Member IMC Group

Ingersoll Cutting Tools

TECHNICAL GUIDE

TURNING TOOLS

SFEED UP HIGH SPEED & FEED

Ingersoll's standard program comprises a broad and world-wide established range of cutting tools, suitable for the most various applications.

This range of cutting tools is constantly expanded: End mills, shell end mills, shoulder-type milling cutters, face mills, slotting cutters, form milling cutters, indexable drills, solid carbide, adaptions, set-up equipment and indexable inserts. With a complete line of turning and grooving tools we offer our customers a further product area and thus comprehensive expertise from a single source. The development and production of special-purpose tools according to customer-specific requirements is another important factor for Ingersoll Werkzeuge GmbH.

Our know-how and great potential of experience, combined with our own demand for quality, functionality and innovation, guarantees our customers the optimum cutting tool solution – for individual machining tasks, for all industries.

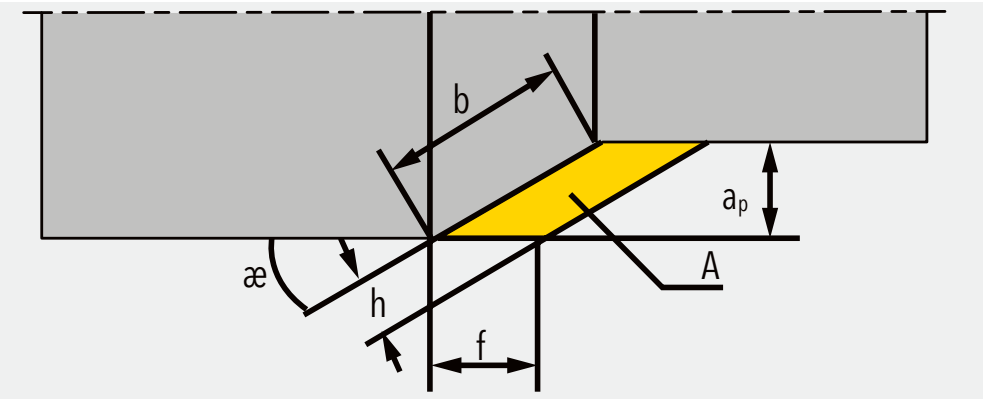
Content

General formulas

Recommended values required drive power (approximation formulas)		
Steel	kW	$P_e = \frac{a_p \times f \times v_c}{20}$
Cast	kW	$P_e = \frac{a_p \times f \times v_c}{25}$
Aluminum alloys	kW	$P_e = \frac{a_p \times f \times v_c}{100}$

Value	Unit	Formula
spindle speed	rev./min	$n = \frac{v_c \times 1000}{D \times \pi}$
cutting speed	m/min	$v_c = \frac{D \times \pi \times n}{1000}$
feed rate	mm/min	$v_f = f \times n$
chip removal rate	cm³/min	$Q = A \times v_c = a_p \times f \times v_c$
specific cutting force	N/mm²	$k_c = k \times C_1 \times C_2$
theoretical roughness depth	µm	$R_{th} = \frac{f^2}{8 \times r}$
chip cross-section	mm²	$A = a \times f$
requied drive power	kW	$P_e = \frac{F_c \times v_c}{\eta} = \frac{P_c}{\eta}$
efficiency rate	–	$\eta = \frac{P_c}{P_e} = \frac{P_{ab}}{P_{zu}}$
cutting force	N	$F_c = A \times k_c / A = a_p \times f$
required cutting power	kW	$P_c = F_c \times v_c$

Symbol	Unit	Definition
V_c	m/min	cutting speed
D	mm	diameter
n	rev./min	spindle speed
π	–	Pi
F_c	N	cutting force
k_c	N/mm²	specific cutting force
P_c	kW	cutting power (1W = 1 N/sec)
P_e	kW	requied drive power
η	–	total efficiency rate
f	mm	feed
V_f	mm/min	feed rate
r	mm	corner radius
h	mm	chip thickness
A	mm²	chip cross-section
k	–	table value for specif. cutting force
C_1	–	correction factor v_c
C_2	–	correction factor machining process
R_{th}	µm	theoretical roughness depth
P_{ab}	kW	output power
P_{zu}	kW	input power
b	mm	chip width
æ	°	entering angle
Q	cm³/min	chip removal rate
a_p	mm	depth of cut (mm)



Drive power

Required drive power, approximately determined with the help of the specific chip removal rate Qsp!

$$P_{mot} = \frac{Q\ (cm^3/min)}{Qsp\ (cm^3/kW \times min)}$$

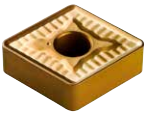
$$P_{mot} = \frac{a \times Vf}{1000 \times Qsp}$$

Table for Qsp of different materials depending on f
Qsp (cm³/kW·min) if

Workpiece Material	f = 0.1 mm	f = 0.25 mm	f = 0.6 mm
35NiCrMo16	15 – 17	18 – 20	22 – 24
38CrAlMo7	16 – 18	19 – 21	23 – 25
42 CrMo 4	16,5 – 18,5	19,5 – 21,5	23,5 – 25,5
X5CrNiMo18 10	17,5 – 19,5	20,5 – 22,5	24,5 – 26,5
50CrV4	17,5 – 19,5	20,5 – 22,5	24,5 – 27
16MnCr5	18 – 20	21,5 – 23,5	25,5 – 28
C45 – C60	19,5 – 21,5	23,5 – 25,5	28 – 31
Ti6Al4V	20 – 22	26 – 28	31 – 33
GGG	25 – 27,5	30 – 33	36 – 39
GG 26	28 – 31	33,5 – 37	39,5 – 43
GTW – GTS	32,5 – 36	38,5 – 42	45,5 – 49
MS 80	39 – 43	58 – 62	69 – 73
Al – Si	69 – 72	82 – 85	–
Al – Mg	83 – 85	100 – 105	–

Example:
Workpiece, stability and machine condition:
Material: 42CrMo4
Workpiece: Ø 1800 mm
Insert: CNMM 190624 HY TT8125

Vc = 160 m/min
f = 0,8 mm
a = 10 mm
n ≈ 28 rpm



Calculation P_{mot}:

- Q=a x f x Vc
- Q=1280 cm³/min
- Qsp=24 cm³/kW x min (see Qsp table)
- $P_{mot} = \frac{Q\ (cm^3/min)}{Qsp\ (cm^3/kW \times min)} = \frac{1280\ cm^3/min}{24 cm^3/kW \times min}$
- $P_{mot} \approx 53$ kW

Important!
Only a rough calcuation to determine required power or cutting data! Depending on many factors, e.g. entering angle, chipbreaker, cutting edge preparation, etc.

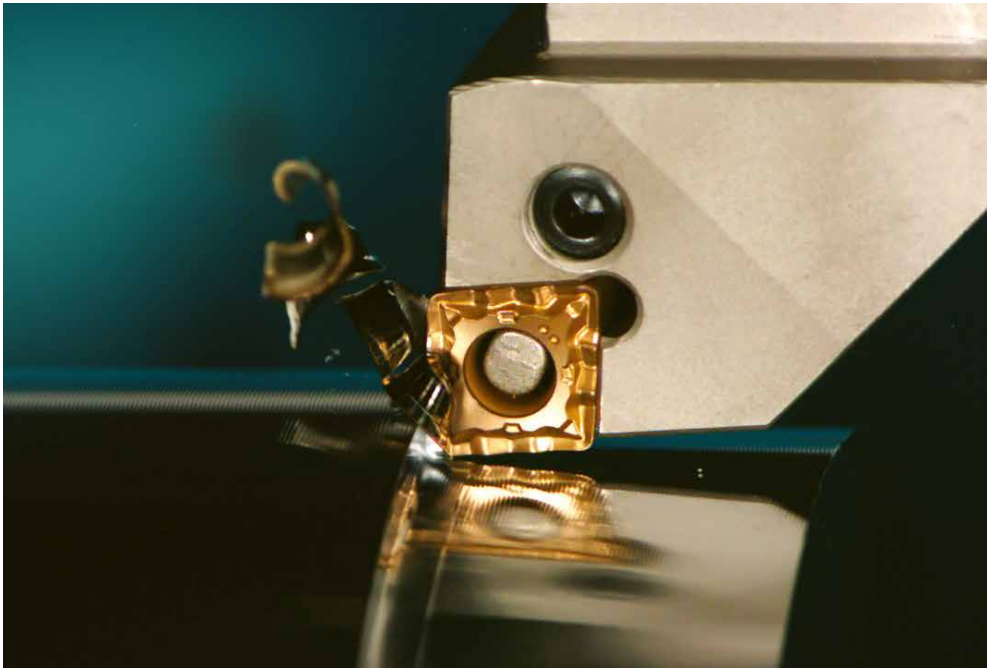
Grades – coatings

	Grade	Color	ISO range	Turning	Threading	Grooving	Workpiece material and application
CVD coated	TT3005	Copper	S05–S20	•			For high-speed finishing of heat-resistant superalloys
	TT5100	Gold	P20–P35	•		•	Medium turning of low carbon steel and alloyed steel
			M20–M35			•	Medium and low speed machining of stainless steel
	TT7005	Black	K01–K15	•			High speed continuous turning of gray and ductile cast iron
	TT7015	Black	K10–K25	•			General, continuous and interrupted turning of gray and ductile cast iron
	TT7025	Black	K10–K25	•			For low cutting speeds and interrupted turning in cast iron
	TT7100	Gold	P30–P45	•			Interrupted and rough turning of steel
	TT8105	Black/Gold	P01–P15	•			High speed turning of steel
	TT8115	Black/Gold	P05–P20	•			High speed turning of steel
	TT8125	Black/Gold	P15–P30	•			General turning of steel
	TT8135	Black/Gold	P25–P40	•			Heavy interrupted turning of steel. Improved higher toughness and superior fracture resistance
	TT9100	Gold	P10–P25			•	High speed turning and grooving
	TT9215	Copper	M05–M20	•			High speed turning of stainless steel
			S05–S20	•			High and medium speed machining of heat-resistant alloy
	TT9225	Copper	M15–M30	•			General turning of stainless steel
			S15–S30	•			Medium speed machining of heat-resistant alloy
	TT9235	Copper	M25–M40	•			Low speed and interrupted turning of stainless steel
			S25–S40	•			Low speed machining of heat-resistant alloy
PVD coated	TT3010	Gold	S05–S25	•			General turning with low cutting depths
	TT3020	Gold	S10–S30	•			General turning at low to medium cutting speeds
	TT4410	Copper	P05 – P25	•			High speed turning of small parts for steel in continuous conditions
			M05 – M 25	•			High speed turning of small parts for stainless steel in continuous conditions
			S05 – S25	•			High speed turning of small parts for titanium alloys in continuous conditions
	TT4430	Copper	P20 – P40	•			General turning of small parts for steel
			M20 – M40	•			General turning of small parts for stainless steel
			S20 – S40	•			General turning of small parts for titanium alloys
	TT5080	Gold	M05–M25	•			High speed finish turning of stainless steel
			S05–S25	•			High speed turning of heat-resistant alloy
	TT6080	Gold	K05–K25			•	General machining of gray and ductile cast iron
			H05–H25			•	Finish and medium machining of hardened steel
	TT7010	Gold	P05–P25		•		Threading of steel
			K05–K25		•		Threading of cast iron
	TT7220	Gray	P25–P45			•	Parting, grooving and turn grooving of steel
			M25–M45			•	Parting, grooving and turn grooving of stainless steel
	TT8010	Gold	P30–P50		•		For a wide range of threading on low carbon steel and low carbon alloyed steel
			M30–M50		•		For a wide range of threading on stainless steel and exotic materials
			S30–S50		•		Toughest grade in threading product line
	TT8020	Gray	P30–P50	•		•	Interrupted and rough machining of steel
			M30–M50	•		•	Interrupted and rough machining of stainless steel
			S30–S50	•		•	Low speed and interrupted machining of heat-resistant alloy
	TT8080	Gold	M30–M50	•			Excellent performance for stainless steel at low cutting speed and interrupted turning
			S30–S50	•			Excellent performance for heat resistant alloys at low cutting speed and interrupted turning
	TT9020	Gray	P20–P40	•			For small parts turning on steel
			M20–M40	•			General machining of stainless steel
	TT9080	Gold	P20–P40			•	General machining of steel
			M20–M40	•		•	General machining of stainless steel
			S20–S40	•		•	General machining of heat-resistant alloy

	Grade	Color	ISO range	Turning	Threading	Grooving	Workpiece material and application
Carbide	K10	Metal	K05–K15	•		•	General machining of cast iron
			N05–N15	•		•	General machining of aluminum alloys and non-ferrous materials
			S05–S15	•		•	General machining of heat-resistant alloy
Cermet	PV3010	Gold	P05–P20	•		•	High speed finish machining of carbon steel, alloyed steel, mild steel, mold steel and free cutting steel
			M05–M20	•		•	High speed finishing of stainless steel
			K05–K20	•		•	High speed finishing of cast iron
	CT3000	Metal	P10–P20	•		•	Finish machining of carbon steel, alloyed steel, mild steel and mold steel. Good surface roughness
			M10–M20	•		•	Finish machining of stainless steel. Good surface roughness
			K10–K20	•		•	Finish machining of cast iron
Coated ceramic	AB2010	Gold	H01–H10	•			High speed turning of hardened steel. Shiny yellow color
	SC10	Gold	K20–K30	•			Roughing of cast iron with and without coolant
Ceramic	AW120	Blue	K01–K10	•			High speed continuous turning of cast iron. Excellent wear resistance
	AB20	Black	H01–H10	•			Turning of high hardness steel and cast iron (HRC 50-65)
	AB30	Black	K05–K15	•		•	Continuous to light interrupted turning of cast iron without coolant
			H05–H15	•		•	High speed turning of hardened steel (HRC 40-50)
	AS500	Gray	K10–K20	•		•	Roughing of cast iron with and without coolant
	AS10	Gray	K20–K30	•		•	Turning of cast iron
	AS20	Brown	S05–S20	•			High speed turning of superalloy
	TC430	Green	S01–S15	•		•	High speed turning of superalloy. Whisker ceramics
	TC3020	White	S15 – S25	•			General turning of super alloys
	TC3030	Black	S25 – S35	•			Rough turning of super alloys
CBN	TB610	Dark gray	H01–H10	•		•	Continuous turning of case hardened steel
	TB650	Dark gray	H10–H20	•		•	General turning of case hardened steel
	TB670	Dark gray	H15–H25	•		•	General turning of hardened steel
	TB730	Dark gray	K15–K25	•		•	High speed precision turning of cast iron in continuous cut and interrupted cut
			S05–S20	•		•	Severe interrupted turning of heat-resistant alloy
	TB2015	Dark gray	H10–H20	•			Light interrupted turning of hardened steel
	TB7015	Dark gray	K10 – K20	•			High speed turning of cast iron
			H25 – H35			•	General turning of carbide roll
	TB7020	Dark gray	K10 – K25				High speed and light interrupted turning of cast iron
	KB90A	Dark gray	K10–K25	•			High speed precision turning of cast iron
PCD	KP300	Black	N10–N20	•		•	General turning of non-ferrous materials
	TD810		N05 – N15	•			Bi-modal composition for high speed turning of non-ferrous materials, high Si aluminum alloy, ceramic and sintered tungsten carbide
	TD830		N20 – N35	•			Low Si aluminum alloys and composite plastics

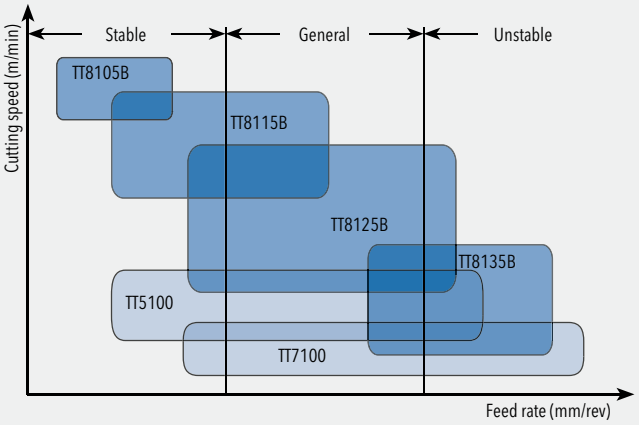
Grades

Application	Grade	ISO					
Turning	TT3005				S05–S20		Harder
	TT3010				S05–S25		
	TT3020				S10-S30		
	TT7005			K01-K15			
	TT7015			K10-K25			
	TT7025			K10–K25			
	TT8105	P01-P15					
	TT8115	P05-P20					
	TT9215		M05-M20		S05-S20		
	TT5080		M05-M25		S05-S25		
	TT8125	P15-P30					
	TT5100	P20-P35					
	TT9225		M15-M30		S15-S30		
	TT9020	P20-P40	M20-M40				
	TT9080		M20-M40		S20-S40		
	TT8135	P25-P40					
	TT7100	P30-P45					
	TT9235		M25-M40		S25-S40		
	TT8080		M30-M50		S30-S50		
	TT8020	P30-P50	M30-M50		S30-S50		Tougher
Threading	TT7010	P05-P25		K05-K25			Harder
	TT9030	P20-P40	M20-M40		S20-S40		
	TT8010	P30-P50	M30-M50		S30-S50		Tougher
Grooving	TT6080			K05-K25		H05-H25	Harder
	TT9100	P10-P25					
	TT5100	P20-P35	M20-M35				
	TT9080	P20-P40	M20-M40		S20-S40		
	TT7220	P25-P45	M25-M45				
	TT8020	P30-P50	M30-M50		S30-S50		Tougher

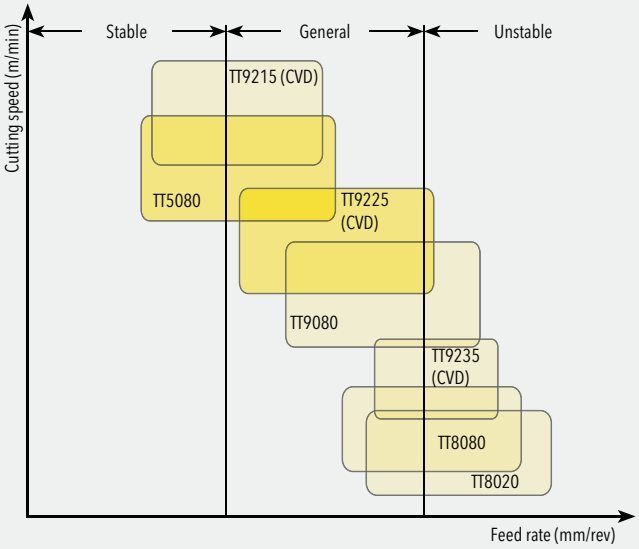


Notes

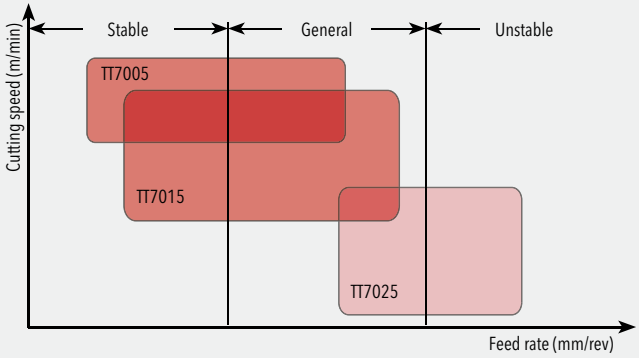
For steel (CVD coated)



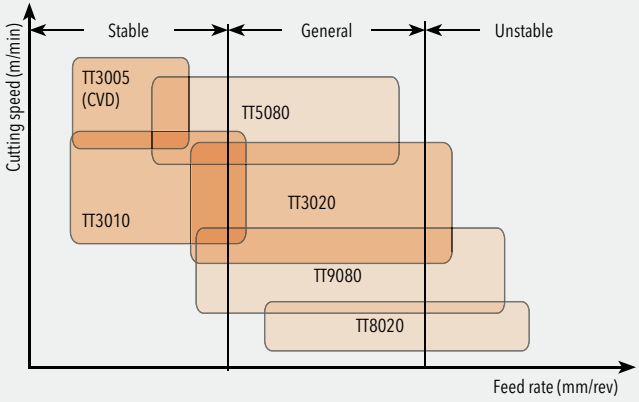
For stainless steel (CVD & PVD coated)



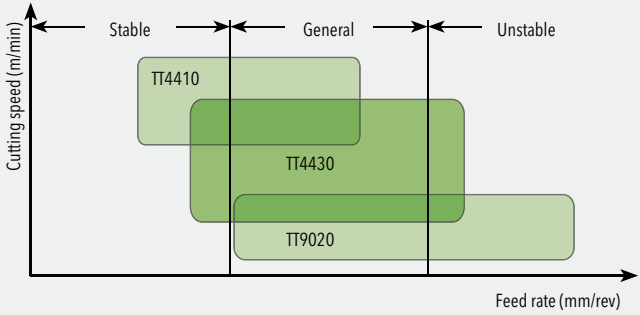
For cast iron (CVD coated)



For super alloys (CVD & PVD coated)



For small parts machining (PVD coated)



Turning insert designation system

C
Shape

C

D

E

H

K

R

S

T

V

W

N
Clearance angle

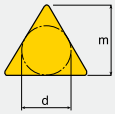
N

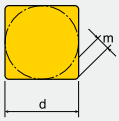
B

C

P

M
Tolerance





	m	t	d
A	±0.005	±0.025	±0.025
F	±0.005	±0.025	±0.013
C	±0.013	±0.025	±0.025
H	±0.013	±0.025	±0.013
E	±0.025	±0.025	±0.025
G	±0.025	±0.13	±0.025
M	±0.08 - ±0.18	±0.13	±0.05 - ±0.13
U	±0.13 - ±0.38	±0.13	±0.08 - ±0.25

Diameter of IC	Tolerance for m	
	Class M	Class U
6.35	±0.08	±0.13
9.52	±0.08	±0.13
12.70	±0.13	±0.20
15.88	±0.15	±0.27
19.05	±0.15	±0.27
25.40	±0.18	±0.38
31.75	±0.18	±0.38
	for d	
	Class M	Class U
6.35	±0.05	±0.08
9.52	±0.05	±0.08
12.70	±0.08	±0.13
15.88	±0.10	±0.18
19.05	±0.10	±0.18
25.40	±0.13	±0.25
31.75	±0.13	±0.25

G
Type

A

G

M

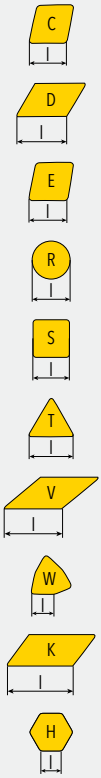
R

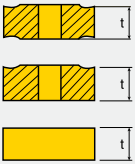
B, W

T, H

Z, X Special

12	04	08	(R)	MP
Cutting edge length	Thickness	Corner radius	Holder version	Chipbreaker designation





01 = 1.59 mm
T1 = 1.98mm
02 = 2.38mm
T2 = 2.78mm
03 = 3.18mm
T3 = 3.97mm
04 = 4.76mm
05 = 5.56mm
06 = 6.35mm
07 = 7.94mm
09 = 9.52mm

01	r= 0.1
02	r= 0.2
04	r= 0.4
05	r= 0.5
08	r= 0.8
12	r= 1.2
16	r= 1.6
20	r= 2.0
24	r= 2.4
32	r= 3.2

Right hand

Left hand

See chipbreaker tables starting on page 30

Tool holder designation system

P – Clamping system

B, P, H
Lever lock

C
Top clamp

S
Screw clamp

M
Multi lock

T, D
Double clamp

W
Wedge clamp

C – Insert shape

C

D

E

H

K

R

S

T

V

W

L – Approach angle

Symbol	Shape	Offset
A	90° / 90°	×
B	75°	×
D	45°	×
E	60°	×
F	90°	0
G	90° / 90°	0
J	93°	0
K	75°	0
L	95°	0
M	50°	×
N	63°	×
R	75°	0
S	45°	0
T	60°	0
U	93°	0
V	72,5°	×
W	60°	0
X	SPECIAL	
C*	90°	×
H*	107,5°	0
Q*	45°	0

Note: 0 = I.S.O.,
× = Ingersoll standard

N – Insert clearance angle

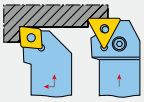
N

B

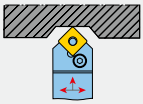
C

P

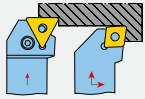
R – Holder version



Right hand



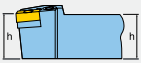
Neutral



Left hand

25

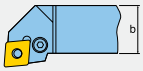
Shank height



Integers to be preceded by 0
e.g.: h=8mm
indicated by 08

25

Shank width



Integers to be preceded by 0
e.g.: b=8mm
indicated by 08

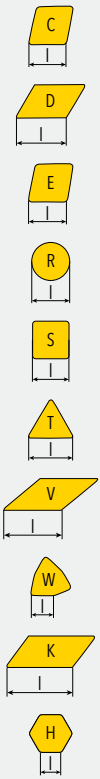
M

Tool length

Symbol	L (mm)
A	32
B	40
C	50
D	60
E	70
F	80
G	90
H	100
J	110
K	125
L	140
M	150
N	160
P	170
Q	180
R	200
S	250
T	300
U	350
V	400
W	450
Y	500
X	SPECIAL

12

Cutting edge length



Manufacturer's type

Determined by manufacturer

Boring bar designation system

S	32	S	–	C	T
Boring bar	Bar diameter	Tool length		Clamping system	Insert shape

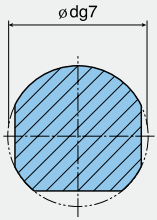
S: Steel shank

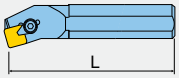
A: Coolant through steel shank

C: Carbide shank

E: Coolant through carbide shank

X: Special





K	125
M	150
Q	180
R	200
S	250
T	300
U	350
V	400
W	450
Y	500
X	SPECIAL

B, P, H
Lever lock

C
Top clamp

S
Screw clamp

M
Multi lock

T, D
Double clamp

W
Wedge clamp

C

D

E

H

K

R

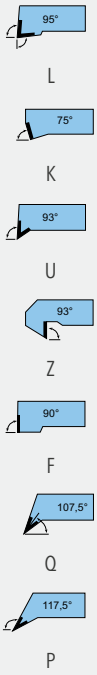
S

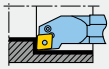
T

V

W

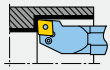
F	P	R	–	16	–	
Approach angle	Insert clearence angle	Holder version		Cutting edge length		Manufacturer's type





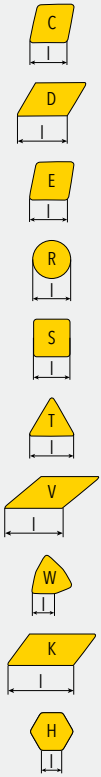
Right hand

Left handed insert used



Left hand

Right handed insert used

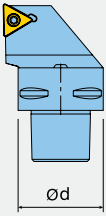


Determined by manufacturer

C-Adapter designation system

C4 – T – C – L – N

C4 – C-Adapter



Symbol	Ød (mm)
C4	40
C5	50
C6	63
C8	80

T – Clamping system

B, P, H
Lever lock

C
Top clamp

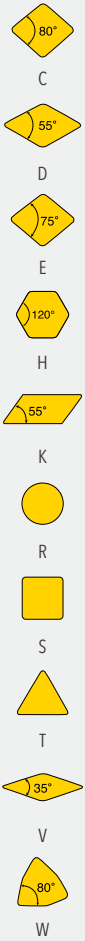
S
Screw clamp

M
Multi lock

T, D
Double clamp

W
Wedge clamp

C – Insert shape

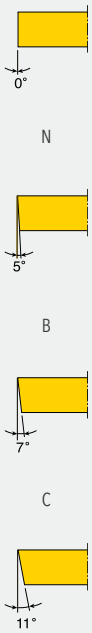


L – Approach angle

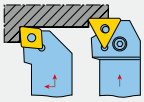
Symbol	Shape	Offset
A	90° / 90°	×
B	75°	×
D	45°	×
E	60°	×
F	90°	0
G	90° / 90°	0
J	93°	0
K	75°	0
L	95°	0
M	50°	×
N	63°	×
R	75°	0
S	45°	0
T	60°	0
U	93°	0
V	72,5°	×
W	60°	0
X	SPECIAL	
C*	90°	×
H*	107,5°	0
Q*	45°	0

Note: 0 = I.S.O. ,
× = Ingersoll standard

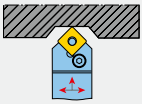
N – Insert clearance angle



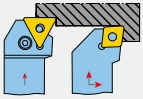
R	27	055	–	09	–	
Holder version	Classification of tool	Tool length		Cutting edge length		Manufacturer's type



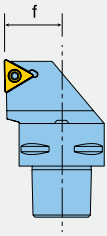
Right hand

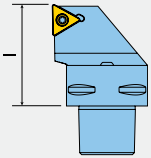


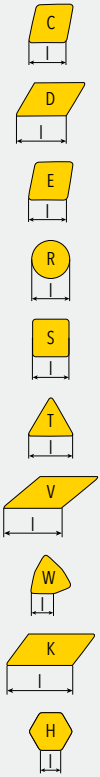
Neutral



Left hand



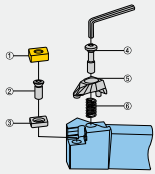




Determined by manufacturer

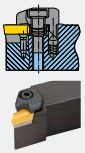
Clamping system

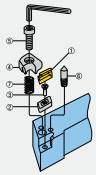
T-holder type(T)



1. Insert
2. Shim screw
3. Shim
4. Clamp screw
5. Clamp
6. Spring

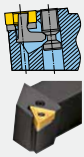
Top clamp type (C)

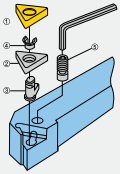




1. Insert
2. Shim
3. Shim screw
4. Clamp
5. Clamp screw
6. Pin and spring
7. Clamp spring

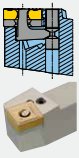
Lever lock type (P)

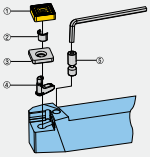




1. Insert
2. Shim
3. Hool lever
4. Shim pin
5. Clamp screw

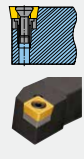
Hook lever type (H)

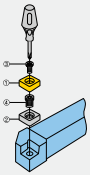




1. Insert
2. Shim pin
3. Shim
4. Hook lever
5. Screw

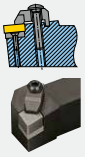
Screw clamp type (S)

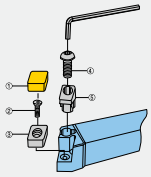




1. Insert
2. Shim
3. Screw
4. Shim screw

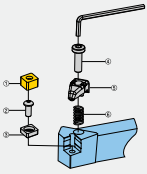
Ceramic T-holder (T)





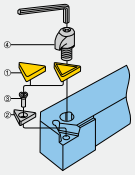
1. Insert
2. Shim screw
3. Shim
4. Clamp screw
5. Clamp

Ceramic dimple holder (T)



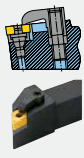
1. Insert
2. Shim screw
3. Shim
4. Clamp screw
5. Clamp
6. Spring

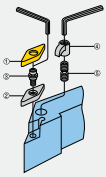
Wedge clamp type (W)



1. Insert
2. Shim
3. Shim screw
4. Wedge set

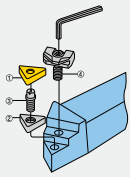
Multi lock type(M)





1. Insert
2. Shim
3. Lock pin
4. Clamp
5. Clamp screw

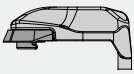
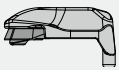
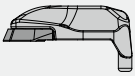
Wedge clamp type (W)

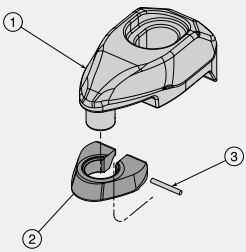


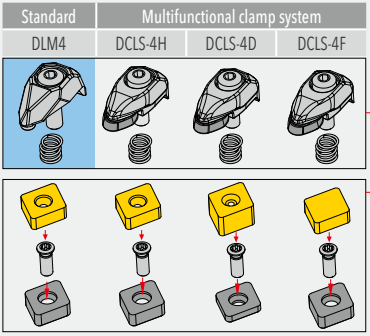
1. Insert
2. Shim
3. Clamp screw
4. Clamp

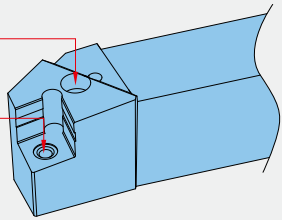
Clamping system / Tightening torque

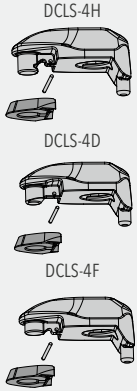
Multifunctional clamp system

Clamp	Designation	Component			Insert	Shim
		① Clamp	② CTC-Plate	③ Pin		
	DCLS-4H	DCL 4H	DCL 4-PL	PIN 0683	CN_A 1204	TSC 44
					DN_A 1504	TSD 44
					DN_A 1506	TSD 43
					SN_A 1204	TSS 44
	DCLS-4D	DCL 4D	DCL 4-PL	PIN 0683CV	CN_X 1207 CH	TSC 42
					DN_X 1507 CH	TSD 42
					SN_X 1207 CHX	TSS 42
	DCLS-4F	DCL 4F	DCL 4-PL	PIN 0683	CN_N 1204	TSC 44
					CN_N 1207	TSC 42
					DN_N 1504	TSD 44
					DN_N 1507	TSD 42
					SN_N 1204	TSS 44
					SN_N 1207	TSS 42









Tightening torque

Holder	Clamping screw	Torque (Nm)
PCLNR XXXX X12	LCS 4S	4
TCLNR XXXX X12	DLS	4.2
TCLNR XXXX X0904	DLS 3-NX	2
HCLNR XXXX X0904	LCS 3	3
LCL 08-NX	LCS 3-NX	3
LCL 09-NX	LCS 3	3
LCL 08B-NX	LCS 3B	2.5
LCL 09B-NX	LCS 3B	2.5
LCL 11-NX	LCS 4	4
LCL 11-NX	LCS 4S	4

for more tightening torques see "Screws & Tightening Torques" at the end of the technical manual for turning

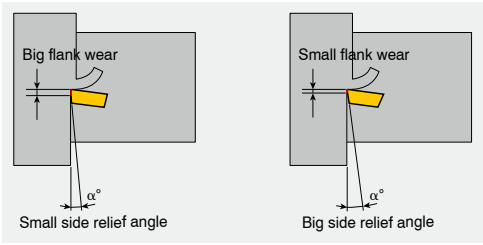
Angle

Side relief angle

Main effects
- Friction decrease between cutting edge and material

Bigger side relief angle
- Decreased flank wear
- Weak cutting edge
- For sticky materials

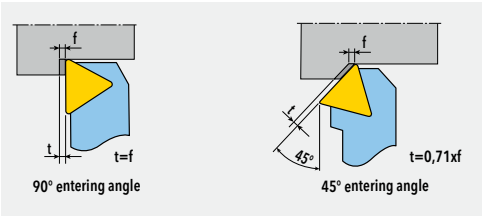
Recommendation
- Steel 5–7°
- Non ferrous materials 8–12°
- High hardness materials 4–5°



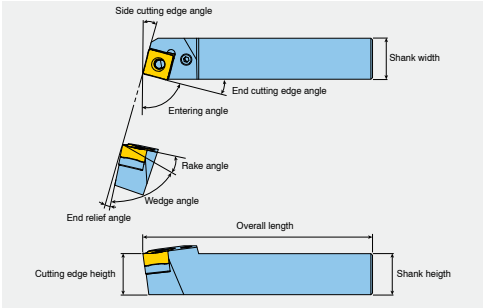
Entering angle æ

90° Entering angle
- Low radial force
- - For small part machining
- - Improved chip breaking
- - For finishing applications

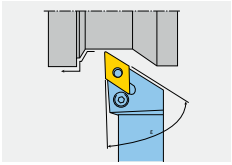
45° Entering angle
- Low impact load
- Changed feed force and radial force
- Changed thickness of chip
- higher tool-life
- higher feed rate



Angles at the cutting edge



End cutting edge angle ε

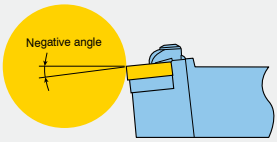


End cutting edge angle
- Strong cutting edge
- Increased vibration

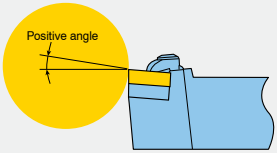
Small end cutting edge angle for roughing
Big end cutting edge angle for finishing

Three standard rake angles

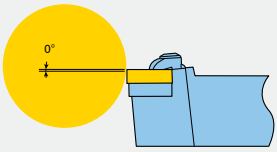
Negative rake angle
- Steel
- Cast iron



Positive rake angle
- Aluminum
- Copper
- High temp. alloys
- for vibration protection



Neutral rake angle

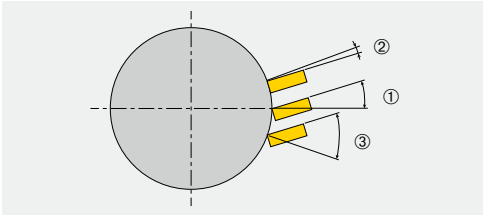


Angle / Seright insert size

Influence of the center height on the clearance angle

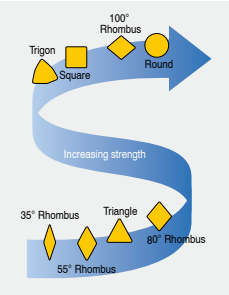
① General machining

Avoid
② Relief angle decrease:
Not easy to machine because of workpiece friction
③ Rake angle increase:
Easy to break because of high cutting force



Selecting insert shape

8 Basic insert shapes



Strong cutting edge
High cutting force

Weak cutting edge
Low cutting force

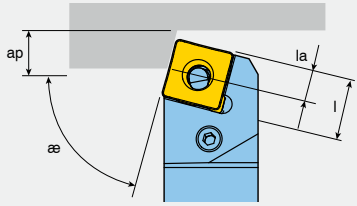
Cutting depth of different insert shape

The theoretical values below for the depth of cut are suitable for optimal cutting conditions (safe roughing without interruptions in cut). If the insert is only used for a short time (e.g. reworking a shoulder), the entire length of the cutting edge can be used. If the conditions change, for example an interrupted cut or an unstable set-up, the cutting depth should be corrected downwards accordingly.

C	D	K	R
			
la = 2/3 x l	la = 1/2 x l	la = 1/2 x l	la = 0,4 x iC
S	**T**	**V**	**W**
			
la = 2/3 x l	la = 1/2 x l	la = 1/4 x l	la = 3/4 x l

Seright insert size

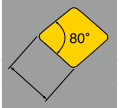
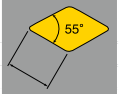
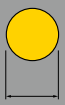
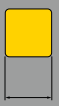
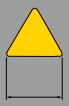
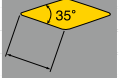
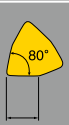
The cutting edge length (la) results from the shape of the insert, the entering angle (æ) of the tool holder and the cutting depth (mm) (ap). The optimum insert size can thus be determined theoretically using the table below.
In order to ensure reliable machining, the insert should be selected slightly larger than the real cutting depth (mm). Particular attention should be paid to this in suboptimal conditions to avoid insert breakage!



æ		ap (mm)										
		1	2	3	4	5	6	7	8	9	10	15
		la (mm)										
	90°	1	2	3	4	5	6	7	8	9	10	15
105°	75°	1.05	2.1	3.1	4.1	5.2	6.2	7.3	8.3	9.3	11	16
120°	60°	1.2	2.3	3.5	4.7	5.8	7	8.2	9.3	11	12	18
135°	45°	1.4	2.9	4.3	5.7	7.1	8.5	10	12	13	15	22
150°	30°	2	4	6	8	10	12	14	16	18	20	30
165°	15°	4	8	12	16	20	24	27	31	35	39	58

Insert size

The selection of the correct insert size depends on many factors.
For safe machining processes, the following depths of cut should be used depending on the insert size:

Insert shape		insert size	process-secure max. cutting depth ap (mm) 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16
C		04	
		06	
		09	
		12	
		16	
		19	
		25	
D		07	
		11	
		15	
R		06	
		08	
		10	
		12	
		15	
		16	
		19	
		20	
		25	
		32	
S		09	
		12	
		15	
		19	
		25	
		31	
		38	
T		06	
		11	
		16	
		22	
		27	
		33	
V		11	
		16	
		22	
W		06	
		08	

Technical informations

Feed rate

The feed is to be selected depending on the corner radius.
wThe feed ranges for the different corner radii are listed below.

Corner radius	Feed range
0.2 mm	f=0.05 – 0.15 mm/rev
0.4 mm	f=0.12 – 0.25 mm/rev
0.8 mm	f=0.25 – 0.50 mm/rev
1.2 mm	f=0.36 – 0.70 mm/rev
1.6 mm	f=0.50 – 1.00 mm/rev
2.4 mm	f=0.70 – 1.60 mm/rev

As a rule, the feed rate for roughing should be around half the corner radius.
The roughness of the machined surface can be influenced by the choice of the corner radius. See below

Surface quality

Roughness depth R in µm	$R_{t\,max}$	equates to R_a	roughness class. no.	ISO 1302
63–100	R_t100	12.5–25	N11	25
40–63	R_t63	6.3–25	N10	12.5
31.5–40	R_t40	4.9–6.3	N9	6.3
25–31.5	$R_t31.2$	4.0–4.9		
16–25	R_t25	2.5–4.0	N8	3.2
10–16	R_t16	1.6–2.5		
6.3–10	R_t10	1.0–1.6	N7	1.6

Surface quality

Achievable surface quality with standard radii
Select the largest possible corner radius according to the workpiece contour.
The larger the corner radius, the better the surface quality that can be achieved.

	corner radius mm 3-edged insert/ round insert Ø mm	Theoretical Ra / Rz values depending on feed rate and corner radius						Feed range depending on corner radius and kind of machining	
		Ra/Rz in µm						medium machining up to roughing	Finishing up to medium machining
		0.4/1.6	1.6/6.3	3.2/12.5	6.3/25	8/32	32/100	feed f in mm	
		feed f in mm							
	0.2	0.05	0.08	0.13	–	–	–	–	0.04–0.15
	0.4	0.07	0.11	0.17	0.22	–	–	–	0.07–0.22
	0.8	0.10	0.15	0.24	0.30	0.38	–	0.25–0.60	0.10–0.30
	1.2	–	0.19	0.29	0.37	0.47	–	0.35–0.85	0.20–0.40
	1.6	–	–	0.34	0.43	0.54	1.08	0.40–1.00	–
	2.4	–	–	0.42	0.53	0.66	1.32	0.50–1.2	–
	6	0.20	0.31	0.49	0.62	–	–	–	0.20–0.60
	8	0.23	0.36	0.56	0.72	–	–	–	0.23–0.70
	10	0.25	.040	0.63	0.80	1.00	–	–	0.25–0.80
	12	–	0.44	0.69	0.88	1.10	–	0.40–0.80	–
	16	–	0.51	0.80	1.01	1.26	2.54	0.50–1.00	–
	20	–	–	0.89	1.13	1.42	2.94	0.60–1.25	–
	25	–	–	–	1.26	1.58	3.33	0.70–1.50	–

Selection of the insert radius (e.g.: CNMG 1204 & DCMT 11T3

goals

- in finishing:
  Chip control and excellent surfaces
- in medium machining:
  excellent surface quality and productivity
- in roughing:
  stability and productivity

Classcification	Finishing	Medium	Roughing
recommended feed	1/4 x R	1/3 x R	1/2 x R

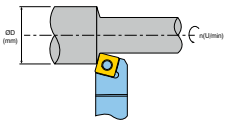
Cutting speed

High cutting speed

- Improved surface finish
- Increased productivity
- Low tool life

Low cutting speed

- Built-up-edge

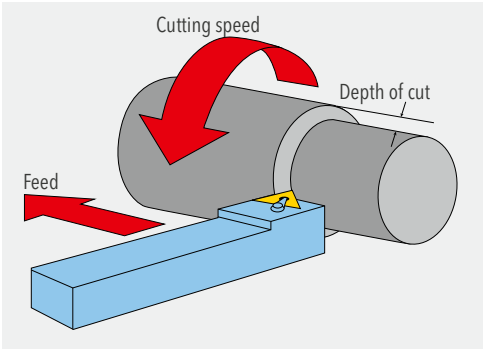


D: diameter of workpiece (mm)
n: rev./min

Influences on tool life

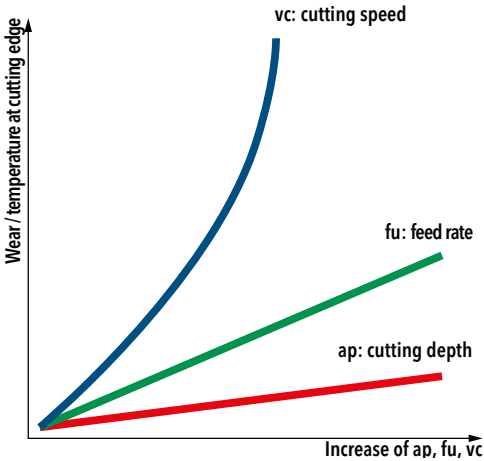
Machining parameters

- Cutting speed vc
- Feed fu
- Depth of cut ap



If x is increased by 50%, the tool life is reduced by	
x = Depth of cut (mm) (mm)	15%
x = Feed rate (mm/rev)	60%
x = Cutting speed (m/min)	90%

Tool life optimization



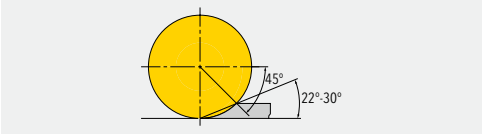
- Maximize depth of cut (mm):
  - Reduce number of cuts
- Maximize feed rate:
  - Shorter contact time
- Adjust cutting speed:
  - lower: less wear
  - higher: higher productivity

Measures against notch wear in superalloys

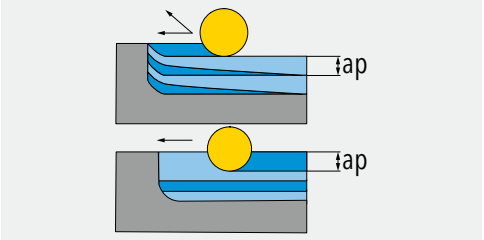
- Use round insert tools and pay attention to the ratio between the insert diameter and the depth of cut (mm)

6,35	0,889
9,52	1,397
12,70	1,905
19,06	2,794
25,40	3,81

- minimize entering angle



- Vary the cutting depth (mm) (so that the wear does not stick on the cutting edge)
- The depth of cut (mm) should be 15% of insert diameter (optimum)
- The depth of cut (mm) should be 25% of insert diameter (maximum)



- When machining forged skin, use lower depths of cut (mm)

Correct set-up of long workpieces

When machining long, slim workpieces without a tailstock or counter spindle, make sure that the clamping length does not exceed a length-to-diameter ratio of 2:1. If the workpiece is additionally supported by a tailstock center or a counter spindle, this rule of thumb can be exceeded.

It is recommended to use large entering angles, small radii and sharp cutting edges to avoid vibrations and runout.

Optimum machining results

Problem														
wear						workpiece problems				chip breakage				
flank wear	crater wear	chipping	plastic deformation	insert breakage	build-up edges	vibrations	hickey and burr formation	cambered surface	surface quality	chip too long (thread chips)	chips too short (broken chips)			
−−	−−		−−		−−	−			+	−		cutting speed	cutting parameters	remedies, course of action
~		−−	−	−−		+		−−	−−	++	−−	feed rate		
−	−−	−−	−				−−	−	−			feed rate (center area)		
		++	~		−−	~	−−	−−	−	−−	++	chipbreaker	selection of inserts	
++		++	++	+		−	−−	−	+			corner radius		
++	++	−−	++	−−								Grade		
		~		~		~		~	~			tool clamping	general criteria	
		~		~		~		~	~			workpiece clamping		
		~		~		~			−			overhang		
~		~				~	~		~			center height		
•	~		•		•		•		•	•		coolant		

Explanation:

++: increase, enlarge / high effective
+: increase, enlarge / low effective
~: check, optimize
−−: avoid, decrease / high effective
−: avoid, decrease / low effective
•: use

Chipbreaker

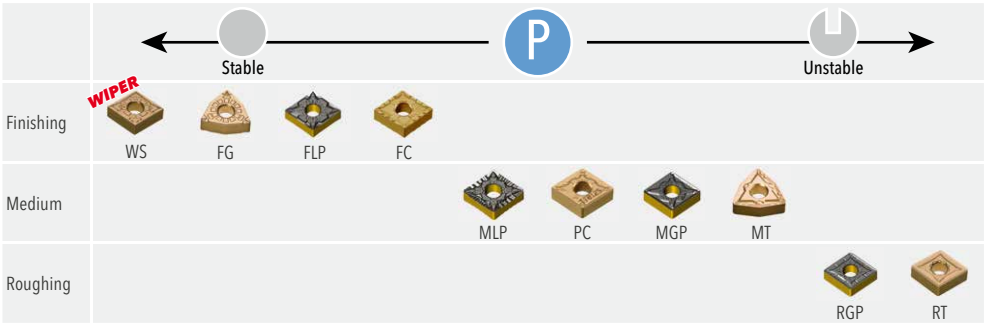
	No indication, chipbreaker for general machining
DNUX	Medium to light machining
EA	Finishing, exotic materials
EH	Heavy-duty machining
EM	Medium, stainless steel
ET	Roughing, exotic materials
FA	Super finishing
FC	Finishing, sharp
FF	Finishing to medium application
FG	General finishing, tight chipbreaker
FGS	Finishing, heat-resistant materials
FL	High positive aluminum geometry
FLP	Finishing
FS	Super finishing
FT	Finishing to medium application, strong cutting edge
GF	Super finishing
GU	Medium roughing, tough rake angle
GW	Super finishing
HB	Roughing, positive rake angle
HT	Roughing, tough rake angle, high feed
HY	Roughing, negative rake angle
HZ	Roughing, negative rake angle
KNUX	Roughing, positive cutting geometry
KT	Roughing, tough rake angle
MC	Medium, negative rake angle
MG-	Medium roughing, medium use

MGP	Medium machining
MGS	Medium to light machining, tough rake angle
MK	Medium application
ML	Medium to light machining, high positive rake angle
MLP	Medium machining
MM	Medium, large range
MP	Medium, positive rake angle
MT	Medium roughing, tough rake angle
PC	Medium machining
RA	Roughing, tough rake angle
RGP	Roughing
RH	Roughing, high feed
RH(N)	Roughing, positive rake angle
RT	Roughing, tough rake angle
RX	Roughing, positive rake angle
SA	Super finishing, high positive
SF	Finishing, stainless steel
SH	Finishing
SL	Finishing
SM	Finishing, stable cutting edge
SU	Medium roughing, tough rake angle for super alloys
VF	Vibration free
WA	Wiper insert
WS	Wiper insert, super finishing
WT	Wiper insert, medium roughing

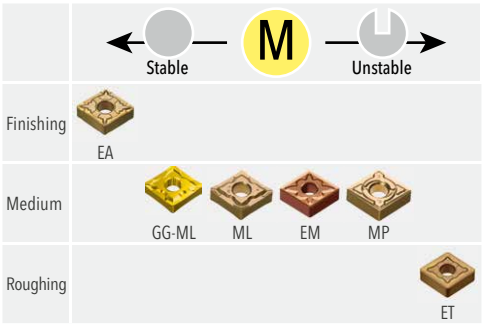
Recommendations for Chipbreakers

ISO Negative inserts

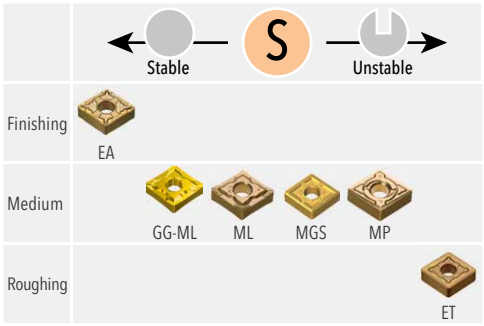
For steel



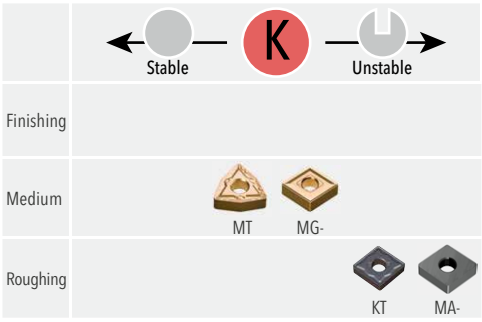
For stainless steel



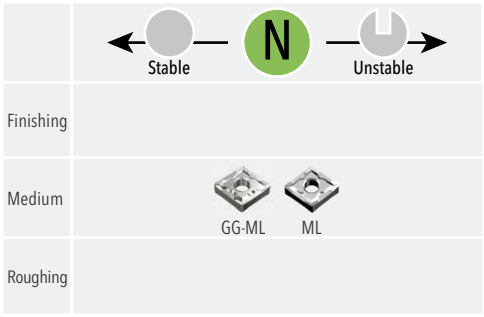
For super alloys



For cast iron



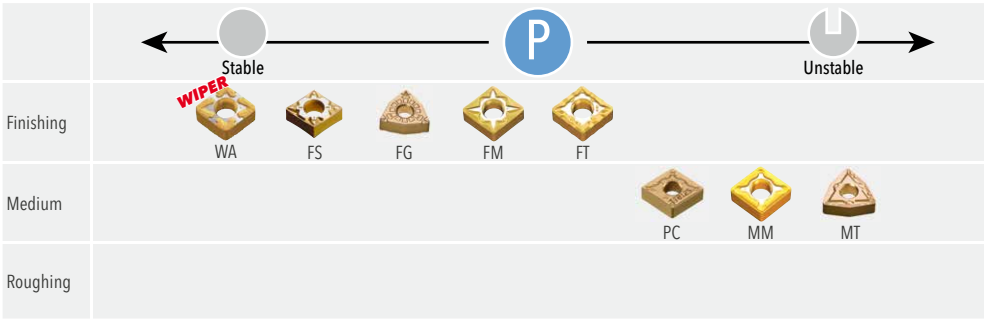
For aluminum



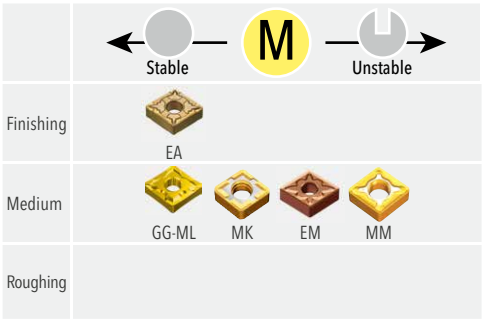
Recommendations for Chipbreakers

RhinoTurn Negative inserts

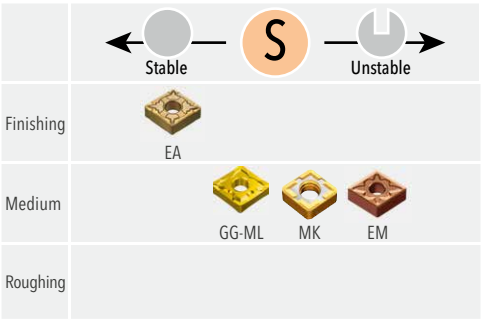
For steel



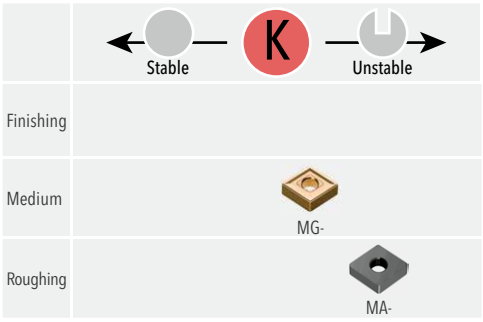
For stainless steel



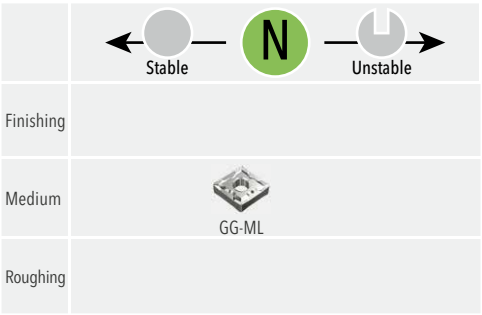
For super alloys



For cast iron



For aluminum



ISO Positive inserts

For steel

	Stable — P — Unstable
Finishing	FA, FG
Medium	FM, PC, MT
Roughing	

For stainless steel

	Stable — M — Unstable
Finishing	FA, FG
Medium	PC
Roughing	

For super alloys

	Stable — S — Unstable
Finishing	FG
Medium	PC
Roughing	

For cast iron

	Stable — K — Unstable
Finishing	
Medium	MT
Roughing	

For aluminum

	Stable — N — Unstable
Finishing	
Medium	GT-FL
Roughing	

Recommendations for Chipbreakers

Chipbreakers for Swiss turn (Ground type)

RhinoTurn Negative inserts

	Stable ← P M S → Unstable
Finishing	 VNGX-FS
Finishing-Medium	 DNGG-FU
Roughing	 GG-ML

ISO Positive inserts

	Stable ← P M S → Unstable
Finishing	 SL
Finishing-Medium	 SA  SM
Roughing	 SH

Chipbreaker

Negative insert

Chipbreaker designation and geometry					Machining and features
FS		CNMG 0904		A B	• For super finishing • Steel machining • Excellent chip control • Minimal vibration because of low machining load
FA		CNMG 1204		A B	• For super finishing • Steel, stainless steel and heat resistant alloy machining • Excellent chip control
EA		CNMG 1204		A B	• For finishing • Exotic materials • Excellent chip control at low feeds and depths of cut
FLP		CNMG 1204		A B	• For finishing applications for steel machining • Wide supporting area
FG		WNMG 0604		A B	• For finishing and semi finishing • Steel, stainless steel and cast iron machining • Low cutting forces
SF		CNMG 1204		A B	• For finishing • Stainless steel and heat resistant alloy machining • Low cutting forces
FX		VNMG 1604		A B	• For finishing • low carbon steel • Narrow chipbreaker for excellent chip control
FC		CNMG 1204		A B	• Ideal for finishing • Low carbon steel & low carbon alloy steel • Effective chip breaking in both turning and facing operations
FM		CNMG 0904		A B	• For medium machining to semi-finishing • Steel machining
MLP		CNMG 1204		A B	• For semi-finishing and medium applications on steel • Wave cutting edge
MC		CNMG 1204		A B	• For medium machining • Steel and cast iron machining • Strong rake geometry • Excellent chip control on medium turning machining
FT		CNMG 0904		A B	• For medium machining to semi-finishing • Steel machining • Serrated cutting edge
PC		CNMG 1204		A B	• For medium machining to semi-finishing • Steel & Automotive component • Positive geometry • Excellent chip control on medium machining
VF		DNMG 1504		A B	• For slender workpiece machining • Vibration free • Steel and stainless steel machining • High positive rake geometry to minimize cutting forces
MGS		CNMG 1204		A B	• Low cutting resistance and heat generation in high-temperature alloy maching • High rake angle for smooth chip formation
ML		CNMG 1204		A B	• For medium light machining • Stainless steel, steel and aluminum • Very high positive rake geometry to minimize built-up-edge and cutting forces
MP		CNMG 1204		A B	• For medium machining • Steel and stainless steel • High positive rake geometry to optimize machining and provide stable machining conditions

Chipbreaker

Negative insert

Chipbreaker designation and geometry					Machining and features
EM		CNMG 1204		A B	• For medium machining • Stainless steel machining • Sharp land design for low cutting force
MK		CNMG 09004		A B	• For medium machining • Stainless steel and heat resistant alloy machining • Sharp geometry to minimize builtup edge
MM		CNMG 0904		A B	• For general use • Steel and stainless steel machining • Positive rake angle
MGP		CNMG 1204		A B	• Wide range for medium application on steel • Wide groove and serveral dimples
MT		WNMG 0804		A B	• For medium rough machining • Steel, cast iron and stainless steel • Tough rake angle for general use
MG-		CNMG 1204		A B	• For medium rough machining • Steel and cast iron machining • Strong rake geometry • Suitable for manual lathes
ET		CNMG 1204		A B	• For roughing on exotic materials • Low cutting force • Wide chip control range when roughing
RGP		CNMG 1204		A B	• For roughing applications on steel • Reliable cutting edge with low cutting force
RT		CNMG 1906		A B	• For roughing • Steel and cast iron machining • Very strong rake geometry
KT		CNMG 1204		A B	• For roughing • Cast iron machining • Reliable, consistent performance
HB		CNMX 1607		A B	• For semi heavy rough machining • Steel and alloy steel machining • Double sided semiheavy turn insert • Stable contact surface with special seat
RH(N)		CNMM 1906		A B	• For high feed rough machining • Steel, cast iron and stainless steel machining • Very strong rake geometry
RX		CNMM 1906		A B	• For semi heavy rough machining • Steel, stainless steel and cast iron machining • Strong cutting edge with flat land • Low cutting force
RH		CNMM 1906		A B	• For roughing • Steel, stainless steel and cast iron machining • Very strong rake geometry
EH		CNMM 2509		A B	• For heavy rough machining on stainless steel • Low cutting force • Excellent chip control due to specialized chip breaker • One sided turn insert
HT		SNMM 1906		A	• For heavy rough machining • Low cutting force for low horse power machines • Excellent chip control due to changeable land and a flexible chipbreaker
HY		CNMM 2509		A B	• For heavy rough machining • For large depth of cut and high feed • Strong cutting edge credit to a wide land and large land angle

Negative insert

Chipbreaker designation and geometry					Machining and features
HZ		CNMM 2509		A B	• For heavy rough machining • For large depth of cut and high feed • Extremely strong cutting edge credit to a wide land and large land angle
WIPER WS		CNMG 1204		A B	• For super finishing • Steel, cast iron and stainless steel machining • Excellent chip control and low cutting forces
WIPER WA		CNMG 0904		A B	• For super finish applications • Steel, cast iron and stainless steel machining • Excellent surface roughnes after machining
WIPER WT		CNMG 1204		A B	• For medium machining to roughing • Steel, cast iron and stainless steel machining • Stable cut and low cutting forces at high feed rates

HNMG Type insert

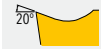
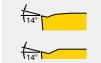
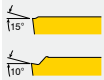
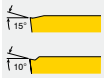
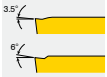
Chipbreaker designation and geometry					Machining and features
GU		HNMG 0504		A B	• For medium machining • For general turning of steels and cast irons • Strong rake geometry
SU		HNMG 0504		A B	• For exotic materials • Stainless steels, super alloys, low carbon steels, low carbon alloy steel machining • Sharp geometry to minimize builtup edge

Positive insert

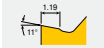
Chipbreaker designation and geometry					Machining and features
FA		DCMT 11T3		A B	• For super finishing • Very tight chipbreaker • Excellent chip control
FG		CCMT 09T3		A B	• For finishing to medium light machining • Steel and stainless steel machining • Low cutting forces • Excellent chip control
PC		CCMT 09T3		A B	• For medium machining • Suitable for a wide variety of materials • Low cutting force
MT		CCMT 09T3		A	• For medium to medium rough machining • Steel, stainless steel and cast iron machining • Negative rake geometry for general use
PMR-		TPMR 1103		A	• For medium to medium rough machining • Steel, stainless steel and cast iron • Positive rake geometry
RA		RCMX 3209		A	• For heavy and interrupted machining • Steel, stainless steel and cast iron machining • Optimized chip groove geometry
CMX-		RCMX 1204		A	• For high feed rough machining • Steel, stainless steel and cast iron machining • Strong rake geometry
WT		CCMT 09T3		A B	• For medium machining to roughing • Steel, cast iron and stainless steel machining • Stable cut and low cutting forces at high feed rates

Chipbreaker

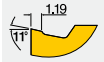
Positive insert – polished

Chipbreaker designation and geometry					Machining and features
FF		CCGT 0301		A	• For finish to medium machining • For small component machining • Excellent surface finish
GF		CCET 0602		A	• For super finish machining • Steel, stainless steel and alloy steel machining
GW		CCET 0602		A	• For super finish machining • Wiper geometry for good surface finish • Steel, stainless steel and alloy steel machining
FGS		VBGT 1604		A B	• For finishing • Heat resistant alloy machining
SL		CCGT 09T3		A B	• High performance in low depth of cut and low feed machining • Excellent chip segmentation due to wave geometry edge and special inclined design
SM		CCGT 09T3		A B	• 1st recommended chip breaker for Swiss type automatic lathe • Stable cutting edge and low cutting resistance
PC		CCGT 09T3		A B	• For medium machining • Suitable for a wide variety of materials • Low cutting force
FL		CCGT 1209		A	• For finish to medium machining • Aluminum machining • Very high positive rake geometry to minimize built-up edges
SA		CCGT 09T3		A B	• For finish to medium machining • Steel, stainless steel, super alloy machining • Low cutting force

DNUX type insert

Chipbreaker designation and geometry					Machining and features
11		DNUX 1304		A	• For medium machining with less than 5 mm depth of cut • Steel and stainless steel machining • Positive rake geometry to minimize cutting forces

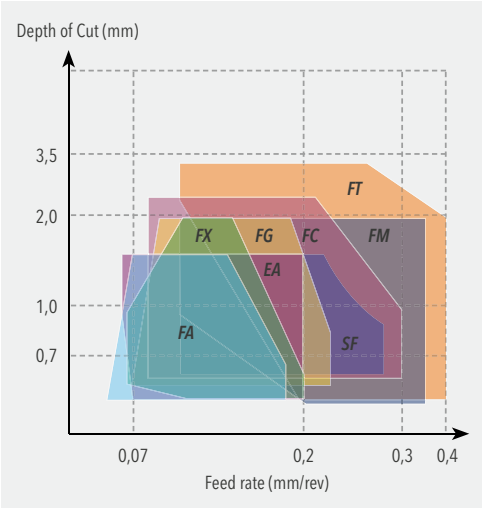
KNUX type insert

Chipbreaker designation and geometry					Machining and features
11		KNUX 1604		A	• For medium light to medium machining • Steel and stainless steel machining • Positive rake geometry to minimize cutting forces • Excellent chip control
12		KNUX 1604		A	• For medium to medium rough machining • Steel and stainless steel • Strong rake geomerty • Wide chip control range

Chipbreaker application range

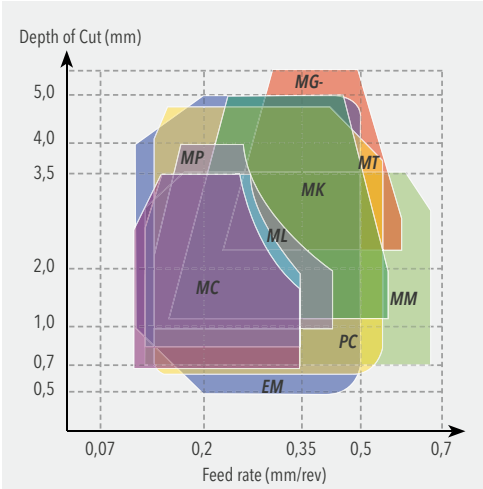
Negative inserts

For Finishing Applications



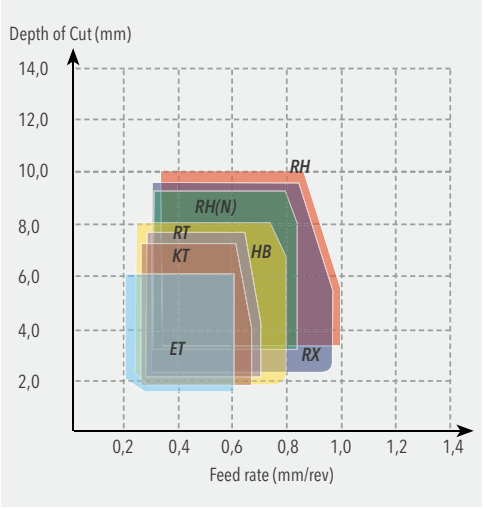
Example:
Material: C45
Cutting speed: Vc=200 m/min

For Medium Applications



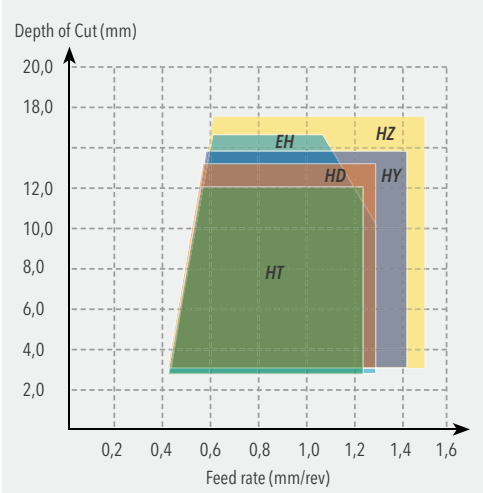
Example:
Material: C45
Cutting speed: Vc=200 m/min

For Roughing Applications



Example:
Material: C45
Cutting speed: Vc=200 m/min

For Heavy Machining

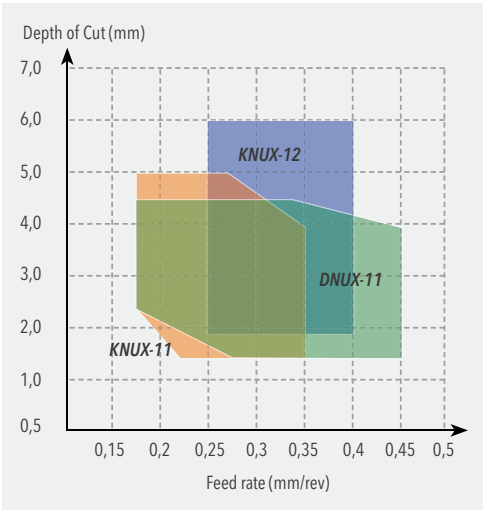


Example:
Material: C45
Cutting speed: Vc=200 m/min

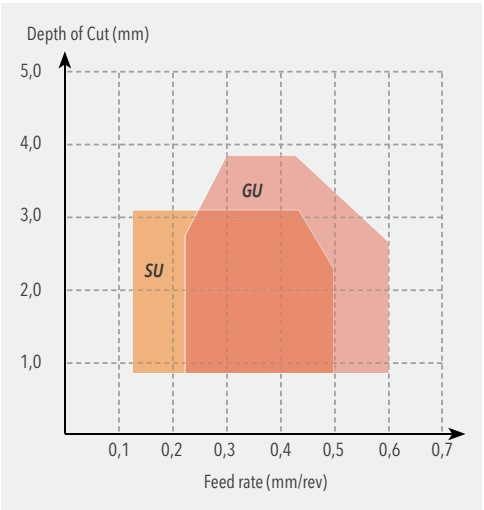
Chipbreaker application range

Negative Inserts

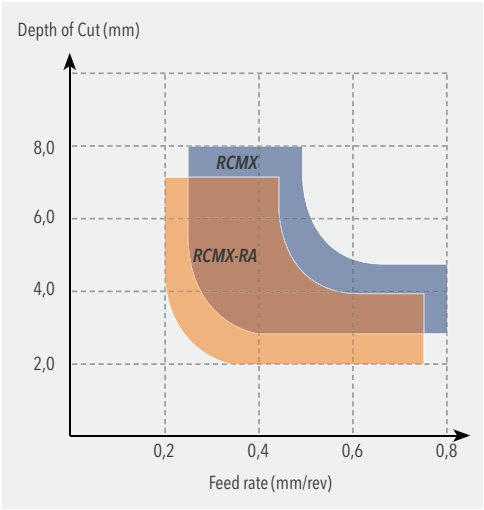
KNUX Type



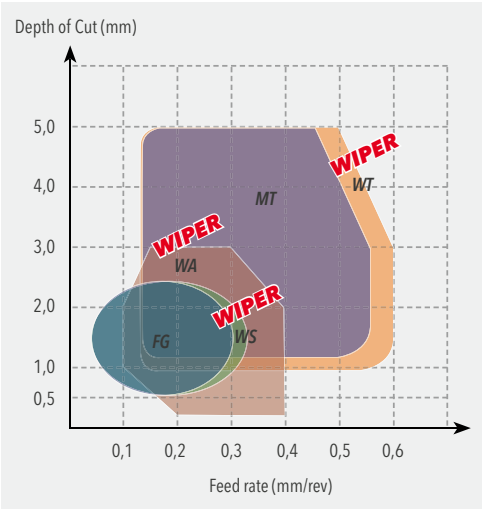
HNMG Type



Round Insert for Roughing Applications

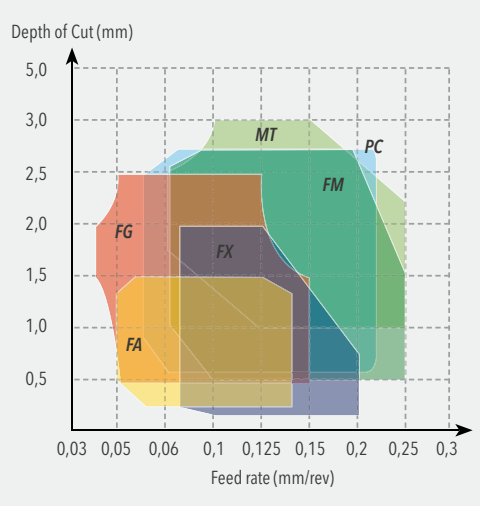


Wiper Insert

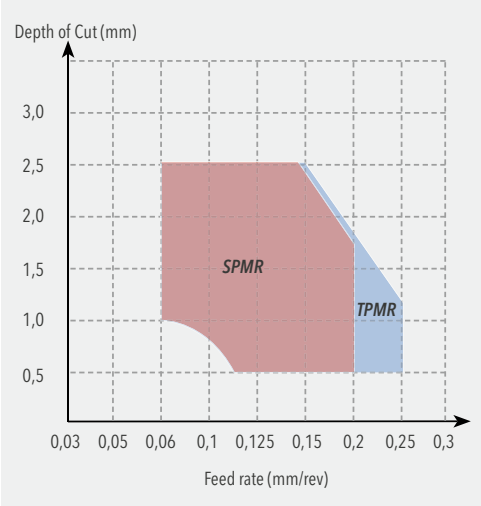


Positive Inserts

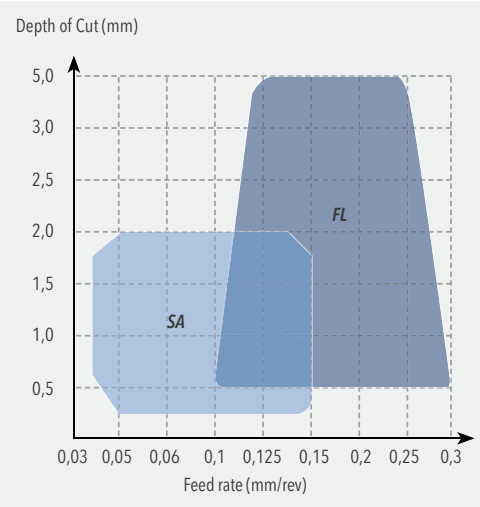
For Finish to Medium Applications



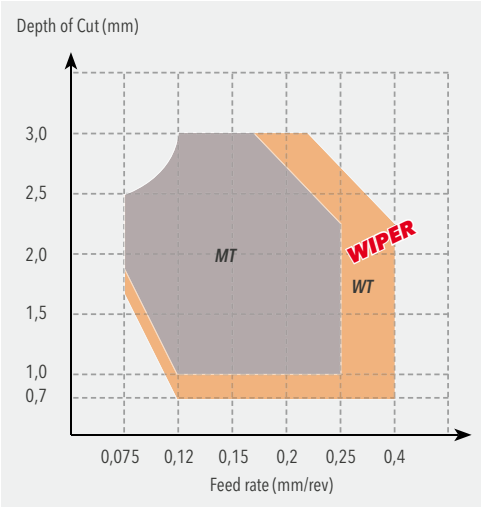
For Medium Applications



Ground Insert for Finishing Applications



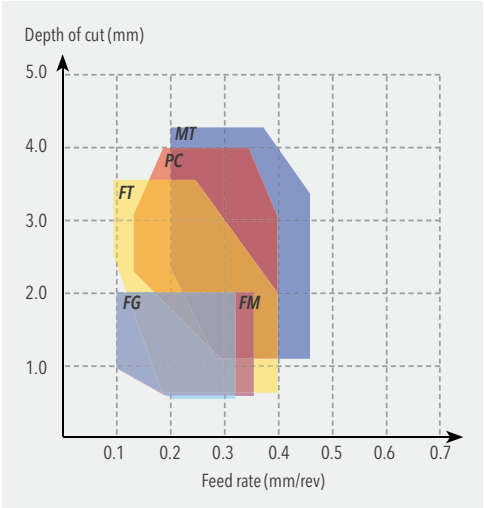
Wiper Insert



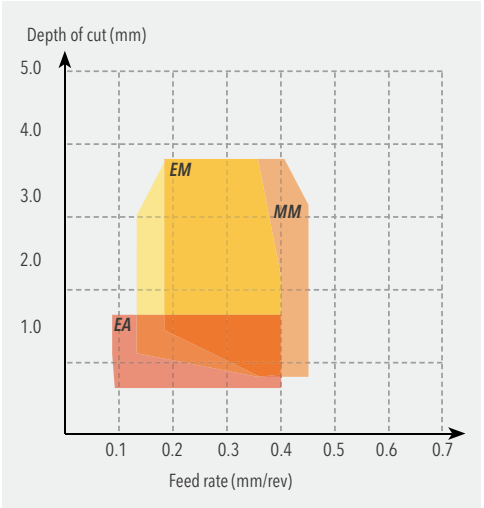
Chipbreaker apllication range / wiper inserts

RhinoTurn Insert

Chipbreaker for steel



Chipbreaker for stainless steel

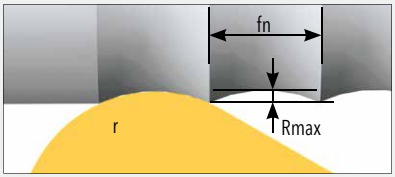


Wiper inserts

Technical Features & Advantages

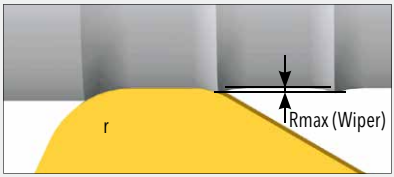
- Compared to standard inserts, the wiper insert achieves the same surface quality with double feed ranges
- With same feed rates, the RhinoTurn wiper insert achieves 2-3 times better surface quality
- Reliable surface roughness over a large feed range
- Increased productivity due to higher feed rates

Standard insert



conventional Radius
Rmax = fn^2 x 1000/8r

Wiper insert



Radius with large secondary cutting edge
Rmax (Wiper) = Rmax/2

Wiper insert

Please observe before use of wiper inserts:

Recommended combination of holder and wiper insert:
In order to achieve the full wiper effect of the insert, please combine holders and inserts as recommended in the table:

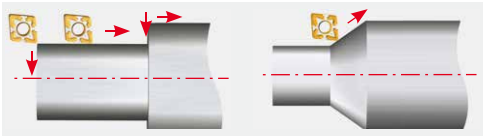
Tool holder	Wiper-Insert
Approach angle at 95°	CNMG-WA (80° corner), WNMX-WA
Approach angle at 75°	CNMG-WA (100° corner)
Approach angle at 93°	DNMG-WA
Approach angle at 91°	TNMG-WA

Only with these combinations of holders and wiper inserts the optimal wiper effect can be achieved during machining.

Application

Effective application
- Machining of straight surfaces parallel or perpendicular to the center line of the workpiece

Ineffective application
- Machining of conical or curved surfaces

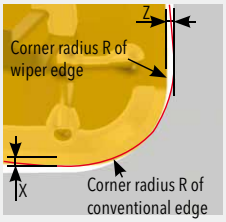


* Due to the vibrations that occur, the use of wiper inserts is not recommended for internal machining on large overhangs

Insert cutting edge height

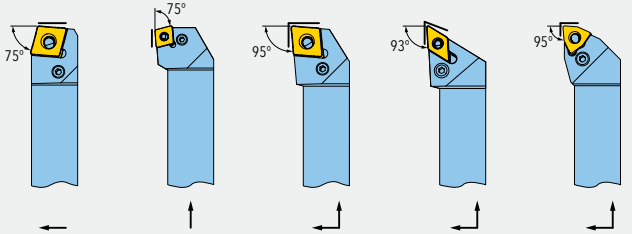
To adjust the height of the wiper insert's cutting edge to the same height as the standard insert, the following correction values must be used:

Deviation from adjusting position				
Insert type	Corner radius R	Designation	X (mm)	Z (mm)
C & W (80°)	0.4	CNMG 090404 WA WNMX 060404 WA	0.03	0.03
	0.8	CNMG 090408 WA WNMX 060408 WA	0.03	0.03
	1.2	CNMG 090412 WA WNMX 060412 WA	0.05	0.05
C (100°)	0.4	CNMG 090404 WA	0.03	0
	0.8	CNMG 090408 WA	0.03	0
	1.2	CNMG 090412 WA	0.06	0
D (55°)	0.4	DNMG 130504 WA	0.02	0
	0.8	DNMG 130508 WA	0.05	0.01
	1.2	DNMG 130512 WA	0.07	0.02
T (60°)	0.4	TNMG 130404 WA	0.02	0
	0.8	TNMG 130408 WA	0.05	0.01
	1.2	TNMG 130412 WA	0.08	0.01



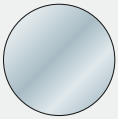
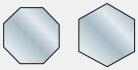
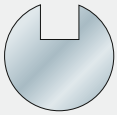
Cutting angle

By using wiper inserts (WS, WT, WA), high-quality surfaces can be achieved very cost-efficiently.



Choosing the right insert

Insert Geometry by Workpiece Shape

← sharp	Cutting edge strength	blunt →
FA-EA-FG-SF-FC-PC-VF-ML-EM-MP-MT-MC-MG-ET-RT-KT		
Workpiece types		Chipbreaker recommendation for medium to rough machining
		ML, MP, PC, MT
		MT, PC, MP, MC
		MC, MT, ET, MG-, KT, RT
 Severe interrupted cutting – Strong geometry required		RT, MC, MG-, MT, KT

CVD Cutting materials

CVD Cutting materials

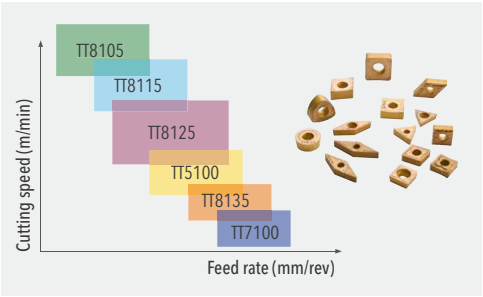
Features

- Excellent surface finish on the workpiece
- Improved adhesion and insert chipping resistance
- Stable and extended tool life in continuous and interrupted cutting operations
- Reduced cutting forces and minimized built-up edge on exotic materials

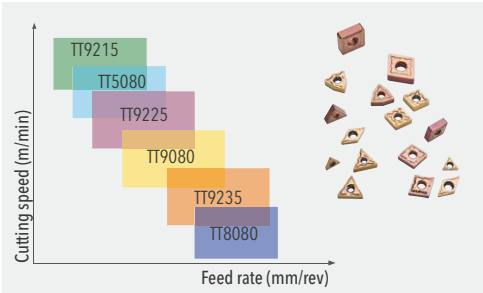
Type	Corner radius R	Designation
Black/Gold 	Steel	TT8105; TT8115; TT8125; TT8135
Magenta 	Stainless steel	TT9215; TT9225; TT9235; TT5080; TT9080; TT8080
	Superalloy	
Black 	Cast iron	TT7005; TT7015; TT7025

Chipbreaker application range

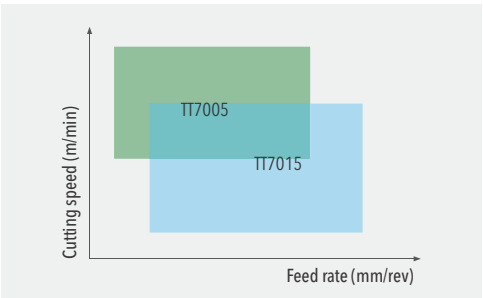
Steel



Stainless steel and superalloy



Cast iron



Recommended Cutting Conditions

Material			Condition	Tensile strength (N/mm2)	Hardness HB	Cutting speed Vc (m/min)				
						Coated				
						TT7005	TT7015	TT7025	TT8105	TT8115
P	Non-alloy steel, cast steel, free cutting steel	< 0,25% C	Annealed	420	125	–	–	–	310-580	280-530
		≥ 0,25% C	Annealed	650	190	–	–	–	270-530	240-480
		< 0,55% C	Quenched and tempered	850	250	–	–	–	230-490	200-440
		≥ 0,55% C	Annealed	750	220	–	–	–	250-500	220-450
			Quenched and tempered	1000	300	–	–	–	210-470	180-420
	Low alloy steel		Annealed	600	200	–	–	–	230-550	200-500
			Quenched and tempered	930	275	–	–	–	180-330	150-280
			Quenched and tempered	1000	300	–	–	–	160-300	130-250
			Quenched and tempered	1200	350	–	–	–	150-280	120-230
	High alloy steel, cast steel and tool steel		Annealed	680	200	–	–	–	210-420	190-380
			Quenched and tempered	1100	325	–	–	–	100-200	90-180
M	Stainless steel and cast steel		Ferritic/ martensitic	680	200	–	–	–	–	–
			Martensitic	820	240	–	–	–	–	–
			Austenitic	600	180	–	–	–	–	–
K	Gray cast iron (GG)		Ferritic	–	160	300-550	290-450	280-400	–	–
			Pearlitic	–	250	300-430	250-360	200-320	–	–
	Cast iron nodular (GGG)		Ferritic	–	130	160-400	150-350	140-300	–	–
			Pearlitic	–	230	140-350	130-300	120-280	–	–
	Malleable cast iron		Ferritic	–	180	200–460	250–390	230-350	–	–
			Pearlitic	–	260	180–350	200–320	180-300	–	–
N	Aluminum - wrought alloy		Not cureable	–	60	–	–	–	–	–
			Cured	–	100	–	–	–	–	–
	Aluminum cast, alloyed	> 12% Si	Not cureable	–	75	–	–	–	–	–
			Cured	–	90	–	–	–	–	–
		> 12% Si	High temp.	–	130	–	–	–	–	–
	Copper alloys	> 1% Pb	Free cutting	–	110	–	–	–	–	–
			Brass	–	90	–	–	–	–	–
			Electrolitic copper	–	100	–	–	–	–	–
	Non-metallic		Duroplastics, fiber plastics	–	–	–	–	–	–	–
			Hard rubber	–	–	–	–	–	–	–
S	High temp. alloys	Fe based	Annealed	–	200	–	–	–	–	–
			Cured	–	280	–	–	–	–	–
		Ni or Co based	Annealed	–	250	–	–	–	–	–
			Cured	–	350	–	–	–	–	–
			Cast	–	320	–	–	–	–	–
	Titanium, Ti alloys		–	Rm 400	–	–	–	–	–	–
		Alpha+beta alloys cured		Rm 1050	–	–	–	–	–	–
H	Hardened steel		Hardened	–	55 HRC	–	–	–	–	–
			Hardened	–	60 HRC	–	–	–	–	–
	Chilled cast iron		Cast	–	400 HRB	–	–	–	–	–
	Cast iron nodular		Hardened	–	55HRC	–	–	–	–	–

Cutting speed Vc (m/min)												
Coated												
TT8125	TT8135	TT9215	TT9225	TT9235	TT5100	TT7100	TT3005	TT5080	TT4410	TT3010	TT3020	TT9080
230-480	190-400	–	–	–	200-450	170-380	–	–	170-380	–	–	–
200-420	170-360	–	–	–	170-390	150-340	–	–	170-340	–	–	–
160-380	130-320	–	–	–	130-350	110-300	–	–	150-270	–	–	–
190-400	160-340	–	–	–	160-370	140-320	–	–	170-270	–	–	–
150-350	120-300	–	–	–	120-320	100-280	–	–	150-250	–	–	–
170-400	130-280	–	–	–	140-370	110-260	–	–	150-270	–	–	–
140-250	80-170	–	–	–	110-220	60-150	–	–	60-130	–	–	–
120-230	70-150	–	–	–	90-200	50-120	–	–	50-100	–	–	–
110-200	60-140	–	–	–	80-170	40-120	–	–	30-100	–	–	–
140-280	100-220	–	–	–	110-250	80-200	–	–	60-180	–	–	–
70-130	45-100	–	–	–	40-100	40-90	–	–	40-80	–	–	–
–	–	160-250	120-200	110-170	–	–	–	160-390	150-380	–	–	120-290
–	–	150-230	110-180	100-150	–	–	–	160-280	150-270	–	–	120-270
–	–	130-220	100-170	90-150	–	–	–	100-250	90-240	–	–	90-240
–	–	–	–	–	–	–	–	–	–	–	–	–
–	–	–	–	–	–	–	–	–	–	–	–	–
–	–	–	–	–	–	–	–	–	–	–	–	–
–	–	–	–	–	–	–	–	–	–	–	–	–
–	–	–	–	–	–	–	–	–	–	–	–	–
–	–	–	–	–	–	–	–	–	–	–	–	–
–	–	–	–	–	–	–	–	–	–	–	–	–
–	–	–	–	–	–	–	–	–	–	–	–	–
–	–	–	–	–	–	–	–	–	–	–	–	–
–	–	–	–	–	–	–	–	–	–	–	–	–
–	–	–	–	–	–	–	–	–	–	–	–	–
–	–	–	–	–	–	–	–	–	–	–	–	–
–	–	–	–	–	–	–	–	–	–	–	–	–
–	–	–	–	–	–	–	–	–	–	–	–	–
–	–	–	–	–	–	–	–	–	–	–	–	–
–	–	–	–	–	–	–	–	–	–	–	–	–
–	–	40-80	30-70	30-60	–	–	60-200	50-180	40-170	50-170	40-165	40-160
–	–	30-70	20-60	20-50	–	–	50-180	40-160	40-150	40-150	30-145	30-130
–	–	35-70	25-60	25-50	–	–	55-120	45-100	45-90	45-90	35-85	35-80
–	–	30-70	20-60	20-50	–	–	45-110	35-90	30-80	35-80	30-75	30-70
–	–	30-70	20-60	20-50	–	–	40-100	30-80	30-80	30-70	30-65	30-60
–	–	–	–	–	–	–	120-220	110-200	110-190	110-190	100-185	90-180
–	–	–	–	–	–	–	60-120	50-100	50-90	50-90	40-85	40-80
–	–	–	–	–	–	–	–	–	–	–	–	–
–	–	–	–	–	–	–	–	–	–	–	–	–
–	–	–	–	–	–	–	–	–	–	–	–	–
–	–	–	–	–	–	–	–	–	–	–	–	–

Recommended Cutting Conditions

Material			Condition	Tensile strength (N/mm2)	Hardness HB	Cutting speed Vc (m/min)				
						Coated				Uncoated
						TT4430	TT9020	TT8080	TT8020	K10
P	Non-alloy steel, cast steel, free cutting steel	< 0,25% C	Annealed	420	125	160-370	150-350	110-310	100-300	–
		≥ 0,25% C	Annealed	650	190	160-340	150-320	110-280	100-270	–
		< 0,55% C	Quenched and tempered	850	250	140-270	130-250	90-210	80-200	–
		≥ 0,55% C	Annealed	750	220	160-270	140-260	100-220	90-210	–
			Quenched and tempered	1000	300	140-250	130-230	90-190	80-180	–
	Low alloy steel		Annealed	600	200	140-270	130-250	90-210	80-200	–
			Quenched and tempered	930	275	60-130	50-130	40-120	40-120	–
			Quenched and tempered	1000	300	50-100	40-100	40-90	40-90	–
			Quenched and tempered	1200	350	30-100	30-100	30-90	30-90	–
	High alloy steel, cast steel and tool steel		Annealed	680	200	60-180	60-180	60-160	60-160	–
			Quenched and tempered	1100	325	40-80	40-80	40-80	40-80	–
M	Stainless steel and cast steel		Ferritic / martensitic	680	200	120-270	120-270	110-260	100-250	–
			Martensitic	820	240	120-250	120-250	110-240	100-230	–
			Austenitic	600	180	90-220	90-220	80-200	80-200	–
K	Gray cast iron (GG)		Ferritic	–	160	–	–	–	–	110-180
			Pearlitic	–	250	–	–	–	–	95-140
	Cast iron nodular (GGG)		Ferritic	–	130	–	–	–	–	95-135
			Pearlitic	–	230	–	–	–	–	90-125
	Malleable cast iron		Ferritic	–	180	–	–	–	–	110-140
			Pearlitic	–	260	–	–	–	–	90-125
N	Aluminum - wrought alloy		Not cureable	–	60	–	–	–	–	200-1000
			Cured	–	100	–	–	–	–	200-1000
	Aluminum cast, alloyed	> 12% Si	Not cureable	–	75	–	–	–	–	50-400
			Cured	–	90	–	–	–	–	50-500
		> 12% Si	High temp.	–	130	–	–	–	–	40-350
	Copper alloys	> 1% Pb	Free cutting	–	110	–	–	–	–	50-500
			Brass	–	90	–	–	–	–	50-500
			Electrolitic copper	–	100	–	–	–	–	30-300
	Non-metallic		Duroplastics, fiber plastics	–	–	–	–	–	–	50-300
			Hard rubber	–	–	–	–	–	–	50-150
S	High temp. alloys	Fe based	Annealed	–	200	40-160	–	30-80	20-70	55-85
			Cured	–	280	30-130	–	20-60	10-50	40-65
		Ni or Co based	Annealed	–	250	35-80	–	20-50	10-40	32-55
			Cured	–	350	30-70	–	20-40	10-30	21-40
			Cast	–	320	30-60	–	20-30	10-20	16-26
	Titanium, Ti alloys	–		Rm 400	–	90-180	–	80-160	70-150	50-75
		Alpha+beta alloys cured		Rm 1050	–	40-80	–	30-50	20-40	45-70
H	Hardened steel		Hardened	–	55 HRC	–	–	–	–	–
			Hardened	–	60 HRC	–	–	–	–	–
	Chilled cast iron		Cast	–	400 HRB	–	–	–	–	–
	Cast iron nodular		Hardened	–	55HRC	–	–	–	–	–

Cutting speed Vc (m/min)												
Cermet		Ceramic										PCD
PV3010	CT3000	AW120	AB2010	AB20	AB30	TC430	TC3020	TC3030	AS500	SC10	AS10	TD810
350-650	300-570	-	-	-	-	-	-	-	-	-	-	-
270-520	250-500	-	-	-	-	-	-	-	-	-	-	-
240-480	220-460	-	-	-	-	-	-	-	-	-	-	-
260-500	240-470	-	-	-	-	-	-	-	-	-	-	-
240-460	220-440	-	-	-	-	-	-	-	-	-	-	-
240-540	220-520	-	-	-	-	-	-	-	-	-	-	-
190-330	170-300	-	-	-	-	-	-	-	-	-	-	-
170-300	150-270	-	-	-	-	-	-	-	-	-	-	-
140-270	130-250	-	-	-	-	-	-	-	-	-	-	-
260-405	250-395	-	-	-	-	-	-	-	-	-	-	-
140-205	130-195	-	-	-	-	-	-	-	-	-	-	-
200-300	180-270	-	-	-	-	-	-	-	-	-	-	-
200-270	170-250	-	-	-	-	-	-	-	-	-	-	-
170-260	150-240	-	-	-	-	-	-	-	-	-	-	-
230-330	220-320	-	-	-	600-1200	-	-	-	600-1000	500-900	500-900	-
215-290	205-280	-	-	-	500-900	-	-	-	550-900	450-800	450-800	-
145-220	135-200	600-1200	-	-	450-610	-	-	-	400-650	345-580	345-580	-
105-150	95-140	500-900	-	-	350-510	-	-	-	300-550	250-480	250-480	-
170-265	160-255	600-800	-	-	600-800	-	-	-	550-800	500-740	500-740	-
180-240	170-230	500-700	-	-	500-700	-	-	-	450-750	400-640	400-640	-
-	-	-	-	-	-	-	-	-	-	-	-	300-2500
-	-	-	-	-	-	-	-	-	-	-	-	300-2500
-	-	-	-	-	-	-	-	-	-	-	-	200-1500
-	-	-	-	-	-	-	-	-	-	-	-	200-1500
-	-	-	-	-	-	-	-	-	-	-	-	80-1000
-	-	-	-	-	-	-	-	-	-	-	-	60-600
-	-	-	-	-	-	-	-	-	-	-	-	60-600
-	-	-	-	-	-	-	-	-	-	-	-	30-400
-	-	-	-	-	-	-	-	-	-	-	-	100-1000
-	-	-	-	-	-	-	-	-	-	-	-	100-600
-	-	-	-	-	-	-	200-350	150-250	-	-	-	-
-	-	-	-	-	-	-	200-350	150-250	-	-	-	-
-	-	-	-	-	-	270-400	200-350	150-250	-	-	-	-
-	-	-	-	-	-	230-330	200-350	150-250	-	-	-	-
-	-	-	-	-	-	210-300	200-350	150-250	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	95-145	90-140	50-100	-	-	-	-	-	-	-
-	-	-	-	-		-	-	-	-	-	-	-
-	-	-	-	-	60-120	-	-	-	-	-	-	-
-	-	-	-	-	50-100	-	-	-	-	-	-	-

Recommended Cutting Conditions

Material			Condition	Tensile strength (N/mm2)	Hardness HB	Cutting speed Vc (m/min)				
						PCD		CBN		
						KP300	TD830	TB610	TB2015	TB650
P	Non–alloy steel, cast steel, free cutting steel	< 0,25% C	Annealed	420	125	–	–	–	–	–
		≥ 0,25% C	Annealed	650	190	–	–	–	–	–
		< 0,55% C	Quenched and tempered	850	250	–	–	–	–	–
		≥ 0,55% C	Annealed	750	220	–	–	–	–	–
			Quenched and tempered	1000	300	–	–	–	–	–
	Low alloy steel		Annealed	600	200	–	–	–	–	–
			Quenched and tempered	930	275	–	–	–	–	–
			Quenched and tempered	1000	300	–	–	–	–	–
			Quenched and tempered	1200	350	–	–	–	–	–
	High alloy steel, cast steel and tool steel		Annealed	680	200	–	–	–	–	–
			Quenched and tempered	1100	325	–	–	–	–	–
M	Stainless steel and cast steel		Ferritic / martensitic	680	200	–	–	–	–	–
			Martensitic	820	240	–	–	–	–	–
			Austenitic	600	180	–	–	–	–	–
K	Gray cast iron (GG)		Ferritic	–	160	–	–	–	–	–
			Pearlitic	–	250	–	–	–	–	–
	Cast iron nodular (GGG)		Ferritic	–	130	–	–	400–800	350–700	350–700
			Pearlitic	–	230	–	–	450–700	400–600	400–600
	Malleable cast iron		Ferritic	–	180	–	–	–	–	–
			Pearlitic	–	260	–	–	–	–	–
N	Aluminum – wrought alloy		Not cureable	–	60	300–2300	300–2000	–	–	–
			Cured	–	100	300–2300	300–2000	–	–	–
	Aluminum cast, alloyed	> 12% Si	Not cureable	–	75	200–1400	200–1300	–	–	–
			Cured	–	90	200–1400	200–1300	–	–	–
		> 12% Si	High temp.	–	130	80–900	80–800	–	–	–
	Copper alloys	> 1% Pb	Free cutting	–	110	60–550	60–500	–	–	–
			Brass	–	90	60–550	60–500	–	–	–
			Electrolitic copper	–	100	30–380	30–360	–	–	–
	Non–metallic		Duroplastics, fiber plastics	–	–	100–900	100–800	–	–	–
			Hard rubber	–	–	100–550	100–500	–	–	–
S	High temp. alloys	Fe based	Annealed	–	200	–	–	–	–	–
			Cured	–	280	–	–	–	–	–
		Ni or Co based	Annealed	–	250	–	–	–	–	–
			Cured	–	350	–	–	–	–	–
			Cast	–	320	–	–	–	–	–
	Titanium, Ti alloys		–	Rm 400	–	–	–	–	–	–
		Alpha+beta alloys cured		Rm 1050	–	–	–	–	–	–
H	Hardened steel		Hardened	–	55 HRC	–	–	–	–	90–200
			Hardened	–	60 HRC	–	–	–	–	80–180
	Chilled cast iron		Cast	–	400 HRB	–	–	–	–	–
	Cast iron nodular		Hardened	–	55HRC	–	–	–	–	–

Cutting speed Vc (m/min)												
CBN					–							
TB670	TB730	TB7015	TB7020	KB90A	–	–	–	–	–	–	–	–
–	–	–	–	–	–	–	–	–	–	–	–	–
–	–	–	–	–	–	–	–	–	–	–	–	–
–	–	–	–	–	–	–	–	–	–	–	–	–
–	–	–	–	–	–	–	–	–	–	–	–	–
–	–	–	–	–	–	–	–	–	–	–	–	–
–	–	–	–	–	–	–	–	–	–	–	–	–
–	–	–	–	–	–	–	–	–	–	–	–	–
–	–	–	–	–	–	–	–	–	–	–	–	–
–	–	–	–	–	–	–	–	–	–	–	–	–
–	–	–	–	–	–	–	–	–	–	–	–	–
–	–	–	–	–	–	–	–	–	–	–	–	–
–	–	–	–	–	–	–	–	–	–	–	–	–
–	–	–	–	–	–	–	–	–	–	–	–	–
–	–	–	–	–	–	–	–	–	–	–	–	–
–	300–1200	300–1200	300–800	300–1200	–	–	–	–	–	–	–	–
–	200–1000	200–1000	500–1000	200–1000	–	–	–	–	–	–	–	–
300–600	–	–	100–500	–	–	–	–	–	–	–	–	–
350–500	–	–	300–700	–	–	–	–	–	–	–	–	–
–	–	–	50–100	–	–	–	–	–	–	–	–	–
–	–	–	80–150	–	–	–	–	–	–	–	–	–
–	–	–	–	–	–	–	–	–	–	–	–	–
–	–	–	–	–	–	–	–	–	–	–	–	–
–	–	–	–	–	–	–	–	–	–	–	–	–
–	–	–	–	–	–	–	–	–	–	–	–	–
–	–	–	–	–	–	–	–	–	–	–	–	–
–	–	–	–	–	–	–	–	–	–	–	–	–
–	–	–	–	–	–	–	–	–	–	–	–	–
–	–	–	–	–	–	–	–	–	–	–	–	–
–	–	–	–	–	–	–	–	–	–	–	–	–
–	–	–	–	–	–	–	–	–	–	–	–	–
–	–	–	–	–	–	–	–	–	–	–	–	–
–	–	–	–	–	–	–	–	–	–	–	–	–
–	–	–	–	–	–	–	–	–	–	–	–	–
–	–	–	–	–	–	–	–	–	–	–	–	–
–	–	–	–	–	–	–	–	–	–	–	–	–
–	–	–	–	–	–	–	–	–	–	–	–	–
–	–	–	–	–	–	–	–	–	–	–	–	–
90–180	80–130	–	–	–	–	–	–	–	–	–	–	–
80–150	60–120	–	–	–	–	–	–	–	–	–	–	–
100–200	120–180	120–180	–	120–180	–	–	–	–	–	–	–	–
–	100–140	100–140	–	100–140	–	–	–	–	–	–	–	–

CBN inserts & ceramic inserts

Hardened cast iron, hardened steel, chilled cast iron, etc.

Grade		Machining and material
CBN	TB610	for general machining with continuous cut
	TB650	for general machining of case hardening steel
	TB670	for general machining of hardened steel
	TB730	for general machining of heat-resistant alloys with interrupted cut
Ceramic	AB2010	for turning of hardened steel with high cutting speed
	AB20	for precise turning of hardened steel
	AB30	for finishing hardened carbon steel and low-alloy steels of 45-55 HRC

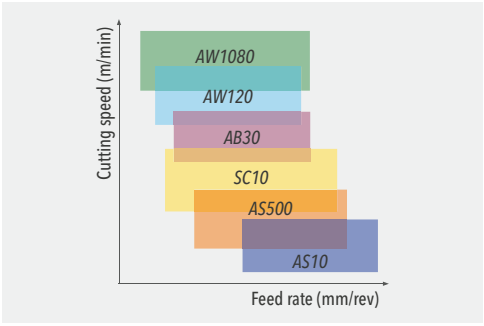
Ceramic Inserts

Strength properties

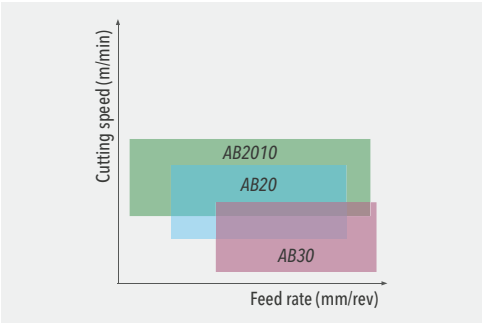
Grade		AW20	AB2010	AB20	AB30	TC430	AS500
Composition		Al_2O_3 ZrO_2	Al_2O_3 - Ti(C.N)	Al_2O_3 - Ti(C.N)	Al_2O_3 - TiC	SiC Whisker	SiAlON
Density (g/cm^3)		4.05	4.30	4.30	4.25	3.74	3.21
Hardness	HRA	94.0	94.5	94.5	94.5	95.1	94.3
	Vickers	1800	2050	2050	2050	2100	1800
Bending strength (MPa)		600	650	650	700	700	850

Application range of ceramic grades

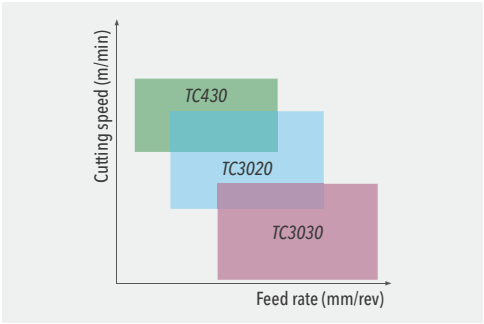
Cast iron



Hardened steel (HRC 40~60)



Super alloy



Characteristics

Grade	TB610	TB650	TB670	TB730	KB90A
TRS (GPa)	0.8 – 0.9	1.0 – 1.1	1.0 – 1.1	0.9 – 2.0	1.1 – 1.2
Hardness (GPa)	27 – 28	30 – 32	31 – 33	39 – 42	35 – 38

TB610

- High wear resistant cubic boron nitride with low CBN content
- For precise machining of hardened steel (harder than HRC 45) as well as tool steel, die steel, case-hardening steel and HSS
- For continuous cutting

TB650

- Wear resistant cubic boron nitride with low CBN-content
- Designed for finishing to roughing applications on hardened steels (harder than 45HRC).
- Can be applied to light interrupted cutting applications.

TB670

- High hardness and impact resistance
- For continuous to severe interrupted turning of hardened steel (harder than 40 HRC)
- For alloyed steel, tool steel

TB7015

- For high-speed machining of cast iron
- Suitable for machining hard metal

TB7020

- Full CBN with excellent impact resistance
- For high-speed machining of cast iron

TB730

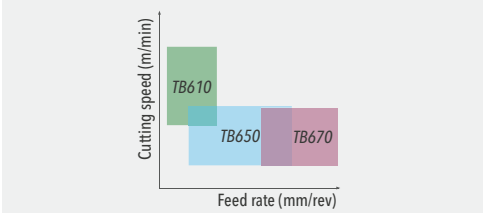
- Tough cubic boron nitride with high CBN content
- For high speed machining of cast iron
- For rough and medium machining of hardened steel
- Excellent for interrupted cutting

KB90A

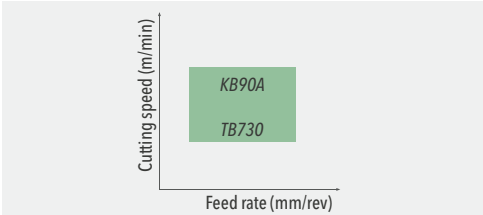
- Solid CBN with excellent impact resistance.
- For high speed machining of cast iron.
- Can be applied for rough to medium machining of hardened steel.

Application range

Hardened steel



Cast iron



Designation of CBN inserts

Inserts	Description
CNMA 120408 **LN** :	Large size CBN tip
CNMA 120408 **LS** :	Regular size CBN tip
CNMA 120408 **LS2** :	Small size CBN tip with two corners
RCGX 090300 **FT** :	Full top CBN
CNMN 090308 **SD** :	Solid CBN
CNGA 120408 **WZ-LS2**:	Wiper geometry

Hardened cast iron, hardened steel, Chilled cast iron, etc.

Material and Workpiece	Insert		Cutting parameters
	Designation	Grade	
Hardened steel, sleeve (65 - 68 HRC)	VNMA 160404	TB610	V=140 m/min; f=0.09 mm/rev; ap=0.1 mm; dry. continuous cut
Nitrided shaft, (60 - 62 HRC)	TNMA 160408	TB610	V=200 m/min; f=0.1 mm/rev; ap=0.15 mm; dry. continuous cut
Hardened steel, ring (60 - 62 HRC)	TPGX 110304	TB610	V=150 m/min; f=0.07 mm/rev; ap=0.1 mm; dry. continuous cut
Hardened steel, gear ring (82HRA)	CNMA 120408	TB730	V=110 m/min; f=0.08 mm/rev; ap=0.1 mm; dry. interrupted cut
GG25, engine block (285 - 305 HRB)	TCGW 110204	TB730	V=550 m/min; f=0.12 mm/rev; ap=0.5 mm; wet. continuous cut
Hardened steel, shaft (60 - 62 HRC)	CNMA 120408	TB730	V=100 m/min; f=0.1 mm/rev; ap=0.2 mm; dry. interrupted cut
Hardened steel, socket (58 - 60 HRC)	TNMA 160404 LN	TB650	V=80 m/min; f=0.1 mm/rev; ap=0.13 mm; dry. continuous cut
Sintered metal, sleeve	TPGH 110304	TB730	V=170 m/min; f=0.13 mm/rev; ap=0.5 mm; dry; interrupted cut
Nitrided steel, flange (50 - 62 HRC)	CNMA 120408	TB650	V=75 m/min; f=0.15 mm/rev; ap=0.08 mm; wet. interrupted cut
Hardened steel, sleeve (40 - 50 HRC)	CCGW 09T304 LS	TB6550	V=138 m/min; f=0.1 mm/rev; ap=0.1 mm; wet. continuous cut
Nitrided steel, sun gear (58 - 62 HRC)	CNMA 120408 LN	TB650	V=100 - 120 m/min; f=0.15 mm/rev; ap=0.3 - 0.4 mm; dry. continuous cut
Nitrided steel, gear ring (58 - 62 HRC)	CNMA 120408 LS	TB670	V=120 m/min; f=0.15 mm/rev; ap=0.1 mm; wet. continuous cut

Cutting parameters (CBN & ceramic) / Designation of edge preparation

Material			Grade	Machi-ning	smooth cut	Slightly interrupted cut	Severely interrupted cut	Dry	Wet	Vc (m/min)	f (mm)	ap (mm)
P	Alloyed steel		TC3030	Roughing	–	–	–	●	–	600–800	0.05–0.20	0.5–1.2
M	Stainless steel		TC3020	Roughing	–	–	–	●	–	600–1000	0.05–0.20	0.5–1.2
K	Gray cast iron (GG)		AS500	Roughing & Finishing	○	●	●	●	○	400–1000	0.20–0.60	0.1–3.0
			AS10	Roughing & Finishing	○	●	●	●	●	400–800	0.20–0.80	0.1–4.0
			AW120	–	●	○	–	●	–	400–1000	0.10–0.40	0.5–2.0
			KB90A	Roughing	○	●	●	●	○	700–1800	0.18–0.70	0.5–1.5
			KB90A	Finishing	○	●	●	●	○	700–2000	0.10–0.40	0.1–0.5
	Cast iron nodular (GGG)		AS500	Roughing & Finishing	–	–	–	●	○	500–630	0.10–0.20	0.5–1.5
			KB90A	Finishing	–	–	–	●	○	700–2000	0.10–0.40	0.1–0.5
	Malleable cast iron		KB90A	Finishing	○	●	–	○	●	120–220	0.08–0.20	0.1–1.5
S	Super alloys		TC3020	Roughing	○	●	–	–	●	200–350	0.10–0.40	1.0–4.5
			TC3030	Roughing	–	○	●	–	●	150–250	0.20–0.50	1.0–4.5
		Fe-base	TC3020	Roughing	–	–	–	●	–	915–2135	0.05–0.20	1.0–2.0
			TC3030	Roughing	–	–	–	●	–	305–915	0.05–0.20	1.0–2.0
		Ni- & Co-base	TC3020	Roughing	–	–	–	●	–	610–1680	0.05–0.20	1.0–3.0
			TC3030	Roughing	–	–	–	●	–	275–1220	0.05–0.20	1.0–3.0
H	Hardened steel	HRC 40~50	AB20 / AB2010	–	●	–	–	●	●	100–400	0.10–0.20	0.1–0.8
			AB30	–	○	–	–	●	●	100–300	0.10–0.20	0.1–0.8
		HRC>50	AB20 / AB2010	–	●	–	–	●	●	50–250	0.05–0.20	0.1–0.8
			TB610	–	●	–	–	○	●	90–250	0.05–0.20	0.1–1.0
			TB670	–	–	○	●	●	○	30–180	0.05–0.20	0.1–1.0
			KB90A	Roughing	–	–	–	●	–	100–300	0.05–0.30	0.5–1.2
			KB90A	Finishing	–	–	–	●	–	110–650	0.05–0.25	0.1–0.4
	Chilled cast iron		KB90A	Roughing	–	–	–	●	–	150–280	0.07–0.25	0.5–1.5
			KB90A	Finishing	–	–	–	●	–	230–320	0.05–0.20	0.1–0.5

●: first choice ○: second choice

Designation of edge preparation

1. Cutting edge design of the CBN inserts

Grade	Specification		
	Length of chamfer (mm)	Angle (°)	Honing (mm)
TB610, TB650, TB670	0.13	20	0.015
TB730, KB90	0.13	20	–
KB90A	0.2	20	0.015

1. Cutting edge design of the ceramic inserts

1. Common style

Grade	Width	Angle
AB2010, AB20, AB30, TC430, AS500, SC10, AS10, AS20	0.20 mm	25°
AW20	0.20 mm	20°

2. Others

Designation	Width	Angle
T2	0.10 mm	30°
T3	0.15 mm	30°
T4	0.20 mm	30°
T5	0.30 mm	30°
T6	0.10 mm	20°
T7	0.20 mm	20°

Designation of edge preparation

2. Rounded honing

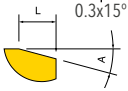
Symbol	Grade	R
E	AS20	0.05
E03	All	0.03

Example: CNGA 120408 E03
H 0,03

3. Single chamfer

Symbol	L	A	Symbol	L	A	Symbol	L	A
T1	0.05	20°	T9	1.5	10°	T17	0.15	20°
T2	0.1	30°	T10	1.5	20°	T18	0.1	25
T3	0.15	30°	T11	1.5	30°	T19	2.0	20°
T4	0.2	30°	T12	0.25	20°	T20	1.5	15°
T5	0.3	30°	T13	0.25	30°	T21	0.1	15°
T6	0.1	20°	T14	1.6	10°	T22	0.15	15°
T7	0.2	20°	T15	0.2	25°	T23	0.15	25°
T8	0.3	20°	T16	0.25	25°			

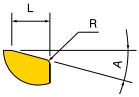
Ex.: Standard
CNGA 120408 T2
0.1x30°
Es.: Special
CNGA 120408 T03015
0.3x15°



4. Single chamfer and rounded honing

Symbol	L	A	R	Remarks
S1	0.05	20°	0.02	–
S2	0.1	30°	0.02	–
S3	0.15	30°	0.02	–
S1-V	0.05	20°	0.02	–
S2-V	0.1	30°	0.02	only hard metal
S3-V	0.15	30°	0.02	only hard metal

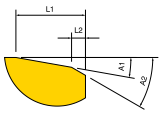
Ex.: Standard
CNGA 120408 S2
0.1x30° + R0.02



5. Double chamfer

First chamfer			Second chamfer					
Symbol	L1	A1	Symbol	L2	A2	Symbol	L2	A2
K1	1.0	10°	T1	0.05	20°	T13	0.25	30°
K2	1.0	15°	T2	0.1	30°	T14	1.6	10°
K3	1.5	10°	T3	0.15	30°	T15	0.2	25°
K4	1.5	15°	T4	0.2	30°	T16	0.25	25°
K5	2.0	10°	T5	0.3	30°	T17	0.15	20°
K6	2.0	15°	T6	0.1	20°	T18	0.1	25°
K7	2.5	10°	T7	0.2	20°	T19	2.0	20°
K8	2.5	15°	T8	0.3	20°	T20	1.5	15°
K9	3.0	10°	T9	1.5	10°	T21	0.1	15°
K10	3.0	15°	T10	1.5	20°	T22	0.15	15°
K11	0.5	15°	T11	1.5	30°	T23	0.15	25°
			T12	0.25	20°			

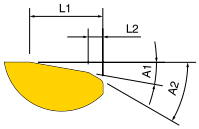
Ex.: Standard
SNGN 250724 K4T3
1.5x15° + 0.15x30°



6. Double chamfer and rounded honing

First chamfer			second chamfer		
Symbol	L1	A1	Symbol	L2	A2
P1	1.0	10°	T1	0.05	20°
P2	1.0	15°	T2	0.1	30°
P3	1.5	10°	T3	0.15	30°

Ex.: Standard
SNGN 250724 P4T3
1.5x15° + 0.15x30° + R0.02



PCD inserts / Insert selection by workpiece material

Physical properties

Grade	Feature	PCD (µm)	TRS (GPa)
KP100	Toughness (High Co)	2	1.5–1.6
KP300	↕	10	1.3–1.4
TD810		2.30	1.2–1.3
KP500	Hardness (High PCD)	25	1.0–1.2

KP500
- Super abrasion resistant grade
- Designed for fine finishing with slightly interrupted or continous cut
- For high Si aluminum alloy(Si >12.2%), metal workpieces and sintered tungsten carbide

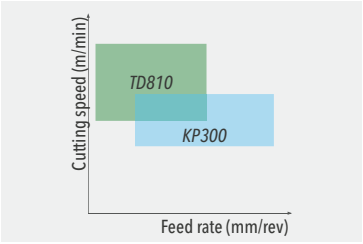
TD810
- Highly densified grade with mixed coarse and fine grains
- Combination of wear resistance and toughness
- For MMC, high Si-Al alloys, high strength cast irons, bi-metal applications, etc

KP300
- This KP300 is for general machining
- Tough grade with high wear resistance
- For low to medium Si aluminum alloy (Si ≤ 12.2%), copper alloy and non-ferrous metal

KP100
- Low content poly-crystalline diamond with fine grain
- High edge strength and good surface finish
- For plastic, wood and pure aluminum

Application range

Non-ferrous metals



Applications

Material	first choice	second choice
Al alloys, Si≤12%	–	KP300
Al alloys, Si>12%	–	TD810
MMC (Al–SiC, usw.)	TD810	KP300
Composite material (CFRP, GFRP, etc.)	–	TD810
Bi metals	TD810	KP300
Ceramic, hard metal	TD810	–
Cu & Mg alloys	–	KP300
Ti alloys	–	KP300

Insert selection by workpiece material

1. Material
- Select material to be machined

2. Cutting speed
- Select the appropriate grade to suit the application cutting speed

3. Feed rate
- Select the required feed rate

4. Depth of cut
- Select the appropriate chipbreaker based on feed and depth of cut

: The upper bar shows the feed rate
: The lower bar shows the cutting depth

5. Consideration should also be given to the workpiece shape
- Continuous cut, interrupted cut and heavily interrupted cut

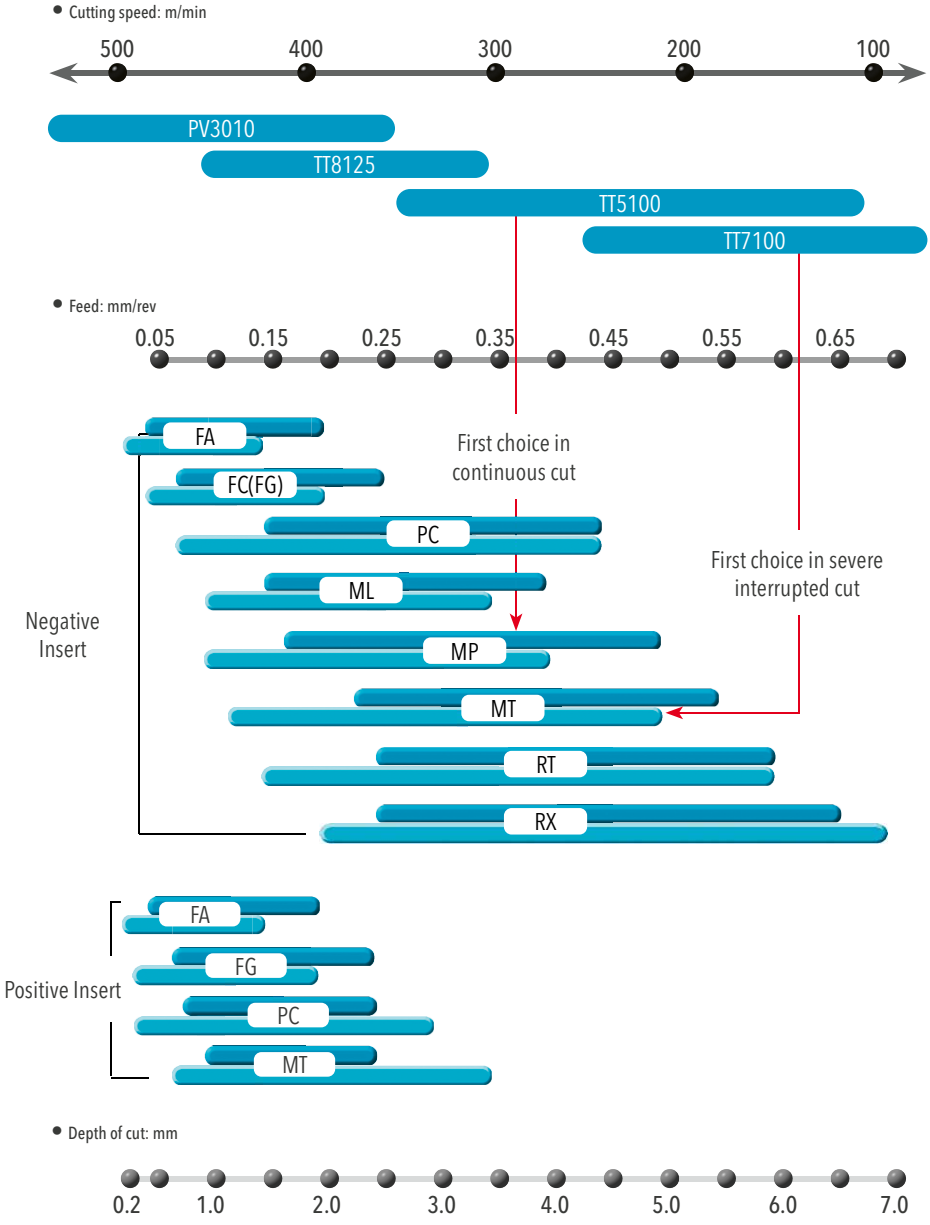
6. Select insert type and insert corner radius to suit application

7. Use the Application Charts

Notes

0.15% Carbon Steel (HB 150)

Germany		UK	France	Italy	USA
Material number	DIN	BS	ANFOR	UNI	AISI/SAE
1.0401	C15	080M15	XC12	C15C16	1015

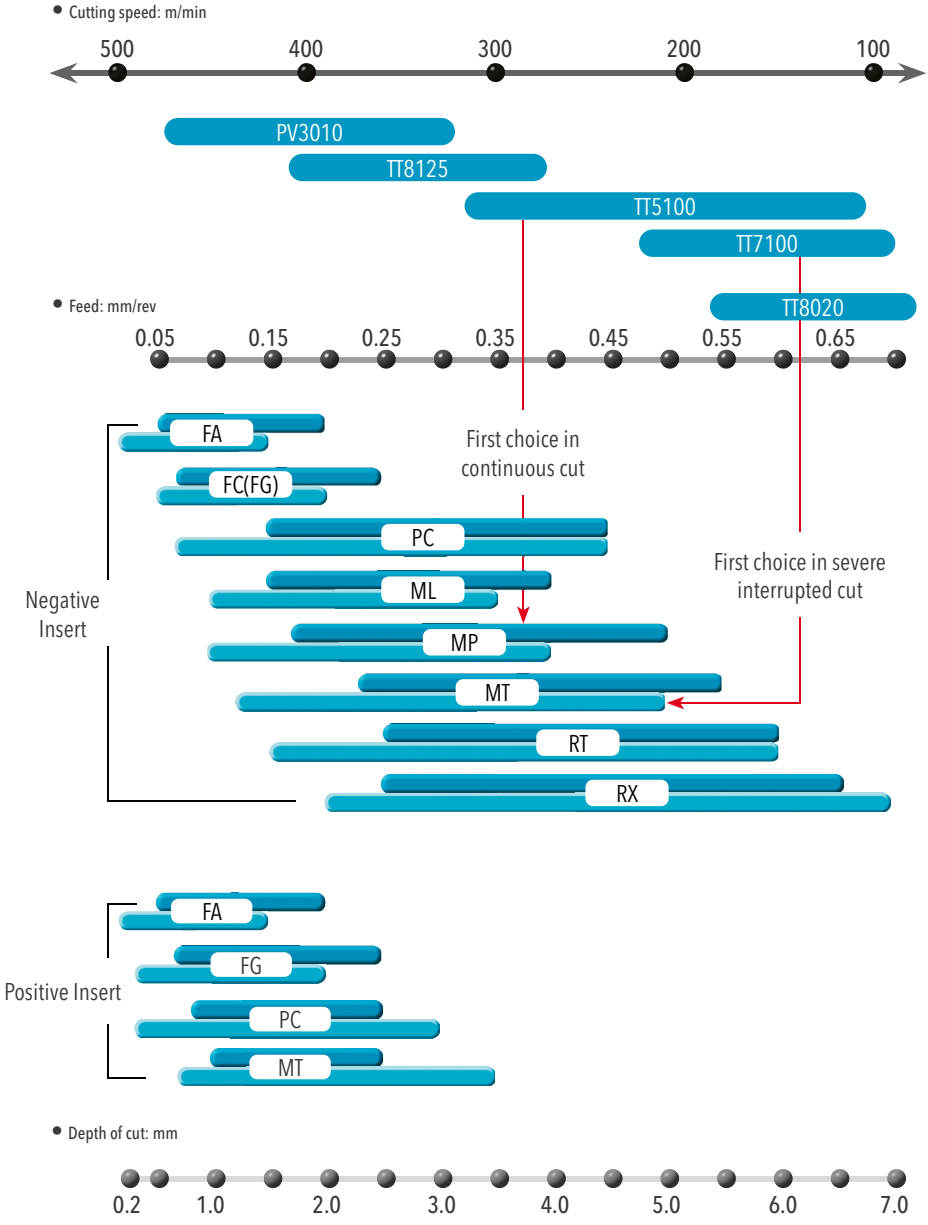


Examples

Example 1	**Component description:**	Pulley, low carbon (0.1% C) steel
	Recommended insert:	CNMG 120408 MC TT8125
	Cutting conditions: Wet cutting, External turning, continuous cut	Cutting parameters: Vc=500~440 m/min, f=0.2–0.3 mm/rev, ap=0.7 mm
Example 2	**Component description:**	Pump, very low carbon steel
	Recommended insert:	CNMG 120412 MT TT7100
	Cutting conditions: Wet cutting, External turning, continuous cut	Cutting parameters: Vc=100 m/min, f=0.55 mm/rev, ap=2.0 mm
Example 3	**Component description:**	Pulley, low carbon(0.2% C) steel
	Recommended insert:	CNMG 120408 SF TT8115
	Cutting conditions: Wet cutting, Internal turning, continuous cut	Cutting parameters: Vc=300 m/min, f=0.24 mm/rev, ap=0.5–0.7 mm
Example 4	**Component description:**	Case, low carbon steel (0.25%)
	Recommended insert:	CNMG 120408 MP TT5100
	Cutting conditions: Wet cutting, Face turning, continuous cut	Cutting parameters: Vc=280 m/min, f=0.2 mm/rev, ap=1.0–2.0 mm
Example 5	**Component description:**	Retainer, very low carbon steel
	Recommended insert:	SNMG 120412 MT TT7100
	Cutting conditions: Wet cutting, External turning, severe interrupted cut	Cutting parameters: Vc=537 m/min, f=0.45 mm/rev, ap=0.5 mm
Example 6	**Component description:**	Impeller, very low carbon steel
	Recommended insert:	CNMG 120404 SF TT5100
	Cutting conditions: Dry cutting, Internal turning, continuous cut	Cutting parameters: Vc=245 m/min, f=0.2 mm/rev, ap=0.5 mm

Low Carbon (C=0.13-0.22%) Alloy Steel(HB150-180)

Germany		UK	France	Italy	USA
Material number	DIN	BS	ANFOR	UNI	AISI/SAE
1.7015	15Cr3	523M12	12C3	16MnCr5	5115

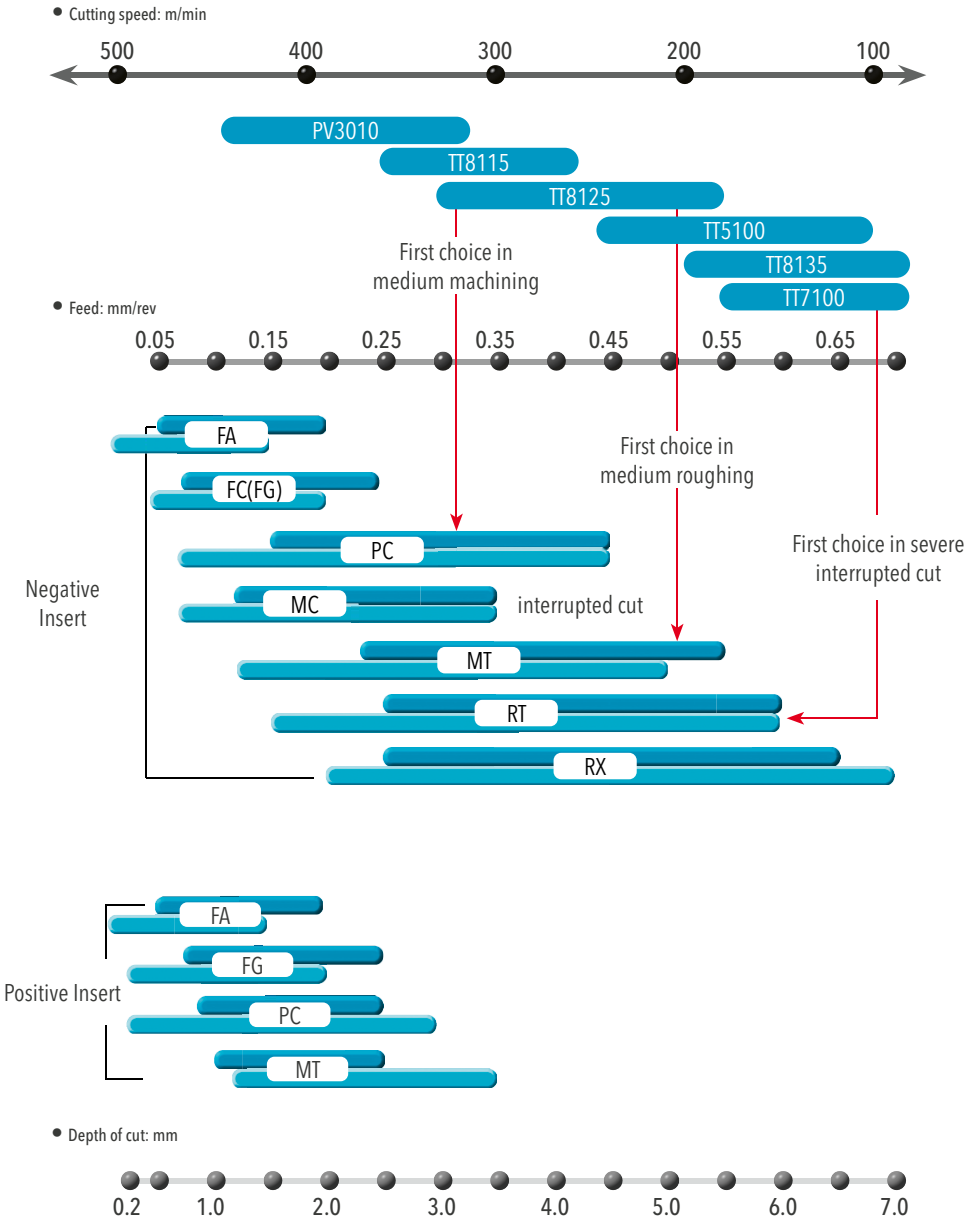


Examples

Example 1	Component description:	Pinion drive, low carbon (0.2% C) Cr-Mo alloy steel
	Recommended insert:	DNMG 150608 PC TT8125
	Cutting conditions: Wet cutting, External turning, continuous cut	Cutting parameters: Vc=250 m/min, f=0.3 mm/rev, ap=1.0–2.5 mm
Example 2	**Component description:**	Gear, low carbon (0.2% C) Cr-Mo alloy steel
	Recommended insert:	CNMG 120408 MT TT8125
	Cutting conditions: Wet cutting, Internal turning, continuous cut	Cutting parameters: Vc=100 m/min, f=0.55 mm/rev, ap=2.0 mm
Example 3	**Component description:**	Engine gear, low carborn (0.2% C) Cr-Mo alloy steel
	Recommended insert:	CNMG 120408 ML TT5100
	Cutting conditions: Wet cutting, Face & External turning, continuous cut	Cutting parameters: Vc=300 m/min, f=0.25 mm/rev, ap=1.3 mm
Example 4	**Component description:**	Idler gear, low carborn (0.2% C) Cr-Mo alloy steel
	Recommended insert:	DNMG 150608 ML TT8020
	Cutting conditions: Wet cutting, External turning, interrupted & continuous cut	Cutting parameters: Vc=150–230 m/min, f=0.15 mm/rev, ap=1.0–1.5 mm
Example 5	**Component description:**	Bevel gear shaft, low carbon (0.2% C) Cr alloy steel
	Recommended insert:	DNMG 150608 FG TT5100
	Cutting conditions: Wet cutting, Face & External turning, continuous cut	Cutting parameters: Vc=250 m/min, f=0.28 mm/rev, ap=0.5 mm
Example 6	**Component description:**	Tripod housing, low carbon (0.2% C) Cr-Mo alloy steel
	Recommended insert:	DNMG 150608 FC TT8115
	Cutting conditions: Wet cutting, External turning, light interrupted cut	Cutting parameters: Vc=300 m/min, f=0,22–0,25 mm/rev, ap=1,0 mm

0.45% Carbon Steel (HB180-200)

Germany		UK	France	Italy	USA
Material number	DIN	BS	ANFOR	UNI	AISI/SAE
1.0503	C45	080M46	CC45	C45	1045



Examples

Example 1	Component description:	Front Hub, 0.43% carbon steel
	Recommended insert:	CNMG 120408 MC TT8115
	Cutting conditions: Wet cutting, External turning, continuous cut	Cutting parameters: Vc=250 m/min, f=0.2–0.25 mm/rev, ap=1.0–1.5 mm

Example 2	**Component description:**	Differential drive gear, 0.38% carbon steel
	Recommended insert:	DNMG 150608 PC TT8115
	Cutting conditions: Wet cutting, External turning, continuous cut	Cutting parameters: Vc=454 m/min, f=0.35 mm/rev, ap=1.0 mm

Example 3	**Component description:**	Drive wheel (mechanical engineering), 0.45% carbon steel
	Recommended insert:	CNMG 120408 PC TT8125
	Cutting conditions: Wet cutting, External turning, continuous cut	Cutting parameters: Vc=280 m/min, f=0.2 mm/rev, ap=2.0 mm

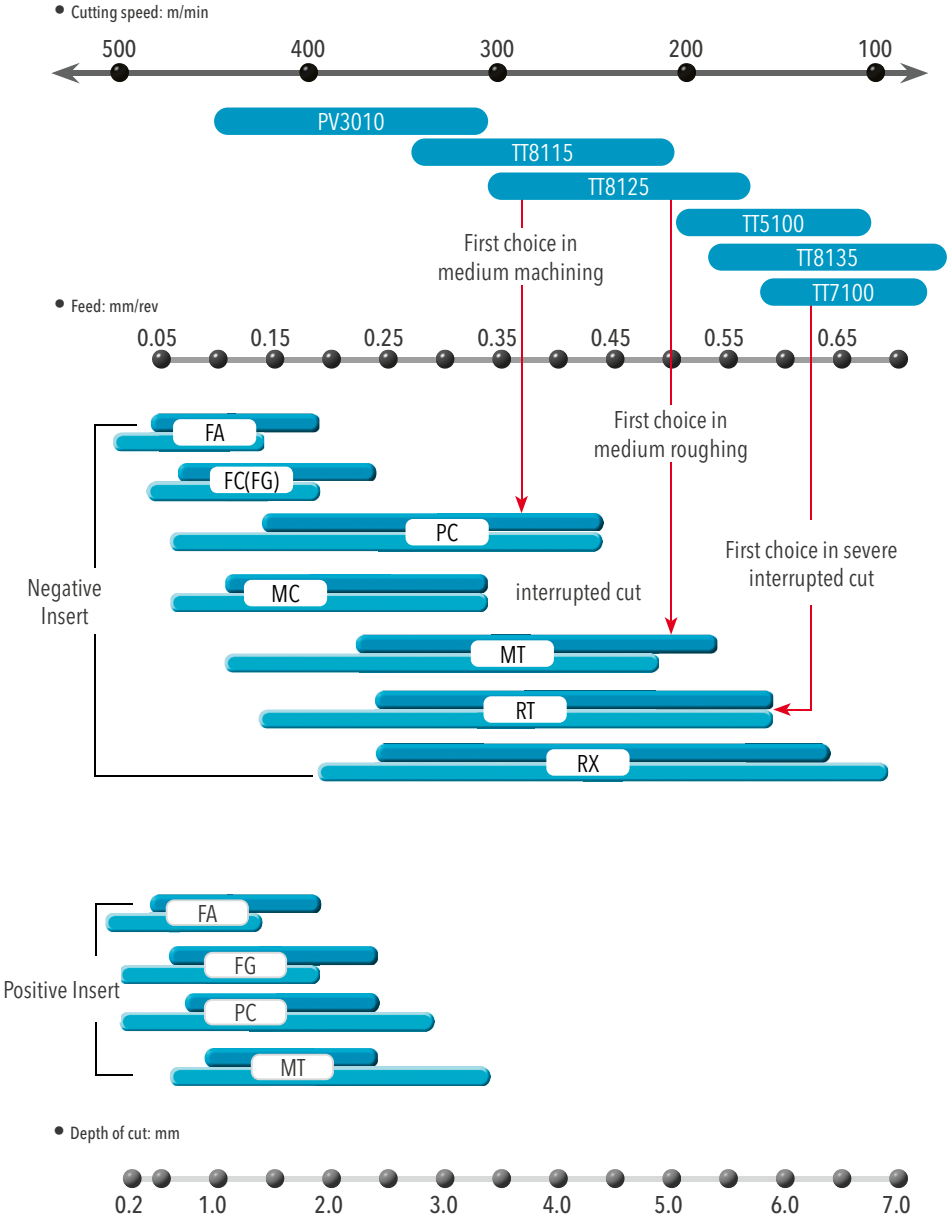
Example 4	**Component description:**	Gear shaft, 0.45% carbon steel
	Recommended insert:	CNMG 120408 MT TT8125
	Cutting conditions: Wet cutting, External turning, continuous cut	Cutting parameters: Vc=345 m/min, f=0.3 mm/rev, ap=3.0 mm

Example 5	**Component description:**	Connection flange, 0.45% carbon steel
	Recommended insert:	CNMG 120408 FL TT8125
	Cutting conditions: Wet cutting, External turning, interrupted cut	Cutting parameters: Vc=211 m/min, f=0.2 mm/rev, ap=1.5–2.0 mm

Own example	**Component description:**	
	Recommended insert:	
	Cutting conditions:	Cutting parameters:

0.55% Carbon Steel (HB200-220)

Germany		UK	France	Italy	USA
Material number	DIN	BS	ANFOR	UNI	AISI/SAE
1.0535	C55	070M55	XC55	C55	1055



Examples

Example 1	Component description:	CV Joint, 0.55% carbon steel
	Recommended insert:	CNMG 120408 MC TT8115
	Cutting conditions: Wet cutting, External turning, continuous cut	Cutting parameters: Vc=345~125 m/min, f=0.25 mm/rev, ap=1.0–2.0 mm

Example 2	**Component description:**	Sleeve, 0.55% carbon steel
	Recommended insert:	WNMG 080408 MT TT8115
	Cutting conditions: Wet cutting, External turning, continuous cut	Cutting parameters: Vc=280 m/min, f=0.35 mm/rev, ap=2.0 mm

Example 3	**Component description:**	King pin, 0.55% carbon steel
	Recommended insert:	WNMG 080408 RT TT5100
	Cutting conditions: Wet cutting, External turning, interrupted cut	Cutting parameters: Vc=200 m/min, f=0.4 mm/rev, ap=2.0 mm

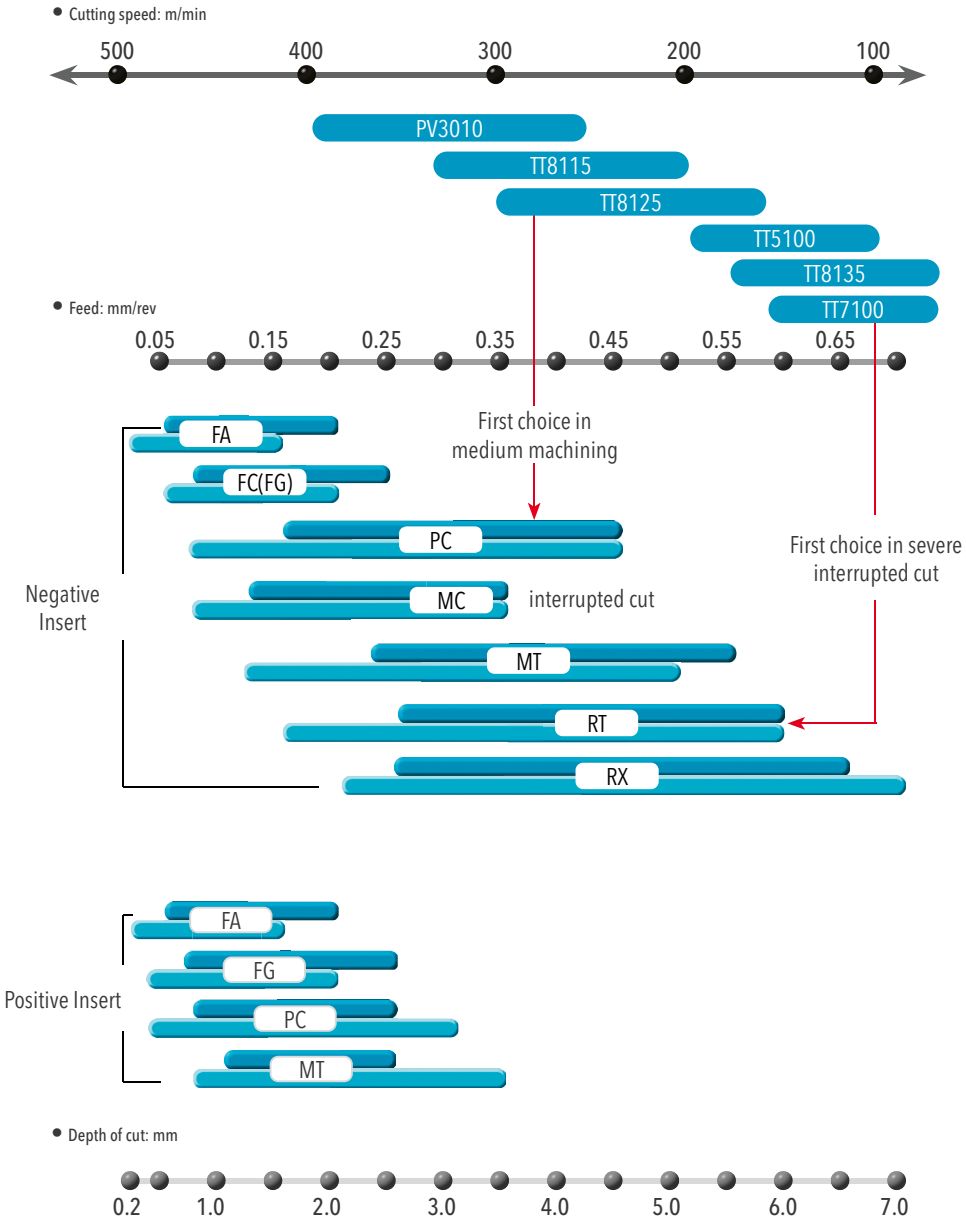
Own example	**Component description:**	
	Recommended insert:	
	Cutting conditions:	Cutting parameters:

Own example	**Component description:**	
	Recommended insert:	
	Cutting conditions:	Cutting parameters:

Own example	**Component description:**	
	Recommended insert:	
	Cutting conditions:	Cutting parameters:

Cr-Mo Alloy Steel (HB200-220)

Germany		UK	France	Italy	USA
Material number	DIN	BS	ANFOR	UNI	AISI/SAE
1.7225	42CrMo4	708M40	42CD4	42CrMo	4140



Examples

Example 1	Component description:	Pin, Cr-Mo alloy steel
	Recommended insert:	WNMG 080408 PC TT8125
	Cutting conditions: Wet cutting, External turning, continuous cut	Cutting parameters: Vc=160 m/min, f=0.3 mm/rev, ap=3.0 mm

Example 2	**Component description:**	Gear Shaft, Cr-Mo alloy steel
	Recommended insert:	TNMG 160408 PC TT8125
	Cutting conditions: Wet cutting, External turning, continuous cut	Cutting parameters: Vc=220 m/min, f=0.33 mm/rev, ap=2.0 mm

Example 3	**Component description:**	Shaft, Cr-Mo alloy steel
	Recommended insert:	CNMG 120412 PC TT8125
	Cutting conditions: Wet cutting, External turning, continuous cut	Cutting parameters: Vc=160 m/min, f=0.4 mm/rev, ap=3.0 mm

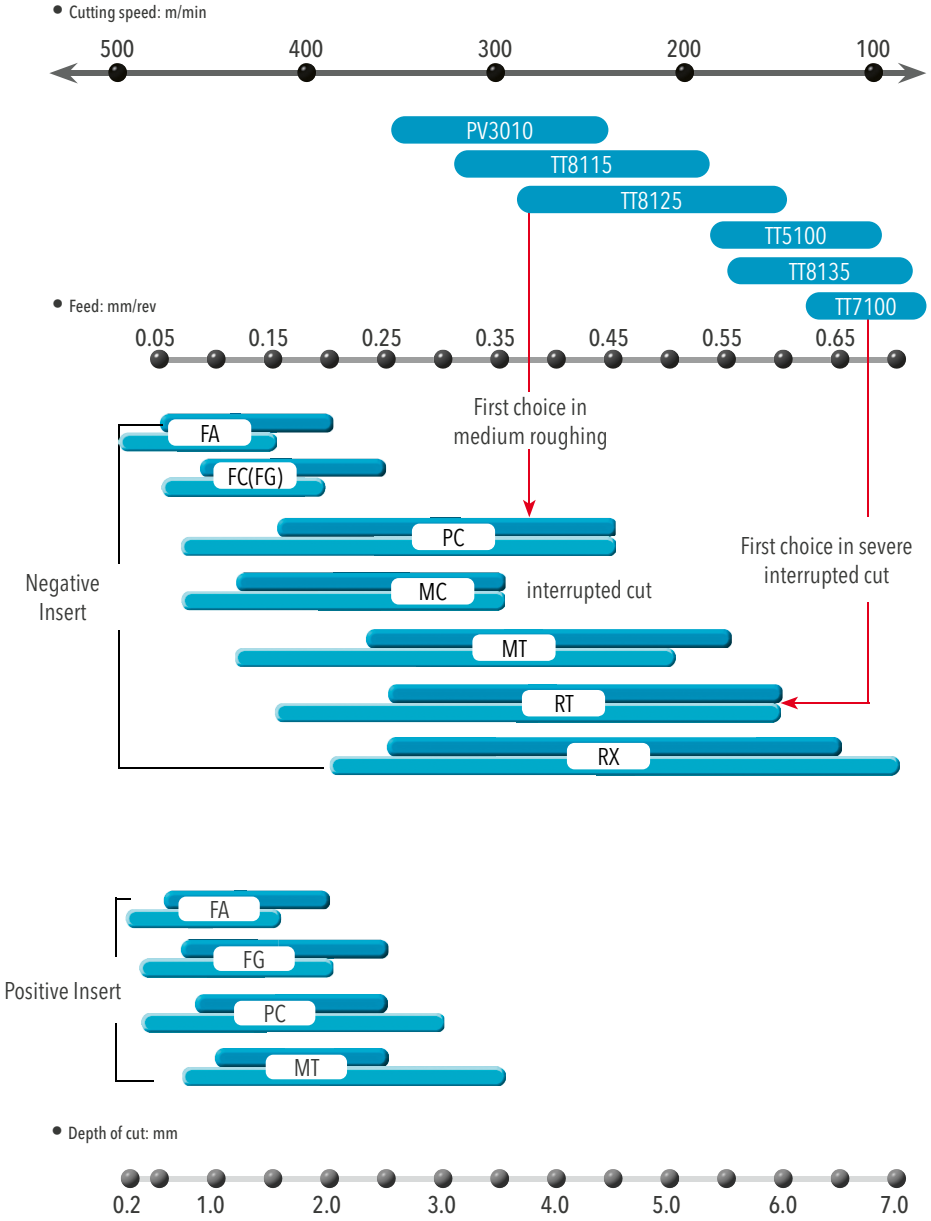
Example 4	**Component description:**	Shaft, Cr-Mo alloy steel (240-270BHN)
	Recommended insert:	DCMT 11T304 FG PV3010
	Cutting conditions: Wet cutting, External turning, continuous cut	Cutting parameters: Vc=366 m/min, f=0.15 mm/rev, ap=0.25 mm

Example 5	**Component description:**	Roller, Cr-Mo alloy steel
	Recommended insert:	CNMG 120408 PC TT8115
	Cutting conditions: Wet cutting, External turning, continuous cut	Cutting parameters: Vc=330 m/min, f=0.25 mm/rev, ap=2.0–2.5 mm

Example 6	**Component description:**	Tie Rod, Cr-Mo alloy steel
	Recommended insert:	CCMT 09T0308 PC TT8125
	Cutting conditions: Wet cutting, External turning, continuous cut	Cutting parameters: Vc=180 m/min, f=0.17–0.2 mm/rev, ap=1.5 mm

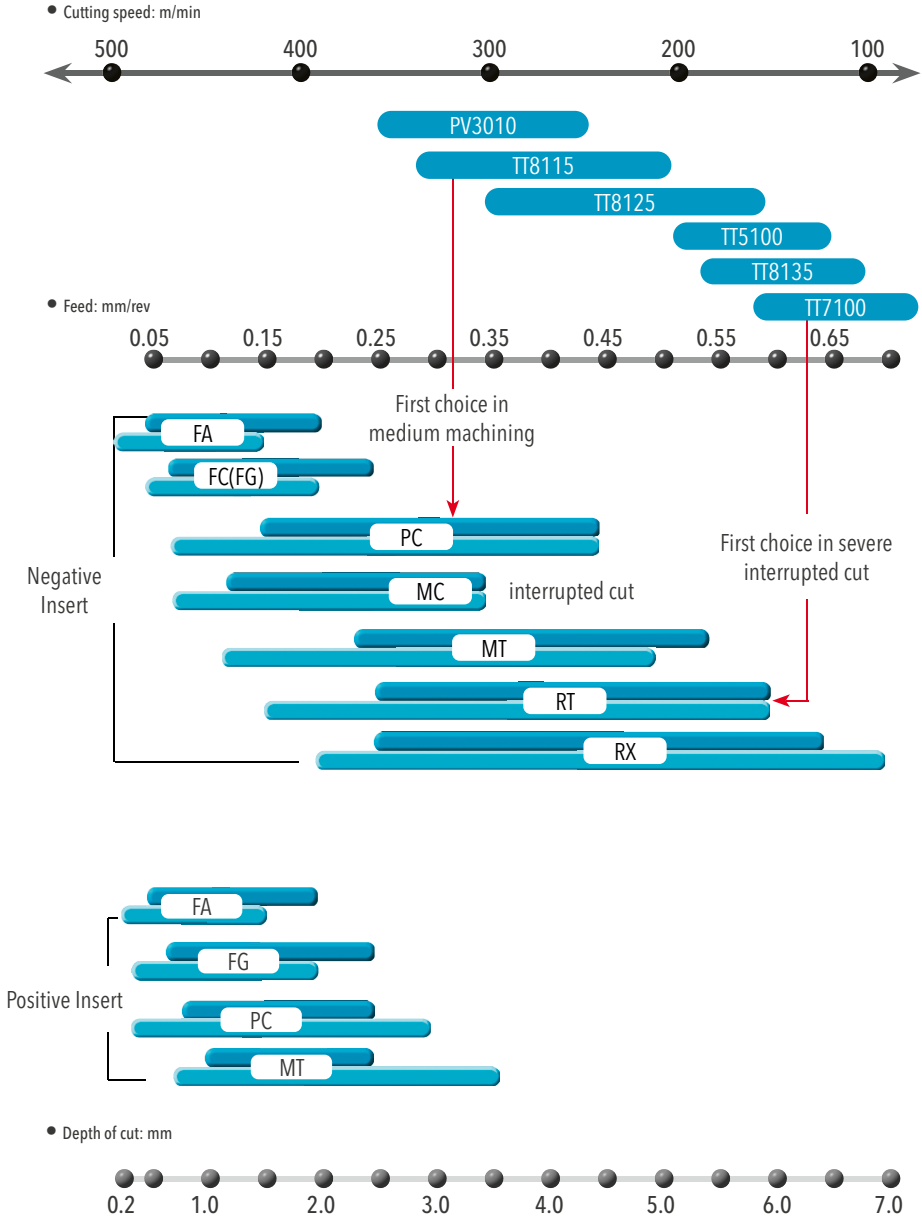
Ni-Cr-Mo Alloy Steel (HB200-220)

Germany		UK	France	Italy	USA
Material number	DIN	BS	ANFOR	UNI	AISI/SAE
1.6511	36CrNiMo4	-	-	-	4340



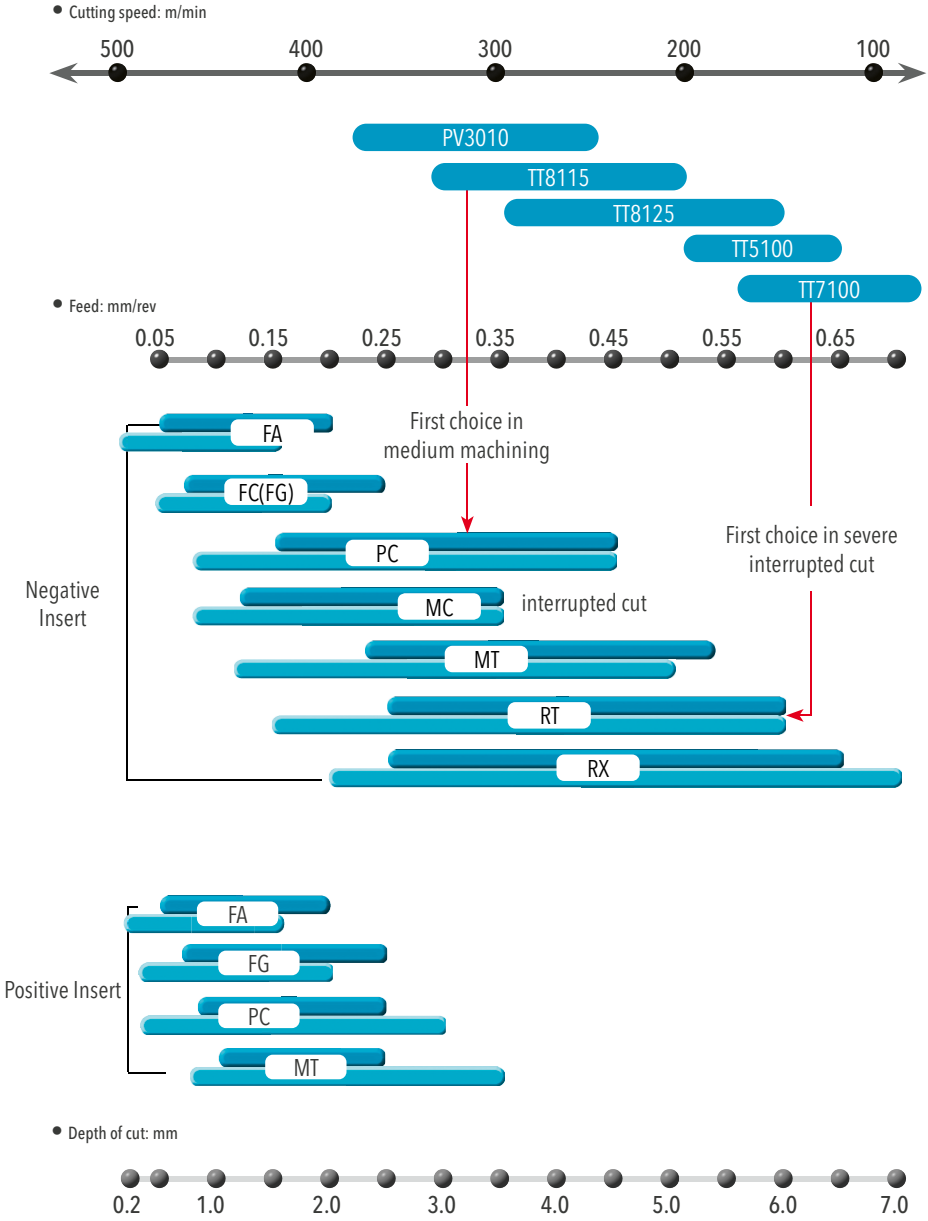
Carbon Tool Steel : C= 1.0-1.1% (HB200-220)

Germany		UK	France	Italy	USA
Material number	DIN	BS	ANFOR	UNI	AISI/SAE
1,1274	Ck101	–	–	–	WI-10



Bearing Steel (HB200-220)

Germany		UK	France	Italy	USA
Material number	DIN	BS	ANFOR	UNI	AISI/SAE
1.2067	100Cr6	-	-	-	52100



Examples

Example 1	Component description:	Ball bearing, bearing steel
	Recommended insert:	DNMG 150608 FG TT8115
	Cutting conditions: Wet cutting, External turning, continuous cut	Cutting parameters: Vc=220–280 m/min, f=0.1~0.2 mm/rev, ap=0.5–1.0 mm

Example 2	**Component description:**	Inner ball bearing, bearing steel
	Recommended insert:	CNMG 120408 PC TT8115
	Cutting conditions: Wet cutting, Internal turning, continuous cut	Cutting parameters: Vc=290 m/min, f=0.3 mm/rev, ap=2.0 mm

Example 3	**Component description:**	Ball bearing, bearing steel
	Recommended insert:	DNMG 150608 PC TT8105
	Cutting conditions: Wet cutting, Internal turning, continuous cut	Cutting parameters: Vc=390 m/min, f=0.18 mm/rev, ap=0.4 mm

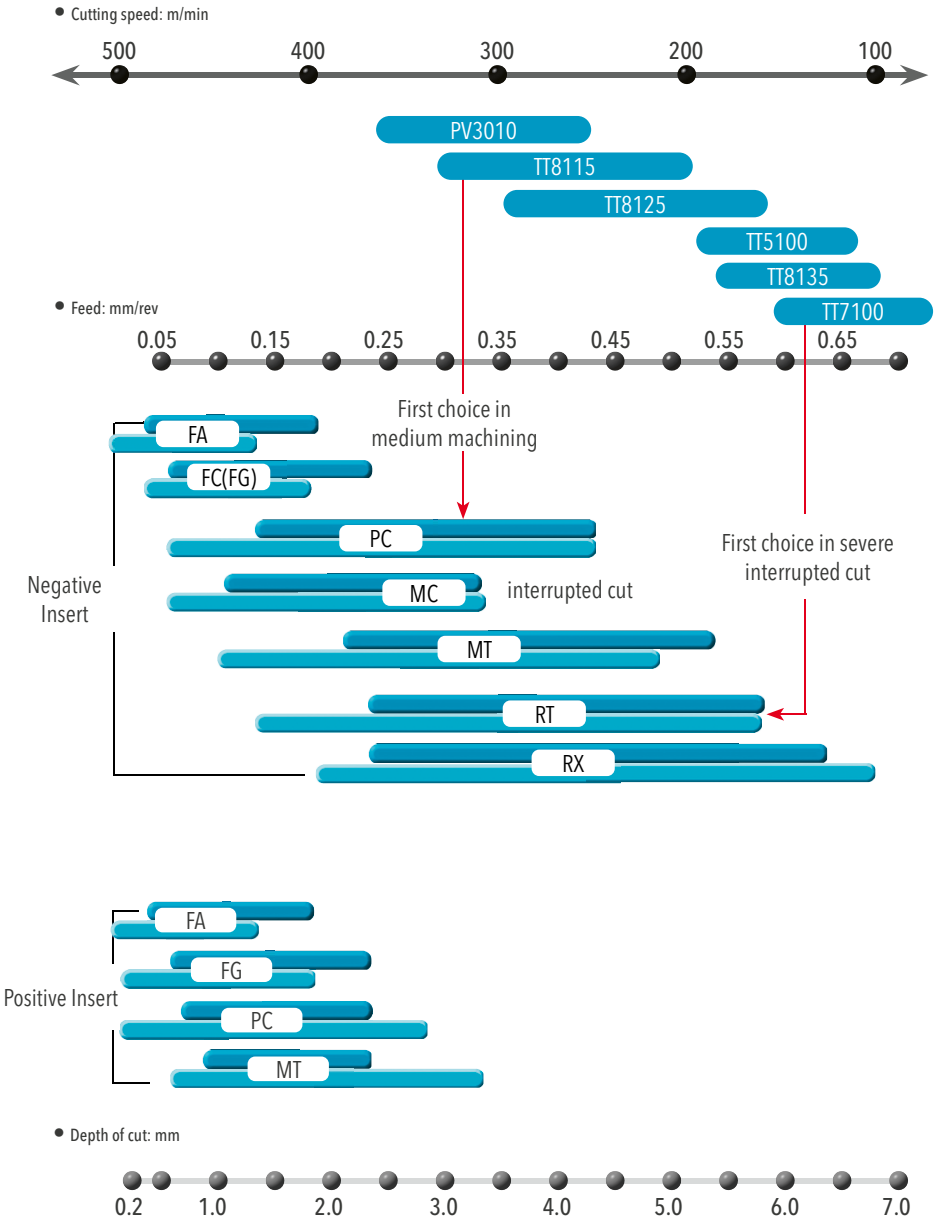
Own example	**Component description:**	
	Recommended insert:	
	Cutting conditions:	Cutting parameters:

Own example	**Component description:**	
	Recommended insert:	
	Cutting conditions:	Cutting parameters:

Own example	**Component description:**	
	Recommended insert:	
	Cutting conditions:	Cutting parameters:

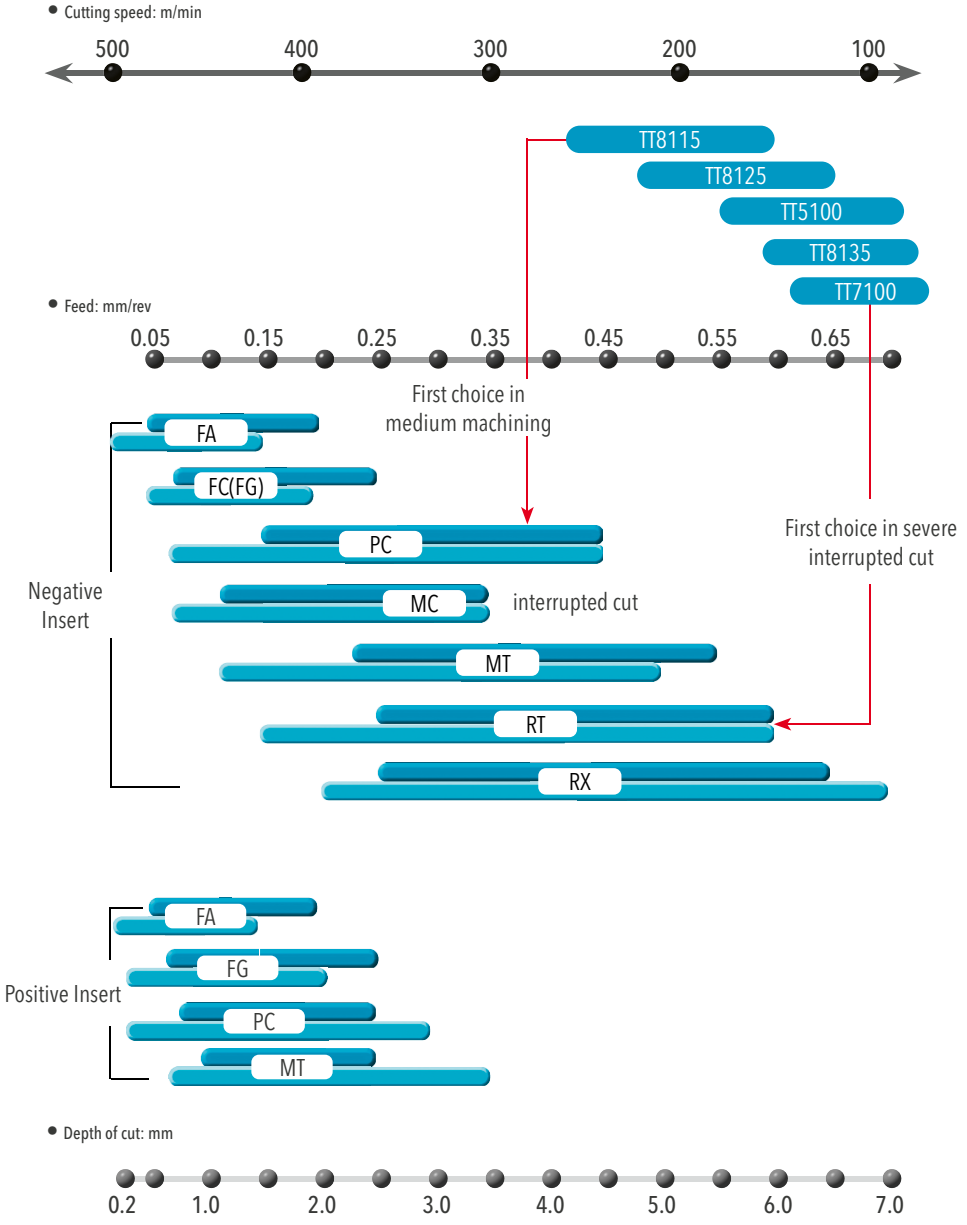
Alloy Tool Steel (HB200-220)

Germany		UK	France	Italy	USA
Material number	DIN	BS	ANFOR	UNI	AISI/SAE
1.2833	100V1	BW2	Y105V	–	W2



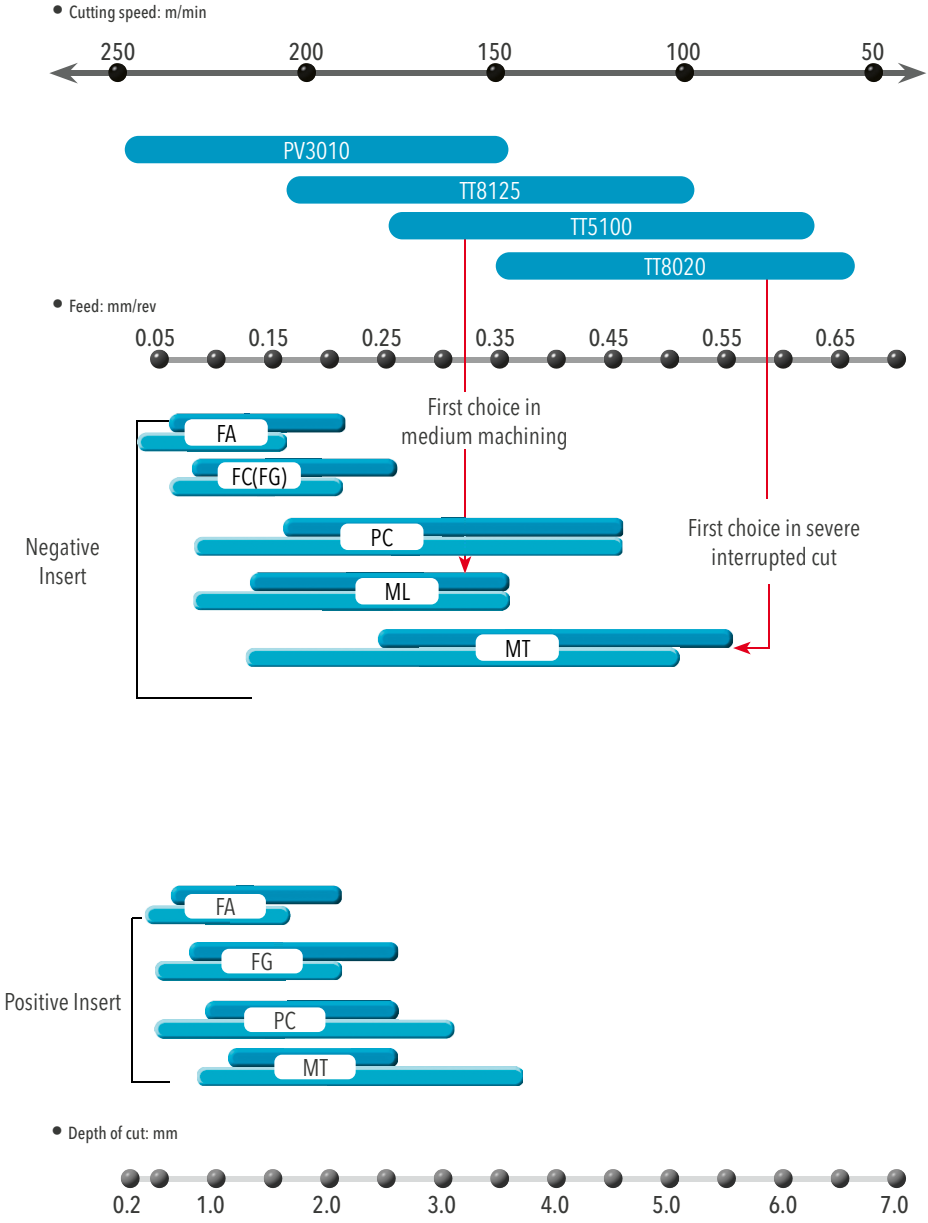
Cold forming Steel (HB220-260)

Germany		UK	France	Italy	USA
Material number	DIN	BS	ANFOR	UNI	AISI/SAE
1.2344	X40CrMoV5-1	BH13	Z40CDV5	X35CrMoV05KU	H13STD61



High Speed Steel (HB220-260)

Germany		UK	France	Italy	USA
Material number	DIN	BS	ANFOR	UNI	AISI/SAE
1.3255	S18-1-2-5	BT	Z80WKCV	X78WC01805KU	T4



Examples

Example 1	Component description:	Tap, 8% cobalt high speed steel
	Recommended insert:	DNMG 150608 ML TT5100
	Cutting conditions: Wet cutting, External turning, continuous cut	Cutting parameters: Vc=170 m/min, f=0,15 mm/rev, ap=0,5 mm

Example 2	**Component description:**	End mill, High speed steel
	Recommended insert:	TNMG 160404 R TT5100
	Cutting conditions: Wet cutting, External turning, continuous cut	Cutting parameters: Vc=50 m/min, f=0,06 mm/rev, ap=1,7 mm

Own example	**Component description:**	
	Recommended insert:	
	Cutting conditions:	Cutting parameters:

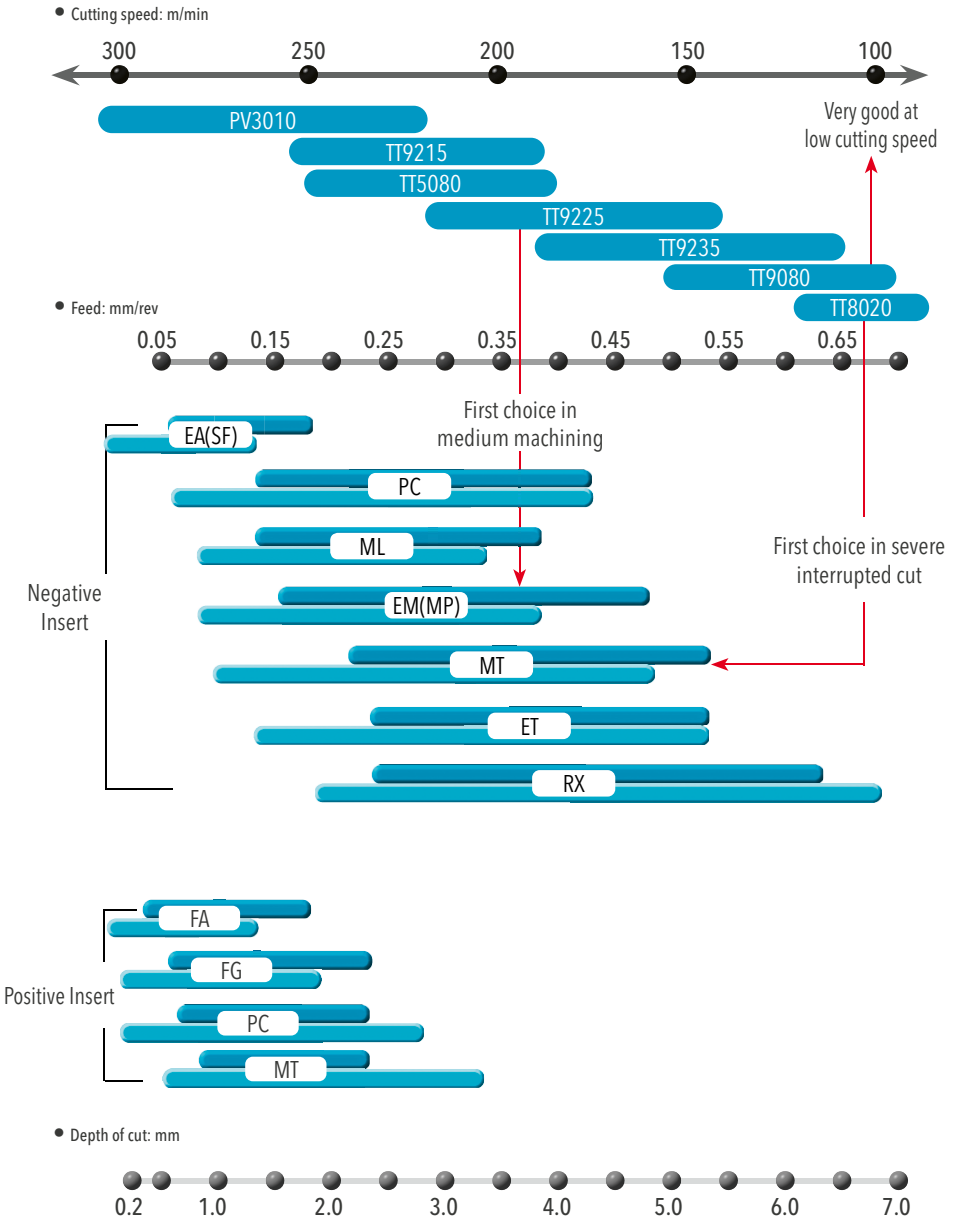
Own example	**Component description:**	
	Recommended insert:	
	Cutting conditions:	Cutting parameters:

Own example	**Component description:**	
	Recommended insert:	
	Cutting conditions:	Cutting parameters:

Own example	**Component description:**	
	Recommended insert:	
	Cutting conditions:	Cutting parameters:

Martensitic/Ferritic Stainless Steel (HB180-200)

Germany		UK	France	Italy	USA
Material number	DIN	BS	ANFOR	UNI	AISI/SAE
1.4016	X6Cr17	430S15	Z8C17	X6Cr17	430



Examples

Own example		
	Component description:	
	Recommended insert:	
	Cutting conditions:	Cutting parameters:

Own example		
	Component description:	
	Recommended insert:	
	Cutting conditions:	Cutting parameters:

Own example		
	Component description:	
	Recommended insert:	
	Cutting conditions:	Cutting parameters:

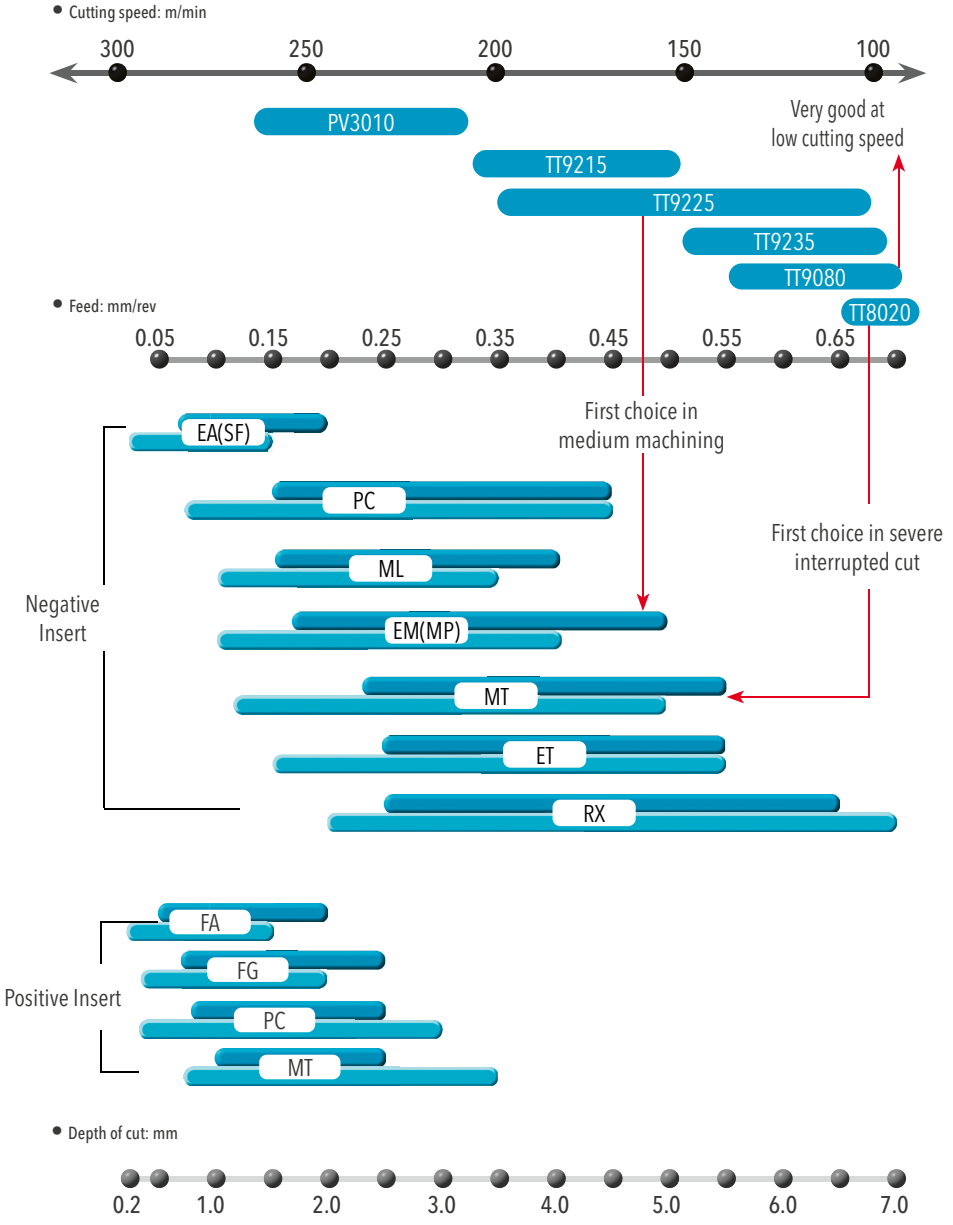
Own example		
	Component description:	
	Recommended insert:	
	Cutting conditions:	Cutting parameters:

Own example		
	Component description:	
	Recommended insert:	
	Cutting conditions:	Cutting parameters:

Own example		
	Component description:	
	Recommended insert:	
	Cutting conditions:	Cutting parameters:

Austenitic Stainless Steel (HB180-200)

Germany		UK	France	Italy	USA
Material number	DIN	BS	ANFOR	UNI	AISI/SAE
1.4401	X5CR´rNiMo17-12	316S16	Z6CND17.11	X5CrNiMo17-12	316



Examples

Example 1	Component description:	Axle, 316L stainless steel
	Recommended insert:	CNMG 190612 ET TT9225
	Cutting conditions: Wet cutting, External turning, continuous cut	Cutting parameters: Vc=80 m/min, f=0.4 mm/rev, ap=4.0 mm

Example 2	**Component description:**	Nut, 304 stainless steel
	Recommended insert:	CNMG 120408 PC TT9225
	Cutting conditions: Wet cutting, External turning, light interrupted cut	Cutting parameters: Vc=190 m/min, f=0.15 mm/rev, ap=1.0–2.0 mm

Example 3	**Component description:**	Plug, duplex stainless steel
	Recommended insert:	CNMG 120408 EM TT9225
	Cutting conditions: Wet cutting, External turning	Cutting parameters: Vc=160 m/min, f=0.2 mm/rev, ap=2.0 mm

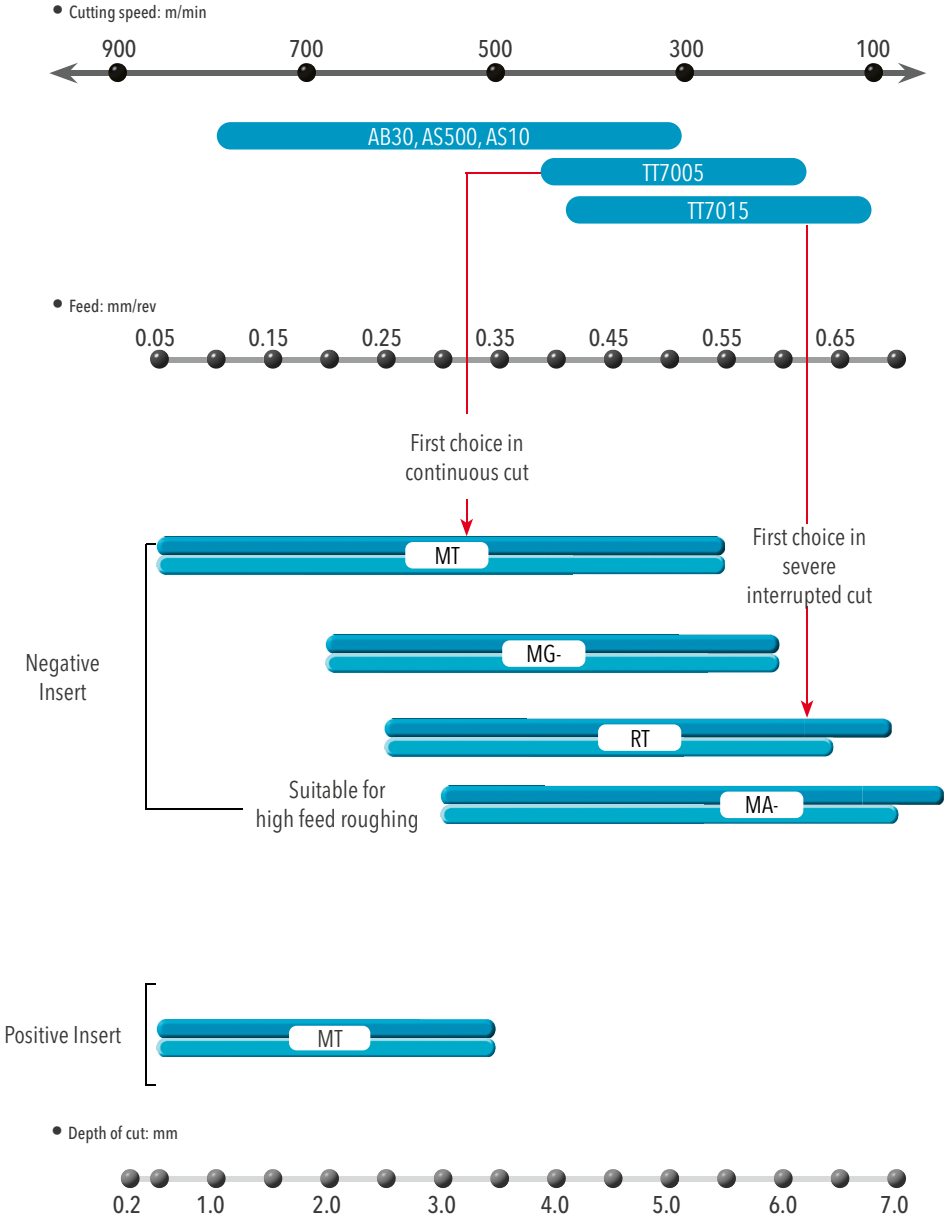
Example 4	**Component description:**	Impeller, 316 stainless steel
	Recommended insert:	CNMG 120408 MP TT9235
	Cutting conditions: Wet cutting, External turning, interrupted cut	Cutting parameters: Vc=100 m/min, f=0.12 mm/rev, ap=0.7 mm

Example 5	**Component description:**	Flange, 316F stainless steel
	Recommended insert:	WNMG 080412 PC TT9080
	Cutting conditions: Wet cutting, Face turning	Cutting parameters: Vc=130 m/min, f=0.2 mm/rev, ap=1.0 mm

Example 6	**Component description:**	Flange, 304L stainless steel
	Recommended insert:	CNMG 120408 EM TT9225
	Cutting conditions: Wet cutting, External turning, continuous cut	Cutting parameters: Vc=170 m/min, f=0.23 mm/rev, ap=3.0 mm

Gray Cast Iron (HB180-220)

Germany		UK	France	Italy	USA
Material number	DIN	BS	ANFOR	UNI	AISI/SAE
0.6030	GG30	Grade 300	Ft30D	G30	N045B



Examples

Example 1	Component description:	Top Plange, gray cast iron
	Recommended insert:	CNMG 120412 RTTT7005
	Cutting conditions: Wet cutting, Internal turning, light interrupted cut	Cutting parameters: Vc=365 m/min, f=0.3–0.5 mm/rev, ap=1.5 mm

Example 2	**Component description:**	Break disc, gray cast iron
	Recommended insert:	CNMG 120412 RTTT7005
	Cutting conditions: Wet cutting, External turning, continuous cut	Cutting parameters: Vc=600 m/min, f=0.3 mm/rev, ap=2.0 mm

Example 3	**Component description:**	Brake disc, gray cast iron
	Recommended insert:	CNGX 120712 CH AS500
	Cutting conditions: Wet cutting, External turning, continuous cut	Cutting parameters: Vc=800 m/min, f=0.45 mm/rev, ap=2.5 mm

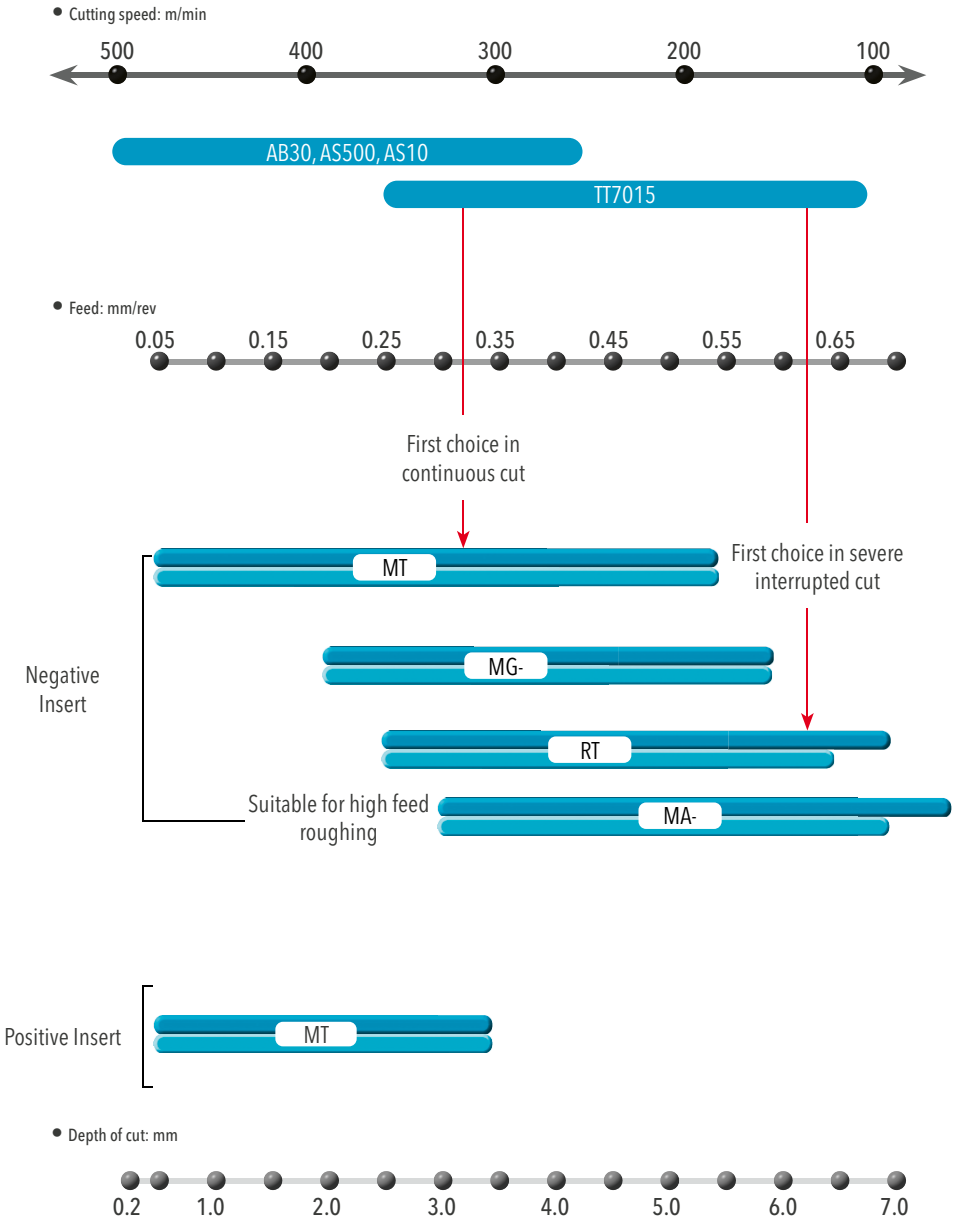
Example 4	**Component description:**	Brake disc, gray cast iron
	Recommended insert:	SNGX 120716 CH AS10
	Cutting conditions: Wet cutting, External turning, continuous cut	Cutting parameters: Vc=600 m/min, f=0.55 mm/rev, ap=4.0 mm

Example 5	**Component description:**	Cylinder jam, gray cast iron (180-230HB)
	Recommended insert:	TNGN 160804 AB30
	Cutting conditions: Wet cutting, External turning, continuous cut	Cutting parameters: Vc=800 m/min, f=0.35 mm/rev, ap=0.5 mm

Example 6	**Component description:**	Brake disk, gray cast iron (180-230HB)
	Recommended insert:	SNGN 120716 AW120
	Cutting conditions: Wet cutting, External turning, continuous cut	Cutting parameters: Vc=925 m/min, f=0.4 mm/rev, ap=0.5 mm

Ductile Cast Iron (HB180-220)

Germany		UK	France	Italy	USA
Material number	DIN	BS	ANFOR	UNI	AISI/SAE
0.7040	GGG40	SNG 420/12	FGS400-12	GS400-12	60-40-18

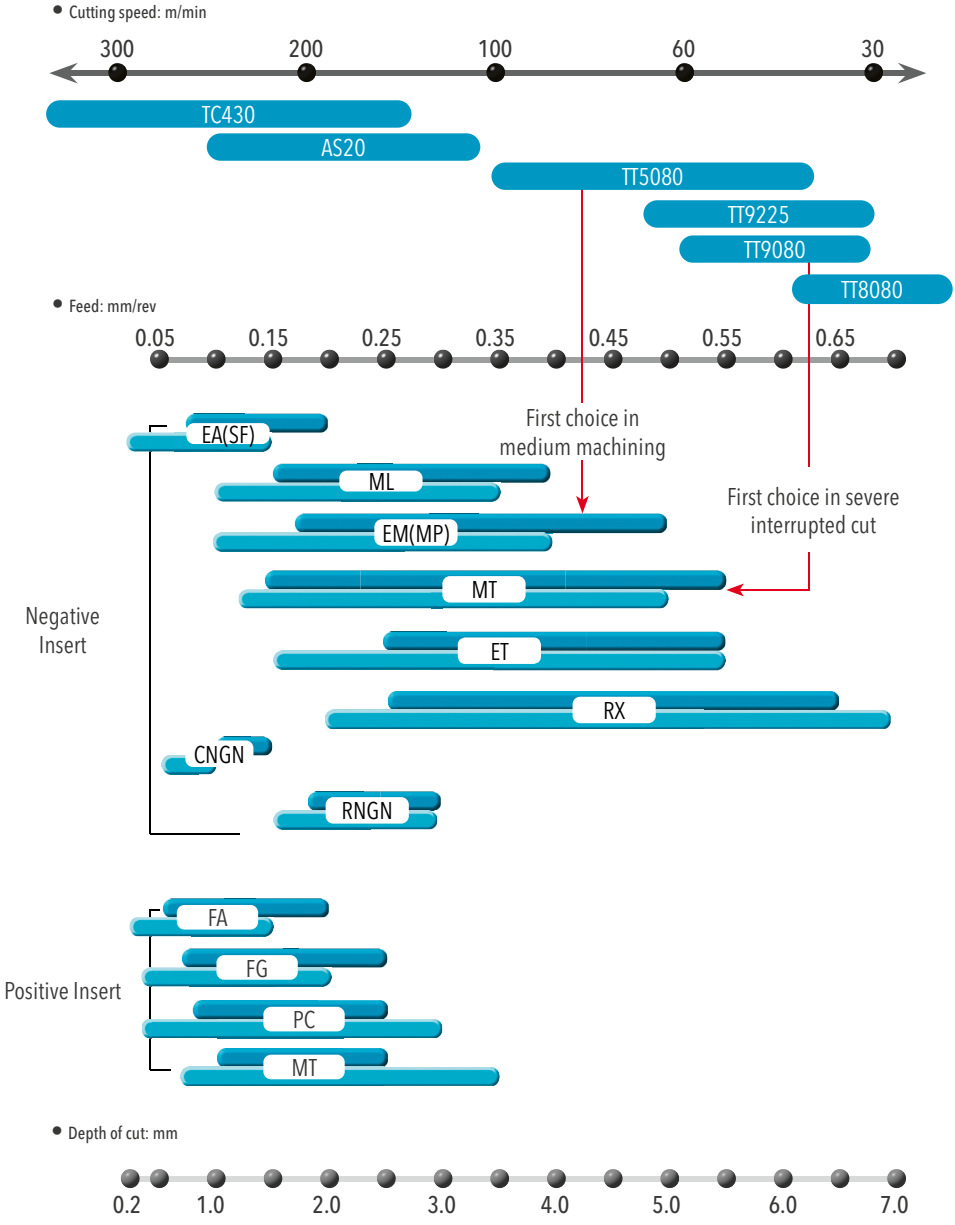


Examples

Example 1	Component description:	Pump cover, ductile cast iron
	Recommended insert:	WNMA 080408 TT7015
	Cutting conditions: Wet cutting, External & face turning, severe interrupted cut	Cutting parameters: Vc=220 m/min, f=0.3 mm/rev, ap=2.0–3.0 mm
Example 2	**Component description:**	Pressure plate, ductile cast iron
	Recommended insert:	CNMG 120412 RT TT7015
	Cutting conditions: Wet cutting, External turning, continuous & interrupted cut	Cutting parameters: Vc=270 m/min, f=0.2~0.48 mm/rev, ap=0.5 mm
Example 3	**Component description:**	Hub, ductile cast iron
	Recommended insert:	CNMG 120412 RT TT7015
	Cutting conditions: Wet cutting, External turning, continuous & interrupted cut	Cutting parameters: Vc=200 m/min, f=0.17–0.3 mm/rev, ap=2.5 mm
Example 4	**Component description:**	Axle housing, ductile cast iron
	Recommended insert:	CNMG 120412 RT TT7015
	Cutting conditions: Wet cutting, External turning, continuous & interrupted cut	Cutting parameters: Vc=260 m/min, f=0.23 mm/rev, ap=5.0 mm
Example 5	**Component description:**	Fly wheel, ductile cast iron
	Recommended insert:	CNGX 120712 CH AS500
	Cutting conditions: Wet cutting, External & face turning, continuous cut	Cutting parameters: Vc=800 m/min, f=0.4 mm/rev, ap=2.5 mm
Own example	**Component description:**	
	Recommended insert:	
	Cutting conditions:	Cutting parameters:

Ni Based Super Alloy

Germany		UK	France	Italy	USA
Material number	DIN	BS	ANFOR	UNI	AISI/SAE
2.4668	NiCr19NbMo	–	–	–	5662



Examples

Example 1	Component description:	Ball, Inconel 625
	Recommended insert:	CNMG 120408 ML TT5080
	Cutting conditions: Wet cutting, Internal turning, continuous cut	Cutting parameters: Vc=40 m/min, f=0.2 mm/rev, ap=0.5 mm

Example 2	**Component description:**	Axle, Inconel 718
	Recommended insert:	CNMG 120408 EM TT5080
	Cutting conditions: Wet cutting, External turning, continuous cut	Cutting parameters: Vc=60 m/min, f=0.18 mm/rev, ap=0.8 mm

Example 3	**Component description:**	Axle, Inconel 718
	Recommended insert:	CNMG 120408 MP TT5080
	Cutting conditions: Wet cutting, External turning, continuous cut	Cutting parameters: Vc=50 m/min, f=0.22 mm/rev, ap=2.0 mm

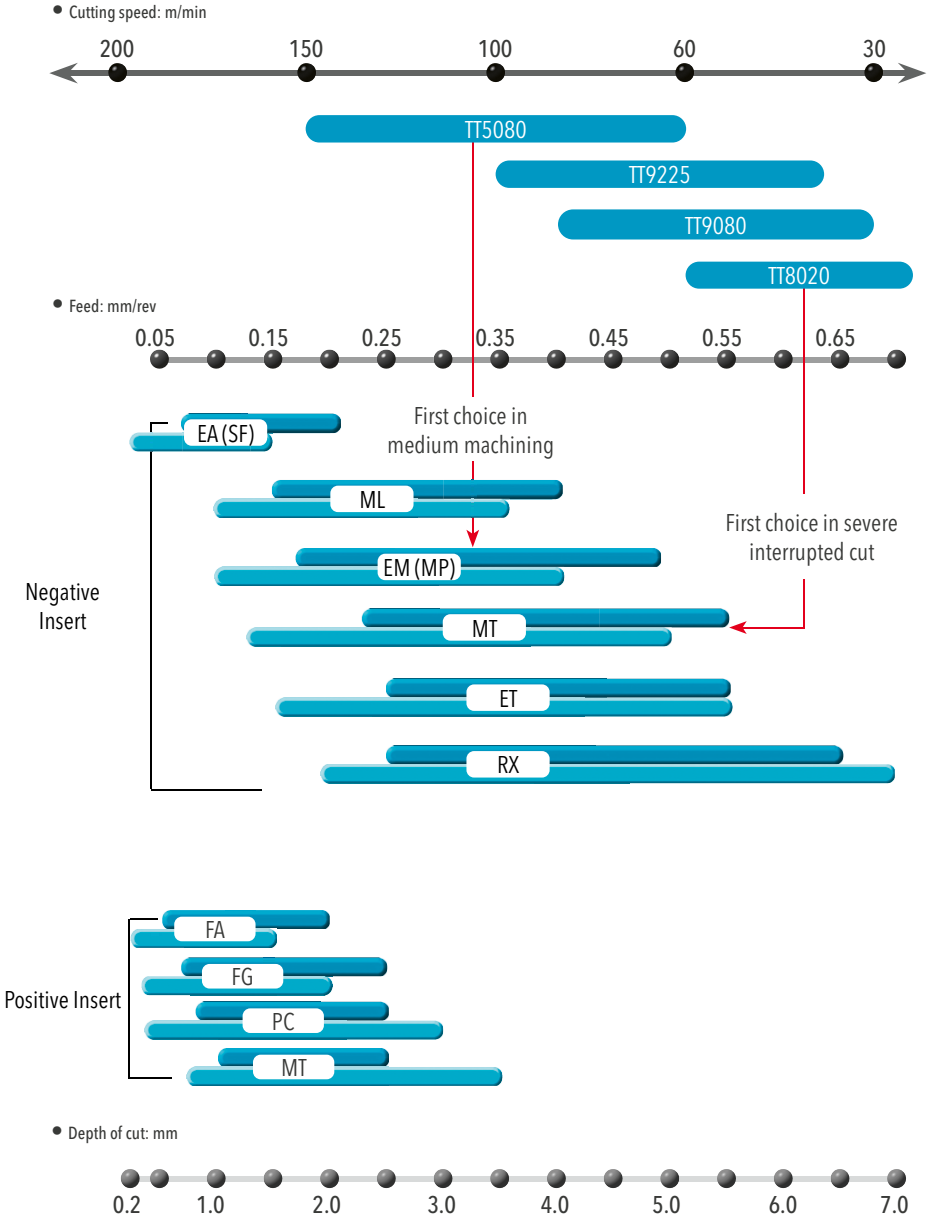
Example 4	**Component description:**	Turbine disk, Inconel 718
	Recommended insert:	CNMG 120408 EM TT9080
	Cutting conditions: Wet cutting, External turning, continuous cut	Cutting parameters: Vc=25 m/min, f=0.25 mm/rev, ap=1.5 mm

Example 5	**Component description:**	Sleeve, Inconel 718
	Recommended insert:	RNGN 120700 T7 TC430
	Cutting conditions: Wet cutting, External turning, continuous cut	Cutting parameters: Vc=180 m/min, f=0,2 mm/rev, ap=2,5 mm

Own example	**Component description:**	
	Recommended insert:	
	Cutting conditions:	Cutting parameters:

Titanium Alloy

Germany		UK	France	Italy	USA
Material number	DIN	BS	ANFOR	UNI	AISI/SAE
–	–	–	–	–	–

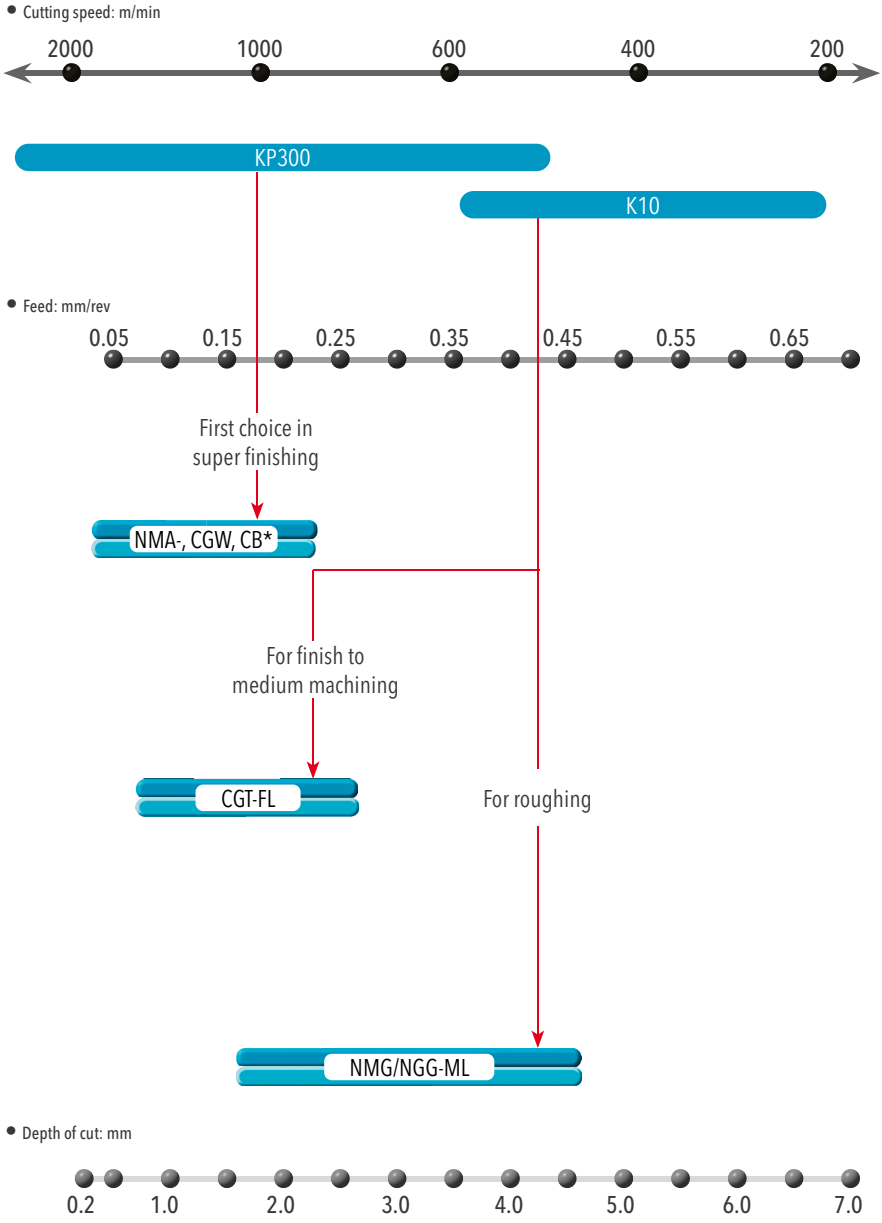


Examples

Example 1	Component description:	Sleeve, Titanium alloy
	Recommended insert:	CNMG 120408 MP TT5080
	Cutting conditions: Wet cutting, External turning, continuous cut	Cutting parameters: Vc=85 m/min, f=0.3 mm/rev, ap=2.5 mm
Example 2	**Component description:**	Pin, Titanium alloy
	Recommended insert:	CNMG 120408 EM TT5080
	Cutting conditions: Wet cutting, External turning, continuous cut	Cutting parameters: Vc=60 m/min, f=0.3 mm/rev, ap=2.0 mm
Example 3	**Component description:**	Valve spindle, Titanium alloy
	Recommended insert:	CCMT 09T304 TT9225
	Cutting conditions: Wet cutting, External turning, continuous cut	Cutting parameters: Vc=40 m/min, f=0.12 mm/rev, ap=0.5 mm
Example 4	**Component description:**	Pin, Titanium alloy
	Recommended insert:	WNMG 080408 EA TT9080
	Cutting conditions: Wet cutting, External turning, continuous cut	Cutting parameters: Vc=50 m/min, f=0.12 mm/rev, ap=0.3 mm
Own example	**Component description:**	
	Recommended insert:	
	Cutting conditions:	Cutting parameters:
Own example	**Component description:**	
	Recommended insert:	
	Cutting conditions:	Cutting parameters:

Low Si Aluminum Alloy (12.2%<Si)

Germany		UK	France	Italy	USA
Material number	DIN	BS	ANFOR	UNI	AISI/SAE
3.2982	AlSi12	LM20	-	-	A413.0



Examples

Example 1	Component description:	Aluminum wheel, Aluminum alloy with 7% Si
	Recommended insert:	DCGT 11T308 FL K10
	Cutting conditions: Wet cutting, Internal turning, continuous cut	Cutting parameters: Vc=1500 m/min, f=0.3 mm/rev, ap=2.0 mm

Example 2	**Component description:**	Aluminum wheel, Aluminum alloy with 7% Si
	Recommended insert:	VCGW 160408 LN-7 KP300
	Cutting conditions: Wet cutting, Internal turning, continuous cut	Cutting parameters: Vc=2000 m/min, f=0.15 mm/rev, ap=0.2 mm

Example 3	**Component description:**	Pump case, Aluminum alloy with 8% Si
	Recommended insert:	TCGT 16T308 FL K10
	Cutting conditions: Wet cutting, Internal turning, continuous cut	Cutting parameters: Vc=400 m/min, f=0.1 mm/rev, ap=1.75 mm

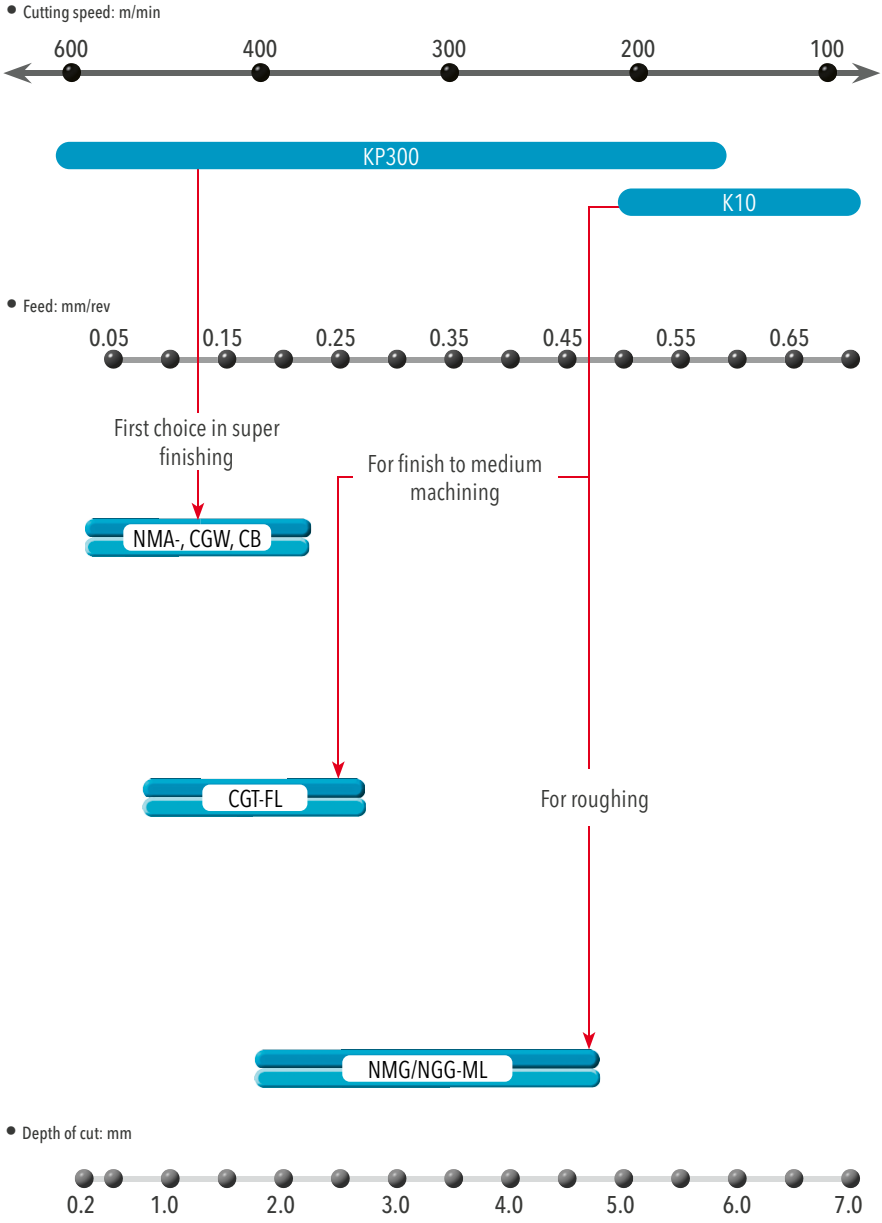
Example 4	**Component description:**	Cylinder head, Aluminum alloy with 12% Si
	Recommended insert:	TCGT 110204 KP300
	Cutting conditions: Wet cutting, External turning, continuous cut	Cutting parameters: Vc=500 m/min, f=0.24 mm/rev, ap=1.5 mm

Own example	**Component description:**	
	Recommended insert:	
	Cutting conditions:	Cutting parameters:

Own example	**Component description:**	
	Recommended insert:	
	Cutting conditions:	Cutting parameters:

High Si Aluminum Alloy (Si≥12%)

Germany		UK	France	Italy	USA
Material number	DIN	BS	ANFOR	UNI	AISI/SAE
–	–	LM16	–	–	B55.0



Examples

Example roughing	Component description:	Piston for diesel engine, Aluminum alloy with18% Si
	Recommended insert:	SCGT 120408 FL K10
	Cutting conditions: Wet cutting, External turning, continuous cut	Cutting parameters: Vc=180 m/min, f=0.33 mm/rev, ap=1.0 mm

Example finishing	**Component description:**	Piston for diesel engine, Aluminum alloy with18% Si
	Recommended insert:	CCGW 09T308 LN-7 KP300
	Cutting conditions: Wet cutting, External turning, continuous cut	Cutting parameters: Vc=300 m/min, f=0.15 mm/rev, ap=0.2 mm

Own example	**Component description:**	
	Recommended insert:	
	Cutting conditions:	Cutting parameters:

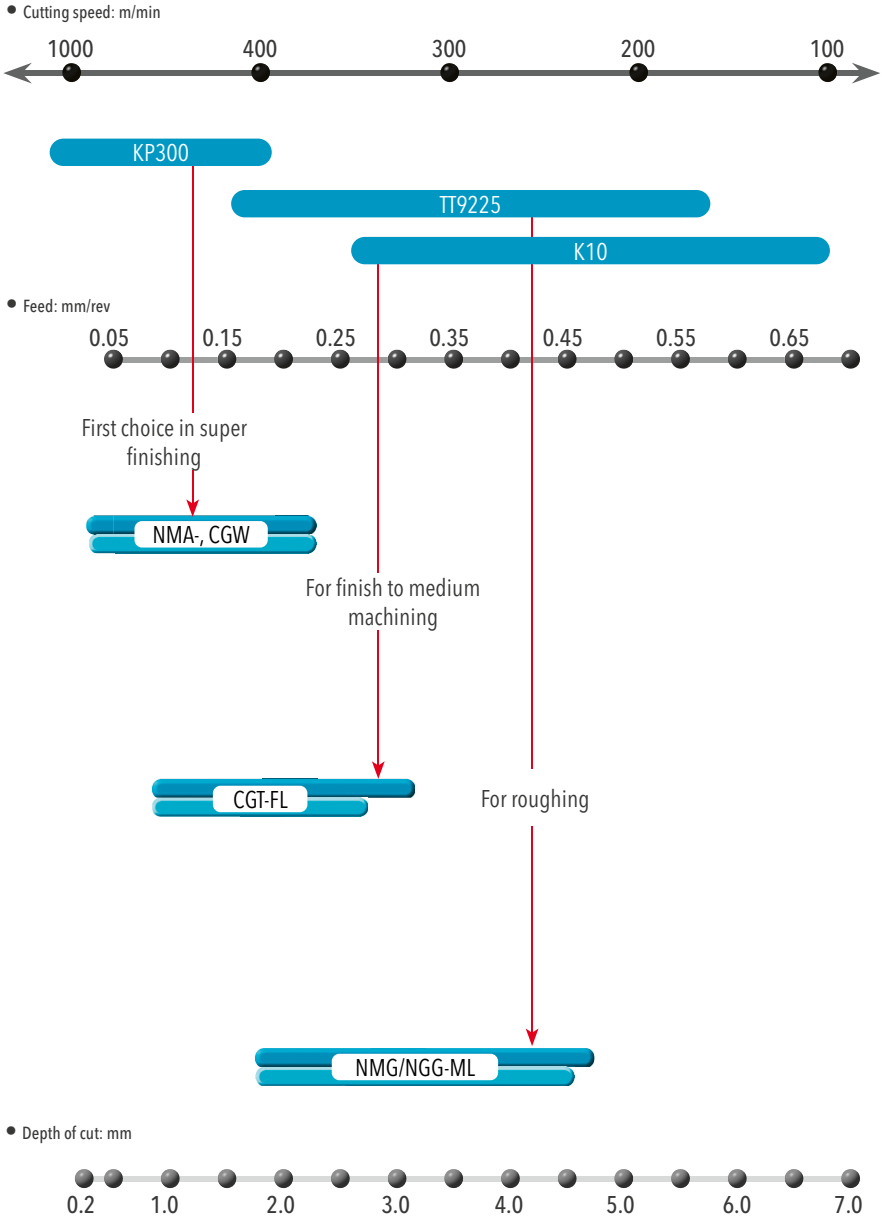
Own example	**Component description:**	
	Recommended insert:	
	Cutting conditions:	Cutting parameters:

Own example	**Component description:**	
	Recommended insert:	
	Cutting conditions:	Cutting parameters:

Own example	**Component description:**	
	Recommended insert:	
	Cutting conditions:	Cutting parameters:

Copper Alloy

Germany		UK	France	Italy	USA
Material number	DIN	BS	ANFOR	UNI	AISI/SAE
–	–	–	–	–	–



Examples

Example 1	Component description:	Ring, Brass
	Recommended insert:	TCGT 16T308 FL K10
	Cutting conditions: Wet cutting, External turning, continuous cut	Cutting parameters: Vc=70 m/min, f=0.15 mm/rev, ap=0.6 mm

Example 2	**Component description:**	Pipe, Brass
	Recommended insert:	SNMG 190612 MT TT9225
	Cutting conditions: Wet cutting, External turning, continuous cut	Cutting parameters: Vc=250 m/min, f=0.45 mm/rev, ap=3.0–4.0 mm

Eigenes 3	**Component description:**	Guide ring, Brass
	Recommended insert:	DCGT 11T304 FL K10
	Cutting conditions: Dry cutting, Internal turning, continuous & interrupted cut	Cutting parameters: Vc=390 m/min, f=0.12 mm/rev, ap=1.5 mm

Own example	**Component description:**	
	Recommended insert:	
	Cutting conditions:	Cutting parameters:

Own example	**Component description:**	
	Recommended insert:	
	Cutting conditions:	Cutting parameters:

Own example	**Component description:**	
	Recommended insert:	
	Cutting conditions:	Cutting parameters:

Recommended cutting parameters, grades and chipbreakers

Insert type	Application	Depth of cut (mm)	Workpiece. stability and machine condition	First and second choice	Workpiece Material											
					0.15% Carbon steel (HB=150)				0.45% Carbon steel (HB 180–200)				0.55% Carbon steel (HB 200–220)			
					Grade	chipbreaker	V_c (m/min)	f_n (mm/rev)	Grade	chipbreaker	V_c (m/min)	f_n (mm/rev)	Grade	chipbreaker	V_c (m/min)	f_n (mm/rev)
N	F	–1.0	Best	1	PV3010	FC	475	0.12	PV3010	FG	355	0.15	PV3010	FG	330	0.15
				2	CT3000	FC	430	0.12	TT8115	FG	340	0.15	TT8115	FG	315	0.15
	M	1.0–2.5	Best	1	TT5100	ML	330	0.20	TT8115	MP	330	0.30	TT8115	MP	305	0.30
				2	TT8125	ML	420	0.20	TT8125	MP	300	0.30	TT8125	MP	280	0.30
			Normal	1	TT5100	MP	315	0.24	TT8115	PC	310	0.30	TT8115	PC	290	0.30
				2	TT8125	MP	400	0.24	TT8125	PC	280	0.30	TT8125	PC	260	0.30
			Poor	1	TT8020	MT	235	0.24	TT8135	RT	190	0.32	TT8135	RT	180	0.32
				2	–	–	–	–	–	–	–	–	–	–	–	–
		2.5–4.0	Best	1	TT5100	PC	300	0.28	TT8115	PC	310	0.35	TT8115	MP	290	0.35
				2	TT8125	PC	385	0.28	TT8125	PC	280	0.35	TT8125	PC	260	0.35
			Normal	1	TT5100	MT	285	0.28	TT8125	PC	280	0.35	TT8125	MT	260	0.35
				2	TT8125	MT	370	0.28	TT8125	MT	265	0.40	TT8125	MG–	245	0.40
			Poor	1	TT8020	MT	215	0.24	TT8135	RT	180	0.36	TT8135	RT	180	0.36
				2	–	–	–	–	–	–	–	–	–	–	–	–
	R	4.0–7.0	Normal	1	TT5100	RT	230	0.45	TT8125	RT	260	0.56	TT8125	RT	240	0.56
				2	TT8125	RT	320	0.45	TT8115	RT	290	0.56	TT8135	RT	270	0.56
			Poor	1	TT8020	RT	180	0.36	TT8135	RT	180	0.45	TT8135	RT	160	0.45
				2	–	–	–	–	–	–	–	–	–	–	–	–
		7.0–	Normal	1	TT5100	RH	210	0.57	TT8125	RH	245	0.71	TT8125	RH	225	0.71
				2	–	–	–	–	–	–	–	–	–	–	–	–
			Poor	1	TT8020	RH	165	0.46	TT8135	RH	165	0.57	TT8135	RH	150	0.57
				2	–	–	–	–	–	–	–	–	–	–	–	–
P	F	–1.0	Best	1	PV3010	FG	475	0.12	PV3010	FG	355	0.15	PV3010	FG	330	0.15
				2	CT3000	FG	420	0.12	CT3000	FG	315	0.15	CT3000	FG	295	0.15
	M	1.0–3.5	Best	1	TT5100	MT	285	0.17	TT8115	MT	310	0.20	TT8115	MT	285	0.20
				2	TT8125	MT	370	0.17	TT8125	MT	280	0.20	TT8125	MT	255	0.20
			Normal	1	TT5100	MT	275	0.17	TT8125	MT	280	0.20	TT8125	MT	255	0.20
				2	TT8125	MT	350	0.17	TT5100	MT	215	0.20	TT5100	MT	195	0.20
			Poor	1	TT8020	MT	220	0.17	TT8135	MT	190	0.20	TT8135	MT	180	0.20
				2	–	–	–	–	–	–	–	–	–	–	–	–

Explanation:

N:	negative Insert
P:	positive Insert
F:	Finishing
M:	Medium
R:	Roughing
Best:	continuous cut, good rigidity, stable cutting conditions
Normal:	slightly interrupted cut, good rigidity, medium machining and roughing
Poor:	severely interrupted cut, poor rigidity, low cutting speed

Workpiece Material																
Low carbon (0.13 – 0.22%) alloy steel (HB150 – 180)				Cr–Mo alloy steel (HB 200–220)				Ni–Cr–Mo alloy steel (HB 200–220)				Bearing steel (HB 200–220)			
Grade	chipbreaker	V_c (m/min)	f_n (mm/rev)	Grade	chipbreaker	V_c (m/min)	f_n (mm/rev)	Grade	chipbreaker	V_c (m/min)	f_n (mm/rev)	Grade	chipbreaker	V_c (m/min)	f_n (mm/rev)
PV3010	FC	420	0.12	PV3010	FG	330	0.15	PV3010	FG	320	0.15	PV3010	FG	330	0.15
CT3000	FC	380	0.12	TT8115	FG	315	0.15	TT8115	FG	305	0.15	TT8115	FG	315	0.15
TT5100	ML	295	0.20	TT8115	MP	305	0.30	TT8115	MP	295	0.30	TT8115	MP	305	0.30
TT8125	ML	375	0.20	TT8125	MP	280	0.30	TT8125	MP	270	0.30	TT8125	MP	280	0.30
TT5100	PC	285	0.24	TT8115	PC	290	0.30	TT8115	PC	280	0.30	TT8115	PC	290	0.30
TT8125	PC	365	0.24	TT8125	MC	260	0.30	TT8125	PC	250	0.30	TT8125	PC	260	0.30
TT8020	MT	205	0.24	TT8135	RT	180	0.32	TT8135	RT	170	0.32	TT8135	RT	180	0.32
–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
TT5100	PC	265	0.28	TT8115	PC	290	0.35	TT8115	PC	280	0.35	TT8115	PC	290	0.35
TT8125	PC	340	0.28	TT8125	PC	260	0.35	TT8125	PC	250	0.35	TT8125	PC	260	0.35
TT5100	MT	255	0.28	TT8125	MT	260	0.35	TT8125	MT	250	0.35	TT8125	MT	260	0.35
TT8125	MT	315	0.28	TT8125	MG–	245	0.40	TT8125	MG–	240	0.40	TT8125	MG–	245	0.40
TT8020	MT	190	0.24	TT8135	RT	180	0.36	TT8135	RT	170	0.36	TT8135	RT	180	0.36
–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
TT5100	RT	205	0.45	TT8125	RT	240	0.56	TT8125	RT	235	0.56	TT8125	RT	240	0.56
TT8125	RT	250	0.45	TT8115	RT	270	0.56	TT8115	RT	260	0.56	TT8115	RT	270	0.56
TT8020	RT	160	0.36	TT8135	RT	160	0.45	TT8135	RT	160	0.45	TT8135	RT	160	0.45
–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
TT5100	RH	185	0.57	TT8125	RH	225	0.71	TT8125	RH	220	0.71	TT8125	RH	225	0.71
–	–	–	–	–	RT	225	0.64	TT8125	RT	220	0.64	–	–	–	–
TT8020	RH	150	0.46	TT7100	RH	140	0.57	TT8135	RH	150	0.57	TT8135	RH	150	0.57
–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
PV3010	FG	420	0.12	PV3010	FG	330	0.15	PV3010	FG	320	0.15	PV3010	FG	330	0.15
CT3000	FG	380	0.12	CT3000	FG	295	0.15	CT3000	FG	285	0.15	CT3000	FG	295	0.15
TT5100	MT	265	0.17	TT8115	MT	285	0.20	TT8115	MT	275	0.20	TT8115	MT	285	0.20
TT8125	MT	345	0.17	TT8125	MT	255	0.20	TT8125	MT	250	0.20	TT8125	MT	255	0.20
TT5100	MT	255	0.17	TT8125	MT	255	0.20	TT8125	MT	250	0.20	TT8125	MT	255	0.20
TT8125	MT	330	0.17	TT5100	MT	195	0.20	TT5100	MT	190	0.20	TT5100	MT	195	0.20
TT8020	MT	205	0.17	TT8135	MT	180	0.20	TT8135	MT	170	0.20	TT8135	MT	180	0.20
–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–

Recommended cutting parameters, grades and chipbreakers

Insert type	Application	Depth of cut (mm)	Workpiece. stability and machine condition	First and second choice	Workpiece Material											
					Carbon tool steel (HB 200–220)				Alloy tool steel (HB 200–220)				HSS (HB 220–260)			
					Grade	chipbreaker	V_c (m/min)	f_n (mm/rev)	Grade	chipbreaker	V_c (m/min)	f_n (mm/rev)	Grade	chipbreaker	V_c (m/min)	f_n (mm/rev)
N	F	–1.0	Best	1	PV3010	FG	330	0.15	PV3010	FG	320	0.15	PV3010	FG	230	0.10
				2	TT8115	FG	315	0.15	TT8115	FG	305	0.15	CT3000	FG	210	0.10
	M	1.0–2.5	Best	1	TT8115	MP	305	0.30	TT8115	MP	295	0.30	TT5080	ML	180	0.15
				2	TT8125	MP	280	0.30	TT8125	MP	250	0.30	TT5100	ML	160	0.15
			Normal	1	TT8115	PC	290	0.30	TT8115	PC	280	0.30	TT5080	MP	170	0.20
				2	TT8125	PC	260	0.30	TT8125	PC	250	0.30	TT5100	MP	150	0.20
			Poor	1	TT8135	RT	180	0.32	TT8135	RT	170	0.32	TT5100	MT	135	0.25
				2	–	–	–	–	–	–	–	–	–	–	–	–
		2.5–4.0	Best	1	TT8115	MT	290	0.35	TT8115	PC	280	0.35	TT5080	MP	170	0.20
				2	TT8125	MT	260	0.35	TT8125	PC	250	0.35	TT5100	MP	145	0.20
			Normal	1	TT8125	MT	260	0.35	TT8125	MT	250	0.35	TT5080	MT	160	0.25
				2	TT8125	MG–	245	0.40	TT8125	MG–	240	0.40	TT5100	MT	135	0.25
			Poor	1	TT8135	RT	180	0.36	TT8135	RT	170	0.36	TT8135	RT	140	0.25
				2	–	–	–	–	–	–	–	–	–	–	–	–
	R	4.0–7.0	Normal	1	TT8125	RT	240	0.56	TT8125	RT	235	0.56	–	–	–	–
				2	TT8115	RT	270	0.56	TT8115	RT	260	0.56	–	–	–	–
			Poor	1	TT8135	RT	160	0.45	TT8135	RT	140	0.45	–	–	–	–
				2	–	–	–	–	–	–	–	–	–	–	–	–
		7.0–	Normal	1	TT8125	RH	225	0.71	TT8115	RH	220	0.71	–	–	–	–
				2	–	–	–	–	–	–	–	–	–	–	–	–
			Poor	1	TT8135	RH	150	0.57	TT8135	RH	140	0.57	–	–	–	–
				2	–	–	–	–	–	–	–	–	–	–	–	–
P	F	–1.0	Best	1	PV3010	FG	330	0.15	PV3010	FG	320	0.15	PV3010	FG	230	0.10
				2	CT3000	FG	295	0.15	CT3000	FG	285	0.15	CT3000	FG	210	0.10
	M	1.0–3.5	Best	1	TT8115	MT	285	0.20	TT8115	MT	275	0.20	TT5080	MT	165	0.15
				2	TT8125	MT	255	0.20	TT8125	MT	250	0.20	TT5100	MT	145	0.15
			Normal	1	TT8125	MT	255	0.20	TT8125	MT	250	0.20	TT5080	MT	160	0.15
				2	TT5100	MT	195	0.20	TT5100	MT	190	0.20	TT5100	MT	140	0.15
			Poor	1	TT8135	MT	180	0.20	TT8135	MT	170	0.20	TT8135	MT	135	0.15
				2	–	–	–	–	–	–	–	–	–	–	–	–

Explanation:

N:	negative Insert
P:	positive Insert
F:	Finishing
M:	Medium
R:	Roughing
Best:	continuous cut, good rigidity, stable cutting conditions
Normal:	slightly interrupted cut, good rigidity, medium machining and roughing
Poor:	severely interrupted cut, poor rigidity, low cutting speed

Workpiece Material																
Cold working die steel (HB 220–260)				High hardness material (40HRC)				Martensitic/ferritic stainless steel (HB 180–200)				Austenitic stainless steel (HB 180–200)				
Grade	chipbreaker	V_c (m/min)	f_n (mm/rev)	Grade	chipbreaker	V_c (m/min)	f_n (mm/rev)	Grade	chipbreaker	V_c (m/min)	f_n (mm/rev)	Grade	chipbreaker	V_c (m/min)	f_n (mm/rev)	
TT8115	FG	240	0.14	AB2010	–	120	0.10	PV3010	SF	330	0.12	PV3010	SF	265	0.12	
TT8125	FG	210	0.14	TB610	–	120	0.10	TT9215	EA	260	0.12	TT9215	EA	210	0.12	
TT8115	MP	230	0.28	AB2010	–	120	0.15	TT9215	EM	230	0.20	TT9215	EM	200	0.20	
TT8125	MP	210	0.28	TB670	–	120	0.15	–	–	–	–	–	–	–	–	
TT8115	PC	215	0.28	AB20	–	100	0.15	TT9225	EM	210	0.24	TT9225	EM	185	0.24	
TT8125	PC	195	0.28	TB730	–	100	0.15	TT9235	MP	180	0.24	TT9235	MP	145	0.24	
TT8135	RT	130	0.29	AB30	–	80	0.10	TT9080	MT	170	0.24	TT9080	MT	135	0.24	
–	–	–	–	KB90A	–	80	0.10	–	–	–	–	–	–	–	–	
TT8115	PC	215	0.32	AB20	–	100	0.15	TT9225	EM	200	0.24	TT9225	EM	160	0.24	
TT8125	PC	195	0.32	KB90A	–	100	0.15	–	–	–	–	–	–	–	–	
TT8125	MT	175	0.32	AB20	–	100	0.15	TT9225	MP	190	0.28	TT9225	MP	150	0.28	
TT8125	MG–	185	0.37	KB90A	–	100	0.15	TT9235	MT	165	0.28	TT9235	MT	135	0.28	
TT8135	RT	130	0.33	AB30	–	80	0.10	TT9080	MT	165	0.24	TT9080	MT	125	0.24	
–	–	–	–	KB90A	–	80	0.10	–	–	–	–	–	–	–	–	
TT8125	RT	180	0.52	–	–	–	–	TT9225	ET	170	0.45	TT9225	ET	130	0.45	
TT8115	RT	205	0.52	–	–	–	–	–	–	–	–	–	–	–	–	
TT8135	RT	125	0.41	–	–	–	–	TT9080	ET	150	0.36	TT9080	ET	110	0.36	
–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	
TT8125	RH	170	0.65	–	–	–	–	TT9225	RX	160	0.64	TT9225	RX	120	0.64	
–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	
TT8135	RH	115	0.52	–	–	–	–	TT9080	RX	135	0.55	TT9080	RX	100	0.55	
–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	
PV3010	FG	250	0.14	TB670	–	150	0.10	PV3010	FG	330	0.12	PV3010	FG	265	0.12	
CT3000	FG	225	0.14	AB20	–	120	0.10	TT9215	FG	270	0.12	TT9215	FG	220	0.12	
TT8115	MT	215	0.18	TB670	–	150	0.12	TT9225	PC	195	0.17	TT9225	PC	160	0.17	
TT8125	MT	195	0.18	AB20	–	120	0.12	–	–	–	–	–	–	–	–	
TT8125	MT	215	0.18	AB20	–	100	0.12	TT9225	PC	185	0.17	TT9225	PC	150	0.17	
TT5100	MT	195	0.18	TB670	–	100	0.12	TT9235	MT	160	0.17	TT9235	MT	130	0.17	
TT8135	MT	160	0.18	AB30	–	80	0.08	TT9080	MT	150	0.17	TT9080	MT	120	0.17	
–	–	–	–	KB90A	–	80	0.08	–	–	–	–	–	–	–	–	

Recommended cutting parameters, grades and chipbreakers

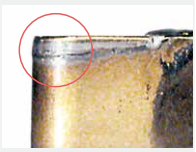
Insert type	Application	Depth of cut (mm)	Workpiece. stability and machine condition	First and second choice	Workpiece Material											
					Gray cast iron (HB 180 – 220))				Ductile cast iron (HB 200 – 240)				Ni based super alloy			
					Grade	chipbreaker	V_c (m/min)	f_n (mm/rev)	Grade	chipbreaker	V_c (m/min)	f_n (mm/rev)	Grade	chipbreaker	V_c (m/min)	f_n (mm/rev)
N	F	–1.0	Best	1	AS500	–	600	0.25	AS500	–	440	0.20	TC430	–	250	0.15
				2	TT7005	MT	400	0.25	TT7005	MT	320	0.20	TT5080	EA	60	0.15
	M	1.0–2.5	Best	1	AS500	–	570	0.35	AS500	–	420	0.30	TC430	–	250	0.15
				2	TT7005	MT	380	0.35	TT7005	MT	305	0.30	TT5080	EM	60	0.20
			Normal	1	AS10	–	540	0.35	AS10	–	400	0.30	TT5080	MP	50	0.20
				2	TT7005	MT	360	0.35	TT7005	MT	290	0.30	–	–	–	–
			Poor	1	TT7005	RT	320	0.40	TT7015	RT	250	0.35	TT9080	MT	35	0.20
				2	TT7015	RT	270	0.40	–	–	–	–	–	–	–	–
		2.5–4.0	Best	1	AS10	–	540	0.35	AS10	–	400	0.30	TT5080	EM	50	0.20
				2	TT7005	MT	360	0.35	TT7005	MT	275	0.30	–	–	–	–
			Normal	1	AS10	–	510	0.35	AS10	–	380	0.30	TT5080	MP	45	0.20
				2	TT7005	RT	320	0.40	TT7015	MT	260	0.35	–	–	–	–
			Poor	1	TT7005	RT	300	0.40	TT7015	RT	235	0.35	TT9080	MT	30	0.20
				2	TT7015	RT	255	0.40	–	–	–	–	–	–	–	–
	R	4.0–7.0	Normal	1	TT7005	RT	300	0.60	TT7015	RT	240	0.52	TT5080	ET	40	0.20
				2	–	–	–	–	–	–	–	–	–	–	–	–
			Poor	1	TT7015	RT	240	0.60	TT7015	RT	225	0.52	TT9080	ET	25	0.20
				2	–	–	–	–	–	–	–	–	–	–	–	–
		7.0–	Normal	1	TT7005	RT	270	0.80	TT7015	RT	210	0.70	–	–	–	–
				2	–	–	–	–	–	–	–	–	–	–	–	–
			Poor	1	TT7015	RT	220	0.80	TT7015	RT	200	0.70	–	–	–	–
				2	–	–	–	–	–	–	–	–	–	–	–	–
P	F	–1.0	Best	1	TT7005	MT	400	0.18	TT7005	MT	320	0.15	TT5080	FG	60	0.10
				2	TB730	–	700	0.15	–	–	–	–	–	–	–	–
	M	1.0–3.5	Best	1	TT7005	MT	380	0.25	TT7005	MT	305	0.20	TT5080	PC	50	0.15
				2	–	–	–	–	–	–	–	–	–	–	–	–
			Normal	1	TT7005	MT	360	0.25	TT7005	MT	290	0.20	TT5080	PC	45	0.15
				2	TT7015	MT	305	0.25	TT7015	MT	250	0.20	–	–	–	–
			Poor	1	TT7015	MT	290	0.25	TT7015	MT	235	0.20	TT9080	MT	30	0.15
				2	–	–	–	–	–	–	–	–	–	–	–	–

Explanation:

N:	negative Insert
P:	positive Insert
F:	Finishing
M:	Medium
R:	Roughing
Best:	continuous cut, good rigidity, stable cutting conditions
Normal:	slightly interrupted cut, good rigidity, medium machining and roughing
Poor:	severely interrupted cut, poor rigidity, low cutting speed

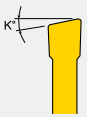
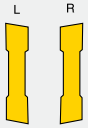
Workpiece Material															
Titanium alloy				Low SI aluminum alloy (12.2% < Si)				High Si aluminum alloy (12.2% ≥ Si)				Copper alloy			
Grade	chipbreaker	V_c (m/min)	f_u (mm/rev)	Grade	chipbreaker	V_c (m/min)	f_u (mm/rev)	Grade	chipbreaker	V_c (m/min)	f_u (mm/rev)	Grade	chipbreaker	V_c (m/min)	f_u (mm/rev)
TT5080	EA	100	0.15	KP300	–	1300	0.10	KP300	–	600	0.10	KP300	–	1100	0.10
–	–	–	–	K10	ML	500	0.15	K10	ML	150	0.15	TT5100	ML	500	0.15
TT5080	EM	90	0.20	KP300	–	1300	0.15	KP300	–	600	0.15	KP300	–	1100	0.15
–	–	–	–	K10	ML	500	0.35	K10	ML	150	0.30	TT5100	ML	400	0.25
TT5080	MP	80	0.20	KP300	–	1300	0.15	KP300	–	600	0.15	KP300	–	1100	0.15
–	–	–	–	K10	ML	500	0.35	K10	ML	150	0.30	TT5100	ML	400	0.25
TT8020	MT	50	0.20	KP300	–	1000	0.15	KP300	–	600	0.15	KP300	–	900	0.15
–	–	–	–	K10	ML	400	0.35	K10	ML	120	0.30	TT5100	MP	320	0.25
TT5080	EM	80	0.20	KP300	–	1300	0.15	KP300	–	600	0.15	KP300	–	1100	0.15
–	–	–	–	K10	ML	500	0.35	K10	ML	150	0.30	TT5100	MP	400	0.30
TT5080	MP	70	0.20	KP300	–	1300	0.15	KP300	–	600	0.15	KP300	–	1100	0.15
–	–	–	–	K10	ML	500	0.35	K10	ML	150	0.30	TT5100	MP	400	0.30
TT8020	MT	45	0.20	KP300	–	1000	0.15	KP300	–	600	0.15	KP300	–	900	0.15
–	–	–	–	K10	ML	400	0.35	K10	ML	120	0.30	TT5100	MT	320	0.30
TT5080	ET	60	0.20	–	–	–	–	–	–	–	–	–	–	–	–
–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
TT8020	ET	40	0.20	–	–	–	–	–	–	–	–	–	–	–	–
–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
TT5080	FG	100	0.10	KP300	–	1300	0.10	KP300	–	600	0.10	KP300	–	1100	0.10
–	–	–	–	K10	FL	500	0.15	K10	FL	150	0.13	TT5100	FG	400	0.15
TT5080	PC	80	0.15	KP300	–	1300	0.15	KP300	–	600	0.15	KP300	–	1100	0.15
–	–	–	–	K10	FL	500	0.25	K10	FL	150	0.22	TT5100	FG	400	0.20
TT5080	PC	75	0.15	KP300	–	1300	0.15	KP300	–	600	0.15	KP300	–	1100	0.15
–	–	–	–	K10	FL	500	0.25	K10	FL	150	0.22	TT5100	FG	400	0.20
TT8020	MT	50	0.15	KP300	–	1000	0.15	KP300	–	500	0.15	KP300	–	900	0.15
–	–	–	–	K10	FL	400	0.25	K10	FL	120	0.25	TT5100	MT	320	0.20

Types of wear

Causes			Solution
Crater Wear		• Excessive cutting speed or feed rate (alloy steel and over 0.3% carbon steel) • Workpiece material contains high hardness chemical elements (tool steel, die steel)	• Reduce cutting speed or feed rate or use more wear resistant grade • Use coolant • Use more positive rake geometry
Flank Wear		• Excessive cutting speed (alloy steel and over 0.3% carbon steel) • Workpiece material contains high hardness chemical elements (tool steel, die steel) • Increase cutting speed if abnormal flank wear is caused by a very slow cutting speed	• Reduce cutting speed or feed rate or use more wear resistant grade • Use coolant • Use more positive rake geometry
Deformation		• Excessive cutting speed or feed rate	• Reduce cutting speed or feed rate or use more wear resistant grade • Use coolant • Use stronger insert geometry
Chipping		• Excessive feed rate • Interrupted cutting	• Reduce feed rate • Use tougher grade • Use stronger insert geometry • Remove coolant completely or apply coolant correctly
Notching		• Machining scale part • From machining work hardened materials	• Use tougher grade • Use stronger insert geometry • Increase lead angle
Built-Up-Edge		• Slow cutting speed • Sticky materials	• Increase cutting speed • Use more positive rake geometry • Increase lead angle
Mechanical Fracture		• Excessive feed rates when interrupted cutting	• Use tougher grade • Use stronger insert geometry • Reduce feed rate • Remove coolant completely or apply coolant correctly • Increase cutting speed
Thermal Cracking		• Repeated thermal shock (interrupted cutting)	• Use tougher grade • Use stronger insert geometry • Reduce feed rate • Remove coolant completely or apply coolant correctly

Notes

Insert designation system

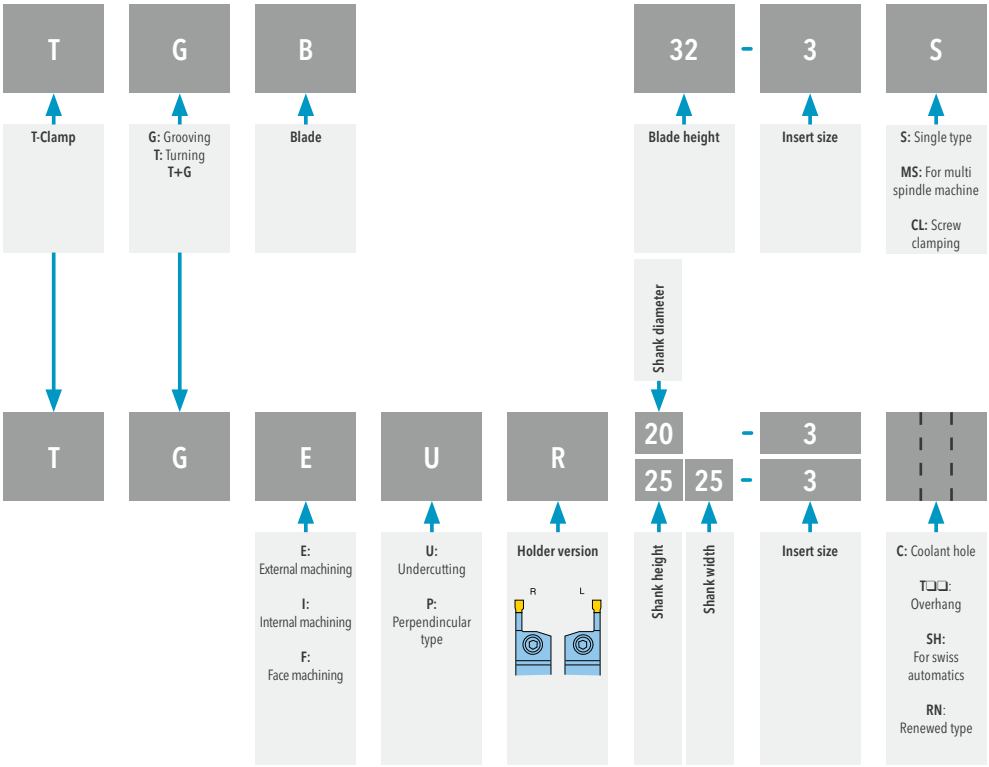
T	D	C	3	–	6	R	S
						Only for RH or LH insert	
T-Clamp	**D:** Double ended insert **S:** Single ended insert	**Chipbreaker Type** **C:** For medium machining **J:** For light machining	**Width of insert (mm)** 2 = 2.0 3 = 3.0 4 = 4.0 5 = 5.0 6 = 6.0		**Lead angle** 	**Version of insert** 	**Sharp corner**

Parting & Grooving

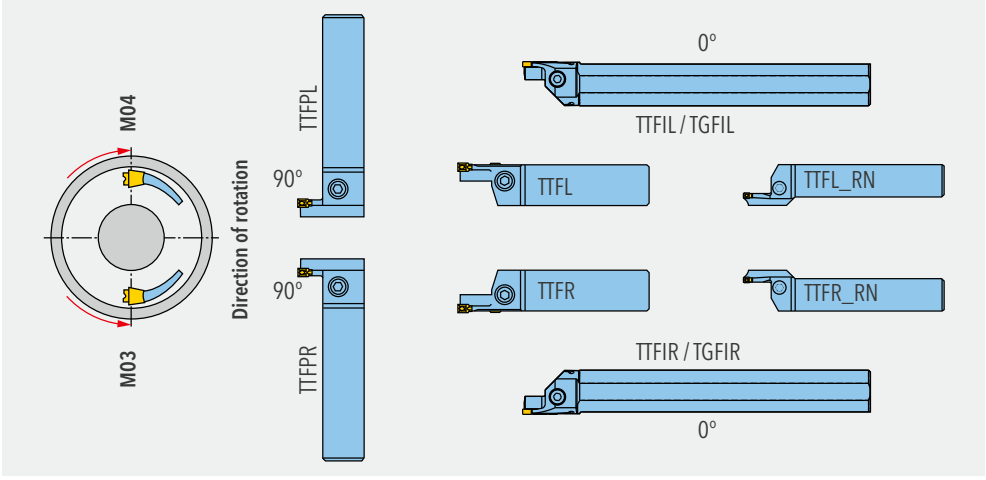
Turning, grooving & face machining

T	D	F	T	3.00	E	–	0,40	R
T-Clamp	**D:** Double ended insert **S:** Single ended insert	**F:** Face turning & grooving **I:** Internal turning & grooving **X: External, internal, face turning & grooving**	**Chipbreaker type** **T:** For carbon steel, alloyed steel, stainless steel, high temp. alloy, cast iron **A:** For aluminum **G:** Without chipbreaker **U:** Universal chipbreaker for groove turning	**Width of insert(mm)** ❑, ❑❑: Precision insert ❑: Pressed insert	**E:** For turning **No designation:** for precision grooving		**Corner radius** ❑, ❑❑: Precision insert ❑, ❑: Pressed insert	**For face machining**  **Application** **R** insert on 'R' tool **L** insert on 'L' tool

Blade & holder designation system



Direction of axial tools



TClampUltraPlus System

For multifunctional operations in one system

- Safe Grooving
- Parting and Grooving
- Shallow Grooving
- Turning and Grooving
- Precision Grooving and Recessing
- Face Grooving and Face Turning
- Undercutting and Recessing

Inserts

- Accuracy with good repeatability
- Pressed chipbreaker
- Top and bottom prismatic guides hold the insert firmly and accurately in the correct position
- TDJ/C is a unique double-ended insert for deep grooving and parting
- TSJ/C is a unique single-ended insert for deep grooving and parting
- TDT double-ended insert for side turning and grooving
- TDA double-ended insert for aluminum machining

Blades & Integral shank tool

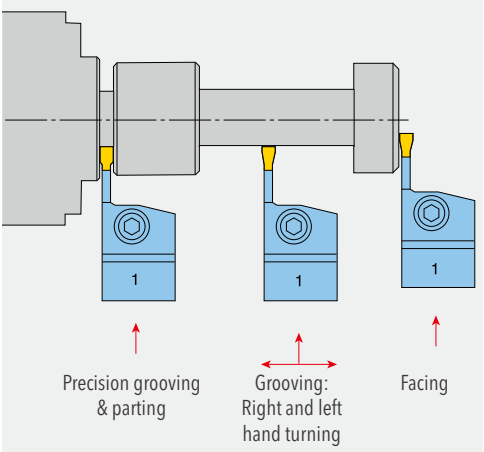
- Simple, accurate and rapid indexing
- Top and bottom seated insert alignment
- Stable support against side forces
- No additional spare parts
- Uses standard holder shanks

Advantages of TClampUltraPlus system

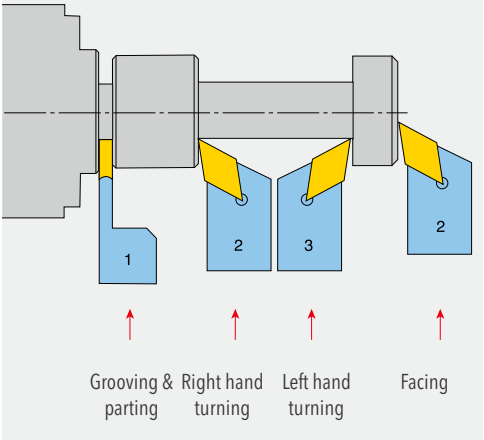
- TClampUltraPlus is available as either double-ended or single ended insert for maximum economy
- Multifunctional use. Right-hand and left-hand turning, grooving and parting with a single tool
- TClampUltraPlusr replaces one or more ISO tools.
- Short cycle time.
- Short set-up with less downtime.
- Less tool changes
- Shorter machining time. The excellent surface finish obtained from rough turning may eliminate finish turning

TClampUltraPlus system vs. ISO-standard

TClampUltraPlus system

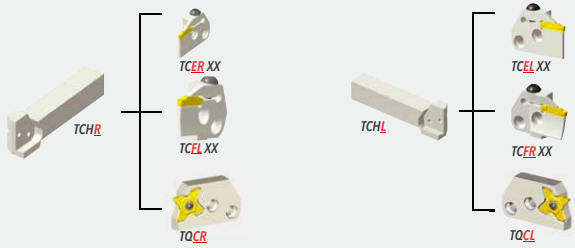


ISO-standardsystem



Adapter and Holder selection / Grades

Parallel Type



Perpendicular Type

C-Adapter & HSK-T Adapter

Grades – Coatings

Quality		ISO	Machining and material
TB2012	CBN	H10–H20	For processing hardened steel in continuous and light interrupted cut
TT6080	PVD coated	K05–K25	Especially suitable for cast steel and nodular cast iron (GGG) with interrupted cut
		H05–H25	
TT9100	PVD coated	P10–P25	A CVD coating with very tough and wear resistant substrate base. Recommended for machining of steel with high cutting speed
TT5100	CVD coated	P20–P35	A CVD coated grade for machining carbon steels, alloy steels and stainless steels with outstanding results
		M20–M35	
TT9080	PVD coated	P20–P40	A submicron PVD coated substrate for machining steel, stainless steel and exotic alloys
		M20–M40	
		S20–S40	
TT7220	PVD coated	P25–P45	A PVD coated grade for machining in carbon steel and alloy steel
		M25–M45	
TT8020	PVD coated	P30–P50	Ingersoll's toughest PVD grade for severely interrupted cuts and stainless steel and exotic alloy machining
		M30–M50	
		S30–S50	
CT3000	Cermet	P10–P20	A tough new reinforced cermet grade with excellent wear resistance. Recommended for grooving, parting & turning alloy steels and stainless steels with good surface quality and long tool life
		M10–M20	
		K10–K20	

Cutting parameters acc. to Grade und Application

Material			Condition	Tensile strength (N/mm²)	Hardness HB	Cutting speed Vc(m/min) Groove-turn. profiling. grooving				
						TT9100	TT9030 TT9080 TT7220	TT9080 TT9080	TT9080	TT8020
P	Non-alloy steel. cast steel. free cutting steel	< 0.25% C	Annealed	420	125	100–230	100–200	–	–	100–180
		≥ 0.25% C	Annealed	650	190	100–210	100–180	–	–	100–150
		< 0.55% C	Quenched & tempered	850	250	80–180	80–160	–	–	80–130
		≥ 0.55% C	Annealed	750	220	80–180	80–160	–	–	80–130
			Quenched & tempered	1000	300	70–150	70–130	–	–	70–120
	Low alloy steel		Annealed	600	200	100–200	100–160	–	–	10–150
			Quenched & tempered	930	275	90–180	80–160	–	–	80–150
			Quenched & tempered	1000	300	80–170	80–150	–	–	80–130
			Quenched & tempered	1200	350	80–150	80–130	–	–	80–120
	High alloy steel. cast steel and tool steel		Annealed	680	200	90–140	90–130	–	–	90–110
			Quenched & tempered	1100	325	50–80	50–80	–	–	50–70
M	Stainless steel and cast steel		Ferritic / martensitic	680	200	–	–	80–170	–	80–170
			Martensitic	820	240	–	–	80–150	–	80–150
			Austenitic	600	180	–	–	80–170	–	80–170
K	Gray cast iron (GG)		Ferritic	–	160	–	–	–	–	–
			Pearlitic	–	250	–	–	–	–	–
	Cast iron nodular (GGG)		Ferritic	–	130	–	–	–	–	–
			Pearlitic	–	230	–	–	–	–	–
	Malleable cast iron		Ferritic	–	180	–	–	–	–	–
			Pearlitic	–	260	–	–	–	–	–
N	Aluminum - wrought alloy		Not cureable	–	60	–	–	–	–	–
			Cured	–	100	–	–	–	–	–
	Aluminumcast. alloyed	> 12% Si	Not cureable	–	75	–	–	–	–	–
			Cured	–	90	–	–	–	–	–
		> 12% Si	High heat resistant	–	130	–	–	–	–	–
	Copper alloys	> 1% Pb	Free cutting	–	110	–	–	–	–	–
			Brass	–	90	–	–	–	–	–
			Electrolyte copper	–	100	–	–	–	–	–
	Non-metallic		Duroplastics. fiber plastics	–	–	–	–	–	–	–
			Hard rubber	–	–	–	–	–	–	–
S	High temp. alloys	Fe based	Annealed	–	200	–	–	–	30–50	20–30
			Cured	–	280	–	–	–	20–40	15–20
		Ni or Co based	Annealed	–	250	–	–	–	20–30	15–20
			Cured	–	350	–	–	–	15–20	15–20
			Cast	–	320	–	–	–	15–20	15–20
	Titanium. Ti alloys		–	Rm 400	–	–	–	–	130–170	80–100
		Alpha+beta alloys cured		Rm 1050	–	–	–	–	40–70	15–30
H	Hardened steel		Hardened	–	55 HRC	–	–	–	–	–
			Hardened	–	60 HRC	–	–	–	–	–
	Chilled cast iron		Cast	–	400 HRB	–	–	–	–	–
	Cast iron nodular		Hardened	–	55HRC	–	–	–	–	–

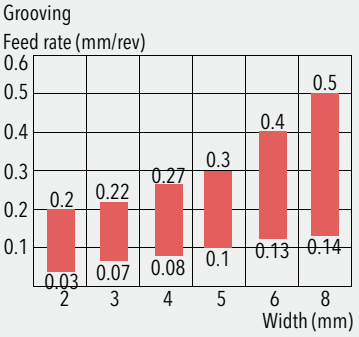
Ceramic T-ClampUltraPlus insert

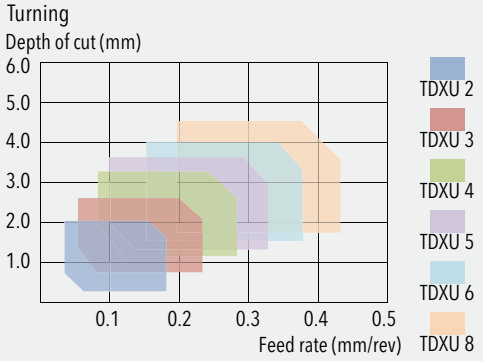
Material		Grooving	Turning
Cast iron	Vc (m/min)	600–800	600–800
	F (mm/rev)	0.1–0.2	0.1–0.24
High hardened steel	Vc (m/min)	250–350 (up to 55 HRC)	250–350
	F (mm/rev)	0.08–0.20 (up to 55 HRC)	0.08–0.20

Above cutting data is adapted to TDT 4E-0.4T CE AB30

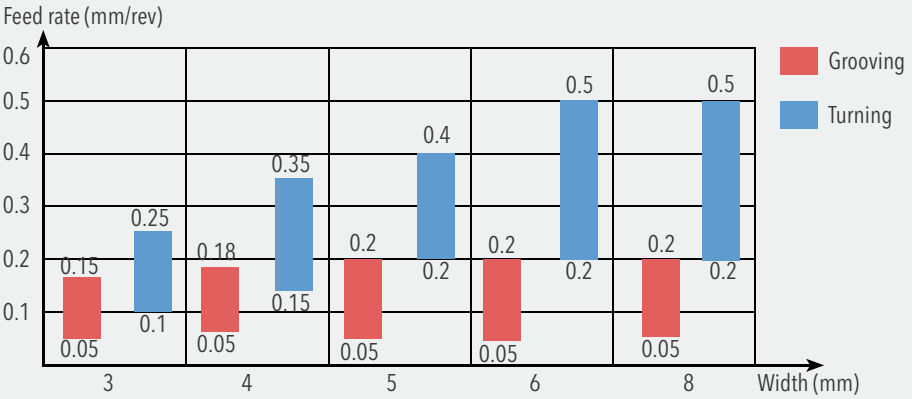
Cutting speed Vc(m/min)												
Groove-turn. profiling. grooving						Internal grooving. face grooving						
TT6300	TT6080	CT3000	TB650	KP300	K10	TT9030 TT9080 TT7220	TT9030 TT9080	TT9080	TT8020	TT6300	TT6080	K10
–	–	100-210	–	–	–	–	100-150	–	80-110	–	–	–
–	–	100-200	–	–	–	–	60-100	–	60-90	–	–	–
–	–	80-180	–	–	–	–	–	–	–	–	–	–
–	–	80-180	–	–	–	–	60-110	–	50-90	–	–	–
–	–	70-150	–	–	–	–	–	–	–	–	–	–
–	–	100-180	–	–	–	–	60-110	–	40-70	–	–	–
–	–	90-180	–	–	–	–	70-110	–	40-60	–	–	–
–	–	80-170	–	–	–	–	–	–	–	–	–	–
–	–	80-150	–	–	–	–	60-90	–	30-50	–	–	–
–	–	90-130	–	–	–	–	60-90	–	30-50	–	–	–
–	–	50-80	–	–	–	–	50-80	–	30-40	–	–	–
–	–	80-170	–	–	–	–	–	50-130	40-80	–	–	–
–	–	80-150	–	–	–	–	–	–	–	–	–	–
–	–	80-170	–	–	–	–	–	40-130	30-80	–	–	–
150-270	110-250	–	–	–	70-100	–	–	–	–	90-140	70-120	40-60
120-170	90-140	–	–	–	50-90	–	–	–	–	80-120	60-100	40-60
150-250	120-230	–	–	–	70-100	–	–	–	–	90-130	70-110	40-60
120-200	90-180	–	–	–	60-90	–	–	–	–	80-110	60-90	30-50
120-200	90-180	–	–	–	60-120	–	–	–	–	80-130	60-110	20-40
100-180	80-150	–	–	–	50-80	–	–	–	–	60-100	50-90	20-40
–	–	–	–	150-2500	300-800	–	–	–	–	–	–	100-300
–	–	–	–	150-2500	230-310	–	–	–	–	–	–	100-300
–	–	–	–	150-2500	280-830	–	–	–	–	–	–	100-300
–	–	–	–	150-2500	200-510	–	–	–	–	–	–	100-300
–	–	–	–	330-800	130-300	–	–	–	–	–	–	80-200
–	–	–	–	–	–	–	–	–	–	–	–	–
–	–	–	–	330-800	120-200	–	–	–	–	–	–	80-150
–	–	–	–	190-400	90-150	–	–	–	–	–	–	60-100
–	–	–	–	–	–	–	–	–	–	–	–	–
–	–	–	–	–	–	–	–	–	–	–	–	–
–	–	–	–	–	30-40	–	–	–	–	–	–	–
–	–	–	–	–	20-40	–	–	–	–	–	–	–
–	–	–	–	–	20-30	–	–	–	–	–	–	–
–	–	–	–	–	15-20	–	–	–	–	–	–	–
–	–	–	–	–	15-20	–	–	–	–	–	–	–
–	–	–	–	–	100-130	–	–	–	–	–	–	–
–	–	–	–	–	20-50	–	–	–	–	–	–	–
30-50	–	–	90-110	–	20-40	–	–	–	–	15-25	–	15-20
30-50	–	–	80-100	–	20-30	–	–	–	–	15-25	–	15-20
30-50	–	–	180-200	–	20-50	–	–	–	–	15-25	–	15-25
30-50	–	–	90-110	–	20-40	–	–	–	–	15-25	–	15-25

TDXU cutting data

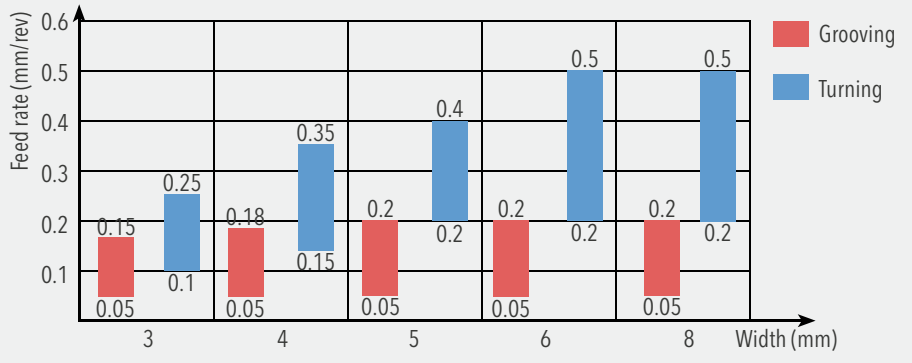




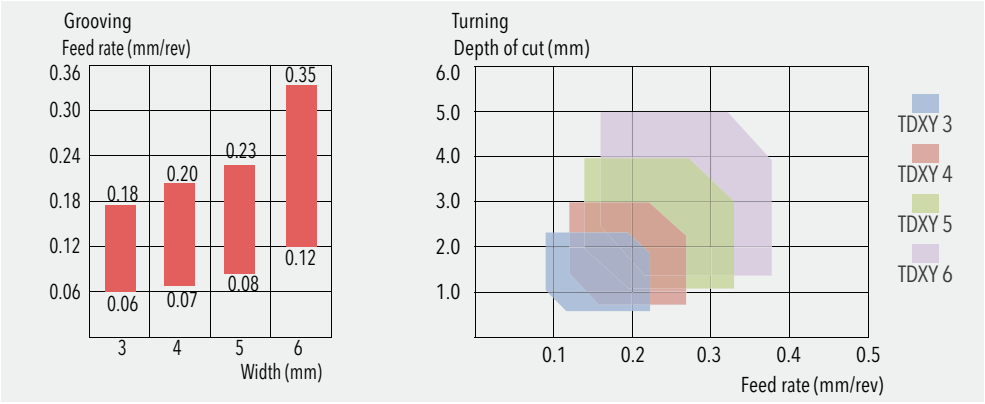
TDT cutting data



TDXT cutting data

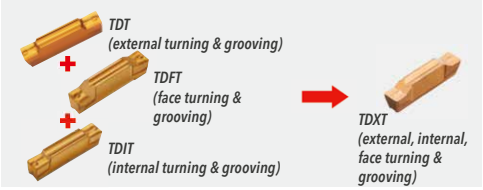


TDXY cutting data



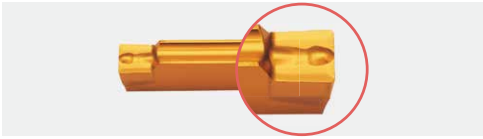
Multifunctional insert TDXT

The pressed-to-size TDXT insert now covers the application range for which the 3 different insert types TDT, TDFT and TDIT series were previously used: the TDT insert for external turning and grooving, the TDFT insert type for face turning and face grooving and the TDIT insert for internal turning and grooving. Further advantages are the profitability achieved through tool cost savings and that existing standard holders can be used.

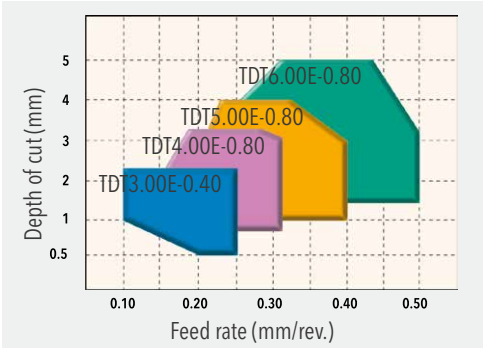


Chipbreaker type T

- The T-type chipbreaker is available for turning and grooving of steel, alloy steel and stainless steel
- Inserts with T-type chipbreaker contain a central chipbreaking island for multi-direction chip control
- Machining range when turning depends on insert width.



Recommended feed range

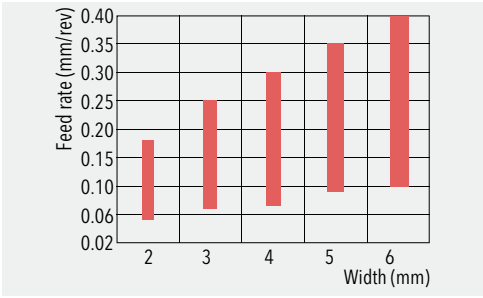


Reduce cutting speed for internal & axial machining by 20-30%

Chipbreaker type C

- For hard materials and tough applications
- For general applications on steel, alloy steel and stainless steel
- Medium-to-high feeds

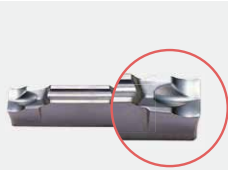
Recommended feed range



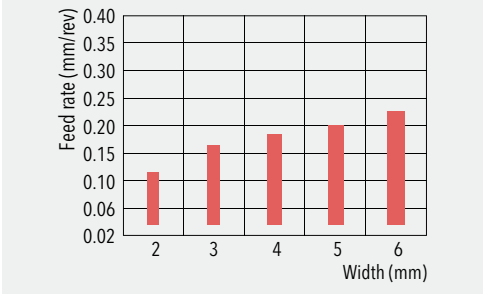
For R/L inserts, reduce feed rate by 20–40%

Chipbreaker type J

- For soft materials, parting of tubes, small diameters and thin-walled parts
- Low forces and smaller burrs
- Improved straightness
- Low-to-medium feeds



Recommended feed range

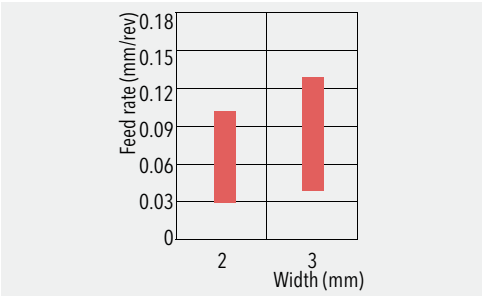


For R/L inserts, reduce feed rate by 20–40%

Chipbreaker type UF

- Narrow chipbreaker
- Good chip control in low feed of ductile materials and low carbon steel
- For Cr-Ni alloy steel and bearing steel

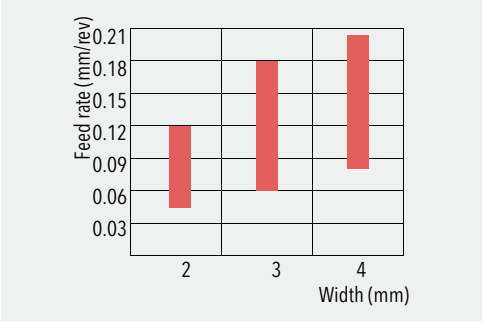
Recommended feed range



Chipbreaker type V

- Sharp cutting edge and wide groove with minimized burrs
- For tubes of small size workpiece
- For stainless steel and mild steel

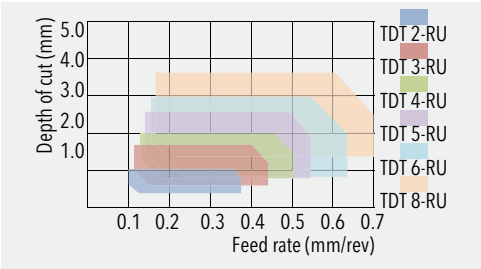
Recommended feed range



Chipbreaker type RU

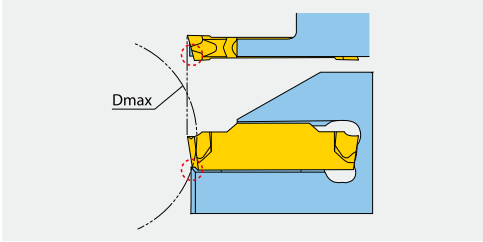
- Profiling in steel and cast iron
- Tough cutting edge
- Good chip control even in low depth
- Good surface finish
- High feed rate and low depth of cut

Recommended feed range



Inserts for grooving and parting

In the case of inserts with a right/left design, the insert seat can be damaged when machining large diameters. To avoid this, note Dmax in relation to the selected insert:

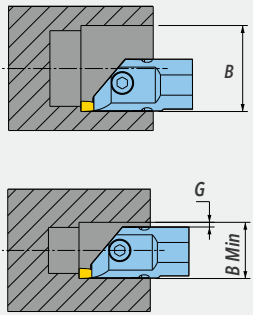


Designation	Insert	Dmax (mm)
TDC	TDC 2-15 RS/LS	28
	TDC 3-15 RS/LS	29
	TDC 4-5 R/L	30
TSC	TSC 3-15 R/L	96
TDJ	TDJ 2-15 RS/LS	28
	TDJ 3-15 RS/LS	29
	TDJ 4-15 R/L	30
TSJ	TSJ 3-15 R/L	103
	TSJ 3-15 RS/LS	34

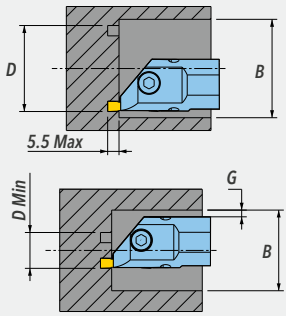
TGIFR/L

W	Min. Bore Dia		Dmin		Dmax
	d=25	d=32	TDFT / TDXU	TDT / TDC / TDJ	
3	26.3	33.3	20	44	∞
4	26.8	33.8	18	42	
5	26.3	33.3	20	50	
6	26.8	33.8	18	48	

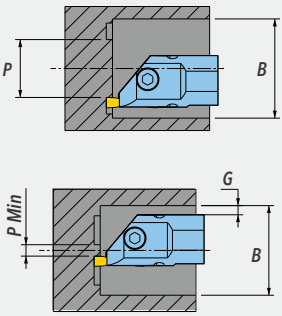
Boring
B Min.=F+d/2+W/2+2G



Face grooving
D Min.=2F+d+W-B+2G



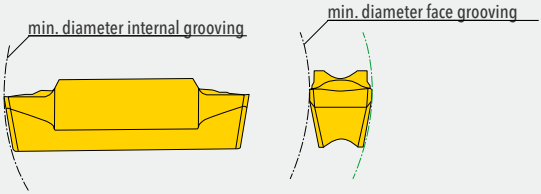
Face recessing
P Min.=2F+d-W-B+2G



"F" can be found in the catalog for turning tools

Inserts for grooving, parting und recess turning

Smallest diameter (Dmin) for internal grooving and first recess of face machining:



Designation	Size [mm]	min. dia. internal grooving [mm]	min. dia. face grooving [mm]
TDXT TDXU (Allround insert)	2	24	468
	3	24	18
	4	21	18
	5	30	20
	6	31	18
	8	33	23
TDJ	1.4	26	442
	2	40	752
	3	50	54
	4	50	34
	5	60	49
	6	60	46
TDC	2	40	745
	3	50	54
	4	50	34
	5	60	49
	6	60	46
	8	70	32
TDT	3	40	44
	4	40	42
	5	50	50
	6	50	48
	8	62	34
	10	62	30
TDT RU	2	41	294
	3	33	41
	4	33	36
	5	38	54
	6	40	54
	8	51	45
TDIT	3	24	44
	4	21	42
	5	30	50
	6	31	48
	8	33	34
TDFT	3	40	18
	4	40	18
	6	50	18
TDIM	2	11	30
	3	11	27
TDIP	1	12	1126
	1.2	12	1126
	1.4	13	129
	1.5	13	129
	2	13	154
	2.15	13	63
	2.5	11	X
	3	11	52

Above table applies to inserts only.

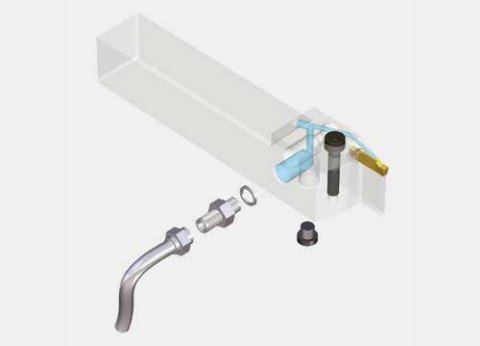
Verify tool holder minimum dia. prior to machining.

Holder with high pressure coolant supply / turning and grooving

Advantage of high-pressure holder

- Excellent performance especially on difficult-to-cut materials such as titanium, inconel and high-temperature alloys
- Very good chip breaking
- Very good cooling
- Increases the service life of the tool
- Increase productivity due to increased tool life

Designation	70 bar flow (L/min)	100 bar flow (L/min)	140 bar flow (L/min)
TTER/L 20-3-TB	5–7	7–9	9–11
TTER/L 20-4-TB	6–8	10–12	12–14
TTER/L 25-3-TB	6–8	8–10	10–12
TTER/L 25-4-TB	10–12	14–16	16–18
TTER/L 25-5-TB	13–16	19–21	22–24
TTER/L 25-6-TB	13–16	19–21	22–24
TTER/L 25-8-TB	13–-16	19–21	22–24



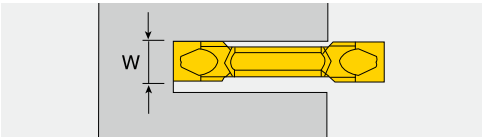
Maximum pressure 300 bar

Thanks to three connections, the holders can be used in various machines

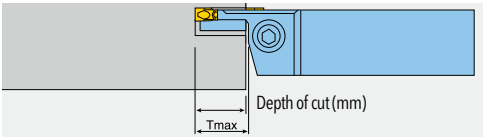
Selection of tool

Please note the following three tips for choosing the right tool:

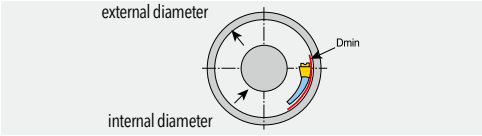
Select the widest possible cutting insert according to the cutting width and the geometry to be machined.



Select the shortest tool projection length according to the required machining depth.



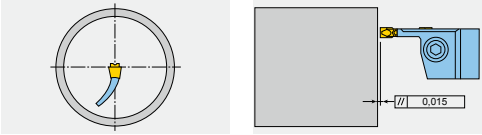
Select the tool with the largest machining diameter, depending on the diameter for the first Cut-in.



Tool set-up

Check and set the following tool positions before machining:

Check the cutting edge height to the center of rotation axis, turn to the center and check for protrudings.



Check parallelism of cutting edge and the machined surface. Exact positioning results in good surface quality when face turning.

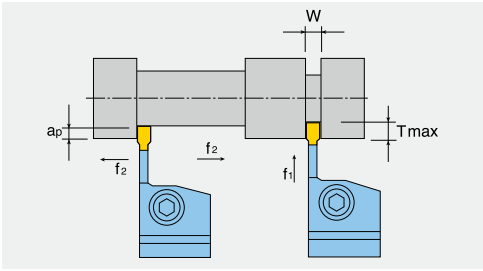
Explanation of cutting parameters

Grooving:

- V_c – Cutting speed (m/min)
- T_{max} – Maximum depth (mm)
- f1 – Feed in radial direction (mm)

Turning

- V_c – Cutting speed (m/min)
- T_{max} – Maximum depth (mm)
- f2 – Feed in radial direction (mm)



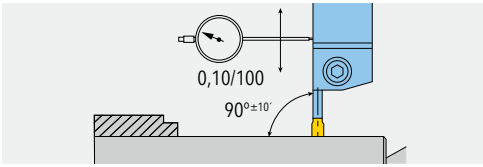
Corner Radii - Lateral Turning

Choose large corner radii for long tool life.

- Choose small corner radii to reduce cutting load and lower feed with narrow inserts

90° mounting

It's very important that the insert is mounted at 90° to the center-line of the workpiece in order to obtain a perpendicular surface and reduce the risk of vibration.



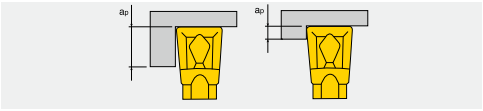
Tool holder or blade

To minimize risk of vibration and deflection always choose:

- Tool holder or blade with the smallest possible overhang.
- Tool holder with maximum shank dimension

Depth of cut

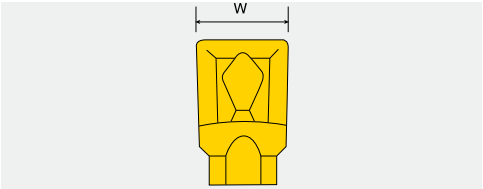
- Minimum depth of cut corresponds to the the corner radii
- Maximum depth of cut depends on maximum possible load
- Depth of cut depends on chipbreaking range



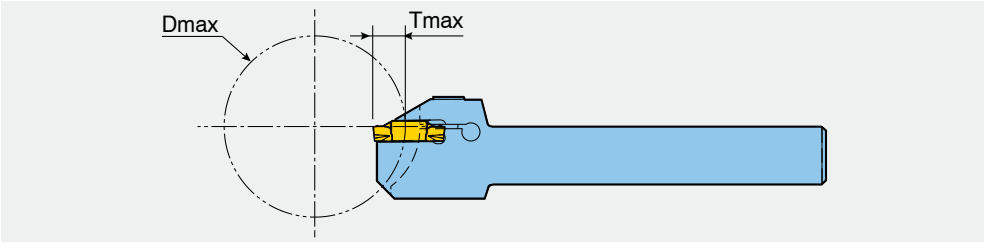
Large depth of cut causes large deflection and large frontal clearance.
With small depth of cut, deflection and frontal clearance may be too small.

Insert width

- Insert width strongly affects strength
- For most efficient machining select the widest possible insert
- Chipbreaking range depends on insert width
- A narrow width improves chipbreaking at lower feed rates
- Wide inserts and strong blades require high forces and feed rates to achieve a frontal clearance angle.



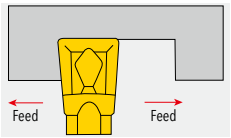
Cutting depth for tool diameter on the example TTER / L-D



	Designation		Tmax																							
			1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
TTER/L	1010-1.4T15-D40	Dmax					∞						269	120	79	59	40	–	–	–	–	–	–	–	–	–	–
	1212-1.4T15-D40						∞						269	120	79	59	40	–	–	–	–	–	–	–	–	–	–
	1616-1.4T20-D45						∞								432	193	125	94	76	64	57	45	–	–	–	–	–
	2020-1.4T20-D45						∞								432	193	125	94	76	64	57	45	–	–	–	–	–
	1010-2T15-D40						∞						269	120	79	59	40	–	–	–	–	–	–	–	–	–	–
	1212-2T15-D40						∞						269	120	79	59	40	–	–	–	–	–	–	–	–	–	–
	1616-2T20-D45						∞								432	193	125	94	76	64	57	45	–	–	–	–	–
	2020-2T20-D45						∞								432	193	125	94	76	64	57	45	–	–	–	–	–
	2525-2T20-D45						∞				1468	339	193	136	106	87	75	67	60	56	52	45	–	–	–	–	–
	1212-3T15-D40						∞						269	120	79	59	40	–	–	–	–	–	–	–	–	–	–
	1616-3T20-D45						∞								432	193	125	94	76	64	57	45	–	–	–	–	–
	2020-3T20-D45						∞								432	193	125	94	76	64	57	45	–	–	–	–	–
	2525-3T20-D45						∞				1468	339	193	136	106	87	75	67	60	56	52	45	–	–	–	–	–
	2525-3T25-D60						∞											1810	418	237	167	130	107	91	81	73	60

Turning feed

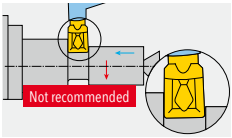
- Feed depends on chipbreaking range of the insert
- Maximum feed depends on insert width and is a function of maximum load
- High feed with small corner radii may reduce tool life
- Maximum feed should not exceed the corner radii
- For better chip formation when grooving, feed can be interrupted at small intervals



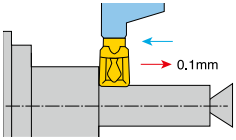
Maximum Feed:
$f_{max} = W \times 0.075$

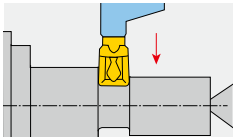
Multifunctional operations

The tools are multifunctional tools able to operate in a sequence of grooving and turning modes. Moving from turning to grooving requires consideration of the basic principle to eliminate the possibility of insert breakage.
In this situation one must release the side deflection necessary in turning but not recommended in grooving.



Grooving with an isolated tool





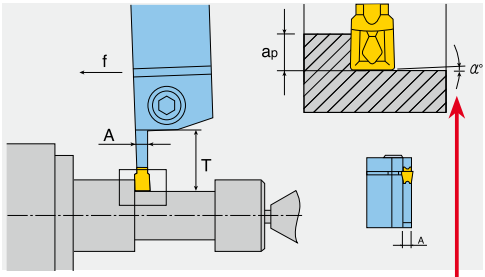
Retract the tool after turning, then continue with grooving

Clearance angle

The clearance angle a° is a function of the side cutting forces and is not constant contrariwise to the ISO inserts.

The deflection is influenced by:
- Feed: f
- Depth of cut: ap
- Overhang: T
- Cutting speed: Vc
- Workpiece Material

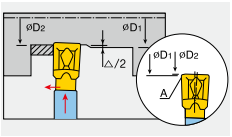
When these factors are properly applied, the insert (a°) creates a "Wiper" action providing excellent surface quality and tolerance.



Clearance angle between the insert and workpiece

Finishing operations

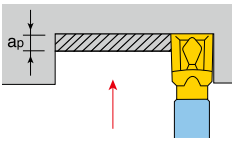
A compensation factor for the finish diameter must be used in the final machining operation.



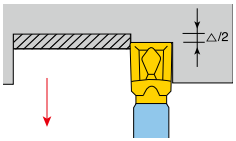
Not recommended

$$\frac{\Delta}{2} = \frac{ØD1 - ØD2}{2}$$

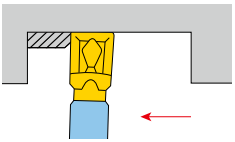
Using the compensation factor will eliminate the difference in part diameter.
Follow this simple procedure during machining:



1. Groove to the final diameter.



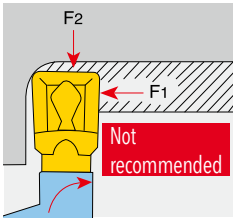
2. Pull the tool back, with a value of Δ/2.



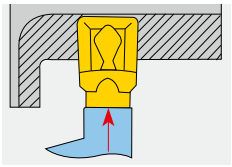
3. Continue the finish turning operation.

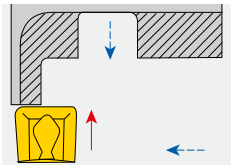
Machining a radius or chamfer

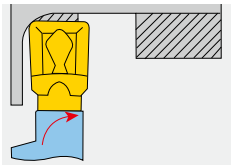
The machining of a corner with a radius or a chamfer larger than the radius of the insert always requires the combination of movement in two directions. Problems, such as insert breakage, result when this combined operation is used while the insert is plunged into the workpiece with material on all sides. Insert breakage is caused by forces acting simultaneously in two different directions F1 and F2 as shown.
See picture.

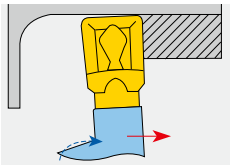


Recommended procedure to optimize machining and to prevent cutting edge breakage





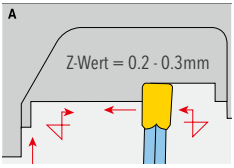




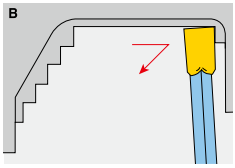
Actual move Prior move

Machining between walls

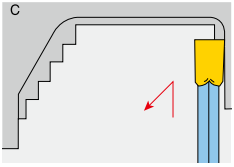
One of the most important advantages of TClamp Ultra Plus system is the ability to machine between walls. To achieve the best result - follow recommended sequence:
Leave steps near a wall. Don't arrive with the same Z-value!



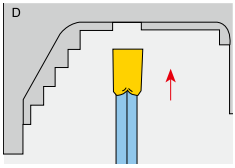
1. Roughing



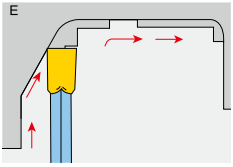
2. Roughing



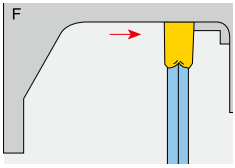
3. Finishing



4. Finishing



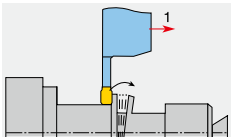
5. Finishing



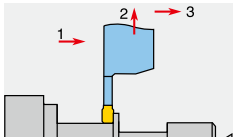
6. Finishing

Eliminating a "hanging ring"

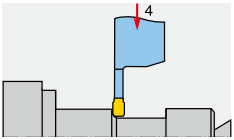
When turning at the end of a bar or toward a recess between two walls, a 'Hanging Ring' may be formed.
To eliminate the 'Hanging Ring':



1. Roughing (incorrect)



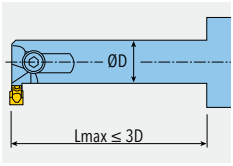
2. Roughing (correct)



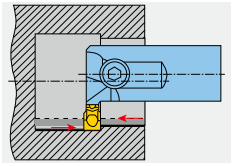
3. Roughing (correct)

Optimizing internal machining

- The first pass uses one corner for roughing.
- The other corner is used on the return path for semi-finishing or finishing.



Tool holder overhang

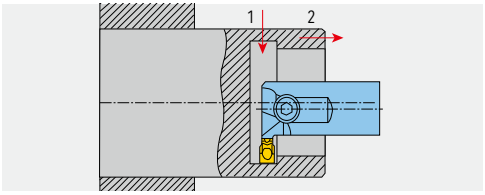


Efficient use of insert corners

Improving internal turning in a blind hole

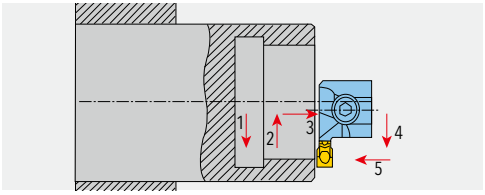
Internal turning in a blind hole brings about the problem of chip evacuation. When the tool reaches the rear side wall, chips may be caught between the wall and the insert, causing breakage.

Two solutions that can eliminate this problem:



First solution

1. Start by grooving at the rear wall.
2. Continue by turning from the inside toward the outside.

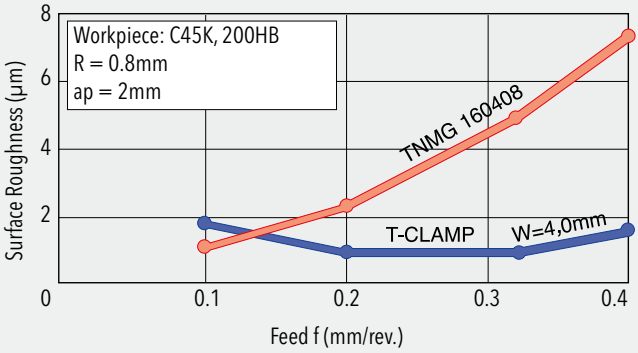


Second solution

1. Start by grooving at the rear wall.
2. Pull the tool back to the outside.
   Turn the final diameter from outside toward the groove.

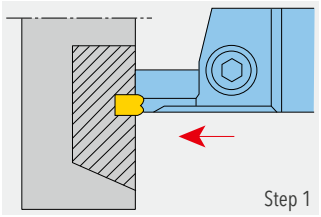
Surface quality - Eliminating grinding operations

TClampUltraPlus tools produce a surface quality that is far better than turning with ISO inserts. When turning, TClampUltraPlus tools produce a surface quality that can be called a finished surface.

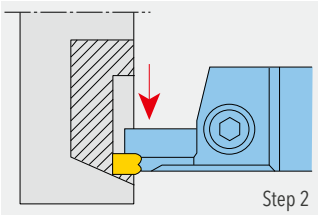


Optimizing the machining procedure for roughing

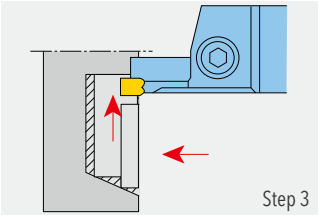
Basic steps for roughing operations when face turning with TClampUltraPlus tools



Grooving into initial diameter range



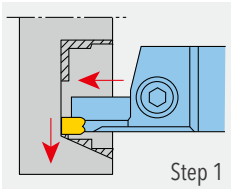
Turning away from center



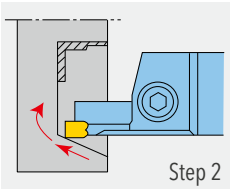
Face turning toward center

Optimizing the machining procedure for finishing

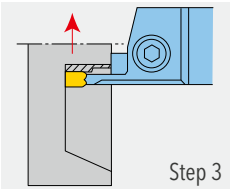
Basic steps for finishing operations when face turning with TClampUltraPlus tools



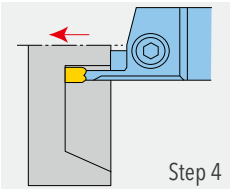
After initial groove move away from center



Finish external diameter and radius



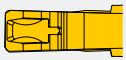
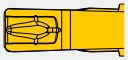
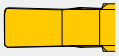
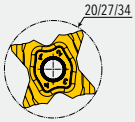
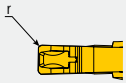
Face turning towards the center



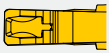
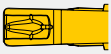
Finish internal diameter

Notes

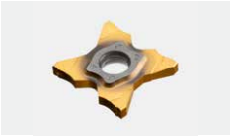
Designation system of GoldFlex with corner radius

T	Q	J	27	2.00	0.10
Manufacturer's designation	GoldFlex	Chipbreaker type	Diameter	Width of insert	Corner radius
Determined by manufacturer		 **C:** For medium  **J:** For light  **S:** For light & tailor made	 Two-digit number e.g.: Ø=27mm indicated by 27	 W: 1.00 = 1.00 mm; 1.50 = 1.50 mm; 2.53 = 2.53 mm; 3.18 = 3.18 mm	 r: 0.10 = 0.1 mm; 0.20 = 0.2 mm; 0.30 = 0.3 mm; 0.40 = 0.4 mm

Designation system of GoldFlex with lead angle

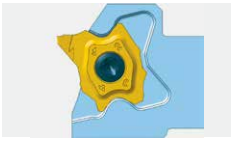
T	Q	J	27	1.50	6	L
Manufacturer's designation	GoldFlex	Chipbreaker type	Diameter	Width of insert	Lead angle	Hand of insert
Determined by manufacturer		 **C:** For medium  **J:** For light  **S:** For light & tailor made	 Two-digit number e.g.: Ø=27mm indicated by 27	 W: 1.00 = 1.00 mm; 1.50 = 1.50 mm; 2.53 = 2.53 mm; 3.18 = 3.18 mm		 **L:** Left-hand  **R:** Right-hand

4 cutting edges with chipformer for grooving, parting and recessing



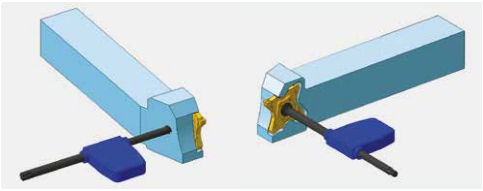
4 cutting edges with S-, C- or J-type chipformer.
Excellent chip controll and high quality surface at finish grooving.

3 contact points
with lateral clamping by Torx screw.
For perfect insert positioning.



4 cutting edges
Even if edges are broken any remaining edges can still be used.

Protection by pocket seats.
Pocket protects unused 3 edges from chips during the machining process.

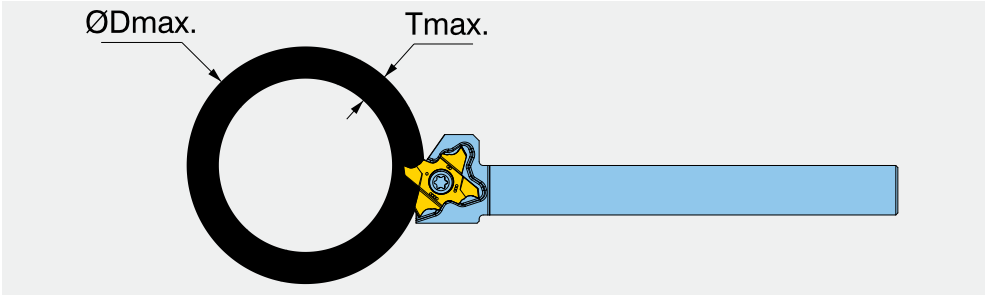


Insert indexing is possible from both sides of the holder by special Torx screw driver. Suitable for Swiss-type lathes.

Left-hand

Right-hand

To ensure that the inserts are securely clamped in the two holders, the right-hand holders have a left-hand thread and the left-hand holders have a right-hand thread



Precision grooving and parting insert with J-Type chipbreaker

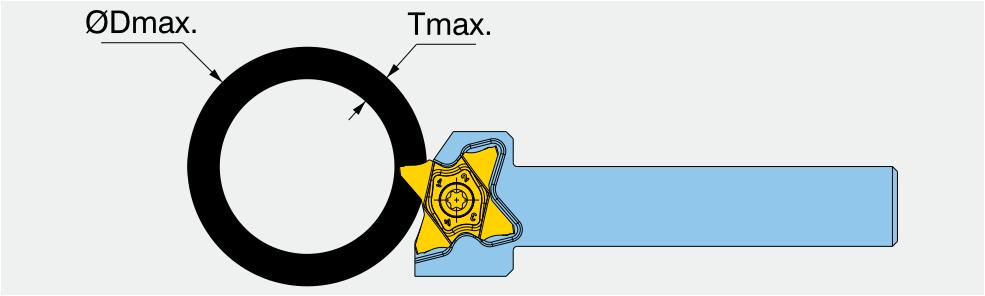
Designation	Feed (mm/rev)	W±0.02	R	Tmax	ØDmax				
					T ≤ 2.7	T ≤ 3.5	T ≤ 4.0	T ≤ 4.5	T ≤ 5.0
TQJ 20-1.00-0.10-R/L	0.03–0.07	1.00	0.10	2.7	∞	–	–	–	–
TQJ 20-1.50-0.20-R/L	0.03–0.08	1.50	0.20	5.0	∞	70	50	30	16
TQJ 20-2.00-0.20-R/L	0.04–0.10	2.00	0.20	5.0	∞	70	50	30	16

∞ = No limitation / grooving is only possible with 2.39 mm and wider inserts.

Precision grooving and parting insert with S-Type chipbreaker

Designation	Feed (mm/rev)	W±0.02	R	Tmax	ØDmax					
					T ≤ 2.2	T ≤ 2.7	T ≤ 3.5	T ≤ 4.5	T ≤ 4.5	T ≤ 5.0
TQS 20-0.50-0.05-R/L	0.03–0.07	0.50	0.05	2.2	∞	–	–	–	–	–
TQS 20-1.00-0.10-R/L	0.03–0.07	1.00	0.10	2.7	∞	∞	–	–	–	–
TQS 20-1.50-0.10-R/L	0.03–0.10	1.50	0.10	5.0	∞	∞	70	50	30	16
TQS 20-2.00-0.10-R/L	0.04–0.12	2.00	0.10	5.0	∞	∞	70	50	30	16
TQS 20-2.00-1.00-R/L*	0.05–0.13	2.00	1.00	5.0	∞	∞	70	50	30	16
TQS 20-2.50-0.10-R/L	0.04–0.15	2.50	0.10	5.0	∞	∞	70	50	30	16
TQS 20-3.00-0.10-R/L	0.04–0.16	3.00	0.10	5.0	∞	∞	70	50	30	16
TQS 20-3.00-1.50-R/L*	0.04–0.16	3.00	1.50	5.0	∞	∞	70	50	30	16

∞ = No limitation / grooving is only possible with 2.39 mm and wider inserts. * Full radius insert

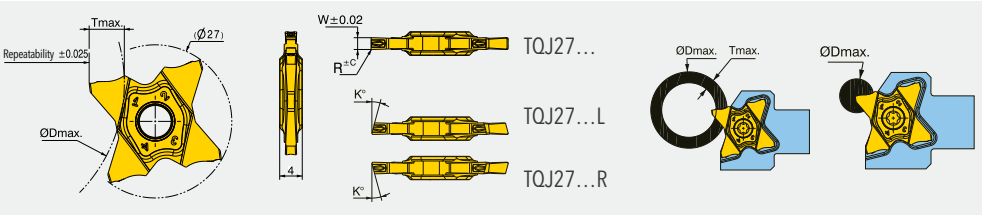


Precision grooving and parting insert

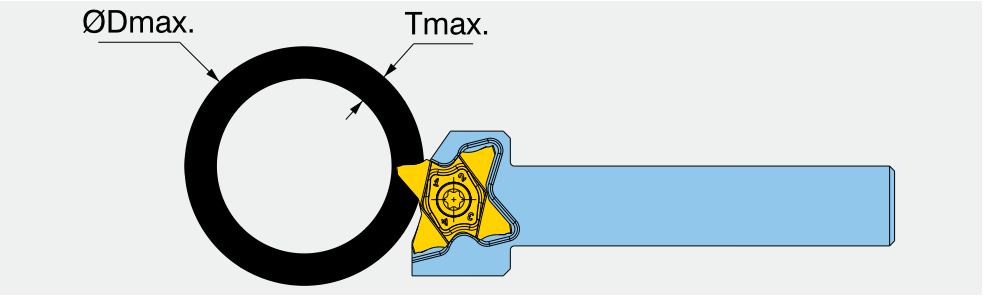
Designation	Feed (mm/rev)	W±0.02	R	Tmax	ØDmax								
					T ≤ 3.0	T ≤ 3.5	T ≤ 4.0	T ≤ 4.5	T ≤ 5.0	T ≤ 5.5	T ≤ 6.0	T ≤ 6.2	T ≤ 6.4
TQJ 27-0.50-0.00	0.02-0.04	0.50	0.00	1.0	–	–	–	–	–	–	–	–	–
TQJ 27-0.50-0.04	0.02-0.04	0.50	0.04	2.5	–	–	–	–	–	–	–	–	–
TQJ 27-0.75-0.10	0.02-0.05	0.75	0.10	2.5	–	–	–	–	–	–	–	–	–
TQJ 27-0.80-0.00	0.02-0.05	0.80	0.00	1.6	–	–	–	–	–	–	–	–	–
TQJ 27-1.00-0.06	0.03-0.07	1.00	0.06	3.5	∞	600	–	–	–	–	–	–	–
TQJ 27-1.00-0.10	0.03-0.07	1.00	0.10	3.5	∞	600	–	–	–	–	–	–	–
TQJ 27-1.04-0.00	0.03-0.07	1.04	0.00	2.0	–	–	–	–	–	–	–	–	–
TQJ 27-1.20-0.00	0.03-0.07	1.20	0.00	2.0	–	–	–	–	–	–	–	–	–
TQJ 27-1.25-0.10	0.03-0.07	1.25	0.10	3.5	∞	600	–	–	–	–	–	–	–
TQJ 27-1.25-0.20	0.03-0.07	1.25	0.20	3.5	∞	600	–	–	–	–	–	–	–
TQJ 27-1.40-0.00	0.03-0.08	1.40	0.00	2.0	–	–	–	–	–	–	–	–	–
TQJ 27-1.47-0.00	0.03-0.08	1.47	0.00	2.5	–	–	–	–	–	–	–	–	–
TQJ 27-1.50-0.10	0.03-0.08	1.50	0.10	5.7	∞	600	280	180	130	–	–	–	–
TQJ 27-1.50-0.20	0.03-0.08	1.50	0.20	5.7	∞	600	280	180	130	–	–	–	–
TQJ 27-1.57-0.15	0.03-0.08	1.57	0.15	3.0	∞	–	–	–	–	–	–	–	–
TQJ 27-1.57-0.79	0.05-0.08	1.57	0.79	3.0	∞	–	–	–	–	–	–	–	–
TQJ 27-1.70-0.10	0.03-0.08	1.70	0.10	3.0	∞	–	–	–	–	–	–	–	–
TQJ 27-1.75-0.10	0.03-0.08	1.75	0.10	3.0	∞	–	–	–	–	–	–	–	–
TQJ 27-1.75-0.20	0.03-0.08	1.75	0.20	3.0	∞	–	–	–	–	–	–	–	–
TQJ 27-1.78-0.18	0.04-0.10	1.78	0.18	3.0	∞	–	–	–	–	–	–	–	–
TQJ 27-1.85-0.20	0.04-0.10	1.85	0.20	3.0	∞	–	–	–	–	–	–	–	–
TQJ 27-1.96-0.15	0.04-0.10	1.96	0.15	3.0	∞	–	–	–	–	–	–	–	–
TQJ 27-2.00-0.10	0.04-0.10	2.00	0.10	6.4	∞	600	280	180	130	105	60	50	30
TQJ 27-2.00-0.20	0.04-0.10	2.00	0.20	6.4	∞	600	280	180	130	105	60	50	30
TQJ 27-2.00-1.00	0.05-0.11	2.00	1.00	3.5	∞	–	–	–	–	–	–	–	–
TQJ 27-2.22-0.15	0.04-0.10	2.22	0.15	3.5	∞	600	–	–	–	–	–	–	–
TQJ 27-2.30-0.20	0.04-0.10	2.30	0.20	3.5	∞	600	–	–	–	–	–	–	–
TQJ 27-2.39-0.15	0.04-0.10	2.39	0.15	5.0	∞	600	280	180	130	–	–	–	–
TQJ 27-2.39-1.20	0.05-0.11	2.39	1.20	5.0	∞	600	280	180	130	–	–	–	–
TQJ 27-2.47-0.20	0.04-0.10	2.47	0.20	5.0	∞	600	280	180	130	–	–	–	–
TQJ 27-2.50-0.10	0.04-0.10	2.50	0.10	5.0	∞	600	280	180	130	–	–	–	–
TQJ 27-2.50-0.30	0.05-0.12	2.50	0.30	5.0	∞	600	280	180	130	–	–	–	–
TQJ 27-2.70-0.10	0.05-0.12	2.70	0.10	6.2	∞	600	280	180	135	105	85	78	–
TQJ 27-2.87-0.20	0.05-0.12	2.87	0.20	6.2	∞	600	280	180	135	105	85	78	–
TQJ 27-3.00-0.00	0.05-0.12	3.00	0.00	6.4	∞	600	280	180	135	105	85	78	55
TQJ 27-3.00-0.20	0.05-0.12	3.00	0.20	6.4	∞	600	280	180	135	105	85	78	55
TQJ 27-3.00-0.30	0.05-0.12	3.00	0.30	6.4	∞	600	280	180	135	105	85	78	55
TQJ 27-3.00-0.40	0.05-0.12	3.00	0.40	6.4	∞	600	280	180	135	105	85	78	55
TQJ 27-3.00-1.50	0.06-0.12	3.00	1.50	6.4	∞	600	280	180	135	105	85	78	55
TQJ 27-3.15-0.15	0.05-0.12	3.15	0.15	6.4	∞	600	280	180	135	105	85	78	68
TQJ 27-3.18-0.20	**0.05-0.12**	**3.18**	**0.20**	**6.4**	**∞**	**600**	**280**	**180**	**135**	**105**	**85**	**78**	**68**

∞ = No limitation / grooving is only possible with 2.39 mm and wider inserts.

Precision grooving and parting insert



Designation	Feed (mm/rev)	W±0.02	R	κ	Parting to center	Parting hollow bars	
					ØDmax	Tmax	ØDmax
TQJ 27-1.00-15R/L	0.02–0.06	1.00	0.06	15°	7.0	3.5	600
TQJ 27-1.50-6R/L	0.02–0.06	1.50	0.06	6°	12.0	5.7	35
TQJ 27-1.50-15R/L	0.02–0.06	1.50	0.06	15°	12.0	5.7	35
TQJ 27-2.00-6R/L	0.03–0.08	2.00	0.10	6°	13.0	6.4	30
TQJ 27-2.00-15R/L	0.03–0.08	2.00	0.10	15°	13.0	6.4	30



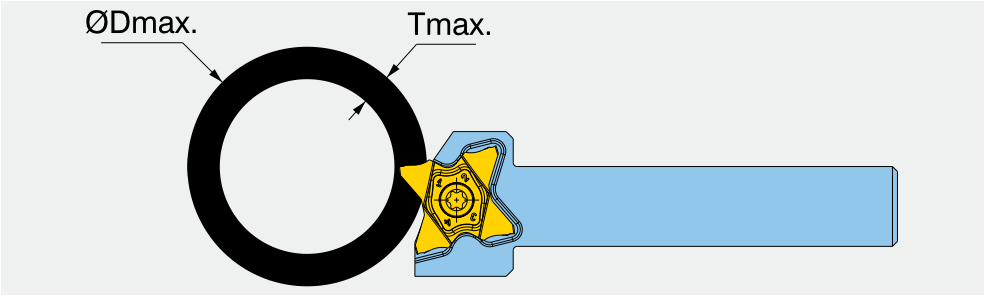
Full radius insert

Designation	Feed (mm/rev)	W±0.02	R	Tmax	ØDmax									
					T ≤ 3.0	T ≤ 3.5	T ≤ 4.0	T ≤ 4.5	T ≤ 5.0	T ≤ 5.5	T ≤ 5.7	T ≤ 6.0	T ≤ 6.2	T ≤ 6.4
TQJ 27-1.57-0.79	0.05–0.08	1.57	0.79	3.0	∞	–	–	–	–	–	–	–	–	–
TQJ 27-2.00-1.00	0.05–0.11	2.00	1.00	3.5	∞	600	–	–	–	–	–	–	–	–
TQJ 27-2.39-1.20	0.05–0.11	2.39	1.20	5.7	∞	600	280	180	130	50	35	–	–	–
TQJ27-3.00-1.50	0.06–0.12	3.00	1.50	6.4	∞	600	280	180	135	105	95	85	78	55

∞ = No limitation / grooving is only possible with 2.39 mm and wider inserts.

Circlip grooving and shallow grooving inserts

Designation	Feed (mm/rev)	W±0.02	R	Tmax	For circlip width
TQJ 27-1.10-0.08-CG	0.03–0.07	1.10	0.08	1.50	1.10
TQJ 27-1.30-0.08-CG	0.03–0.07	1.30	0.08	1.50	1.30
TQJ 27-1.60-0.08-CG	0.03–0.08	1.60	0.08	2.00	1.60
TQJ 27-1.85-0.08-CG	0.03–0.08	1.85	0.08	2.00	1.85
TQJ 27-2.15-0.08-CG	0.04–0.10	2.15	0.08	2.50	2.15
TQJ 27-2.65-0.15-CG	0.05–0.12	2.65	0.15	2.50	2.65

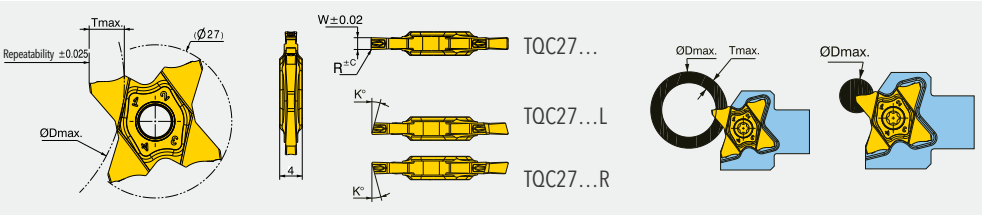


Precision grooving and parting insert

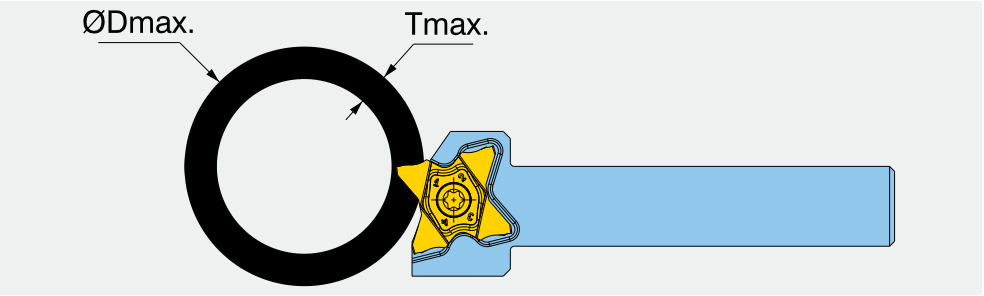
Designation	Feed (mm/rev)	W ±0.02	R	Tmax	ØDmax										
					T ≤ 3.0	T ≤ 3.5	T ≤ 4.0	T ≤ 4.5	T ≤ 5.0	T ≤ 5.5	T ≤ 5.7	T ≤ 6.0	T ≤ 6.2	T ≤ 6.4	T ≤ 6.5
TQC 27-1.50-0.10	0.05–0.08	1.50	0.10	5.7	∞	600	280	180	130	50	35	–	–	–	–
TQC 27-1.50-0.20	0.05–0.06	1.50	0.20	5.7	∞	600	280	180	130	50	35	–	–	–	–
TQC 27-1.57-0.15	0.05–0.08	1.57	0.15	3.0	∞	–	–	–	–	–	–	–	–	–	–
TQC 27-1.70-0.10	0.05–0.09	1.70	0.10	3.0	∞	–	–	–	–	–	–	–	–	–	–
TQC 27-1.75-0.10	0.05–0.10	1.75	0.10	3.0	∞	–	–	–	–	–	–	–	–	–	–
TQC 27-1.75-0.20	0.05–0.09	1.75	0.20	3.0	∞	–	–	–	–	–	–	–	–	–	–
TQC 27-1.78-0.18	0.05–0.11	1.78	0.18	3.0	∞	–	–	–	–	–	–	–	–	–	–
TQC 27-1.85-0.20	0.05–0.11	1.85	0.20	3.0	∞	–	–	–	–	–	–	–	–	–	–
TQC 27-1.96-0.15	0.05–0.11	1.96	0.15	3.0	∞	–	–	–	–	–	–	–	–	–	–
TQC 27-2.00-0.10	0.05–0.17	2.00	0.10	6.4	∞	600	280	180	130	105	85	60	50	30	–
TQC 27-2.00-0.20	0.05–0.15	2.00	0.20	6.4	∞	600	280	180	130	105	85	60	50	30	–
TQC 27-2.22-0.15	0.05–0.15	2.22	0.15	3.5	∞	600	–	–	–	–	–	–	–	–	–
TQC 27-2.30-0.20	0.05–0.16	2.30	0.20	3.5	∞	600	–	–	–	–	–	–	–	–	–
TQC 27-2.39-0.15	0.05–0.16	2.39	0.15	5.7	∞	600	280	180	130	50	35	–	–	–	–
TQC 27-2.47-0.20	0.05–0.19	2.47	0.20	5.7	∞	600	280	180	130	50	35	–	–	–	–
TQC 27-2.50-0.10	0.05–0.20	2.50	0.10	5.7	∞	600	280	180	130	50	35	–	–	–	–
TQC 27-2.50-0.30	0.05–0.17	2.50	0.30	5.7	∞	600	280	180	130	50	35	–	–	–	–
TQC 27-2.70-0.10	0.05–0.19	2.70	0.10	6.2	∞	600	280	180	135	105	95	85	78	–	–
TQC 27-2.87-0.20	0.05–0.19	2.87	0.20	6.2	∞	600	280	180	135	105	95	85	78	–	–
TQC 27-3.00-0.00	0.05–0.11	3.00	0	6.4	∞	600	280	180	135	105	95	85	78	55	–
TQC 27-3.00-0.20	0.06–0.23	3.00	0.20	6.4	∞	600	280	180	135	105	95	85	78	55	–
TQC 27-3.00-0.30	0.06–0.25	3.00	0.30	6.4	∞	600	280	180	135	105	95	85	78	55	–
TQC 27-3.00-0.40	0.06–0.25	3.00	0.40	6.4	∞	600	280	180	135	105	95	85	78	55	–
TQC 27-3.15-0.15	0.06–0.21	3.15	0.15	6.4	∞	600	280	180	135	105	95	85	78	68	–
TQC 27-3.18-0.20	0.06–0.23	3.18	0.20	6.4	∞	600	280	180	135	105	95	85	78	68	–
TQC 27-3.30-0.10	0.06–0.23	3.30	0.10	6.5	∞	600	280	180	135	105	85	65	50	40	35
TQC 27-3.48-0.20	0.06–0.23	3.48	0.20	6.5	∞	600	280	180	135	105	85	65	50	40	35
TQC 27-3.56-0.20	0.06–0.23	3.56	0.20	6.5	∞	600	280	180	135	105	85	65	55	40	35
TQC 27-3.74-0.20	0.06–0.23	3.74	0.20	6.5	∞	600	280	180	135	105	85	65	55	40	35
TQC 27-3.98-0.20	0.07–0.30	3.98	0.20	6.5	∞	600	280	180	135	105	95	85	78	40	45
TQC 27-4.00-0.30	0.07–0.30	4.00	0.30	6.5	∞	600	280	180	135	105	95	85	78	40	45
TQC 27-4.00-0.40	0.07–0.30	4.00	0.40	6.5	∞	600	280	180	135	105	95	85	78	40	45
TQC 27-4.00-0.80	0.07–0.30	4.00	0.80	6.5	∞	600	280	180	135	105	95	85	78	40	45
TQC 27-4.15-0.15	0.07–0.30	4.15	0.15	6.5	∞	600	280	180	135	105	95	85	78	40	45
TQC 27-4.23-0.10	0.07–0.30	4.23	0.10	6.5	∞	600	280	180	135	105	95	85	78	55	65

∞ = No limitation / grooving is only possible with 2.39 mm and wider inserts.

Precision grooving and parting insert



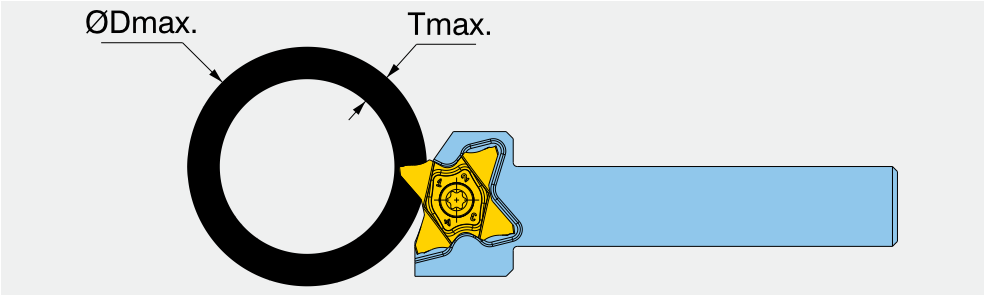
Designation	Feed (mm/rev)	W±0.02	R	κ	Parting to center	Parting hollow bars	
					ØDmax	Tmax	ØDmax
TQC 27-1.50-6R/L	0.03–0.07	1.50	0.06	6°	12.0	5.7	35
TQC 27-1.50-15R/L	0.03–0.07	1.50	0.06	15°	12.0	5.7	35
TQC 27-2.00-6R/L	0.04–0.14	2.00	0.10	6°	13.0	6.4	30
TQC 27-2.00-15R/L	0.04–0.14	2.00	0.10	15°	13.0	6.4	30



Full radius insert

Designation	Feed (mm/rev)	W±0.02	R	Tmax	ØDmax									
					T ≤ 3.0	T ≤ 3.5	T ≤ 4.0	T ≤ 4.5	T ≤ 5.0	T ≤ 5.5	T ≤ 5.7	T ≤ 6.0	T ≤ 6.2	T ≤ 6.4
27-1.57-0.79	0.05–0.09	1.57	0.79	3.0	∞	–	–	–	–	–	–	–	–	–
27-2.00-1.00	0.05–0.13	2.00	1.00	3.5	∞	600	–	–	–	–	–	–	–	–
27-2.39-1.20	0.06–0.17	2.39	1.20	5.7	∞	600	280	180	130	50	35	–	–	–
27-3.00-1.50	0.06–0.20	3.00	1.50	6.4	∞	600	280	180	135	105	95	85	78	55

∞ = No limitation / grooving is only possible with 2.39 mm and wider inserts.

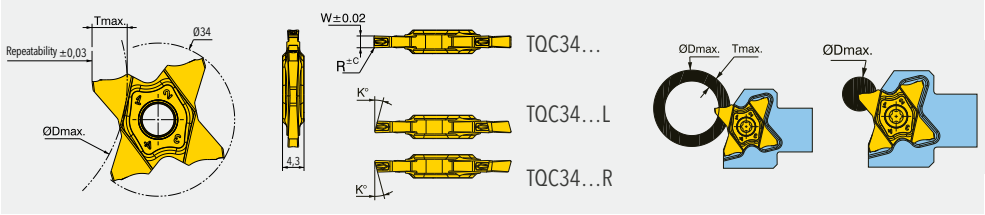


Precision grooving and parting insert

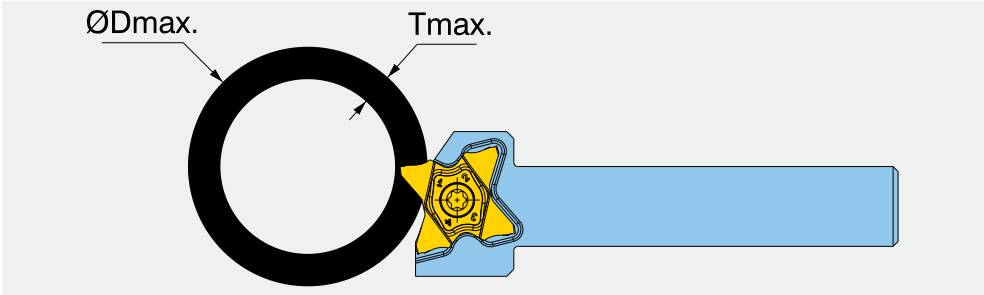
Designation	Feed (mm/rev)	W ±0.02	R	Tmax	ØDmax									
					T ≤ 3.0	T ≤ 3.5	T ≤ 4.0	T ≤ 4.5	T ≤ 5.0	T ≤ 5.5	T ≤ 5.7	T ≤ 6.0	T ≤ 6.2	T ≤ 6.4
TQS 27-1.00-0.10	0.03–0.07	1.00	0.10	3.5	∞	600	–	–	–	–	–	–	–	–
TQS 27-1.50-0.20	0.03–0.10	1.50	0.20	5.7	∞	600	280	180	130	50	35	–	–	–
TQS 27-2.00-0.20	0.04–0.10	2.00	0.20	6.4	∞	600	280	180	130	105	85	60	50	30
TQS 27-2.39-0.15	0.04–0.15	2.39	0.15	5.7	∞	600	280	180	130	50	35	–	–	–
TQS 27-2.47-0.20	0.04–0.15	2.47	0.20	5.7	∞	600	280	180	130	–	–	–	–	–
TQS 27-2.50-0.20	0.04–0.15	2.50	0.20	5.7	∞	600	280	180	130	50	35	–	–	–
TQS 27-3.00-0.20	0.04–0.15	3.00	0.20	6.4	∞	600	280	180	135	105	95	85	78	55
TQS 27-3.18 -0.20	0.05–0.16	3.18	0.20	6.4	∞	600	280	180	135	105	95	85	78	68

∞ = No limitation / grooving is only possible with 2.39 mm and wider inserts.

Precision grooving and parting insert



Designation	Feed (mm/rev)	W±0.02	R	K	Parting to center	Parting hollow bars	
					ØDmax	Tmax	ØDmax
TQC 34-1.50-8R/L	0.03–0.10	1.50	0.07	8	18.5	9	40
TQC 34-2.00-6R/L	0.03–0.15	2.00	0.10	6	18.5	9	40
TQC 34-2.00-15R/L	0.03–0.15	2.00	0.10	15	18.5	9	40
TQC 34-3.00-6R/L	0.03–0.18	3.00	0.20	6	20.0	10	20



Deep grooving and parting insert

Designation	Feed (mm/ rev)	W ±0.02	R	Tmax	ØDmax						
					T ≤ 4.0	T ≤ 5.0	T ≤ 6.0	T ≤ 7.0	T ≤ 8.0	T ≤ 9.0	T ≤ 10.0
TQC 34-1.50-0.15	0.05-0.12	1.50	0.15	9.0	∞	400	190	125	90	40	–
TQC 34-2.00-0.20	0.05-0.18	2.00	0.20	9.0	∞	400	190	125	90	40	–
TQC 34-2.30-0.20	0.05-0.18	2.30	0.20	9.0	∞	400	190	125	90	45	–
TQC 34-2.47-0.20	0.05-0.18	2.47	0.20	10.0	∞	400	190	125	90	45	20
TQC 34-2.50-0.20	0.05-0.21	2.50	0.20	10.0	∞	400	190	125	90	45	20
TQC 34-2.70-0.10	0.05-0.21	2.70	0.10	10.0	∞	400	190	125	90	45	20
TQC 34-3.00-0.20	0.05-0.25	3.00	0.20	10.0	∞	400	190	125	90	50	20
TQC 34-3.00-0.40	0.05-0.25	3.00	0.40	10.0	∞	400	190	125	90	50	20
TQC 34-3.18-0.20	0.05-0.25	3.18	0.20	10.0	∞	400	190	125	90	50	20
TQC 34-3.50-0.25	0.07-0.30	3.50	0.25	10.0	∞	400	190	125	90	50	20
TQC 34-4.00-0.30	0.07-0.30	4.00	0.30	10.0	∞	400	190	125	90	50	20

∞ = No limitation / grooving is only possible with 2.39 mm and wider inserts.

Full raius insert

Designation	Feed (mm/ rev)	W ±0.02	R	Tmax	ØDmax						
					T ≤ 4.0	T ≤ 5.0	T ≤ 6.0	T ≤ 7.0	T ≤ 8.0	T ≤ 9.0	T ≤ 10.0
TQC 34-2.00-1.00	0.05-0.11	2.00	1.00	9.0	∞	400	190	125	90	40	–
TQC 34-2.39-1.20	0.05-0.11	2.39	1.20	10.0	∞	400	190	125	90	45	20
TQC 34-3.00-1.50	0.06-0.12	3.00	1.50	10.0	∞	400	190	125	90	50	20

∞ = No limitation / grooving is only possible with 2.39 mm and wider inserts.

Notes

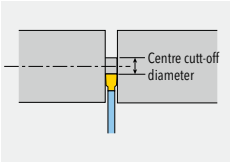
Different wear types at inserts / Trouble shooting

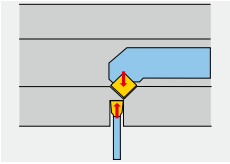
Different wear types at inserts

Problem	Possible Cause	Remedy
1. Rapid flank wear reduces tool life 	• Cutting speed too high • Carbide with too low wear resistance	• Decrease cutting speed • Use a carbide with higher hardness or a coated carbide
2. Cratering reduces tool life 	• High cutting temperature on insert rake face due to high feed and speed	• Decrease feed and speed • Use coated grade
3. Cutting edge chipping 	• High load on insert. • Insert width too narrow. • Grade too brittle	• Use wider insert for maximum support • Decrease feed and speed • Choose a tougher grade
4. Plastic deformation 	• High heat pressure decreasing carbide hardness	• Use a bigger corner radius • Decrease feed and speed • Choose carbide with higher hardness
5. Chip control. Spaghetti-like chips wrap around the holder and interfere with machining	• Small depth of cut • Feed too slow • Insert width too large • Insert radius too large	• Check chipbreaking range • Increase depth of cut • Increase feed rate • Use narrower insert with a smaller radius
6. Poor surface finish	• Small depth of cut, i.e. less than corner radius	• Increase depth of cut to minimum radius size
7. Vibration and poor surface quality	• Too small a secondary clearance angle between the workpiece and the cutting insert leads to friction behavior.	• Increase feed to get suitable secondary clearance angle • Before starting, check that the front cutting edge is parallel to workpiece

1. To reduce burr

- On CNC reduce feed by at least 25% when approaching center stub diameters ≈ WOC
- Check center height of cutting edge
- Use insert with entering angle
- If a cutting insert with a 0° entering angle has to be used, the smallest possible cutting width should be selected
- Apply a supporting part-catcher (or adjust concentricity)
- For hollow bars, it is better to machine chamfers using ID boring tool prior to parting operation. (See picture)



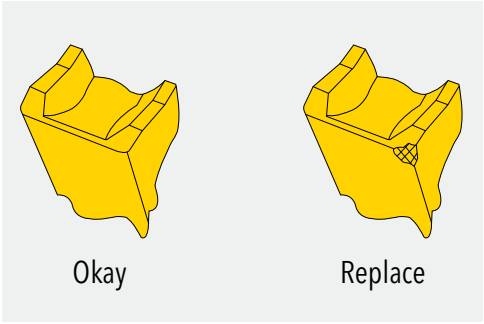


2. To improve surface finish

- Increase cutting speed
- Use neutral inserts
- Select chipformer that provides optimum chip control
- Use coated carbide
- Improve coolant application
- Eliminate chatter

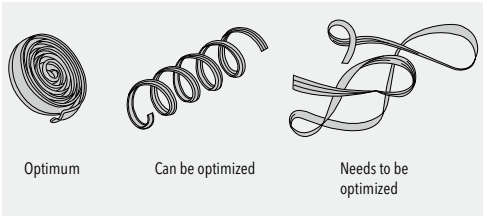
3. To improve flatness

- Check inserts and replace any that show wear
- Use cutting insert with 0° entering angle
- Use largest blade possible, i.e. TGB 32- instead of TGB 26
- Increase blade thickness and insert width
- Minimize blade overhang
- Check alignment and perpendicularity of tool to machine axis
- Optimize workpiece chucking
- Lock the carriage on manually operated lathes
- Apply coolant abundantly (excluding Ceramic AB30)
- Reduce feed



4. To Improve Chip Control

- Replace worn inserts
- Choose a more appropriate chipbreaker
- Use cutting insert with 0 ° entering angle
- Check alignment and perpendicularity of tool to machine axis
- Apply coolant abundantly
- Increase feed
- Briefly interrupt the feed for the first recess so that the chip can flow out of the cut groove

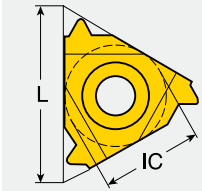


5. To prevent or reduce built-up edge

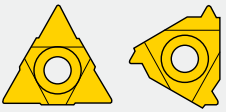
- Use appropriate carbide grade and geometry
- Increase speed
- Increase coolant flow

Designation system of thread turning inserts

16	E	R	M
Insert size	Application	Hand of tool	Type



L (mm)	IC
06	3.968 mm = 5/32"
08	4.762 mm = 3/16"
11	6.350 mm = 1/4"
16	9.525 mm = 3/8"
22	12.700 mm = 1/2"
27	15.875 mm = 5/8"



E: External

I: Internal

UE: U-type, external

UI: U-type, internal

UEI: U-type, external and internal

R = Right hand

L = Left hand

RL = Right and left hand

M:
Pressed chipbreaker
" – No indication, ground

Designation system of threading tool holders

S	E	R	2525
Clamping system	Application	Hand of tool	Shank size

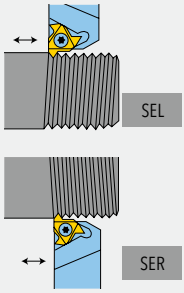
S = Screw clamping

E: External

I: Internal

R = Right hand

L = Left hand



External tool holder:

Shank: h x b
2020 = 20 x 20 mm

Internal tool holders:

Shank: Diameter d
0025 = Diameter 25 mm

1.50

Pitch

Full profile
(Value by number)
0,35 – 9,0 mm
72 – 2 TPI

Partial profile
(Range by letter)

	mm	TPI
A	0.50 – 1.5	48 – 16
AG	0.50 – 3.0	48 – 8
G	1.75 – 3.0	14 – 8
N	3.50 – 5.0	7 – 5
U	5.50 – 9.0	4.5 – 2.75
Q	5.50 – 6.0	4.5 – 4

ISO

Thread standard

60	– Partial profile 60°
55	– Partial profile 55°
ISO	– ISO metric
UN	– American UN
W	– Withworth
BSPT	– British BSPT
RND	– Round DIN 405
TR	– Trapeze DIN 103
ACME	– ACME
STACME	– Stub ACME
ABUT	– American Buttress
UNJ	– UNJ
NPT	– NPT
API RD	– API Round
BUT	– API Buttress Casing
VAM	– VAM
API	– API

2M

No. of teeth (optional)

2M = 2 Teeth

3M = 3 Teeth

TT9030

Grade

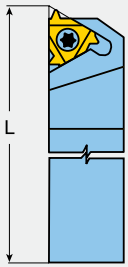
Coated
TT7010
TT8010
TT9030

Uncoated
CT3000 (Cermet)
P30

M

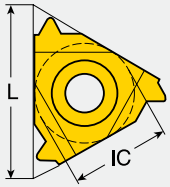
Tool length

	mm
D –	60
F –	80
H –	100
K –	125
L –	140
M –	150
P –	170
R –	200
S –	250
T –	300
U –	350
V –	400



16

Insert size



L (mm)	IC
06	3.968 mm = 5/32"
08	4.762 mm = 3/16"
11	6.350 mm = 1/4"
16	9.525 mm = 3/8"
22	12.700 mm = 1/2"
27	15.875 mm = 5/8"

Optional specifications

U: For U-type inserts

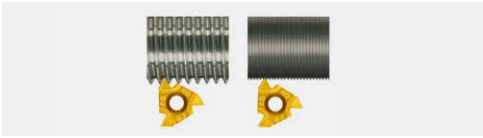
B: Bore for coolant

C: Carbide shank

SP: Special

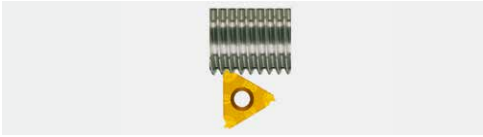
Partial profile

- Suitable for a wide range of standard threads and pitches with same angles (60° or 55°)
- Inserts with small root-corner radius suitable for the smallest pitch range
- To complete outside and internal diameters additional operations are necessary
- Not recommended for mass production
- Use of different inserts is not necessary
- **Attention:** Observe the corner radii in the base



Full profile

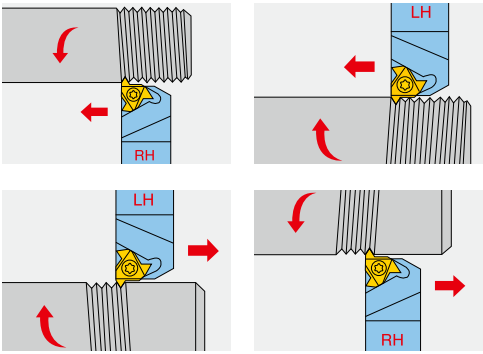
- Performs the complete thread profile
- Root corner radius is suitable only for the relevant pitch
- Useable for mass production
- Suitable for one profile only



Application methods of threading inserts

External Thread

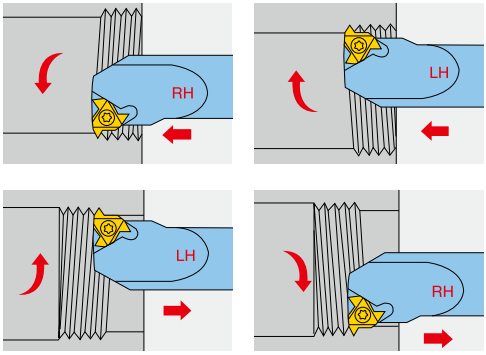
Right-hand thread | Left-hand thread



Change shim to negative | Change shim to negative

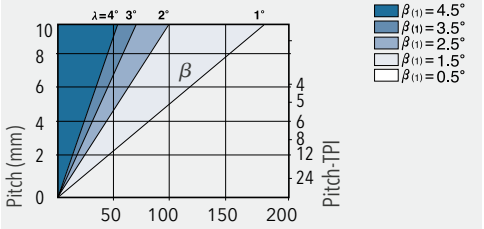
Internal Thread

Right-hand thread | Left-hand thread



Change shim to negative | Change shim to negative

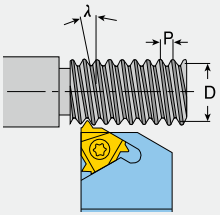
Helix angle λ evaluation



(1)β - effective inclination angle

$$tg\,\lambda = \frac{1 \times P}{\pi \times D}$$

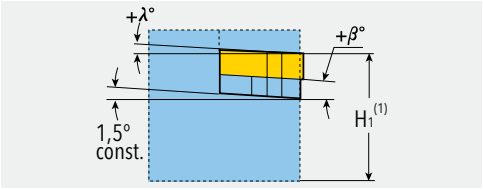
$$\lambda^{\circ} = \frac{20 \times P}{D}$$



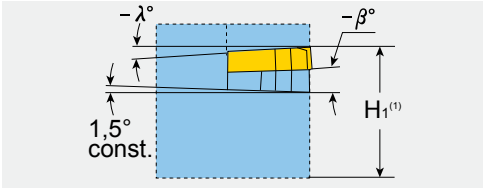
P - Pitch in mm
D - Effective diameter of thread in mm
λ - Angle of inclination

Shim selection according to thread helix angle λ

Standard														
Thread helix angle		>4°		3°-4°		2°-3°		1°-2°	0°-1°		Negative shim			
Inclination angle β		4.5°		3.5°		2.5°		1.5°	0.5°		-0.5°		4.5°	
I(IC)	Tool holder	Shim Designation												
16	EX RH OR IN LH	AE 16	+4.5	AE 16	+3.5	AE 16	+2.5	AE 16	AE 16	+0.5	AE 16	-0.5	AE 16	-1.5
(3/8)	EX LH OR IN RH	AI 16	+4.5	AI 16	+3.5	AI 16	+2.5	AI 16	AI 16	+0.5	AI 16	-0.5	AI 16	-1.5
22	EX RH OR IN LH	AE 22	+4.5	AE 22	+3.5	AE 22	+2.5	AE 22	AE 22	+0.5	AE 22	-0.5	AE 22	-1.5
(1/2)	EX LH OR IN RH	AI 22	+4.5	AI 22	+3.5	AI 22	+2.5	AI 22	AI 22	+0.5	AI 22	-0.5	AI 22	-1.5
27	EX RH OR IN LH	AE 27	+4.5	AE 27	+3.5	AE 27	+2.5	AE 27	AE 27	+0.5	AE 27	-0.5	AE 27	-1.5
(5/8)	EX LH OR IN RH	AI 27	+4.5	AI 27	+3.5	AI 27	+2.5	AI 27	AI 27	+0.5	AI 27	-0.5	AI 27	-1.5
22U	EX RH OR IN LH	AE 22U	+4.5	AE 22U	+3.5	AE 22U	+2.5	AE 22U	AE 22U	+0.5	AE 22U	-0.5	AE 22U	-1.5
(1/2U)	EX LH OR IN RH	AI 22U	+4.5	AI 22U	+3.5	AI 22U	+2.5	AI 22U	AI 22U	+0.5	AI 22U	-0.5	AI 22U	-1.5
27U	EX RH OR IN LH	AE 27U	+4.5	AE 27U	+3.5	AE 27U	+2.5	AE 27U	AE 27U	+0.5	AE 27U	-0.5	AE 27U	-1.5
(5/8U)	EX LH OR IN RH	AI 27U	+4.5	AI 27U	+3.5	AI 27U	+2.5	AI 27U	AI 27U	+0.5	AI 27U	-0.5	AI 27U	-1.5



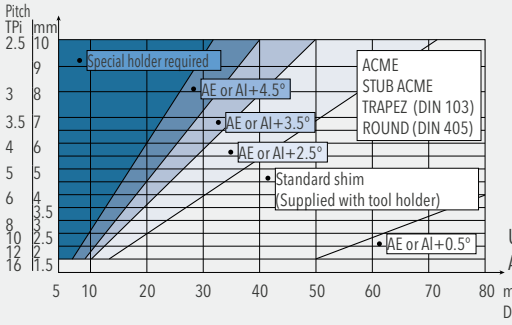
Shims for negative inclination β used when turning:
RH thread with LH holder or LH thread with RH holder.

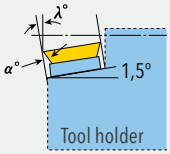


Shims for positive inclination β used when turning:
RH thread with RH holder or LH thread with LH holder.

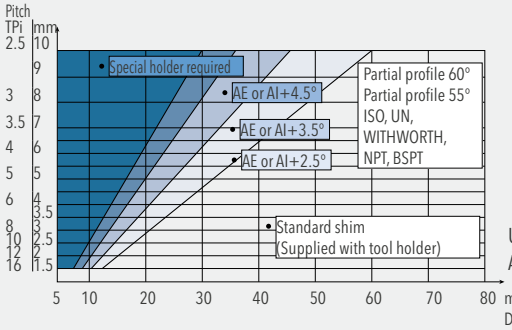
(1) **H1** remains constant regardless of the selected shim

Thread helix angle and shim selection

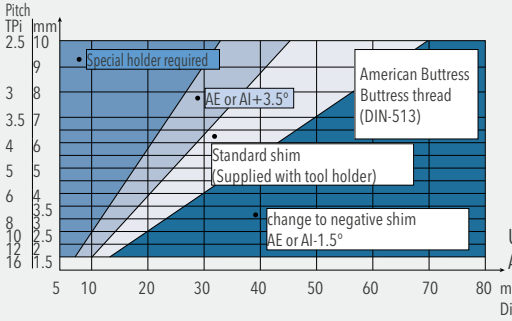


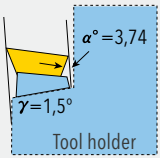


Use AE shims for EX-RH and IN-LH tool holders and AI shims for IN-RH and EX-LH tool holders



Use AE shims for EX-RH and IN-LH tool holders and AI shims for IN-RH and EX-LH tool holders

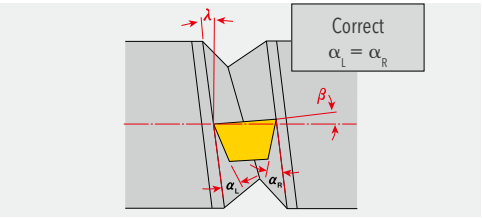


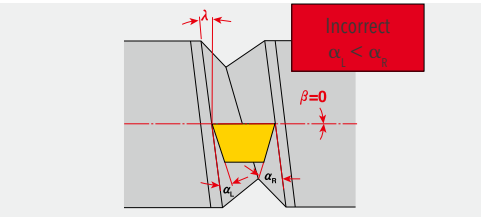


Use AE shims for EX-RH and IN-LH tool holders and AI shims for IN-RH and EX-LH tool holders

Flank clearance and effective inclination angle

Inclination angle β of the cutting edges corresponds to a specific thread helix angle λ and insures equal clearance angle on both sides of insert.

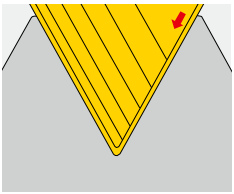




α - Flank clearance angle
λ - Helix angle
β - Effective inclination angle is achived by selecting the suitable shim

Infeed methods for threading operations

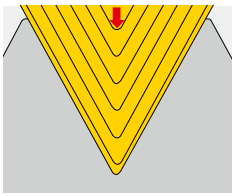
Flank feed



Advantages: less vibrations, less heat development at cutting edge, high process reliability, simple programming, good chip control

Disadvantage: uneven insert wear

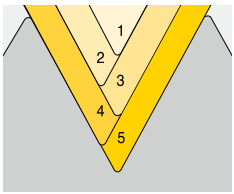
Radial infeed



Advantages: uniform insert wear, for conventional machines, for small pitches (<1.5 mm), good control of cold hardened materials

Disadvantages: poor chip control, vibrations can occur

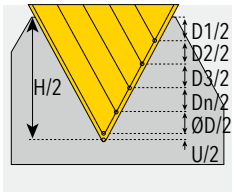
Alternating flank infeed



Advantages: uniform insert wear, longer tool life, for large thread pitches

Disadvantages: complex programming

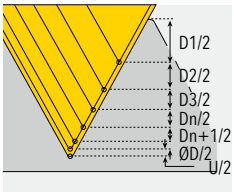
Flank equal



Equal depth of cut for each pass

$$\frac{D1}{2} = \frac{D2}{2} = \frac{D3}{2} = \frac{Dn}{2}$$

Flank diminishing



Diminished depth of cut for each pass

$$\frac{D1}{2} > \frac{D2}{2} > \frac{D3}{2} > \frac{Dn}{2} > \frac{Dn+1}{2}$$

H – Depth of thread profile
D – Depth of pass
U – Depth of finishing pass

Improve thread quality and increase tool life

- Adjust infeed method
- Define number and size of infeeds
- Choose correct insert geometry
- Adjust clearance angle to the diameter using shims
- Adjust the cutting speed of machining
- Improve chip control by infeed method and chip breakers
- Avoid noncutting passes
- Optimize coolant supply

Increase productivity

- Full profile inserts are faster because larger infeed depths can be achieved
- Multi-tooth inserts reduce cost per cutting edge and increase productivity

Maximum depth of first cut for CNC control / external threading - M-type inserts

Full profile	Pitch		Insert designation	No. of passes		Max. depth for first pass (D1) mm									
						Low carbon steel		High carbon steel		Alloy steel		Stainless steel		Aluminum	
	mm	TPI		Min	Max	Eq. [2]	Dim. [3]	Eq. [2]	Dim. [3]	Eq. [2]	Dim. [3]	Eq. [2]	Dim. [3]	Eq. [2]	Dim. [3]
ISO metric	1.00	–	16 ERM 1.00 ISO	5	9	0.34	0.51	0.31	0.46	0.27	0.41	0.22	0.33	0.48	0.71
	1.25	–	16 ERM 1.25 ISO	6	11	0.42	0.63	0.38	0.57	0.34	0.50	0.27	0.41	0.59	0.88
	1.50	–	16 ERM 1.50 ISO	6	12	0.46	0.69	0.41	0.62	0.37	0.55	0.30	0.45	0.64	0.97
	1.75	–	16 ERM 1.75 ISO	8	13	0.48	0.72	0.43	0.65	0.38	0.58	0.31	0.47	0.67	1.01
	2.00	–	16 ERM 2.00 ISO	8	14	0.50	0.75	0.45	0.68	0.40	0.60	0.33	0.49	0.70	1.05
	2.50	–	16 ERM 2.50 ISO	10	15	0.53	0.80	0.48	0.72	0.42	0.64	0.34	0.52	0.74	1.12
	3.00	–	16 ERM 3.00 ISO	12	17	0.56	0.84	0.50	0.76	0.45	0.67	0.36	0.55	0.78	1.18
American UN	–	24	16 ERM 24 UN	5	9	0.34	0.51	0.31	0.46	0.27	0.41	0.22	0.33	0.48	0.71
	–	20	16 ERM 20 UN	6	10	0.42	0.63	0.38	0.57	0.34	0.50	0.27	0.41	0.59	0.88
	–	18	16 ERM 18 UN	6	11	0.46	0.69	0.41	0.62	0.37	0.55	0.30	0.45	0.64	0.97
	–	16	16 ERM 16 UN	7	12	0.47	0.71	0.42	0.64	0.38	0.57	0.31	0.46	0.66	0.99
	–	14	16 ERM 14 UN	6	13	0.46	0.69	0.41	0.62	0.37	0.55	0.28	0.41	0.64	0.97
	–	12	16 ERM 12 UN	8	14	0.50	0.75	0.45	0.68	0.40	0.60	0.33	0.49	0.70	1.05
	–	8	16 ERM 8 UN	12	17	0.56	0.84	0.50	0.76	0.45	0.67	0.36	0.55	0.78	1.18
British BSW	–	19	16 ERM 19 W	6	11	0.35	0.52	0.32	0.47	0.28	0.42	0.21	0.31	0.49	0.73
	–	16	16 ERM 16 W	7	12	0.47	0.71	0.42	0.64	0.38	0.57	0.31	0.46	0.66	0.99
	–	14	16 ERM 14 W	8	13	0.50	0.75	0.45	0.68	0.40	0.60	0.33	0.49	0.70	1.05
	–	11	16 ERM 11 W	9	14	0.44	0.66	0.40	0.59	0.35	0.53	0.29	0.43	0.62	0.92
NPT	–	18	16 ERM 18 NPT	10	20	0.24	0.36	0.22	0.32	0.19	0.29	0.16	0.23	0.34	0.50
	–	14	16 ERM 14 NPT	13	26	0.24	0.36	0.22	0.32	0.19	0.29	0.14	0.22	0.34	0.50
	–	11.5	16 ERM 11.5 NPT	15	24	0.27	0.40	0.24	0.36	0.22	0.32	0.18	0.26	0.38	0.56
	–	8	16 ERM 8 NPT	17	30	0.31	0.46	0.28	0.41	0.25	0.37	0.20	0.30	0.43	0.64
Round	–	6	16 ERM 6 RND	9	20	0.42	0.63	0.38	0.57	0.34	0.50	0.27	0.41	0.59	0.88
Partial profile 60°	0.50-1.50	48-16	16 ERM A 60	–[1]	–[1]	0.22	0.33	0.20	0.30	0.18	0.26	0.14	0.21	0.31	0.46
	1.75-3.00	14-8	16 ERM G 60	–[1]	–[1]	0.50	0.75	0.45	0.68	0.40	0.60	0.33	0.49	0.70	1.05
	0.50-3.00	48-8	16 ERM AG 60	–[1]	–[1]	0.24	0.36	0.22	0.32	0.19	0.29	0.16	0.23	0.34	0.50
	3.50-5.00	7-5	22 ERM N 60	–[1]	–[1]	0.41	0.62	0.37	0.56	0.33	0.50	0.27	0.40	0.57	0.87
Partial profile 55°	1.75-3.00	14-8	16 ERM G 55	–[1]	–[1]	0.50	0.75	0.45	0.68	0.40	0.60	0.33	0.49	0.70	1.05
	0.50-3.00	48-8	16 ERM AG 55	–[1]	–[1]	0.22	0.33	0.20	0.30	0.18	0.26	0.14	0.21	0.31	0.46

[1] As per the number of passes for the relevant pitch [2] Equal depth of cut method [3] Diminished depth of cut for each pass method

Maximum depth of first cut for CNC control / internal threading - M-type inserts

Full profile	Pitch		Insert designation	No. of passes		Max. depth for first pass (D1) mm									
						Low carbon steel		High carbon steel		Alloy steel		Stainless steel		Aluminum	
	mm	TPI		Min	Max	Eq. [2]	Dim. [3]	Eq. [2]	Dim. [3]	Eq. [2]	Dim. [3]	Eq. [2]	Dim. [3]	Eq. [2]	Dim. [3]
ISO metric	1.50	–	11 IRM 1.50 ISO	10	20	0.20	0.30	0.18	0.27	0.16	0.24	0.12	0.18	0.28	0.42
	1.00	–	16 IRM 1.00 ISO	9	16	0.14	0.20	0.13	0.18	0.11	0.16	0.09	0.13	0.20	0.28
	1.25	–	16 IRM 1.25 ISO	9	16	0.19	0.28	0.17	0.25	0.15	0.22	0.12	0.18	0.27	0.39
	1.50	–	16 IRM 1.50 ISO	10	20	0.20	0.30	0.18	0.27	0.16	0.24	0.12	0.18	0.28	0.42
	1.75	–	16 IRM 1.75 ISO	11	18	0.21	0.32	0.19	0.29	0.17	0.26	0.14	0.21	0.29	0.45
	2.00	–	16 IRM 2.00 ISO	12	21	0.22	0.33	0.20	0.30	0.18	0.26	0.14	0.21	0.31	0.46
	2.50	–	16 IRM 2.50 ISO	14	21	0.23	0.34	0.21	0.31	0.18	0.27	0.15	0.22	0.32	0.48
	3.00	–	16 IRM 3.00 ISO	16	22	0.24	0.35	0.22	0.32	0.19	0.29	0.16	0.23	0.34	0.50
American UN	–	20	16 IRM 20 UN	7	13	0.20	0.30	0.18	0.27	0.16	0.24	0.12	0.18	0.28	0.42
	–	18	16 IRM 18 UN	8	15	0.20	0.30	0.18	0.27	0.16	0.24	0.12	0.18	0.28	0.42
	–	16	16 IRM 16 UN	11	19	0.20	0.30	0.18	0.27	0.16	0.24	0.13	0.20	0.28	0.42
	–	14	16 IRM 14 UN	11	20	0.21	0.31	0.19	0.28	0.17	0.25	0.13	0.19	0.29	0.43
	–	12	16 IRM 12 UN	12	21	0.23	0.34	0.21	0.31	0.18	0.27	0.15	0.22	0.32	0.48
	–	8	16 IRM 8 UN	14	20	0.24	0.36	0.22	0.32	0.19	0.29	0.16	0.23	0.34	0.50
British BSW	–	19	16 IRM 19 W	7	12	0.28	0.42	0.25	0.38	0.22	0.34	0.17	0.25	0.39	0.59
	–	16	16 IRM 16 W	9	14	0.26	0.39	0.23	0.35	0.21	0.31	0.17	0.25	0.36	0.55
	–	14	16 IRM 14 W	10	16	0.27	0.41	0.24	0.37	0.22	0.33	0.18	0.27	0.38	0.57
	–	11	16 IRM 11 W	12	19	0.31	0.46	0.28	0.41	0.25	0.37	0.20	0.30	0.43	0.64
NPT	–	14	16 IRM 14 NPT	21	35	0.13	0.20	0.12	0.18	0.10	0.16	0.08	0.12	0.18	0.28
	–	11.5	16 IRM 11.5 NPT	21	33	0.17	0.25	0.15	0.23	0.14	0.20	0.11	0.16	0.24	0.35
	–	8	16 IRM 8 NPT	20	34	0.23	0.34	0.21	0.31	0.18	0.27	0.14	0.20	0.32	0.48
Round	–	6	16 IRM 6 RND	12	24	0.30	0.46	0.27	0.41	0.24	0.37	0.20	0.30	0.42	0.64
Partial profile 60°	0.50-1.25	48-16	06 IRM A 60	–[1]	–[1]	0.22	0.33	0.20	0.30	0.18	0.26	0.14	0.21	0.31	0.46
	0.50-1.50	48-16	08 IRM A 60	–[1]	–[1]	0.13	0.20	0.12	0.18	0.10	0.16	0.08	0.13	0.18	0.28
	0.50-1.50	48-16	11 IRM A 60	–[1]	–[1]	0.13	0.20	0.12	0.18	0.10	0.16	0.08	0.13	0.18	0.28
	0.50-1.50	48-16	16 IRM A 60	–[1]	–[1]	0.13	0.20	0.12	0.18	0.10	0.16	0.08	0.13	0.18	0.28
	1.75-3.00	14-8	16 IRM G 60	–[1]	–[1]	0.22	0.33	0.20	0.30	0.18	0.26	0.14	0.21	0.31	0.46
	0.50-3.00	48-8	16 IRM AG 60	–[1]	–[1]	0.14	0.21	0.13	0.19	0.11	0.17	0.09	0.14	0.20	0.29
	3.50-5.00	7-5	22 IRM N 60	–[1]	–[1]	0.23	0.34	0.21	0.31	0.18	0.27	0.15	0.22	0.32	0.48
Partial profile 55°	1.75-3.00	14-8	16 IRM G 55	–[1]	–[1]	0.34	0.50	0.31	0.45	0.27	0.40	0.22	0.33	0.48	0.70
	0.50-3.00	48-8	16 IRM AG 55	–[1]	–[1]	0.14	0.20	0.13	0.18	0.11	0.16	0.09	0.13	0.20	0.28

[1] As per the number of passes for the relevant pitch [2] Equal depth of cut method [3] Diminished depth of cut for each pass method

Number of cutting passes for regular type inserts

Pitch [mm]	Pitch [TPI]	Number of passes
0.5	48	4–6
1.0	24	5–9
1.5	16	5–12
2.0	12	6–14
2.5	10	7–15
3.0	8	8–17
4.0	6	10–20
6.0	4	11–22

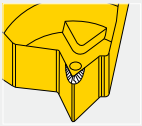
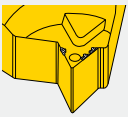
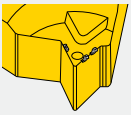
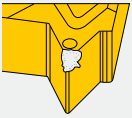
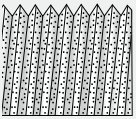
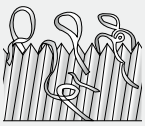
Recommended number of passes for multi-tooth insert

Full profile	Insert designation	No. of passes	1st pass	2nd pass	3rd pass	4th pass	External / internal
ISO metric	16 ER 1.0 ISO 3M	2	0.39	0.24	–	–	External
	16 ER 1.5 ISO 2M	3	0.40	0.31	0.21	–	External
	22 ER 1.5 ISO 3M	2	0.54	0.38	–	–	External
	22 ER 2.0 ISO 2M	3	0.56	0.42	0.27	–	External
	22 ER 2.0 ISO 3M	2	0.75	0.50	–	–	External
	27 ER 3.0 ISO 2M	4	0.60	0.52	0.44	0.30	External
	16 IR 1.0 ISO 3M	2	0.32	0.26	–	–	Internal
	16 IR 1.5 ISO 2M	3	0.36	0.29	0.22	–	Internal
	22 IR 1.5 ISO 3M	2	0.49	0.38	–	–	Internal
	22 IR 2.0 ISO 2M	3	0.50	0.40	0.25	–	Internal
	22 IR 2.0 ISO 3M	2	0.72	0.43	–	–	Internal
	27 IR 3.0 ISO 2M	4	0.57	0.45	0.38	0.33	Internal
American UN	16 ER 16 UN 2M	3	0.45	0.32	0.20	–	External
	22 ER 16 UN 3M	2	0.60	0.37	–	–	External
	22 ER 12 UN 2M	3	0.60	0.39	0.31	–	External
	22 ER 12 UN 3M	2	0.80	0.50	–	–	External
	27 ER 8 UN 2M	4	0.63	0.55	0.42	0.36	External
	16 IR 16 UN 2M	3	0.40	0.29	0.23	–	Internal
	22 IR 16 UN 3M	2	0.57	0.35	–	–	Internal
	22 IR 12 UN 2M	3	0.55	0.39	0.28	–	Internal
	22 IR 12 UN 3M	2	0.75	0.47	–	–	Internal
	27 IR 8 UN 2M	4	0.65	0.49	0.42	0.27	Internal
NPT	22 ER 11.5 NPT 2M	4	0.55	0.46	0.35	0.32	External
	27 ER 11.5 NPT 3M	3	0.75	0.57	0.36	–	External
	27 ER 8 NPT 2M	4	0.80	0.62	0.54	0.45	External
	22 IR 11.5 NPT 2M	4	0.55	0.46	0.35	0.32	Internal
	27 IR 11.5 NPT 3M	3	0.75	0.57	0.36	–	Internal
	27 IR 8 NPT 2M	4	0.80	0.62	0.54	0.45	Internal
Whitworth	16 ER 14 W 2M	3	0.51	0.39	0.26	–	External
	22 ER 14 W 3M	2	0.72	0.44	–	–	External
	22 ER 11 W 2M	3	0.65	0.46	0.37	–	External
	16 IR 14 W 2M	3	0.51	0.39	0.26	–	Internal
	22 IR 14 W 3M	2	0.72	0.44	–	–	Internal
	22 IR 11 W 2M	3	0.65	0.46	0.37	–	Internal
API Round	22 ER 10 API RD 2M	3	0.58	0.53	0.30	–	External
	27 ER 10 API RD 3M	2	0.98	0.43	–	–	External
	27 ER 8 API RD 2M	3	0.82	0.59	0.40	–	External
	22 IR 10 API RD 2M	3	0.58	0.53	0.30	–	Internal
	27 IR 10 API RD 3M	2	0.98	0.43	–	–	Internal
	27 IR 8 API RD 2M	3	0.82	0.59	0.40	–	Internal

Cutting parameters

Material			Condition	Tensile strength (N/mm²)	Hardness HB	Material No.	Cutting speed Vc(m/min)			
							Coated			Uncoated
							TT7010	TT9030	TT8010	P30
P	Non–alloy steel, cast steel, free cutting steel	< 0,25% C	Annealed	420	125	1	120-200	140-220	85-125	80-120
		≥ 0,25% C	Annealed	650	190	2	120-200	140-220	85-125	80-120
		< 0,55% C	Quenched and tempered	850	250	3	110-190	130-210	80-120	70-110
		≥ 0,55% C	Annealed	750	220	4	110-190	130-210	80-120	70-110
			Quenched and tempered	1000	300	5	90-170	110-190	70-100	65-95
	Low alloy steel		Annealed	600	200	6	70-120	70-120	50-70	70-110
			Quenched and tempered	930	275	7	90-170	110-190	70-100	65-95
			Quenched and tempered	1000	300	8	80-120	100-140	60-100	70-110
			Quenched and tempered	1200	350	9	70-120	90-140	40-80	40-80
	High alloy steel, cast steel and tool steel		Annealed	680	200	10	70-100	70-100	40-70	40-70
			Quenched and tempered	1100	325	11	40-80	40-80	40-70	40-70
M	Stainless steel and cast steel		Ferritic / martensitic	680	200	12	85-125	90-130	40-70	40-70
			Martensitic	820	240	13	120-180	130-190	80-120	80-120
			Austenitic	600	180	14	50-100	60-110	40-60	40-60
K	Gray cast iron (GG)		Ferritic	–	160	15	-	100-140	80-120	-
			Pearlitic	–	250	16	-	110-150	80-120	-
	Cast iron nodular (GGG)		Ferritic	–	130	17	-	110-150	80-120	-
			Pearlitic	–	230	18	-	80-120	80-120	-
	Malleable cast iron		Ferritic	–	180	19	-	110-150	60-100	-
			Pearlitic	–	260	20	-	80-120	55-95	-
N	Aluminum – wrought alloy		Not cureable	–	60	21	-	1300-1500	700-900	-
			Cured	–	100	22	-	400-600	330-430	-
	Aluminumcast, alloyed	> 12% Si	Not cureable	–	75	23	-	500-800	350-450	-
			Cured	–	90	24	-	370-470	300-360	-
		> 12% Si	high temp. resistant	–	130	25	-	200-280	150-210	-
	Copper alloys	> 1% Pb	Free cutting	–	110	26	-	260-340	160-240	-
			Brass	–	90	27	-	350-450	250-310	-
			Electrolyte–Copper	–	100	28	-	100-140	80-120	-
	Non–metallic		Duroplastics, fiber plastics	–	–	29	-	250-350	160-200	-
			Hard rubber	–	–	30	-	250-350	150-210	-
S	High temp. alloys	Fe based	Annealed	–	200	31	-	50-70	20-50	-
			Cured	–	280	32	-	30-50	20-50	-
		Ni or Co based	Annealed	–	250	33	-	30-50	20-40	-
			Cured	–	350	34	-	20-40	15-30	-
			Cast	–	320	35	-	20-40	15-30	-
	Titanium, Ti alloys		–	Rm 400	–	36	-	120-140	90-110	-
		Alpha+beta alloys cured		Rm 1050	–	37	-	40-60	20-50	-
H	Hardened steel		Hardened	–	55 HRC	38	-	30-60	20-35	-
			Hardened	–	60 HRC	39	-	20-40	20-30	-
	Chilled cast iron		Cast	–	400 HRB	40	-	20-40	20-30	-
	Cast iron nodular		Hardened	–	55HRC	41	-	20-30	15-25	-

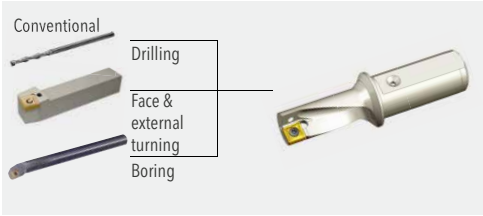
Types of wear

Problem	Caused by	Solution
Flank wear 	• Cutting speed too high • Depth of cut too small • Highly abrasive material • Inadequate coolant supply • Wrong inclination shim • Wrong turned dia. prior to threading • Insert is above center height	• Reduce RPM • Increase depth of cut • Modify flank infeed • Use coated grade • Apply coolant • Reselect shim • Check turned dia. • Check center height
Fracture 	• Cutting speed too high • Depth of cut too large • Wrong grade • Poor chip control • Inadequate coolant supply • Center height incorrect	• RPM is not correct • Reduce depth of cut • Use coated grade • Use tougher grade • Modify flank infeed • Apply coolant • Adjust center height
Deformation 	• Excessive heat in cutting zone • Wrong grade • Inadequate coolant supply	• Reduce RPM • Reduce depth of cut • Check turned dia. • Use coated grade • Use harder grade • Apply more coolant
Built-up edge 	• Cutting speed too low • Wrong grade • Inadequate coolant supply	• Increase RPM • Increase depth of cut • Use coated grade • Apply coolant
Cutting edge break 	• Cutting speed too low • Depth of cut too large • Wrong grade • Wrong turned dia. prior to threading • Corner height incorrect • Depth of cut too shallow • Wrong inclination shim • Tool overhang too long	• Increase RPM • Reduce depth of cut • Increase number of infeed passes • Check turned dia. • Adjust center height • Modify flank infeed • Reselect shim • Reduce tool overhang
Bad surface 	• Wrong cutting speed • Excessive heat in cutting zone • Poor chip control • Inadequate coolant supply • Wrong inclination shim • Tool overhang too long • Center height incorrect	• Increase RPM • Reduce RPM • Reduce depth of cut • Modify flank infeed • Apply coolant • Reselect shim • Reduce tool overhang • Check center height
Bad chip flow 	• Excessive heat in cutting zone • Wrong grade • Inadequate coolant supply • Wrong turned dia. prior to threading	• Reduce RPM • Change depth of cut • Use coated grade • Check turned dia. • Use M-type insert • Apply coolant

Types of wear

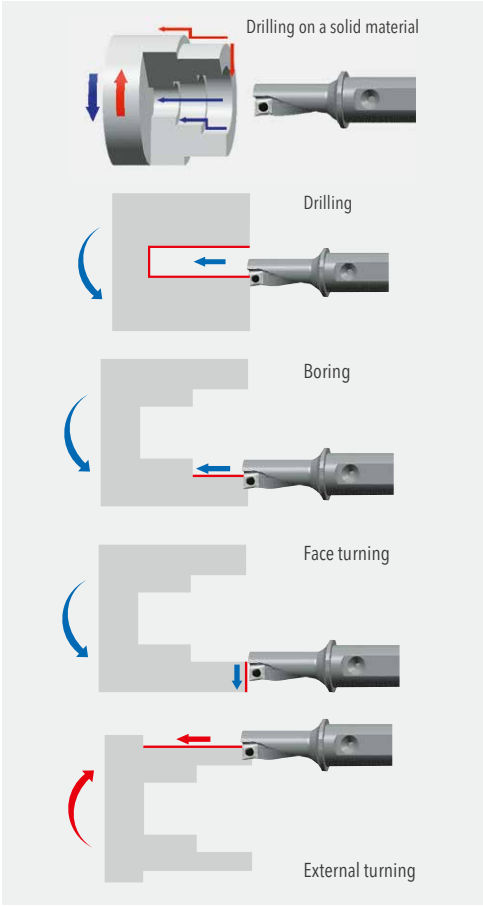
Problem	Caused by	Solution
Poor thread profile	• Thread profile angle and corner radius are incorrect; inserts for external turning were choosen for internal machining and vice versa. • Wrong center height • Holder not 90 ° to the workpiece axis • Pitch error of machine	• Choose right tool/insert combination • Adjust center height • Adjust to 90° • Correct the machine
General poor surface quality of the entire thread	• Cutting speed too low • Insert is above centerline of workpiece • Uncontrolled chip flow	• Increase cutting speed • Correct center height • Select C-type insert with modified flank infeed
Poor chip control	• Wrong infeed method • Wrong insert geometry	• Use modified flank infeed of 3° - 5° • Use C-type geometry with modified flank infeed of 1°
Low thread profile	• Incorrect center height • Broken insert • Excessive wear	• Adjust center heigth • Exchange insert

Multi-function system



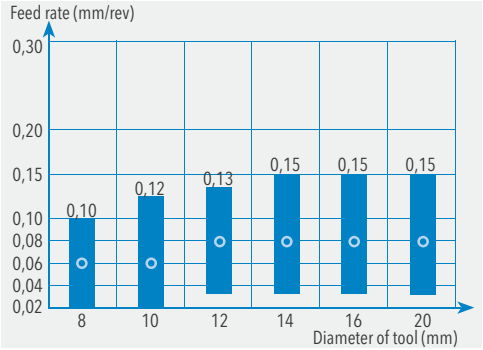
- Turning, boring and drilling with one tool
- Short set-up and cycle time
- Minimized tool positions and reduced tooling cost

Applications

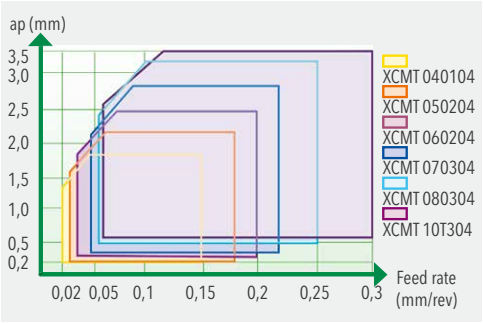


Chip control range

Drilling (Material: 41CrMo4 (19HRC), Vc=120m/min)

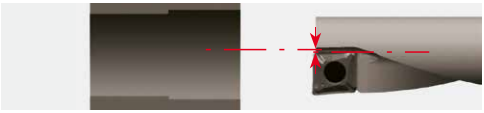


Turning (Material: C45 (220 BHN), Vc=150m/min)



Radial adjustment

Radial adjustment is dependent on drill diameter
Optimal positioning for the pilot hole = (Dmin + Dmax)/2

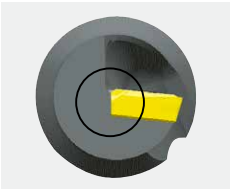


Tool holder	Drill dia. (mm)	Dmin (mm)	Dmax (mm)
TCAP 08 -	8	7.86	8.35
TCAP 10 -	10	9.82	10.60
TCAP 12 -	12	11.82	12.60
TCAP 14 -	14	13.80	14.60
TCAP 16 -	16	15.76	16.50
TCAP 20 -	20	19.80	20.60
TCAP 25 -	25	24.75	25.20
TCAP 32 -	32	31.80	32.15

Set-up

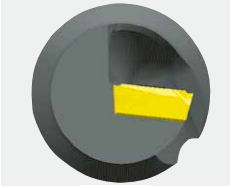
Insert positioning

- Cutting edge for drilling should be positioned in the center of tool body



Correct

Correct



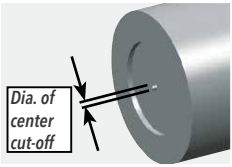
Incorrect

Coolant pressure

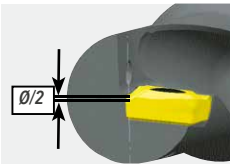
- Must be min. 2 bar, optimal pressure is above 5 bar

Optimization of chip control

- *Low carbon material:*
  Increasing the cutting speed causes thinner chips because the biggest problems arise with thick chips.
- *High carbon material:*
  Good chip flow but high wear? Maintain cutting speed and reduce feed.



Please check formation of core and its size after drilling depth of 3 - 6 mm.
Diameter of core should be 0.15 to 0.45 mm.



With Ingersoll TGHR clamping unit, the exact setting of the Y-axis is very easy to carry out.

- If no drill core appears:
  Vibrations can occur and the insert can break
- If the diameter of the drill core is out of tolerance, overload and vibration problems can occur.

Cutting speed (Vc)

Material	Hardness (BHN)	Cutting Speed: Vc (m/min)	
		Drilling	Turning & internal machining
Low carbon steel (–0,25% C)	– 150	130 – 240	150 – 270
Carbon steel (0,25%< C)	150 – 250	90 – 160	100 – 180
Low alloy steel	– 180	120 – 210	140 – 230
Medium alloy steel	200 – 250	70 – 140	80 – 160
High alloy steel	250 – 350	50 – 100	60 – 120
Martensitic stainless steel	– 200	110 – 180	130 – 200
Austentic stainless steel	– 200	90 – 160	100 – 180
Gray cast iron	180 – 220	110 – 180	120 – 200
Ductile cast iron	200 – 240	90 – 160	100 – 180
Aluminum alloy	60 – 130	100 – 500	150 – 600
Copper alloy	90 – 100	100 – 400	100 – 500

Infeed (ap) & Feed (f)

Designation	Application	Cutting parameters	
		ap (mm)	f (mm/rev)
XCMT 040104	Turning	0.6 (0.2 – 1.8)	0.05 (0.02 – 0.15)
	Drilling	–	0.06 (0.02 – 0.10)
XCMT 050204	Turning	0.8 (0.2 – 2.2)	0.08 (0.03 – 0.18)
	Drilling	–	0.06 (0.02 – 0.12)
XCMT 060204	Turning	1.0 (0.3 – 2.5)	0.08 (0.03 – 0.20)
	Drilling	–	0.08 (0.03 – 0.13)
XCMT 070304	Turning	1.2 (0.4 – 2.8)	0.12 (0.05 – 0.22)
	Drilling	–	0.08 (0.03 – 0.15)
XCMT 080304	Turning	1.5 (0.4 – 3.2)	0.12 (0.05 – 0.25)
	Drilling	–	0.08 (0.03 – 0.15)
XCMT 10T304	Turning	1.8 (0.5 – 3.5)	0.12 (0.06 – 0.30)
	Drilling	–	0.08 (0.03 – 0.15)
XCMT 130404	Turning	2.0 (0.6 – 3.8)	0.14 (0.06 – 0.35)
	Drilling	–	0.09 (0.05 – 0.18)
XCMT 170508	Turning	2.2 (0.6 – 4.2)	0.15 (0.08 – 0.40)
	Drilling	–	0.09 (0.06 – 0.20)

Comparison of Chipbreaker

			Ingersoll	Sandvik	Kennametal	Seco	Walter	Valenite	Mitsubishi	Sumitomo	Kyocera	Tungaloy	Korloy	Iscar
Negative insert	Steel	Double sided	WS, WA	WF	FW	W-MF2	NF	W3	SW	LUW, SEW	WP	FW, AFW	VW	WF
			WT	WMX, WM	MW, RW	W-M3, W-M6, W-MF5	NM	W6	MW	GUW	WQ	SW, ASW	LW	WG
			FLP, FA, FS,GG-FU, FX	–	FF, FS	FF1, FF2	FP5	F2	FH, FP, FS, FY	FA, FL	DP, GP, PP, VF	TF, 01, CB, ZF	HU, VL	SF
			FLP, FG, FM	QF	FP, LF, FN	MF2	NF3, NF4	–	LP, SH	SU	HQ	NS, 11, TS, AS, TSF	VG, VF, VQ	NF, F3P
			MLP, FC, FT	PF, XF	–	–	NS6	–	SA	LU, SE, SX	CQ, PQ, CJ	SS, NM, ZM	VB, VC, HC	–
			VF, DNUX,	K	–	UX	–	–	ES	GX, HM	–	S	–	–
			MLP, MC	–	MN	MR3	MP3	–	–	–	GS	–	–	–
			MGP, PC, MM	PM, XM, QM	P	MF3, MF5, M3	MP5, MM5 (NM4)	M2	MP, MV, MA	GU, UG	PG, PS	TM, AM	VM, HS, HG	M3P,TF
			MGP, MT	HM, XMR	MP, RP, RM		NM6, NM9	M3	MH	UX, GE	HS, CS	–	HM, GM	GN
			MGP, MG–		MG–, UN	M4, MR4	MG–	–	MG–	UZ	MG–, C	33, 37, 38, DM, MG–	B25	MG–
			RGP, RT	PR	RN	M5, MR7, M6	NR4, RP5, RP7	R3	RP, GH	ME, MU, MX	PT, GT, PH, HT	TH	HR, GR	NR, R3P
			FLP, FS,GG-FU, MLP, FC	WL, LC	–	–	–	–	FS, FY, SY	FL	XF, XP,XP-T, XQ, XS	17	VL	–
		Single sided	RX	PR	RM	–	NRF	–	–	–	PX	–	–	–
			RH	QR, MR	MR, RP	R6, RR9, R4, R5, 37, RR6	NR6	R6	HZ	MP, HG, HP	HX	TRS, 57	GH	R3P, NM
			HT, HD	HR, 31	RH	R8, 56, 57, R7	NRR	–	HCS, HX, HBS	HF, HU	–	65, TU	VT	–
			HY, HZ	–	–	–	–	–	HV, HDS, HXD	HW	–	–	VH	–
	Stainless Steel*		EA, SF	MF	FP	MF1	NF4	F5	FS, LM	SU	MQ, GU	SF	HA, VP2	SF, F3M
			EM, ML	MM	MP, UP, MR	MF4	MM5 (NM4)	–	MS, GM, MA	EX, UP, GU	MS, MU	SS, S	HS, GS, MM	TF, VL, M3M
			ET	MR, MM–MR	RP	MR6, MF5, MM–MR6	NR4, NRS	M5	RM	MU, HM	HU	SM	HR, VM, RM	MR, R3M
	Cast iron*		MT	KM	–	M4	NM, MK5	–	LK, MA, MK	UZ	KQ, MG–	CF, CM	VM	GN
			MG–	–	MG–,RN	M5	NM5, RK5	–	MG–, GK	–	KG, C	MG–	–	MG–
			KT, RT	KR	UN	MR7	RK7	–	GH, RK	GZ	KH, ZS, GC	CH	VK, GR	–
	Alu-minum*		ML	QM, 23	MS, MP	–	–	–	MJ	UP, GX, AG	A3, AH	P	HA	PP
	Heat-resistant materials*		EA, SF	SF	GG–FS	MF1	NF4	F5	FJ, LS	EF	MQ	HRF	VP1	SF
			GG–ML	SGF, GP–	MS, GP–K	M1	GG–NFT	–	MJ	SU, UP	TK	–	VP2	PP
			MP, SU,MK, ET	QM, SM, 23, SR, SMR	UP, P, RP	MF4, MF5, M5, MR3, MR4	NMS, NMT, NRS, NRT	M2	MS, GJ, RS	EG, EX, MU	MS, MU	HRM, HMM, SA	VP3, VM	TF, VL, MR
Positive insert	Steel		WT	WM	MW	W–F2	PM	–	MW	–	–	–	–	WG
			FA, FX	PF, UF	UF, 11, GM	FF1	PF4	–	FV	LU, FP	XP, GK, GP, DP, VF	01, PF, PSF	VL, HFP	38, PF
			GT–SL, GT–SA, GT–SM	–	–	–	–	–	SMG	FC	CF, GF, CK	JS	–	–
			FG	UM, XF	FP, LF	F1	PS5	PM3, PM4	SQ,SV	FK, SU, SC, SK	XQ, GK	–	VF, HMP, C05	SM, 16, GT–
			PC, GT–SH, FM	PM	MP	–	–	PM3, PM4	SQ, SV	FK, SU, SC, SK	XQ, GK	–	VF, HMP, C05	SM, 16, GT–
			GT–SA, MT	PR, UR	MF	F2, MF2, M5	E47, MT–	PM5	MQ, MV, MT–, G	SF, MU	MT–	PM	C25	14, 17, 19, MT–
			PMR–	PMR–	PMR–	–	PMR–	–	PMR–	UJ	G, PMR–	23	–	–
	Alu-minum		GT–SA, FL	AL	HP	AL	PM2	IL	AZ	AW, AG	AH	AL	AK, AR	AF, AS
	Heat-re-sistant materials		GT–FGS, SA	GT–UM	GT–HP, LF	GT–F1	GT–PF2	GT–PM2	GT–FJ	GT–SI	–	–	GT–VP1	–
			FG	MF, UM	FP, LF	F1, F2	PF4, PS5	1A	FM, LM, SV	SU	MQ	PSF	VL	PF
			PC	MM	FP, LF	MF2	PM5	2A	MM, MV	MU	MQ	PSS, PS, PM	MP	PF

*Double sided

Grade Comparison Table

Coated carbide metals

ISO	Ingersoll	Sandvik	Walter	Seco	Kennametal	MMC	Sumitomo	Tungaloy	Kyocera	Korloy	Iscar
P	TT8105	GC4305, GC4205	WPP05S, WPP05	TP0501, TP0500	KCP05	UE6105, UE6005	AC810P	T9105, T9005	CA510, CA5505	–	–
	TT8115	GC4315, GC4215	WPP10S, WPP10, WPV10	TP1501, TP1500	KCP10, KCP10B	MC6015, UE6110	AC8015P, AC820, AC1000	T9215, T9115, T9015	VP5115, CA515, CA5515	NC3215, NC3010	IC8150, IC9150
	TT8125, TT5100	GC4325, GC4225	WPP20S, WMP20S, WPV20	TP2501, TP2500	KCP25, KCP25B	MC6025, UE6020	AC8025P, AC2000	T9125, T9025	VP5125, CA525, CA5525, CA025P	NC3225, NC3220, NC5330, NC3120	IC8250, IC9250
	TT8135, TT7100	GC4235, GC2135	WPP30S, WPP30	TP3501, TP3500	KCP30, KCP40	MC6035, UH6400	AC8035P, AC830P, AC3000	T9135, T9035	CA530, CA5535	NC500H, NC5340, NC5350, NC3030	IC8350, IC9350
M	TT9215, TT5080	GC2015	WSM01, WSM10, WSM10S, WAM10	TM2000, TH1000, TS2000, TS2050, CP200	KCM15, KCU10 KCS10, KC5510, KC5010	MC7015, US7020, VP10RT	AC6020M, AC610M, AC5015S, AC510U, ACZ150, AC520U	T6120, AH110, AH120	KX409, CA6515, PR930, AH8005, AH8015	NC9115, NC9020, PC8105, PC8110	IC6015, IC807
	TT9225, TT9080	GC2025, GC2220	WMP20S, WSM20, WSM21	TS2500, CP500	KCM25B, KCM25, KCU25, KC5525, KC5025	MC7025, US735, MH515, VP15TF, VP20MF, VP20RT, UP20M	AC6030M, AC630M, AC5025S, AC6040M, AC1030U, AC530U	T6130, AH630, AH725	CA6525, PR1025, PR1125, PR1225, PR1425	NC9125, NC5330, NC5340, PC8115, PC5300, PC9030	IC6025
	TT9235, TT8080, TT8020	GC2135, GC2035, GC30	WSM30, WAM30	TM4000, CP60	KCM35B, KCM35	MP7035, UH6400, MP7035	AC6040M	AH6030, T6030, AH645	PR1325, PR1535	NC9135, NC5350, PC5400	IC5400, IC3028
K	TT7005	GC3205, GC3005	WKK10S, WAK10	TK0501, TK1001, TK1000	KCK05	MC5005, UC5105	AC405K	T5105, T5010	CA310, CA4505, CA4010	NC6205, NC6105	IC5005, IC4028
	TT7015	GC3210, GC3015	WKK20S, WAK20	TK2001, TK2000	KCK15, KCK15B	MC5015, UC5115	AC410K, AC415K	T5115, T5020, T515	CA315, CA4515, CA4115	NC6210, NC6110, NC6315	IC5010
	TT7025	GC3215, GC3225	WAK30	–	KCK20B, KCK20	MH515	AC420K	T5125	CA320, CA4120	NC6215	–
S	TT3005, TT5080, TT3010	GCS05F, GC1105, GC1115	WSM01	CP200, CP250, TH1000, TH1500, TS2000, TS2500	KCU10, KCS10, KC5510, KC5010	US905, MP9005, MP9015, VP05RT, VP10RT	AC5015S, AC510U, ACZ150	AH8005, AH1 10, AH905, AH8015	AH905, AH8005, AH8015, PR1305	PC8105, PC8110	IC807, IC806, IC1007, IC907
H	TT3020, TT9080, TT8080	GC15, GC1125, GC1135, GC1515, GC1525	WSM10, WSM10S, WSM21, WSM20 , WSM20S, WSM30, WSM30S	TS2500, CP500, CP600	KCU25, KCU30, KC5525, KC5025	VP15TF, VP20RT	AC520U, AC5025S, AC6040M, AC1030U, AC530U	AH9030, AH120, AH725, SH730, AH7025, AH6030	PR1310, PR005S, PR015S, PR1125, PR1325 , PR1535	PC8115, PC5300, PC5400	IC808 IC908

PCD grades

ISO	Ingersoll	Iscar	Tungaloy	Sumitomo	Sandvik	Kennametal	Mitsubischi	Kyocera	Seco	NTK
N01-N10	TD810	ID8	DX180, DX160	DA90	–	KD1405	MD203	KPD230	PCD30M, PCD30	–
N05-N20	KP300	ID5	DX140	DA150	CD10	KD1400	MD220	KPD010	PCD20	PD1
N15-N30	TD830		DX120, DX110	DA2200, DA1000	–	KD1425	MD205	KPD001	PCD10, PCD05	PD2

MiniTurn grades

ISO	Ingersoll	Arno	Diametal	Kyocera	NTK	Tungaloy	Sumitomo
P	TT4410, TT4430, TT9020	AM5015, AM5025, AM5120	D60, D30, D10	PR1725, PR1425, PR1005, PR1025, PR1115, PR1225, PR930, PR1535	VM1, DM4, DT4, TM4, ZM3, QM3	AH710, SH725, SH730, AH725, AH7025, AH730, AH9030, AH120, AH130, AH3135	AC510U, AC520U, AC1030U, AC530U, ACZ150
M	TT4410, TT4430, TT9020	AM5110, AN5015, AM5025, AM5120, AM5220, AM5130	D60, D30, D20, D10	PR1725, PR1425, PR1025, PR1125, PR1225, PR930, PR1535	VM1, DM4, DT4, TM4, ZM3, QM3	AH710, SH725, AH725, AH120, AH130	AC510U, AC520U, AC1030U, AC530U, ACZ150
S	TT4410, TT4430, TT9020	AM5110, AM5015, AM5025, AM5120, AM5220, AM5130	D60, D30, D20	PR1725, PR1425, PR1025, PR1125, PR1225, PR930, PR1535	DM4, DT4, TM4, QM3	AH905, AH8005, AH8015, AH110, SH730, AH725, AH120	AC510U, AC520U, AC1030U, AC530U, ACZ150

Cermet grades

ISO	Ingersoll	Sandvik	Kennametal	Sumitomo	Kyocera	Tungaloy	Mitsubishi	Korloy	Seco	NTK	Ceramtec
P01	PV3010	–	KT315	T110A, T1000A, T1500Z	PV30, TN30, PV710, PV720	GT720, NS710	AP25N, VP25N, NX2525	CC1500	–	T3N	SC35
P10	CT3000	CT5005, CT5015, CT525, GC1525	KT5020, KT125, KT150	T1500A, T1200A, T2000Z	PV7025, PV60, TN60, TN610, TN620	GT730, GT530, AT9530, GT9530, NS520, NS720	MP3025, UP35N	CC2500, CN1500, CN2000, CC125	TP1030, CMP, CM	T15, C30, Q50	SC15, SC8015, SC7035, SC40
P20	CT7000	CT530	KT1120, KT175	T3000Z, T130Z	TN100M, TC60M, PV90	NS730, NS530, NS9530	VP45N, NX99, NX3035	CN2500, CN20, CN30	TP1020, C15M	N20, Z15, C50, C7X	SC7015, SC60
M01	PV3010	–	KT315	–	PV30, TN30, PV7010	GT720, NS710	AP25N, NX2525	CC105, CC115, CN1000	–	T3N	SC35
M10	CT3000	CT5005, CT5015, CT525, GC1525	KT5020, KT125, KT150	T1500A	PV7020, PV60, TN6010, TN6020, TN60	GT730, GT530, NS520, NS720	MP3025, UP35N	CN2000, CC125	TP1030, CMP, CM	T15, C30, Q50	SC15, SC8015, SC7035, SC40
M20	CT7000	CT530	KT1120, KT175	T250A	TN100M, TC60M, PV90	NS730, NS530	VP45N, NX99, NX3035	CN20, CN30	TP1020, C15M	N20, Z15, C50, C7X	SC7015, SC60
K10	CT3000	CT5015	KT125	–	TN60, TN6020	GT730, NS730, NS530	–	CN2000	C15M	T15, Z15, C7Z	SC7015

Grade Comparison Table

CBN grades

Application		Ingersoll	Iscar	Tungaloy	Sumitomo	Sandvik	Kennametal	Mitsubischi	Kyocera	Seco
Cast iron	General	T7015, T730	IB90, IB05S, IB10S	BX930, BX850, BX950, BX470, BX480	BN500, BN7500, BN7000, BN700, BNC500	CB50, CB7050	KB1630, KB1345, KB5630, KB9640	MB4020, MB710, MB730	KBN60M, KBN65B, KBN65M, KBN70M	CBN200, CBN400C
	Solid CBN	KB90A, T7020	–	BX90S, BXC90	BNS800	–	–	MBS140	KBN900	CBN300, CBN350
Hardened Steel	Continuous	T610	IB10H, IB50, IB10HC	BX310	BN1000, BNX1, BNC80, BNC100, BNC2010	CB7105, CB7015	KB1610, KB5610, KB9610	MBC010, MB8025, BC8105	KBN510, KBN10M, KBN10C, KBN25C	CBN10, CBN050C
	General	T2015, T650	IB20H, IB55, IB25HA	BX330, BX530, BXM10	BN250, BN2000, BNX20, BNC160, BNC2020	CB7115, CB7025	KB1625, KB5625	MB810, MB820, BC8110	KBN525, KBN05M, KBN25M	CBN100, CBN160C
		T670	IB25HC	BX360, BX380, BXM20, BXA20	BNX25, BN350, BNC200, BNC300	CB7125, CB7135, CB50	–	MB825, MB8025, BC8120, MB835, BC8020, BC8130	KBN30M	CBN150, CBN170, CBN060K, CBN100P

Ceramic grades

Application	Composition	Ingersoll	Sandvik	Kennametal	Ceramtec	NTK	Kyocera	Sumitomo	Tungaloy
Cast iron	Al_2O_3, ZrO_2	AW120	CC620	–	SN60, SN80	HC1, HW2	KA30	–	–
	Al_2O_3, TiC	AB30	CC650	KY1615	SH2, SH4	HC2, HC5, HC6	A65	NB90S, NB90M	LX21
	Si_3N_4, Al_2O_3, Y_2O_3, AlN	AS500	–	KY1310, KY3000	SL506, SL508, SL606, SL608	SX9	–	–	–
	Si_3N_4, ZrO_2, Al_2O_3, Y_2O3	AS10	CC6090, CC6190	KY1320, KY3500, KYK10	SL500, SL808	SX1, SX6, SX8	KS6000, KS6050	SN2000K, SN2100K, NS260	FX105, CX710
	CVD beschichtet	SC10	CC1690	KY3400, KYK25	SL550C, SL554C, SL654C, SL658C, SL854C, SL858C	SP2, SP9	CS7050	NS260C	–
High heat-resistant materials	Al_2O_3, TiCN	AB20	–	–	SH2, SH4	HC2, HC5, HC7	–	–	LX10
	PVD beschichtet	AB2010	CC6050	KY4400	–	ZC4, ZC7	A66N, PT600M	NB100C	LX11
Hardened Steel	Al_2O_3, SiC whisker	TC430	CC670	KY4300	–	WA1, WA5	–	WX2000	–
	Si_3N_4, TiN	TC3020, TC3030	CC6060, CC6065	KY2100, KY1540, KYS30, KYS25, KYS30P	–	SX5, SX7, SX9	KS6030, KS6040	SN1000S, SN2000S	–

Parting and grooving grades

ISO	Ingersoll	Sandvik	Walter	Seco	Kennametal	MMC	Sumitomo	Tungaloy	Kyocera	Korloy	Iscar
P	TT5100 TT9080 TT9030 TT4430 TT7220 TT8020	CT525 GC3115 GC4325 GC4225 GC1125 GC2135 GC1135 GC1145	WSM13S WKP23S WSM23S WKP33S WSM33S WSM43S	CP200 TGP25 TGP35 TGP45 T25M T350M CP500 CP60	KCP10 KCP10B KCP25 KCP25B KT315 KC9110 KC9125 KCU10 KCU25 KCM35B	NX2525 NY5015 VP10RT VP20RT RT9010 RT9020	AC830P AC530U ACZ150 AC510U AC520U T2500A	GH130 AH725 T9215 AH725 AH7025 SH730 GH730 SH730 NS9530 T9530 AH710 J740 TX10S UX30	PV7040 PR915, PR1115 PR1215 TN620,TN6020 TN60, TN90 TC40, TC60 CR9025 PR1025 PR1225 PR1625 PR930 PR630 PR660 PR1535	CN20 A30 NC3020 NC3120 NC3225 NC3030 NC5330 NC9025 PC3535 PC5300 PC9030 PC230	IC20N IC907 IC507 IC1007 IC9015 IC9025 IC9054 IC807(907) IC808(908) IC1008 IC8250 IC250(950) IC5400 IC354 IC328 IC830(928) IC228
M	TT5100 TT3010 TT9080 TT9030 TT4430 TT7220 TT8020	H13A GC1005 GC1105 GC1125 GC2135 GC1135 GC1145	WSM13S WSM23S WSM33S WSM43S	CP200 TGP25 TGP35 TGP45 T25M T350M 890 CP500 HX 883 CP600	K313 KCU10 KC5010 KCU25 KC5025 KCM35B	VP10RT VP20RT	ACZ150 AC510U AC520U AC530U AC6040M	GH130 AH725 SH725 SH7025 SH730 GH730 J740 AH710	PV7040 PR915, PR1115 PR1215 TN620, TN6020 TN60, TN90 TC40, TC60 CR9025 PR1025, PR1225, PR930 PR630 PR660 PR1535	NC9025 NC5330 PC9030 PC5300	IC1007 IC807 IC907 IC808(908) IC1008 IC8250 IC5400 IC1028 (830,928) IC354 IC328 IC228
K	K10 TT7505 TT6080 TT9080 TT9030	H13A GC3115 GC4225 GC1125 GC1025 GC1125 GC1135	WTA33 WKP13S WAK20 WKP23S WAK30 WKP33S WPP23	TGH1050 TGK1500 CBN200 CP200 890 HX TGP25 TGP35 TGP45 883 CP500 CP600	K313 KCU10 KCP25B KCU25	MY5015 VP10RT VP20RT	G10E AC510U AC520U AC530U AC425K	GH130 AH725 AH710 SH730 GH730 TH10	A65 A66N PT600M PV7040 PR905 TN60 TC40 KW10 GW15 PR1215	NC5330 PC5300 A30 NC6110 PC9030 PC215K PC6510	IC20 IC1007 IC5010 IC428 IC418 IC807 IC907 IC808(908) IC8250 IC250(950) IC228
N	K10 TT9080 TT9030	H13A GC1005 GC1105 GC1115 GC1025	WK1	890 883 HX	K313 KCU10 KC5010 KCU25 KCM35B	RT9010 RT9020	ACZ150 G10E AC530U	TH10 KC05F KS05F SH725 SH730	KPD001 KPD010 KW10 GW15 PDL025	G10E H01 A30 PC215K	ID5 IC20 IC08 IC228 IC28
S	K10 TT3010 TT9080 TT9030 TT4430 TT8020	GC1005 GC1105 GC1115 GC1025 GC1145	WSM13S WSM23S WSM33S WSM43S	TGH1050 890 CP200 HX CP500 883 CP600 CBN010 CBN170 CBN170C	K313 KCU10 KC5010 KCU25 KC5025	RT9010 RT9020 VP10RT VP20RT	AC425K G10E AC1030U	AH905 GH130 AH725 AH7025 SH725 SH730 TH10	KPD001 KPD010 KW10 GW15	PC5300	IC804 IC806 IC1007 IC807 IC907 IC07 IC20 IC08 IC808(908) IC1008 IC830(928)
H	TT6080	CB7015 CB7115	WAK20	CBN10 TGH1050 T350M HX CBN200 CP200 890 883	KCU10 KCU25		H10	BX360	KBN510 KBN525 A65 A66N PT600M		IB50 IC1007 IC807 IC907 IC808(908)

Hardness Conversion Table

Vickers	Brinell		Rockwell				Shore	Tensile strength N/mm²
HV	HBS	HBW	HRA	HRB	HRC	HRD	HS	
1900	–	–	93.1	–	80.5	–	–	–
1800	–	–	92.6	–	79.2	–	–	–
1700	–	–	91.9	–	77.9	–	–	–
1600	–	–	91.3	–	76.6	–	–	–
1500	–	–	90.5	–	75.3	–	–	–
1450	–	–	90.1	–	74.6	–	–	–
1400	–	–	89.6	–	74.0	–	–	–
1350	–	–	89.1	–	73.4	–	–	–
1300	–	–	88.7	–	72.7	–	–	–
1250	–	–	88.3	–	72.1	–	–	–
1200	–	–	87.9	–	71.5	–	–	–
1150	–	–	87.5	–	70.9	–	–	–
1100	–	–	87.1	–	70.3	–	–	–
1050	–	–	86.6	–	69.6	–	–	–
1000	–	–	86.2	–	68.9	–	–	–
940	–	–	85.6	–	68.0	76.9	97	–
920	–	–	85.3	–	67.5	76.5	96	–
900	–	–	85.0	–	67.0	76.1	95	–
880	–	(767)	84.7	–	66.4	75.7	93	–
860	–	(757)	84.4	–	65.9	75.3	92	–
840	–	(745)	84.1	–	65.3	74.8	91	–
820	–	(733)	83.8	–	64.7	74.3	90	–
800	–	(722)	83.4	–	64.0	74.8	88	–
780	–	(710)	83.0	–	63.3	73.3	87	–
760	–	(698)	82.6	–	62.5	72.6	86	–
740	–	(684)	82.2	–	61.8	72.1	84	–
720	–	(670)	81.8	–	61.0	71.5	83	–
700	–	(656)	81.3	–	60.1	70.8	81	–
690	–	(647)	81.1	–	59.7	70.5	–	–
680	–	(638)	80.8	–	59.2	70.1	80	–
670	–	630	80.6	–	58.8	69.8	–	–
660	–	620	80.3	–	58.3	69.4	79	–
650	–	611	80.0	–	57.8	69.0	–	–
640	–	601	79.8	–	57.3	68.7	77	2205
630	–	591	79.5	–	56.8	68.3	–	2020
620	–	582	79.2	–	56.3	67.9	75	1985
610	–	573	78.9	–	55.7	67.5	–	1950
600	–	564	78.6	–	55.2	67.0	74	1905
590	–	554	78.4	–	54.7	66.7	–	1860
580	–	515	78.0	–	54.1	66.2	72	1825
570	–	535	77.8	–	53.6	65.8	–	1795
560	–	525	77.4	–	53.0	65.4	71	1750
400	–	517	77.0	–	52.3	64.8	–	1750
540	(496)	507	76.7	–	51.7	64.4	69	1660
530	(488)	497	76.4	–	51.1	66.2	–	1620
520	(480)	488	76.1	–	50.5	63.5	67	1570
510	(473)	479	75.7	–	49.8	62.9	–	1530

Vickers	Brinell		Rockwell				Shore	Tensile strength N/mm²
HV	HBS	HBW	HRA	HRB	HRC	HRD	HS	
500	(465)	471	75.3	–	49.1	62.2	66	1459
490	(456)	460	74.9	–	48.4	61.6	–	1460
480	488	452	74.5	–	47.7	61.3	64	1410
470	441	442	74.1	–	46.9	60.7	–	1570
460	433	433	73.6	–	46.1	60.1	62	1530
450	425	425	73.3	–	45.3	59.4	–	1459
440	415	415	72.8	–	44.5	58.8	59	1460
430	405	405	72.3	–	43.6	58.2	–	1410
420	397	397	71.8	–	42.7	57.5	57	1370
410	388	388	71.4	–	41.8	56.8	–	1330
400	379	379	70.8	–	40.8	56.0	55	1290
390	369	369	70.3	–	39.8	55.2	–	1240
380	360	360	69.8	(110.0)	38.8	54.4	52	1250
370	350	350	69.2	–	37.7	53.6	–	1170
360	341	341	68.7	(109.0)	36.6	52.8	50	1130
350	331	331	68.1	–	35.5	51.9	–	1095
340	322	322	67.6	(108.0)	34.4	51.1	47	1070
330	313	313	67.0	–	33.3	50.2	–	1035
320	303	303	66.4	(107.0)	32.2	49.4	45	1005
310	294	294	65.8	–	31.0	48.4	–	980
300	284	284	65.2	(105.5)	29.8	47.5	42	950
295	280	280	64.8	–	29.2	47.1	–	935
290	275	275	64.5	(104.5)	28.5	46.5	41	915
285	270	270	64.2	–	27.8	46.0	–	905
280	265	265	63.8	(103.5)	27.1	45.3	40	890
275	261	261	63.5	–	26.4	44.9	–	875
270	256	256	63.1	(102.0)	25.6	44.3	38	855
265	252	252	62.7	–	24.8	43.7	–	840
260	247	247	62.4	(101.0)	24.0	43.1	37	825
255	243	243	62.0	–	23.1	42.2	–	805
250	238	238	61.6	99.5	22.2	41.7	36	795
245	233	233	61.2	–	21.3	41.1	–	780
240	228	228	60.7	98.1	20.3	40.3	34	765
230	219	219	–	96.7	(18.0)	–	33	730
220	209	209	–	95.0	(15.7)	–	32	695
210	200	200	–	93.4	(13.4)	–	30	670
200	190	190	–	91.5	(11.0)	–	29	635
190	181	181	–	89.5	(8.5)	–	28	605
180	171	171	–	87.1	(6.0)	–	26	580
170	162	162	–	85.0	(3.0)	–	25	545
160	152	152	–	81.7	(0.0)	–	24	515
150	143	143	–	78.7	–	–	22	490
140	133	133	–	75.0	–	–	21	455
130	124	124	–	71.2	–	–	20	425
127	121	–	–	69.8	–	–	19	410
122	116	–	–	67.6	–	–	18	400
117	111	–	–	65.7	–	–	15	380

Screws and tightening torque

Screws

Designation	Torque (Nm)	Inbus	Torx	Thread	Shape
SO 22050I	0.9	–	T7	M2.2x0.45	
SO 25050I	0.9	–	T7	M2.5x0.45	
SO 25061I	0.9	–	T8	M2.5x0.45	
SO 25065I	0.9	–	T7	M2.5x0.45	
SO 30040I	2.0	–	T9	M3x0.5	
SO 30055I	2.0	–	T9	M3x0.5	
SO 30100I	2.0	–	T9	M3x0.5	
SO 35080I	3.0	–	T15	M3.5x0.6	
SO 35120I	2.0	–	T10	M3.5x0.6	
SO 35124I	3.0	–	T15	M3.5x0.6	
SO 40050I	3.5	–	T15	M4x0.7	
SO40073I	3.5	–	T15	M4x0.7	
SO 40085I	3.5	–	T15	M4x0.7	
SO 45100I	5.0	–	T20	M4.5x0.75	
SO 45130I	5.0	–	T20	M4.5x0.75	
SO 50090I	5.5	–	T20	M5x0.8	
TS 35110I	3.0	–	T15	M3.5x0.6	
TS 40097I	3.5	–	T15	M4x.07	
TS 50A105I	5.5	–	T20	M5x0.8	
SO 50090S	–	3.5	–	M5x0.5	
SO 60105S	–	5	–	M6x0.5	
LCS 2	2.5	2	–	M5x0.8	
LCS 2B	2.5	2	–	M5x0.8	
LCS 3	3.0	2.5	–	M6x1.0	
LCS 3B	2.5	2	–	M5x0.8	
LCS 3-NX	3.0	2.5	–	M6x1.0	
LCS 4	4.0	3	–	M8x1.0	
LCS 4B	3.0	2.5	–	M6x1.0	
LCS 4S	4.0	3	–	M8x1.0	
LCS 5	4.0	3	–	M8x1.0	
LCS 5-25.5	4.0	3	–	M8x1.0	
LCS6	6.0	4	–	M10x1.0	
LCS8	10.0	5	–	M12x1.0	
LCS 8-L39	10.0	5	–	M12x1.0	
LCS 8-L43	10.0	5	–	M12x1.0	
LCS 16C	3.0	2.5	–	M6x1.0	
LCS 25C	6.0	4	–	M10x1.0	
DLS 3	2.0	2.5	–	M4x0.7	
DLS 4	4.2	3	–	M5x0.8	
DLS 5	6.0	4	–	M6x1.0	
RSS M4	–	2	–	M4x0.5	
RSS M5	–	2.5	–	M5x0.5	
SS M4X0.7X4_NL	–	2	–	M4x0.7	
AJM 5F	–	2	–	M5x0.5	
ASM 6	–	2.5	–	M6x0.75	

Tightening torque of tool holder

Screw	Recommended torque (Nm)
SH M5x0.8	5.5
SH M6x1	8.0
SH M8x1.25	12.0

Notes

Notes

Member IMC Group
Ingersoll Cutting Tools

Version 05/22

Ingersoll Cutting Tools
Marketing & Technology

Germany
Ingersoll Werkzeuge GmbH

Kalteiche-Ring 21-25
35708 Haiger, Germany
Phone: +49 2773 742-0
Fax: +49 2773 742-812
Email: info@ingersoll-imc.de
Internet: www.ingersoll-imc.de

USA
Ingersoll Cutting Tools

845 S. Lyford Road
Rockford, Illinois 61108-2749, USA
Phone: +1-815-387-6600
Fax: +1-815-387-6968
Email: info@ingersoll-imc.com
Internet: www.ingersoll-imc.com

France
Ingersoll France

22, rue Albert Einstein
F-77420 CHAMPS-sur-MARNE
Phone: +33 164684536
Fax: +33 164684524
Email: info@ingersoll-imc.fr
Internet: www.ingersoll-imc.fr

www.ingersoll-imc.de