40		0,30 - 0,80	
Structural steel		40 - 50	0,30 - 0,40		0,60 - 1,00	
Fused Metal		50 - 70	0,35 - 0,50		0,60 - 1,20	
		70 - 100	0,40 - 0,50		0,80 - 1,50	
	Greater than 600	Up to 10	0,10 - 0,20	6 - 10	0,10 - 0,30	Emulsible oil Cutting oil
		10 - 22	0,15 - 0,25		0,20 - 0,40	
		22 - 40	0,20 - 0,30		0,30 - 0,60	
		40 - 50	0,30 - 0,40		0,40 - 0,80	
		50 - 70	0,35 - 0,50		0,50 - 0,90	
		70 - 100	0,40 - 0,50		0,60 - 1,20	
Alloy steel	400 - 1000	Up to 10	0,10 - 0,20	4 - 8	0,10 - 0,30	Emulsible oil Cutting oil
		10 - 22	0,15 - 0,25		0,20 - 0,40	
		22 - 40	0,20 - 0,30		0,30 - 0,60	
		40 - 50	0,30 - 0,40		0,40 - 0,80	
		50 - 70	0,35 - 0,50		0,50 - 0,90	
		70 - 100	0,40 - 0,50		0,60 - 1,20	
Stainless steel						
Strongly alloy steel	800 - 1500	Up to 10	0,10 - 0,20	3 - 6	0,10 - 0,20	Emulsible oil Cutting oil
		10 - 22	0,15 - 0,25		0,15 - 0,40	
		22 - 40	0,20 - 0,30		0,30 - 0,50	
		40 - 50	0,30 - 0,40		0,30 - 0,70	
		50 - 70	0,35 - 0,50		0,40 - 0,80	
		70 - 100	0,40 - 0,50		0,50 - 1,00	
Steel with manganese						
Grey cast iron	Up to 200HB	Up to 10	0,10 - 0,20	≤ 200 HB 15 - 30	0,20 - 0,50	Oil Emulsible oil Cutting oil
Spheroidal cast iron (pearlitic)		10 - 22	0,15 - 0,30		0,40 - 0,60	
	Greater than 200 HB	22 - 40	0,30 - 0,40	> 200 HB 10 - 20	0,60 - 1,20	
		40 - 50	0,30 - 0,40		0,75 - 1,50	
		50 - 70	0,35 - 0,50		0,80 - 1,60	
		70 - 100	0,40 - 0,50		1,00 - 1,80	
Malleable cast iron						
Spheroidal cast iron (ferritic)	300 - 700	Up to 10	0,10 - 0,20	8 - 12	0,15 - 0,30	Emulsible oil Cutting oil
		10 - 22	0,15 - 0,25		0,40 - 0,60	
		22 - 40	0,20 - 0,30		0,50 - 1,00	
		40 - 50	0,30 - 0,40		0,75 - 1,50	
		50 - 70	0,35 - 0,50		0,80 - 1,60	
		70 - 100	0,40 - 0,50		1,00 - 1,80	
Copper and alloys	Up to 500	Up to 10	0,10 - 0,25	10 - 18	0,15 - 0,40	Emulsible oil
		10 - 22	0,15 - 0,25		0,20 - 0,60	
		22 - 40	0,25 - 0,40		0,25 - 0,90	
		40 - 50	0,30 - 0,40		0,40 - 1,10	
		50 - 70	0,35 - 0,50		0,50 - 1,20	
		70 - 100	0,40 - 0,50		0,60 - 1,50	
Brass						
Bronze	Up to 600	Up to 10	0,10 - 0,25	10 - 20	0,15 - 0,40	Emulsible oil Cutting oil
		10 - 22	0,15 - 0,25		0,25 - 0,60	
		22 - 40	0,25 - 0,40		0,50 - 0,80	
		40 - 50	0,30 - 0,40		0,60 - 1,00	
		50 - 70	0,35 - 0,50		0,70 - 1,10	
		70 - 100	0,40 - 0,50		0,80 - 1,20	
Bronze phosphorous						
Aluminium and light alloys	Up to 500	Up to 10	0,10 - 0,2	15 - 30	0,20 - 0,40	Emulsible oil Oil Cutting oil
		10 - 22	0,15 - 0,3		0,30 - 0,60	
		22 - 40	0,20 - 0,4		0,40 - 1,00	
		40 - 50	0,30 - 0,4		0,75 - 1,50	
		50 - 70	0,35 - 0,5		0,80 - 1,60	
		70 - 100	0,40 - 0,5		0,90 - 1,80	
Titanium and alloys		Up to 10	0,10 - 0,20	5 - 8	0,15 - 0,30	Emulsible oil Cutting oil
		10 - 22	0,15 - 0,25		0,20 - 0,40	
		22 - 40	0,20 - 0,30		0,30 - 0,50	
		40 - 50	0,30 - 0,40		0,40 - 0,60	
		50 - 70	0,35 - 0,50		0,60 - 0,80	
		70 - 100	0,40 - 0,50		0,80 - 1,20	
Syntetic materials		Up to 10	0,10 - 0,20	15 - 30	0,20 - 0,50	Compressed air Dry Emulsible oil
		10 - 22	0,15 - 0,25		0,40 - 0,80	
		22 - 40	0,20 - 0,30		0,50 - 1,40	
		40 - 50	0,30 - 0,40		0,80 - 1,50	
		50 - 70	0,35 - 0,50		0,90 - 1,60	
		70 - 100	0,40 - 0,50		1,00 - 1,80	

TECHNICAL INFORMATION AND CUTTING PARAMETERS HIGH SPEED & HIGH FEED REAMING

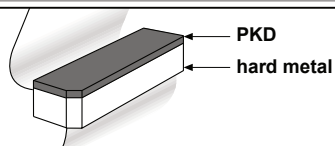
Hard metal brazed carbide coated TiN - TiCN - TiAlN (our ref. TIN - TIC - TIA)
Cermet brazed carbide (our ref. AVC)

*AVC reamers are available coated TiN, TiCN or TiAlN

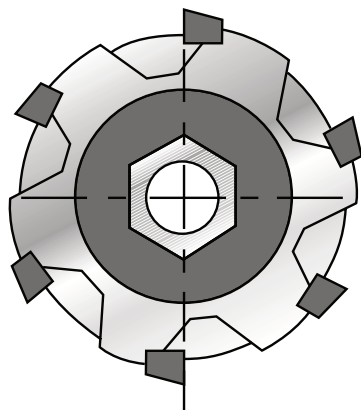
MATERIAL TO WORK	N / mm ²	Reamer Ø mm	STOCK ALLOWANCE Ø mm	H.M. coated TiN - TiCN TiAlN	CERMET AVC *	Lead-in A,G	Lead-in E,N,M
				SURFACE SPEED m / min	SURFACE SPEED m / min	FEED mm / rev	FEED mm / rev
Mild Steel	Up to 600	up to 10	0,08 - 0,15	60 - 80	90 - 300	0,20 - 0,40	0,30 - 0,60
Unalloyed		10 - 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 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
		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
		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
		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
		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

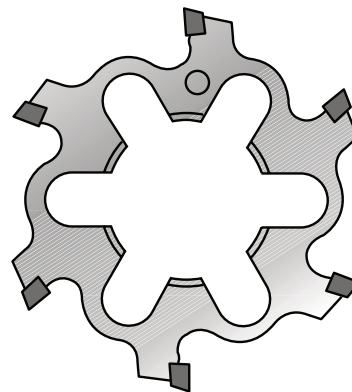
Aluminium with silicon greater than 10% - brazed carbide with PKD



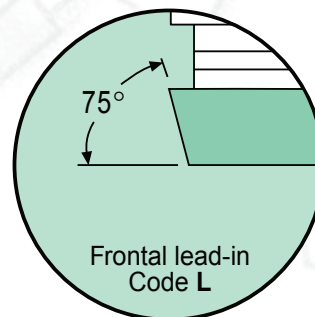
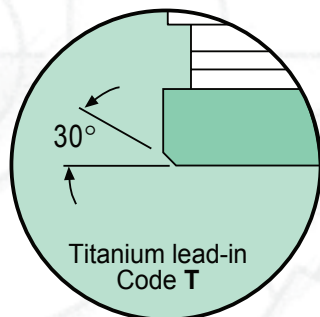
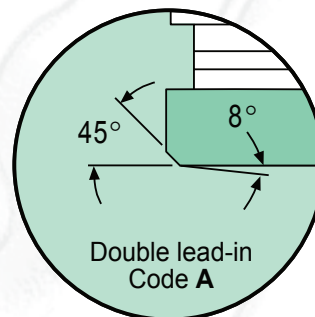
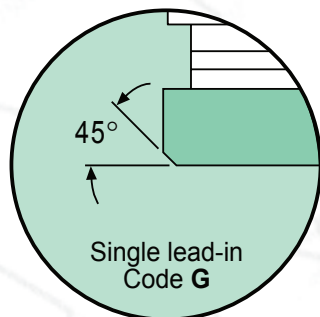
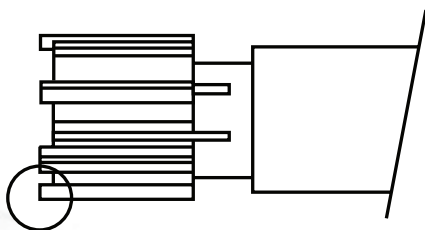
- Surface speed up to 1500 m/min.
- When using PKD reamers a machine tool with high rigidity and absolute precision is a minimum requirement.
- Each application must be assessed by our technical department.



Integral expanding reamer

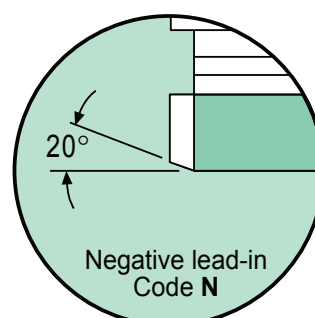
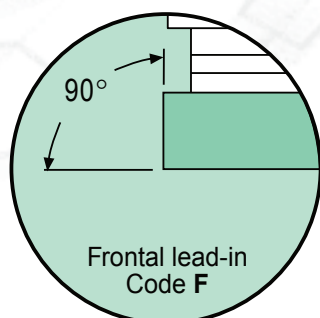


Cutting ring



"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

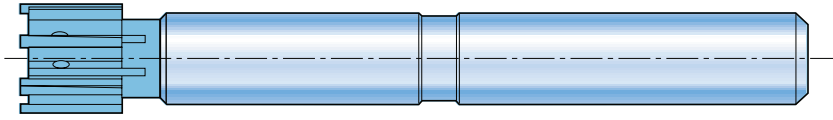
Approach angles

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

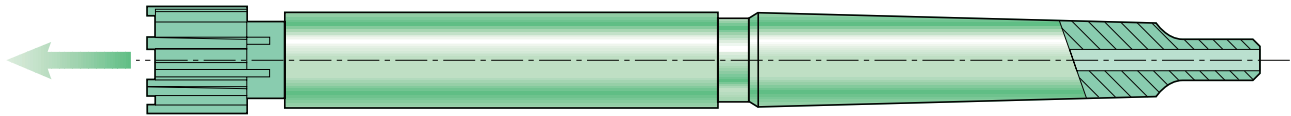
* Do not use negative lead-in on blind holes

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

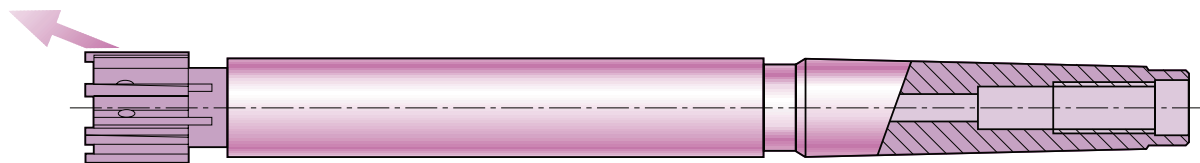
Usually ex-stock: - single lead-in G



Expanding reamers without through tool coolant

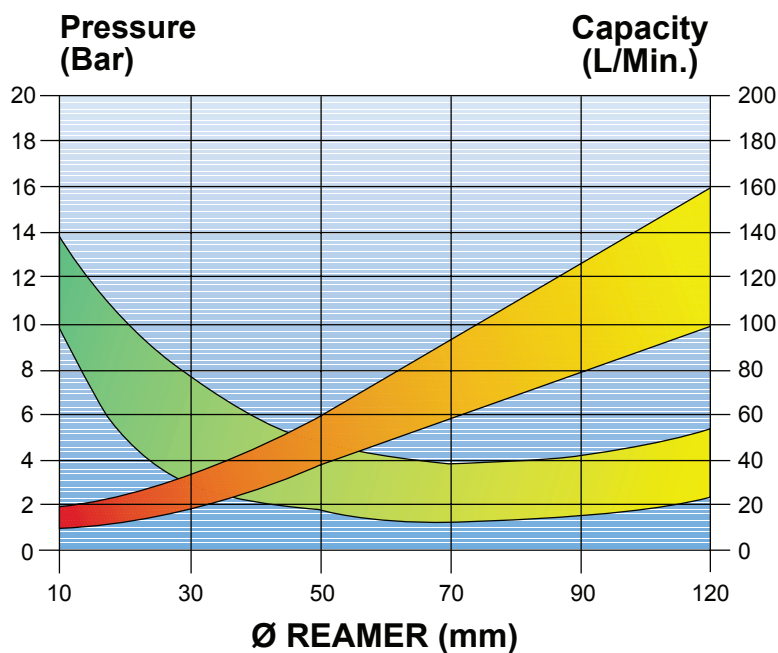


Expanding reamers with central through tool coolant



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

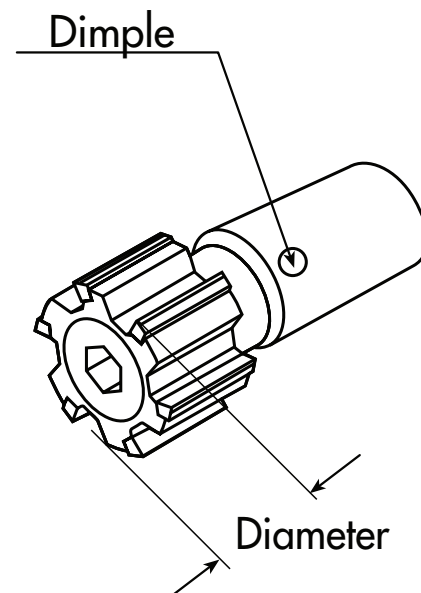
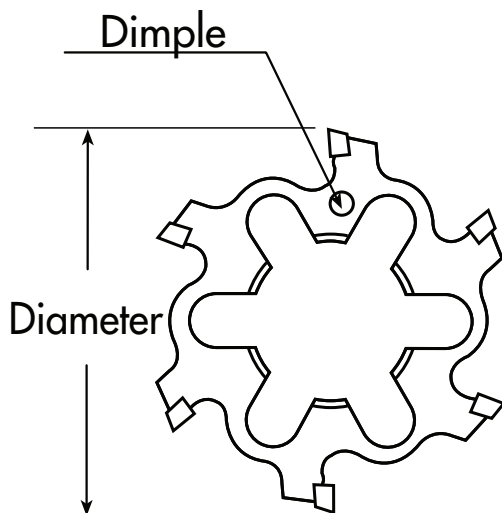
1) Diameter measurement

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.