

TYSON MILLING™

featuring

WIDIA



*High Performance
Milling Cutters & Inserts*



Milling Cutters



p. 2-4

M6800 Square Shoulder
Milling Cutters



p. 5-11

TX90 Square Shoulder
Milling Cutters



p. 12-13

THX90 Helical Square Shoulder
Milling Cutters



p. 14

TXP Chamfer Mills



p. 15

TXP90AF Axial Feed
Milling Cutters



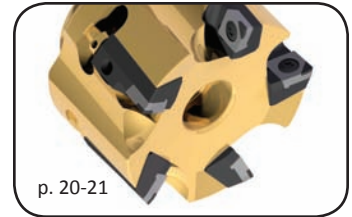
p. 16-17

TS90 Square Shoulder
Milling Cutters



p. 18-19

TA90 Milling Cutters



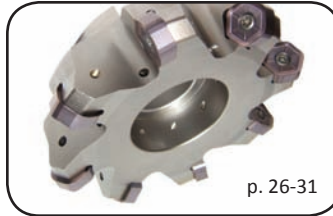
p. 20-21

TCP90-AL Aluminum
Milling Cutters



p. 22-24

TV90 Milling Cutters



p. 26-31

M1200 Milling Cutters



p. 32-33

THP60 Milling Cutters



p. 34

TSN45 High Shear
Milling Cutters



p. 35

TS45F Super Positive
Milling Cutters



p. 36-41

TR360 Copy Milling Cutters



p. 42-43

TBNR Ball Nose Roughing
Milling Cutters



p. 44-47

M270 Finishing
Milling Cutters



p. 48-49

TXD95 High Feed
Milling Cutters



p. 50

TS45 Milling Cutters



p. 51

TT30E / TT45E Chamfer &
Countersink Milling Cutters



p. 52

TPC Plunge Milling Cutters



p. 53

TCCBE Counterbore
Milling Cutters



p. 54

SET-MULTICUT



p. 55-59

Modular Milling System



p. 60

MaxiCool™ Coolant Through
Shell Mill Arbors

Table of Contents

Tooling Showcases:

M6800, TX90, TCP90-AL, M1200, MaxiCool™, Custom Solutions, Manchester	I - VII
---	---------

Milling Cutter Series:

M6800 Square Shoulder Milling Cutters.....	2-4
TX90 Square Shoulder Milling Cutters	5-11
THX90 Helical Square Shoulder Milling Cutters	12-13
TXP Chamfer Mills	14
TXP90AF Axial Feed Milling Cutters	15
TS90 Square Shoulder Milling Cutters	16-17
TA90 Milling Cutters	18-19
TCP90-AL Aluminum Milling Cutters.....	20-21
TV90 Milling Cutters	22-24
M1200 Milling Cutters	26-31
THP60 Milling Cutters	32-33
TSN45 High Shear Milling Cutters.....	34
TS45F Super Positive Milling Cutters	35
TR360 Copy Milling Cutters	36-41
TBNR Ball Nose Roughing Milling Cutters.....	42-43
M270 Finishing Milling Cutters	44-47
TXD95 High Feed Milling Cutters	48-49
TS45 Milling Cutters.....	50
TT30E / TT45E Chamfer & Countersink Milling Cutters	51
TPC Plunge Milling Cutters	52
TCCBE Counterbore Milling Cutters	53
Set-MULTICUT.....	54
Modular Milling System.....	55-59
MaxiCool™ Coolant Through Shell Arbors	60

Milling Inserts:

Milling Inserts	62
-----------------------	----

Technical Information:

Insert Geometries.....	82
Insert Grades	85
Trouble Shooting	90
Technical Data	92

Cutting Data

Cutting Data.....	95
Material Overview	120

<i>Milling Cutter Descriptive Index</i>	<i>1</i>
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new milling program

M6800

WIDIA

**Specifically engineered to
stream line your end milling program!**

- .394" - .618" depth-of-cut capability!
- Aggressive ramping rates!
- Superior surface finish!
- 90° shoulders!
- High rpm capabilities!

Applications

- Pocket milling
- Circular milling
- Profile milling
- Face and shoulder milling
- Slot milling
- Z-Axis milling

Features

- Roughing and finishing with one milling cutter
- Machining of steel, stainless steel, cast iron and difficult to machine materials
- Highly precise pressed indexable inserts
- 2 insert sizes offering maximum DOC of .394" and .618" respectively
- Widia's best grades: TN6405, TN6425, TN6430
- Outstanding Z-Axis milling capabilities
- True 90° Square shoulders
- Easy handling and clamping system, with only one screw
- Through coolant cutter bodies and pre-balancing

NEW!

[Go Back](#)



TX90

High Shear Square Shoulder Milling Cutters & Inserts



- Highly positive and stable geometry reducing power consumption and vibrations

- For use in medium & rough milling applications



Over 90 different standard configurations.. & still growing!

End Mills with weldon flats



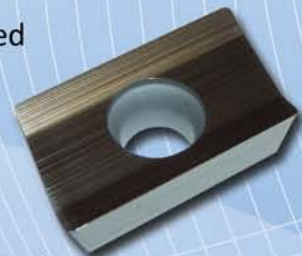
- High shear radial angles allowing good performance in all applications and materials
- Precision ground

- Pressed insert with re-enforced cutting edge
- Allows for high machining rates in semi-finishing and rough milling applications



R8 Shank End Mills

- Specially designed for aluminum
- Higher positive rake angle
- 7 different radii from 1/32" to 5/32"



Complete range of face mills from 1½" to 8"

Coarse Pitch cutters specifically designed for high metal removal rates in aluminum



TCP90-AL

Engineered for High Speed Machining

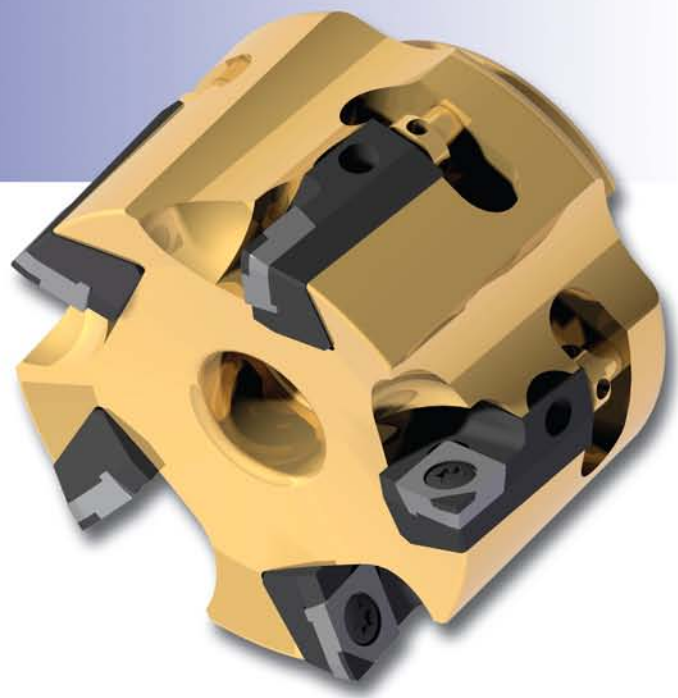
New advanced milling cutter program engineered for high speed machining of non-ferrous material!

Ultra precise finishing with unique wiper-radius PCD inserts and micro-adjustable cartridges!

Milling cutter bodies constructed from lightweight 7075-T6 aviation grade aluminum to maximize RPM while minimizing machine spindle wear!

MaxiCool through coolant enabled for maximum chip evacuation and temperature control!

New CVD diamond grade for extreme tool life!

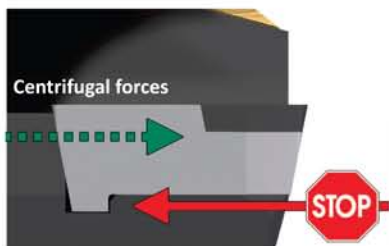


**New
Addition!**



Security Features

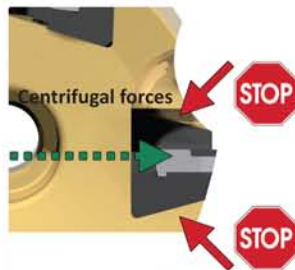
Insert Double Lock



Secondary insert step locks against matching step on insert cartridge

Designed to act as a double lock in conjunction with the insert tapered screw

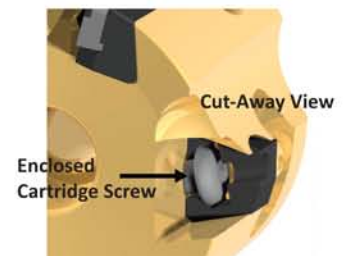
Cartridge Dovetail Lock



Insert cartridge is fitted into cutter body with dovetail design

Centrifugal forces acting on insert cartridge are neutralized by wedge profile of cartridge and matching shape on cutter body

Enclosed Cartridge Clamping Screw

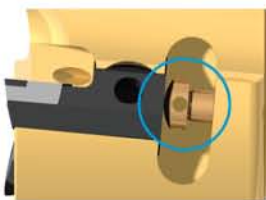


Unique cartridge shrouds cartridge clamp screw within steel body

Potential screw breakage is contained within steel of cartridge – the screw has no place to eject

Performance Features

Micro Adjustable



Easily pre-set cartridges to within microns

All new milling cutters are factory pre-set in height to within ± 0.0004 with a master gauge insert

Through Coolant Enabled



Coolant ports are directed at the cutting edge to extend tool life and improve surface finishes

Wiper Radius



Unique wiper is a compound radius that outperforms traditional wiper flats

With every insert in the cutter loaded with the wiper radius, super finishing is easily attained

[Go Back](#)

M1200

Specifically engineered to deliver consistent performance in demanding milling applications!

**Up to 50%
longer tool life!**

12 true cutting edges
lower your cost per edge!

Use less horsepower -
And gain up to 30% in productivity!

Easy to use -
One screw enables fast, accurate indexing!

MaxiCool through coolant enabled!
(Coolant through arbors also available)



**NEW!
1/2" I.C.
Inserts!**



introducing

MAXICOOL™



An extensive line of
through coolant face mills &
through coolant arbors

*Maximize tool life & surface finish,
while minimizing thermal shock & re-cutting of chips*

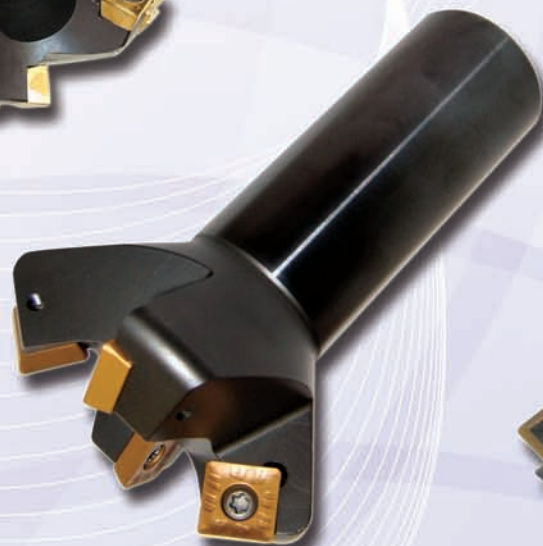
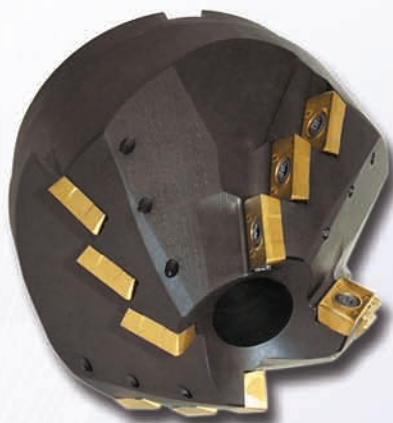
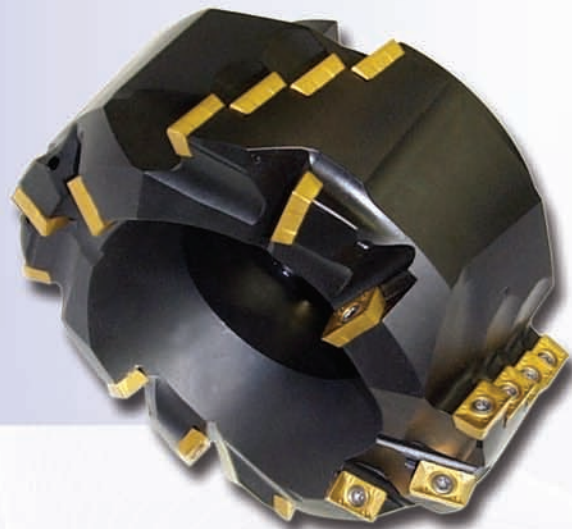


CUSTOM SOLUTIONS

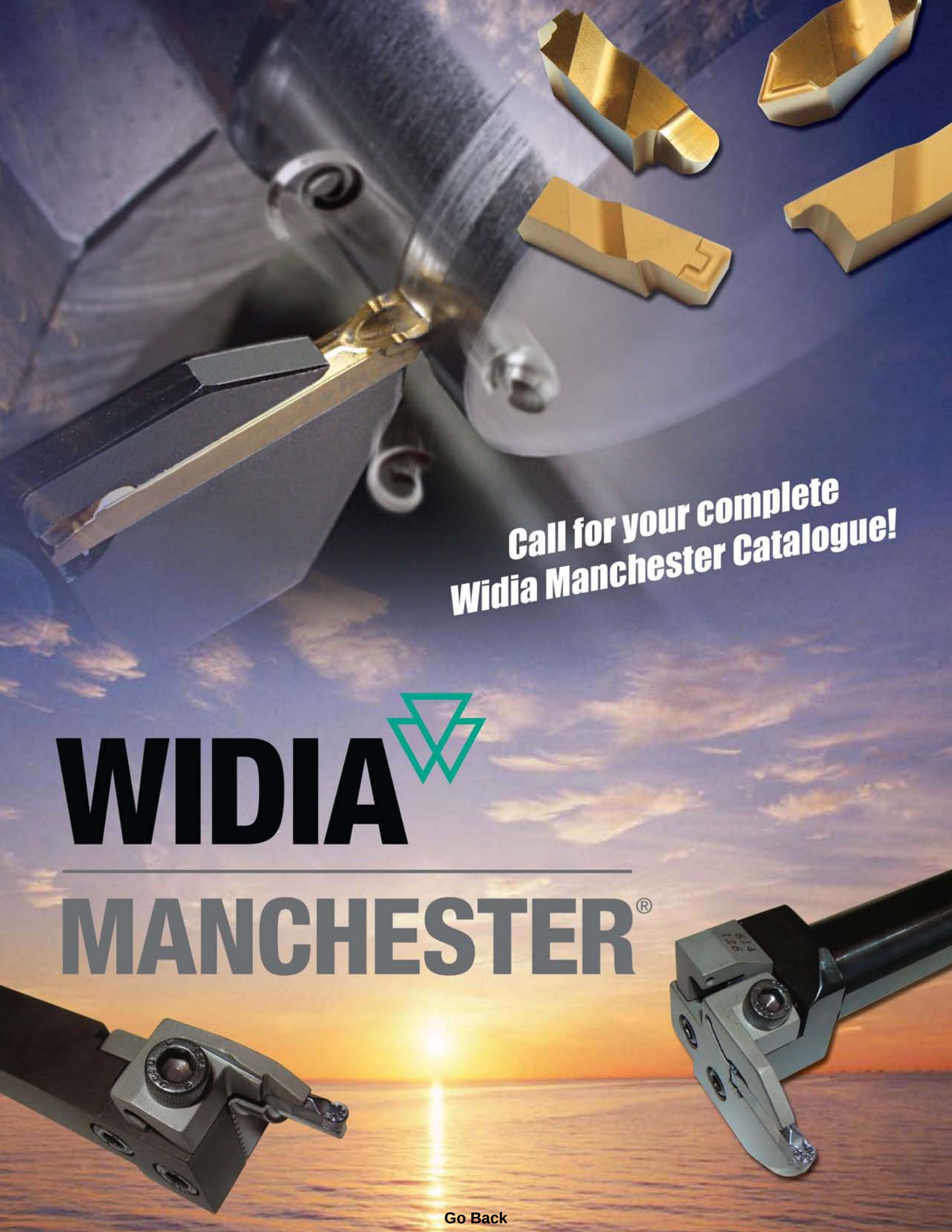
Made to Order

In Addition to our extensive line up of milling cutters, we offer our customers the option of customized single and multiple pocket tooling.

We have the technical background and equipment to create special tools to suit your specific applications with short lead times and competitive pricing.



[Go Back](#)



**Call for your complete
Widia Manchester Catalogue!**

WIDIA 
MANCHESTER®



[Go Back](#)

Milling Cutter Index

M6800 Square Shoulder Milling Cutters

Standard Length End Mills	2
Extended Length End Mills.....	2
Standard Series Face Mills	3
Inserts for M6800 Milling Cutters	4

TX90 Square Shoulder Milling Cutters

Standard Length End Mills	5
Extended Length End Mills.....	6
Standard Length Cylindrical Shank End Mills	7
Extended Length Cylindrical Shank End Mills	7
R-8 Shank End Mills.....	8
Screw-On Milling Cutters	8
Standard Series Face Mills	9
Coarse Pitch Series Face Mills	10
Inserts for TX90 Milling Cutters.....	11

THX90 Helical Square Shoulder Milling Cutters

Helical End Mills.....	12
Helical Shell Mills	12
Insert for THX90 Milling Cutters.....	13

TXP Chamfer Mills

30° Chamfer Mills.....	14
41° Chamfer Mills.....	14
45° Chamfer Mills.....	14
60° Chamfer Mills.....	14
Inserts for TXP Chamfer Mills.....	14

TXP90AF Axial Feed Milling Cutters

End Mills	15
Face Mills	15
Inserts for TXP90AF Milling Cutters	15

TS90 Square Shoulder Milling Cutters

End Mills using 1/2" I.C. Inserts	16
Face Mills using 1/2" I.C. Inserts	16
Face Mills using 5/8" I.C. Inserts	16
Inserts for TS90 Milling Cutters.....	17

TA90 Milling Cutters

Regular Length End Mills.....	18
Extended Length End Mills.....	18
Helical End Mills.....	18
Face Mills	19
Inserts for TA90 Milling Cutters.....	19

TCP90-AL Aluminum Milling Cutters

TCP90 Face Mills	20
Inserts for TCP90 Milling Cutters.....	21

TV90 Milling Cutters

Standard Length End Mills	22
Extended Length End Mills.....	22
Face Mills	23
Screw-On Milling Cutters	24
Inserts for TV90 Milling Cutters	24

M1200 Milling Cutters

Using 1/2" I.C. Inserts	
Mini End Mills	26
Mini End Mills - Extended Length	26
Mini Screw-On Milling Cutters	26
Mini Extra Coarse Pitch Face Mills	27
Mini Coarse Pitch Face Mills	27
Mini Fine Pitch Face Mills.....	27

Using 5/8" I.C. Inserts

End Mills	28
Extra Coarse Pitch Face Mills	28
Pitch Coarse Face Mills.....	29
Fine Pitch Face Mills.....	29
High Feed Face Mills	30
Inserts for M1200 Milling Cutters	30,31

THP60 Milling Cutters

End Mills	32
Face Mills	32
Inserts for THP60 Milling Cutters	33

TSN45 High Shear Milling Cutters

End Mills	34
Face Mills	34
Inserts for TSN45 Milling Cutters	34

TS45F Super Positive Milling Cutters

Face Mills	35
Inserts for TS45F Milling Cutters	35

TR360 Copy Milling Cutters

Standard Length End Mills	36,37
Cylindrical Shank End Mills	38
Screw-On Milling Cutters	38
Face Mills using 15° Positive Inserts.....	39
Face Mills using 7° Positive Inserts.....	40
Inserts for TR360 Milling Cutters	41

TBNR Ball Nose Roughing Milling Cutters

End Mills	42
Screw-On Milling Cutters	43
Inserts for TBNR Milling Cutters.....	43

M270 Finishing Milling Cutters - Ball Nose

Extended Length Steel Shank with Cylindrical Shank End Mills	44
Extended Length Carbide Shank with Cylindrical Shank End Mills	44
Inserts for M270 Ball Nose Milling Cutters	45

M270 Finishing Milling Cutters - Toroidal

Corner Radius End Mill with Straight Carbide Shank Backdraft.....	46
Corner Radius End Mill with Straight Carbide Shank Backdraft.....	46
Inserts for M270 Toroidal Milling Cutters	47

TXD95 High Feed Milling Cutters

Standard Length End Mills	48
Standard Length End Mills	48
Screw-On Milling Cutters	48
Face Mills	49
Inserts for TXD95 Milling Cutters	49

TS45 Milling Cutters

End Mills	50
Face Mills	50
Inserts for TS45 Milling Cutters.....	50

TT30E / TT45E Chamfer & Countersink

Milling Cutters

Style "A" End Mills - 30°	51
Style "B" End Mills - 45°	51
Inserts for TT30E / TT45E Milling Cutters.....	51

TPC Plunge Milling Cutters

Standard Length End Mills	52
Extended Length End Mills.....	52
Inserts for TPC Milling Cutters.....	52

TCCBE Counterbore Milling Cutters

End Mills - Inch.....	53
End Mills - Metric.....	53
Inserts for TCCBE Milling Cutters	53

Set-MULTICUT

End Mills	54
Inserts for MULTICUT Set	54

Modular Milling System

TX90 Screw-On Milling Cutters	55
TBNR Screw-On Milling Cutters.....	55
TR360 Screw-On Milling Cutters	56
TV90 Screw-On Milling Cutters	56
M1200 Screw-On Milling Cutters	57
TXD95 Screw-On Milling Cutters	57
Weldon Straight Shanks	58
Cylindrical Straight Shanks	58
Extensions	59
Reducers	59

MaxiCool™ Coolant Through Shell Arbors

CV40 / CV50 Shell Arbors.....	60
BT40 Shell Arbors.....	60

Milling Inserts	62
Insert Geometries.....	82
Insert Grades	85
Trouble Shooting	90
Technical Data	92
Cutting Data.....	95
Material Overview.....	120

High Shear Square Shoulder Milling Cutters

Specifically engineered to stream line your end milling program!

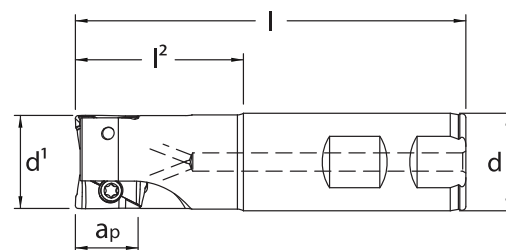
Applications

- Pocket milling
- Circular milling
- Profile milling
- Face and shoulder milling
- Slot milling
- Z axis milling

Features

- Roughing and finishing with one milling cutter
- Machining of steel, stainless steel, cast iron and difficult to machine materials
- Highly precise pressed indexable inserts
- 2 insert sizes offering maximum DOC of .394" and .618" respectively
- Widia's best grades: TN6405, TN6425, TN6430
- Outstanding Z-Axis milling capabilities
- True 90° square shoulders
- Easy handling and clamping system, with only one screw
- Through coolant cutter bodies

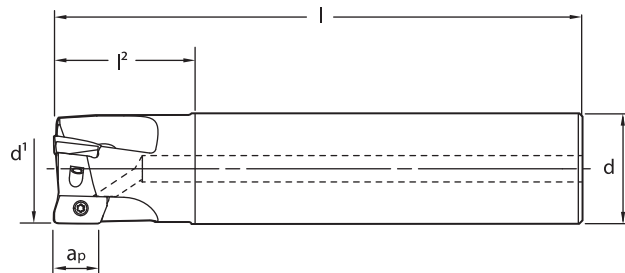
**New
Addition!**



Standard Length End Mills with Coolant Through

Designation	d ¹	d	l	l ²	Max. ap ¹	flutes	Insert	Insert Screw	Wrench
M6800M-D062W062-L300-Z2	.625	.625	3.00	1.004	.394	2	BDMT-11T3__ER-ML BDMT-11T3__ER-MS BDGT-11T30_FR-AL	214.61.209	214.80.866
M6800M-D075W075-L325-Z3	.750	.750	3.25	1.201	.394	3			
M6800M-D100W075-L325-Z3	1.000	.750	3.25	1.161	.394	3			
M6800M-D100W100-L375-Z3	1.000	1.000	3.75	1.280	.394	3	BDMT-1704__ER-ML BDMT-1704__ER-MS BDGT-1704__FR-AL	214.61.210	214.80.824
M6800LX-D100W100-L375-Z2	1.000	1.000	3.75	1.437	.618	2			
M6800LX-D125W125-L400-Z3	1.250	1.250	4.00	1.595	.618	3			
M6800LX-D150W125-L435-Z4	1.500	1.250	4.35	1.988	.618	4			

Remember to use COPASLIP® anti-seize compound on all insert screws



Extended Length Cylindrical Shank End Mills with Coolant Through

Designation	d ¹	d	l	l ²	Max. ap ¹	flutes	Insert	Insert Screw	Wrench
M6800LX-D100C100-L630-Z2	1.000	1.000	6.30	4.200	.618	2	BDMT-1704__ER-ML BDMT-1704__ER-MS BDGT-1704__FR-AL	214.61.210	214.80.824
M6800LX-D150C125L945-Z2	1.500	1.250	9.45	2.579	.618	2			

Remember to use COPASLIP® anti-seize compound on all insert screws

M6800 Cutting Data

High Shear Square Shoulder Milling Cutters



- .394" - .618" depth-of-cut capability!
- Aggressive ramping rates!
- Superior surface finish!
- True 90° shoulders!
- High rpm capabilities!

Standard Series Face Mills

Designation	d ¹	d	d ⁶	h	Max. ap1	flutes	Insert	Insert Screw	Wrench
M6800M-D150B075-H157-Z5	1.500	.750	1.26	1.57	.394	5	BDMT-11T3__ER-ML BDMT-11T3__ER-MS BDGT-11T30__FR-AL	214.61.209	214.80.866
M6800M-D200B075-H157-Z5	2.000	.750	1.60	1.57	.394	5			
M6800M-D250B075-H157-Z6	2.500	.750	1.60	1.57	.394	6			
M6800M-D300B100-H196-Z7	3.000	1.000	1.92	1.96	.394	7			
M6800M-D400B150-H248-Z9	4.000	1.500	2.62	2.48	.394	9			
M6800LX-D200B075-H158-Z4	2.000	.750	1.60	1.58	.618	4	BDMT-1704__ER-ML BDMT-1704__ER-MS BDGT-1704__FR-AL	214.61.210	214.80.824
M6800LX-D250B075-H158-Z5	2.500	.750	1.60	1.58	.618	5			
M6800LX-D300B100-H197-Z6	3.000	1.000	1.92	1.97	.618	6			
M6800LX-D400B150-H248-Z7	4.000	1.500	2.62	2.48	.618	7			

Remember to use COPASLIP® anti-seize compound on all insert screws

M6800 Cutting Data

M6800 Test Report

		WIDIA	COMPETITOR
Cutter:	M6800M Ø .750"	Cutting Speed (sfm):	290
Insert:	BDMT-11T308ER-ML	feed per tooth:	.005"
Grade:	TN6430	axial cutting depth:	.197"
Operation:	Contour milling	parts / index:	23
Material:	ASTM A236 steel, grade D	width of cut:	.750"
Tool Life Increase: 130%			

High Shear Square Shoulder Milling Cutters

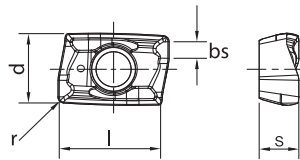
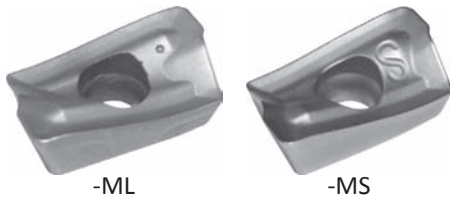
BDMT

ML - Light edge preparation, reduced cutting force. For finishing applications with highest degree of accuracy.
For cast iron, steel and alloy steel.

MS - Sharpest edge, reduced cutting force up to 20%. For low carbon and stainless steels.

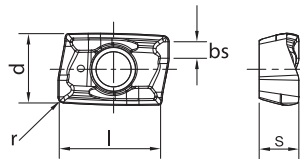
BDGT

AL - Peripheral ground with polished rake face optimized for aluminum applications.



M6800 Inserts

Designation	l	d	s	bs	r	M6800 Inserts										THR-S		
						TN6405	TN6425	TN6430										
						Coated										Uncoated		
BDMT-11T304ER-ML	.433	.262	.150	.070	.016	●	●											
BDMT-11T308ER-ML		.263		.055	.031	●	●											
BDMT-11T312ER-ML		.263		.040	.047	●	●											
BDMT-11T316ER-ML		.264		.021	.063	●	●											
BDMT-11T320ER-ML		.265		--	.079	●	●											
BDMT-11T331ER-ML		.266		--	.122	●	●											
BDMT-170404ER-ML	.699	.378	.193	.090	.016	●	●											
BDMT-170408ER-ML				.074	.031	●	●											
BDMT-170412ER-ML				.059	.047	●	●											
BDMT-170416ER-ML				.041	.063	●	●											
BDMT-170420ER-ML		.379		.025	.079	●	●											
BDMT-170431ER-ML		.380		--	.122	●	●											
BDMT-11T304ER-MS	.433	.262	.150	.071	.016	●	●											
BDMT-11T308ER-MS		.263		.055	.031	●	●											
BDMT-170404ER-MS	.669	.378	.193	.090	.016	●	●											
BDMT-170408ER-MS				.074	.031	●	●											



M6800 Aluminum Inserts

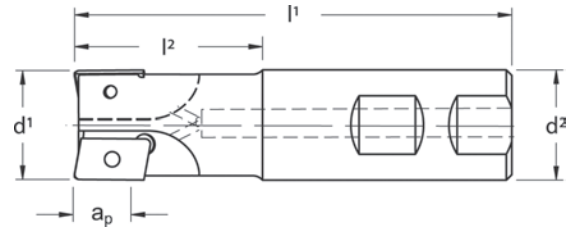
Designation	l	d	s	bs	r	M6800 Aluminum Inserts										THR-S		
						TN6405	TN6425	TN6430										
						Coated										Uncoated		
BDGT-11T302FR-AL	.433	.261	.153	.079	.008											●		
BDGT-11T304FR-AL		.263		.071	.016											●		
BDGT-11T308FR-AL		.263		.055	.031											●		
BDGT-170404FR-AL	.669	.378	.201	.091	.016											●		
BDGT-170408FR-AL		.379		.075	.031											●		
BDGT-170420FR-AL		.380		.024	.083											●		
BDGT-170431FR-AL		.382		--	.136											●		

TX90 (M680)

High Shear Square Shoulder Milling Cutters

With over 90 different standard configurations ...

... And still growing!



Standard Length End Mills

Designation	d ¹	d ²	l ¹	l ²	Max. ap	flutes	Insert	Insert Screw	Wrench
TXD90-0500	.500	.625	3.00	1.09	.33	1	222.79.600 222.79.610	214.80.687	214.80.866 (S/D) 214.80.011 (F/T)
TXD90-0625	.625	.625	3.00	1.09	.33	2			
TXD90-0750	.750	.750	3.50	1.47	.33	2			
TXD90-0750F	.750	.750	3.50	1.47	.33	3			
TXD90-0875	.875	.750	3.50	1.47	.33	3			
TXD90-1000	1.000	.750	3.50	1.47	.33	3			
TXD90-1000F	1.000	1.000	4.00	1.72	.33	4	222.79.400 222.79.500 222.79.510 222.79.550 222.79.564 222.79.572 222.79.574	214.80.388	214.80.824 (S/D) 214.80.012 (F/T)
TXP90-0750	.750	.750	3.50	1.47	.55	1			
TXP90-1000	1.000	.750	3.70	1.67	.55	2			
TXP90-1000-4	1.000	1.000	4.00	1.72	.55	2			
TXP90-1250	1.250	1.250	4.00	1.72	.55	3			
TXP90-1500	1.500	1.250	4.40	2.12	.55	3			
TXP90-1500F	1.500	1.250	4.40	2.12	.55	4			
TXP90-2000EM	2.000	1.250	4.00	1.72	.55	4			

Remember to use COPASLIP® anti-seize compound on all insert screws

Standard Length End Mills with Coolant Through

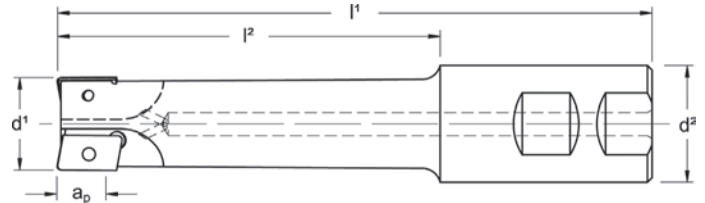
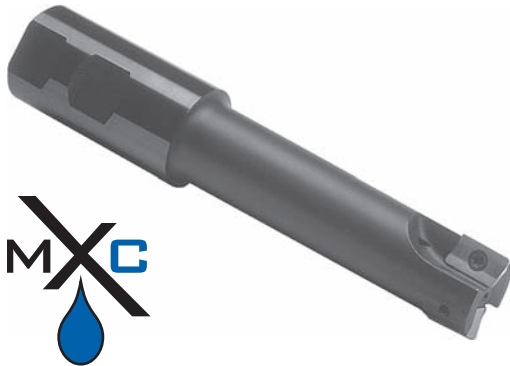
Designation	d ¹	d ²	l ¹	l ²	Max. ap	flutes	Insert	Insert Screw	Wrench
TXD90-0500C	.500	.625	3.00	1.09	.33	1	222.79.600 222.79.610	214.80.687	214.80.866 (S/D) 214.80.011 (F/T)
TXD90-0625C	.625	.625	3.00	1.09	.33	2			
TXD90-0750C	.750	.750	3.50	1.47	.33	2			
TXD90-0750FC	.750	.750	3.50	1.47	.33	3			
TXD90-0875C	.875	.750	3.50	1.47	.33	3			
TXD90-1000C	1.000	.750	3.50	1.47	.33	3			
TXD90-1000-4C	1.000	1.000	4.00	1.72	.33	3			
TXD90-1000FC	1.000	1.000	4.00	1.72	.33	4			
TXD90-1250C	1.250	1.250	4.00	1.72	.33	5	222.79.400 222.79.500 222.79.510 222.79.550 222.79.564 222.79.572 222.79.574	214.80.388	214.80.824 (S/D) 214.80.012 (F/T)
TXD90-1500C	1.500	1.250	4.40	2.12	.33	5			
TXP90-0750C	.750	.750	3.50	1.47	.55	1			
TXP90-1000C	1.000	.750	3.70	1.67	.55	2			
TXP90-1000-4C	1.000	1.000	4.00	1.72	.55	2			
TXP90-1250C	1.250	1.250	4.00	1.72	.55	3			
TXP90-1500C	1.500	1.250	4.40	2.12	.55	3			
TXP90-1500FC	1.500	1.250	4.40	2.12	.55	4			
TXP90-2000EMC	2.000	1.250	4.00	1.72	.55	4			

Remember to use COPASLIP® anti-seize compound on all insert screws

TX90 Cutting Data

TX90 (M680)

High Shear Square Shoulder Milling Cutters



Extended Length End Mills

Designation	d ¹	d ²	l ¹	l ²	Max. ap	flutes	Insert	Insert Screw	Wrench
TXD90-0500-XL	.500	.625	3.91	2.00	.33	1	222.79.600 222.79.610	214.80.687	214.80.866 (S/D) 214.80.011 (F/T)
TXP90-1000-5L	1.000	1.250	5.00	2.72	.55	2	222.79.400 222.79.500	214.80.388	214.80.824 (S/D) 214.80.012 (F/T)
TXP90-1000-5XL	1.000	1.250	6.40	4.12	.55	2	222.79.510 222.79.550		
TXP90-1250-L	1.250	1.250	5.00	2.72	.55	3	222.79.564 222.79.572		
TXP90-1500-L	1.500	1.250	6.00	3.72	.55	3	222.79.574		

Remember to use COPASLIP® anti-seize compound on all insert screws

Extended Length End Mills with Coolant Through

Designation	d ¹	d ²	l ¹	l ²	Max. ap	flutes	Insert	Insert Screw	Wrench
TXD90-0500-XLC	.500	.625	3.91	2.00	.33	1	222.79.600 222.79.610	214.80.687	214.80.866 (S/D) 214.80.011 (F/T)
TXD90-0625-XLC	.625	.750	4.53	2.50	.33	2			
TXD90-0750-LC	.750	.750	3.78	1.75	.33	2			
TXD90-0750-XLC	.750	1.000	4.81	2.53	.33	2			
TXD90-0750-XXLC	.750	1.000	6.31	4.03	.33	2			
TXD90-1000-4XXLC	1.000	1.000	8.00	2.25	.33	3			
TXP90-1000-4LC	1.000	1.000	5.28	3.00	.55	2	222.79.400 222.79.500 222.79.510 222.79.550 222.79.564 222.79.572 222.79.574	214.80.388	214.80.824 (S/D) 214.80.012 (F/T)
TXP90-1000-4XXLC	1.000	1.000	8.00	2.25	.55	2			
TXP90-1000-5LC	1.000	1.250	5.00	2.72	.55	2			
TXP90-1000-5XLC	1.000	1.250	6.40	4.12	.55	2			
TXP90-1000-5XXLC	1.000	1.250	8.40	6.12	.55	2			
TXP90-1250-LC	1.250	1.250	5.00	2.72	.55	3			
TXP90-1250-XLC	1.250	1.250	6.40	4.12	.55	3			
TXP90-1250-XXLC	1.250	2.000	9.25	6.00	.55	3			
TXP90-1250-5XXLC	1.250	1.250	10.00	3.00	.55	3			
TXP90-1500-LC	1.500	1.250	6.00	3.72	.55	3			
TXP90-1500-XLC	1.500	2.000	7.25	4.00	.55	3			
TXP90-1500-5XXLC	1.500	1.250	10.00	7.72	.55	3			
TXP90-1500-XXLC	1.500	2.000	9.25	6.00	.55	3			

Remember to use COPASLIP® anti-seize compound on all insert screws

TX90 Cutting Data

TX90 (M680)

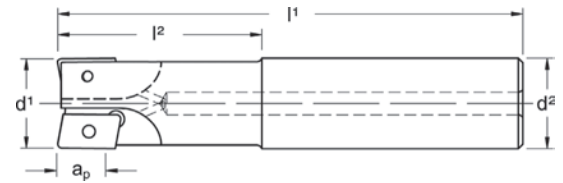
High Shear Square Shoulder Milling Cutters

Featuring:

- Cylindrical Shanks
- Coolant through
- Extra long shanks

Specifically designed for:

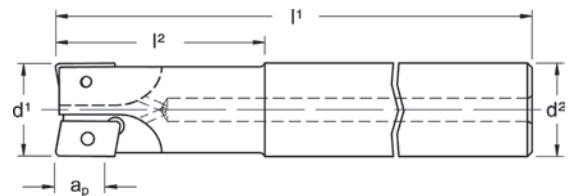
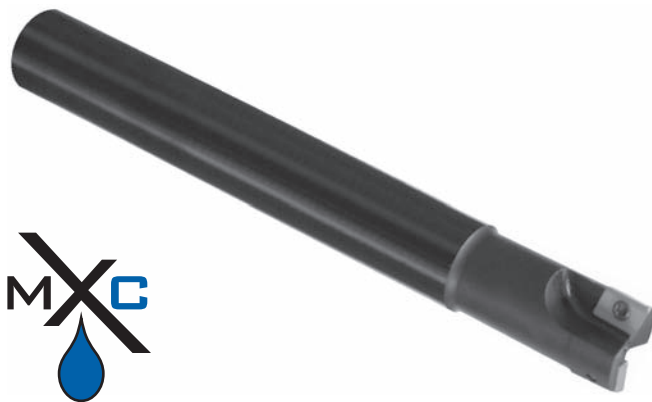
- Milling Chucks
- Hydraulic Chucks
- Shrink-fit Systems



Standard Length Cylindrical Shank End Mills with Coolant Through

Designation	d ¹	d ²	l ¹	l ²	Max. ap	flutes	Insert	Insert Screw	Wrench
TXD90CY-0625C	.625	.625	3.00	1.09	.33	2	222.79.600 222.79.610	214.80.687	214.80.866 (S/D) 214.80.011 (F/T)
TXD90CY-0750C	.750	.750	3.50	1.46	.33	2			
TXD90CY-1000-4C	1.000	1.000	4.00	1.71	.33	3			
TXP90CY-1000-4C	1.000	1.000	4.00	1.71	.55	2	222.79.400 222.79.500 222.79.510 222.79.550 222.79.564 222.79.572 222.79.574	214.80.388	214.80.824 (S/D) 214.80.012 (F/T)
TXP90CY-1250-5C	1.250	1.250	4.00	1.71	.55	3			
TXP90CY-1500-5C	1.500	1.250	4.50	2.00	.55	4			

Remember to use COPASLIP® anti-seize compound on all insert screws



Extended Length Cylindrical Shank End Mills with Coolant Through

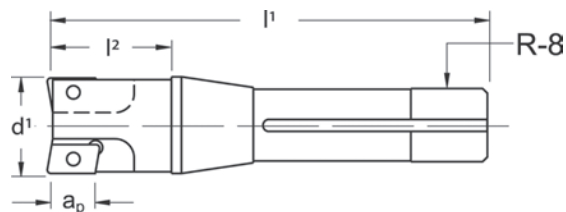
Designation	d ¹	d ²	l ¹	l ²	Max. ap	flutes	Insert	Insert Screw	Wrench
TXD90CY-0625-XXLC	.625	.625	6.00	2.00	.33	2	222.79.600 222.79.610	214.80.687	214.80.866 (S/D) 214.80.011 (F/T)
TXD90CY-0750-XXLC	.750	.750	8.00	2.00	.33	2			
TXD90CY-1000-4XXLC	1.000	1.000	8.00	2.25	.33	3			
TXP90CY-1000-4XXLC	1.000	1.000	8.00	2.25	.55	2	222.79.400 222.79.500 222.79.510 222.79.550 222.79.564 222.79.572 222.79.574	214.80.388	214.80.824 (S/D) 214.80.012 (F/T)
TXP90CY-1250-5XXLC	1.250	1.250	10.00	3.00	.55	3			
TXP90CY-1500-5XXLC	1.500	1.250	10.00	7.50	.55	3			

Remember to use COPASLIP® anti-seize compound on all insert screws

TX90 Cutting Data

TX90 (M680)

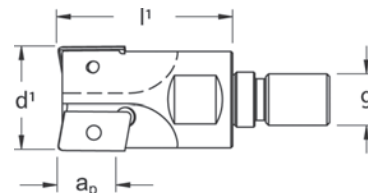
High Shear Square Shoulder Milling Cutters



R-8 Shank End Mills

Designation	d ¹	Shank	l ¹	l ²	Max. ap	flutes	Insert	Insert Screw	Wrench
TXP90-1250-R8	1.250	R-8	5.63	1.50	.55	3	222.79.400 222.79.500 222.79.510	214.80.388	214.80.824 (S/D) 214.80.012 (F/T)
TXP90-1500-R8	1.500	R-8	5.63	1.50	.55	3	222.79.550 222.79.564		
TXP90-2000-R8	2.000	R-8	5.63	1.50	.55	3	222.79.572 222.79.574		

Remember to use COPASLIP® anti-seize compound on all insert screws



Screw-On Milling Cutters

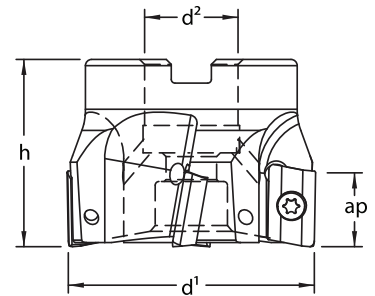
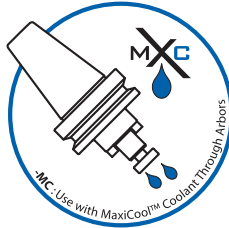
Designation	d ¹	d ¹ mm	g	l ¹	Max. ap	flutes	Insert	Insert Screw	Wrench
TXD90-0500-TS	.500	12.70	M6	1.10	.33	1	222.79.600 222.79.610	214.80.687	214.80.866 (S/D) 214.80.011 (F/T)
TXD90-0625-TS	.625	15.87	M8	1.10	.33	2			
TXD90-0750-TS	.750	19.05	M10	1.18	.33	2			
TXD90-0984-TS	.984	25.00	M12	1.18	.33	3			
TXD90-1000-TS	1.000	25.40	M12	1.50	.33	3			
TXD90-1260-TS	1.260	32.00	M16	1.57	.33	5	222.79.400 222.79.500 222.79.510 222.79.550 222.79.564 222.79.572 222.79.574	214.80.388	214.80.824 (S/D) 214.80.012 (F/T)
TXP90-0975-TS	.975	24.77	M12	1.50	.55	2			
TXP90-0984-TS	.984	25.00	M12	1.18	.55	2			
TXP90-1000-TS	1.000	25.40	M12	1.50	.55	2			
TXP90-1250-TS	1.250	31.75	M16	1.75	.55	3			
TXP90-1260-TS	1.260	32.00	M16	1.57	.55	3			
TXP90-1378-TS	1.378	35.00	M16	1.57	.55	3			
TXP90-1500-TS	1.500	38.10	M16	1.75	.55	3			
TXP90-1575-TS	1.575	40.00	M16	1.57	.55	4			

Remember to use COPASLIP® anti-seize compound on all insert screws

TX90 Cutting Data

TX90 (M680)

High Shear Square Shoulder Milling Cutters



Standard Series Face Mills

Designation	d ¹	d ²	h	Max. ap	flutes	lbs.	Insert	Insert Screw	Wrench
TXD90-1500SM	1.500	.750	1.75	.33	5	.55	222.79.600	214.80.687	214.80.866 (S/D)
TXD90-2000	2.000	.750	1.50	.33	7	.70	222.79.610		214.80.011 (F/T)
TXP90-1500SM	1.500	.750	1.75	.55	4	.45	222.79.400 222.79.500 222.79.510 222.79.550 222.79.564 222.79.572 222.79.574	214.80.388	214.80.824 (S/D) 214.80.012 (F/T)
TXP90-2000	2.000	.750	1.50	.55	4	.60			
TXP90-2000F	2.000	.750	1.50	.55	5	.60			
TXP90-2500	2.500	1.000	1.75	.55	5	1.30			
TXP90-3000	3.000	1.000	2.00	.55	6	2.25			
TXP90-4000	4.000	1.250	2.00	.55	7	3.20			
TXP90-4000F	4.000	1.500	2.00	.55	8	3.35			
TXP90-5000	5.000	1.500	2.00	.55	8	5.15			
TXP90-6000	6.000	1.500	2.00	.55	9	7.65			
TXP90-6000F	6.000	2.000	2.50	.55	10	7.95			
TXP90-8000*	8.000	2.500	2.50	.55	12	14.00			

*Cutter supplied with 4 holes on a 4" bolt circle

Remember to use COPASLIP® anti-seize compound on all insert screws

Standard Series Face Mills with Coolant Through

Designation	d ¹	d ²	h	Max. ap	flutes	lbs.	Insert	Insert Screw	Wrench
TXD90-1500SM-MC	1.500	.750	1.75	.33	5	.55	222.79.600	214.80.687	214.80.866 (S/D)
TXD90-2000-MC	2.000	.750	1.50	.33	7	.70	222.79.610		214.80.011 (F/T)
TXP90-1500SM-MC	1.500	.750	1.75	.55	4	.45	222.79.400 222.79.500 222.79.510 222.79.550 222.79.564 222.79.572 222.79.574	214.80.388	214.80.824 (S/D) 214.80.012 (F/T)
TXP90-2000-MC	2.000	.750	1.50	.55	4	.60			
TXP90-2000F-MC	2.000	.750	1.50	.55	5	.60			
TXP90-2500-MC	2.500	1.000	1.75	.55	5	1.30			
TXP90-3000-MC	3.000	1.000	2.00	.55	6	2.25			
TXP90-4000-MC	4.000	1.250	2.00	.55	7	3.20			

*Cutter supplied with 4 holes on a 4" bolt circle

Remember to use COPASLIP® anti-seize compound on all insert screws

TX90 Cutting Data

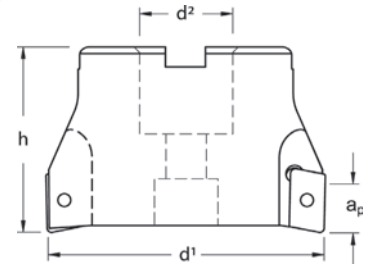
TX90 (M680)

High Shear Square Shoulder Milling Cutters



Featuring:

- Specifically designed for aluminum machining
- Allows for full depths of cut and wider widths of cut
- Optimized speeds and feeds while lowering horsepower consumption



Coarse Pitch Face Mills

Designation	d ¹	d ²	h	Max. ap	flutes	lbs.	Insert	Insert Screw	Wrench
Through Coolant Enabled							222.79.400 222.79.500 222.79.510 222.79.550 222.79.564 222.79.572 222.79.574	214.80.388	214.80.824 (S/D) 214.80.012 (F/T)
TXP90-2000AL-3-MC	2.000	.750	1.50	.55	3	.60			
TXP90-2500AL-3-MC	2.500	1.000	2.00	.55	3	1.15			
TXP90-3000AL-3-MC	3.000	1.000	2.00	.55	3	1.90			
TXP90-4000AL-4XMC	4.000	1.250	2.00	.55	4	2.70			
Standard Non-Through coolant									
TXP90-4000AL-4	4.000	1.500	2.00	.55	4	2.85			
TXP90-5000AL-5	5.000	1.500	2.00	.55	5	4.80			
TXP90-6000AL-6	6.000	2.000	2.50	.55	6	8.45			

Remember to use COPASLIP® anti-seize compound on all insert screws

TX90 Cutting Data

for TX90 High Shear Square Shoulder Milling Cutters

Inserts with optimized geometries and large selection of radii from 1/32" - 5/32" for steel, cast steel and aluminum alloys. Very effective with high metal removal rates in medium and heavy duty milling.

222.79.400

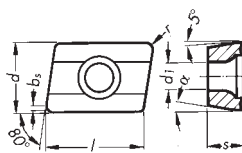
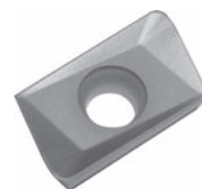
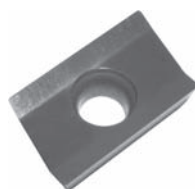
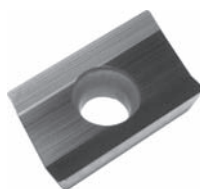
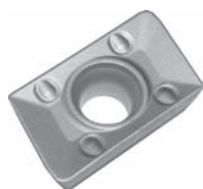
222.79.500 / 600

222.79.510 / 610

222.79.550

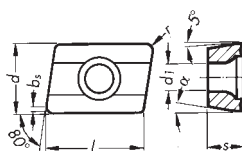
222.79.564

222.79.572 / 574



TX90 Inserts

Designation	l	s	r	d	d'	bs	a	Coated						Uncoated					Cermets	
222.79.400	.635	3/16	3/64	3/8	.173	.047	11°	●	●	●	●	●	●	●	●	●	●	●	●	●
222.79.600	.381	1/8	1/32	1/4	.110	.039	15°	●	●	●	●	●	●	●	●	●	●	●	●	●
222.79.530	.635	3/16	1/32	3/8	.173	.071	11°	●	●	●	●	●	●	●	●	●	●	●	●	●
222.79.500			3/64			.059	11°	●	●	●	●	●	●	●	●	●	●	●	●	●
222.79.532			1/16			.031	11°	●	●	●	●	●	●	●	●	●	●	●	●	●
222.79.534 ⁽²⁾			5/64			.020	11°	●	●	●	●	●	●	●	●	●	●	●	●	●
222.79.536 ⁽²⁾			3/32			--	11°	●	●	●	●	●	●	●	●	●	●	●	●	●
222.79.538 ⁽²⁾			1/8			--	11°	●	●	●	●	●	●	●	●	●	●	●	●	●
222.79.540 ⁽²⁾			5/32			--	11°	●	●	●	●	●	●	●	●	●	●	●	●	●
222.79.564 ⁽³⁾	.635	3/16	3/64	3/8	.173	.067	11°	●	●	●	●	●	●	●	●	●	●	●	●	●
222.79.572	.634	3/16	.031	.386	.173	.071	11°	●	●	●	●	●	●	●	●	●	●	●	●	●
222.79.574	.634	3/16	.047	.375	.173	.059	11°	●	●	●	●	●	●	●	●	●	●	●	●	●



TX90 Alu. Inserts

Designation	l	s	r	d	d'	bs	a	Coated						Uncoated					Cermets	
222.79.610 ^{(1)*}	.381	1/8	1/32	.264	.110	.039	15°	●	●	●	●	●	●	●	●	●	●	●	●	●
222.79.510 ^{(1)*}	.635	.183	1/32	.386	.173	.067	11°	●	●	●	●	●	●	●	●	●	●	●	●	●
222.79.512 ^{(1)*}			3/64			.055	11°	●	●	●	●	●	●	●	●	●	●	●	●	●
222.79.514 ^{(1)*}			1/16			.035	11°	●	●	●	●	●	●	●	●	●	●	●	●	●
222.79.516 ^{(1,2)*}			5/64			.016	11°	●	●	●	●	●	●	●	●	●	●	●	●	●
222.79.518 ^{(1,2)*}			3/32			---	11°	●	●	●	●	●	●	●	●	●	●	●	●	●
222.79.520 ^{(1,2)*}			1/8			---	11°	●	●	●	●	●	●	●	●	●	●	●	●	●
222.79.522 ^{(1,2)*}			5/32			---	11°	●	●	●	●	●	●	●	●	●	●	●	●	●
222.79.550 ^{(1)*}	.635	.183	1/64	.386	.173	.078	11°	●	●	●	●	●	●	●	●	●	●	●	●	●
222.79.552 ^{(1)*}			1/32			.067	11°	●	●	●	●	●	●	●	●	●	●	●	●	●
222.79.554 ^{(1)*}			3/64			.055	11°	●	●	●	●	●	●	●	●	●	●	●	●	●

- Note 1: Due to the higher side rake angles, 222.79.510 - 522, 222.79.550 - 222.79.552 & 222.79.610 inserts are wider and will cut oversize.
- Note 2: To provide necessary clearance for the inserts with radii over 5/64", the cutter body must be relieved.
- Note 3: Cutting edges are serrated and marked I & II, are to be mounted alternating edge I & II, and can only be used with a minimum of 2 teeth. Best results achieved when used in cutters with an even number of flutes.
- * Optimized for aluminum.

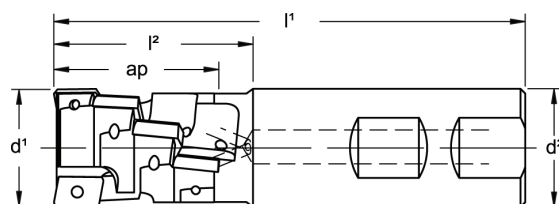
THX90 (M300)

Helical Square Shoulder Milling Cutters

The Extended Program:

In addition to the proven helical end mills in the 1" to 2" diameter range, helical shell mills are also available from 2" to 3" diameters with coarse tooth pitches, for low-powered machine tools and slot milling, as well as trimming and shoulder milling.

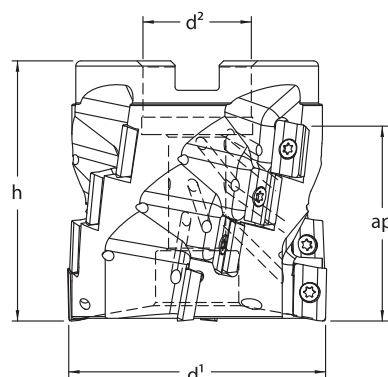
Our THX90 helical cutters are ideal for rough-milling large grooves and shoulders. Large overall cutting-edge lengths, and the efficient use of each flute, guarantees a wide range of applications and high performance.



Helical End Mills with Coolant Through for Profiling & Milling

Designation	d ¹	d ²	l ¹	l ²	Max. ap	flutes	No. of inserts	Insert	Insert Screw	Wrench
THXD90-1000	1.000	1.000	4.00	1.72	1.30	2	8	222.79.600 222.79.610	214.80.800	214.80.866 (S/D) 214.80.011 (F/T)
THXD90-1250	1.250	1.250	4.49	2.21	1.30	3	12			
THXD90-1500	1.500	1.250	4.84	2.56	1.61	3	15			
THXP90-1250	1.250	1.250	4.63	2.35	1.15	2	4	222.79.400 222.79.500 222.79.510 222.79.550 222.79.564 222.79.572 222.79.574	214.80.558	214.80.824 (S/D) 214.80.012 (F/T)
THXP90-1250L	1.250	1.250	4.84	2.56	1.70	2	6			
THXP90-1500	1.500	1.250	5.01	2.73	1.17	3	6			
THXP90-1500L	1.500	1.250	5.01	2.73	1.70	3	9			
THXP90-1750	1.750	1.250	5.01	2.73	1.17	3	6			
THXP90-2000EM	2.000	1.250	5.25	2.97	2.25	3	12			

Remember to use COPASLIP® anti-seize compound on all insert screws



Helical Shell Mills with Coolant Through for Profiling & Milling

Designation	d ¹	d ²	h	Max. ap	flutes	No. of inserts	Insert	Insert Screw	Wrench
THXP90-2000-MC	2.000	.750	2.00	1.17	3	6	222.79.400 222.79.500 222.79.510 222.79.550 222.79.564 222.79.572 222.79.574	214.80.558	214.80.824 (S/D) 214.80.012 (F/T)
THXP90-2000L-MC	2.000	.750	2.50	1.65	3	9			
THXP90-2500-MC	2.500	1.000	2.50	1.65	3	9			
THXP90-2500L-MC	2.500	1.000	3.00	2.13	3	12			
THXP90-3000-MC	3.000	1.250	3.00	2.25	4	16			

Remember to use COPASLIP® anti-seize compound on all insert screws

THX90 Cutting Data

for THX90 High Shear Square Shoulder Milling Cutters

Inserts with optimized geometries and large selection of radii from 1/32" - 5/32" for steel, cast steel and aluminum alloys. Very effective with high metal removal rates in medium and heavy duty milling.

222.79.400

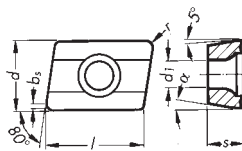
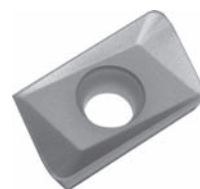
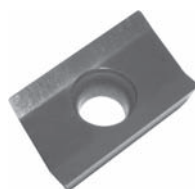
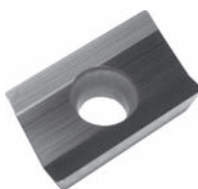
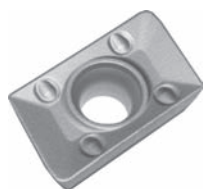
222.79.500 / 600

222.79.510 / 610

222.79.550

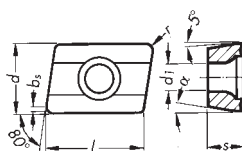
222.79.564

222.79.572 / 574



THX90 Inserts

Designation	l	s	r	d	d'	bs	a	Coated						Uncoated					Cermets	
222.79.400	.635	3/16	3/64	3/8	.173	.047	11°	●	●	●	●	●	●	●	●	●	●	●	●	●
222.79.600	.381	1/8	1/32	1/4	.110	.039	15°	●	●	●	●	●	●	●	●	●	●	●	●	●
222.79.530	.635	3/16	1/32	3/8	.173	.071	11°	●	●	●	●	●	●	●	●	●	●	●	●	●
222.79.500			3/64			.059	11°	●	●	●	●	●	●	●	●	●	●	●	●	●
222.79.532			1/16			.031	11°	●	●	●	●	●	●	●	●	●	●	●	●	●
222.79.534 ⁽²⁾			5/64			.020	11°	●	●	●	●	●	●	●	●	●	●	●	●	●
222.79.536 ⁽²⁾			3/32			--	11°	●	●	●	●	●	●	●	●	●	●	●	●	●
222.79.538 ⁽²⁾			1/8			--	11°	●	●	●	●	●	●	●	●	●	●	●	●	●
222.79.540 ⁽²⁾			5/32			--	11°	●	●	●	●	●	●	●	●	●	●	●	●	●
222.79.564 ⁽³⁾	.635	3/16	3/64	3/8	.173	.067	11°	●	●	●	●	●	●	●	●	●	●	●	●	●
222.79.572	.634	3/16	.031	.386	.173	.071	11°	●	●	●	●	●	●	●	●	●	●	●	●	●
222.79.574	.634	3/16	.047	.375	.173	.059	11°	●	●	●	●	●	●	●	●	●	●	●	●	●

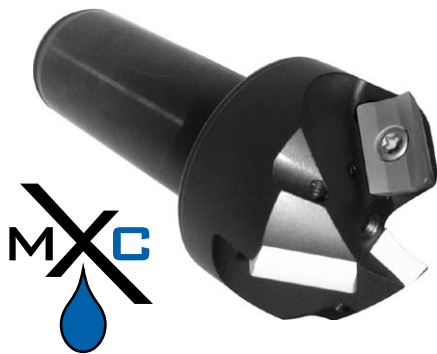


THX90 Alu. Inserts

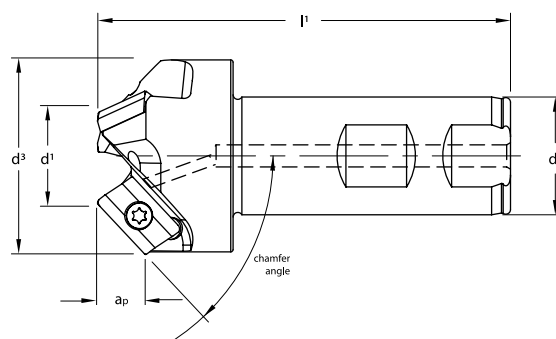
Designation	l	s	r	d	d'	bs	a	Coated						Uncoated					Cermets	
222.79.610 ^{(1)*}	.381	1/8	1/32	.264	.110	.039	15°	●	●	●	●	●	●	●	●	●	●	●	●	●
222.79.510 ^{(1)*}	.635	.183	1/32	.386	.173	.067	11°	●	●	●	●	●	●	●	●	●	●	●	●	●
222.79.512 ^{(1)*}			3/64			.055	11°	●	●	●	●	●	●	●	●	●	●	●	●	●
222.79.514 ^{(1)*}			1/16			.035	11°	●	●	●	●	●	●	●	●	●	●	●	●	●
222.79.516 ^{(1,2)*}			5/64			.016	11°	●	●	●	●	●	●	●	●	●	●	●	●	●
222.79.518 ^{(1,2)*}			3/32			---	11°	●	●	●	●	●	●	●	●	●	●	●	●	●
222.79.520 ^{(1,2)*}			1/8			---	11°	●	●	●	●	●	●	●	●	●	●	●	●	●
222.79.522 ^{(1,2)*}			5/32			---	11°	●	●	●	●	●	●	●	●	●	●	●	●	●
222.79.550 ^{(1)*}	.635	.183	1/64	.386	.173	.078	11°	●	●	●	●	●	●	●	●	●	●	●	●	●
222.79.552 ^{(1)*}			1/32			.067	11°	●	●	●	●	●	●	●	●	●	●	●	●	●
222.79.554 ^{(1)*}			3/64			.055	11°	●	●	●	●	●	●	●	●	●	●	●	●	●

- Note 1: Due to the higher side rake angles, 222.79.510 - 522, 222.79.550 - 222.79.552 & 222.79.610 inserts are wider and will cut oversize.
- Note 2: To provide necessary clearance for the inserts with radii over 5/64", the cutter body must be relieved.
- Note 3: Cutting edges are serrated and marked I & II, are to be mounted alternating edge I & II, and can only be used with a minimum of 2 teeth. Best results achieved when used in cutters with an even number of flutes.
- * Optimized for aluminum.

Chamfer Mills with Coolant



**New
Addition!**



30° Chamfer Mills with Coolant Through

Designation	d ¹	d ²	d ³	l ¹	Max. ap	flutes	Insert	Insert Screw	Wrench
TXP30-0750-CH	.750	.750	1.275	3.00	.50	2	222.79.400 222.79.500 222.79.510	214.80.388	214.80.824 (S/D) 214.80.012 (F/T)
TXP30-1000-CH	1.000	1.000	1.525	3.50	.52	3			
TXP30-1250-CH	1.250	1.250	1.775	3.50	.52	3			

Remember to use COPASLIP® anti-seize compound on all insert screws

41° Chamfer Mills with Coolant Through

Designation	d ¹	d ²	d ³	l ¹	Max. ap	flutes	Insert	Insert Screw	Wrench
TXP41-0688-CH	.688	.750	1.375	3.00	.68	2	222.79.400 222.79.500 222.79.510	214.80.388	214.80.824 (S/D) 214.80.012 (F/T)
TXP41-0938-CH	.938	1.000	1.625	3.50	.68	3			
TXP41-1188-CH	1.188	1.250	1.875	3.50	.68	3			

Remember to use COPASLIP® anti-seize compound on all insert screws

45° Chamfer Mills with Coolant Through

Designation	d ¹	d ²	d ³	l ¹	Max. ap	flutes	Insert	Insert Screw	Wrench
TXP45-0688-CH	.688	.750	1.425	3.00	.73	2	222.79.400 222.79.500 222.79.510	214.80.388	214.80.824 (S/D) 214.80.012 (F/T)
TXP45-0938-CH	.938	1.000	1.675	3.50	.73	3			
TXP45-1188-CH	1.188	1.250	1.925	3.50	.73	3			

Remember to use COPASLIP® anti-seize compound on all insert screws

60° Chamfer Mills with Coolant Through

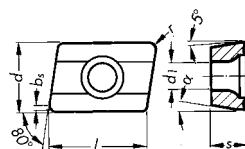
Designation	d ¹	d ²	d ³	l ¹	Max. ap	flutes	Insert	Insert Screw	Wrench
TXP60-0500-CH	.500	.750	1.355	3.00	.85	2	222.79.400 222.79.500 222.79.510	214.80.388	214.80.824 (S/D) 214.80.012 (F/T)
TXP60-0750-CH	.750	1.000	1.605	3.50	.85	3			
TXP60-1000-CH	1.000	1.250	1.855	3.50	.85	3			

Remember to use COPASLIP® anti-seize compound on all insert screws



222.79.400

222.79.500 / 510



TXP Inserts

Designation	l	s	r	d	d ¹	bs	a	Coated	Uncoated	Cermet
222.79.400	.635	3/16	3/64	3/8	.173	.047	11°	●	●	●
222.79.500	.635	3/16	3/64	3/8	.173	.059	11°	●	●	●
222.79.510 ^{(1)*}	.635	.183	1/32	.386	.173	.067	11°	●	●	●

Note 1: Due to the higher side rake angles, 222.79.510 - 522, 222.79.550 - 222.79.552 & 222.79.610 inserts are wider and will cut oversize.

TXP90AF

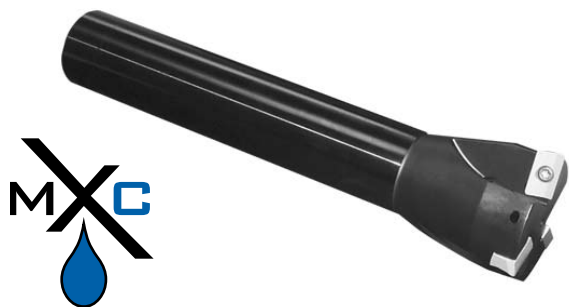
Axial Feed Milling Cutters

Axial feed or plunge milling:

Allows milling operations to be performed in the direction of the spindle's axial movement.

Higher feed rates:

By greatly reducing radial pressure on the tool, axial feed milling allows for higher feed rates.



Indexable insert:

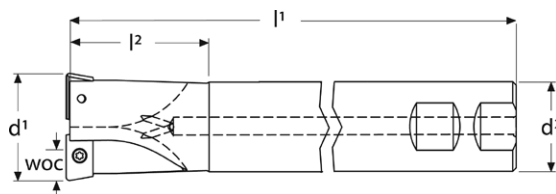
Cutters utilize high performance milling inserts and grades that combine for high metal removal rates in rough milling.

Up to 0.400" width of cut:

Effectively remove more material in one pass than conventional milling techniques. Please note: with axial feed cutters you cannot plunge into solid material.

Decreased tool deflection:

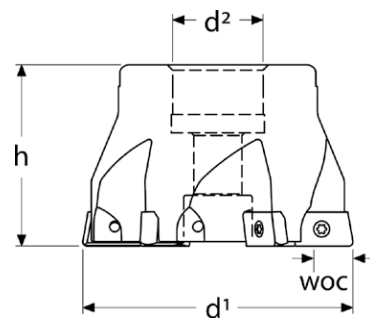
Axial feed or plunge milling decreases cutter deflection, as all cutting forces are directed back into the spindle.



Extended Length End Mills with Coolant Through

Designation	d ¹	d ²	l ¹	l ²	W.O.C.	flutes	Insert	Insert Screw	Wrench
TXP90AF-1500C	1.500	1.250	8.00	2.00	.40	2	222.79.501	214.80.388	214.80.824 (S/D)
TXP90AF-2000C	2.000	1.250	8.00	2.00	.40	3			214.80.012 (F/T)

Remember to use COPASLIP® anti-seize compound on all insert screws

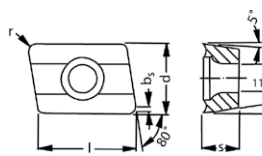
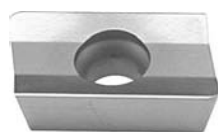


Face Mills

Designation	d ¹	d ²	h	W.O.C.	flutes	lbs.	Insert	Insert Screw	Wrench
TXP90AF-2500	2.500	.750	1.50	.40	5	.85	222.79.501	214.80.388	214.80.824 (S/D)
TXP90AF-3000	3.000	1.000	2.00	.40	6	2.15			214.80.012 (F/T)
TXP90AF-4000	4.000	1.500	2.50	.40	7	4.10			

Remember to use COPASLIP® anti-seize compound on all insert screws

TXP90AF Cutting Data

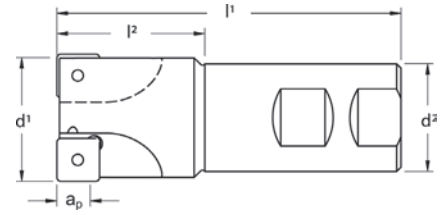


TXP90AF Inserts

Designation	l	s	r	d	d ¹	bs	TN7525	TN6525	TN7535	TN6540	TN450	TN5515	TN6510	TN6520	TN2510	TTM	TTR	THM	THR	THM-U	TTI-25
222.79.501	.635	.187	.047	.375	.173	.059			●		●	●									

TS90 (M690)

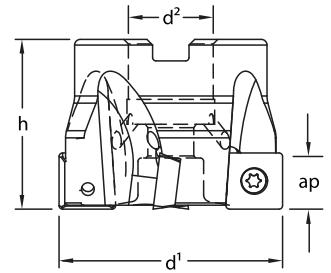
Square Shoulder Milling Cutters



End Mills using 1/2" I.C. Inserts

Designation	d ¹	d ²	l ¹	l ²	Max. ap	flutes	Insert	Insert Screw	Wrench
TS90E-1.5SD4	1.500	1.250	4.00	1.72	.40	3	SDMT-1204 PDR	214.80.388	214.80.824 (S/D)
TS90E-2SD4	2.000	1.250	4.00	1.72	.40	4			214.80.012 (F/T)

Remember to use COPASLIP® anti-seize compound on all insert screws



Face Mills using 1/2" I.C. Inserts

Designation	d ¹	d ²	h	Max. ap	flutes	lbs.	Insert	Insert Screw	Wrench
TS90-2SD4	2.000	.750	1.50	.40	4	.50	SDMT-1204 PDR	214.80.388	214.80.824 (S/D) 214.80.012 (F/T)
TS90-2SD4F	2.000	.750	1.50	.40	5	.50			
TS90-2.5SD4	2.500	1.000	1.75	.40	5	1.00			
TS90-2.5SD4F	2.500	1.000	1.75	.40	6	1.35			
TS90-3SD4	3.000	1.000	2.00	.40	6	2.00			
TS90-4SD4	4.000	1.500	2.00	.40	8	2.70			
TS90-5SD4F	5.000	1.500	2.00	.40	9	5.25			
TS90-6SD4	6.000	2.000	2.50	.40	10	8.15			

Remember to use COPASLIP® anti-seize compound on all insert screws

Face Mills using 5/8" I.C. Inserts

Designation	d ¹	d ²	h	Max. ap	flutes	lbs.	Insert	Insert Screw	Wrench
TS90-2SD5	2.000	.750	1.50	.50	4	.50	SDMT-1506 PDR	214.80.073	214.80.994 (S/D) 214.80.076 (F/T)
TS90-2.5SD5	2.500	1.000	1.75	.50	5	1.00			
TS90-3SD5	3.000	1.000	2.00	.50	6	2.00			
TS90-4SD5	4.000	1.500	2.00	.50	8	2.70			
TS90-5SD5	5.000	1.500	2.00	.50	9	5.25			
TS90-6SD5	6.000	2.000	2.50	.50	10	8.15			
TS90-8SD5*	8.000	2.500	2.50	.50	13	14.40			
TS90-10SD5*	10.000	2.500	2.50	.50	16	22.70			

* Cutter supplied with 4 holes on a 4" bolt circle

Remember to use COPASLIP® anti-seize compound on all insert screws

TS90 Cutting Data

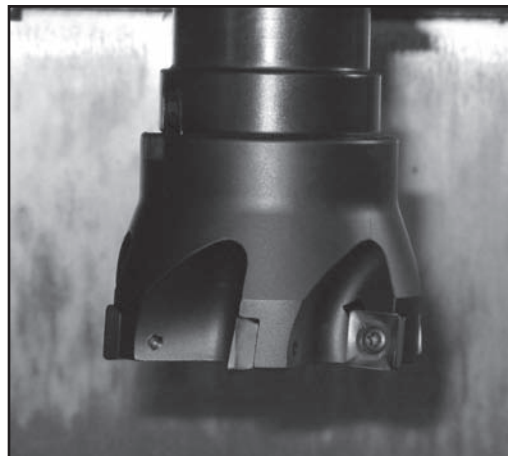
TS90 (M690)

Inserts for TS90 Square Shoulder Milling Cutters

The TS90 Square Shoulder Milling Cutters are an ideal tool for 90° slot and shoulder milling. They are available in diameters from 1½" to 6", using ½" I.C. inserts, and 2" to 10" using 5/8" I.C. inserts.

The cutter bodies are manufactured with premium hardened steel for rigidity. The TS90s use indexable inserts with four effective cutting edges, which are securely clamped with Torx® screws.

The TS90 cutter delivers optimum milling performance with outstanding chip evacuation. The cutters operate smoothly with low power requirements. These cutters are ideal for slot milling, edge trimming, square shoulder milling and face milling, in materials ranging from low alloy steels to stainless and high alloy steels, as well as grey, ductile and nodular cast iron.



Positive geometries and strengthened cutting edges guarantee trouble-free machining of a wide range of materials. 4 usable cutting edges.

SDMT

ML - For cast iron machining and finishing on non-rigid machines and setups.

MH - For most applications.

SDMX

New Addition!

MM - Positive pressed geometry engineered to reduce cutting forces enabling increased feed rates.

MH - Similar to the MM but with reinforced cutting edge for heavy duty milling.



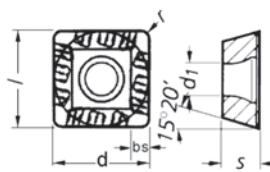
SDMT-ML



SDMT-MH



SDMX-MM / MH



TS90 Inserts

							TN7525	TN6525	TN7535	TN6540	TN450	TN5515	TN6510	TN6520	TN2510	TTM	TTR	THM	THR	THM-U		TTI-25	
Designation	l	s	r	d	d'	bs	Coated								Uncoated				Cermet				
SDMT-1204 PDR-ML	.500	3/16	3/64	1/2	.173	---	●	●	●	●	●	●	●	●	●	●	●	●				●	
SDMT-1506 PDR-ML	.625	1/4	3/64	5/8	.217	---	●		●	●	●	●			●	●	●					●	
SDMT-1204 PDR-MH	.500	3/16	3/64	1/2	.173	---	●	●	●	●	●	●	●	●	●	●	●	●				●	
SDMT-1506 PDR-MH	.625	1/4	3/64	5/8	.217	---	●		●	●	●	●			●	●						●	
SDMX-120408R-MM	.500	.188	.031	1/2	.173	.076	●	●		●													
SDMX-120412R-MM			.047			.061	●	●	●	●		●											
SDMX-150612R-MM	.625	.250	.047	5/8	.217	.057	●		●	●		●											
SDMX-120408R-MH	.500	.188	.031	1/2	.173	.076	●		●	●		●											
SDMX-120412R-MH			.047			.061	●	●	●	●		●		●									
SDMX-120416R-MH			.063			.059			●	●		●											
SDMX-150612R-MH	.625	.250	.047	5/8	.217	.057	●		●	●		●											
SDMX-150616R-MH			.063			.059			●	●		●											

TA90 (M680 Super)

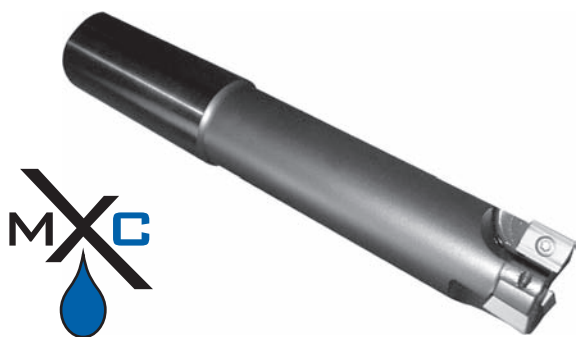
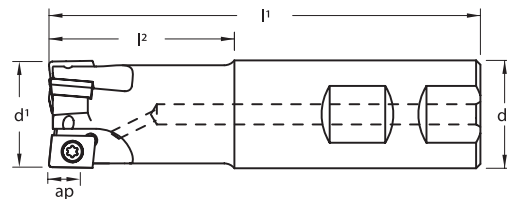
Milling Cutters



Regular Length End Mills with Coolant Through

Designation	d ¹	d ²	ap	l ¹	l ²	flutes	Insert	Insert Screw	Wrench
TA90-0750C	.750	.750	.33	3.50	1.46	2	AONT-10T308	214.80.672	214.80.866 (S/D) 214.80.011 (F/T)
TA90-1000-4C	1.000	1.000	.33	4.00	1.71	3			
TA90-1250C	1.250	1.250	.33	4.00	1.71	4			
TA90-1500C	1.500	1.250	.33	4.40	--	5			

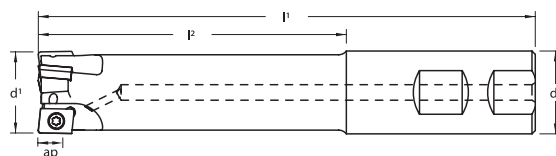
Remember to use COPASLIP® anti-seize compound on all insert screws



Extended Length End Mills with Coolant Through

Designation	d ¹	d ²	ap	l ¹	l ²	flutes	Insert	Insert Screw	Wrench
TA90-0750-XLC	.750	.750	.33	6.00	3.96	2	AONT-10T308	214.80.672	214.80.866 (S/D) 214.80.011 (F/T)
TA90-1000-XLC	1.000	1.000	.33	6.00	3.71	3			
TA90-1250-XLC	1.250	1.250	.33	6.00	3.71	4			
TA90-1500-XLC	1.500	1.250	.33	8.00	--	5			

Remember to use COPASLIP® anti-seize compound on all insert screws



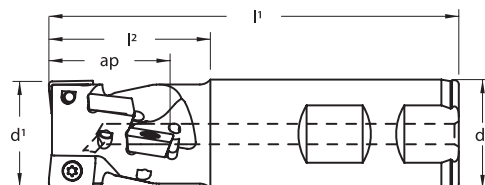
TA90 Cutting Data



Helical End Mills with Coolant Through

Designation	d ¹	d ²	ap	l ¹	l ²	flutes	# of inserts	Insert	Insert Screw	Wrench
THA90-1000	1.000	1.000	1.10	3.77	1.49	2	6	AONT-10T308	214.80.672	214.80.866 (S/D) 214.80.011 (F/T)
THA90-1250	1.250	1.250	1.45	4.33	2.05	3	12			

Remember to use COPASLIP® anti-seize compound on all insert screws



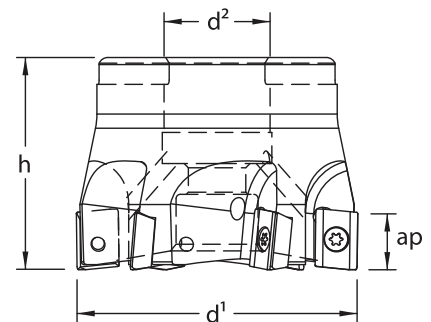
THA90 Cutting Data

TA90 (M680 Super)

Milling Cutters

The newly developed TA90 end and face mills, in conjunction with our new Widia AONT carbide inserts, deliver exceptional performance in all milling applications. The strengthened inserts offer excellent results in slotting, as well as peripheral milling.

Although designed for rapid metal removal, the TA90 still produces excellent surface finishes. The insert is available in 3 cutting geometries, ML for light machining, MM for medium machining and MH for heavy machining. To ensure utmost performance on all materials, these inserts are available in a variety of high performance milling grades.



Face Mills

Designation	d ¹	d ²	ap	h	flutes	lbs	Insert	Insert Screw	Wrench
TA90-2000	2.00	.750	.33	1.50	6	.75	AONT-10T308	214.80.672	214.80.866 (S/D) 214.80.011 (F/T)
TA90-2500	2.50	1.000	.33	1.75	7	1.55			
TA90-3000	3.00	1.000	.33	2.00	8	2.35			
TA90-4000	4.00	1.500	.33	2.00	10	3.15			

Remember to use COPASLIP® anti-seize compound on all insert screws

TA90 Cutting Data

MH - for heavy machining (scale, severe interruptions)

MM - for medium range metal removal with reinforced cutting edge

ML - for light machining, especially suited for stainless steels, including austenitic and martensitic



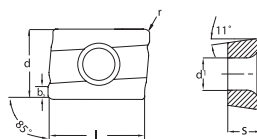
-MH



-MM



-ML



AONT- ...

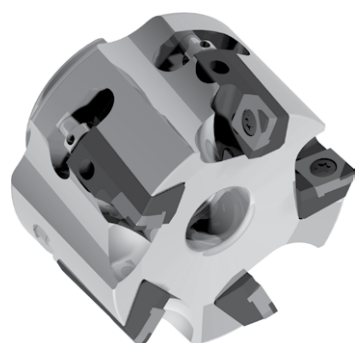
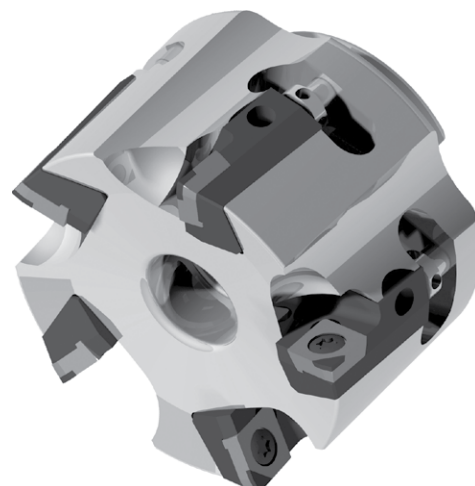
Designation	l	s	r	d	d ¹	bs	TN7525	TN6525	TN7535	TN6540	TN450	TN5515	TN6510	TN6520	TN2510	TN6501	TN6502	TTM	TTR	THM	TTI-25
AONT-10T308-MH	.407	.156	.031	.297	.134	.039	●	●	●	●	●	●						●			●
AONT-10T308-MM	.407	.156	.031	.297	.134	.039	●		●		●	●						●		●	●
AONT-10T308-ML	.407	.156	.031	.297	.134	.039	●	●	●	●	●	●	●			●	●		●		

TCP90-AL

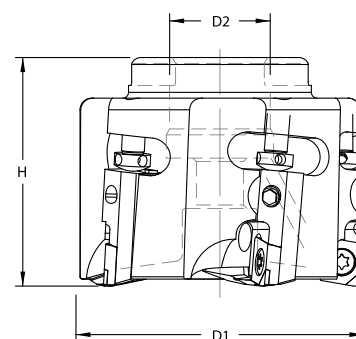
Face Mills for PCD Milling Applications

Featuring BECKER PCD Inserts

- New advanced milling cutter program engineered for high speed machining of non-ferrous material!
- Ultra precise finishing with unique wiper-radius PCD inserts and micro-adjustable cartridges!
- Milling cutter bodies constructed from lightweight 7075-T6 aviation grade aluminum to maximize RPM while minimizing machine spindle wear!
- MaxiCool through coolant enabled for maximum chip evacuation and temperature control!
- New CVD diamond grade for extreme tool life!



**New
Addition!**



Face Mills for PCD Milling Applications

Designation	D1	D2	H	Flutes	Insert	Cartridge	Cartridge Clamp Screw	Insert Torx Screw	Height Adj. Screw
TCP90-2000-AL	2.000	.750	2.00	3	CPGW-32.51PDR	BC1000X500	M5 SHBS	TCP951	HAS6823
TCP90-2500-AL	2.500	1.000	2.00	5					
TCP90-3000-AL	3.000	1.000	2.00	7					
TCP90-4000-AL	4.000	1.250	2.00	10					
TCP90-5000-AL	5.000	1.500	2.00	11					
TCP90-6000-AL	6.000	1.500	2.00	13					

Performance Report

Application:

Milling the face of a cast aluminum oil pan. Material is A380 Aluminum consisting of 9% silicon.

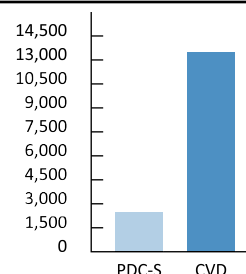
Cutting Data:

100mm diameter cutter (Z=10)
8000 RPM (through tool coolant)
5420 mm/min feedrate
1-2mm D.O.C.
Rz = 1.8 micron

Part life:

PDC-S= 2,500 pieces
CVD= 13,500 pieces

540% Increase in tool life using CVD



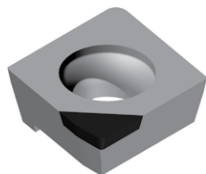
TCP90-AL

Face Mills for PCD Milling Applications

PDC-S

Performance: Polycrystalline carbide reinforced diamond of coarse grit size, good edge sharpness and low cutting pressure allowing close tolerances. Best performances for milling. High flank wear resistance and toughness.

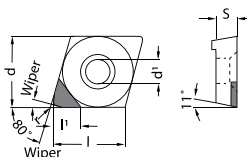
Application: Finishing, general purpose and milling of all non-metallics with medium to high content of abrasive reinforcement or silicon.



CVD

Performance: Solid diamond with no structure. Cutting edge is extremely sharp and without microfractures generating no cutting pressure, allowing burr-free results with tolerances close to zero. Extremely flank wear resistant with maximum thermal conductivity, and good toughness.

Application: Super finishing to roughing of all nonferrous metals and non-metallics with abrasive reinforcement or silicon. (HSC - High Tech)

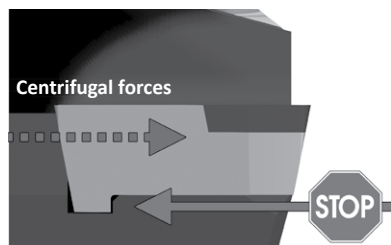


CPGW with Wiper

Designation	l	l'	s	r	d	d'	DP									
CPGW-32.51PDR	.382	.169	.156	.016	.375	.173	●	●								

Security Features

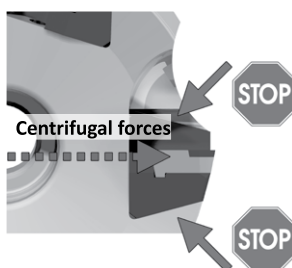
Insert Double Lock



Secondary insert step locks against matching step on insert cartridge

Designed to act as a double lock in conjunction with the insert tapered screw

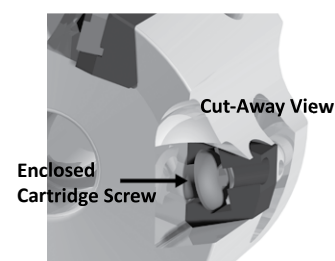
Cartridge Dovetail Lock



Insert cartridge is fitted into cutter body with dovetail design

Centrifugal forces acting on insert cartridge are neutralized by wedge profile of cartridge and matching shape on cutter body

Enclosed Cartridge Clamping Screw

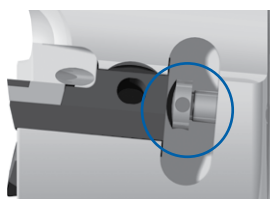


Unique cartridge shrouds cartridge clamp screw within steel body

Potential screw breakage is contained within steel of cartridge – the screw has no place to eject

Performance Features

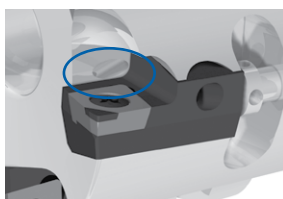
Micro Adjustable



Easily pre-set cartridges to within microns

All new milling cutters are factory pre-set in height to within ± 0.0004 with a master gauge insert

Through Coolant Enabled



Coolant ports are directed at the cutting edge to extend tool life and improve surface finishes

Wiper Radius



Unique wiper is a compound radius that outperforms traditional wiper flats

With every insert in the cutter loaded with the wiper radius, super finishing is easily attained

TV90

For Non-Ferrous & Plastic Materials

Application

High speed milling of:

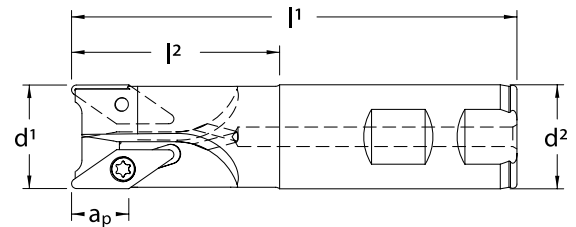
- Aluminum alloys
- Copper alloys
- Plastic materials
- Can be used for edge and slot milling, as well as axial plunge milling
- Excellent for deep cavity work
- Suitable for soft non-ferrous materials
- Up to .500" depth of cut
- Exceptionally high feed rates (over 200 IPM)
- Maximum metal removal on any machine
- Wide range of product available

Features / Benefits

- High positive geometry insert with wave shape topography eliminates edge build-up and provides efficient chip removal
- End mills designed with coolant bore holes directed toward cutting edges
- Insert grade TK10MP is specifically designed for the machining of aluminum and non-ferrous materials that require high cutting speeds



New Addition!

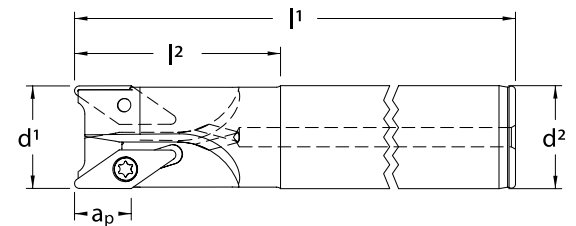


End Mills Optimized Design for Aluminum

Designation	d ¹	d ²	l ¹	l ²	Max. ap	Max Plunge	flutes	Insert	Insert Screw	Wrench
TVP90-0750C	.750	.750	3.28	1.25	.40	.200	2	VPGT-221-ALM	LF-89972	214.80.866 (S/D) 214.80.011 (F/T)
TVP90-1000XC	1.000	1.000	4.28	2.00	.40	.200	3			
TVP90-1000C	1.000	1.000	4.28	2.00	.53	.250	2	VPGT-333-ALM VPGT-33PPFR-ALM*	LF-57106	214.80.824 (S/D) 214.80.012 (F/T)
TVP90-1250C	1.250	1.250	4.28	2.00	.53	.250	2			
TVP90-1500C	1.500	1.250	4.28	2.00	.53	.250	3			

* To provide necessary clearance when using VPGT-33PPFR-ALM inserts, the cutting body must be relieved

Remember to use COPASLIP® anti-seize compound on all insert screws



Extra Length End Mills Optimized Design for Aluminum

Designation	d ¹	d ²	l ¹	l ²	Max. ap	Max Plunge	flutes	Insert	Insert Screw	Wrench
TVP90CY-0750-XLC	.750	.750	6.75	1.25	.40	.200	2	VPGT-221-ALM	LF-89972	214.80.866 (S/D) 214.80.011 (F/T)
TVP90CY-1000X-XLC	1.000	1.000	8.00	2.00	.40	.200	3			
TVP90CY-1000-XLC	1.000	1.000	8.00	2.00	.53	.250	2	VPGT-333-ALM VPGT-33PPFR-ALM*	LF-57106	214.80.824 (S/D) 214.80.012 (F/T)
TVP90CY-1250-XLC	1.250	1.250	8.00	2.00	.53	.250	2			
TVP90CY-1500-XLC	1.500	1.250	8.00	2.00	.53	.250	3			

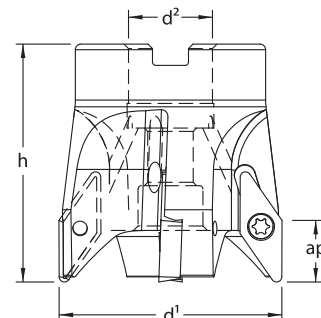
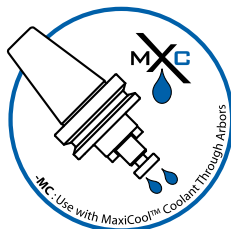
* To provide necessary clearance when using VPGT-33PPFR-ALM inserts, the cutting body must be relieved

Remember to use COPASLIP® anti-seize compound on all insert screws

TV90 Cutting Data

TV90

For Non-Ferrous & Plastic Materials

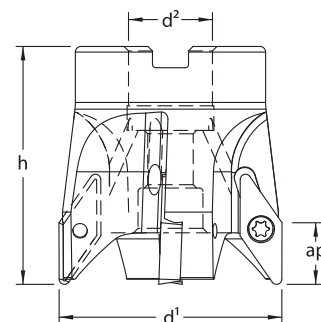
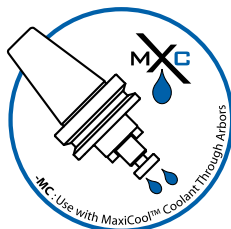


Face Mills Optimized Design for Aluminum

Designation	d ¹	d ²	h	Max. ap	Max Plunge	No. of inserts	Insert	Insert Screw	Wrench
Through Coolant Enabled							VPGT-333-ALM VPGT-33PPFR-ALM*	LF-57106	214.80.824 (S/D) 214.80.012 (F/T)
TVP90-2000-MC	2.00	.750	2.12	.53	.250	4			
TVC90-2000-MC	2.00	.750	2.12	.59	.300	3	VCGT-43.58-ALM	C-1250	214.80.824 (S/D) 214.80.076 (F/T)
TVC90-2500-MC	2.50	1.000	2.12	.59	.300	4			
TVC90-3000-MC	3.00	1.000	2.12	.59	.300	5			
Standard Non-Through Coolant									
TVC90-4000	4.00	1.500	2.12	.59	.300	6			
* To provide necessary clearance when using VPGT-33PPFR-ALM inserts, the cutting body must be relieved									

* To provide necessary clearance when using VPGT-33PPFR-ALM inserts, the cutting body must be relieved

Remember to use COPASLIP® anti-seize compound on all insert screws



Face Mills Optimized Design for Aluminum

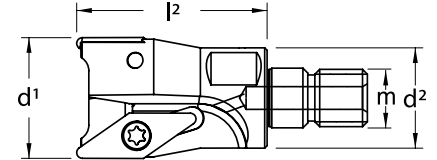
Designation	d ¹	d ²	h	Max. ap	Max Plunge	No. of inserts	Insert	Insert Screw	Wrench
Through Coolant Enabled							VCGT-43.58-ALM	C-1250	214.80.824 (S/D) 214.80.076 (F/T)
TVC90-2500AL-3-MC	2.50	1.000	2.12	.59	.300	3			
TVC90-3000AL-3-MC	3.00	1.000	2.12	.59	.300	3			
Standard Non-Through Coolant									
TVC90-4000AL-4	4.00	1.500	2.12	.59	.300	4			

Remember to use COPASLIP® anti-seize compound on all insert screws

TV90 Cutting Data

TV90

For Non-Ferrous & Plastic Materials



Screw-On Milling Cutters Optimized Design for Aluminum

Designation	d ¹	d ²	l ²	m	Max. ap	Max Plunge	flutes	Insert	Insert Screw	Wrench
Standard Non-Through Coolant								VPGT-221-ALM	LF-89972	214.80.866 (S/D) 214.80.011 (F/T)
TVP90-0750-TS	.750	.709	1.18	M10	.40	.200	2			
Through Coolant Enabled										
TVP90-1000XC-TS	1.000	.827	1.57	M12	.40	.200	3	VPGT-333-ALM VPGT-33 PPFR-ALM*	LF-57106	214.80.824 (S/D) 214.80.012 (F/T)
TVP90-1000C-TS	1.000	.827	1.57	M12	.53	.250	2			
TVP90-1250C-TS	1.250	1.142	1.97	M16	.53	.250	2			
TVP90-1500C-TS	1.500	1.142	1.97	M16	.53	.250	3			
* To provide necessary clearance when using VPGT-33PPFR-ALM inserts, the cutting body must be relieved										

* To provide necessary clearance when using VPGT-33PPFR-ALM inserts, the cutting body must be relieved

Remember to use COPASLIP® anti-seize compound on all insert screws

TV90 Cutting Data

TK10M - Uncoated K10/C2 wear resistant grade, suited for machining of non-ferrous materials, high temp. alloys as well as synthetic materials including fibreglass, graphite and plastic. Recommended to run with coolant only when materials require wet machining.

TK10MP - TiAlN coated K10/C2 grade designed for high speed machining of aluminum and other nonferrous material. Recommended to run with coolant.

TK10TB - PVD diamond film coating offering greatly extended tool life over conventional carbide. Recommended specifically for synthetic materials such as graphite.



Designation	l	s	r	d	d ¹	a
VCGT-43.58-ALM	.870	7/32	.118	1/2	.216	7°
VPGT-221-ALM	.437	1/8	1/64	1/4	.110	11°
VPGT-333-ALM	.654	3/16	3/64	3/8	.173	11°
VPGT-33 PPFR-ALM	.654	3/16	--	3/8	.173	11°

TV90 Inserts											
TK10MP										TK10TB	
Coated								Diamond Coated			TK10M
●											●
●								●			●
●								●			●
●											●

WIN WITH WIDIA™

WIDIA 



Victory™ M1200 Face Mill Series

M1200 | M1200 High-Feed | M1200 Mini

Twelve cutting edges per insert — run quieter at higher speeds and feeds, using far less power versus ANY competitive double-sided platform.

Productivity: Exceptional chip forming and evacuation in any material.

Performance: Superb surface finishes.

Value: Extraordinary tool life — in all workpieces and cutting conditions.

M1200 High-Feed

- Feed rates up to .098" per tooth.
- 15° lead angle enables superior chip-thinning.

M1200 Mini

- Ideal for low depth of cut work.
- Axial depth of cut up to .138".

 **WIDIA
VICTORY**
Win with Widia™

M1200

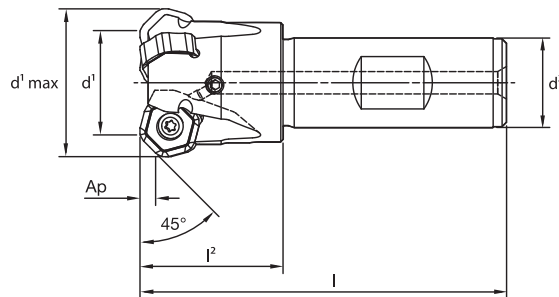
Milling Cutters using 1/2" I.C. Inserts

Specifically engineered to deliver consistent performance in demanding milling applications!

**New
Addition!**



**1/2"
I.C. Inserts**



Mini End Mills using 1/2" I.C. Inserts

Designation	Dia d ¹	d ²	d ¹ Max	l	l ²	Ap	Flutes	Insert	Insert Screw	Wrench
M1200MINI-1.00HN2EM	1.000	.750	1.34	3.28	1.25	.138	2	HNGJ-0704_ HNPJ-0704_ XNGJ-0704_	214.60.345	214.80.824 (S/D) 214.80.012 (F/T)
M1200MINI-1.00HN3EM	1.000	.750	1.34	3.28	1.25	.138	3			
M1200MINI-1.25HN3EM	1.250	1.000	1.59	3.78	1.50	.138	3			
M1200MINI-1.25HN4EM	1.250	1.000	1.59	3.78	1.50	.138	4			

Remember to use COPASLIP® anti-seize compound on all insert screws

Mini End Mills - Extended Length Cylindrical Shank using 1/2" I.C. Inserts

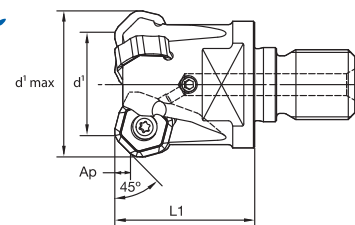
Designation	Dia d ¹	d ²	d ¹ Max	l	Ap	Flutes	Insert	Insert Screw	Wrench
M1200MINI-1.00HN2EM-L	1.000	.750	1.34	4.80	.138	2	HNGJ-0704_ HNPJ-0704_ XNGJ-0704_	214.60.345	214.80.824 (S/D) 214.80.012 (F/T)
M1200MINI-1.00HN2EM-XL	1.000	1.000	1.34	8.00	.138	2			
M1200MINI-1.00HN3EM-L	1.000	.750	1.34	4.80	.138	3			
M1200MINI-1.00HN3EM-XL	1.000	1.000	1.34	8.00	.138	3			
M1200MINI-1.25HN3EM-L	1.250	1.000	1.59	5.20	.138	3			
M1200MINI-1.25HN4EM-L	1.250	1.000	1.59	5.20	.138	4			

Remember to use COPASLIP® anti-seize compound on all insert screws



**1/2"
I.C. Inserts**

**New
Addition!**



Mini Screw-On Milling Cutters using 1/2" I.C. Inserts

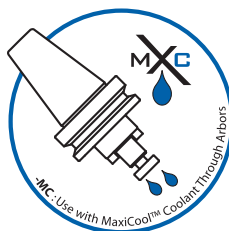
Designation	Dia D ¹	D ¹ Max	L1	Ap	Thread	Flutes	Insert	Insert Screw	Wrench
M1200MINI-1.00HN2TS	1.000	1.34	1.25	.138	M16	2	HNGJ-0704_ HNPJ-0704_ XNGJ-0704_	214.60.345	214.80.824 (S/D) 214.80.012 (F/T)
M1200MINI-1.00HN3TS	1.000	1.34	1.25	.138	M16	3			
M1200MINI-1.25HN3TS	1.250	1.59	1.50	.138	M16	3			
M1200MINI-1.25HN4TS	1.250	1.59	1.50	.138	M16	4			
M1200MINI-1.50HN4TS	1.500	1.84	1.50	.138	M16	4			
M1200MINI-1.50HN5TS	1.500	1.84	1.50	.138	M16	5			

Remember to use COPASLIP® anti-seize compound on all insert screws

M1200 Cutting Data

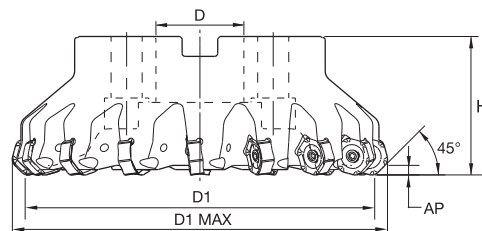
M1200

Milling Cutters using 1/2" I.C. Inserts



1/2"
I.C. Inserts

**New
Addition!**



Mini Extra Coarse Pitch Face Mills using 1/2" I.C. Inserts

Designation	Dia D'	D	D' Max	H	AP	Flutes	Insert	Insert Screw	Wrench
M1200MINI-20HN4E	2.000	.750	2.34	1.58	.138	4	HNGJ-0704_ HNPJ-0704_ XNGJ-0704_	214.60.345	214.80.824 (S/D) 214.80.012 (F/T)
M1200MINI-25HN4E	2.500	.750	2.84	1.58	.138	4			
M1200MINI-30HN5E	3.000	1.000	3.34	1.75	.138	5			
M1200MINI-40HN6E	4.000	1.500	4.34	1.75	.138	6			

Remember to use COPASLIP® anti-seize compound on all insert screws

Mini Coarse Pitch Face Mills using 1/2" I.C. Inserts

Designation	Dia D'	D	D' Max	H	AP	Flutes	Insert	Insert Screw	Wrench
M1200MINI-20HN5C	2.000	.750	2.34	1.58	.138	5	HNGJ-0704_ HNPJ-0704_ XNGJ-0704_	214.60.345	214.80.824 (S/D) 214.80.012 (F/T)
M1200MINI-25HN6C	2.500	.750	2.84	1.58	.138	6			
M1200MINI-30HN8C	3.000	1.000	3.34	1.75	.138	8			
M1200MINI-40HN9C	4.000	1.500	4.34	1.75	.138	9			

Remember to use COPASLIP® anti-seize compound on all insert screws

Mini Fine Pitch Face Mills using 1/2" I.C. Inserts

Designation	Dia D'	D	D' Max	H	AP	Flutes	Insert	Insert Screw	Wrench
M1200MINI-20HN6M	2.000	.750	2.34	1.58	.138	6	HNGJ-0704_ HNPJ-0704_ XNGJ-0704_	214.60.345	214.80.824 (S/D) 214.80.012 (F/T)
M1200MINI-25HN8M	2.500	.750	2.84	1.58	.138	8			
M1200MINI-30HN10M	3.000	1.000	3.34	1.75	.138	10			
M1200MINI-40HN12M	4.000	1.500	4.34	1.75	.138	12			

Remember to use COPASLIP® anti-seize compound on all insert screws

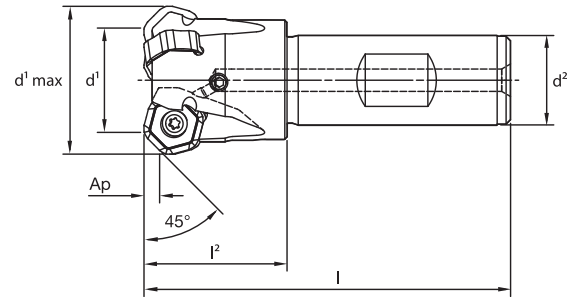
M1200 Cutting Data

M1200

Milling Cutters using 5/8" I.C. Inserts



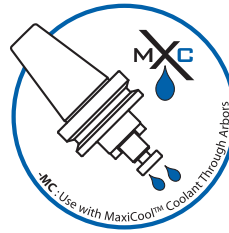
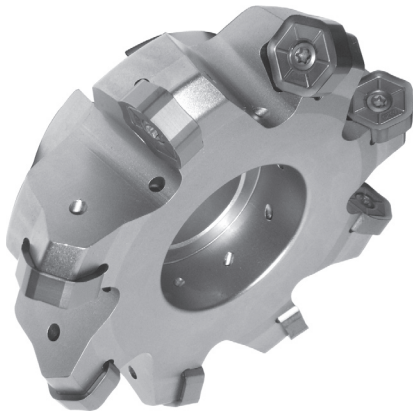
5/8"
I.C. Inserts



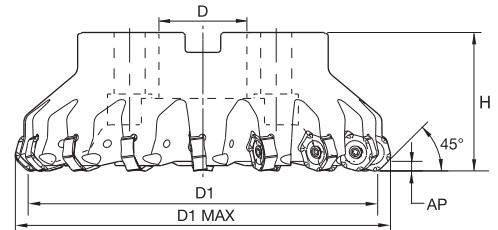
End Mills using 5/8" I.C. Inserts

Designation	Dia d ¹	d ²	d ¹ Max	l	l ²	Ap	Flutes	Insert	Insert Screw	Wrench
M1200-15HN3C	1.500	1.250	1.934	4.21	1.97	.175	3	HNGJ-0905_ HNPJ-0905_ XNGJ-0905_	214.60.345	214.80.824 (S/D) 214.80.012 (F/T)

Remember to use COPASLIP® anti-seize compound on all insert screws



5/8"
I.C. Inserts



Extra Coarse Face Mills using 5/8" I.C. Inserts

Designation	D ¹	D	D ¹ max	H	AP	flutes	Insert	Insert Screw	Wrench
M1200-25HN4E	2.500	.750	2.93	1.57	.177	4	HNGJ-0905_ HNPJ-0905_ XNGJ-0905_	214.60.345	214.80.824 (S/D) 214.80.012 (F/T)
M1200-30HN5E	3.000	1.000	3.43	1.75	.177	5			
M1200-40HN6E	4.000	1.250	4.43	1.75	.177	6			
M1200-40HN6EX	4.000	1.500	4.43	1.75	.177	6			
M1200-50HN8E	5.000	1.500	5.43	2.38	.177	8			
M1200-60HN0E	6.000	2.000	6.43	2.38	.177	9			
M1200-80HN10E*	8.000	2.500	8.43	2.38	.177	10			
M1200-10HN12E*	10.000	2.500	10.43	2.38	.177	12			
M1200-12HN14E*	12.000	2.500	12.43	3.15	.177	14			

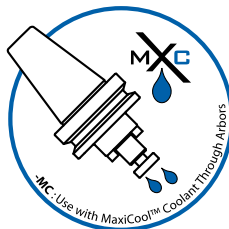
* Cutter supplied with 4 holes on a 4" bolt circle

Remember to use COPASLIP® anti-seize compound on all insert screws

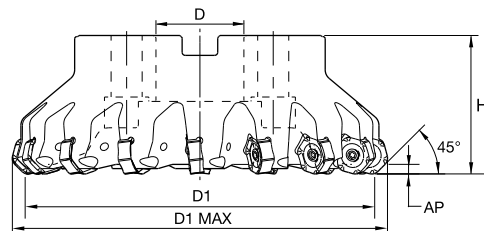
M1200 Cutting Data

M1200

Milling Cutters using 5/8" I.C. Inserts



5/8"
I.C. Inserts



Coarse Pitch Face Mills using 5/8" I.C. Inserts

Designation	D'	D	D' max	H	AP	flutes	Insert	Insert Screw	Wrench
M1200-20HN4C	2.000	.750	2.43	1.57	.177	4	HNGJ-0905_ HNPJ-0905_ XNGJ-0905_	214.60.345	214.80.824 (S/D) 214.80.012 (F/T)
M1200-25HN6C	2.500	.750	2.93	1.57	.177	6			
M1200-30HN6C	3.000	1.000	3.43	1.75	.177	6			
M1200-40HN8C	4.000	1.250	4.43	1.75	.177	8			
M1200-50HN10C	5.000	1.500	5.43	2.38	.177	10			
M1200-60HN12C	6.000	2.000	6.43	2.38	.177	12			
M1200-80HN16C*	8.000	2.500	8.43	2.38	.177	16			
M1200-10HN20C*	10.000	2.500	10.43	2.38	.177	20			
M1200-12HN24C*	12.000	2.500	12.43	3.15	.177	24			
* Cutter supplied with 4 holes on a 4" bolt circle									

Remember to use COPASLIP® anti-seize compound on all insert screws

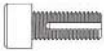
Fine Pitch Face Mills using 5/8" I.C. Inserts

Designation	D'	D	D' max	H	AP	flutes	Insert	Insert Screw	Wrench
M1200-20HN5M	2.000	.750	2.43	1.57	.177	5	HNGJ-0905_ HNPJ-0905_ XNGJ-0905_	214.60.345	214.80.824 (S/D) 214.80.012 (F/T)
M1200-25HN7M	2.500	.750	2.93	1.57	.177	7			
M1200-30HN9M	3.000	1.000	3.43	1.75	.177	9			
M1200-40HN11M	4.000	1.250	4.43	1.75	.177	11			
M1200-40HN11C	4.000	1.500	4.43	1.75	.177	11			
M1200-50HN14M	5.000	1.500	5.43	2.38	.177	14			
M1200-60HN16M	6.000	2.000	6.43	2.38	.177	16			

Remember to use COPASLIP® anti-seize compound on all insert screws

M1200 Cutting Data

Spare Parts for M1200 Face Mills

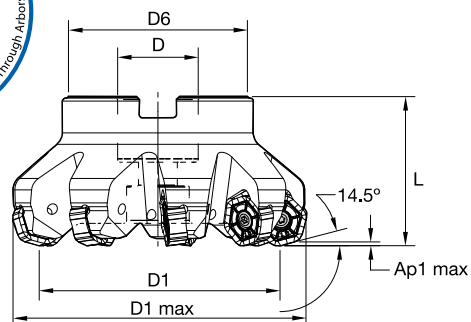
Face Mill Diameter (D1)	slotted screw 	fastening screw 	coolant cap 
2.000	214.61.024	--	--
2.500	214.61.024	--	--
3.000	214.61.028	--	--
4.000	--	214.61.095	--
5.000	--	214.61.105	214.61.118
6.000	--	214.61.106	214.61.119

M1200

High Feed Milling Cutters



5/8"
I.C. Inserts

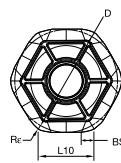


High Feed Face Mills

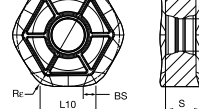
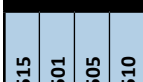
Designation	D1	D	D1 max	D6	H	AP	flutes	Insert	Insert Screw	Wrench
M1200HF-20HN4C	2.000	.750	2.70	1.593	1.58	.087	4	HNGJ-0905_ HNPJ-0905_ XNGJ-0905_	214.60.345	214.80.824 (S/D) 214.80.012 (F/T)
M1200HF-25HN5C	2.500	.750	3.20	1.986	1.58	.087	5			
M1200HF-30HN6C	3.000	1.000	3.70	2.189	1.75	.087	6			
M1200HF-40HN8C	4.000	1.500	4.70	3.661	1.75	.087	8			
M1200HF-50HN9C	5.000	1.500	5.70	3.652	2.38	.087	9			
M1200HF-60HN12C	6.000	2.000	6.70	4.722	2.38	.087	12			

Remember to use COPASLIP® anti-seize compound on all insert screws

M1200 Cutting Data



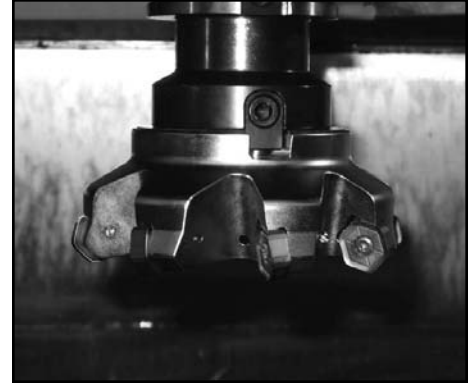
HNGJ - M1200 Inserts

								TN5515	TN6501	TN6505	TN6510	TN6520	TN6525	TN6540	TN7535					THM-U	
Designation	Cutting Edges	D	S	L10	BS	R	Coated										Uncoated				
For Light Duty Machining																					
HNGJ-0704-ANEN-LD	12	.500	.176	.268	.064	.047	●		●	●	●	●	●								
HNGJ-070432-ANEN-LD			.176		--	.126				●		●	●								
HNGJ-0905-ANEN-LD	12	.625	.220	.338	.071	.047	●					●	●	●	●						
For General Duty Machining																					
HNGJ-0905-ANSN-GD	12	.625	.220	.338	.071	.047	●					●	●	●	●						
For Heavy Duty Machining																					
HNGJ-0905-ANSN-HD	12	.625	.220	.338	.065	.047	●					●	●	●							
HNGJ-090543-ANSN-HD				.334		.171						●	●	●							
For Aluminum Machining																					
HNGJ-0704-ANFN-LDJ	12	.500	.176	.268	.064	.047		●											●		
HNGJ-0905-ANFN-LDJ	12	.625	.220	.338	.071	.047		●											●		

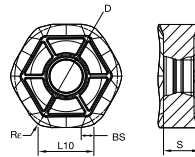
M1200

Inserts for M1200 Milling Cutters

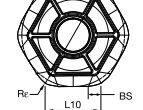
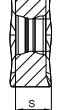
- LD Honed edge preparation used in light machining.
- GD Medium T-land and honed edge preparation used in medium machining.
Good first choice for general-purpose use.
- HD 0° to negative T-land and hone edge preparation used in heavy machining.
Good first choice for heavy feeds and severely interrupted cuts.
- 3W Chamfer-protected edge preparation. Identifies “Wiper” inserts that allow for a finer finish and are used in combination with -GD geometry inserts to permit roughing and finishing in one pass.
- LDJ Wiper insert geometry used in conjunction with HNGJ-...LDJ insert to permit roughing and finishing in one pass. Specifically for aluminum.

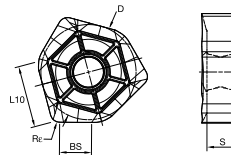


Up to 50% Longer Tool Life!



HNPJ - M1200 Inserts

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XNGJ - M1200 Inserts

															TN5515	TN6501	TN6510	TN6520	TN6525	TN6540	TN7535																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																															
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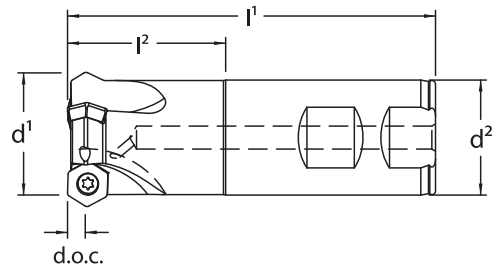
* 3 RH and 3 LH cutting edges

THP60 (M640)

Milling Cutters

The newly developed THP60 end and face mills offer exceptional, economical performance for general face milling applications. End mills and face mills from 2" diameter to 4" diameter are MaxiCool™ enabled giving further benefit of increased performance.

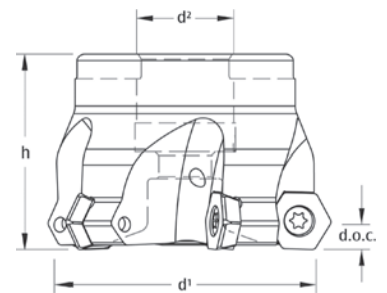
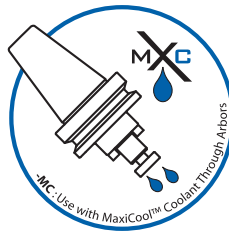
With inserts having an economical 6 cutting edges, together with Widia proven milling grades, all material groups are covered to take profitability to the next level.



End Mills with Coolant Through

Designation	d ¹	d ²	l ¹	l ²	d.o.c.	flutes	Insert	Insert Screw	Wrench
THP60-1250-C	1.250	1.250	4.00	1.72	.189	3	HPGT-06T3... HPPT-06T3...	214.80.388	214.80.824 (S/D) 214.80.012 (F/T)
THP60-1500-C	1.500	1.250	4.00	1.72	.189	4			

Remember to use COPASLIP® anti-seize compound on all insert screws



Face Mills with Coolant Through

Designation	d ¹	d ²	h	d.o.c.	flutes	lbs	Insert	Insert Screw	Wrench
Through Coolant Enabled							HPGT-06T3... HPPT-06T3...	214.80.388	214.80.824 (S/D) 214.80.012 (F/T)
THP60-2000-MC	2.000	.750	1.50	.189	5	.70			
THP60-2500-MC	2.500	1.000	1.75	.189	6	1.45			
THP60-3000-MC	3.000	1.000	2.00	.189	7	2.30			
THP60-4000-MC	4.000	1.250	2.00	.189	9	3.85			
Standard Non-Through coolant							HPGT-06T3... HPPT-06T3...	214.80.388	214.80.824 (S/D) 214.80.012 (F/T)
THP60-4000	4.000	1.500	2.00	.189	9	3.40			
THP60-5000	5.000	1.500	2.00	.189	10	5.25			
THP60-6000	6.000	1.500	2.00	.189	12	7.85			

Remember to use COPASLIP® anti-seize compound on all insert screws

THP60 Cutting Data

THP60 (M640)

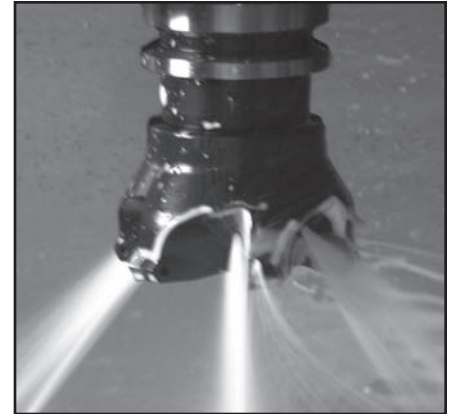
Inserts for THP60 Milling Cutters

Featuring:

- differential pitch insert spacing to provide exceptionally smooth cutting action
- through coolant capable
- minimal axial and radial run-out
- four insert geometries

Available in 7 grades:

- 4 coated carbide grades
- 2 uncoated carbide grades
- 1 cermet grade



LD



GD



AL



3W



LD - for light machining

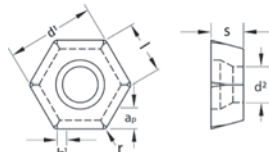
GD - for general face milling in steels and cast irons

AL - optimized for aluminum applications

3W - wiper insert geometry when exceptional surface finish is required (3 wiper edges)

Insert Style / Combination

	Material	Insert	Insert style / combination	ap max (inch)	fz max (inch)	Vc max (RPM)
 $\phi = 1\frac{1}{4}'' + 1\frac{1}{2}''$ $\phi = 2'' - 6''$	Al	HPGT-06T3DZFR-LDAL		.118	.016	8,000
	steel & cast iron	HPGT-06T3DZER-LD		.118	.010	
		HPGT-06T3DZEN-GD & HPGT-06T3DZER-GD3W	+	.180	.010	
		HPGT-06T3DZEN-GD		.180	.010	
		HPPT-06T3DZEN-GD		.180	.014	



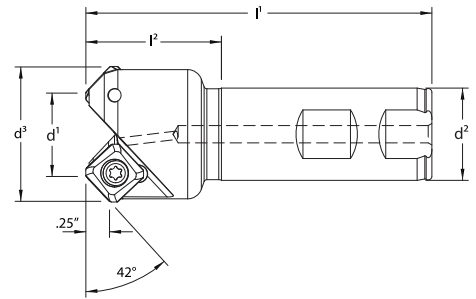
THP60 Inserts

Designation	l	s	r	d ¹	d ²	ap	b ¹	Coated				Uncoated		Cermet	
HPPT-06T3DZEN-GD	.236	.156	.039	.433	.173	.180	-	●	●	●					
HPGT-06T3DZEN-GD	.236	.156	.039	.433	.173	.180	-	●	●	●	●			●	
HPGT-06T3DZEN-GD3W*	.236	.156	.039	.433	.173	.180	.157	●	●	●	●			●	
HPGT-06T3DZER-LD	.236	.156	.039	.433	.173	.118	.098	●	●	●				●	
HPGT-06T3DZFR-LDAL	.236	.156	.039	.433	.173	.118	.079					●	●		

*only use in combination with HPGT....GD

TSN45 (M660)

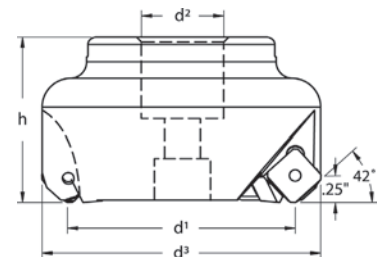
High Shear Milling Cutters



End Mills for High Metal Removal

Designation	d ¹	d ²	d ³	l ¹	l ²	Flutes	Insert	Insert Screw	Wrench
TSN45-1000	1.000	1.000	1.54	3.75	1.47	2	SNKT-1205 SNMT-1205 XNKT-1205	214.80.072	214.80.994 (S/D) 214.80.076 (F/T)
TSN45-1250	1.250	1.250	1.79	4.00	1.72	3			
TSN45-1500	1.500	1.250	2.04	4.00	1.72	4			
TSN45-2000EM	2.000	1.250	2.52	4.00	1.72	4			

Remember to use COPASLIP® anti-seize compound on all insert screws



Face Mills for High Metal Removal

Designation	d ¹	d ²	d ³	h	Flutes	lbs.	Insert	Insert Screw	Wrench
TSN45-2000	2.000	.750	2.52	2.00	4	1.45	SNKT-1205 SNMT-1205 XNKT-1205	214.80.073	214.80.994 (S/D) 214.80.076 (F/T)
TSN45-2500	2.500	1.000	3.02	2.00	5	2.20			
TSN45-3000	3.000	1.000	3.56	2.00	6	3.00			
TSN45-4000	4.000	1.250	4.58	2.00	7	3.70			
TSN45-5000	5.000	1.500	5.52	2.00	8	5.75			
TSN45-6000	6.000	1.500	6.52	2.00	10	8.65			
TSN45-8000*	8.000	2.500	8.52	2.50	12	17.45			

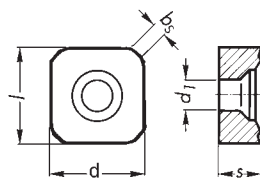
* Cutter supplied with 4 holes on a 4" bolt circle

Remember to use COPASLIP® anti-seize compound on all insert screws



SN_T

XNKT



TSN45 Cutting Data

TSN45 Inserts

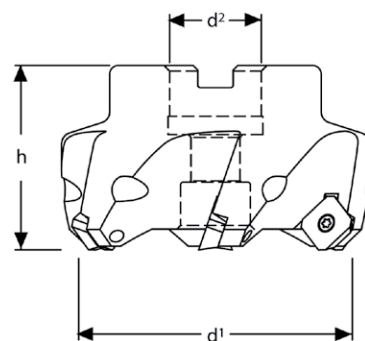
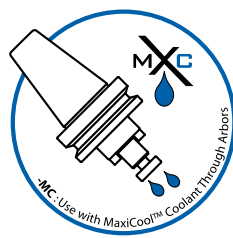
Designation	l	s	r	d	d ¹	bs	TN7525	TN6525	TN7535	TN6540	TN450	TN5515	TN6510	TN6520	TN2510	TTM	TTR	THM	THR	THM-U	TTI-25
SNKT-1205 AZER-20	.500	7/32	--	1/2	.217	.061	●	●	●	●	●	●	●	●	●						●
SNKT-1205 AZR-21	.500	7/32	--	1/2	.217	.061	●					●			●			●			●
SNKT-1205 AZR-31	.500	7/32	--	1/2	.217	.061	●	●	●	●	●	●			●	●					
SNMT-1205 AZR-31	.500	7/32	--	1/2	.217	.061	●	●	●	●	●	●			●	●					
XNKT-1205 AZER-11	.500	7/32	--	1/2	.217	.315	●	●				●			●			●			●
XNKT-1205 AZTR-12	.500	7/32	--	1/2	.217	.315	●					●			●						●

TS45F

Super Positive Milling Cutters

Super milling cutter with 45° entering angle that decreases cutting forces and allows a high feed on limited capacity machines. Inserts are mounted using Torx® locking screws for uninterrupted chip flow.

TS45F cutters use thicker inserts, allowing for high feed rates. This face milling cutter works well on steels, stainless steels, alloyed steels, cast iron and aluminum alloys.



Face Mills

Designation	d ¹	d ²	h	Flutes	lbs	Insert	Insert Screw	Wrench
TS45F-20SE43X-MC	2.000	.750	1.75	4	1.05	SEHT-43 SEHW-43 SEKT-43 SEKW-43	214.80.072	214.80.994 (S/D) 214.80.076 (F/T)
TS45F-25SE43X-MC	2.500	1.000	2.00	5	2.00			
TS45F-30SE43X-MC	3.000	1.000	2.00	6	2.65			
TS45F-40SE43X-MC	4.000	1.250	2.00	7	3.50			
TS45F-50SE43X	5.000	1.500	2.00	8	5.95			
TS45F-60SE43X	6.000	1.500	2.00	9	8.90			

Remember to use COPASLIP® anti-seize compound on all insert screws

TS45F Cutting Data



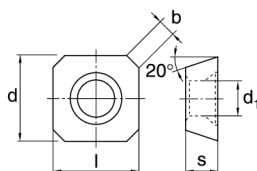
SEHT-ALC



SEHT / SEKT



SEHW / SEKW

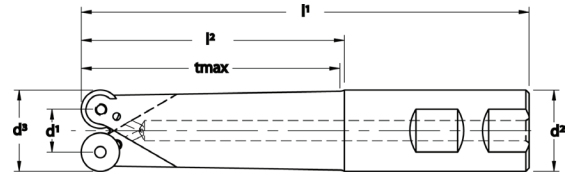
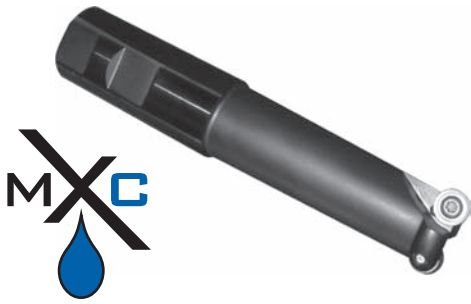


TS45F Inserts

Designation	l	s	r	d	d ¹	b													
							TP30MC	TP40MP	TK10MP								TP25M	TK10M	
							Coated										Uncoated		
SEHT-43 AF	.500	3/16	---	1/2	.217	.062	●												
SEHT-43 AFFN-ALC	.500	3/16	---	1/2	.217	.062											●		
SEHW-43 AF	.500	3/16	---	1/2	.217	.062	●												
SEKT-43 AFSN	.500	3/16	---	1/2	.217	.062	●										●		
SEKW-43 AFSN	.500	3/16	---	1/2	.217	.062	●												

TR360 (M100)

Copy Milling Cutters



End Mills with Coolant Through using 15° Positive Inserts for Profiling & Contouring

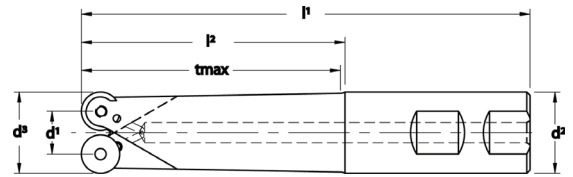
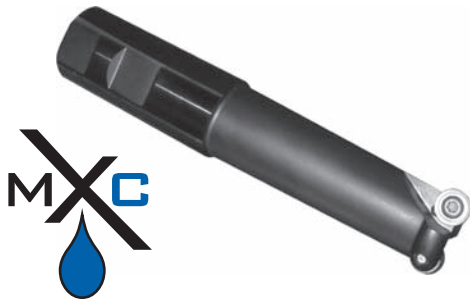
Designation	d ³	d ¹	d ²	l ¹	l ²	tmax	ramp angle	flutes	Insert	Insert Screw	Wrench
TR360-0500-36	.500	.185	.625	3.65	1.74	1.64	10°	1	(8mm insert size) RDMT-0802MOT RDMW-0802MOT RDHT-0802MOT	214.80.013	214.80.866 (S/D) 214.80.011 (F/T)
TR360-0500-44	.500	.185	.625	4.40	2.49	2.39	10°	1			
TR360-0500-51	.500	.185	.625	5.15	3.24	3.14	10°	1			
TR360-0625-36A	.625	.310	.625	3.65	1.74	1.74	10°	1			
TR360-0625-36	.625	.310	.625	3.65	1.74	1.74	60°	2			
TR360-0625-44A	.625	.310	.625	4.40	2.49	2.49	10°	1			
TR360-0625-44	.625	.310	.625	4.40	2.49	2.49	60°	2			
TR360-0625-52A	.625	.310	.750	5.28	3.25	3.14	10°	1			
TR360-0625-52	.625	.310	.750	5.28	3.25	3.14	60°	2			
TR360-0625-60	.625	.310	.750	6.03	4.00	3.89	60°	2			
TR360-0625-70	.625	.310	1.000	7.03	4.75	1.65	60°	2			
TR360-0750-37X	.750	.435	.750	3.78	1.75	1.74	22°	2			
TR360-0750-45X	.750	.435	.750	4.53	2.50	2.40	22°	2			
TR360-0750-55X	.750	.435	1.000	5.53	3.25	3.06	22°	2			
TR360-0750-70X	.750	.435	1.000	7.03	4.75	4.56	22°	2			
TR360-1000R08-47	1.000	.685	1.000	4.78	2.50	2.50	10°	3			
TR360-1000R08-55	1.000	.685	1.000	5.53	3.25	3.25	10°	3			
TR360-1000R08-67	1.000	.685	1.000	6.78	4.50	4.50	10°	3			
TR360-1250R08-47	1.250	.935	1.250	4.78	2.50	2.50	6°	5			
TR360-1250R08-62	1.250	.935	1.250	6.28	4.00	4.00	6°	5			

Remember to use COPASLIP® anti-seize compound on all insert screws

TR360 Cutting Data

TR360 (M100)

Copy Milling Cutters



End Mills with Coolant Through using 15° Positive Inserts for Profiling & Contouring

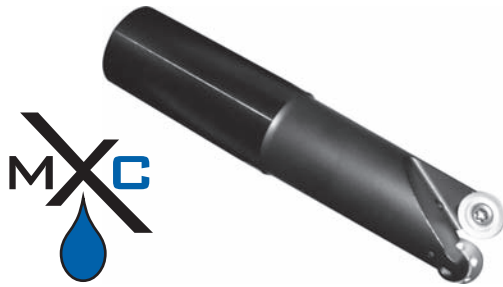
Designation	d ³	d ¹	d ²	l ¹	l ²	t _{max}	ramp angle	flutes	Insert	Insert Screw	Wrench
TR360-0750-37	.750	.356	.750	3.78	1.75	1.74	40°	2	(10mm insert size) RDMT-1003MOT RDMW-1003MOT RDHT-1003MOT	214.80.951	214.80.824 (S/D) 214.80.012 (F/T)
TR360-0750-45	.750	.356	.750	4.53	2.50	2.49	40°	2			
TR360-0750-55	.750	.356	1.000	5.53	3.25	3.06	40°	2			
TR360-0750-62	.750	.356	1.000	6.28	4.00	3.81	40°	2			
TR360-0750-70	.750	.356	1.000	7.03	4.75	4.56	40°	2			
TR360-1000-52X	1.000	.606	1.000	5.28	3.00	2.94	17°	2			
TR360-1000-67X	1.000	.606	1.250	6.78	4.50	4.44	17°	2			
TR360-1000-74X	1.000	.606	1.250	7.46	5.19	5.12	17°	2			
TR360-1000R10-40	1.000	.606	1.000	4.00	1.71	1.71	86°	3			
TR360-1000R10-52	1.000	.606	1.000	5.28	3.00	3.00	94°	3			
TR360-1000R10-67	1.000	.606	1.000	6.78	4.50	4.50	97°	3			
TR360-1250R10-40	1.250	.856	1.250	4.00	1.71	1.71	105°	4			
TR360-1250R10-52	1.250	.856	1.250	5.28	3.00	3.00	109°	4			
TR360-1250R10-67	1.250	.856	1.250	6.78	4.50	4.50	119°	4			
TR360-1000-47	1.000	.528	1.000	4.78	2.50	2.49	50°	2	(12mm insert size) RDMT-1204MOT-X RDMW-1204MOT-X RDHT-1204MOT-X	214.80.388	214.80.824 (S/D) 214.80.012 (F/T)
TR360-1000-55	1.000	.528	1.000	5.53	3.25	3.19	50°	2			
TR360-1000-64	1.000	.528	1.250	6.40	4.12	3.93	50°	2			
TR360-1000-71	1.000	.528	1.250	7.15	4.87	4.68	50°	2			
TR360-1250-54	1.250	.778	1.250	5.40	3.12	3.11	23°	2			
TR360-1250-61	1.250	.778	1.250	6.15	3.87	3.86	23°	2			
TR360-1250-72	1.250	.778	1.500	7.25	4.56	4.34	23°	2			
TR360-1250-80	1.250	.778	1.500	8.00	5.31	5.09	23°	2			
TR360-1500-56X	1.500	1.028	1.250	5.65	3.37	3.25	27°	3			
TR360-1500-71X	1.500	1.028	1.250	7.15	4.87	4.75	27°	3	(16mm insert size) RDMT-1605MOT-X RDMW-1605MOT-X RDHT-1605MOT-X	214.80.072	214.80.994 (S/D) 214.80.076 (F/T)
TR360-1500-54	1.500	.870	1.250	5.40	3.12	3.11	27°	2			
TR360-1500-61	1.500	.870	1.250	6.15	3.87	3.86	27°	2			
TR360-1500-72	1.500	.870	1.500	7.25	4.56	4.56	27°	2			
TR360-1500-80	1.500	.870	1.500	8.00	5.31	5.31	27°	2			

Remember to use COPASLIP® anti-seize compound on all insert screws

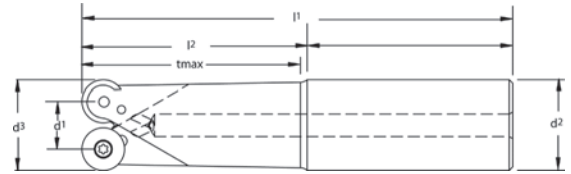
TR360 Cutting Data

TR360 (M100)

Copy Milling Cutters

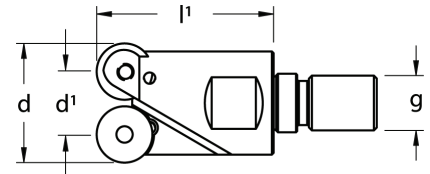


Cylindrical Shank End Mills with Coolant Through using 15° Positive Inserts for Profiling & Contouring



Designation	d ³	d ¹	d ²	l ¹	l ²	tmax	ramp angle	flutes	Insert	Insert Screw	Wrench
TR360CY-0500-36	.500	.185	.625	3.65	1.74	1.64	10°	1	(8mm insert size) RDM_-0802MOT	214.80.013	214.80.866 (S/D) 214.80.011 (F/T)
TR360CY-0500-51	.500	.185	.625	5.15	3.24	3.14	10°	1			
TR360CY-0625-36	.625	.310	.625	3.65	1.74	1.74	60°	2			
TR360CY-0625-44	.625	.310	.625	4.40	2.49	2.49	60°	2			
TR360CY-0625-60	.625	.310	.750	6.03	4.00	3.89	60°	2			
TR360CY-0750-37X	.750	.435	.750	3.78	1.75	1.74	22°	2			
TR360CY-0750-45X	.750	.435	.750	4.53	2.50	2.49	22°	2			
TR360CY-0750-62X	.750	.435	.750	6.28	4.25	4.24	22°	2			
TR360CY-1000-47	1.000	.528	1.000	4.78	2.50	2.49	50°	2	(12mm insert size) RDM_-1204MOT-X	214.80.388	214.80.824 (S/D) 214.80.012 (F/T)
TR360CY-1000-71	1.000	.528	1.250	7.15	4.87	4.68	50°	2			

Remember to use COPASLIP® anti-seize compound on all insert screws



Screw-On Milling Cutters using 15° Positive Inserts for Copying & Face Milling

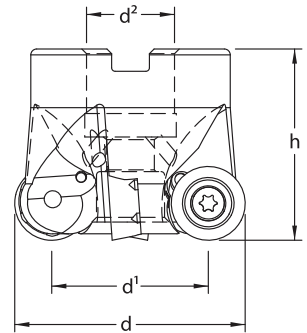
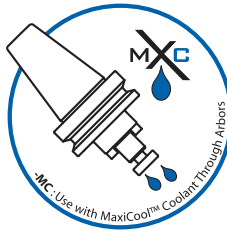
Designation	d	d mm	d ¹	g	l ¹	flutes	Insert	Insert Screw	Wrench
TR360-0500-TS	.500	12.70	.185	M6	1.10	1	(8mm insert size) RDM_-0802MOT	214.80.013	214.80.866 (S/D) 214.80.011 (F/T)
TR360-0500L-TS	.500	12.70	.185	M8	2.00	1			
TR360-0625-TS	.625	15.87	.310	M8	1.10	2			
TR360-0750-TS	.750	19.05	.435	M10	1.18	2			
TR360-1000R08-TS	1.000	25.40	.685	M12	1.50	3			
TR360-1250R08-TS	1.250	31.75	.935	M16	1.75	5	(10mm insert size) RDM_-1003MOT	214.80.951	214.80.824 (S/D) 214.80.012 (F/T)
TR360-0984-TS	.984	25.00	.591	M12	1.18	2			
TR360-1000R10-TS	1.000	25.40	.606	M12	1.50	3			
TR360-1181-TS	1.181	30.00	.787	M16	1.57	3	(12mm insert size) RDM_-1204MOT-X	214.80.388	214.80.824 (S/D) 214.80.012 (F/T)
TR360-1250R10-TS	1.250	31.75	.856	M16	1.75	4			
TR360-0945-TS	.945	24.00	.472	M12	1.18	2			
TR360-1000-TS	1.000	25.40	.528	M12	1.50	2			
TR360-1250-TS	1.250	31.75	.778	M16	1.75	2			
TR360-1378-TS	1.378	35.00	.906	M16	1.57	3	(16mm insert size) RDM_-1605MOT-X	214.80.072	214.80.994 (S/D) 214.80.076 (F/T)
TR360-1500-TS	1.500	38.10	1.028	M16	1.75	3			
TR360-1575-TS	1.575	40.00	1.102	M16	1.57	4			
TR360-1260-TS	1.260	32.00	.630	M16	1.57	2	(16mm insert size) RDM_-1605MOT-X	214.80.072	214.80.994 (S/D) 214.80.076 (F/T)

Remember to use COPASLIP® anti-seize compound on all insert screws

TR360 Cutting Data

TR360 (M100)

Copy Milling Cutters



Face Mills using 15° Positive Inserts for Copying & Face Milling

Designation	d	d¹	d²	h	ramp angle	flutes	lbs	Insert	Insert Screw	Wrench
Through Coolant Enabled								(8mm insert size) RDM_-0802MOT	214.80.013	214.80.866 (S/D) 214.80.011 (F/T)
TR360-2RD08-MC	2.000	1.685	.750	1.63	1.8°	7	.85			
TR360-2RD10-MC	2.000	1.606	.750	1.63	4	5	.65	(10mm insert size) RDM_-1003MOT	214.80.951	214.80.824 (S/D) 214.80.012 (F/T)
TR360-2.5DR10-MC	2.500	2.106	1.000	1.75	3	6	1.20			
TR360-3RD10-MC	3.000	2.608	1.000	2.00	2.5°	8	2.00			
TR360-2RD12-MC	2.000	1.528	.750	1.63	10°	4	.65	(12mm insert size) RDM_-1204MOT-X	214.80.388	214.80.824 (S/D) 214.80.012 (F/T)
TR360-2RD12F-MC	2.000	1.528	.750	1.63	10°	5	.65			
TR360-2.5RD12F-MC	2.500	2.028	1.000	1.75	8°	6	1.20			
TR360-3RD12F-MC	3.000	2.528	1.000	2.00	5°	7	2.00			
TR360-2RD16-MC	2.000	1.370	.750	1.63	12°	3	.55	(16mm insert size) RDM_-1605MOT-X	214.80.072	214.80.994 (S/D) 214.80.076 (F/T)
TR360-2.5RD16-MC	2.500	1.870	1.000	1.75	8°	4	1.05			
TR360-3RD16-MC	3.000	2.370	1.000	2.00	11°	5	1.65			
TR360-4RD16-MC	4.000	3.370	1.250	2.00	7°	6	2.55			
Standard Non Through Coolant										
TR360-6RD16	6.000	5.370	1.500	2.00	7°	7	6.65			
TR360-8RD16*	8.000	7.370	2.000	2.50	8°	8	12.75			
* Cutter supplied with 4 holes on a 4" bolt circle										

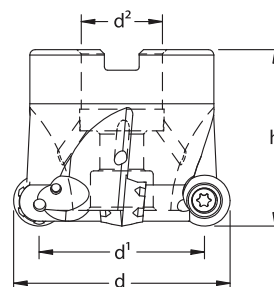
* Cutter supplied with 4 holes on a 4" bolt circle

Remember to use COPASLIP® anti-seize compound on all insert screws

TR360 Cutting Data

TR360 (M100)

Copy Milling Cutters



Face Mills using 7° Positive Inserts for Milling, Duplicating, & Drilling

Designation	d	d¹	d²	h	ramp angle	flutes	lbs	Insert	Insert Screw	Wrench
Through Coolant Enabled								(16mm insert size) RCMT-1606MOT-X RCMT-1606MO-43M	214.80.072	214.80.994 (S/D) 214.80.076 (F/T)
TR360-2RC16-MC	2.000	1.370	.750	1.63	12°	3	.60			
TR360-2.5RC16-MC	2.500	1.870	1.000	1.75	8°	4	1.10			
TR360-3RC16-MC	3.000	2.370	1.000	2.00	11°	5	1.70			
TR360-3RC16X-MC	3.000	2.370	1.250	2.00	11°	5	2.60			
TR360-4RC16-MC	4.000	3.370	1.250	2.00	7°	7	2.60			
TR360-4RC16X-MC	4.000	3.370	1.500	2.00	7°	7	2.65			
Standard Non Through Coolant										
TR360-6RC16	6.000	5.370	1.500	2.00	7°	9	6.60			
TR360-6RC16X	6.000	5.370	2.000	2.50	7°	9	7.15			
TR360-8RC16*	8.000	7.370	2.000	2.50	8°	11	14.25			
TR360-8RD16*	8.000	7.370	2.000	2.50	8°	8	12.75			
* Cutter supplied with 4 holes on a 4" bolt circle										

* Cutter supplied with 4 holes on a 4" bolt circle

Remember to use COPASLIP® anti-seize compound on all insert screws

TR360 Cutting Data

TR360 (M100)

Inserts for TR360 Copy Milling Cutters

RCMT-43 - Free-cutting geometry for roughing and finishing, provides excellent surface finish. Outstanding chip control, especially with light depths of cut. Preferred geometry for alloy and plain carbon steels.

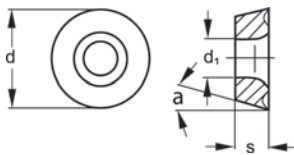
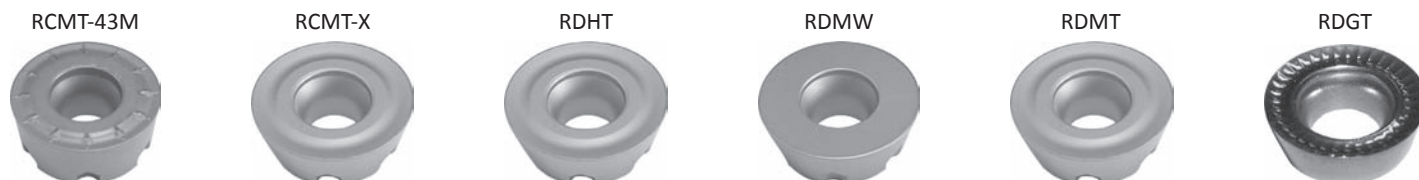
RCMT - Particularly used for face and drill milling, or in particularly rigid conditions.

RDHT - Tolerance class H with ground diameter of $\pm 13 \mu\text{m}$ tolerance for semi-finishing and finishing.

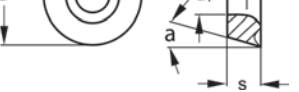
RDMT - Particularly for milling with long overhangs

RDMW - Ideal for vibration-prone applications because the insert is less positive.

RDGT - Highly positive geometry with polished rake face giving reduced cutting forces. Ideal for non-ferrous materials.



TR360 Inserts



Designation	l	s	r	d	d'	a	Coated								Uncoated				Cermet		
							TN7525	TN6525	TN7535	TN6540	TN450	TN5515	TN6520	TN2510	THAL	TTM	TTR	THM	TK10M		
7° Inserts																					
RCMT-1606MO-43M*	--	1/4	--	.630	.217	7°	●	●	●	●	●	●	●	●						●	
RCMT-1606MOT-X*	--	1/4	--	.630	.217	7°	●		●		●	●	●							●	
15° Inserts																					
RDGT-0802MO-AL	--	3/32	--	.315	.134	15°													●		
RDGT-1003MO-AL	--	1/8	--	.394	.173	15°													●		
RDHT-0802MOT	--	3/32	--	.315	.134	15°	●				●										
RDHT-1003MOT	--	1/8	--	.394	.173	15°	●				●					●					
RDHT-1204MOT-X*	--	3/16	--	.472	.173	15°	●					●				●					●
RDHT-1605MOT-X*	--	7/32	--	.630	.217	15°	●					●									●
RDMT-0802MOT	--	3/32	--	.315	.134	15°	●	●	●	●	●					●		●			
RDMT-1003MOT	--	1/8	--	.394	.173	15°	●	●		●	●					●		●			
RDMT-1204MOT-X*	--	3/16	--	.472	.173	15°	●	●		●	●					●		●			
RDMT-1605MOT-X*	--	7/32	--	.630	.217	15°	●	●	●	●	●					●		●			
RDMW-0802MOT	--	3/32	--	.315	.134	15°			●	●	●	●		●	●	●		●			
RDMW-1003MOT	--	1/8	--	.394	.173	15°	●		●	●	●	●		●	●	●		●			●
RDMW-1204MOT-X*	--	3/16	--	.472	.173	15°	●		●	●	●	●		●	●	●		●			
RDMW-1605MOT-X*	--	7/32	--	.630	.217	15°	●		●	●	●	●		●		●		●			

* Inserts have anti-rotation lock

Roughing Ball Nose Milling Cutters

Roughing Ball Nose Cutters Cover a Wide Range of Applications

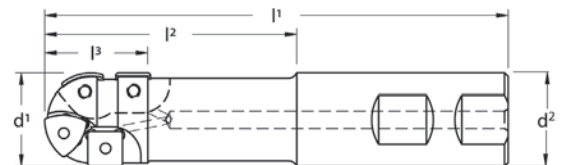
Performance and Versatility

The TBNR copy-milling cutter works equally well on conventional milling machines, copy milling machines and NC machines.

Mainly employed in the production of molds and dies, this universal tool is also proven in volume production, e.g. in housing manufacture. It not only performs all kinds of copy-milling operations, but can also plunge-cut at an angle. Its capabilities even include drilling from the solid. The key to this exemplary versatility lies in the cutter design and in the special arrangement of the indexable inserts.

The TBNR can also be fitted with precision-ground inserts if required. The inserts are held in place by countersunk screws, ensuring optimum chip flow since there are no interfering top clamping elements.

The TBNR ball nose copy-milling cutter is supplied in diameters ranging from 5/8" to 2".



End Mills with Coolant Through

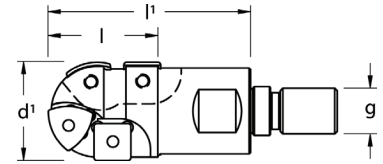
Designation	d	d ¹	d ²	l ²	l ³	Insert		Insert Screw	Screw Driver Type Wrench
Regular Length						Radius (QTY.)	Square (QTY.)		
TBNR-0625R	.625	.750	3.50	1.47	.71	222.67.102 (2)	SPNX-21.51 (2)	214.80.061(Rad.) 214.80.687(Sq.)	214.80.059 214.80.866
TBNR-0750R	.750	.750	4.00	1.97	.75	222.67.104 (2)	SPNX-21.51 (2)	214.80.687	214.80.866
TBNR-1000R	1.000	1.000	4.00	1.72	1.11	222.67.106 (2)	SDNT-322 (2)	214.80.951	214.80.824
TBNR-1250R	1.250	1.250	5.00	2.72	1.22	222.67.108 (2)	SDNT-322 (2)	214.80.388	214.80.824
TBNR-1500R	1.500	1.250	5.00	2.72	1.37	222.67.112 (2)	SDNT-322 (2)	214.80.388	214.80.824
TBNR-2000R	2.000	2.000	6.25	3.00	1.81	222.67.114 (3)	SPNT-432 (2)	214.80.072	214.80.994
Extended Length									
TBNR-0625	.625	.750	4.00	1.97	.71	222.67.102 (2)	SPNX-21.51 (2)	214.80.061(Rad.) 214.80.687(Sq.)	214.80.059 214.80.866
TBNR-0750	.750	.750	5.00	2.97	.75	222.67.104 (2)	SPNX-21.51 (2)	214.80.687	214.80.866
TBNR-1000	1.000	1.000	5.00	2.72	1.11	222.67.106 (2)	SDNT-322 (2)	214.80.951	214.80.824
TBNR-1250	1.250	1.250	6.00	3.72	1.22	222.67.108 (2)	SDNT-322 (2)	214.80.388	214.80.824
TBNR-1500	1.500	1.250	6.00	3.72	1.38	222.67.112 (2)	SDNT-322 (2)	214.80.388	214.80.824
TBNR-2000	2.000	2.000	7.25	4.00	1.81	222.67.114 (3)	SPNT-432 (2)	214.80.072	214.80.994
Extra Long Length									
TBNR-2000LX	2.000	2.000	10.00	6.75	1.81	222.67.114 (3)	SPNT-432 (3)	214.80.072	214.80.994
TBNR-2000L	2.000	2.000	10.00	6.75	3.00	222.67.114 (3)	SPNT-432 (5)	214.80.072	214.80.994

Remember to use COPASLIP® anti-seize compound on all insert screws

TBNR Cutting Data

TBNR (M28)

Roughing Ball Nose Milling Cutters

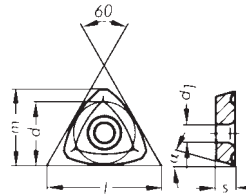


Screw-On Milling Cutters

Designation	d1	g	l1	l	flutes	Insert		Insert Screw	Screw Driver Type Wrench
						Radius (QTY.)	Square (QTY.)		
TBNR-0625-TS	.625	M8	1.50	.71	1	222.67.102 (2)	SPNX-21.51 (2)	214.80.061(Rad.) 214.80.687(Sq.)	214.80.059 214.80.866
TBNR-0750-TS	.750	M10	1.50	.75	1	222.67.104 (2)	SPNX-21.51 (2)	214.80.687	214.80.866
TBNR-1000-TS	1.000	M12	2.00	1.10	1	222.67.106 (2)	SDNT-322 (2)	214.80.951	214.80.824
TBNR-1250-TS	1.250	M16	1.75	1.22	1	222.67.108 (2)	SDNT-322 (2)	214.80.388	214.80.824

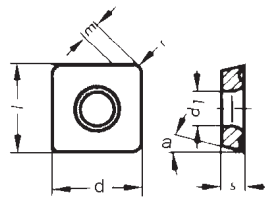
Remember to use COPASLIP® anti-seize compound on all insert screws

TBNR Cutting Data



TBNR Radius Inserts

																TN7525	TN6525	TN7535	TN6540	TN450	TN5515	TN6510	TN6520	TN2510	TTM	TTR	THM	THR	THM-U	TTI-25
Designation	l	s	r	d	d'	m	a	Coated								Uncoated					Cermet									
222.67.102 (5/8")	---	3/32	---	7/32	.100	.263	11°	●		●							●	●	●	●										
222.67.104 (3/4")	---	7/64	---	1/4	.110	.303	11°	●		●							●	●	●	●										
222.67.106 (1")	---	1/8	---	3/8	.173	.446	15°	●	●	●	●	●					●	●	●	●										
222.67.108 (1¼")	---	3/16	---	13/32	.173	.500	15°	●		●		●					●	●	●	●										
222.67.112 (1½")	---	3/16	---	1/2	.173	.611	11°										●	●	●											
222.67.114 (2")	---	3/16	---	1/2	.217	.593	11°	●		●							●	●												



TBNR Square Inserts

								TN7525	TN6525	TN7535	TN6540	TN450	TN5515	TN6510	TN6520	TN2510	TTM	TTR	THM	THR	THM-U	TTI-25
Designation	l	s	r	d	d'	m	a	Coated								Uncoated				Cermet		
SDNT-322	.375	1/8	1/32	3/8	.173	.065	15°	●		●		●	●			●	●	●	●			
SPNT-432	.500	3/16	1/32	1/2	.217	.091	11°	●		●		●				●	●	●	●			
SPNX-21.51	.250	7/64	1/64	1/4	.110	.045	11°	●		●						●	●	●	●			

Finishing Ball Nose Cutters

M270 Finish Mill Series

... Specifically engineered to streamline your finish milling operations!

Performance Features:

The indexable insert has two flutes covering an arc of 230° to give a wider range of applications when compared with tools having semicircular inserts.

Outstanding cutting performance is guaranteed by exact insert positioning and secure screw locking. The positive cutting edge geometry results in superior surface finishes, especially on inclined work surfaces. All inserts are precision ground to ensure precise milling of workpiece contours.

The RH insert, being precision ground all over, meets the most exacting demands. Together with our TBNR ball-nose cutter for roughing, there is now a complete and cost-effective contour milling system available from one source.

Range:

A choice of five cutter diameters from 3/8" to 1" are available in two popular shank styles. To allow you to select the best cutting material for your operation, four different grades are available, from the high-productivity grade TN6525 to the proven hardmetal grades TTM and THM.

For the finish milling of parts with convex and concave contours, we now offer a line of replaceable insert ballnose cutters that completely fulfill toolmakers' needs. Offering outstanding cost-efficiency, the M270 ball-nose finishing mill replaces conventional solid and brazed end mills in the manufacture of molds and dies.



Extended Length Steel Shank End Mill with Cylindrical Shank

Designation	Ø d ¹	d ²	l ¹	l ²	Insert	Insert Screw	Wrench
M270B-D037C050-L550	.375	.500	5.550	1.800	M270BR/BF-0375/10MM	274.86.105	274.97.262
M270B-D050C050-L575	.500	.500	5.750	2.000	M270BR/BF-0500/12MM	274.86.106	274.97.262
M270B-DC062C062-L600	.625	.625	6.000	2.300	M270BR/BF-0625/16MM	274.86.107	274.97.993
M270B-D075C075-L700	.750	.750	7.000	2.800	M270BR/BF-0750/20MM	274.86.108	274.97.993
M270B-D100C100-L800	1.000	1.000	8.000	3.500	M270BR/BF-1000/25MM	274.86.109	274.97.898

Remember to use COPASLIP® anti-seize compound on all insert screws

Extended Length Carbide Shank End Mill with Cylindrical Shank

Designation	Ø d ¹	d ²	l ¹	l ²	Insert	Insert Screw	Wrench
M270B-D037C050-L550C	.375	.500	5.550	1.800	M270BR/BF-0375/10MM	274.86.105	274.97.262
M270B-D050C050-L575C	.500	.500	5.750	2.000	M270BR/BF-0500/12MM	274.86.106	274.97.262
M270B-DC062C062-L600C	.625	.625	6.000	2.300	M270BR/BF-0625/16MM	274.86.107	274.97.993
M270B-D075C075-L700C	.750	.750	7.000	2.800	M270BR/BF-0750/20MM	274.86.108	274.97.993
M270B-D100C100-L800C	1.000	1.000	8.000	3.500	M270BR/BF-1000/25MM	274.86.109	274.97.898

Remember to use COPASLIP® anti-seize compound on all insert screws

M270 Cutting Data

Inserts for M270 Finishing Ball Nose Cutters

- Ball Nose, Torus Back Draft and High FEED inserts
- Highly accurate inserts and rigid clamping systems
- Torus and High FEED inserts use the same holder
- V-shape pocket and insert design for a higher rigidity
- Easy and precise assembly
- HF insert diameters providing more shank clearance

Highest accuracy on insert tolerances

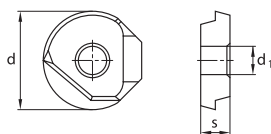
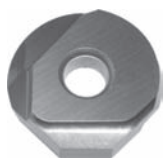
For process reliability and higher performance

HF High FEED inserts as standard offering

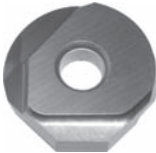
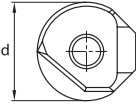
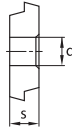
Performance booster in roughing applications

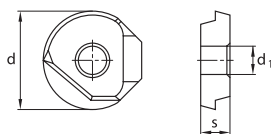
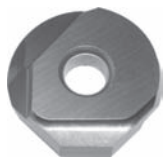
Steel and Carbide Shanks available

Maximum stability and accuracy in every milling situation

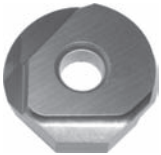
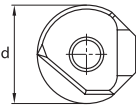
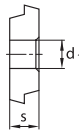


M270 Inserts - Inch

																					M270 Inserts - Inch														
							TN7525	TN6525	TN7535	TN6540	TN450	TN5515	TN2505	TN2510	TN2525	TTM	TTR	THM	THR	THM-U				TTI-25											
Designation	l	s	r	d	d¹	m	Coated								Uncoated					Cermet															
M270BR-0375	--	.094	--	.375	.138	--			●					●																					
M270BR-0500	--	.125	--	.500	.138	--			●					●																					
M270BR-0625	--	.187	--	.625	.181	--			●					●																					
M270BR-0750	--	.187	--	.750	.181	--			●					●		●																			
M270BR-1000	--	.187	--	1.000	.220	--			●					●																					
M270BF-0375	--	.094	--	.375	.138	--							●		●																				
M270BF-0500	--	.125	--	.500	.138	--							●		●																				
M270BF-0625	--	.187	--	.625	.181	--							●																						
M270BF-0750	--	.187	--	.750	.181	--							●		●	●																			
M270BF-1000	--	.187	--	1.000	.220	--							●																						



M270 Inserts - METRIC

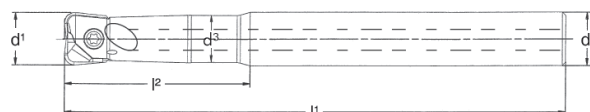
					M270 Inserts - METRIC																	
					TN7525	TN6525	TN7535	TN6540	TN450	TN5515	TN2505	TN2510	TN2525	TTM	TTR	THM	THR	THM-U	TTI-25			
Designation	l	s	r	d	d¹	m	Coated								Uncoated					Cermet		
M270BR-10MM	--	.094	--	.394	.138	--	●		●					●		●						
M270BR-12MM	--	.125	--	.472	.138	--	●		●	●				●		●						
M270BR-16MM	--	.187	--	.630	.181	--	●		●	●				●		●						
M270BR-20MM	--	.187	--	.787	.181	--	●		●	●				●		●						
M270BR-25MM	--	.187	--	.984	.220	--	●		●					●		●						
M270BR-32MM	--	.187	--	1.260	.260	--	●		●					●		●						
M270BF-10MM	--	.094	--	.394	.138	--							●	●			●					
M270BF-12MM	--	.125	--	.472	.138	--		●						●	●		●					
M270BF-16MM	--	.187	--	.630	.181	--		●						●	●		●				●	
M270BF-20MM	--	.187	--	.787	.181	--		●						●	●		●					
M270BF-25MM	--	.187	--	.984	.220	--								●	●		●				●	
M270BF-32MM	--	.187	--	1.260	.260	--								●	●			●				

Finishing Corner Radius End Mills

- The industry's premier cutter for high performance line-by-line finish milling
- Perform semi-finishing and finishing operations with one milling system
- Highly accurate, with axial runout of $\pm .0004$ and radial runout of $\pm .0001$
- Easy and accurate clamping system
- Expanded offering of corner radii inserts now available



**New
Addition!**



Corner Radius End Mill with Straight Shank Backdraft

Designation	$\varnothing d^1$	d^2	d^3	l^1	l^2	Insert	Insert Screw	Wrench
M270T-D037C037-L555	.375	.375	.345	5.550	1.800	M270TF-0375R0031 M270TF-10R__ M270HF-0375	274.86.105	274.97.262
M270T-D050C050-L575	.500	.500	.417	5.750	2.000	M270TF-0500R0063 M270TF-12R__ M270HF-0500	274.86.106	274.97.262
M270T-D062C062-L600	.625	.625	.559	6.000	2.300	M270TF-0625R0126 M270TF-16R__ M270HF-0625	274.86.107	274.97.993
M270T-D075C075-L700	.750	.750	.707	7.000	2.800	M270TF-0750R0126 M270TF-20R__ M270HF-0750	274.86.108	274.97.993

Remember to use COPASLIP® anti-seize compound on all insert screws

Corner Radius End Mill with Straight Carbide Shank Backdraft

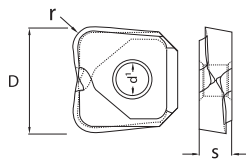
Designation	$\varnothing d^1$	d^2	d^3	l^1	l^2	Insert	Insert Screw	Wrench
M270T-D037C050-L555C	.375	.500	.345	5.550	1.800	M270TF-0375R0031 M270TF-10R__ M270HF-0375	274.86.105	274.97.262
M270T-D050C050-L575C	.500	.500	.417	5.750	2.000	M270TF-0500R0063 M270TF-12R__ M270HF-0500	274.86.106	274.97.262
M270T-D062C062-L600C	.625	.625	.559	6.000	2.300	M270TF-0625R0126 M270TF-16R__ M270HF-0625	274.86.107	274.97.993
M270T-D075C075-L700C	.750	.750	.707	7.000	2.800	M270TF-0750R0126 M270TF-20R__ M270HF-0750	274.86.108	274.97.993

Remember to use COPASLIP® anti-seize compound on all insert screws

M270 Cutting Data

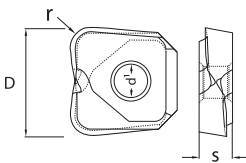
M270 Cutting Data - HF

Inserts for M270 Finishing Toroidal Cutters



M270 Inserts - TF - Inch

Designation	D	s	r	d'	D.O.C.	Coated						Uncoated					Cermet	
M270TF-0375R0031	.375	.094	.031	.138	.031							●						
M270TF-0500R0063	.500	.125	.063	.138	.063							●						
M270TF-0625R0095	.625	.187	.095	.181	.095							●						
M270TF-0750R0126	.750	.187	.126	.181	.126							●						

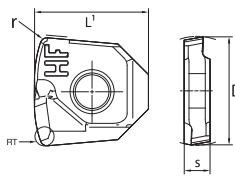


M270 Inserts - TF - Metric

Designation	D	s	r	d'	D.O.C.	Coated						Uncoated					Cermet	
M270TF-10R03	10mm	.094	.012	.138	.012							●						
M270TF-10R05			.020		.020							●						
M270TF-10R1			.040		.040						●							
M270TF-12R03	12mm	.125	.012	.138	.012							●						
M270TF-12R05			.020		.020							●						
M270TF-12R1			.040		.040							●						
M270TF-12R2			.079		.079						●							
M270TF-16R03	16mm	.187	.012	.181	.012							●						
M270TF-16R05			.020		.020							●						
M270TF-16R1			.040		.040							●						
M270TF-16R2			.079		.079							●						
M270TF-16R3			.118		.118						●							
M270TF-20R03	20mm	.187	.012	.181	.012							●						
M270TF-20R05			.020		.020							●						
M270TF-20R1			.040		.040							●						
M270TF-20R2			.079		.079							●						
M270TF-20R3			.118		.118						●							



**High Feed
Inserts**



M270 Inserts - HF - Inch

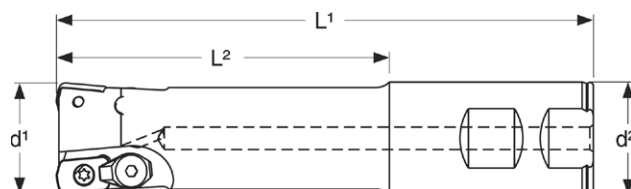
Designation	D	S	R	RT	D.O.C. max	d'	Coated						Uncoated					Cermet	
M270HF-0375	.375	.094	.023	.044	.024	.138				●		●							
M270HF-0500	.500	.125	.031	.057	.024	.138				●		●							
M270HF-0625	.625	.187	.039	.070	.035	.181				●		●							
M270HF-0750	.750	.187	.047	.090	.043	.181				●		●							

"RT" = Programming Radius

TXD95

High Feed Milling Cutters

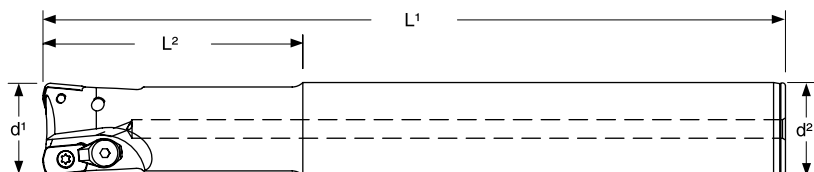
Remarkably high metal removal rates are delivered by the new TXD95 High Feed mills. Feed ranges of 0.050" to 0.060" per tooth are easily achieved in tool and mold steels with reduced chatter and vibration during machining of deep cavities. The TXD95 High Feed mills will completely change your approach to material removal.



End Mills

Designation	d ¹	d ²	L ¹	L ²	flutes	Insert	Clamp	Clamp Screw	Torx Screw	Torx Wrench
TXD95HF-1250C	1.250	1.250	6.00	3.719	2	XDGW-1604HO XDGW-1604H20 XDGW-1604TH05 XDGW-1604TH20	214.85.892	214.85.898	214.80.388	214.80.824
TXD95HF-1500C	1.500	1.250	6.00	3.719	3					

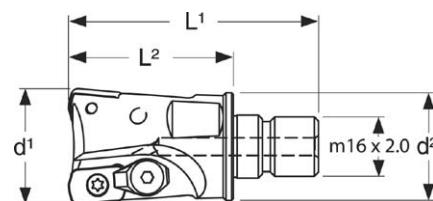
Remember to use COPASLIP® anti-seize compound on all insert screws



Cylindrical Shank End Mills

Designation	d ¹	d ²	L ¹	L ²	flutes	Insert	Clamp	Clamp Screw	Torx Screw	Torx Wrench
TXD95HFCY-1250-XLC	1.250	1.250	10.00	3.700	2	XDGW-1604HO XDGW-1604H20 XDGW-1604TH05 XDGW-1604TH20	214.85.892	214.85.898	214.80.388	214.80.824
TXD95HFCY-1500-XLC	1.500	1.250	10.00	2.500	3					

Remember to use COPASLIP® anti-seize compound on all insert screws



Screw-On Milling Cutters

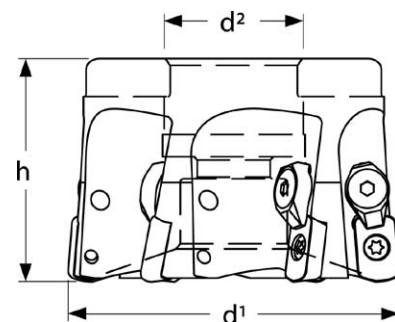
Designation	d ¹	d ²	L ¹	L ²	flutes	Insert	Clamp	Clamp Screw	Torx Screw	Torx Wrench
TXD95HF-1250-TS	1.250	1.142	2.65	1.75	2	XDGW-1604HO XDGW-1604H20 XDGW-1604TH05 XDGW-1604TH20	214.85.892	214.85.898	214.80.388	214.80.824
TXD95HF-1500-TS	1.500	1.142	3.03	2.12	3					

Remember to use COPASLIP® anti-seize compound on all insert screws

TXD95

High Feed Milling Cutters

- High feed rates
- Reduced power consumption
- Reduced chatter / vibration
- Smooth cutting action even while fully extended from spindle
- Depth of cut up to .080"
- New nickel finish for improved surface wear and chip evacuation
- Excellent grade selection (9 grades available)
- Innovative insert design with reinforced cutting edge
- Unique top clamp design provides excellent insert stability for extended tool life



Face Mills

Designation	d ¹	d ²	h	flutes	Insert	Clamp	Clamp Screw	Torx Screw	Torx Wrench
TXD95HF-2000	2.000	.750	1.75	4	XDGW-1604HO XDGW-1604H20 XDGW-1604TH05 XDGW-1604TH20	214.85.892	214.85.898	214.80.388	214.80.824
TXD95HF-2500	2.500	1.000	1.75	5					
TXD95HF-3000	3.000	1.250	2.00	6					
TXD95HF-4000	4.000	1.500	2.00	7					

Remember to use COPASLIP® anti-seize compound on all insert screws

TP765A (HC-P25)

First choice for steel applications. Good balance of wear resistance, toughness and edge strength. The coating is AlTiN for high performance milling in steel. Must be run dry.

TP745T (HC-P40)

For steel applications where greater toughness is required (i.e. scale or severe interruption). The substrate for this grade is very tough, making it the perfect choice for unfavourable conditions. The coating is TiAlN for high performance milling in steel. This grade can be run dry or wet.

TP765T (HC-P25)

Similar to TP765A using the same substrate but with TiAlN coating. This grade can be run dry or wet.

TP745A (HC-P40)

Similar to TP745T using the same tough substrate but with AlTiN coating for harder materials and high temperature conditions. This grade must be run dry.

TK532T (HC-K15)

For machining of cast irons and austenitic (300 and PH series) stainless steels. High wear resistance, with a micro grain substrate, suitable for abrasive materials. The coating is TiAlN. This grade can be run dry or wet.

TK532A (HC-K15)

Very similar to TK532T but with AlTiN coating. This grade must be run dry.

TK209A (HC-K30)

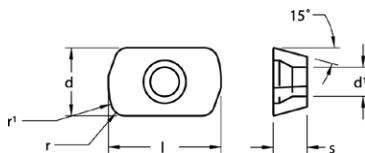
Very wear resistant AlTiN grade with a micro grain substrate designed for machining of hardened steels and chilled cast irons. High cutting speed can be achieved even on pre-hardened mold and die steels.

TK209T (HC-K30)

Very similar to TK209A but with TiAlN coating.

TK532 (HW-K15)

This uncoated grade is for machining of aluminum and other non-ferrous materials. Also suitable for short chipping cast irons when an uncoated grade is desired.

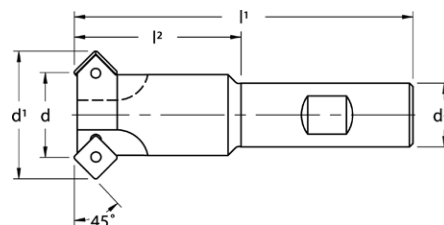


TXD95 Inserts

Designation	l	s	r	r ¹	d	d ¹	T-Land	Hone	TP765A	TP765T	TP745A	TP745T	TK532A	TK532T	TK209A	TK209T	TK532	TTI-25
XDGW-1604H0	.625	.1875	.078	.375	.375	.160	--	--										
XDGW-1604H20							--	.002"										
XDGW-1604TH05							.010" x 20°	.0005"	●	●								
XDGW-1604TH20							.010" x 20°	.002"			●	●						

TS45

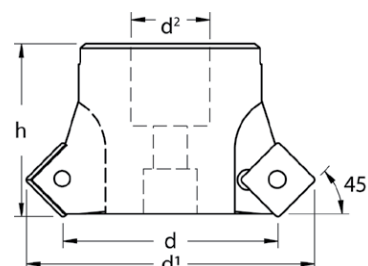
45° Chamfer Milling Cutters



End Mills

Designation	d	d ¹	d ²	l ¹	l ²	Flutes	Chamfer Min-Max	Insert	Insert Screw	Wrench
Regular Length										
TSD45-0625	.625	1.130	.750	3.00	.97	2	.67 - 1.11	SDMW-322 SDNT-322	214.80.951	214.80.824 (S/D) 214.80.012 (F/T)
TSD45-0750	.750	1.255	.750	3.30	1.27	2	.79 - 1.235			
TSD45-1000	1.000	1.505	.750	4.00	1.97	2	1.04 - 1.48			
TSD45-1250	1.250	1.755	1.250	4.00	1.72	3	1.29 - 1.73			
TSP45-1500	1.500	2.182	1.250	4.00	1.72	3	1.54 - 2.11	SPMW-432 SPNT-432	214.80.072	214.80.994 (S/D) 214.80.076 (F/T)
Extended Length										
TSD45-0625-L	.625	1.130	.750	8.00	1.49	2	.67 - 1.11	SDMW-322 SDNT-322	214.80.951	214.80.824 (S/D) 214.80.012 (F/T)
TSD45-1000-L	1.000	1.505	1.000	8.00	1.49	2	1.04 - 1.48			

Remember to use COPASLIP® anti-seize compound on all insert screws



Face Mills

Designation	d	d ¹	d ²	h	Flutes	Chamfer Min-Max	Insert	Insert Screw	Wrench
TSP45-2000	2.000	2.680	.750	1.60	4	2.04 - 2.66	SPMW-432 SPNT-432	214.80.072	214.80.076 (F/T) 214.80.994 (S/D)

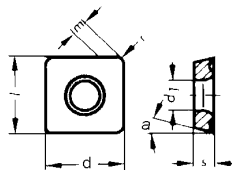
Remember to use COPASLIP® anti-seize compound on all insert screws

TS45 Cutting Data



SDMW / SPMW

SDNT / SPNT

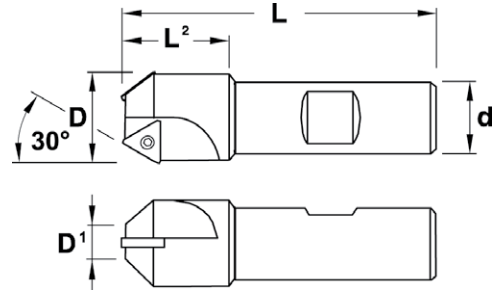


TS45 Inserts

TN7525	TN6525	TN7535	TN6540	TN450	TN5515	TN6510	TN6520	TN2510	TTM	TTR	THM	THR	THM-J	TTI-25
Coated									Uncoated			Cermet		
●									●	●	●			
				●					●	●	●	●		
●		●		●	●			●	●	●	●			
●		●		●				●	●	●	●			

TT30E / TT45E

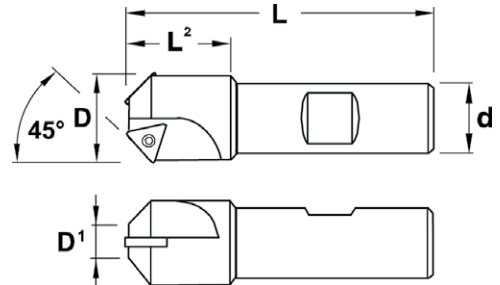
Chamfer & Countersink Milling Cutters



Style "A" - 30°

Designation	D	D'	d	L	L ²	Flutes	Insert	Insert Screw	Wrench
TT30E-062TC2	.625	.213	.500	2.75	.94	1	TCM_-21.5_	C-1425	C-5507
TT30E-102TC2	1.020	.622	.750	3.54	1.18	2			

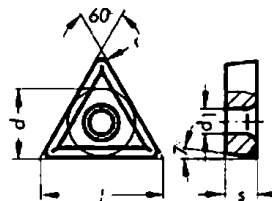
Remember to use COPASLIP® anti-seize compound on all insert screws



Style "B" - 45°

Designation	D	D'	d	L	L ²	Flutes	Insert	Insert Screw	Wrench
TT45E-062TC2	.625	.047	.500	2.75	.94	1	TCM_-21.5_	C-1425	C-5507
TT45E-083TC2	.830	.244	.750	3.54	1.10	2			

Remember to use COPASLIP® anti-seize compound on all insert screws



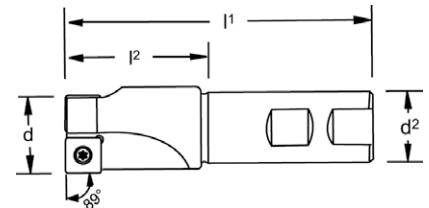
TT30E/TT45E Inserts

Designation	l	s	r	d	d'	Coated						Uncoated			Cermet	
TCMT-21.51	.433	3/32	1/64	1/4	.110											
TCMT-21.52			1/32													

Plunge Milling Cutters

The TPC cutter permits the machine operator to drill and side mill with the same tool. Drilling depths of 3/4 of the insert height are possible. (Deeper holes are attainable, but chip evacuation is extremely important.)

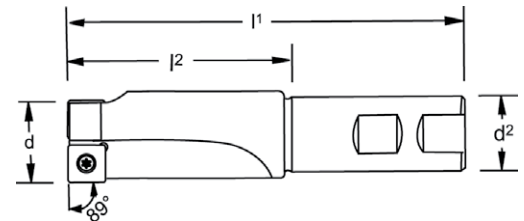
Enclosed pockets are an ideal application for the TPC end mill. Several different insert styles are available, both in coated and uncoated milling grades.



Standard Length End Mills for Drilling and Milling

Designation	d	d ²	l ¹	l ²	Flutes	Insert	Insert Screw	Wrench
TPC-0730	.730	.750	3.03	1.00	1	SDMW-322 SDNT-322	214.80.951	214.80.824 (S/D) 214.80.012 (F/T)
TPC-1000	1.000	1.000	3.50	1.25	2			
TPC-1000-3	1.000	.750	3.25	1.25	2			
TPC-1250	1.250	1.000	4.00	1.50	2	SPMW-432 SPNT-432	214.80.072	214.80.994 (S/D) 214.80.076 (F/T)
TPC-1500	1.500	1.250	4.00	1.50	2			

Remember to use COPASLIP® anti-seize compound on all insert screws



Extended Length End Mills for Drilling and Milling

Designation	d	d ²	l ¹	l ²	Flutes	Insert	Insert Screw	Wrench
TPC-0730-XL	.730	.750	3.53	1.50	1	SDMW-322 SDNT-322	214.80.951	214.80.824 (S/D) 214.80.012 (F/T)
TPC-1000-XL	1.000	1.000	4.31	2.03	2			
TPC-1250-XL	1.250	1.000	4.81	2.50	2	SPMW-432 SPNT-432	214.80.072	214.80.994 (S/D) 214.80.076 (F/T)
TPC-1500-XL	1.500	1.250	5.40	3.00	2			

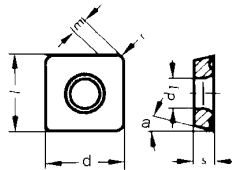
Remember to use COPASLIP® anti-seize compound on all insert screws

TPC Cutting Data



SDMW / SPMW

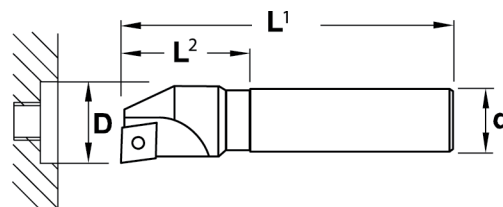
SDNT / SPNT



TPC Inserts

Designation	l	s	r	d	d ¹	m	a	Coated				Uncoated				Cermet			
SDMW-322	.375	1/8	1/32	3/8	.173	.065	15°	●					●	●	●				
SPMW-432	.500	3/16	1/32	1/2	.217	.091	11°				●		●	●	●				
SDNT-322	.375	1/8	1/32	3/8	.173	.065	15°	●		●		●	●	●					
SPNT-432	.500	3/16	1/32	1/2	.217	.091	11°	●		●		●	●	●					

Counterbore Milling Cutters



End Mills for Counterboring - INCH

Designation	Cap Screw Size	D	d	L ¹	L ²	Insert	Insert Lock Screw #	Wrench
TCCBE-025-CC2	1/4	.406	.500	3.00	.59	CCM_-21.5_	C-1425	C-5507
TCCBE-031-CC2	5/16	.500	.500	3.00	.74			
TCCBE-037-CC3	3/8	.594	.625	3.50	1.18	CCM_-32.5_	C-1440	C-5515
TCCBE-050-CC3	1/2	.781	.625	3.50	1.26			
TCCBE-062-CC3	5/8	.969	.750	3.50	1.26			
TCCBE-075-CC3	3/4	1.188	.750	3.50	1.26			

Remember to use COPASLIP® anti-seize compound on all insert screws

End Mills for Counterboring - METRIC

Designation	Cap Screw Size	D	d	L ¹	L ²	Insert	Insert Lock Screw #	Wrench
TCCBE-M6-CC2	M6	11	12	85	15	CCM_-21.5_	C-1425	C-5507
TCCBE-M8-CC2	M8	14	12	85	19			
TCCBE-M10-CC3	M10	17	16	95	30	CCM_-32.5_	C-1440	C-5515
TCCBE-M12-CC3	M12	19	16	95	32			
TCCBE-M14-CC3	M14	22	16	95	32			
TCCBE-M16-CC3	M16	25	16	95	32			

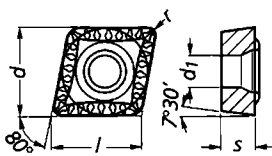
Remember to use COPASLIP® anti-seize compound on all insert screws



CCMT



CCMT-MU

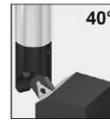
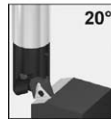
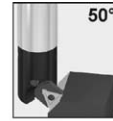
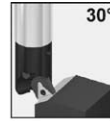
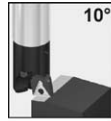
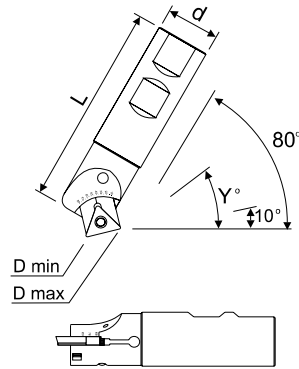


TCCBE Inserts

Designation	l	s	r	d	d ¹	Coated								Uncoated				Cermet		
CCMT-21.51	.254	3/32	1/64	1/4	.114		●	●	●	●					●	●				
CCMT-21.51T			1/64								●			●	●					
CCMT-21.52			1/32					●	●											
CCMT-32.51	.380	5/32	1/64	3/8	.173		●	●	●						●	●	●			
CCMT-32.52			1/32					●	●					●	●	●				
CCMT-32.53			3/64					●	●						●					
CCMT-32.51-MU	.380	5/32	1/64	3/8	.173		●		●	●										
CCMT-32.52-MU			1/32					●	●	●	●									

SET-MULTICUT-I

Adjustable Chamfer & Countersink Milling Cutters



Designation	d	L	Y	D MIN	D MAX	Insert	Cartridge	Insert Screw	Wrench
TTMCE-020TC2	.750	3.93	10°	.197	1.024	TCM_-21.5_	6921	1225	5507
			20°	.315	1.063				
			30°	.394	1.063				
			40°	.512	1.063				
			45°	.551	1.063				
			50°	.591	1.063				
			60°	.669	1.024				
			70°	.748	.984				
TTMCE-020TC3	1.000	3.93	80°	.787	.945	TCM_-32.5_	6926	1440	5515
			10°	.197	1.260				
			20°	.236	1.299				
			30°	.276	1.339				
			40°	.394	1.299				
			45°	.433	1.299				
			50°	.512	1.260				
			60°	.630	1.220				
			70°	.748	1.142				
			80°	.906	1.063				

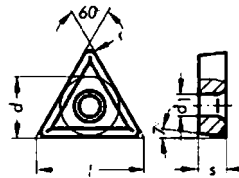
Set includes the two tools in the above table, excluding inserts. Individual tools can be ordered separately.



TCMT



TCMT-MU



SET-MULTICUT Inserts

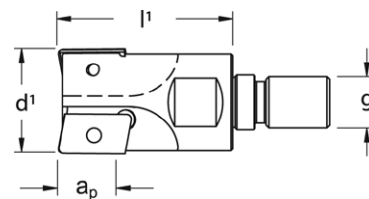
Designation	l	s	r	d	d'	TN6010	TN6025	TN7110	TN7115	TN7125	TN7135	TN8025	TN5105	TN5120	TTM	TTR	THM	TTI-05	TTI-15
						Coated								Uncoated				Cermet	
TCMT-21.51	.433	3/32	1/64	1/4	.110			●	●	●	●			●	●			●	
TCMT-21.52			1/32					●	●	●	●			●	●			●	
TCMT-32.51	.650	5/32	1/64	3/8	.173			●	●	●	●			●	●	●			
TCMT-32.52			1/32					●	●	●	●			●	●	●			
TCMT-32.53			3/64					●			●			●					
TCMT-21.51-MU	.433	3/32	1/64	1/4	.110			●	●	●		●		●					
TCMT-21.52-MU			1/32									●		●					
TCMT-32.51-MU	.650	5/32	1/64	3/8	.173	●	●	●	●	●	●	●	●						
TCMT-32.52-MU			1/32			●	●	●	●	●	●	●	●						
TCMT-32.53-MU			3/64			●	●					●							

Modular Milling System

Screw-On Milling Cutters

Modular tool design offering many combinations:

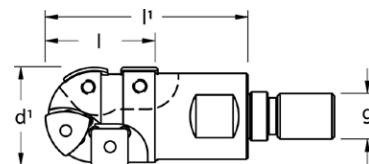
- Cylindrical Shank holders
- Complete range of extensions & reducers
- Milling cutters with M6, M8, & M10 thread-on shanks
- Strong connection between the adaptor and the screw-on mill by means of a cylindrical fit, face contact and a thread-on screw
- Common holder for different applications, thereby reducing inventories



TX90 Screw-On Milling Cutters

Designation	d ¹	d ¹ mm	g	l ¹	Max. ap	flutes	Insert	Insert Screw	Wrench
TXD90-0500-TS	.500	12.70	M6	1.10	.33	1	222.79.600 222.79.610	214.80.687	214.80.866 (S/D) 214.80.011 (F/T)
TXD90-0625-TS	.625	15.87	M8	1.10	.33	2			
TXD90-0750-TS	.750	19.05	M10	1.18	.33	2			
TXD90-0984-TS	.984	25.00	M12	1.18	.33	3			
TXD90-1000-TS	1.000	25.40	M12	1.50	.33	3			
TXD90-1260-TS	1.260	32.00	M16	1.57	.33	5			
TXP90-0975-TS	.975	24.77	M12	1.50	.55	2	222.79.400 222.79.500 222.79.510 222.79.550 222.79.564 222.79.572 222.79.574	214.80.388	214.80.824 (S/D) 214.80.012 (F/T)
TXP90-0984-TS	.984	25.00	M12	1.18	.55	2			
TXP90-1000-TS	1.000	25.40	M12	1.50	.55	2			
TXP90-1250-TS	1.250	31.75	M16	1.75	.55	3			
TXP90-1260-TS	1.260	32.00	M16	1.57	.55	3			
TXP90-1378-TS	1.378	35.00	M16	1.57	.55	3			
TXP90-1500-TS	1.500	38.10	M16	1.75	.55	3			
TXP90-1575-TS	1.575	40.00	M16	1.57	.55	4			

Remember to use COPASLIP® anti-seize compound on all insert screws



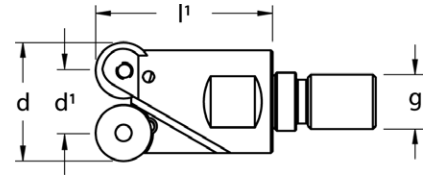
TBNR Screw-On Milling Cutters

Designation	d ¹	g	l ¹	l	flutes	Insert		Insert Screw	Screw Driver Type Wrench
						Radius (QTY.)	Square (QTY.)		
TBNR-0625-TS	.625	M8	1.50	.71	1	222.67.102 (2)	SPNX-21.51 (2)	214.80.061(Rad.) 214.80.687(Sq.)	214.80.059 214.80.866
TBNR-0750-TS	.750	M10	1.50	.75	1	222.67.104 (2)	SPNX-21.51 (2)	214.80.687	214.80.866
TBNR-1000-TS	1.000	M12	2.00	1.10	1	222.67.106 (2)	SDNT-322 (2)	214.80.951	214.80.824
TBNR-1250-TS	1.250	M16	1.75	1.22	1	222.67.108 (2)	SDNT-322 (2)	214.80.388	214.80.824

Remember to use COPASLIP® anti-seize compound on all insert screws

Modular Milling System

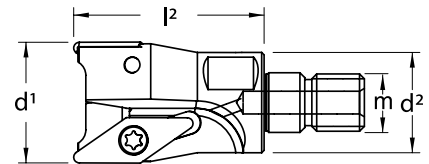
Screw-On Milling Cutters



TR360 Screw-On Mills using 15° Positive Inserts for Copying & Face Milling

Designation	d	d mm	d'	g	l'	flutes	Insert	Insert Screw	Wrench
TR360-0500-TS	.500	12.70	.185	M6	1.10	1	(8mm insert size) RDM_-0802MOT	214.80.013	214.80.866 (S/D) 214.80.011 (F/T)
TR360-0500L-TS	.500	12.70	.185	M8	2.00	1			
TR360-0625-TS	.625	15.87	.310	M8	1.10	2			
TR360-0750-TS	.750	19.05	.435	M10	1.18	2			
TR360-1000R08-TS	1.000	25.40	.685	M12	1.50	3			
TR360-1250R08-TS	1.250	31.75	.935	M16	1.75	5	(10mm insert size) RDM_-1003MOT	214.80.951	214.80.824 (S/D) 214.80.012 (F/T)
TR360-0984-TS	.984	25.00	.591	M12	1.18	2			
TR360-1000R10-TS	1.000	25.40	.606	M12	1.50	3			
TR360-1181-TS	1.181	30.00	.787	M16	1.57	3			
TR360-1250R10-TS	1.250	31.75	.856	M16	1.75	4			
TR360-0945-TS	.945	24.00	.472	M12	1.18	2	(12mm insert size) RDM_-1204MOT-X	214.80.388	214.80.824 (S/D) 214.80.012 (F/T)
TR360-1000-TS	1.000	25.40	.528	M12	1.50	2			
TR360-1250-TS	1.250	31.75	.778	M16	1.75	2			
TR360-1378-TS	1.378	35.00	.906	M16	1.57	3			
TR360-1500-TS	1.500	38.10	1.028	M16	1.75	3			
TR360-1575-TS	1.575	40.00	1.102	M16	1.57	4	(16mm insert size) RDM_-1605MOT-X	214.80.072	214.80.994 (S/D) 214.80.076 (F/T)
TR360-1260-TS	1.260	32.00	.630	M16	1.57	2			

Remember to use COPASLIP® anti-seize compound on all insert screws



TV90 Screw-On Mills Optimized Design for Aluminum

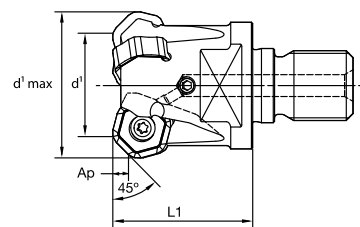
Designation	d ¹	d ²	l ²	m	Max. ap	Max Plunge	flutes	Insert	Insert Screw	Wrench
Standard Non-Through Coolant								VPGT-221-ALM	LF-89972	214.80.866 (S/D) 214.80.011 (F/T)
TVP90-0750-TS	.750	.709	1.18	M10	.40	.200	2			
Through Coolant Enabled										
TVP90-1000XC-TS	1.000	.827	1.57	M12	.40	.200	3			
TVP90-1000C-TS	1.000	.827	1.57	M12	.53	.250	2	VPGT-333-ALM VPGT-33 PPFR-ALM*	LF-57106	214.80.824 (S/D) 214.80.012 (F/T)
TVP90-1250C-TS	1.250	1.142	1.97	M16	.53	.250	2			
TVP90-1500C-TS	1.500	1.142	1.97	M16	.53	.250	3			
* To provide necessary clearance when using VPGT-33PPFR-ALM inserts, the cutting body must be relieved										

* To provide necessary clearance when using VPGT-33PPFR-ALM inserts, the cutting body must be relieved

Remember to use COPASLIP® anti-seize compound on all insert screws

Modular Milling System

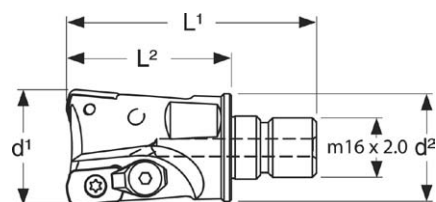
Screw-On Milling Cutters



Mini Screw-On Milling Cutters using 1/2" I.C. Inserts

Designation	Dia D ¹	D ¹ Max	L ¹	Ap	Thread	Flutes	Insert	Insert Screw	Wrench
M1200MINI-1.00HN2TS	1.00	1.34	1.25	.138	M16	2	HNGJ-0704_ HNPJ-0704_ XNGJ-0704_	214.60.345	214.80.824 (S/D) 214.80.012 (F/T)
M1200MINI-1.00HN3TS	1.00	1.34	1.25	.138	M16	3			
M1200MINI-1.25HN3TS	1.25	1.59	1.50	.138	M16	3			
M1200MINI-1.25HN4TS	1.25	1.59	1.50	.138	M16	4			
M1200MINI-1.50HN4TS	1.50	1.84	1.50	.138	M16	4			
M1200MINI-1.50HN5TS	1.50	1.84	1.50	.138	M16	5			

Remember to use COPASLIP® anti-seize compound on all insert screws



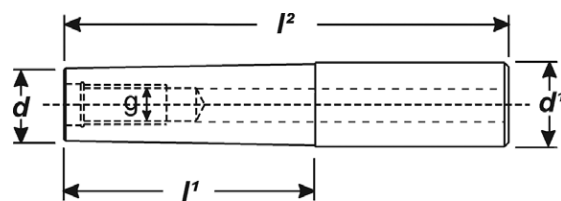
Screw-On Milling Cutters

Designation	d ¹	d ²	L ¹	L ²	flutes	Insert	Clamp	Clamp Screw	Torx Screw	Torx Wrench
TXD95HF-1250-TS	1.250	1.142	2.65	1.75	2	XDGW-1604HO XDGW-1604H20 XDGW-1604TH05 XDGW-1604TH20	214.85.892	214.85.898	214.80.388	214.80.824
TXD95HF-1500-TS	1.500	1.142	3.03	2.12	3					

Remember to use COPASLIP® anti-seize compound on all insert screws

Modular Milling System

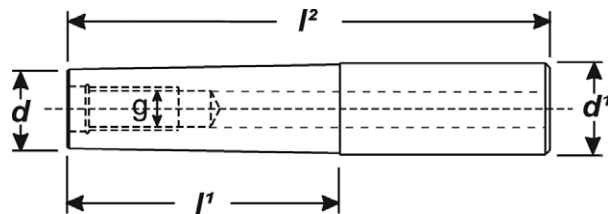
Straight Shanks



Weldon Straight Shanks

Designation	g	d	d'	l'	l²
SS050-M6-2	M6	.382	.500	2.00	3.78
SS050-M6-3	M6	.382	.500	3.00	4.78
SS063-M8-2	M8	.512	.625	2.00	3.90
SS063-M8-3	M8	.512	.625	3.00	4.90
SS063-M8-4	M8	.512	.625	4.00	5.90
SS075-M10-3	M10	.709	.750	3.00	5.03
SS075-M10-5	M10	.709	.750	5.00	7.03
SS100-M12-3*	M12	.827	1.000	3.00	5.28
SS125-M12-5*	M12	.827	1.250	5.00	7.28
SS125-M16-3*	M16	1.142	1.250	3.00	5.28
SS125-M16-5*	M16	1.142	1.250	5.00	7.28
SS125-M16-7*	M16	1.142	1.250	7.00	9.28

* With internal coolant supply



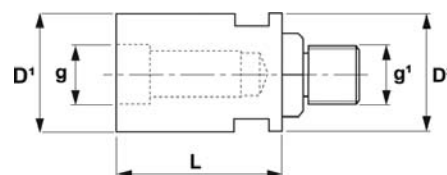
Cylindrical Straight Shanks

Designation	g	d	d'	l'	l²
SS050CY-M6-2	M6	.382	.500	2.00	3.78
SS050CY-M6-3	M6	.382	.500	3.00	4.78
SS063CY-M8-2	M8	.512	.625	2.00	3.90
SS063CY-M8-3	M8	.512	.625	3.00	4.90
SS063CY-M8-4	M8	.512	.625	4.00	5.90
SS075CY-M10-3	M10	.709	.750	3.00	5.03
SS075CY-M10-5	M10	.709	.750	5.00	7.03
SS100CY-M12-3*	M12	.827	1.000	3.00	5.28
SS125CY-M12-5*	M12	.827	1.250	5.00	7.28
SS125CY-M16-3*	M16	1.142	1.250	3.00	5.28
SS125CY-M16-5*	M16	1.142	1.250	5.00	7.28
SS125CY-M16-7*	M16	1.142	1.250	7.00	9.28

* With internal coolant supply

Modular Milling System

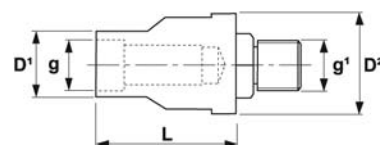
Extensions / Reducers



Extensions

Designation	g	g ¹	D ¹	D ²	L
EX-M6	M6	M6	.382	.382	.98
EX-M8	M8	M8	.512	.512	1.18
EX-M10	M10	M10	.709	.709	1.37
EX-M12*	M12	M12	.827	.827	1.57
EX-M16*	M16	M16	1.142	1.142	1.57

* With internal coolant supply



Reducers

Designation	g	g ¹	D ¹	D ²	L
RD-M8/M6	M6	M8	.382	.512	.98
RD-M10/M8	M8	M10	.512	.709	1.18
RD-M12/M10	M10	M12	.709	.827	1.38
RD-M16/M12*	M12	M16	.827	1.142	1.57

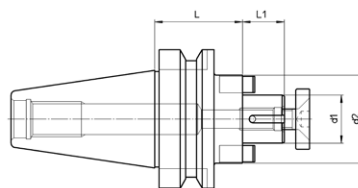
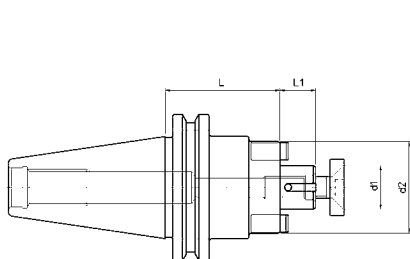
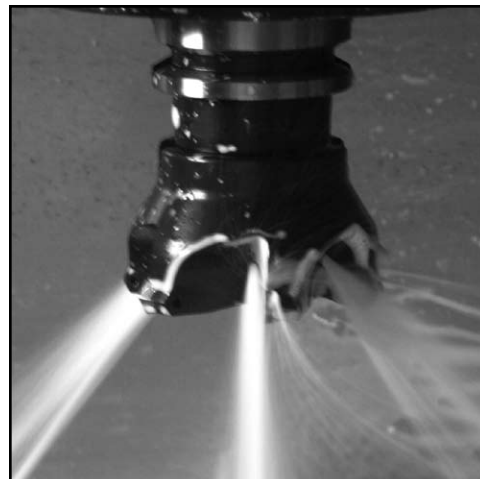
* With internal coolant supply

MaxiCool™ Shell Arbors

CV / BT Shell Arbors

Coolant through shell arbors used with coolant through face mills are designed to **BLAST AWAY** the effects of thermal shock!

- Maximize cutting parameters!
- Maximize insert life!
- Maximize profits!
- Minimize thermal shock!
- Minimize possible re-cutting of chips!
- Superior surface finishes!



CV40

Designation	d ¹	d ²	L	L ¹	lbs
CV40SM-0750-2.00	3/4	1.57	2.00	.68	1.54
CV40SM-0750-4.00			4.00		1.98
CV40SM-1000-2.00	1.00	1.96	2.00	.68	1.98
CV40SM-1000-4.00			4.00		2.64
CV40SM-1250-2.25	1-1/4	2.36	2.25	.68	3.30
CV40SM-1250-4.00			4.00		3.96
CV40SM-1500-2.25	1-1/2	2.75	2.25	.94	5.72
CV40SM-1500-4.00			4.00		6.38

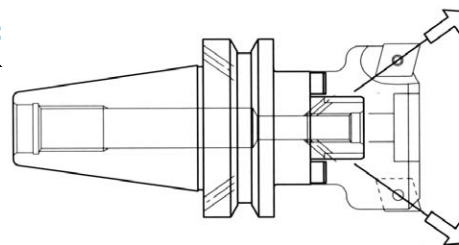
BT40

Designation	d ¹	d ²	L	L ¹	lbs
BT40SM-0750-2.00	3/4	1.57	2.00	.68	1.54
BT40SM-0750-4.00			4.00		3.96
BT40SM-1000-2.00	1.00	1.96	2.00	.68	1.98
BT40SM-1000-4.00			4.00		4.84
BT40SM-1250-2.25	1-1/4	2.36	2.25	.68	3.30
BT40SM-1250-4.00			4.00		5.94

CV50

Designation	d ¹	d ²	L	L ¹	lbs
CV50SM-0750-2.00	3/4	1.57	2.00	.68	5.06
CV50SM-0750-4.00			4.00		6.16
CV50SM-0750-6.00			6.00		9.90
CV50SM-1000-2.00	1.00	1.96	2.00	.68	5.50
CV50SM-1000-4.00			4.00		6.82
CV50SM-1000-6.00			6.00		12.10
CV50SM-1250-2.25	1-1/4	2.36	2.25	.68	7.48
CV50SM-1250-4.00			4.00		8.80
CV50SM-1250-6.00			6.00		14.30
CV50SM-1500-2.25	1-1/2	3.46	2.25	.94	8.36
CV50SM-1500-4.00			4.00		9.46
CV50SM-1500-6.00			6.00		16.50

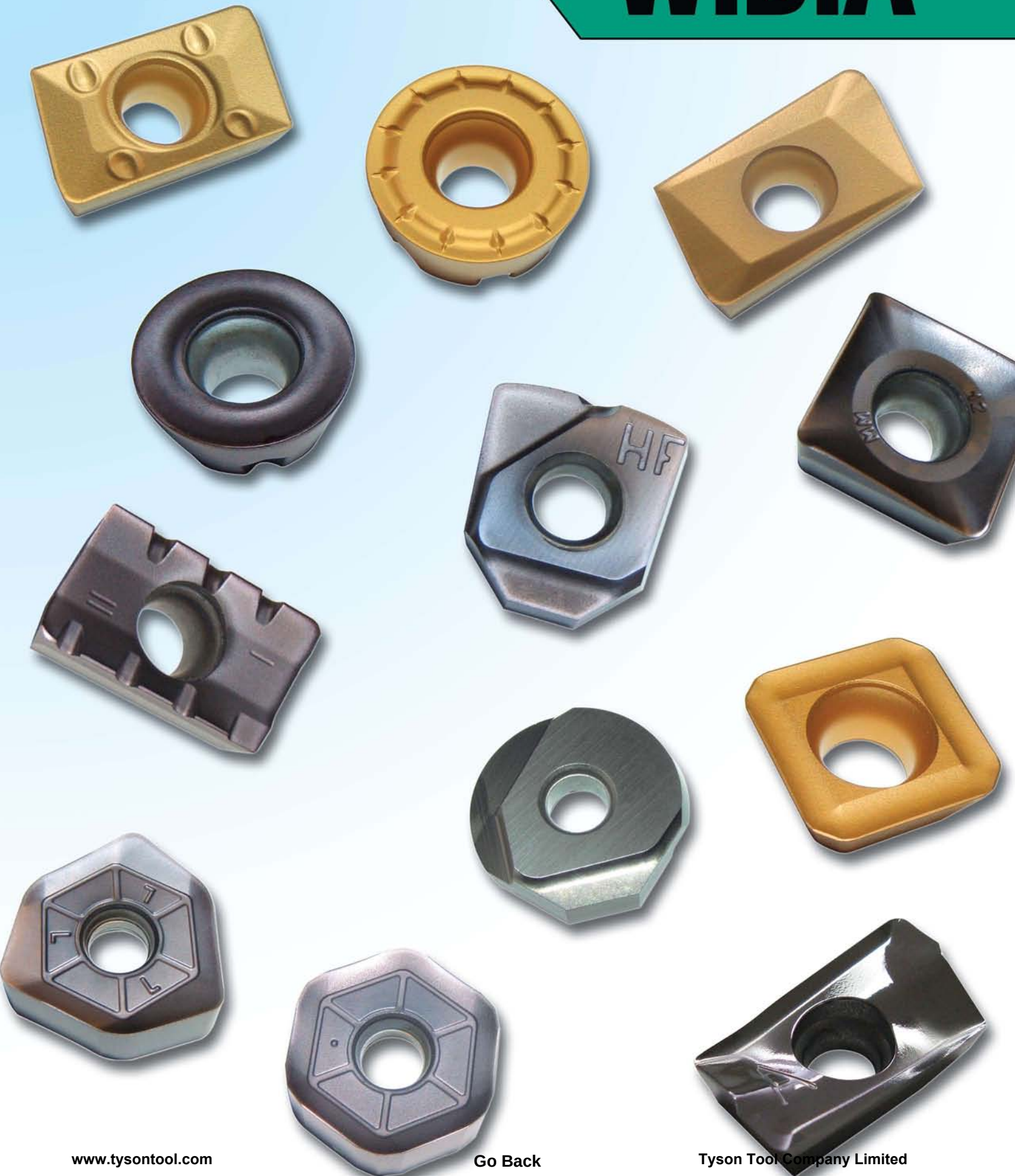
MAXICOOL™



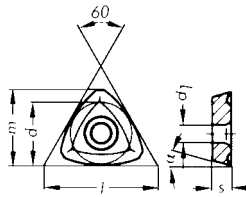
All our shell mill holders are manufactured to use milling cutter bodies equipped with bores for coolant through

carbide milling inserts

WIDIA 

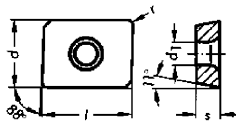


Indexable Inserts for Milling



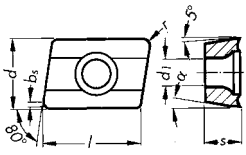
222.67.1 .. TBNR

Designation	l	s	r	d	d'	m	a	Coated							Uncoated				Cermet	
222.67.102	--	3/32	--	7/32	.100	.263	11°	●	●	●	●	●	●	●	●	●	●	●	●	●
222.67.104	--	7/64	--	1/4	.110	.303	11°	●	●	●	●	●	●	●	●	●	●	●	●	●
222.67.106	--	1/8	--	3/8	.173	.446	15°	●	●	●	●	●	●	●	●	●	●	●	●	●
222.67.108	--	3/16	--	13/32	.173	.498	15°	●	●	●	●	●	●	●	●	●	●	●	●	●
222.67.112	--	3/16	--	1/2	.173	.611	15°	●	●	●	●	●	●	●	●	●	●	●	●	●
222.67.114	--	3/16	--	1/2	.217	.593	11°	●	●	●	●	●	●	●	●	●	●	●	●	●



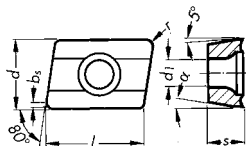
222.79.1 .. M21

Designation	l	s	r	d	d'	m	Coated							Uncoated				Cermet	
222.79.100	.590	1/8	1/32	3/8	.173	--	●	●	●	●	●	●	●	●	●	●	●	●	●
222.79.110	.625	3/16	3/64	1/2	.217	--	●	●	●	●	●	●	●	●	●	●	●	●	●



222.79.400 TX90

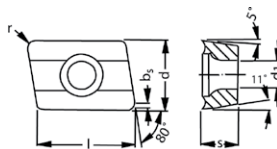
Designation	l	s	r	d	d'	bs	a	Coated							Uncoated				Cermet	
222.79.400	.635	3/16	3/64	3/8	.173	.047	11°	●	●	●	●	●	●	●	●	●	●	●	●	●



222.79.500 / 600 TX90

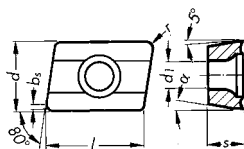
Designation	l	s	r	d	d'	bs	a	Coated							Uncoated				Cermet	
222.79.530	.635	3/16	1/32	3/8	.173	.071	11°	●	●	●	●	●	●	●	●	●	●	●	●	●
222.79.500			3/64			.059		●	●	●	●	●	●	●	●	●	●	●	●	●
222.79.532			1/16			.032		●	●	●	●	●	●	●	●	●	●	●	●	●
222.79.534			5/64			.020		●	●	●	●	●	●	●	●	●	●	●	●	●
222.79.536			3/32			--		●	●	●	●	●	●	●	●	●	●	●	●	●
222.79.538			1/8			--		●	●	●	●	●	●	●	●	●	●	●	●	●
222.79.540			5/32			--		●	●	●	●	●	●	●	●	●	●	●	●	●
222.79.572	.634	3/16	.031	.386	.173	.071	11°	●	●	●	●	●	●	●	●	●	●	●	●	●
222.79.574			.047	.375		.059		●	●	●	●	●	●	●	●	●	●	●	●	●
222.79.600	.381	1/8	1/32	1/4	.110	.039	15°	●	●	●	●	●	●	●	●	●	●	●	●	●

Indexable Inserts for Milling



222.79.501 TXP90AF

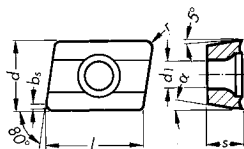
Designation	l	s	r	d	d'	bs	a	Coated						Uncoated				Cermet	
222.79.501	.635	.187	3/64	.375	.173	.059	11°			●		●	●						



222.79.510 / 610 TX90

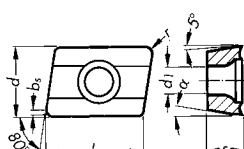
Designation	l	s	r	d	d'	bs	a	Coated						Uncoated				Cermet	
222.79.510 *	.635	.183	1/32	.386	.173	.067	11°						●		●				
222.79.512 *			3/64			.055							●		●				
222.79.514 *			1/16			.035							●		●				
222.79.516 *			5/64			.016							●		●				
222.79.518 *			3/32			--							●		●				
222.79.520 *			1/8			--							●		●				
222.79.522 *			5/32			--							●		●				
222.79.610 *	.381	1/8	1/32	.264	.110	--	15°							●					

*Optimized for Aluminum



222.79.55 TX90

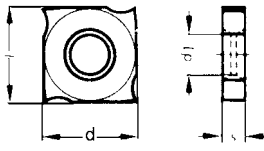
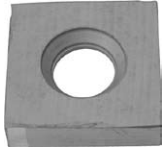
Designation	l	s	r	d	d'	bs	a	Coated						Uncoated				Cermet	
222.79.550	.635	.184	1/64	.386	.173	.078	11°						●			●			
222.79.552			1/32			.067							●			●			
222.79.554			3/64			.055							●			●			



222.79.564 TX90

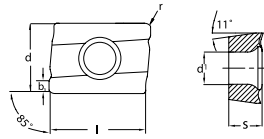
Designation	l	s	r	d	d'	bs	a	Coated						Uncoated				Cermet	
222.79.564	.635	.183	3/64	.386	.173	.067	11°	●	●	●	●	●	●	●					

Indexable Inserts for Milling



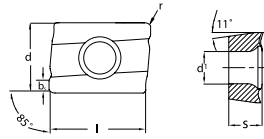
235.06. ... M95

Designation	l	s	r	d	d'	m	TN7525	TN6525	TN7535	TN6540	TN450	TN5515	TN6510	TN6520	TN2510	TTM	TTR	THM	THR	THM-U	TTI-25
							Coated									Uncoated				Cermet	
235.06.599	.433	.091	--	.433	.142	--	●				●	●				●	●	●			
235.06.600	.433	.106	--	.433	.142	--	●				●	●				●	●				
235.06.601	.500	1/8	--	1/2	.197	--	●				●	●				●	●	●			
235.06.602	.500	.213	--	1/2	.197	--	●				●	●				●	●	●			



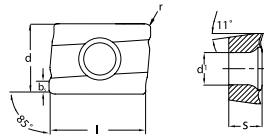
AONT- ... -MH TA90

Designation	l	s	r	d	d'	bs	TN7525	TN6525	TN7535	TN6540	TN450	TN5515	TN6510	TN6520	TN2510	TTM	TTR	THM	THR	THM-U	TTI-25
							Coated									Uncoated				Cermet	
AONT-10T308-MH	.407	.156	.031	.297	.134	.039	●	●	●	●	●	●				●					●



AONT- ... -MM TA90

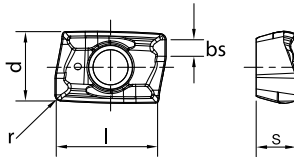
Designation	l	s	r	d	d'	bs	TN7525	TN6525	TN7535	TN6540	TN450	TN5515	TN6510	TN6520	TN2510	TTM	TTR	THM	THR	THM-U	TTI-25
							Coated									Uncoated				Cermet	
AONT-10T308-MM	.407	.156	.031	.297	.134	.039	●		●		●	●				●		●			●



AONT- ... -ML TA90

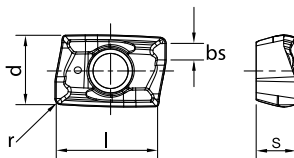
Designation	l	s	r	d	d'	bs	TN7525	TN6525	TN7535	TN6540	TN450	TN5515	TN6510	TN6520	TN2510	TN6501	TN6502	THM	THR	THM-U	TTI-25
							Coated									Uncoated		Cermet			
AONT-10T308-ML	.407	.156	.031	.297	.134	.039	●	●	●	●	●	●	●	●	●	●	●	●			

Indexable Inserts for Milling



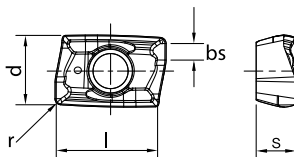
BDMT- ... -ML M6800

Designation	l	d	s	bs	r	TN6405	TN6425	TN6430					THR-S			TTI-25
						Coated				Uncoated				Cermet		
BDMT-11T304ER-ML	.433	.264	.150	.070	.016	●		●								
BDMT-11T308ER-ML				.055	.031	●		●								
BDMT-11T312ER-ML				.040	.047	●		●								
BDMT-11T316ER-ML				.021	.063	●		●								
BDMT-11T320ER-ML				--	.079	●		●								
BDMT-11T331ER-ML				--	.122	●		●								
BDMT-170404ER-ML	.433	.378	.193	.090	.016	●		●								
BDMT-170408ER-ML				.074	.031	●		●								
BDMT-170412ER-ML				.059	.047	●		●								
BDMT-170416ER-ML				.041	.063	●		●								
BDMT-170420ER-ML				.025	.079	●		●								
BDMT-170431ER-ML				--	.122	●		●								



BDMT- ... -MS M6800

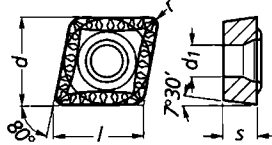
Designation	l	d	s	bs	r	TN6405	TN6425	TN6430					THR-S			TTI-25
						Coated				Uncoated				Cermet		
BDMT-11T304ER-MS	.433	.264	.150	.070	.016		●	●								
BDMT-11T308ER-MS				.055	.031		●	●								
BDMT-170404ER-MS	.433	.378	.193	.900	.016		●	●								
BDMT-170408ER-MS				.740	.031		●	●								



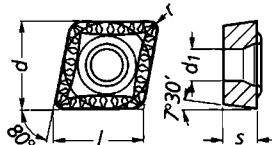
BDGT- ... -AL M6800

Designation	l	d	s	bs	r	TN6405	TN6425	TN6430					THRS			TTI-25
						Coated				Uncoated				Cermet		
BDGT-11T302FR-AL	.433	.261	.153	.079	.008								●			
BDGT-11T304FR-AL		.263		.071	.016								●			
BDGT-11T308FR-AL		.263		.055	.031								●			
BDGT-170404FR-AL	.669	.378	.201	.091	.016								●			
BDGT-170408FR-AL		.379		.075	.031								●			
BDGT-170420FR-AL		.380		.024	.083								●			
BDGT-170431FR-AL		.382		--	.136								●			

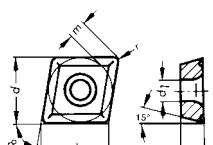
Indexable Inserts for Milling



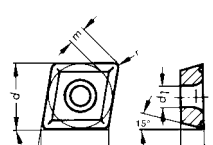
CCMT										TCCBE							
TN7110	TN7115	TN7125	TN7135	TN8025	TN5105	TN5120				TTM	TTR	THM	THR	THM-U		TTI-25	
Coated										Uncoated					Cermet		
		●	●	●	●						●	●					
						●					●	●					
		●	●														
		●	●	●						●	●	●					
		●	●								●						



CCMT- ... -MU								TCCBE							
TN7110	TN7115	TN7125	TN7135	TN35	TN8025	TN5105	TN5120		TTM	TTR	THM	THR	THM-U		TTI-25
Coated								Uncoated				Cermet			
		●		●	●	●									
		●	●	●	●	●									

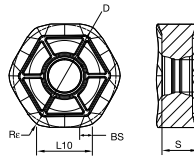


CDNT- ...																
TN7525	TN6525	TN7535	TN6540	TN450	TN5515	TN6510	TN6520	TN2510								
Coated									Uncoated			Cermet				
									●		●					
									●							



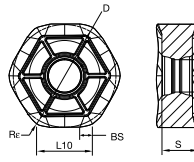
CPNT- ...																
TN7525	TN6525	TN7535	TN6540	TN450	TN5515	TN6510	TN6520	TN2510								
Coated									Uncoated			Cermet				
		●														
		●							●		●					
		●							●		●					
		●							●	●	●					

Indexable Inserts for Milling

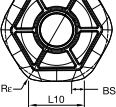


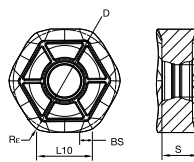
HNGJ - LD M1200

Designation	Cutting Edges	D	S	L10	BS	R	Coated							Uncoated			Cermet		
For Light Duty Machining																			
HNGJ-0704-ANEN-LD	12	.500	.176	.268	.064	.047	●	●	●	●	●	●							
HNGJ-070432-ANEN-LD			.176		--	.126			●		●	●							
HNGJ-0905-ANEN-LD	12	.625	.220	.338	.071	.047	●				●	●	●	●					

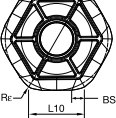


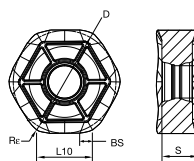
HNGJ -GD M1200

			TN515	TN601	TN605	TN610	TN620	TN625	TN640	TN735				THM-U					TTI-25	
Designation	Cutting Edges	D	S	L10	BS	R	Coated					Uncoated					Cermet			
For General Duty Machining																				
HNGJ-0905-ANSN-GD	12	.625	.220	.338	.071	.047	●					●	●	●	●					

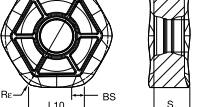


HNGJ - HD M1200

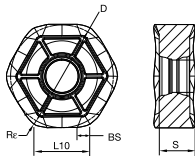
																								TN5515	TN6501	TN6505	TN6510	TN6520	TN6525	TN6540	TN7535																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																															
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HNGJ - LDJ M1200

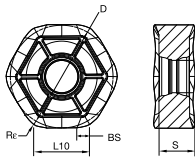
							TN5515	TN6501	TN6505	TN6510	TN6520	TN6525	TN6540	TN7535				THM-U				TTI-25	
Designation	Cutting Edges	D	S	L10	BS	R	Coated								Uncoated				Cermet				
For Aluminum Machining																							
HNGJ-0704-ANFN-LDJ	12	.500	.176	.268	.064	.047		●										●					
HNGJ-0905-ANFN-LDJ	12	.625	.220	.338	.071	.047		●										●					

Indexable Inserts for Milling



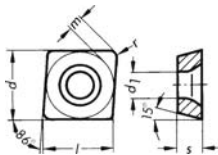
HNPJ - GD M1200

Designation	Cutting Edges	D	S	L10	BS	R	Coated							Uncoated				Cermet	
For General Duty Machining																			
HNPJ-0704-ANSN-GD	12	.500	.176	.269	.050	.047	●	●	●		●	●							
HNPJ-0905-ANSN-GD	12	.625	.220	.338	.071	.047	●		●	●	●	●							



HNPJ - HD M1200

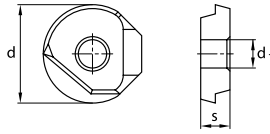
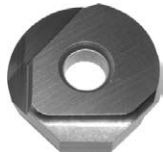
Designation	Cutting Edges	D	S	L10	BS	R	Coated							Uncoated				Cermet	
For Heavy Duty Machining																			
HNPJ-0704-ANSN-HD	12	.500	.176	.269	.049	.047	●	●	●	●	●								
HNPJ-070432-ANSN-HD				.269	--	.126		●	●	●	●								
HNPJ-0905-ANSN-HD	12	.625	.220	.338	.065	.047	●		●	●	●								
HNPJ-090543-ANSN-HD			.220	.334	--	.171			●	●									



MDH_ - ... M900

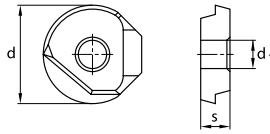
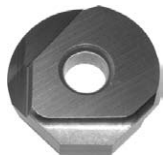
Designation	l	s	r	d	d1	m	Coated							Uncoated			Cermet	
MDHX-09T308	.376	.156	.031	.375	.134	.072	●		●		●	●		●		●		
MDHW-120408	.501	.187	.031	.500	.217	.102	●		●		●	●		●	●	●		

Indexable Inserts for Milling



M270BR / BF M270

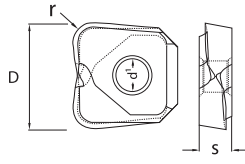
Designation	l	s	r	d	d ¹	m	Coated							Uncoated					Cermets	
M270BR-0375	--	.094	--	.375	.138	--														
M270BR-0500	--	.125	--	.500	.138	--														
M270BR-0625	--	.187	--	.625	.181	--														
M270BR-0750	--	.187	--	.750	.181	--														
M270BR-1000	--	.187	--	1.000	.220	--														
M270BF-0375	--	.094	--	.375	.138	--														
M270BF-0500	--	.125	--	.500	.138	--														
M270BF-0625	--	.187	--	.625	.181	--														
M270BF-0750	--	.187	--	.750	.181	--														
M270BF-1000	--	.187	--	1.000	.220	--														



M270BR / BF - Metric M270

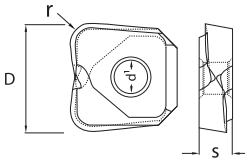
Designation	l	s	r	d	d ¹	m	Coated							Uncoated					Cermets	
M270BR-10MM	--	.094	--	.394	.138	--														
M270BR-12MM	--	.125	--	.472	.138	--														
M270BR-16MM	--	.187	--	.630	.181	--														
M270BR-20MM	--	.187	--	.787	.181	--														
M270BR-25MM	--	.187	--	.984	.220	--														
M270BR-32MM	--	.187	--	1.260	.260	--														
M270BF-10MM	--	.094	--	.394	.138	--														
M270BF-12MM	--	.125	--	.472	.138	--														
M270BF-16MM	--	.187	--	.630	.181	--														
M270BF-20MM	--	.187	--	.787	.181	--														
M270BF-25MM	--	.187	--	.984	.220	--														
M270BF-32MM	--	.187	--	1.260	.260	--														

Indexable Inserts for Milling



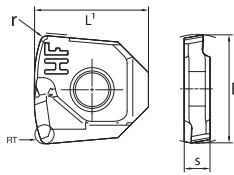
M270TF-										M270				
TN7525	TN6525	TN7535	TN6540	TN450	TN5515	TN2505	TN2510	TN2525	TTM	TTR	THM	THR	THM-U	TTI-25
Coated									Uncoated			Cermet		
						●		●						
						●		●						
						●		●						
						●		●						

Designation	D	s	r	d'	D.O.C.
M270TF-0375R0031	.375	.094	.031	.138	.031
M270TF-0500R0063	.500	.125	.063	.138	.063
M270TF-0625R0095	.625	.187	.095	.181	.095
M270TF-0750R0126	.750	.187	.126	.181	.126



M270TF- Metric										M270				
TN7525	TN6525	TN7535	TN6540	TN450	TN5515	TN2505	TN2510	TN2525	TTM	TTR	THM	THR	THM-U	TTI-25
Coated									Uncoated			Cermet		
						●		●						
						●		●						
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Designation	s	r	D	d'	D.O.C.
M270TF-10R03	.094	.012	10mm	.138	.012
M270TF-10R05		.020			.020
M270TF-10R1		.040			.040
M270TF-12R03	.125	.012	12mm	.138	.012
M270TF-12R05		.020			.020
M270TF-12R1		.040			.040
M270TF-12R2		.079			.079
M270TF-16R03	.187	.012	16mm	.181	.012
M270TF-06R05		.020			.020
M270TF-16R1		.040			.040
M270TF-16R2		.079			.079
M270TF-16R3		.118			.118
M270TF-20R03	.187	.012	20mm	.181	.012
M270TF-20R05		.020			.020
M270TF-20R1		.040			.040
M270TF-20R2		.079			.079
M270TF-20R4		.118			.118

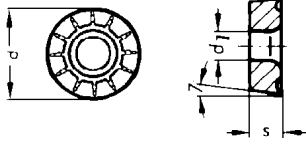


M270HF-										M270				
TN7525	TN6525	TN7535	TN6540	TN450	TN5515	TN2505	TN2510	TN2525	TTM	TTR	THM	THR	THM-U	TTI-25
Coated									Uncoated			Cermet		
			●			●								
			●			●								
			●			●								
			●			●								

Designation	D	S	R	RT	D.O.C. max	d'
M270HF-0375	.375	.094	.023	.044	.024	.138
M270HF-0500	.500	.125	.031	.057	.024	.138
M270HF-0625	.625	.187	.039	.070	.035	.181
M270HF-0750	.750	.187	.047	.090	.043	.181

"RT" = Programming Radius

Indexable Inserts for Milling

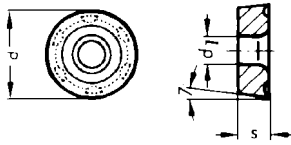


RCMT-1606MO- TR360

TN7525	TN6525	TN7535	TN6540	TN450	TN5515	TN6510	TN6520	TN2510	TTM	TTR	THM	THR	THM-U	TTI-25
●	●	●	●	●				●						●

Designation	l	s	r	d	d'	m
RCMT-1606MO-43M*	--	1/4	--	.630	.213	--

*Inserts have integrated anti-rotation lock

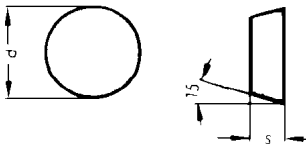


RCMT-1606MOT- TR360

TN7525	TN6525	TN7535	TN6540	TN450	TN5515	TN6510	TN6520	TN2510	TTM	TTR	THM	THR	THM-U	TTI-25
●		●		●	●			●	●					

Designation	l	s	r	d	d'	m
RCMT-1606MOT-X*	--	1/4	--	.630	.217	--

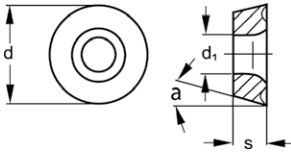
*Inserts have integrated anti-rotation lock



RDH-16M M40

TN7525	TN6525	TN7535	TN6540	TN450	TN5515	TN6510	TN6520	TN2510	TTM	TTR	THM	THR	THM-U	TTI-25
									●					

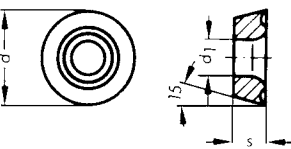
Designation	l	s	r	d	d'	m
RDH-16M	--	3/16	--	.630	--	--



RDGT- ... TR360

TN7525	TN6525	TN7535	TN6540	TN450	TN5515	TN6520	TN2510	THAL	TTM	TTR	THM	THR	THM-U	TTI-25

Designation	l	s	r	d	d'	a
RDGT-0802MO-AL	--	3/32	--	.315	.134	15°
RDGT-1003MO-AL	--	1/8	--	.394	.173	15°



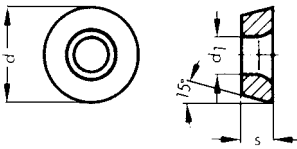
RDHT- ... TR360

TN7525	TN6525	TN7535	TN6540	TN450	TN5515	TN6510	TN6520	TN2510	TTM	TTR	THM	THR	THM-U	TTI-25
●				●										
●				●					●					
●				●	●				●					●
●				●	●									●

Designation	l	s	r	d	d'	m
RDHT-0802MOT	--	3/32	--	.315	.134	--
RDHT-1003MOT	--	1/8	--	.394	.173	--
RDHT-1204MOT-X *	--	3/16	--	.472	.173	--
RDHT-1605MOT-X *	--	7/32	--	.630	.217	--

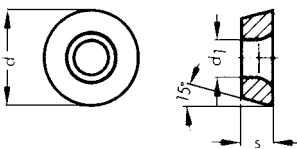
*Inserts have integrated anti-rotation lock

Indexable Inserts for Milling



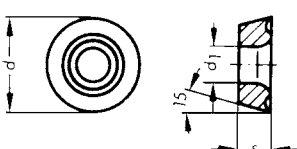
RDHW- ... -MH TR360

Designation	l	s	r	d	d ¹	m	Coated						Uncoated				Cermet	
RDHW-0802MO-MH	---	3/32	---	.315	.134	---												
RDHW-1003MO-MH	---	1/8	---	.394	.173	---												
RDHW-1204MO-MH	---	3/16	---	.472	.173	---												
RDHW-1605MOT-MH	---	7/32	---	.630	.217	---												
RDHW-12T3MOT-MH	---	5/32	---	.472	.173	---												
RDHW-1604MOT-MH	---	3/16	---	.630	.217	---												



RDHW- ... -ML TR360

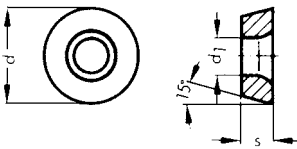
Designation	l	s	r	d	d ¹	m	Coated						Uncoated				Cermet	
RDHW-0802MO-ML	---	3/32	---	.315	.134	---												
RDHW-1003MO-ML	---	1/8	---	.394	.173	---												
RDHW-1204MO-ML	---	3/16	---	.472	.173	---												
RDHW-1605MO-ML	---	7/32	---	.630	.217	---												



RDMT- ... TR360

Designation	l	s	r	d	d ¹	m	Coated						Uncoated				Cermet	
RDMT-0802MOT	--	3/32	--	.315	.134	--												
RDMT-1003MOT	--	1/8	--	.394	.173	--												
RDMT-1204MOT-X*	--	3/16	--	.472	.173	--												
RDMT-1605MOT-X*	--	7/32	--	.630	.217	--												

*Inserts have integrated anti-rotation lock

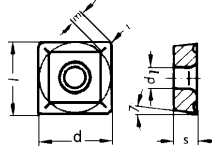


RDMW- ... TR360

Designation	l	s	r	d	d ¹	m	Coated						Uncoated				Cermet	
RDMW-0802MOT	--	3/32	--	.315	.134	--												
RDMW-1003MOT	--	1/8	--	.394	.173	--												
RDMW-1204MOT-X*	--	3/16	--	.472	.173	--												
RDMW-1605MOT-X*	--	7/32	--	.630	.217	--												

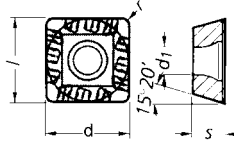
*Inserts have integrated anti-rotation lock

Indexable Inserts for Milling



SCKM-1205 ACTR

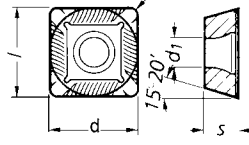
Designation	l	s	r	d	d'	m	Coated						Uncoated					Cermet	
SCKM-1205 ACTR	.500	.197	--	1/2	.215	--													



SDMT- ... -MH

TS90

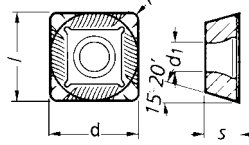
Designation	l	s	r	d	d'	m	Coated						Uncoated					Cermet	
SDMT-1204 PDR-MH	.500	3/16	3/64	1/2	.173	--													
SDMT-1506 PDR-MH	.625	1/4	3/64	5/8	.217	--													



SDMT- ... -ML

TS90

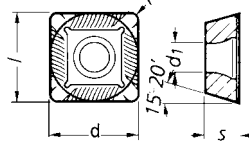
Designation	l	s	r	d	d'	m	Coated						Uncoated					Cermet	
SDMT-1204 PDR-ML	.500	3/16	3/64	1/2	.173	--													
SDMT-1506 PDR-ML	.625	1/4	3/64	5/8	.217	--													



SDMX- ... -MM

TS90

Designation	l	s	r	d	d'	bs	Coated						Uncoated					Cermet	
SDMX-120408R-MM	.500	.188	.031	1/2	.173	.076													
SDMX-120412R-MM			.047			.061													
SDMX-150612R-MM	.625	.250	.047	5/8	.217	.057													

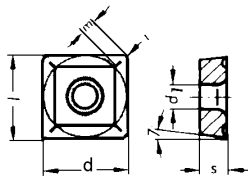


SDMX- ... -MH

TS90

Designation	l	s	r	d	d'	bs	Coated						Uncoated					Cermet	
SDMX-120408R-MH	.500	.188	.031	1/2	.173	.076													
SDMX-120412-MH			.047			.061													
SDMX-120416-MH			.063			.059													
SDMX-150612R-MH	.625	.250	.047	5/8	.217	.057													
SDMX-150616R-MH			.063			.059													

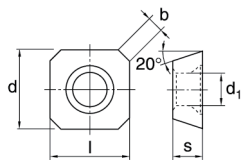
Indexable Inserts for Milling



SDNT- ...

TS45

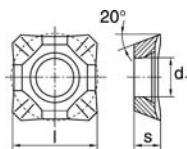
Designation	l	s	r	d	d'	m	Coated						Uncoated				Cermet	
SDNT-21.51T	.250	3/32	1/64	1/4	.110	.045												
SDNT-322	.375	1/8	1/32	3/8	.173	.065												



SEHT-43 AF

TS45F

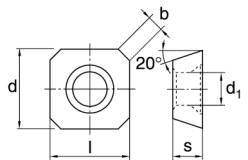
Designation	l	s	r	d	d'	b	Coated						Uncoated				Cermet	
SEHT-43 AF	.500	3/16	---	1/2	.217	.062												



SEHT-43- ... -ALC

TS45F

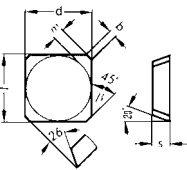
Designation	l	s	r	d	d'	bs	Coated						Uncoated				Cermet	
SEHT-43 AFFN-ALC	.500	3/16	---	1/2	.217	.062												



SEHW-43 AF

TS45F

Designation	l	s	r	d	d'	bs	Coated						Uncoated				Cermet	
SEHW-43 AF	.500	3/16	---	1/2	.217	.062												

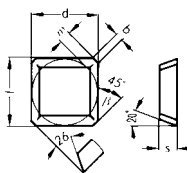


SEK- ... AFN-1

M68

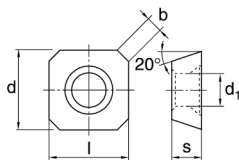
Designation	l	s	r	d	b	m	Coated						Uncoated				Cermet	
SEK-42 AFN-1	.500	1/8	--	1/2	.065	.065												
SEK-43 AFN-1	.500	3/16	--	1/2	.065	.065												
SEK-53 AFN-1	.625	3/16	--	5/8	.075	.089												

Indexable Inserts for Milling



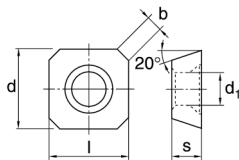
SEKR- ... AFN-1 M68

Designation	l	s	r	d	b	m	Coated						Uncoated				Cermet	
SEKR-42 AFN-1	.500	1/8	--	1/2	.065	.065	●		●		●		●					
SEKR-43 AFN-1	.500	3/16	--	1/2	.065	.065	●		●		●		●					
SEKR-53 AFN-1	.625	3/16	--	5/8	.075	.089	●		●		●				●			



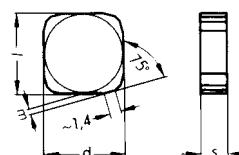
SEKT-43 AFSN TS45F

Designation	l	s	r	d	d'	b	Coated						Uncoated				Cermet	
SEKT-43 AFSN	.500	3/16	---	1/2	.217	.062							●					



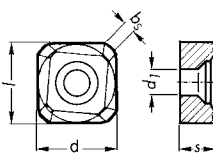
SEKW-43 AFSN TS45F

Designation	l	s	r	d	d'	b	Coated						Uncoated				Cermet	
SEKW-43 AFSN	.500	3/16	---	1/2	.217	.062							●					



SNK- ... EN M50

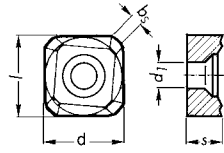
Designation	l	s	r	d	d'	m	Coated						Uncoated				Cermet	
SNK-43 EN	.500	3/16	--	1/2	--	.031							●					
SNK-53 EN	.625	3/16	--	5/8	--	.045							●					



SNKT- ... -20 TSN45

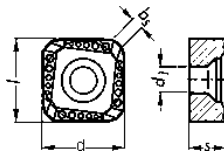
Designation	l	s	r	d	d'	bs	Coated						Uncoated				Cermet	
SNKT-1205 AZER-20	.500	7/32	---	1/2	.217	.061	●	●	●	●	●	●					●	

Indexable Inserts for Milling



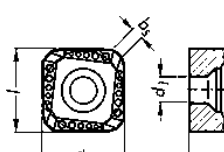
SNKT- ... -21 *TSN45*

Designation	l	s	r	d	d'	bs	TN7525	TN6525	TN7535	TN6540	TN450	TN5515	TN6510	TN6520	TN2510	TTM	TTR	THM	THR	THM-U	TTI-25
SNKT-1205 AZR-21	.500	7/32	--	1/2	.217	.061	●					●			●			●			●
SNKT-1505 AZR-21	.625	7/32	--	5/8	.217	.079						●		●							●



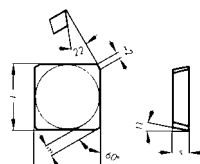
SNKT- ... -31 *TSN45*

Designation	l	s	r	d	d'	bs	TN7525	TN6525	TN7535	TN6540	TN450	TN5515	TN6510	TN6520	TN2510	TTM	TTR	THM	THR	THM-U	TTI-25
SNKT-1205 AZR-31	.500	7/32	--	1/2	.217	.061	●	●	●	●	●	●			●	●					
SNKT-1505 AZR-31	.625	7/32	--	5/8	.217	.079	●		●		●	●			●						



SNMT- ... -31 *TSN45*

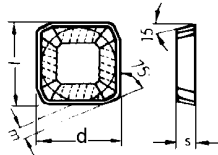
Designation	l	s	r	d	d'	bs	TN7525	TN6525	TN7535	TN6540	TN450	TN5515	TN6510	TN6520	TN2510	TTM	TTR	THM	THR	THM-U	TTI-25
SNMT-1205 AZR-31	.500	7/32	---	1/2	.217	.061	●	●	●	●	●	●			●	●					
SNMT-1505 AZR-31	.625	7/32	---	5/8	.217	.079	●	●	●	●	●										



SPK- ... *M40*

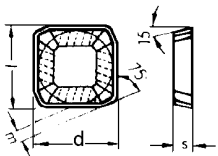
Designation	l	s	r	d	d'	m	TN7525	TN6525	TN7535	TN6540	TN450	TN5505	TN5515	TN6520	TN2510	TTM	TTR	THM	THR	THM-U	TTI-25
SPK-42 EDL	.500	1/8	--	1/2	---	.035										●		●			
SPK-53 EDL	.625	3/16	--	5/8	---	.049										●		●			
SPK-42 EDR	.500	1/8	--	1/2	---	.035	●		●		●		●			●	●	●			●
SPK-53 EDR	.625	3/16	--	5/8	---	.049	●		●		●		●			●	●	●			●

Indexable Inserts for Milling



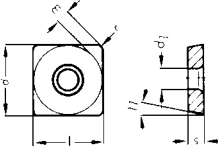
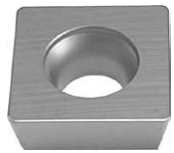
SPKR- ... M40

Designation	l	s	r	d	d'	m	Coated						Uncoated				Cermet	
SPKR-42 EDL	.500	1/8	--	1/2	---	.035												
SPKR-42 EDR	.500	1/8	--	1/2	---	.035			●					●				



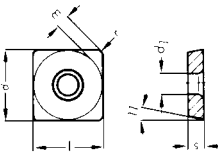
SPKR-42 EDR-MS

Designation	l	s	r	d	d'	m	Coated						Uncoated				Cermet	
SPKR-42 EDR-MS	.500	.125	--	--	--	.035	●				●	●			●	●		



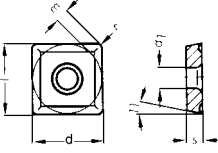
SPHW-432

Designation	l	s	r	d	d'	m	Coated						Uncoated				Cermet	
SPHW-432	.500	.187	.031	1/2	.217	.091								●				



SPMW- 432 TPC

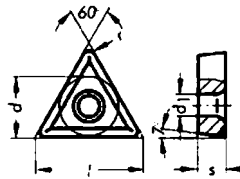
Designation	l	s	r	d	d'	m	Coated						Uncoated				Cermet	
SPMW-432	.500	3/16	1/32	1/2	.217	.091				●				●	●	●	●	



SPNT / SPNX - ... TBNR

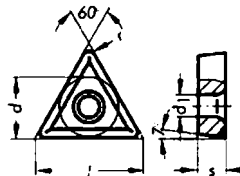
Designation	l	s	r	d	d'	m	Coated						Uncoated				Cermet	
SPNT-432	.500	3/16	1/32	1/2	.217	.091	●		●		●			●	●	●		
SPNX-21.51	.250	7/64	1/64	1/4	.110	.045	●		●					●		●		

Indexable Inserts for Milling



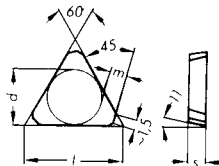
TCMT- ...

Designation	l	s	r	d	d'	TN6010	TN6025	TN7110	TN7115	TN7125	TN7135	TN8025	TN5105	TN5120	TTM	TTR	THM	TTI-05	TTI-15
						Coated									Uncoated			Cermet	
TCMT-21.51	.433	3/32	1/64	1/4	.110			●	●	●	●			●		●		●	
TCMT-21.52			1/32					●	●	●	●			●			●	●	
TCMT-32.51	.650	5/32	1/64	3/8	.173			●	●	●	●			●	●	●			
TCMT-32.52			1/32					●	●	●	●			●	●	●			
TCMT-32.53			3/64					●			●			●					



TCMT- ... -MU

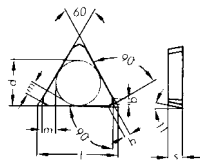
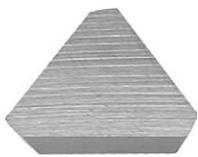
Designation	l	s	r	d	d'	TN6010	TN6025	TN7110	TN7115	TN7125	TN7135	TN8025	TN5105	TN5120	TTM	TTR	THM	TTI-05	TTI-15
						Coated									Uncoated			Cermet	
TCMT-21.51-MU	.433	3/32	1/64	1/4	.110			●	●	●		●		●					
TCMT-21.52-MU			1/32					●	●	●		●		●					
TCMT-32.51-MU	.650	5/32	1/64	3/8	.173	●	●	●	●	●		●	●	●					
TCMT-32.52-MU			1/32			●	●	●	●	●	●	●	●	●					
TCMT-32.53-MU			3/64			●	●				●			●					



TPA - ... AER

M60

Designation	l	s	r	d	d'	m	TN7525	TN6525	TN7535	TN6540	TN450	TN5515	TN6510	TN6520	TN2510	TTM	TTR	THM	THR	THM-U	TTI-25
							Coated									Uncoated				Cermet	
TPA-32 AER	.650	1/8	--	3/8	--	.106										●		●			
TPA-42 AER	.866	1/8	--	1/2	--	.165										●					

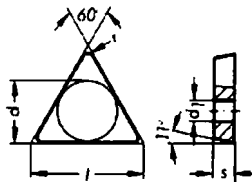


TPA - ... PP

M90

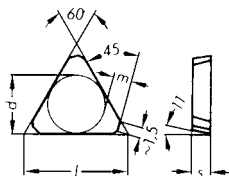
Designation	l	s	r	d	d'	m	TN7525	TN6525	TN7535	TN6540	TN450	TN5515	TN6510	TN6520	TN2510	TTM	TTR	THM	THR	THM-U	TTI-25
							Coated									Uncoated				Cermet	
TPA-22 PP	.433	1/8	--	1/4	--	.068										●		●			
TPA-32 PP	.650	1/8	--	3/8	--	.097										●	●				

Indexable Inserts for Milling



TPG- ...

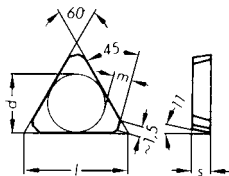
Designation	l	s	r	d	d'	Coated						Uncoated				Cermet	
TPG-21.51	.433	3/32	1/64	1/4	--												
TPG-21.52			1/32														
TPG-322	.650	1/8	1/32	3/8	--												
TPG-323			3/64														



TPJ - ...

M60

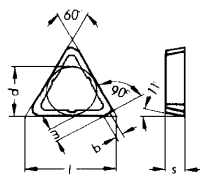
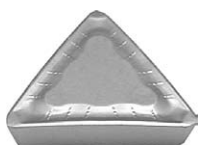
Designation	l	s	r	d	d'	m	Coated						Uncoated				Cermet	
TPJ-32 AEL	.650	1/8	--	3/8	--	.106												
TPJ-42 AEL	.866	1/8	--	1/2	--	.165												
TPJ-32 AER	.650	1/8	--	3/8	--	.106												
TPJ-42 AER	.866	1/8	--	1/2	--	.165												
TPJ-47 AER	.866	5/32	--	1/2	--	.151												



TPK - ...

M40

Designation	l	s	r	d	d'	m	Coated						Uncoated				Cermet	
TPK-32 PDL	.650	1/8	--	3/8	--	.097												
TPK-43 PDL	.866	3/16	--	1/2	--	.140												
TPK-32 PDR	.650	1/8	--	3/8	--	.097												
TPK-43 PDR	.866	3/16	--	1/2	--	.140												

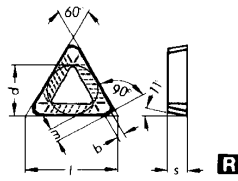


TPKR-43 PDR

M40

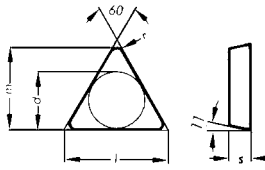
Designation	l	s	r	d	d'	m	Coated						Uncoated				Cermet	
TPKR-43 PDR	.866	3/16	--	1/2	--	.140												

Indexable Inserts for Milling



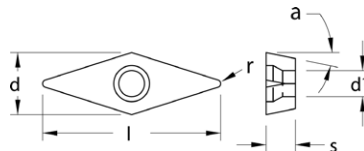
TPKR- ... PDR-MS M60

Designation	l	s	r	d	d'	m	TN7525	TN6525	TN7535	TN6540	TN450	TN5515	TN6510	TN6520	TN2510	TTM	TTR	THM	THR	THM-U	TTI-25
TPKR-32 PDR-MS	.650	1/8	--	3/8	--	.097	●		●			●				●					
TPKR-43 PDR-MS	.866	3/16	--	1/2	--	.140	●		●	●						●					



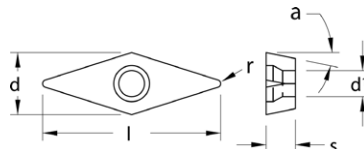
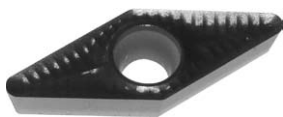
TPU- ...

Designation	l	s	r	d	d'	m	TN7525	TN6525	TN7535	TN6540	TN450	TN5515	TN6510	TN6520	TN2510	TTM	TTR	THM	THR	THM-U	TTI-25
TPU-21.51	.433	3/32	1/64	1/4	--	.359										●					
TPU 21.52			1/32			.344										●					
TPU-221	.433	1/8	1/64	1/4	--	--										●		●			
TPU-222			1/32													●		●			
TPU-321	.650	1/8	1/64	3/8	--	.530										●					
TPU-322			1/32			.531										●	●	●			
TPU-323			3/64			.515										●	●	●			
TPU-432	.866	3/16	1/32	1/2	--	.718										●					
TPU-433			3/64			.703										●	●	●			
TPU-434			1/16			.688										●					



VCGT- ... TV90

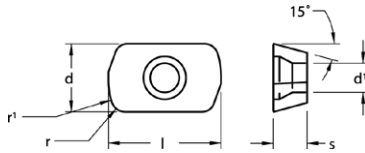
Designation	l	s	r	d	d'	a	TK10MP	TK10TB	TK10M
VCGT-43.58-ALM	.87	7/32	.118	1/2	.216	7°	●		●



VPGT- ... TV90

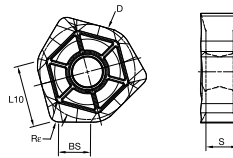
Designation	l	s	r	d	d'	a	TK10MP	TK10TB	TK10M
VPGT-221-ALM	.437	1/8	1/64	1/4	.110	11°	●	●	●
VPGT-333-ALM	.654	3/16	3/64	3/8	.173	11°	●	●	●
VPGT-33 PPFR-ALM	.654	3/16	--	3/8	.173	11°	●		●

Indexable Inserts for Milling



XDGW-1604 ... TXD95

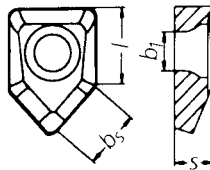
Designation	l	s	r	r'	d	d'	T-Land	Hone	Coated	Uncoated	Cermet
XDGW-1604H0	.625	.1875	.078	.375	.375	.160	--	--		●	
XDGW-1604H20							--	.002"			
XDGW-1604TH05							.010" x 20°	.0005"	●		
XDGW-1604TH20							.010" x 20°	.002"	●		



XNGJ- ... M1200

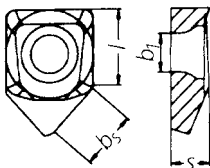
Designation	Cutting Edges	D	S	L10	BS	R	Coated	Uncoated	Cermet
XNGJ-0704-ANEN-LD3W	3*	.500	.176	.267	.267	.051	●		
XNGJ-0905-ANSN-GD3W	3*	.625	.220	.377	.230	.063			
XNGJ-0905-ANFN-LDJ3W	3*	.625	.220	.377	.230	.063	●	●	

* 3 RH and 3 LH cutting edges



XNKT- ... -11 TSN45

Designation	l	s	r	d	d'	bs	Coated	Uncoated	Cermet
XNKT-1205 AZER-11	.500	7/32	--	1/2	.217	.315	●	●	●



XNKT- ... -12 TSN45

Designation	l	s	r	d	d'	bs	Coated	Uncoated	Cermet
XNKT-1205 AZTR-12	.500	7/32	--	1/2	.217	.315	●		●

Technical Information

Insert Geometries for Milling

222.79.400 / 500 / 600

Inserts with optimized geometries and large selection of radii from 1/32" - 5/32" for steel, cast steel and aluminum alloys. Very effective with high metal removal rates in medium and heavy duty milling.



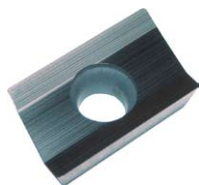
222.79.400

This pressed insert has extra chip control molded into the top of the insert allowing for high machining rates in semi-finishing and rough milling operations.



222.79.500 / 600

High shear radial angles allow for good performance in all applications and materials. Precision ground.



222.79.510 / 610

Sharp rake angles on this precision ground insert make these inserts the first choice for all aluminum machining applications, as well as other non-ferrous materials.



222.79.550

Inserts are precision ground and polished, which reduces frictional resistance during machining and have sharp primary wiper edges for reduced cutting forces and burring. The perfect combination of geometry and grade make this insert ideal for aluminum machining, in either high speed or conventional milling applications.



222.79.564

Inserts used in medium and rough milling applications, offering good performance, mainly under poor conditions, i.e., chattering, vibration, unstable situations, long extended tools or shoulder milling with a small width of cut. Smoother cutting action under poor conditions.



222.79.572 / 222.79.574

Inserts with highly positive and stable geometry, thus reducing power consumption and vibrations. To be used for steel, stainless steel, and cast iron.

222.67.1..



Strong stable geometry for a variety of work piece materials.

SDNT / SPNT / SPNX



Strong stable geometry suitable for most work piece materials.

AONT



-MH

Positive and stable geometry for roughing. For best results in stable machine and workpiece conditions.



-MM

Positive and stable geometry for medium machining. The positive stabilized cutting edge improves the milling action.



-ML

The highly positive geometry for smooth and soft cutting action. Geometry for finishing and light roughing operations. Specially developed for reducing cutting forces and power consumption of machine tools.

BDMT



-ML

Light edge preparation, reduced cutting force. For finishing applications with highest degree of accuracy. For cast iron, steel and alloy steel.



-MS

Sharpest edge, reduced cutting force up to 20%. For low carbon and stainless steels.

BDGT



-AL

Peripheral ground with polished rake face optimized for aluminum applications.

Technical Information

Insert Geometries for Milling

HPGT / HPPT



-LD

for light machining

-GD

for general face milling in steels and cast irons



-AL

optimized for aluminum applications



-3W

wiper insert geometry when exceptional surface finish is required (3 wiper edges)

HNGJ / HNPJ



-LD

Honed edge preparation used in light machining.

-GD

Medium T-land and honed edge preparation used in medium machining. Good first choice for general-purpose use.

-HD

0° to negative T-land and hone edge preparation used in heavy machining. Good first choice for heavy feeds and severely interrupted cuts.

HNGJ



-LDJ

Precision ground and polished geometry for aluminum

XNGJ-GD



-3W

Chamfer-protected edge preparation. Identifies "Wiper" inserts that allow for a finer finish and are used in combination with -GD geometry inserts to permit roughing and finishing in one pass.

XNGJ-LDJ



-LDJ

Wiper insert geometry used in conjunction with HNGJ-...LDJ insert to permit roughing and finishing in one pass. Specifically for aluminum.

M270BR / BF



-BR

Roughing and semi-finishing geometry for contouring in a variety of workpiece materials.

-BF

Precision ground finishing and semi-finishing for contouring in a variety of workpiece materials.

M270TF / HF



TF

Precision ground with corner radius and back taper for helical and pocket milling of pre-hardened and hardened materials.



HF

The design of this insert allows for high speeds and high feed rates with shallow depth of cut. Forces are directed upwards towards the spindle helping to eliminate vibration and deflection allowing for heavy chip loads.

RCMT, RDGT, RDHT, RDMT, & RDMW

Positive free cutting materials



RCMT-43M

Free-cutting geometry for roughing and finishing, provides excellent surface finish. Outstanding chip control, especially with light depths of cut. Preferred geometry for alloy and plain carbon steels.



RDGT

Highly positive geometry with polished to rake face. Giving reduced cutting forces. Ideal for non-ferrous materials.

Technical Information

Insert Geometries for Milling

RCMT, RDGT, RDHT, RDMT, & RDMW

Positive free cutting materials



RDHT

Tolerance class H with ground diameter of +13 µm tolerance for semi-finishing and finishing.

RDMT

Particularly for milling with long overhangs.



RDMW

Particularly for vibration-prone applications, because it is less positive.

SDMT

Positive geometries and strengthened cutting edges guarantee trouble-free machining of a wide range of materials. 4 usable cutting edges.



-ML

For cast iron machining and finishing on non-rigid machines and setups



-MH

For most applications

SDMX

-MM

Positive pressed geometry engineered to reduce cutting forces enabling increased feed rates.



-MH

Similar to the MM but with re-enforced cutting edge for heavy duty milling

SPKR

-MS

Special trough-shaped geometry, cutting forces reduced by the increased cutting angle. This improves machining of thin-walled and unstable parts. Higher cutting speeds are also possible on less powerful machines.



SNKT / SNMT

Geometries with positive rake angles and reinforced cutting edges to reduce cutting forces and improve milling performance.



-20

Particularly positive geometry for light alloy milling work.



-21

General milling of cast irons and finishing of steel.

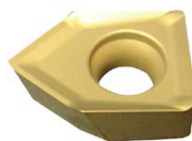


-31

Roughing and finishing of steel.

XNKT

For use in conjunction with SNKT-1205 -21 and -31 inserts



-11

Wiper edge for cast iron



-12

Wiper edge for steel

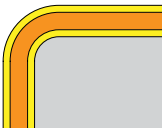
Technical Information

Insert Grades for Milling

Coated Grades			05	10	15	20	25	30	35	40	45	50
TN2505 Coated hardmetal PVD -TiAlOx Light machining For steel and cast iron hardened up to 64 HRC For dry machining or fan coolant		P										
		M										
		K										
		N										
		S										
	HC-C05	H										
TN2510 Coated hardmetal MT-CVD / CVD - TiN-TiCN-Composite Medium and heavy machining For hardened steel, stellite or cast iron up to 64 HRC For mild cast iron at elevated cutting speeds		P										
		M										
		K										
		N										
		S										
	HC-H10	H										
TN2525 Coated hardmetal PVD - TiAlN Light and medium machining For hardened steel and chilled cast iron 50 - 65 HRC		P										
		M										
		K										
		N										
		S										
	HC-H20	H										
TN450 Coated hardmetal CVD - TiN-TiCN-TiN Medium and heavy machining Extremely tough and thermal shock-resistant grade Preferably used with coolant For steels and nodular cast iron		P										
		M										
		K										
		N										
		S										
	HC-P30	H										
TN5415 Coated hardmetal CVD - TiN-TiCN-Al2O3 Light and medium machining For cast irons For dry machining or fan coolant		P										
		M										
		K										
		N										
		S										
	HC-K15	H										
TN5505 Coated hardmetal MT-CVD / CVD - TiN-TiCN-Al2O3 Light machining For cast irons Recommended for use at high cutting speeds in favorable conditions		P										
		M										
		K										
		N										
		S										
	HC-K05	H										
TN5515 Coated hardmetal MT-CVD / CVD - TiN-TiCN-Al2O3 Light and medium machining For cast irons		P										
		M										
		K										
		N										
		S										
	HC-K15	H										

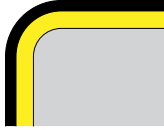
Technical Information

Insert Grades for Milling

Coated Grades			05	10	15	20	25	30	35	40	45	50
TN5520 Coated hardmetal MT-CVD / CVD - TiN-TiCN-Al2O3 Light and medium machining For cast irons		P										
		M										
		K										
		N										
		S										
	HC-K20	H										
TN6405 Coated carbide PVD — TiAlN Multilayer Light and medium machining of cast iron and nodular cast iron		P										
		M										
		K										
		N										
		S										
	HC-K10	H										
TN6425 Coated carbide PVD — TiAlN Multilayer Light and medium machining of stainless steel and high temp alloys		P										
		M										
		K										
		N										
		S										
	HC-M25	H										
TN6430 Coated carbide PVD — TiCN Multilayer. Medium to heavy machining of steel.		P										
		M										
		K										
		N										
		S										
	HC-P25	H										
TN6501 Coated carbide PVD - TiB2 on ultra-fine grain carbide Light machining For aluminum and magnesium alloys		P										
		M										
		K										
		N										
		S										
	HC-N03	H										
TN6502 Coated carbide PVD - TiB2 Light machining For aluminum and magnesium alloys		P										
		M										
		K										
		N										
		S										
	HC-N05	H										
TN6510 Coated carbide PVD - TiAlN Multilayer Light machining For cast irons		P										
		M										
		K										
		N										
		S										
	HC-K10	H										

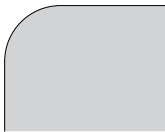
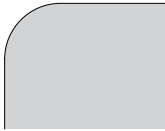
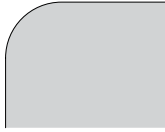
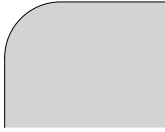
Technical Information

Insert Grades for Milling

Coated Grades			05	10	15	20	25	30	35	40	45	50
TN6520 Coated carbide PVD - TiAlN Multilayer Light and medium machining For cast irons		P										
		M										
		K										
		N										
		S										
	HC-K20	H										
TN6525 Coated carbide PVD - TiAlN Multilayer Light and medium machining For steels and high-strength nodular cast iron		P										
		M										
		K										
		N										
		S										
	HC-P25	H										
TN6540 Coated carbide PVD - TiAlN Multilayer Medium and heavy machining For steels and nodular cast iron		P										
		M										
		K										
		N										
		S										
	HC-P40	H										
TN7435 Coated carbide CVD - TiN-Al2O3 Medium and heavy machining For steels and nodular cast iron Use with or without coolant		P										
		M										
		K										
		N										
		S										
	HC-P35	H										
TN7525 Coated carbide MT-CVD / CVD - TiN-TiCN-Al2O3-TiN Light and medium machining For steels and nodular cast iron		P										
		M										
		K										
		N										
		S										
	HC-P25	H										
TN7535 Coated carbide MT-CVD / CVD - TiN-TiCN-Al2O3 Medium and heavy machining For steels and nodular cast iron Can be used in unfavorable conditions		P										
		M										
		K										
		N										
		S										
	HC-P35	H										
Uncoated Grades			05	10	15	20	25	30	35	40	45	50
THM Uncoated carbide Light and medium machining For cast irons, difficult-to-machine alloys, and all non-ferrous metals and non-metals		P										
		M										
		K										
		N										
		S										
	HW-K15	H										

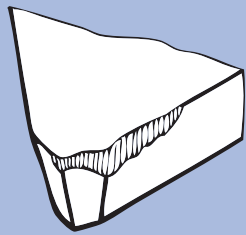
Technical Information

Insert Grades for Milling

Uncoated Grades			05	10	15	20	25	30	35	40	45	50
THM-F Uncoated carbide Light machining For non-ferrous metals and gray or malleable cast iron		P										
		M										
		K										
		N										
		S										
	HF-K10	H										
THM-U Uncoated carbide Ultra fine-grain grade with excellent wear resistance and cutting edge sharpness Light and medium machining For aluminum alloys with max. 12% silicon and magnesium alloys		P										
		M										
		K										
		N										
		S										
	HF-N05	H										
THR Uncoated carbide Medium and heavy machining For cast iron, non-ferrous metals, and titanium alloys		P										
		M										
		K										
		N										
		S										
	HW-K25	H										
TTM Uncoated carbide Medium machining For steels and nodular cast iron		P										
		M										
		K										
		N										
		S										
	HW-P25	H										
TTR Uncoated carbide Medium and heavy machining For steels and nodular cast iron Recommended for unfavorable conditions at low cutting speeds		P										
		M										
		K										
		N										
		S										
	HW-P35	H										
TK10M Uncoated K10 grade. Recommended for machining of non-ferrous materials and high temperature alloys. good wear resistance. designed to run with coolant.		P										
		M										
		K										
		N										
		S										
	HW-K10	H										
Cermet Grades			05	10	15	20	25	30	35	40	45	50
TTI25 Cermet Light and medium machining Extremely good wear resistance For steels and nodular cast iron Recommended at high cutting speeds under favorable conditions		P										
		M										
		K										
		N										
		S										
	HT-P15	H										

Technical Data

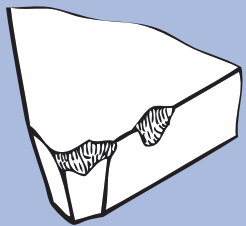
Trouble Shooting for Milling Applications



Flank Wear

General criteria for end of tool life, characterized by an admissible amount of flank wear

- Remedy:**
- select more wear resistant grade
 - reduce cutting speed



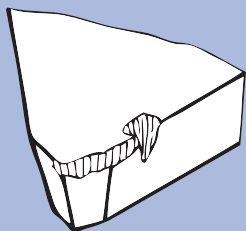
Edge Chipping

Minor chipping along the cutting edge, usually accompanied by flank wear and therefore not always identifiable. Danger of breakage! Edge chipping outside the cutting area is the result of chip impact due to unfavorable chip removal.

- Remedy:**
- select tougher grade
 - use insert with stronger cutting edge geometry
 - reduce feed when starting the cut

Damage caused by chip impact:

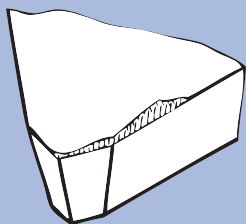
- vary feed
- change chipbreaker geometry
- change cutting edge angle



Notch Wear

Occurs locally in the area of the primary cutting edge where it contacts the workpiece surface. Caused by hard surface layers and work-hardened burrs, especially on austenitic stainless steels. Danger of breakage!

- Remedy:**
- strengthen cutting edge
 - select smaller cutting edge angle (45°)
 - reduce feed

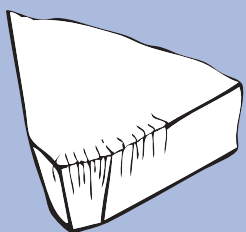


Built-Up Edges

Edge build-up occurs on the rake face as a result of the work material welding together with the cutting material, especially when cutting difficult-to-machine materials.

From time to time the built-up edge will break off and may cause damage to the cutting edge. Built-up edges result in poor surface finish.

- Remedy:**
- increase cutting speed
 - use coated carbides or cermets
 - select positive cutting edge geometry
 - use cutting fluid



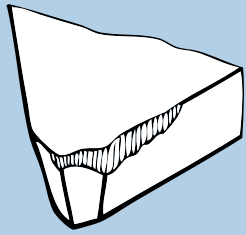
Thermal Cracks

Small cracks running across the cutting edge, caused by thermal shock loads in interrupted cutting operations, particularly in milling. Danger of breakage!

- Remedy:**
- use grade with greater resistance to thermal shock
 - check use of cutting fluid; cutting fluid should not generally be used for milling, except with special grades for wet milling, e.g. TN450, aluminum and titanium alloys, and high-temperature materials
 - use compressed air to remove chips in slot milling

Technical Data

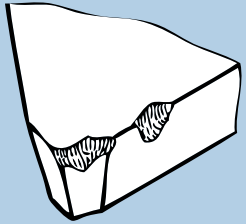
Trouble Shooting for Milling Applications



Flank Wear

General criteria for end of tool life, characterized by an admissible amount of flank wear

- Remedy:**
- select more wear resistant grade
 - reduce cutting speed



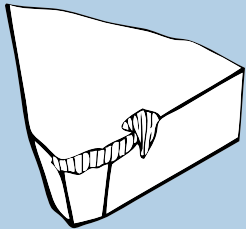
Edge Chipping

Minor chipping along the cutting edge, usually accompanied by flank wear and therefore not always identifiable. Danger of breakage! Edge chipping outside the cutting area is the result of chip impact due to unfavorable chip removal.

- Remedy:**
- select tougher grade
 - use insert with stronger cutting edge geometry
 - reduce feed when starting the cut

Damage caused by chip impact:

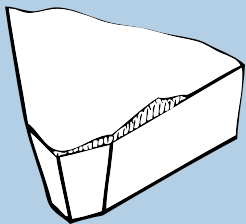
- vary feed
- change chipbreaker geometry
- change cutting edge angle



Notch Wear

Occurs locally in the area of the primary cutting edge where it contacts the workpiece surface. Caused by hard surface layers and work-hardened burrs, especially on austenitic stainless steels. Danger of breakage!

- Remedy:**
- strengthen cutting edge
 - select smaller cutting edge angle (45°)
 - reduce feed

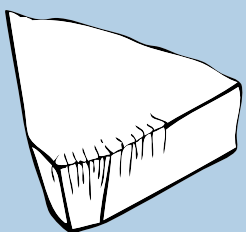


Built-Up Edges

Edge build-up occurs on the rake face as a result of the work material welding together with the cutting material, especially when cutting difficult-to-machine materials.

From time to time the built-up edge will break off and may cause damage to the cutting edge. Built-up edges result in poor surface finish.

- Remedy:**
- increase cutting speed
 - use coated carbides or cermets
 - select positive cutting edge geometry
 - use cutting fluid



Thermal Cracks

Small cracks running across the cutting edge, caused by thermal shock loads in interrupted cutting operations, particularly in milling. Danger of breakage!

- Remedy:**
- use grade with greater resistance to thermal shock
 - check use of cutting fluid; cutting fluid should not generally be used for milling, except with special grades for wet milling, e.g. TN450, aluminum and titanium alloys, and high-temperature materials
 - use compressed air to remove chips in slot milling

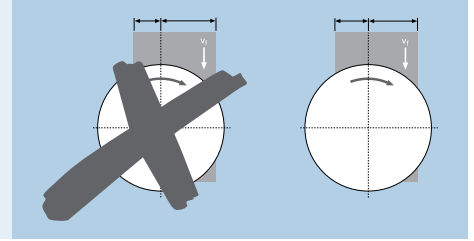
Technical Data

Trouble Shooting for Milling Applications

Burring

Chipping of the workpiece edge when cutter leaves the cut (mainly in cast iron)

- Remedy:**
- select smaller cutting edge angle for the tool
 - select more positive cutting edge geometry
 - change cutter position relative to workpiece



Workpiece Vibrations

- Remedy:**
- clamp workpiece more rigidly
 - change cutter position relative to workpiece
 - select a cutter with a smaller cutting edge angle

Cutter Vibrations

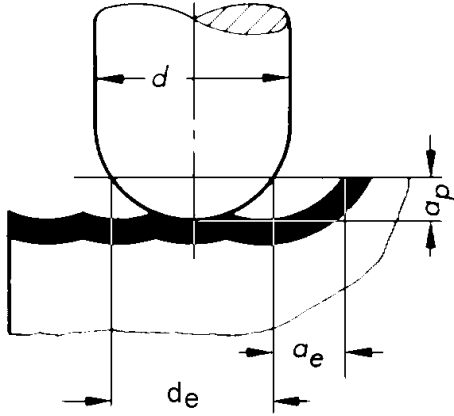
- Remedy:**
- minimize cutter overhang
 - increase feed
 - reduce cutting speed

Use of Cutting Fluids in Milling

- Remedy:**
- cutting fluid should preferably not be used
 - if cutting fluid is essential, then in copious amounts at low pressure

Technical Data

Formulas:



Legend:

p	= 3.1416
a_e	= Width of cut
a_p	= Depth of cut
d	= Diameter of milling cutter, in inches
d_e	= Effective diameter
f_z	= Feed, inches per tooth
h	= Scallop height
ipm	= Feed, inches per minute
ipr	= Inches per revolution
mrr	= Metal removal rate in cubic inches
rpm	= Revolutions per minute
s	= Stepmover value between two cutting passes, in inches
sfm	= Surface feet per minute
z	= Number of effective teeth

To calculate effective diameter of ball nose tool

$$d_e = 2 * \sqrt{\left(\frac{d}{2}\right)^2 - \left(\frac{d}{2} - a_p\right)^2}$$

To calculate inches per revolution

$$ipr = \frac{ipm}{rpm}$$

To calculate sfm when rpm is known

$$sfm = .262 * d * rpm$$

To calculate f_z when ipm, rpm & z are known

$$f_z = \frac{ipm}{z * rpm}$$

To calculate rpm when sfm is known

$$rpm = \frac{sfm * 3.82}{d}$$

To calculate f_z when ipr & z are known

$$f_z = \frac{ipr}{z}$$

To calculate scallop height (cusp height)

$$h = \frac{d}{2} - \sqrt{\left(\frac{d}{2}\right)^2 - \left(\frac{s}{2}\right)^2}$$

To calculate metal removal rate

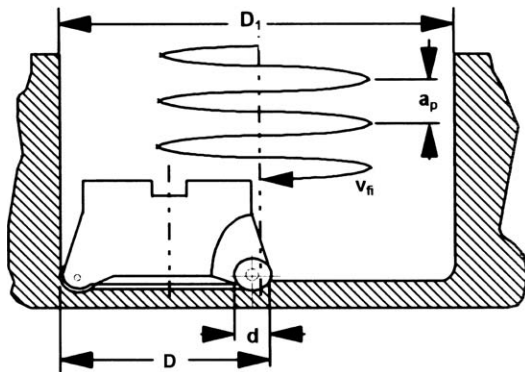
$$mrr = a_p * a_e * ipm$$

To calculate inches per minute (table feed)

$$ipm = f_z * z * rpm$$

Technical Data

Circular and Helical Interpolation:



Circular and Helical Interpolation is an application where the cutter rotates on its own axis together in an orbiting motion around the workpiece (either internally or externally), while at the same time plunging to the required depth of cut. In order to accomplish this application, a machine with three-axis control capabilities is required.

Calculating feed rate: Unlike linear milling applications (face milling) where the tools cutting edge and centerline is identical, circular and helical interpolation feed rate is based only on the tools centerline (Vfi). The following formulas should be used to obtain the optimal running conditions.

Milling Cutter Diameter Selection Calculation:

Note: all values should be in inch

Minimum Cutter Diameter: $D_{\min} = \frac{D_1}{2}$

Optimum / maximum Cutter Diameter: $D_{\text{opt/max}} = \frac{D_1 + d}{2} - 1$

Calculating Feed Rate:

Note: all values should be in inch

Feed Rate Correction for Drill Milling with Round Inserts: $f_{z\text{kor}} = f_z \times \frac{d}{a_p} \times \frac{1}{135} \text{ inv cos}^* \left(1 - \frac{1.5 \times a_p}{d} \right)$

Depth of Cut (ap):

max. $a_p \leq 0.5 \times d$ **opt.** $a_p = 0.25 \times d \times \text{inv cos} = \cos^{-1}$

Feed Rate at Centerline of Tool when Drill Milling (Vfi)

$$V_{fi} = \left(1 - \frac{D}{D_1} \right) \times \text{rpm} \times f_{z\text{kor}} \times T$$

or approximately:

$$V_{fi} = .008 \times \text{rpm} \times f_{z\text{kor}} \times T$$

Definitions

- D** = cutter diameter
- d** = insert diameter
- D1** = workpiece bore diameter
- ap** = depth of cut
- fz** = feed per tooth
- fzkor** = correction feed per tooth
- Vfi** = feed rate at cutters centerline
- T** = number of cutting teeth
- rpm** = revolutions per minute

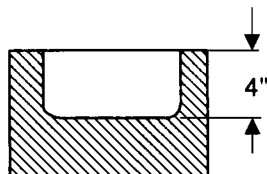
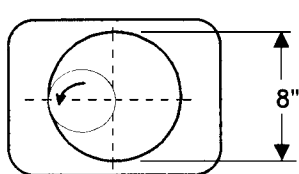
Example:

Cutter Data:

Cutter description:..... TR360 Face Mill
Diameter (D):..... 4"
Insert Diameter: 6299 (16mm)
Insert grade: TN5515
No. of teeth (T):..... 8

Recommended Machining Conditions:

Surface feet/minute (sfm): 533
Spindle speed (rpm): 509
Feed per tooth (fz):..... .008"
Depth of Cut (ap):..... .157" (opt. ap = .25 x .6299)



$$f_{z\text{kor}} = .008 \times \frac{.6299}{.157} \times \text{inv cos} \left(1 - \frac{1.5 \times .157}{.6299} \right) = 0.0122$$

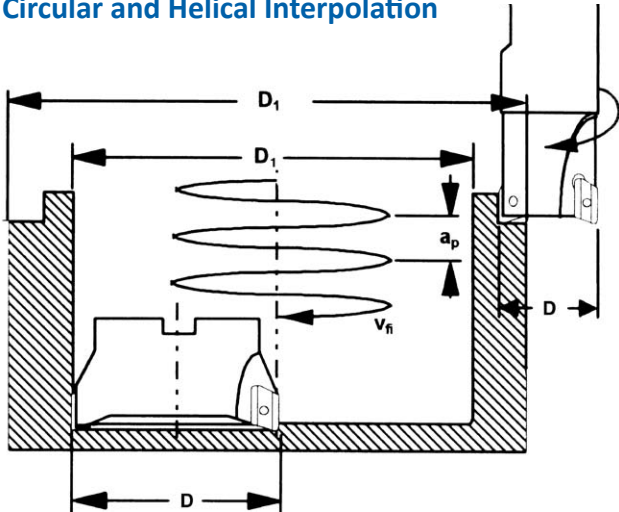
$$V_{fi} = \left(1 - \frac{4}{8} \right) \times .509 \times 0.0122 \times 8 \times 24.798 \text{ or } 25 \text{ ipm}$$

Machining Programming:

In order to maintain the recommended .008" feed per tooth (fz) for this insert size and application, the machine tool should be programmed for a feed of 25" per minute (ipm).

Technical Data

Circular and Helical Interpolation



Circular and Helical Interpolation is an application where the cutter rotates on its own axis together in an orbiting motion around the workpiece (either internally or externally), while at the same time plunging to the required depth of cut. In order to accomplish this application, a machine with three-axis control capabilities is required.

Calculating feed rate: Unlike linear milling applications (face milling) where the tools cutting edge and centerline is identical, circular and helical interpolation feed rate is based only on the tools centerline (Vfi). The following formulas should be used to obtain the optimal running conditions.

Definitions

- D** = cutter diameter
- d** = insert diameter
- D1** = workpiece bore diameter
- ap** = depth of cut
- fz** = feed per tooth
- fzkor** = correction feed per tooth
- Vfi** = feed rate at cutters centerline
- T** = number of cutting teeth
- rpm** = revolutions per minute

Milling Cutter Diameter Selection Calculation

Note: all values should be in inch

Minimum Cutter Diameter: $D_{\min} = \frac{D_1}{2}$

Optimum / Maximum cutter Diameter: $D_{\text{opt/max}} = \frac{D_1 + d}{2} - 1$

Calculating Feed Rate:

Note: all values should be in inch

Feed Rate at the Cutting Edge (Vf) Inches per Minute: $V_f = f_z \times \text{rpm} \times T$

Feed Rate at Centerline of Tool when Drill Milling (Vfi):

Internal Milling Applications:

$$V_{fi} = \frac{V_f \times (D_1 - D)}{D_1}$$

External Milling Applications:

$$V_{fi} = \frac{V_f \times (D_1 - D)}{D_1}$$

Example:

Cutter Data:

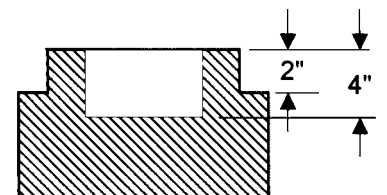
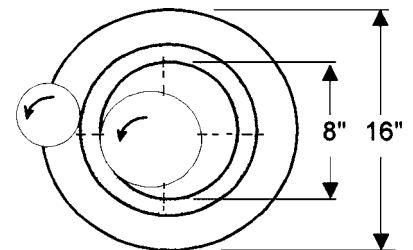
Cutter description:	TXP90 Face Mill	TXP90 End Mill
Diameter (D):	4"	1.5"
Insert number:	222.79.400	222.79.400
Insert grade:	TN7525	TN7525
No. of teeth (T):	8	4

ID: Face Mill $V_f = .008 \times 10 \times 358 = 28.6\text{ipm}$

OD: End Mill $V_f = .004 \times 4 \times 1082 = 17.3\text{ipm}$

Machining Programming:

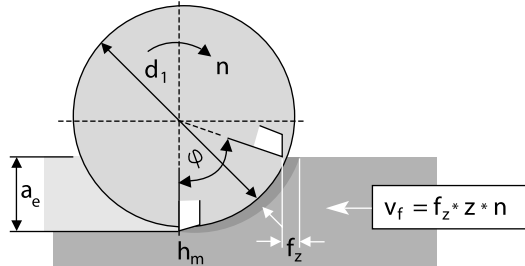
Based on the above OD and ID milling calculations, you must program the machine at the appropriate feed rate (Vfi) for each tools centerline.



Technical Data

Cutting Ratios and Undeformed Chip Thickness in Milling

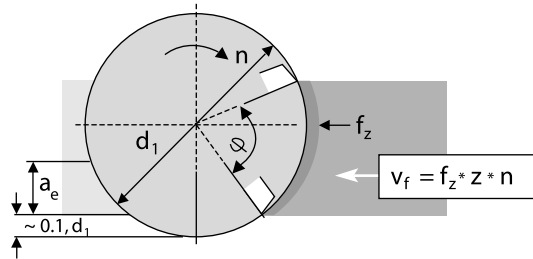
Valid for $a_e < 0.3 d_1$



$$f_z = h_m * \sqrt{\frac{d_1}{a_e}} \quad h_m = f_z * \sqrt{\frac{a_e}{d_1}}$$

At least 2 cutting edges in the working area of the feed motion angle ϕ

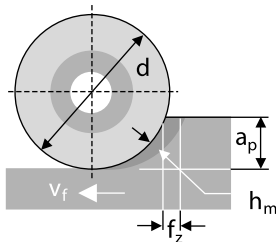
Valid for $a_p < 0.3 d_1$



min. cutter diameter $d_1 \approx 1.25 * a_e$

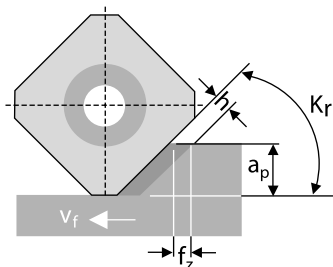
max. width of cut $a_e \approx 0.8 * d_1$

Valid for $a_p < 0.3$



$$f_z = h_m * \sqrt{\frac{d}{a_p}}$$

$$h_m = f_z * \sqrt{\frac{a_p}{d}}$$

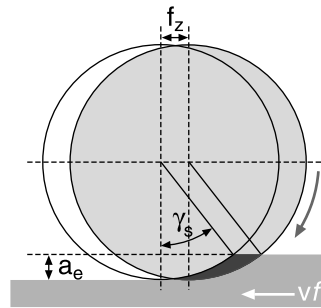
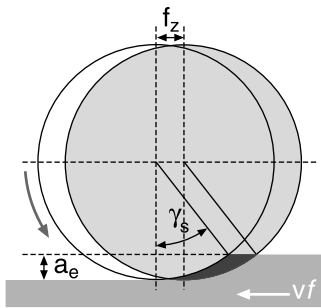


$$f_z = h : \sin \chi_r$$

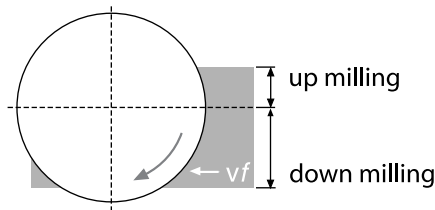
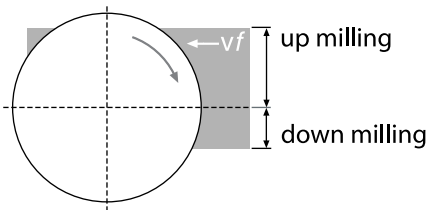
$$h = f_z * \sin \chi_r$$

Technical Data

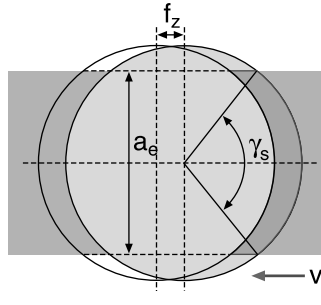
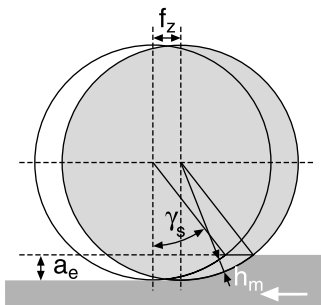
Up Milling / Down Milling with Square Shoulder and Side Face Mills



Up Milling / Down Milling with Face Mills



Average Chip Thickness h_m



Approximate Formula

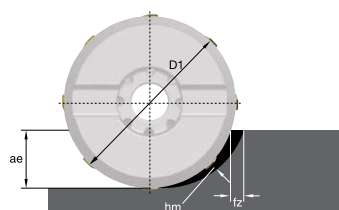
$$a_e \leq \frac{D}{4} : h_m \approx \sqrt{\frac{a_e}{D}} * f_z * \sin \chi_r$$

$$h_m \approx f_z * \sin \chi_r$$

Cutting Data

for M6800 Milling Cutters

ANSI ISO 513	Cutting Data for M6800 Milling Cutters				COATED									UNCOATED		
	Cutter		Carbide Insert		TN6405			TN6425			TN6430			THR-S		
					feed per tooth *(inch)											
	M6800M M6800LX		BDGT-11, BDGT-17-AL		-	-	-	-	-	-	-	-	.002	.006	.012	
			BDMT-11, BDMT-17-MS		-	-	-	.003	.004	.006	.003	.004	.006	-	-	-
			BDMT-11, BDMT-17-ML		.003	.005	.008	-	-	-	.003	.005	.008	-	-	-
P	Work Material	Condition	Hardness HB	Mat. Gr.	vc *(sfm)											
	Carbon steel, Unalloyed steel, cast steel and free cutting steel	< 0.25% C annealed	125	1	-	-	-	720	590	460	920	750	590	-	-	-
		≥ 0.25% C annealed	190	2	-	-	-	660	520	410	820	670	520	-	-	-
		< 0.55% C heat-treated	250	3	-	-	-	610	490	390	770	640	510	-	-	-
		≥ 0.55% C annealed	220	4	-	-	-	540	440	340	690	560	440	-	-	-
		heat-treated	300	5	-	-	-	390	330	250	510	410	330	-	-	-
	Low alloy steel and cast steel	annealed	200	6	-	-	-	510	410	330	660	520	410	-	-	-
		heat-treated	275	7	-	-	-	330	280	210	430	340	280	-	-	-
		heat-treated	300	8	-	-	-	440	360	280	560	460	360	-	-	-
		heat-treated	350	9	-	-	-	330	260	210	410	330	260	-	-	-
	High alloy steel, cast steel & tool steel	annealed	200	10	-	-	-	280	230	180	360	300	230	-	-	-
		heat-treated	325	11	-	-	-	180	150	110	230	180	150	-	-	-
	400 series stainless	FE / MA	200	12	-	-	-	520	430	330	660	540	430	-	-	-
		MA	240	13.1	-	-	-	410	330	260	520	430	340	-	-	-
		MA / PH	330	13.2	-	-	-	300	250	200	380	330	260	-	-	-
M	300 Series	AU	180	14.1	-	-	-	660	460	300	-	-	-	-	-	-
	Stainless	DU	230	14.2	-	-	-	510	360	260	-	-	-	-	-	-
	Duplex	S-AU	200	14.3	-	-	-	360	280	180	-	-	-	-	-	-
	Stainless	AU-PH	330	14.4	-	-	-	330	230	150	-	-	-	-	-	-
K	Grey cast iron	ferrit./pearl.	180	15	820	590	390	-	-	-	590	460	330	-	-	-
		pearlitic	260	16	620	460	330	-	-	-	440	360	280	-	-	-
	Nodular cast iron	ferritic	160	17	690	490	330	-	-	-	490	380	280	-	-	-
		pearlitic	250	18	520	290	160	-	-	-	380	230	130	-	-	-
	Malleable cast iron	ferritic	130	19	690	430	260	-	-	-	490	330	210	-	-	-
pearlitic		230	20	560	330	200	-	-	-	410	260	160	-	-	-	
N	Wrought	Non AG	60	21	-	-	-	-	-	-	-	-	-	2620	1310	660
		AG	100	22	-	-	-	-	-	-	-	-	-	1310	660	330
	Cast aluminum alloys	Non Ag	75	23	-	-	-	-	-	-	-	-	-	2620	1310	660
		Si ≤ 12%	AG	90	24	-	-	-	-	-	-	-	-	1440	720	330
		Si ≥ 12%		130	25	-	-	-	-	-	-	-	-	1050	560	260
S	High Temp	G	200	31	150	110	-	130	100	-	-	-	-	-	-	-
	Alloy FE	AG	280	32	110	100	-	100	80	-	-	-	-	-	-	-
	High Temp	G	250	33	100	70	-	80	70	-	-	-	-	-	-	-
	Alloy	AG	350	34	80	70	-	-	70	-	-	-	-	-	-	-
	Ni / Co	GO	320	35	80	70	-	-	70	-	-	-	-	-	-	-
	Titanium alloys			36	230	200	-	210	180	-	-	-	-	-	-	-
	TiAL6V4	AG		37	230	200	-	210	180	-	-	-	-	-	-	-



$$hm = fz \cdot \sqrt{\frac{ae}{D1}}$$

$$fz = hm \cdot \sqrt{\frac{D1}{ae}}$$

First choice starting speed (vc) are in bold type.
Use corresponding feed (fz).

fz and vc are valid for ae ≥ 0.4 D1.

For smaller ae, fz and vc should be multiplied
by the following factors:

ae / D1	0.02	0.05	0.1	0.2	0.4
fz - Factor	3.5	3	2	1.5	1
fc - Factor	1.6	1.5	1.4	1.3	1.1

Cutting Data

for TA90 / TX90 Milling Cutters

ANSI ISO 513	Cutting Data for TA90 / TX90 Milling Cutters					COATED									CERMET			UNCOATED			
	Cutter	Max ap	Carbide Insert			TN7525 TN6525			TN7535 TN6540			TN450			TTI25			TTM			
						feed per tooth *(inch)															
	TA90	.33	AONT-10T308			.006	.008	.010	.006	.009	.011	.006	.009	.011	.003	.005	.006	.006	.008	.010	
	TXD90	.33	222.79.600			.003	.006	.008	.003	.006	.008	.003	.007	.009	.002	.004	.006	.003	.006	.009	
	TXP90	.55	222.79.400 / 500			.003	.006	.009	.003	.006	.009	.003	.007	.010	.003	.005	.006	.003	.006	.009	
P	Work Material		Condition		Hardness HB	Mat. Gr.	vc *(sfm)														
	Carbon steel, Unalloyed steel, cast steel and free cutting steel	< 0.25% C	annealed		125	1	1080	820	685	915	705	605	620	540	505	1145	885	750	555	490	455
		≥ 0.25% C	annealed		190	2	820	635	555	620	490	425	455	375	360	950	720	605	390	325	295
		< 0.55% C	heat-treated		250	3	685	520	475	520	390	360	375	325	295	785	590	490	325	260	225
		≥ 0.55% C	annealed		220	4	705	555	475	540	425	360	390	360	325	885	655	555	360	275	260
			heat-treated		300	5	605	425	375	455	325	275	325	275	260	-	-	-	275	225	195
	Low alloy steel and cast steel		annealed		200	6	785	605	490	605	455	375	455	375	360	950	705	605	390	325	295
			heat-treated		275	7	605	475	390	455	360	295	360	295	275	-	-	-	295	260	225
			heat-treated		300	8	520	390	340	390	295	260	295	260	225	-	-	-	260	195	180
			heat-treated		350	9	475	340	295	360	260	225	260	180	210	-	-	-	225	160	130
	High alloy steel, cast steel & tool steel		annealed		200	10	605	475	425	455	360	325	390	340	295	915	670	555	360	275	260
			heat-treated		325	11	390	310	260	295	225	195	260	180	210	-	-	-	225	160	130
	400 series stainless		FE / MA		200	12	770	570	490	590	440	375	425	375	340	885	655	555	375	295	275
			MA		240	13.1	670	475	390	505	360	295	360	295	275	750	590	505	325	260	225
			MA / PH		330	13.2	325	225	195	260	180	145	180	145	130	375	295	260	160	130	110
						COATED									CERMET			UNCOATED			
M	Cutter	Max ap	Carbide Insert			TN7525 TN6525			TN7535 TN6540			TN450			TTI25			TTM			
					feed per tooth *(inch)																
	TA90	.33	AONT-10T308			.006	.008	.010	.006	.009	.011	.006	.009	.011	.003	.005	.006	.006	.008	.010	
	TXD90	.33	222.79.600			.003	.006	.008	.003	.006	.008	.003	.007	.009	.002	.004	.006	.003	.006	.009	
	TXP90	.55	222.79.400 / 500			.003	.006	.009	.003	.006	.009	.003	.007	.010	.003	.005	.006	.003	.006	.009	
	Work Material		Condition		Hardness HB	Mat. Gr.	vc *(sfm)														
	300 Series	AU			180	14.1	785	655	520	720	590	520	655	555	520	850	720	590	390	260	225
	Stainless	DU			230	14.2	620	520	440	590	490	440	520	455	440	720	590	490	295	195	180
Duplex	S-AU			200	14.3	455	390	325	425	360	325	390	340	325	555	455	360	210	160	130	
Stainless	AU-PH			330	14.4	390	325	260	360	295	260	325	275	260	425	360	295	195	130	110	
						COATED						UNCOATED			CERMET						
K	Cutter	Max ap	Carbide Insert			TN2510			TN5515 TN6510 TN6520			THM			TTI-25						
					feed per tooth *(inch)																
	TA90	.33	AONT-10T308			-	-	-	.005	.007	.012	.005	.010	.012	.002	.003	.005				
	TXD90	.33	222.79.600			-	-	-	.003	.005	.007	.003	.005	.007	.002	.003	.005				
	TXP90	.55	222.79.400 / 500			.004	.006	.008	.005	.010	.014	.005	.010	.012	.003	.006	.009				
	Work Material		Condition		Hardness HB	Mat. Gr.	vc *(sfm)														
	Grey cast iron	ferrit./pearl.		180	15	1245	915	785	965	705	605	440	325	275	-	-	-				
		pearlitic		260	16	950	720	620	735	555	475	325	260	225	-	-	-				
	Nodular cast iron	ferritic		160	17	1045	785	655	820	605	490	390	295	245	820	620	490				
pearlitic		250	18	785	455	325	605	360	260	275	195	130	620	360	260						
Malleable cast iron	ferritic		130	19	1080	655	520	835	490	390	390	245	160	-	-	--					
	pearlitic		230	20	820	520	390	635	410	295	310	195	130	-	-	-					

Cutting Data

for TA90 / TX90 Milling Cutters

ANSI ISO 513	Cutting Data for TA90 / TX90 Milling Cutters				COATED					UNCOATED								
	Cutter	Max ap	Carbide Insert	TN6501					TN6502			THM-U			THM			
feed per tooth *(inch)																		
TA90				.33	AONT-10T308	-	-	-	-	-	-	-	-	.005	.010	.014		
TXD90				.33	222.79.600	-	-	-	-	-	-	-	-	.003	.005	.007		
TXP90	.55	222.79.400 / 500 / 552	.004	.008	.012	.005	.010	.014	.004	.009	.012	.004	.009	.012				
N	Work Material	Condition		Hardness HB	Mat. Gr.	vc *(sfm)												
	Wrought	Non AG		60	21	6560	3935	3280	5245	3115	2620	6560	3935	3280	2785	2000	1670	
		AG		100	22	3280	1965	1640	2620	1640	1310	3280	1965	1640	1390	1000	835	
	Cast aluminum alloys	Non Ag		75	23	6560	3935	3280	5245	3115	2620	6560	3935	3280	2785	2000	1670	
		Si ≤ 12%	AG	90	24	3605	2130	1640	2950	1800	1475	3605	2130	1640	2230	1640	1390	
			Si ≥ 12%		130	25	2620	1640	1310	2130	1310	980	2620	1640	1310	1390	900	685
	Copper & Copper alloys	Pb > 1%		110	26	-	-	-	-	-	-	-	-	-	1210	820	655	
				90	27	-	-	-	-	-	-	-	-	-	1115	685	555	
				100	28	-	-	-	-	-	-	-	-	-	-	835	505	390
						COATED			UNCOATED									
S	Cutter	Max ap	Carbide Insert	TN5515 TN6510 TN6520					THM									
				feed per tooth *(inch)														
				TA90	.33	AONT-10T308	.003	.004	.005	.003	.004	.005						
	TXD90	.33	222.79.600	-	.002	.004	-	.002	.004									
	TXP90	.55	222.79.400 / 500	.003	.005	.006	.003	.005	.006									
	Work Material	Condition		Hardness HB	Mat. Gr.	vc *(sfm)												
	High Temp	G		200	31	130	95	75	95	75	55							
	Alloy FE	AG		280	32	100	75	65	75	55	45							
	High Temp	G		250	33	80	55	45	55	45	35							
	Alloy	AG		350	34	65	45	35	45	35	30							
	Ni / Co	GO		320	35	-	-	-	-	-	-							
	Titanium alloys				36	-	-	-	225	145	110							
	TiAL6V4	AG			37	-	-	-	180	110	95							

The cutting data given is valid for slot milling with full width of cut $a_e = 100\%$ of the cutter diameter.

For peripheral and shoulder milling with the TX90 end mill, the figures in the table should be converted using the following correction factors:

Ratio $a_e : d_1$	fz factor	SFPM factor
2%	3.5	1.6
5%	3	1.5
10%	2	1.4
20%	1.5	1.3
≥ 40%	1	1.1

Cutting Data

for THA90 / THX90 Helical Milling Cutters

ANSI ISO 513	Cutting Data for THA90 / THX90 Milling Cutters					COATED										UNCOATED			
	Cutter		Carbide Insert		TN7525 TN6525			TN7535 TN6540			TN450				TTM				
					feed per tooth *(inch)														
	THA90 ¹⁾		AONT-10T308		.0024	.0039	.0059	.0024	.0039	.0059	.0024	.0039	.0059	.0024	.0039	.0059			
	THXD90 ¹⁾		222.76.600		--	.003	.005	--	.003	.005	--	.003	.005	--	.003	.005			
	THXP90 ¹⁾		222.79.400 / 500		.0047	.0095	.0126	.0047	.0095	.0126	.0047	.0102	.0138	.0032	.0063	.0087			
P	Work Material		Condition	Hardness HB	Mat. Gr.	vc *(sfm)													
	Carbon steel, Unalloyed steel, cast steel and free cutting steel	< 0.25% C	annealed	125	1	1085	820	690	920	720	625	625	555	490	555	490	460		
		≥ 0.25% C	annealed	190	2	820	655	555	625	490	425	460	390	360	390	325	295		
		< 0.55% C	heat-treated	250	3	690	525	490	525	390	360	390	325	295	325	260	230		
		≥ 0.55% C	annealed	220	4	720	555	490	540	425	360	425	360	325	360	275	260		
			heat-treated	300	5	625	425	390	460	325	275	360	295	260	275	230	195		
	Low alloy steel and cast steel		annealed	200	6	785	625	490	605	460	375	460	390	360	390	325	295		
			heat-treated	275	7	625	490	390	460	360	295	360	295	260	295	260	230		
			heat-treated	300	8	525	390	360	390	295	260	325	260	230	260	195	180		
			heat-treated	350	9	490	360	295	360	260	230	260	180	130	230	160	130		
	High alloy steel, cast steel & tool steel		annealed	200	10	625	490	425	460	360	325	425	360	295	360	275	260		
			heat-treated	325	11	390	310	230	295	230	195	260	180	130	230	160	130		
	400 series stainless		FE / MA	200	12	785	590	490	590	440	375	425	390	325	375	295	275		
			MA	240	13.1	690	480	390	505	360	295	360	295	260	325	260	230		
			MA / PH	330	13.2	360	245	195	260	180	145	180	145	130	160	130	115		
					COATED										UNCOATED				
M	Cutter		Carbide Insert		TN7525 TN6525			TN7535 TN6540			TN450				TTM				
					feed per tooth *(inch)														
	THA90 ¹⁾		AONT-10T308		.0024	.0032	.0047	.0024	.0032	.0047	.0024	.0032	.0047	.0024	.0032	.0047			
	THXD90 ¹⁾		222.76.600		-	.003	.005	-	.003	.005	-	.003	.005	-	-	-			
	THXP90 ¹⁾		222.79.400 / 500		.0032	.0071	.0099	.0032	.0071	.0099	.0032	.0071	.0099	.0032	.0071	.0099			
	Work Material		Condition	Hardness HB	Mat. Gr.	vc *(sfm)													
	300 Series	AU	180	14.1	690	425	295	525	325	230	390	230	195	325	195	130			
	Stainless	DU	230	14.2	555	360	230	425	260	195	310	195	160	260	160	115			
K	Duplex	S-AU	200	14.3	425	275	195	325	195	160	230	160	130	195	115	80			
	Stainless	AU-PH	330	14.4	360	210	160	295	160	130	195	145	115	160	95	65			
						COATED					UNCOATED								
	Cutter		Carbide Insert		TN2510			TN5515 TN6510 TN6520			THM				THR				
					feed per tooth *(inch)														
	THA90 ¹⁾		AONT-10T308		-	-	-	.0032	.0047	.0071	.0032	.0047	.0071	-	-	-			
	THXD90 ¹⁾		222.76.600		-	-	-	.003	.006	.008	.004	.007	.009	-	-	-			
	THXP90 ¹⁾		222.79.400 / 500		.0032	.0063	.0087	.0047	.0102	.0138	.0047	.0118	.0165	-	-	-			
	Work Material		Condition	Hardness HB	Mat. Gr.	vc *(sfm)													
	Grey cast iron	ferrit./pearl.	180	15	1215	885	720	985	720	590	460	325	260	390	295	230			
		pearlitic	260	16	985	690	590	755	555	490	325	260	230	295	230	195			
	Nodular cast iron	ferritic	160	17	950	720	555	820	625	490	390	295	245	360	260	210			
		pearlitic	250	18	855	490	360	625	360	260	360	275	195	325	245	180			
	Malleable cast iron	ferritic	130	19	1015	625	325	820	490	425	490	390	260	460	360	210			
pearlitic		230	20	785	525	360	655	425	295	425	310	195	390	295	160				

Cutting Data

for THA90 / THX90 Helical Milling Cutters

ANSI ISO 513	Cutting Data for THA90 / THX90 Milling Cutters				COATED			UNCOATED		
	Cutter	Carbide Insert			TN6501	TN6502		THM-U	THM	
N					feed per tooth *(inch)					
	THA90 ¹⁾	AONT-10T308			-	-	-	-	-	-
	THXD90 ¹⁾	222.76.610			-	-	-	-	.004	.007 .009
	THXP90 ¹⁾	222.79.510			-	-	-	.0394	.0906	.1182
N	Work Material	Condition	Hardness HB	Mat. Gr.	vc *(sfm)					
	Wrought	Non AG	60	21	6560	3935	3280	5245	3115	2620
		AG	100	22	3280	1965	1640	2620	1640	1310
	Cast aluminum alloys	Non Ag	75	23	6560	3935	3280	5245	3115	2620
		Si ≤ 12%	90	24	3605	1230	1640	2950	1800	1475
		Si ≥ 12%	130	25	2620	1640	1310	2130	1310	980
	Copper & Copper alloys	Pb > 1%	110	26	-	-	-	-	-	-
			90	27	-	-	-	-	-	-
			100	28	-	-	-	-	-	-
	Non Metals			29	-	-	-	-	-	-
				30	-	-	-	-	-	-
S					COATED			UNCOATED		
	Cutter	Carbide Insert			TN5515 TN6510 TN6520	THM	THR			
					feed per tooth *(inch)					
	THA90 ¹⁾	AONT-10T308			.0158	.0236	.0315	.0158	.0236	.0315
	THXD90 ¹⁾	222.76.600			-	-	-	-	.003	.005
	THXP90 ¹⁾	222.79.400 / 500			.0315	.0473	.0552	.0315	.0473	.0552
					.0394	.0591	.0709			
	Work Material	Condition	Hardness HB	Mat. Gr.	vc *(sfm)					
	High Temp	G	200	31	160	120	100	120	95	80
	Alloy FE	AG	280	32	130	95	85	95	75	65
	High Temp	G	250	33	110	80	65	75	60	50
	Alloy	AG	350	34	85	65	50	65	45	40
	Ni / Co	GO	320	35	145	95	85	100	75	65
	Titanium alloys			36	-	-	-	160	130	100
	TiAL6V4	AG		37	-	-	-	135	105	90

The feeds per tooth fz are valid for face milling with width of cut ae ≥ 0.4 d1 and max. depth of cut ap. For smaller widths and depths of cut, the figures in the table should be converted using correction factors (d = dia. of insert, d1 = cutter dia.). The axial feed in plunge milling should be reduced by approximately 40%.

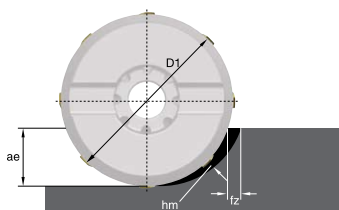
E. - Ratio ae : d1	0.05	0.1	0.2	0.4
fz - Factor	3	2	1.5	1
vc - Factor	1.5	1.4	1.3	1.2

Example:
fz, nom = 0.19 fz, eff = 0.19 x 2 = 0.38 mm / z
vc, nom = 150 vc, eff = 150 x 1.4 = 210 m / min

Cutting Data

for TS90 Milling Cutters

ANSI ISO 513	Cutting Data for TS90 Milling Cutters					COATED													
	Cutter		Carbide Insert		TN2510		TN5515			TN6520			TN6525			TN6540			
					feed per tooth *(inch)														
	TS90			SDMT- ... -ML		.003	.004	.006	.003	.006	.008	-	-	-	.003	.004	.006	.004	.006
SDMT- ... -MH				-	-	-	.004	.007	.010	-	-	-	.003	.006	.0008	.004	.007	.011	
SDMX- ... -MM				.004	.008	.011	.006	.009	.013	.006	.011	.016	.005	.008	.011	.006	.010	.015	
P	Work Material	Condition	Hardness HB	Mat. Gr.	vc *(sfm)														
	Carbon steel, Unalloyed steel, cast steel and free cutting steel	< 0.25% C annealed	125	1	1180	920	750	-	-	-	-	-	-	980	750	620	820	660	560
		≥ 0.25% C annealed	190	2	920	720	620	-	-	-	-	-	-	750	590	490	560	460	390
		< 0.55% C heat-treated	250	3	750	590	520	-	-	-	-	-	-	620	460	430	460	360	330
		≥ 0.55% C annealed	220	4	790	620	560	-	-	-	-	-	-	660	490	460	490	390	330
		heat-treated	300	5	690	460	430	-	-	-	-	-	-	560	390	360	430	300	260
	Low alloy steel and cast steel	annealed	200	6	850	690	560	-	-	-	-	-	-	720	560	460	560	430	330
		heat-treated	275	7	690	560	430	-	-	-	-	-	-	560	460	360	430	330	260
		heat-treated	300	8	590	430	390	-	-	-	-	-	-	460	360	330	360	260	230
		heat-treated	350	9	560	390	330	-	-	-	-	-	-	460	330	260	330	230	200
	High alloy steel, cast steel & tool steel	annealed	200	10	690	560	460	-	-	-	-	-	-	560	460	390	430	330	300
		heat-treated	325	11	430	360	260	-	-	-	-	-	-	360	300	200	260	200	160
	400 series stainless	FE / MA	200	12	850	660	560	-	-	-	-	-	-	720	520	460	520	390	330
		MA	240	13.1	750	560	430	-	-	-	-	-	-	620	460	360	460	330	260
		MA / PH	330	13.2	390	260	230	-	-	-	-	-	-	330	230	160	230	160	130
M	300 Series	AU	180	14.1	-	-	-	-	-	-	-	-	620	390	260	460	300	200	
	Stainless	DU	230	14.2	-	-	-	-	-	-	-	-	490	330	200	390	230	160	
	Duplex	S-AU	200	14.3	-	-	-	-	-	-	-	-	390	260	160	300	160	150	
	Stainless	AU-PH	330	14.4	-	-	-	-	-	-	-	-	330	200	150	260	150	110	
K	Grey cast iron	ferrit./pearl.	180	15	1210	890	720	1080	790	660	950	690	560	-	-	-	-	-	-
		pearlitic	260	16	980	690	590	840	620	540	720	520	460	-	-	-	-	-	-
	Nodular cast iron	ferritic	160	17	950	720	560	900	690	540	790	590	490	750	590	490	560	460	390
		pearlitic	250	18	850	490	360	690	390	300	590	360	260	620	460	430	460	360	330
	Malleable cast iron	ferritic	130	19	1020	620	330	900	540	480	790	460	390	-	-	-	-	-	-
		pearlitic	230	20	790	520	360	720	460	330	620	390	300	-	-	-	-	-	-
S	High Temp	G	200	31	-	-	-	-	-	-	-	-	-	-	-	160	130	110	
	Alloy FE	AG	280	32	-	-	-	-	-	-	-	-	-	-	-	130	100	80	
	High Temp	G	250	33	-	-	-	-	-	-	-	-	-	-	-	80	50	30	
	Alloy	AG	350	34	-	-	-	-	-	-	-	-	-	-	-	70	50	20	
	Ni / Co	GO	320	35	-	-	-	-	-	-	-	-	-	-	-	110	80	50	
	Titanium alloys			36	-	-	-	-	-	-	-	-	-	-	-	230	130	100	
	TiAL6V4	AG		37	-	-	-	-	-	-	-	-	-	-	-	200	100	80	
H	Hardened steel	H	45	38.1	330	260	200	-	-	-	-	-	-	-	-	-	-	-	
		H	55	38.2	330	260	200	-	-	-	-	-	-	-	-	-	-	-	
		H	60	39.1	300	230	160	-	-	-	-	-	-	-	-	-	-	-	
		H	> 62	39.2	300	230	160	-	-	-	-	-	-	-	-	-	-	-	



$$hm = fz \cdot \sqrt{\frac{ae}{D1}}$$

$$fz = hm \cdot \sqrt{\frac{D1}{ae}}$$

First choice starting speed (vc) are in bold type.
Use corresponding feed (fz).

fz and vc are valid for $ae \geq 0.4 D1$.

For smaller ae, fz and vc should be multiplied by the following factors:

ae / D1	0.02	0.05	0.1	0.2	0.4
fz - Factor	3.5	3	2	1.5	1
fc - Factor	1.6	1.5	1.4	1.3	1.1

Cutting Data

for TS90 Milling Cutters

ANSI ISO 513	Cutting Data for TS90 Milling Cutters				COATED									UNCOATED						
	Cutter		Carbide Insert		TN7525			TN7535			TTI25			THM			TTM			
					feed per tooth *(inch)															
	TS90		SDMT- ... -ML		.003	.005	.006	.003	.006	.008	.003	.006	.008	.003	.006	.008	.003	.006	.008	
			SDMT- ... -MH		.003	.005	.008	.004	.007	.010	-	-	-	-	-	-	-	-	-	
			SDMX- ... -MM		.004	.008	.011	.006	.009	.013	.004	.007	.010	.006	.009	.013	.006	.009	.013	
P	Work Material		Condition	Hardness HB	Mat. Gr.	vc *(sfm)														
	Carbon steel, Unalloyed steel, cast steel and free cutting steel	< 0.25% C	annealed	125	1	1080	820	690	920	720	620	1180	980	820	-	-	-	560	490	460
		≥ 0.25% C	annealed	190	2	820	660	560	620	490	430	920	790	690	-	-	-	390	330	300
		< 0.55% C	heat-treated	250	3	690	520	490	520	390	360	820	620	560	-	-	-	330	260	230
		≥ 0.55% C	annealed	220	4	720	560	490	540	430	360	850	690	590	-	-	-	360	280	260
		heat-treated	300	5	620	430	390	460	330	280	-	-	-	-	-	-	280	230	200	
	Low alloy steel and cast steel	annealed	200	6	790	620	490	610	460	380	950	720	590	-	-	-	390	330	300	
		heat-treated	275	7	620	490	390	460	360	300	720	590	490	-	-	-	300	260	230	
		heat-treated	300	8	520	390	360	390	300	260	-	-	-	-	-	-	260	200	180	
		heat-treated	350	9	490	360	300	360	260	230	-	-	-	-	-	-	230	160	130	
	High alloy steel, cast steel & tool steel	annealed	200	10	620	490	430	460	360	330	720	590	490	-	-	-	360	280	260	
		heat-treated	325	11	390	310	230	300	230	200	-	-	-	-	-	-	230	160	130	
	400 series stainless	FE / MA	200	12	790	590	490	590	440	380	920	690	590	-	-	-	380	300	280	
		MA	240	13.1	690	490	390	510	360	300	820	590	490	-	-	-	330	260	230	
		MA / PH	330	13.2	360	250	200	260	180	150	390	300	250	-	-	-	160	130	110	
M	300 Series	AU	180	14.1	690	430	300	520	330	230	1310	850	590	-	-	-	330	200	130	
	Stainless	DU	230	14.2	560	360	230	430	260	200	1080	720	490	-	-	-	260	160	110	
	Duplex	S-AU	200	14.3	430	280	200	330	200	160	890	560	390	-	-	-	200	110	80	
	Stainless	AU-PH	330	14.4	360	210	160	300	160	130	700	430	300	-	-	-	160	100	70	
K	Grey cast iron	ferrit./pearl.	180	15	-	-	-	-	-	-	-	-	-	460	330	260	-	-	-	
		pearlitic	260	16	-	-	-	-	-	-	-	-	-	330	260	230	-	-	-	
	Nodular cast iron	ferritic	160	17	-	-	-	620	490	430	-	-	-	390	300	250	390	330	300	
		pearlitic	250	18	-	-	-	520	390	360	-	-	-	360	280	200	330	260	230	
	Malleable cast iron	ferritic	130	19	-	-	-	-	-	-	-	-	-	490	390	260	-	-	-	
		pearlitic	230	20	-	-	-	-	-	-	-	-	-	430	310	200	-	-	-	
N	Wrought	Non AG	60	21	-	-	-	-	-	-	-	-	-	2950	1970	1640	-	-	-	
		AG	100	22	-	-	-	-	-	-	-	-	-	1480	980	820	-	-	-	
	Cast aluminum alloys	Non Ag	75	23	-	-	-	-	-	-	-	-	-	2950	1970	1640	-	-	-	
		Si ≤ 12%	AG	90	24	-	-	-	-	-	-	-	-	-	2300	1640	1310	-	-	-
		Si ≥ 12%		130	25	-	-	-	-	-	-	-	-	-	1480	920	660	-	-	-
	Copper & Copper alloys	Pb > 1%		110	26	-	-	-	-	-	-	-	-	-	1310	820	660	-	-	-
				90	27	-	-	-	-	-	-	-	-	-	1120	690	520	-	-	-
				100	28	-	-	-	-	-	-	-	-	-	820	520	390	-	-	-
	Non Metals			29	-	-	-	-	-	-	-	-	-	-	1640	1150	660	-	-	-
				30	-	-	-	-	-	-	-	-	-	-	1640	1150	660	-	-	-
S	High Temp	G	200	31	-	-	-	-	-	-	-	-	-	120	80	-	-	-	-	
	Alloy FE	AG	280	32	-	-	-	-	-	-	-	-	-	100	70	-	-	-	-	
	High Temp	G	250	33	-	-	-	-	-	-	-	-	-	80	50	-	-	-	-	
	Alloy	AG	350	34	-	-	-	-	-	-	-	-	-	70	40	-	-	-	-	
	Ni / Co	GO	320	35	-	-	-	-	-	-	-	-	-	100	70	-	-	-	-	
	Titanium alloys			36	-	-	-	-	-	-	-	-	-	160	100	-	-	-	-	
	TiAL6V4	AG		37	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	

Cutting Data

for M1200 Mini Milling Cutters using 1/2" I.C. Inserts

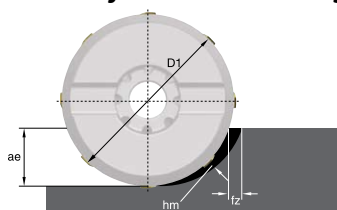
ANSI ISO 513	Cutting Data for M1200 Milling Cutters					COATED										UNCOATED		
	Cutter		Carbide Insert		TN6525			TN6540			TN7535			THM-U				
					feed per tooth *(inch)													
	M1200 Mini Milling Cutters Using 1/2" I.C. Inserts		HNGJ-07- LDJ		-	-	-	-	-	-	-	-	-	.0024	.004	.012		
			HNGJ-07, HNPJ-07- LD		.003	.005	.010	.004	.007	.013	.004	.006	.012	-	-	-		
			HNGJ-07, HNPJ-07- GD		.004	.007	.011	.005	.009	.015	.005	.008	.014	-	-	-		
			HNGJ-07, HNPJ-07- HD		.006	.008	.020	.008	.011	.026	.007	.010	.024	-	-	-		
P	Work Material	Condition	Hardness HB	Mat. Gr.	vc *(sfm)													
	Carbon steel, Unalloyed steel, cast steel and free cutting steel	< 0.25% C annealed	125	1	1150	890	750	950	720	620	1180	920	790	-	-	-		
		≥ 0.25% C annealed	190	2	790	590	520	660	490	430	820	620	540	-	-	-		
		< 0.55% C heat-treated	250	3	660	490	430	560	430	360	690	520	460	-	-	-		
		≥ 0.55% C annealed	220	4	690	520	430	560	430	360	710	540	460	-	-	-		
		heat-treated	300	5	560	430	360	460	330	300	590	430	360	-	-	-		
	Low alloy steel and cast steel	annealed	200	6	750	560	460	620	460	390	790	590	490	-	-	-		
		heat-treated	275	7	560	430	390	460	360	330	590	460	390	-	-	-		
		heat-treated	300	8	490	390	330	430	330	260	520	390	330	-	-	-		
		heat-treated	350	9	430	330	260	360	260	200	460	330	260	-	-	-		
	High alloy steel, cast steel & tool steel	annealed	200	10	560	460	430	460	390	330	590	480	430	-	-	-		
		heat-treated	325	11	390	300	230	330	230	200	390	300	230	-	-	-		
	400 series stainless	FE / MA	200	12	720	560	460	590	460	390	750	570	490	-	-	-		
		MA	240	13.1	620	460	390	520	390	330	660	480	390	-	-	-		
		MA / PH	330	13.2	310	230	200	260	200	160	330	250	200	-	-	-		
M	300 Series	AU	180	14.1	620	390	300	520	330	230	660	390	300	-	-	-		
	Stainless	DU	230	14.2	490	300	230	430	260	200	520	310	230	-	-	-		
	Duplex	S-AU	200	14.3	390	230	160	330	200	130	390	230	180	-	-	-		
	Stainless	AU-PH	330	14.4	330	200	130	260	160	130	330	200	150	-	-	-		
K	Grey cast iron	ferrit./pearl.	180	15	-	-	-	-	-	-	-	-	-	-	-	-		
		pearlitic	260	16	-	-	-	-	-	-	-	-	-	-	-	-		
	Nodular cast iron	ferritic	160	17	790	590	520	660	490	430	820	620	540	-	-	-		
		pearlitic	250	18	660	490	430	560	430	360	690	520	460	-	-	-		
	Malleable cast iron	ferritic	130	19	-	-	-	-	-	-	-	-	-	-	-	-		
		pearlitic	230	20	-	-	-	-	-	-	-	-	-	-	-	-		
N	Wrought	Non AG	60	21	-	-	-	-	-	-	-	-	-	5910	3120	1940		
		AG	100	22	-	-	-	-	-	-	-	-	-	2890	1640	1330		
	Cast aluminum alloys	Non Ag	75	23	-	-	-	-	-	-	-	-	-	5250	2820	1770		
		Si ≤ 12%	AG	90	24	-	-	-	-	-	-	-	-	-	3120	1940	1480	
		Si ≥ 12%		130	25	-	-	-	-	-	-	-	-	-	2230	1480	1030	
	Copper & Copper alloys	Pb > 1%	110	26	-	-	-	-	-	-	-	-	-	2200	1640	1020		
			90	27	-	-	-	-	-	-	-	-	-	2300	2000	1640		
			100	28	-	-	-	-	-	-	-	-	-	2460	2170	1770		
	Non Metals			29	-	-	-	-	-	-	-	-	-	2460	2130	1740		
				30	-	-	-	-	-	-	-	-	-	2300	2150	1640		
S	High Temp	G	200	31	-	-	-	200	160	150	-	-	-	-	-	-		
	Alloy FE	AG	280	32	-	-	-	160	130	110	-	-	-	-	-	-		
	High Temp	G	250	33	-	-	-	110	80	70	-	-	-	-	-	-		
	Alloy	AG	350	34	-	-	-	100	70	50	-	-	-	-	-	-		
	Ni / Co	GO	320	35	-	-	-	100	70	50	-	-	-	-	-	-		
	Titanium alloys			36	-	-	-	260	160	130	-	-	-	-	-	-		
	TiAL6V4	AG		37	-	-	-	230	150	110	-	-	-	-	-	-		

Cutting Data

for M1200 Mini Milling Cutters using 1/2" I.C. Inserts

ANSI ISO 513	Cutting Data for M1200 Milling Cutters				COATED														
	Cutter		Carbide Insert		TN5515			TN6501			TH6505			TN6510			TN6520		
					feed per tooth *(inch)														
	M1200 Mini Milling Cutters Using 1/2" I.C. Inserts		HNGJ-07- LDJ		-	-	-	.003	.004	.012	-	-	-	-	-	-	-	-	-
			HNGJ-07, HNPJ-07- LD		.003	.006	.010	-	-	-	.003	.004	.010	.004	.007	.011	.004	.007	.011
			HNGJ-07, HNPJ-07- GD		.005	.008	.014	-	-	-	-	-	-	.005	.009	.015	.006	.009	.016
			HNGJ-07, HNPJ-07- HD		.007	.010	.022	-	-	-	-	-	-	.008	.011	.024	.008	.011	.024
P	Work Material Condition		Hardness HB	Mat. Gr.	vc *(sfm)														
	Carbon steel, Unalloyed steel, cast steel and free cutting steel	< 0.25% C annealed	125	1	-	-	-	-	-	-	1510	1150	980	-	-	-	-	-	-
		≥ 0.25% C annealed	190	2	-	-	-	-	-	-	1020	750	690	-	-	-	-	-	-
		< 0.55% C heat-treated	250	3	-	-	-	-	-	-	850	660	560	-	-	-	-	-	-
		≥ 0.55% C annealed	220	4	-	-	-	-	-	-	890	690	560	-	-	-	-	-	-
		heat-treated	300	5	-	-	-	-	-	-	720	560	460	-	-	-	-	-	-
	Low alloy steel and cast steel	annealed	200	6	-	-	-	-	-	-	980	720	590	-	-	-	-	-	-
		heat-treated	275	7	-	-	-	-	-	-	720	560	520	-	-	-	-	-	-
		heat-treated	300	8	-	-	-	-	-	-	660	520	430	-	-	-	-	-	-
		heat-treated	350	9	-	-	-	-	-	-	560	430	330	-	-	-	-	-	-
	High alloy steel, cast steel & tool steel	annealed	200	10	-	-	-	-	-	-	720	590	560	-	-	-	-	-	-
		heat-treated	325	11	-	-	-	-	-	-	520	390	300	-	-	-	-	-	-
	400 series stainless	FE / MA	200	12	-	-	-	-	-	-	950	720	590	-	-	-	-	-	-
		MA	240	13.1	-	-	-	-	-	-	820	590	520	-	-	-	-	-	-
		MA / PH	330	13.2	-	-	-	-	-	-	430	300	260	-	-	-	-	-	-
M	300 Series	AU	180	14.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	Stainless	DU	230	14.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	Duplex	S-AU	200	14.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	Stainless	AU-PH	330	14.4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
K	Grey cast iron	ferrit./pearl.	180	15	1740	1280	920	-	-	-	-	-	-	1570	1150	820	1250	920	660
		pearlitic	260	16	1350	1020	750	-	-	-	-	-	-	1210	920	690	980	720	560
	Nodular cast iron	ferritic	160	17	1510	1020	750	-	-	-	1020	750	690	1380	920	690	1120	720	560
		pearlitic	250	18	980	720	560	-	-	-	850	660	560	890	660	490	720	520	390
	Malleable cast iron	ferritic	130	19	1210	950	720	-	-	-	-	-	-	1120	850	660	890	690	520
		pearlitic	230	20	1020	750	590	-	-	-	-	-	-	920	690	520	720	560	430
N	Wrought	Non AG	60	21	-	-	-	6560	3440	2130	-	-	-	-	-	-	-	-	-
		AG	100	22	-	-	-	3220	1800	1480	-	-	-	-	-	-	-	-	-
	Cast aluminum alloys	Non Ag	75	23	-	-	-	5910	3120	1970	-	-	-	-	-	-	-	-	-
		Si ≤ 12%	AG	90	24	-	-	-	3440	2130	1640	-	-	-	-	-	-	-	-
		Si ≥ 12%		130	25	-	-	-	2460	1640	1150	-	-	-	-	-	-	-	-
	Copper & Copper alloys	Pb > 1%		110	26	-	-	-	-	-	-	-	-	-	-	-	-	-	-
				90	27	-	-	-	-	-	-	-	-	-	-	-	-	-	-
				100	28	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Non Metals			29	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
				30	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Factors for M1200 Milling Cutters:



$$hm = fz \cdot \sqrt{\frac{ae}{D1}}$$

$$fz = hm \cdot \sqrt{\frac{D1}{ae}}$$

First choice starting speed (vc) are in bold type.
Use corresponding feed (fz).

fz and vc are valid for ae ≥ 0.4 D1.

For smaller ae, fz and vc should be multiplied
by the following factors:

ae / D1	0.1	0.2	0.3	0.4
fz - Factor	2	1.5	1.3	1
fc - Factor	1.4	1.3	1.2	1.1

Cutting Data

for M1200 Milling Cutters using 5/8" I.C. Inserts

ANSI ISO 513	Cutting Data for M1200 Milling Cutters				COATED									UNCOATED			
	Cutter		Carbide Insert		TN6525			TN6540			TN7535			THM-U			
					feed per tooth *(inch)												
	M1200 Milling Cutters using 5/8" I.C. Inserts		HNGJ-09- LDJ		-	-	-	-	-	-	-	-	-	-	.003	.005	.012
			HNGJ-09, HNPJ-09- LD		.004	.007	.013	.005	.009	.017	.005	.008	.016	-	-	-	
			HNGJ-09, HNPJ-09- GD		.005	.008	.016	.007	.011	.022	.006	.010	.020	-	-	-	
			HNGJ-09, HNPJ-09- HD		.007	.010	.020	.009	.013	.026	.008	.012	.024	-	-	-	
P	Work Material	Condition	Hardness HB	Mat. Gr.	vc *(sfm)												
	Carbon steel, Unalloyed steel, cast steel and free cutting steel	< 0.25% C annealed	125	1	1150	890	750	950	720	620	1180	920	790	-	-	-	
		≥ 0.25% C annealed	190	2	790	590	520	660	490	430	820	620	540	-	-	-	
		< 0.55% C heat-treated	250	3	660	490	430	560	430	360	690	520	460	-	-	-	
		≥ 0.55% C annealed	220	4	690	520	430	560	430	360	710	540	460	-	-	-	
		heat-treated	300	5	560	430	360	460	330	300	590	430	360	-	-	-	
	Low alloy steel and cast steel	annealed	200	6	750	560	460	620	460	390	790	590	490	-	-	-	
		heat-treated	275	7	560	430	390	460	360	330	590	460	390	-	-	-	
		heat-treated	300	8	490	390	330	430	330	260	520	390	330	-	-	-	
		heat-treated	350	9	430	330	260	360	260	200	460	330	260	-	-	-	
	High alloy steel, cast steel & tool steel	annealed	200	10	560	460	430	460	390	330	590	480	430	-	-	-	
		heat-treated	325	11	390	300	230	330	230	200	390	300	230	-	-	-	
	400 series stainless	FE / MA	200	12	720	560	460	590	460	390	750	570	490	-	-	-	
		MA	240	13.1	620	460	390	520	390	330	660	480	390	-	-	-	
		MA / PH	330	13.2	310	230	200	260	200	160	330	250	200	-	-	-	
M	300 Series	AU	180	14.1	620	390	300	520	330	230	660	390	300	-	-	-	
	Stainless	DU	230	14.2	490	300	230	430	260	200	520	310	230	-	-	-	
	Duplex	S-AU	200	14.3	390	230	160	330	200	130	390	230	180	-	-	-	
	Stainless	AU-PH	330	14.4	330	200	130	260	160	130	330	200	150	-	-	-	
K	Grey cast iron	ferrit./pearl.	180	15	-	-	-	-	-	-	-	-	-	-	-	-	
		pearlitic	260	16	-	-	-	-	-	-	-	-	-	-	-	-	
	Nodular cast iron	ferritic	160	17	790	590	520	660	490	430	820	620	540	-	-	-	
		pearlitic	250	18	660	490	430	560	430	360	690	520	460	-	-	-	
	Malleable cast iron	ferritic	130	19	-	-	-	-	-	-	-	-	-	-	-	-	
		pearlitic	230	20	-	-	-	-	-	-	-	-	-	-	-	-	
N	Wrought	Non AG	60	21	-	-	-	-	-	-	-	-	-	5910	3120	1940	
		AG	100	22	-	-	-	-	-	-	-	-	-	2890	1640	1330	
	Cast aluminum alloys	Non Ag	75	23	-	-	-	-	-	-	-	-	-	5250	2820	1770	
		Si ≤ 12%	AG	90	24	-	-	-	-	-	-	-	-	-	3120	1940	1480
		Si ≥ 12%		130	25	-	-	-	-	-	-	-	-	-	2230	1480	1030
	Copper & Copper alloys	Pb > 1%	110	26	-	-	-	-	-	-	-	-	-	2200	1640	1020	
			90	27	-	-	-	-	-	-	-	-	-	2300	2000	1640	
			100	28	-	-	-	-	-	-	-	-	-	2460	2170	1770	
	Non Metals			29	-	-	-	-	-	-	-	-	-	2460	2130	1740	
			30	-	-	-	-	-	-	-	-	-	2300	2150	1640		
S	High Temp	G	200	31	-	-	-	200	160	150	-	-	-	-	-	-	
	Alloy FE	AG	280	32	-	-	-	160	130	110	-	-	-	-	-	-	
	High Temp	G	250	33	-	-	-	110	80	70	-	-	-	-	-	-	
	Alloy	AG	350	34	-	-	-	100	70	50	-	-	-	-	-	-	
	Ni / Co	GO	320	35	-	-	-	100	70	50	-	-	-	-	-	-	
	Titanium alloys			36	-	-	-	260	160	130	-	-	-	-	-	-	
	TiAL6V4	AG		37	-	-	-	230	150	110	-	-	-	-	-	-	

Cutting Data

for M1200 Milling Cutters using 5/8" I.C. Inserts

ANSI ISO 513	Cutting Data for M1200 Milling Cutters					COATED											
	Cutter		Carbide Insert		TN5515			TN6501			TN6510			TN6520			
					feed per tooth *(inch)												
	M1200 Milling Cutters using 5/8" I.C. Inserts		HNGJ-09- LDJ		-	-	-	.003	.005	.012	-	-	-	-	-	-	
			HNGJ-09, HNPI-09- LD		.005	.008	.016	-	-	-	.005	.009	.017	.006	.009	.019	
			HNGJ-09, HNPI-09- GD		.006	.010	.020	-	-	-	.007	.011	.022	.007	.011	.023	
			HNGJ-09, HNPI-09- HD		.008	.012	.024	-	-	-	.009	.013	.026	.009	.014	.027	
P	Work Material		Condition	Hardness HB	Mat. Gr.	vc *(sfm)											
	Carbon steel, Unalloyed steel, cast steel and free cutting steel	< 0.25% C	annealed	125	1	-	-	-	-	-	-	-	-	-	-	-	
		≥ 0.25% C	annealed	190	2	-	-	-	-	-	-	-	-	-	-	-	
		< 0.55% C	heat-treated	250	3	-	-	-	-	-	-	-	-	-	-	-	
		≥ 0.55% C	annealed	220	4	-	-	-	-	-	-	-	-	-	-	-	
			heat-treated	300	5	-	-	-	-	-	-	-	-	-	-	-	
	Low alloy steel and cast steel		annealed	200	6	-	-	-	-	-	-	-	-	-	-	-	
			heat-treated	275	7	-	-	-	-	-	-	-	-	-	-	-	
			heat-treated	300	8	-	-	-	-	-	-	-	-	-	-	-	
			heat-treated	350	9	-	-	-	-	-	-	-	-	-	-	-	
	High alloy steel, cast steel & tool steel		annealed	200	10	-	-	-	-	-	-	-	-	-	-	-	
			heat-treated	325	11	-	-	-	-	-	-	-	-	-	-	-	
	400 series stainless		FE / MA	200	12	-	-	-	-	-	-	-	-	-	-	-	
			MA	240	13.1	-	-	-	-	-	-	-	-	-	-	-	
			MA / PH	330	13.2	-	-	-	-	-	-	-	-	-	-	-	
M	300 Series	AU	180	14.1	-	-	-	-	-	-	-	-	-	-	-		
	Stainless	DU	230	14.2	-	-	-	-	-	-	-	-	-	-	-		
	Duplex	S-AU	200	14.3	-	-	-	-	-	-	-	-	-	-	-		
	Stainless	AU-PH	330	14.4	-	-	-	-	-	-	-	-	-	-	-		
K	Grey cast iron	ferrit./pearl.	180	15	1740	1280	920	-	-	-	1570	1150	820	1250	920	660	
		pearlitic	260	16	1350	1020	750	-	-	-	1210	920	690	980	720	560	
	Nodular cast iron	ferritic	160	17	1510	1020	750	-	-	-	1380	920	690	1120	720	560	
		pearlitic	250	18	980	720	560	-	-	-	890	660	490	720	520	390	
	Malleable cast iron	ferritic	130	19	1210	950	720	-	-	-	1120	850	660	890	690	520	
		pearlitic	230	20	1020	750	590	-	-	-	920	690	520	720	560	430	
N	Wrought	Non AG	60	21	-	-	-	6560	3440	2130	-	-	-	-	-	-	
		AG	100	22	-	-	-	3220	1800	1480	-	-	-	-	-	-	
	Cast aluminum alloys	Non Ag	75	23	-	-	-	5910	3120	1970	-	-	-	-	-	-	
		Si ≤ 12%	AG	90	24	-	-	-	3440	2130	1640	-	-	-	-	-	-
		Si ≥ 12%		130	25	-	-	-	2460	1640	1150	-	-	-	-	-	-
	Copper & Copper alloys	Pb > 1%		110	26	-	-	-	-	-	-	-	-	-	-	-	
				90	27	-	-	-	-	-	-	-	-	-	-	-	
				100	28	-	-	-	-	-	-	-	-	-	-	-	
	Non Metals			29	-	-	-	-	-	-	-	-	-	-	-	-	
					30	-	-	-	-	-	-	-	-	-	-	-	
S	High Temp	G	200	31													
	Alloy FE	AG	280	32													
	High Temp	G	250	33													
	Alloy	AG	350	34													
	Ni / Co	GO	320	35													
	Titanium alloys			36													
	TiAL6V4	AG		37													

Cutting Data

for M1200 High Feed Milling Cutters using 5/8" I.C. Inserts

ANSI ISO 513	Cutting Data for M1200 Milling Cutters				COATED						UNCOATED			
	Cutter		Carbide Insert		TN6540			TN7535			THM-U			
feed per tooth *(inch)														
	M1200 High Feed Milling Cutters using 5/8" I.C. Inserts		- LDJ		-	-	-	-	-	-	.008	.018	.039	
			- LD		.016	.030	.061	.014	.026	.055	-	-	-	
			- GD		.022	.039	.079	.020	.034	.071	-	-	-	
			- HD		.028	.051	.110	.026	.047	.098	-	-	-	
P	Work Material	Condition	Hardness HB	Mat. Gr.	vc *(sfm)									
	Carbon steel, Unalloyed steel, cast steel and free cutting steel	< 0.25% C annealed	125	1	950	720	620	1180	920	790	-	-	-	
		≥ 0.25% C annealed	190	2	660	490	430	820	620	540	-	-	-	
		< 0.55% C heat-treated	250	3	560	430	360	690	520	460	-	-	-	
		≥ 0.55% C annealed	220	4	560	430	360	710	540	460	-	-	-	
		heat-treated	300	5	460	330	300	590	430	360	-	-	-	
	Low alloy steel and cast steel	annealed	200	6	620	460	390	790	590	490	-	-	-	
		heat-treated	275	7	460	360	330	590	460	390	-	-	-	
		heat-treated	300	8	430	330	260	520	390	330	-	-	-	
		heat-treated	350	9	360	260	200	460	330	260	-	-	-	
	High alloy steel, cast steel & tool steel	annealed	200	10	460	390	330	590	480	430	-	-	-	
		heat-treated	325	11	330	230	200	390	300	230	-	-	-	
	400 series stainless	FE / MA	200	12	590	460	390	750	570	490	-	-	-	
		MA	240	13.1	520	390	330	660	480	390	-	-	-	
		MA / PH	330	13.2	260	200	160	330	250	200	-	-	-	
M	300 Series	AU	180	14.1	520	330	230	660	390	300	-	-	-	
	Stainless	DU	230	14.2	430	260	200	520	310	230	-	-	-	
	Duplex	S-AU	200	14.3	330	200	130	390	230	180	-	-	-	
	Stainless	AU-PH	330	14.4	260	160	130	330	200	150	-	-	-	
K	Grey cast iron	ferrit./pearl.	180	15	-	-	-	-	-	-	-	-	-	
		pearlitic	260	16	-	-	-	-	-	-	-	-	-	
	Nodular cast iron	ferritic	160	17	660	490	430	820	620	540	-	-	-	
		pearlitic	250	18	560	430	360	690	520	460	-	-	-	
	Malleable cast iron	ferritic	130	19	-	-	-	-	-	-	-	-	-	
		pearlitic	230	20	-	-	-	-	-	-	-	-	-	
N	Wrought	Non AG	60	21	-	-	-	-	-	-	5910	3120	1940	
		AG	100	22	-	-	-	-	-	-	2890	1640	1330	
	Cast aluminum alloys	Non Ag	75	23	-	-	-	-	-	-	5250	2820	1770	
		Si ≤ 12%	AG	90	24	-	-	-	-	-	-	3120	1940	1480
		Si ≥ 12%		130	25	-	-	-	-	-	-	2230	1480	1030
	Copper & Copper alloys	Pb > 1%	110	26	-	-	-	-	-	-	2200	1640	1020	
			90	27	-	-	-	-	-	-	2300	2000	1640	
			100	28	-	-	-	-	-	-	2460	2170	1770	
	Non Metals			29	-	-	-	-	-	-	2460	2130	1740	
			30	-	-	-	-	-	-	2300	2150	1640		
S	High Temp	G	200	31	200	160	150	-	-	-	-	-	-	
	Alloy FE	AG	280	32	160	130	110	-	-	-	-	-	-	
	High Temp	G	250	33	110	80	70	-	-	-	-	-	-	
	Alloy	AG	350	34	100	70	50	-	-	-	-	-	-	
	Ni / Co	GO	320	35	100	70	50	-	-	-	-	-	-	
	Titanium alloys			36	260	160	130	-	-	-	-	-	-	
	TiAL6V4	AG		37	230	150	110	-	-	-	-	-	-	

Cutting Data

for M1200 High Feed Milling Cutters using 5/8" I.C. Inserts

ANSI ISO 513	Cutting Data for M1200 Milling Cutters					COATED														
	Cutter		Carbide Insert		TN5515			TN6501			TN6510			TN6520			TN6525			
					feed per tooth *(inch)															
	M1200 High Feed Milling Cutters using 5/8" I.C. Inserts		- LDJ		-	-	-	.008	.018	.039	-	-	-	-	-	-	-	-	-	
			- LD		.014	.026	.055	-	-	-	.016	.028	.061	.016	.030	.059	.012	.022	.047	
			- GD		.020	.034	.071	-	-	-	.022	.037	.077	.024	.039	.079	.016	.030	.060	
			- HD		.026	.047	.098	-	-	-	.028	.051	.108	.030	.053	.110	.022	.039	.079	
	P	Work Material		Condition	Hardness HB	Mat. Gr.	vc *(sfm)													
Carbon steel, Unalloyed steel, cast steel and free cutting steel		< 0.25% C	annealed	125	1	-	-	-	-	-	-	-	-	-	-	-	-	1150	890	750
		≥ 0.25% C	annealed	190	2	-	-	-	-	-	-	-	-	-	-	-	-	790	590	520
		< 0.55% C	heat-treated	250	3	-	-	-	-	-	-	-	-	-	-	-	-	660	490	430
		≥ 0.55% C	annealed	220	4	-	-	-	-	-	-	-	-	-	-	-	-	690	520	430
			heat-treated	300	5	-	-	-	-	-	-	-	-	-	-	-	-	560	430	360
Low alloy steel and cast steel			annealed	200	6	-	-	-	-	-	-	-	-	-	-	-	-	750	560	460
			heat-treated	275	7	-	-	-	-	-	-	-	-	-	-	-	-	560	430	390
			heat-treated	300	8	-	-	-	-	-	-	-	-	-	-	-	-	490	390	330
			heat-treated	350	9	-	-	-	-	-	-	-	-	-	-	-	-	430	330	260
High alloy steel, cast steel & tool steel			annealed	200	10	-	-	-	-	-	-	-	-	-	-	-	-	560	460	430
			heat-treated	325	11	-	-	-	-	-	-	-	-	-	-	-	-	390	300	230
400 series stainless			FE / MA	200	12	-	-	-	-	-	-	-	-	-	-	-	-	720	560	460
			MA	240	13.1	-	-	-	-	-	-	-	-	-	-	-	-	620	460	390
			MA / PH	330	13.2	-	-	-	-	-	-	-	-	-	-	-	-	310	230	200
M	300 Series	AU	180	14.1	-	-	-	-	-	-	-	-	-	-	-	-	620	390	300	
	Stainless	DU	230	14.2	-	-	-	-	-	-	-	-	-	-	-	-	490	300	230	
	Duplex	S-AU	200	14.3	-	-	-	-	-	-	-	-	-	-	-	-	390	230	160	
	Stainless	AU-PH	330	14.4	-	-	-	-	-	-	-	-	-	-	-	-	330	200	130	
K	Grey cast iron	ferrit./pearl.	180	15	1740	1280	920	-	-	-	1570	1150	820	1250	920	660	-	-	-	
		pearlitic	260	16	1350	1020	750	-	-	-	1210	920	690	980	720	560	-	-	-	
	Nodular cast iron	ferritic	160	17	1510	1020	750	-	-	-	1380	920	690	1120	720	560	790	590	520	
		pearlitic	250	18	980	720	560	-	-	-	890	660	490	720	520	390	660	490	430	
	Malleable cast iron	ferritic	130	19	1210	950	720	-	-	-	1120	850	660	890	690	520	-	-	-	
pearlitic		230	20	1020	750	590	-	-	-	920	690	520	720	560	430	-	-	-		
N	Wrought	Non AG	60	21	-	-	-	6560	3440	2130	-	-	-	-	-	-	-	-	-	
		AG	100	22	-	-	-	3220	1800	1480	-	-	-	-	-	-	-	-	-	
	Cast aluminum alloys	Non Ag	75	23	-	-	-	5910	3120	1970	-	-	-	-	-	-	-	-	-	
		Si ≤ 12%	AG	90	24	-	-	-	3440	2130	1640	-	-	-	-	-	-	-	-	-
		Si ≥ 12%		130	25	-	-	-	2460	1640	1150	-	-	-	-	-	-	-	-	-
	Copper & Copper alloys	Pb > 1%		110	26	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
				90	27	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
				100	28	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Non Metals			29	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
					30	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
S	High Temp	G	200	31	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	Alloy FE	AG	280	32	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	High Temp	G	250	33	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	Alloy	AG	350	34	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	Ni / Co	GO	320	35	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	Titanium alloys			36	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	TiAL6V4	AG		37	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	

Cutting Data

for THP60 / TSN45 Milling Cutters

ANSI ISO 513	Cutting Data for THP60 / TSN45 Milling Cutters					COATED									CERMET			UNCOATED			
	Cutter		Carbide Insert			TN7525 TN6525			TN7535 TN6540			TN450			TTI25			TTM			
						feed per tooth *(inch)															
	THP60		HP..06T3..			.0059	.0126	.0177	.0059	.0126	.0177	.0059	.0126	.0177	-	-	-	.0059	.0126	.0177	
	TSN45		SN...12/15			.0059	.0126	.0177	.0059	.0126	.0177	.0059	.0126	.0177	.0047	.0095	.0126	.0059	.0126	.0177	
P	Work Material		Condition		Hardness HB	Mat. Gr.	vc *(sfm)														
	Carbon steel, Unalloyed steel, cast steel and free cutting steel	< 0.25% C	annealed	125	1	1345	1065	915	1180	915	785	820	705	655	1475	1130	980	720	635	590	
		≥ 0.25% C	annealed	190	2	1065	820	705	820	620	450	590	490	455	1245	915	785	650	425	390	
		< 0.55% C	heat-treated	250	3	900	685	605	685	520	455	490	425	390	1015	770	655	425	325	295	
		≥ 0.55% C	annealed	220	4	915	705	605	705	540	455	520	455	425	1145	850	720	455	360	325	
		heat-treated	300	5	770	555	475	590	425	360	425	360	325	-	-	-	360	295	260		
	Low alloy steel and cast steel	annealed	200	6	1030	770	635	785	590	490	590	490	455	1245	915	720	520	425	390		
		heat-treated	275	7	770	605	520	590	455	390	455	390	360	1015	720	620	390	325	295		
		heat-treated	300	8	685	520	425	520	390	325	390	325	295	820	570	490	325	260	225		
		heat-treated	350	9	605	425	360	455	325	260	325	225	195	-	-	-	295	195	160		
	High alloy steel, cast steel & tool steel	annealed	200	10	770	620	555	590	475	425	520	440	390	1180	865	720	455	360	325		
		heat-treated	325	11	520	390	325	390	295	225	325	225	180	-	-	-	295	195	160		
	400 series stainless	FE / MA	200	12	980	915	635	750	570	490	555	490	455	1145	850	720	490	390	360		
		MA	240	13.1	850	620	520	655	475	390	455	390	360	980	750	655	425	325	295		
		MA / PH	330	13.2	425	310	260	325	245	195	225	195	180	490	375	325	210	160	145		
						COATED									CERMET			UNCOATED			
M	Cutter		Carbide Insert			TN7525 TN6525			TN7535 TN6540			TN450			TTI25			TTM			
						feed per tooth *(inch)															
	THP60		HP..06T3..			.0047	.0102	.0138	.0047	.0102	.0138	.0047	.0102	.0138				.0047	.0102	.0138	
	TSN45		SN...12/15			.0047	.0102	.0138	.0047	.0102	.0138	.0047	.0102	.0138	.0047	.0095	.0126	.0047	.0102	.0138	
	Work Material		Condition		Hardness HB	Mat. Gr.	vc *(sfm)														
	300 Series	AU	180	14.1	850	520	390	655	390	295	490	295	225	980	785	590	390	260	195		
	Stainless	DU	230	14.2	685	455	310	520	310	225	425	225	180	820	720	505	325	245	180		
	Duplex	S-AU	200	14.3	520	360	245	390	225	180	325	180	130	620	520	360	245	180	130		
Stainless	AU-PH	330	14.4	455	275	210	325	195	145	245	145	110	490	390	275	195	145	110			
						COATED			UNCOATED			CERMET									
K	Cutter		Carbide Insert			TN5515 TN6510 TN6520			THM			TTI25									
						feed per tooth *(inch)															
	THP60		HP..06T3..			.0071	.0142	.0197	.0039	.0095	.0118	.0055	.0071	.0099							
	TSN45		SN...12/15			.0071	.0102	.0197	.0039	.0087	.0118	-	-	-							
	Work Material		Condition		Hardness HB	Mat. Gr.	vc *(sfm)														
	Grey cast iron	ferrit./pearl.	180	15	1570	1145	820	1245	915	770	-	-	-								
		pearlitic	260	16	1210	915	685	950	705	605	-	-	-								
	Nodular cast iron	ferritic	160	17	1375	915	685	1065	770	635	455	340	295								
		pearlitic	250	18	885	655	490	770	475	375	325	225	180								
	Malleable cast iron	ferritic	130	19	1115	850	655	1065	635	505	-	-	-								
pearlitic		230	20	915	685	520	850	520	425	-	-	-									

Cutting Data

for THP60 / TSN45 Milling Cutters

ANSI ISO 513	Cutting Data for THP60 / TSN45 Milling Cutters				COATED					UNCOATED						
	Cutter		Carbide Insert		TN6501			TN6502		THM-U			THM			
					feed per tooth *(inch)											
	THP60		HP..06T3..		.0024	.0047	.0079	.0028	.0071	.0110	.0059	.0138	.0197	.0059	.0138	.0197
TSN45		SN...12/15		-	-	-	-	-	-	.0059	.0138	.0197	.0059	.0138	.0197	
N	Work Material	Condition	Hardness HB	Mat. Gr.	vc *(sfm)											
	Wrought	Non AG	60	21	8200	4920	3935	4920	3605	2950	8200	4920	3935	3280	2460	1965
		AG	100	22	4100	2460	1965	2460	1800	1475	4100	2460	1965	1640	1180	980
	Cast aluminum alloys	Non Ag	75	23	8200	4920	3935	4920	3605	2950	8200	4920	3935	3280	2460	1965
		Si ≤ 12%	90	24	4265	2620	1965	3935	2950	2460	4265	2620	1965	2620	1965	1640
		Si ≥ 12%	130	25	2620	2130	1640	2460	1640	1145	2620	2130	1640	1640	1145	820
	Copper & Copper alloys	Pb > 1%	110	26	-	-	-	-	-	-	-	-	-	-	-	-
			90	27	-	-	-	-	-	-	-	-	-	-	-	-
			100	28	-	-	-	-	-	-	-	-	-	-	-	-
	Non Metals			29	-	-	-	-	-	-	-	-	-	-	-	-
					30	-	-	-	-	-	-	-	-	-	-	-
					COATED			UNCOATED								
S	Cutter		Carbide Insert		TN2510			TN5515		THM-U			THM			
					feed per tooth *(inch)											
	THP60		HP..06T3..		.0039	.0063	.0079	.0039	.0063	.0079	.0039	.0063	.0079	.010	.016	.020
	TSN45		SN...12/15		.0039	.0063	.0079	.0039	.0063	.0079	.0039	.0063	.0079	.010	.016	.020
	Work Material	Condition	Hardness HB	Mat. Gr.	vc *(sfm)											
	High Temp	G	200	31	245	195	175	205	160	145	150	110	95	120	95	80
	Alloy FE	AG	280	32	195	155	135	160	130	110	115	90	75	95	75	65
	High Temp	G	250	33	135	95	75	110	80	65	95	75	60	75	60	50
	Alloy	AG	350	34	95	75	55	80	65	45	75	55	50	65	45	40
	Ni / Co	GO	320	35	110	85	65	90	70	55	75	55	50	65	45	40
	Titanium alloys			36	-	-	-	-	-	-	310	195	155	260	160	130
TiAL6V4	AG		37	-	-	-	-	-	-	275	180	135	225	150	110	

The feeds per tooth fz are valid for a width of cut ae ≥ 0.4 d1 (cutter dia.).

In the case of smaller widths of cut the feed fz should be increased, e.g. for ae : d1 = 0.2 by a factor of 1.5.

Cutting Data

for TR360 Milling Cutters

ANSI ISO 513	Cutting Data for TR360 Milling Cutters				COATED						CERMET			UNCOATED						
	Cutter	Max ap	Carbide Insert		TN7525 TN6525		TN7535 TN6540		TN450		TTI25			TTM						
	TR360 ¹⁾	.157 / .197	RD.. 08/10...		feed per tooth *(inch)															
		.236	RD.. 12...																	
		.315	RC / RD.. 16...																	
P	Work Material		Condition	Hardness HB	Mat. Gr.	vc *(sfm)														
	Carbon steel, Unalloyed steel, cast steel and free cutting steel	< 0.25% C	annealed	125	1	1345	1065	915	1180	915	785	820	705	655	1475	1130	980	1045	635	590
		≥ 0.25% C	annealed	190	2	1065	820	705	820	620	540	590	490	455	1245	915	785	520	425	390
		< 0.55% C	heat-treated	250	3	900	685	605	685	520	455	490	425	390	1015	770	655	425	325	295
		≥ 0.55% C	annealed	220	4	915	705	605	705	540	455	520	455	425	1145	850	720	455	360	325
		heat-treated	300	5	770	555	455	590	425	360	425	360	295	-	-	-	360	295	225	
	Low alloy steel and cast steel		annealed	200	6	1030	770	635	785	590	490	590	490	455	1245	915	785	520	425	390
			heat-treated	275	7	770	605	520	590	455	390	455	390	360	1015	720	620	390	325	295
			heat-treated	300	8	685	520	425	520	390	325	390	325	260	820	570	490	325	260	210
			heat-treated	350	9	605	425	360	455	325	260	325	225	180	-	-	-	295	195	145
	High alloy steel, cast steel & tool steel		annealed	200	10	770	620	555	590	475	425	520	440	390	1180	865	720	455	360	325
			heat-treated	325	11	520	390	325	390	295	225	325	225	180	-	-	-	295	195	145
	400 series stainless		FE / MA	200	12	980	915	635	750	750	490	555	490	455	1145	850	720	490	390	360
			MA	240	13.1	850	625	520	655	475	390	455	390	360	980	750	655	425	325	295
			MA / PH	330	13.2	425	310	260	325	245	195	225	195	180	490	375	325	210	160	145
					COATED						CERMET			UNCOATED						
M	Cutter	Max ap	Carbide Insert		TN7525 TN6525		TN7535 TN6540		TN450		TTI25			TTM						
	TR360 ¹⁾	feed per tooth *(inch)																		
		.157 / .197	RD.. 08/10...																	
		.236	RD.. 12...																	
		.315	RC / RD.. 16...																	
	Work Material		Condition	Hardness HB	Mat. Gr.	vc *(sfm)														
	300 Series	AU	180	14.1	850	720	490	785	655	455	685	590	390	1145	980	750	390	325	260	
	Stainless	DU	230	14.2	720	590	425	620	605	410	555	490	310	885	785	620	325	295	195	
	Duplex	S-AU	200	14.3	555	455	325	455	440	310	425	360	225	720	590	455	275	225	160	
	Stainless	AU-PH	330	14.4	425	360	245	390	325	225	340	295	195	590	490	375	195	160	130	
					COATED				UNCOATED		CERMET									
K	Cutter	Max ap	Carbide Insert		TN2510		TN5515		THM		TTI25									
	TR360 ¹⁾	feed per tooth *(inch)																		
		.157 / .197	RD.. 08/10...																	
		.236	RD.. 12...																	
		.315	RC / RD.. 16...																	
	Work Material		Condition	Hardness HB	Mat. Gr.	vc *(sfm)														
	Grey cast iron	ferrit./pearl.	180	15	1605	1180	980	1245	915	770	520	390	325	-	-	-				
		pearlitic	260	16	1180	915	785	950	705	605	390	295	260	-	-	-				
	Nodular cast iron	ferritic	160	17	1180	980	820	1065	770	635	455	340	295	1275	925	765				
		pearlitic	250	18	885	655	520	770	475	390	325	225	160	925	570	470				
	Malleable cast iron	ferritic	130	19	1045	820	655	1065	635	520	455	295	225	-	-	-				
		pearlitic	230	20	885	685	555	850	520	425	360	225	160	-	-	-				

Cutting Data

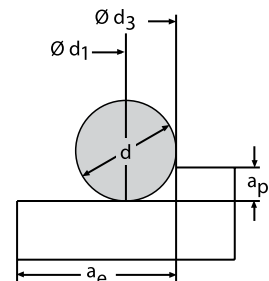
for TR360 Milling Cutters

ANSI ISO 513	Cutting Data for TR360 Milling Cutters					UNCOATED						
	Cutter	Max ap	Carbide Insert		THM							
feed per tooth *(inch)												
	TR360 ¹⁾	.157 / .197	RD.. 08/10...		.0032	.0059	.0079					
		.236	RD.. 12...		.0039	.0087	.0118					
		.315	RC / RD.. 16...		.0047	.0102	.0142					
	N	Work Material	Condition		Hardness HB	Mat. Gr.	vc *(sfm)					
Wrought		Non AG		60	21	3280	2460	1965				
		AG		100	22	1640	1180	980				
Cast aluminum alloys		Non Ag		75	23	3280	2460	1965				
		Si ≤ 12%	AG		90	24	2620	1965	1640			
Si ≥ 12%				130	25	1640	1145	820				
Copper & Copper alloys		Pb > 1%			110	26	1475	1310	980			
				90	27	1310	820	655				
				100	28	980	655	455				
Non Metals					29	1965	1475	980				
				30	1965	1475	980					
						COATED		UNCOATED				
S	Cutter	Max ap	Carbide Insert		TN5515		THM					
					feed per tooth *(inch)							
	TR360 ¹⁾	.157 / .197	RD.. 08/10...		.0032	.0047	.0055	.0032	.0047	.0055		
		.236	RD.. 12...		.0039	.0059	.0071	.0039	.0059	.0071		
		.315	RC / RD.. 16...		.0047	.0071	.0087	.0047	.0071	.0087		
	Work Material	Condition		Hardness HB	Mat. Gr.	vc *(sfm)						
	High Temp	G		200	31	205	160	145	120	95	80	
	Alloy FE	AG		280	32	160	130	110	95	75	65	
	High Temp	G		250	33	110	80	65	75	60	50	
	Alloy	AG		350	34	80	65	45	65	45	40	
	Ni / Co	GO		320	35	90	70	55	65	45	40	
	Titanium alloys				36	-	-	-	260	160	130	
	TiAL6V4	AG			37	-	-	-	225	150	110	
						COATED						
H	Cutter	Max ap	Carbide Insert		TN2510**							
					feed per tooth *(inch)							
	TR360 ¹⁾	.157 / .197	RD.. 08/10...		.0024	.0039	.0047					
		.236	RD.. 12...		.0032	.0055	.0063					
		.315	RC / RD.. 16...		.0039	.0063	.0079					
	Work Material	Condition		Hardness HB	Mat. Gr.	vc *(sfm)						
	Hardened steel	H		45	38.1	950	785	200				
		H		55	38.2	785	655	160				
H			60	39.1	590	490	120					
H			> 62	39.2	390	325	70					

fz-factor for ratio ae:d ¹				
ap	0.05	0.1	0.2	0.4
5% of d	9	6.3	4.3	3.2
10% of d	6.3	4.3	3.2	2.2
20% of d	4.3	3.2	2.2	1.6
40% of d	3.2	4.2	1.6	1.1

SFPM Factors for various fz factors	
fz factor	SFPM factor
9	1.6
6.3	1.5
4.3	1.4
3.2	1.3
2.2	1.2
1.6	1.1
1.1	1

1) The feeds per tooth fz are valid for face milling with width of cut ae ≥ 0.4 d1 and max. depth of cut ap. For smaller widths and depths of cut, the figures in the table should be converted using correction factors (d = dia. of insert, d1 = cutter dia.). The axial feed in plunge milling should be reduced by approximately 40%.



Legend

ae - width of cut
ap - depth of cut
d - insert diameter
Ø d¹ - effective cutter diameter
Ø d³ - nominal cutter diameter

* vc for TN450 = 0.8 Vc for TN7525

* fz for TN450 = fz for TN7525

Cutting Data

for TBNR Ball Nose Cutters

ANSI ISO 513	Cutting Data for TBNR Milling Cutters				COATED						UNCOATED						
	Cutter		Nominal Dia. d1		TN7525 TN6525			TN7535 TN6540			TTM			TTR			
	TBNR		.625 + .750		.0039	.0055	.0063	.0039	.0055	.0063	.0032	.0047	.0055	.0039	.0055	.0063	
	Roughing ae ≥ 40% of d1 (cutter dia.) effective number of teeth z = 1		1.000 - 1.500		.0047	.0071	.0087	.0047	.0071	.0087	.0039	.0063	.0079	.0047	.0071	.0087	
			2.000		.0059	.0091	.0110	.0059	.0091	.0110	.0047	.0079	.0099	.0059	.0091	.0110	
P	Work Material		Condition	Hardness HB	Mat. Gr.	vc *(sfm)											
	Carbon steel, Unalloyed steel, cast steel and free cutting steel	< 0.25% C	annealed	125	1	1045	820	720	1310	850	720	720	635	590	590	590	390
		≥ 0.25% C	annealed	190	2	820	655	590	655	590	490	520	425	390	425	425	295
		< 0.55% C	heat-treated	250	3	620	490	425	590	520	425	425	325	295	360	360	225
		≥ 0.55% C	annealed	220	4	685	555	490	620	555	455	455	360	325	390	390	260
			heat-treated	300	5	555	490	410	410	425	360	360	295	260	295	295	195
	Low alloy steel and cast steel		annealed	200	6	820	655	590	655	590	490	520	425	390	425	425	295
			heat-treated	275	7	620	490	425	555	455	390	390	325	295	325	325	225
			heat-treated	300	8	520	425	325	455	390	325	325	260	225	260	260	180
			heat-treated	350	9	360	295	260	325	275	225	295	195	130	225	225	130
	High alloy steel, cast steel & tool steel		annealed	200	10	685	555	490	620	520	455	455	360	325	390	390	260
			heat-treated	325	11	360	295	260	325	275	225	295	195	130	225	225	130
	400 series stainless		FE / MA	200	12	750	590	520	655	590	490	490	390	360	425	425	260
			MA	240	13.1	625	490	425	555	455	390	425	325	295	360	360	225
			MA / PH	330	13.2	325	260	225	260	225	195	210	160	145	180	180	110
					COATED						UNCOATED						
M	Cutter		Nominal Dia. d1		TN7525 TN6525			TN7535 TN6540			TTM			TTR			
	TBNR		.625 + .750		.0039	.0055	.0063	.0039	.0055	.0063	.0032	.0047	.0055	.0039	.0055	.0063	
	Roughing ae ≥ 40% of d1 (cutter dia.) effective number of teeth z = 1		1.000 - 1.500		.0047	.0071	.0087	.0047	.0071	.0087	.0039	.0063	.0079	.0047	.0071	.0087	
			2.000		.0059	.0091	.0110	.0059	.0091	.0110	.0047	.0079	.0099	.0059	.0091	.0110	
	Work Material		Condition	Hardness HB	Mat. Gr.	vc *(sfm)											
	300 Series	AU	180	14.1	850	720	490	785	655	455	390	325	260	325	260	210	
	Stainless	DU	230	14.2	720	290	425	620	605	410	325	295	195	295	245	195	
	Duplex	S-AU	200	14.3	555	455	325	455	440	310	275	225	160	245	180	130	
Stainless	AU-PH	330	14.4	425	360	245	390	325	225	195	160	130	160	130	95		
					COATED			UNCOATED									
K	Cutter		Nominal Dia. d1		TN2510			THM									
	TBNR		.625 + .750		.0039	.0055	.0087	.0039	.0059	.0071							
	Roughing ae ≥ 40% of d1 (cutter dia.) effective number of teeth z = 1		1.000 - 1.500		.0047	.0063	.0099	.0047	.0075	.0095							
			2.000		.0059	.0079	.0018	.0059	.0099	.0126							
	Work Material		Condition	Hardness HB	Mat. Gr.	vc *(sfm)											
	Grey cast iron	ferrit./pearl.	180	15	1210	885	720	520	390	325							
		pearlitic	260	16	980	685	590	390	295	260							
	Nodular cast iron	ferritic	160	17	950	720	555	455	340	295							
		pearlitic	250	18	850	490	360	325	225	195							
	Malleable cast iron	ferritic	130	19	1015	620	325	455	295	260							
pearlitic		230	20	785	520	360	360	225	195								

* vc for TN450 = 0.8 Vc for TN7525

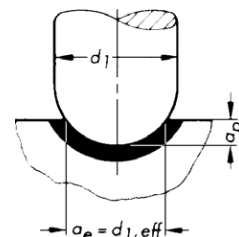
* fz for TN450 = fz for TN7525

Cutting Data

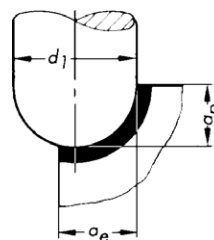
for TBNR Ball Nose Cutters

ANSI ISO 513	Cutting Data for TBNR Milling Cutters				UNCOATED		
	Cutter	Nominal Dia. d1			THM		
					feed per tooth *(inch)		
N	TBNR	.625 + .750			.0039	.0059	.0071
	Roughing $a_e \geq 40\%$ of d1 (cutter dia.) effective number of teeth $z = 1$	1.000 - 1.500			.0047	.0075	.0095
		2.000			.0059	.0099	.0126
S	Work Material	Condition	Hardness HB	Mat. Gr.	vc *(sfm)		
	Wrought	Non AG	60	21	3280	2360	1965
		AG	100	22	1640	2460	980
	Cast aluminum alloys	Non Ag	75	23	3280	2460	1965
		Si $\leq 12\%$ AG	90	24	2620	1965	1640
		Si $\geq 12\%$	130	27	1310	820	655
	Copper & Copper alloys	Pb > 1%	110	28	980	590	455
	UNCOATED				THM		
					feed per tooth *(inch)		
S	TBNR	.625 + .750			.0032	.0047	.0055
	Roughing $a_e \geq 40\%$ of d1 (cutter dia.) effective number of teeth $z = 1$	1.000 - 1.500			.0039	.0059	.0071
		2.000			.0047	.0071	.0087
S	Work Material	Condition	Hardness HB	Mat. Gr.	vc *(sfm)		
	High Temp	G	200	31	120	95	80
	Alloy FE	AG	280	32	95	75	65
	High Temp	G	250	33	75	60	50
	Alloy	AG	350	34	65	45	40
	Ni / Co	GO	320	35	65	45	40
	Titanium alloys			36	260	160	130
	TiAL6V4	AG		37	225	150	110

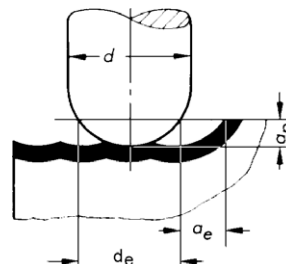
Slotting



Shoulder / Peripheral Milling



Copy / Line by Line Milling



Depth of cut TBNR:

max. $a_p \cong 35\%$ of d^1 in slotting

$\cong 90\%$ of d^1 in shoulder & copy milling

Spindle speed: $RPM = \frac{SFPM}{d^{1eff}} \times 3.82$

d^{1eff}

Cutter diameter: In the case of depths of cut $a_p < 50\%$ of d^1 , the cutting diameter to be used when calculating spindle speed and feed is smaller than the cutter diameter d^1 .

The effective cutting diameter can be read from the table below:

Effective Cutter Diameters						
Depth of cut a_p	Effective cutter diameter d^{1eff} for cutter nominal diameter d^1					
	.625"	.750"	1.00"	1.25"	1.50"	2.00"
.010"	.157	.172	.199	.223	.244	.282
.020"	.220	.242	.280	.314	.344	.398
.030"	.267	.294	.341	.383	.420	.486
.040"	.306	.337	.392	.440	.483	.560
.050"	.339	.374	.436	.490	.539	.624
.075"	.406	.450	.527	.594	.654	.760
.100"	.458	.510	.600	.678	.748	.872
.125"	.500	.559	.661	.750	.829	.968
.250"	.612	.707	.866	1.000	1.118	1.323
.375"	---	.750	.968	1.146	1.299	1.561
.500"	---	---	1.000	1.225	1.414	1.732
.625"	---	---	---	1.250	1.479	1.854
.750"	---	---	---	---	1.500	1.936
1.00"	---	---	---	---	---	2.000

Correction Factors

For stepovers of $\leq 40\%$, the cutting data should be corrected as follows				
Ratio $a_e : d^1$	5%	10%	20%	40%
Feed factor	3	2	1.5	1
SFPM factor	1.5	1.4	1.3	1.2

Notes: * When using short TBNR cutters, select feed approximately 20% higher (factor 1.2).

In copy or line by line milling with smaller widths of cut, higher cutting data are possible. (see correction factors)

Cutting Data

for M270 Ball Nose / Toroidal Cutters

ANSI ISO 513	Cutting Data for M270 Milling Cutters					COATED									UNCOATED		
	Cutter		Carbide Insert		TN2505			TN2510			TN7535			THM			
					feed per tooth *(inch)												
	M270 Ball Nose M270 Toroidal		.375	.0024	.0031	.0039	.0024	.0031	.0047	.0043	.0065	.0078	.0039	.0055	.0063		
			.500	.0028	.0039	.0051	.0028	.0039	.0059	.0052	.0069	.0087	.0055	.0079	.0094		
			.625	.0031	.0047	.0059	.0031	.0047	.0071	.0065	.0087	.0108	.0071	.0098	.0118		
			.750	-	-	-	.0039	.0055	.0087	-	-	-	.0091	.0126	.0150		
P	Work Material		Condition	Hardness HB	Mat. Gr.	vc *(sfm)											
	Carbon steel, Unalloyed steel, cast steel and free cutting steel	< 0.25% C	annealed	125	1	-	-	-	-	-	-	1180	920	790	-	-	-
		≥ 0.25% C	annealed	190	2	-	-	-	-	-	-	820	620	540	-	-	-
		< 0.55% C	heat-treated	250	3	-	-	-	-	-	-	690	520	460	-	-	-
		≥ 0.55% C	annealed	220	4	-	-	-	-	-	-	710	540	460	-	-	-
			heat-treated	300	5	-	-	-	-	-	-	590	430	360	-	-	-
	Low alloy steel and cast steel	annealed	200	6	-	-	-	-	-	-	790	590	490	-	-	-	
		heat-treated	275	7	-	-	-	-	-	-	590	460	390	-	-	-	
		heat-treated	300	8	-	-	-	-	-	-	520	390	330	-	-	-	
		heat-treated	350	9	-	-	-	-	-	-	460	330	260	-	-	-	
	High alloy steel, cast steel & tool steel	annealed	200	10	750	590	560	620	490	460	590	480	430	-	-	-	
		heat-treated	325	11	520	390	330	430	330	260	390	300	230	-	-	-	
	400 series stainless	FE / MA	200	12	950	750	590	790	620	490	750	570	490	-	-	-	
		MA	240	13.1	820	590	520	690	490	430	660	480	390	-	-	-	
		MA / PH	330	13.2	430	330	260	360	260	230	330	250	200	-	-	-	
M	300 Series	AU	180	14.1	-	-	-	-	-	-	660	390	300	-	-	-	
	Stainless	DU	230	14.2	-	-	-	-	-	-	520	310	230	-	-	-	
	Duplex	S-AU	200	14.3	-	-	-	-	-	-	390	230	180	-	-	-	
	Stainless	AU-PH	330	14.4	-	-	-	-	-	-	330	200	150	-	-	-	
K	Grey cast iron	ferrit./pearl.	180	15	-	-	-	2260	1640	1100	-	-	-	-	-	-	
		pearlitic	260	16	-	-	-	1740	1310	980	-	-	-	-	-	-	
	Nodular cast iron	ferritic	160	17	2400	1570	1180	2000	1310	980	820	620	540	750	560	490	
		pearlitic	250	18	1540	1150	850	1280	950	720	690	520	460	620	460	430	
	Malleable cast iron	ferritic	130	19	-	-	-	1460	1210	950	-	-	-	-	-	-	
pearlitic		230	20	-	-	-	1310	980	710	-	-	-	-	-	-		
N	Wrought	Non AG	60	21	-	-	-	-	-	-	-	-	-	3280	2460	1970	
		AG	100	22	-	-	-	-	-	-	-	-	-	1640	1180	980	
	Cast aluminum alloys	Non Ag	75	23	-	-	-	-	-	-	-	-	-	3280	2460	1970	
		Si ≤ 12%	AG	90	24	-	-	-	-	-	-	-	-	2620	1970	1640	
		Si ≥ 12%		130	25	-	-	-	-	-	-	-	-	1640	1150	820	
S	High Temp	G	200	31	-	-	-	-	-	-	-	-	-	120	80	-	
	Alloy FE	AG	280	32	-	-	-	-	-	-	-	-	-	100	70	-	
	High Temp	G	250	33	-	-	-	-	-	-	-	-	-	80	50	-	
	Alloy	AG	350	34	-	-	-	-	-	-	-	-	-	70	40	-	
	Ni / Co	GO	320	35	-	-	-	-	-	-	-	-	-	70	40	-	
	Titanium alloys			36	-	-	-	-	-	-	-	-	-	260	130	-	
	TiAL6V4	AG		37	-	-	-	-	-	-	-	-	-	230	110	-	
H	Hardened steel	H	45	38.1	520	390	260	430	340	260	-	-	-	-	-	-	
		H	55	38.2	520	390	260	430	340	260	-	-	-	-	-	-	
		H	60	39.1	390	330	200	360	280	210	-	-	-	-	-	-	
		H	> 62	39.2	390	330	200	360	280	210	-	-	-	-	-	-	

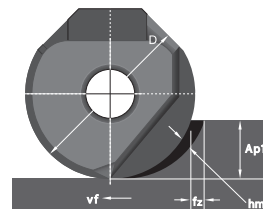
*See page 115 for M270 Application Advice

Cutting Data

for M270 High Feed Cutters

ANSI ISO 513	Cutting Data for M270 Milling Cutters					COATED						
	Cutter		Carbide Insert			TN2505			TN6540			
feed per tooth *(inch)												
	M270 High Feed		.375		.0059	.0098	.0110	.0059	.0118	.0197		
			.500		.0059	.0118	.0138	.0059	.0157	.0197		
			.625		.0059	.0157	.0177	.0059	.0197	.0236		
			.750		.0059	.0197	.0217	.0059	.0236	.0276		
P	Work Material		Condition		Hardness HB	Mat. Gr.	vc *(sfm)					
	Carbon steel, Unalloyed steel, cast steel and free cutting steel	< 0.25% C	annealed	125	1	-	-	-	950	740	620	
		≥ 0.25% C	annealed	190	2	-	-	-	660	490	430	
		< 0.55% C	heat-treated	250	3	-	-	-	560	430	360	
		≥ 0.55% C	annealed	220	4	-	-	-	560	430	360	
		heat-treated	300	5	-	-	-	480	340	300		
	Low alloy steel and cast steel		annealed	200	6	-	-	-	620	480	390	
			heat-treated	275	7	-	-	-	480	360	310	
			heat-treated	300	8	-	-	-	430	310	260	
			heat-treated	350	9	-	-	-	360	260	210	
	High alloy steel, cast steel & tool steel		annealed	200	10	560	460	430	480	380	340	
			heat-treated	325	11	360	260	230	310	230	180	
	400 series stainless		FE / MA	200	12	720	560	460	610	460	390	
			MA	240	13.1	620	460	360	520	380	310	
			MA / PH	330	13.2	330	230	200	260	200	160	
M	300 Series		AU	180	14.1	-	-	-	520	310	230	
	Stainless		DU	230	14.2	-	-	-	430	250	180	
	Duplex		S-AU	200	14.3	-	-	-	310	180	150	
	Stainless		AU-PH	330	14.4	-	-	-	260	160	110	
K	Grey cast iron	ferrit./pearl.		180	15	-	-	-	-	-	-	
		pearlitic		260	16	-	-	-	-	-	-	
	Nodular cast iron	ferritic		160	17	790	590	520	660	490	430	
		pearlitic		250	18	660	520	430	560	430	360	
	Malleable cast iron	ferritic		130	19	-	-	-	-	-	-	
		pearlitic		230	20	-	-	-	-	-	-	
N	Wrought	Non AG		60	21	-	-	-	-	-	-	
		AG		100	22	-	-	-	-	-	-	
	Cast aluminum alloys	Non Ag		75	23	-	-	-	-	-	-	
		Si ≤ 12%	AG	90	24	-	-	-	-	-	-	
	Si ≥ 12%		130	25	-	-	-	-	-	-		
S	High Temp	G		200	31	-	-	-	200	160	150	
	Alloy FE	AG		280	32	-	-	-	160	130	110	
	High Temp	G		250	33	-	-	-	110	80	70	
	Alloy	AG		350	34	-	-	-	100	70	50	
	Ni / Co	GO		320	35	-	-	-	100	70	50	
	Titanium alloys				36	-	-	-	260	160	130	
	TiAL6V4	AG			37	-	-	-	230	150	110	
H	Hardened steel	H		45	38.1	520	390	260	-	-	-	
		H		55	38.2	520	390	260	-	-	-	
		H		60	39.1	390	330	200	-	-	-	
		H		> 62	39.2	390	330	200	-	-	-	

Factors for M270 Ball Nose & Toroidal Milling Cutters:



First choice starting speed (vc) are in bold type. Use corresponding feed (fz).

Given fz is valid for face milling with width of cut (ae) ≥ 0.4 D1 and Ap1 max.

For smaller ae and ap, use the given correction factors (D = dia. of insert, D1 = cutter dia.).

M270 Ball Nose

fz-factor for ratio ae:d ¹				
ap1	0.05	0.1	0.2	0.4
5% of d	9	6.3	4.3	3.2
10% of d	6.3	4.3	3.2	2.2
20% of d	4.3	3.2	2.2	1.6
40% of d	3.2	4.2	1.6	1.1

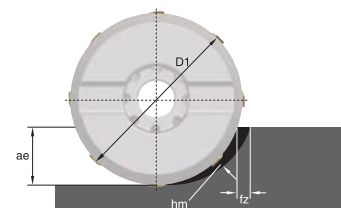
vc-factor at fz-factor							
fz - Factor	9	6.3	4.3	3.2	2.2	1.6	1.1
fc - Factor	1.6	1.5	1.4	1.3	1.2	1.1	1

Example: ae : D1 = 0.1 = 0.2 x D	
fznom = .0080" fz eff=.0080" x 3.2 = .0256"	
vcnom = 525 vc eff = 525 x 1.3 = 683 sfm	

M270 Toroidal

ae / D1	0.02	0.05	0.1	0.2	0.4
fz - Factor	3.5	3	2	1.5	1
fc - Factor	1.6	1.5	1.4	1.3	1.1

Factors for M270 High Feed Milling Cutters:



$$hm = fz \cdot \sqrt{\frac{ae}{D1}} \quad fz = hm \cdot \sqrt{\frac{D1}{ae}}$$

First choice starting speed (vc) are in bold type. Use corresponding feed (fz).

fz and vc are valid for ae ≥ 0.4 D1.

For smaller ae, fz and vc should be multiplied by the factor given below.

ae / D1	0.1	0.2	0.3	0.4
fz - Factor	2	1.5	1.3	1
fc - Factor	1.4	1.3	1.2	1.1

*See page 116 for further M270 High Feed Application Advice

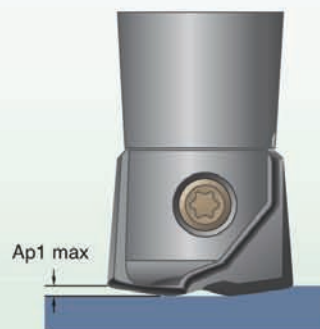
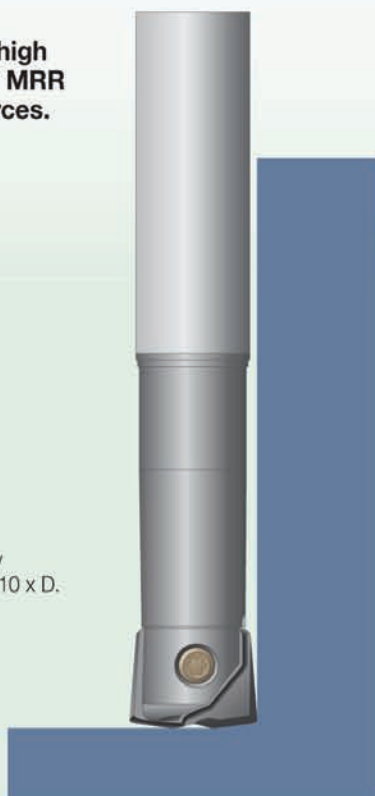
Cutting Data

for M270 High Feed Application Advice

Applying High-Feed Tools

The High-Feed concept bases its strategy in small depth of cut and high fz values, which results in a higher MRR and productivity with low radial forces.

Recommended when long overhang is necessary due to lower radial forces. Maximum L/D ratio of 10 x D.



Small Ap1 values and higher feed rate generate lower cutting forces versus traditional milling strategies.



For CAM programming, the tools can be programmed as a toroidal tool type by using the Rt value as the insert radius.

Rt represents theoretical programming radius

L/D ratio	% of Ap1 max to reduce	% of vc to reduce
<4	0%	0%
4<L/D<7	55-65%	10-15%
>8	65-75%	20-30%

General Programming Information for Applying M270 High-Feed

tool diameter	.375"	.500"	.625"	.750"
recommended starting Ap1 (inch)	.016	.016	.023	.030
Rt CAM programming	.044	.057	.070	.090
fz recommended for general purpose	.020	.022	.024	.030
fz recommended for 45 HRC (approx.)	.015	.018	.022	.026
fz recommended for 55 HRC (approx.)	.012	.014	.018	.020

Use two effective teeth for feed calculations.

For materials above 45 HRC, we recommend adjusting the ae max to 55% of cutting diameter and using no more than 50% of Ap1 max.

While center cutting is possible, we recommend using a ramp angle of 0.5°-1.0° to ensure smooth operation.

Cutting Data

for TS45 End Mills / TS45F Face Mills / TPC Plunge Mills

ANSI ISO 513	Material	TS45 End Mills			TS45F Face Mills			
		MILLING	SFPM		MILLING	SFPM		
		Feed 1)	Coated	Uncoated	Feed 1)	CVDCoated	PVD Coated	Uncoated
P	Steel, unalloyed low carbon	.004 - .012	325 - 731	260 - 585	.004 - .020	400 - 1100	350 - 900	---
	Steel, unalloyed or low-alloy	.004 - .012	284 - 650	228 - 520	.003 - .013	300 - 900	300 - 700	---
	Steel alloy and tool steels	.004 - .012	244 - 569	195 - 455	.003 - .014	250 - 650	175 - 400	---
	High tensile steels	.004 - .010	244 - 488	195 - 390	.003 - .006	---	300 - 500	---
M	Corrosion-resistant steel	.004 - .010	203 - 569	163 - 455	.003 - .012	250 - 650	200 - 600	---
	Cast steel, medium strength	.004 - .012	244 - 488	195 - 390	.003 - .009	300 - 600	250 - 550	---
K	Grey cast iron, medium hardness	.004 - .016	284 - 488	228 - 390	.003 - .009	---	300 - 900	250 - 750
N	Brass	.004 - .010	406 - 731	325 - 585	.004 - .015	---	---	700 - 2000
	Mg-alloyed	.004 - .006	1219 - 3250	975 - 2600	.004 - .015	---	---	700 - 2000
	Si-alloyed	.002 - .006	1016 - 2438	813 - 1950	.004 - .015	---	---	700 - 2000
	Al-alloyed, hypo-eutectic	.004 - .008	1219 - 4063	975 - 3250	.003 - .012	---	---	700 - 1500
	Al-alloyed, hyper-eutectic Si>12%	.004 - .008	1219 - 2031	975 - 1625	.003 - .012	---	---	700 - 1500
ANSI ISO 513	Material	TPC Plunge Mills						
		DRILLING	SFPM		MILLING	SFPM		
		Feed	Coated	Uncoated	Feed 1)	Coated	Uncoated	
P	Steel, unalloyed low carbon	.003 - .008	299 - 673	260 - 585	.003 - .012	325 - 731	260 - 585	
	Steel, unalloyed or low-alloy	.003 - .008	262 - 598	228 - 520	.003 - .012	284 - 650	228 - 520	
	Steel alloy and tool steels	.003 - .008	224 - 523	195 - 455	.003 - .012	244 - 569	195 - 455	
	High tensile steels	.003 - .008	224 - 448	195 - 390	.003 - .012	244 - 488	195 - 390	
M	Corrosion-resistant steel	.002 - .006	187 - 523	163 - 455	.003 - .010	203 - 569	163 - 455	
	Cast steel, medium strength	.002 - .006	224 - 448	195 - 390	.003 - .010	244 - 488	195 - 390	
K	Grey cast iron, medium hardness	.003 - .013	262 - 448	228 - 390	.003 - .015	284 - 488	228 - 390	
N	Brass	.003 - .008	374 - 673	325 - 585	.004 - .010	406 - 731	325 - 585	
	Mg-alloyed	.003 - .005	1121 - 2990	975 - 2600	.004 - .006	1219 - 3250	975 - 2600	
	Si-alloyed	.002 - .005	934 - 2243	813 - 1950	.002 - .006	1016 - 2438	813 - 1950	
	Al-alloyed, hypo-eutectic	.003 - .006	1121 - 3737	975 - 3250	.004 - .008	1219 - 4063	975 - 3250	
	Al-alloyed, hyper-eutectic Si>12%	.003 - .006	1121 - 1869	975 - 1625	.004 - .008	1219 - 2031	975 - 1625	

1) The feeds per tooth fz are valid for a width of cut ae > 40% of the cutter diameter. In the case of smaller widths of cut, the feed fz should be increased as per the following table:

Ratio ae : d1	fz Factor
5%	3
10%	2
20%	1.5
> 40%	1

Legend:

ae = width of cut

d1 = cutter diameter

Feed = fz in inches per tooth

SFPM = Cutting speeds in SFPM (Surface feet per minute)

Cutting Data

for TXP90AF Milling Cutters

ANSI ISO 513	Cutting Data for TXP90AF Milling Cutters					COATED					
	Cutter	Max ap	Carbide Insert	TN7535			TN450				
				feed per tooth *(inch)							
	TXP90AF End Mill	.400	222.79.501	.004	.007	.012	.004	.007	.012		
	TXP90AF Face Mill	.400	222.79.501	.004	.008	.014	.004	.008	.014		
	P	Work Material	Condition	Hardness HB	Mat. Gr.	vc *(sfm)					
Carbon steel, Unalloyed steel, cast steel and free cutting steel		< 0.25% C annealed	125	1	750	700	650	750	700	650	
		≥ 0.25% C annealed	190	2	725	650	600	725	650	600	
		< 0.55% C heat-treated	250	3	700	550	450	700	550	450	
		≥ 0.55% C annealed	220	4	700	600	500	700	600	500	
Low alloy steel and cast steel		heat-treated	300	5	600	450	350	600	450	350	
		annealed	200	6	700	550	450	700	550	450	
		heat-treated	275	7	600	450	350	600	450	350	
		heat-treated	300	8	550	400	300	550	400	300	
High alloy steel, cast steel & tool steel		heat-treated	350	9	500	350	250	500	350	250	
		annealed	200	10	700	550	450	700	550	450	
heat-treated		325	11	500	350	250	500	350	250		
M	Cutter	Max ap	Carbide Insert	TN7535			TN450				
				feed per tooth *(inch)							
	TXP90AF End Mill	.400	222.79.501	.004	.006	.010	.004	.006	.010		
	TXP90AF Face Mill	.400	222.79.501	.004	.008	.012	.004	.008	.012		
	Work Material	Condition	Hardness HB	Mat. Gr.	vc *(sfm)						
	Stainless	DU		12	550	450	350	550	450	350	
	Duplex	S-AU		13	500	350	250	500	350	250	
	Stainless	AU-PH		14	550	450	350	550	450	350	

Scallop Height (h)					
Stepover	Cutter Diameter (d)				
	1.50"	2.00"	2.50"	3.00"	4.00"
.100"	.002	.001	.001	.001	.001
.200"	.007	.005	.004	.003	.003
.300"	.015	.011	.009	.008	.006
.400"	.027	.020	.016	.013	.010
.500"	.043	.032	.025	.021	.016
.600"	.063	.046	.037	.030	.023
.700"	.087	.063	.050	.041	.031
.800"	.116	.083	.066	.054	.040
.900"	.150	.107	.084	.069	.051
1.000"	.191	.134	.104	.086	.064
1.250"	.335	.219	.167	.136	.100
1.500"		.339	.250	.201	.146
1.750"			.357	.282	.202
2.000"			.500	.382	.268
2.250"				.508	.346
2.500"					.439

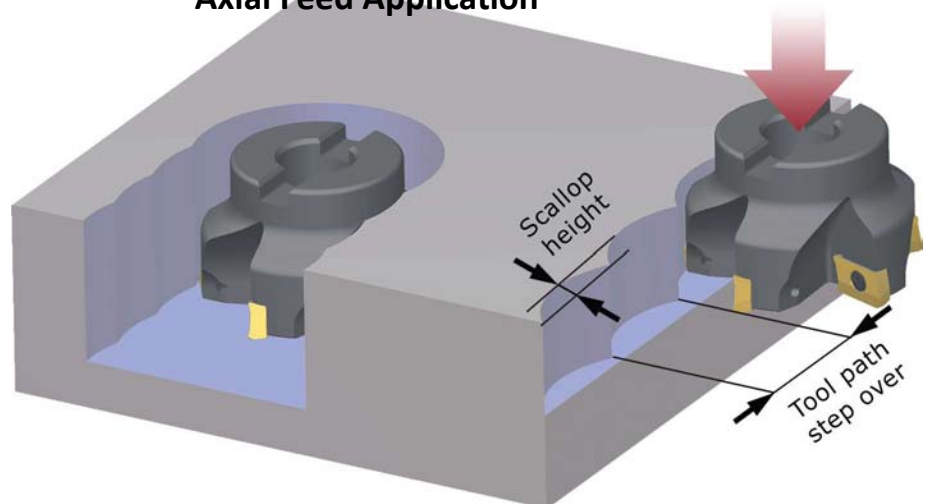
Scallop Height Formula

$$h = \frac{d}{2} - \sqrt{\left(\frac{d}{2}\right)^2 - \left(\frac{s}{2}\right)^2}$$

Legend

h = Scallop height
d = Cutter diameter
s = Stepover

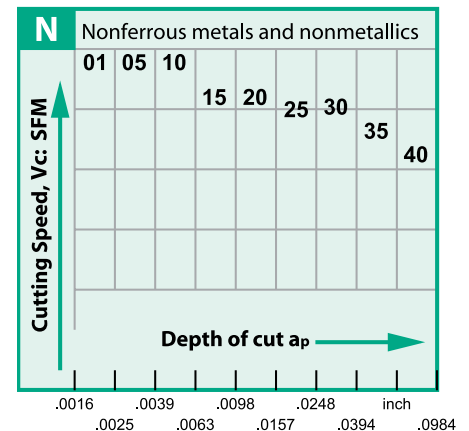
Axial Feed Application



Cutting Data

for TCP90 Milling Cutters / TVP90 Milling Cutters

Materials	Conditions of Chip Removal	Application Range - Cutting Speed N01 - N40		
N Nonferrous metals Aluminum alloys without silicon	High-Speed Milling	N01 - N20 (HSC) 100 µin - 200 µin	N20 - N30 (HSC) 100 µin - 200 µin	N25 - N40 (HSC) 100 µin - 200 µin
	unstable (varied depth)	PDC-S / CVD 2600-14625	PDC-S / CVD 2600-13000	PDC-S / CVD 2600-8125
	continuous	PDC-S / CVD 2600-14625	PDC-S / CVD 2600-13000	PDC-S / CVD 2600-8125
	heavily + slightly interrupted	PDC-S / CVD 2600-14625	PDC-S / CVD 2600-13000	PDC-S / CVD 2600-8125
N Nonferrous metals Aluminum alloys with less than 12% silicon	unstable (varied depth)	PDC-S / CVD 2600-13000	PDC-S / CVD 2600-11375	PDC-S / CVD 2600-8775
	continuous	PDC-S / CVD 2600-13000	PDC-S / CVD 2600-11375	PDC-S / CVD 2600-8775
	heavily + slightly interrupted	PDC-S / CVD 2600-13000	PDC-S / CVD 2600-11375	PDC-S / CVD 2600-8775
N Nonferrous metals Copper and copper alloys brass, bronze, precious metals	unstable (varied depth)	PDC-S / CVD 2600-9750	PDC-S / CVD 2600-8125	PDC-S / CVD 2275-7150
	continuous	PDC-S / CVD 2600-9750	PDC-S / CVD 2600-8125	PDC-S / CVD 2275-7150
	heavily + slightly interrupted	PDC-S / CVD 2600-9750	PDC-S / CVD 2600-8125	PDC-S / CVD 2275-7150
Coolant: Flood or through coolant				



ANSI ISO 513	Cutting Data for TV90 Milling Cutters					COATED			UNCOATED		
	Cutter	Max ap	Carbide Insert		TK10MP			TK10M			
feed per tooth *(inch)											
N	TV90 Face Mill	.50	VCGT / VPGT		.008	.010	.012	.008	.010	.012	
	TV90 End Mill	.38	VCGT / VPGT		.006	.008	.010	.006	.008	.010	
	Work Material		Condition	Hardness HB	Mat. Gr.	vc *(sfm)					
	Wrought	Non AG		60	21	-	-	-	-	-	-
		AG		100	22	-	-	-	-	-	-
	Cast aluminum alloys	Non Ag	75	23	4000	3500	3000	3500	2500	2000	
		Si ≤ 12%	AG	90	24	3100	2800	2000	2600	2000	1500
		Si ≥ 12%		130	25	-	-	-	-	-	-
	Copper & Copper alloys	Pb > 1%		110	26	-	-	-	-	-	-
				90	27	1900	1640	1400	1500	1250	900
			100	28	1180	980	--	800	600	--	

Material Overview

ANSI ISO 513	VDI 3323	Work Material		State	Rm N/mm ²	Hardness	Examples
P	1	Alloy Steels	C < 0.25%	G	420	125	1010, 1015, 1020, 1023, 1102, 1108, 1109, 1213, 1215
	2		0.25 ≤ C < 0.55%	G	650	190	1025, 1030, 1035, 1040, 1041, 1045, 1050, 1140, 1141, 1146, 1330
	3			V	850	250	1025, 1030, 1035, 1040, 1041, 1045, 1050, 1140, 1141, 1146, 1330
	4	Free cutting steel	0.55% ≤ C	G	750	220	1055, 1060, 1151
	5			V	1000	300	1055, 1060, 1151
	6	Low alloy steel		G	600	180	4130, 4137, 4150, 4320, 4340, 5120, 5132, 5135, 5140, 5155, 6150, 8620, 8625, 9260, A 355/A, A 355/C, A 355/D, A485/2, A 485/3, E-3310
	7			V	930	275	
	8			V	1000	300	
	9			V	1200	350	
	10	High alloy steel		G	680	200	440 C, 613, EV 8, M2 regular C, T1
	11	Tool steel		V	1100	325	440 C, 613, EV 8, M2 regular C, T1
	12	Stainless steel		FE / MA	680	200	403, 405, 409, 410, 410 S, 416, 420, 430, 430 Ti, 439, 446,
	13.1			MA	820	240	420, 430 F, 431, 434, 440 B, 440 C
	13.2			MA-PH	1060	330	630, 630
M	14.1	Stainless steel		AU	600	180	301, 303, 304, 304 L, 304 LN, 305, 309 S, 316, 316 L, 316 LN, 317 L, 317 LN
	14.2			DU	740	260	201, 329, 2205
	14.3			S-AU	680	160	310 mod
	14.4			AU-PH	1060	250	17-7 PH, 630
K	15	Grey iron	GG	FE / PE		180	Class 20 B, Class 25 B,
	16			PE		260	Class 30 B, Class 40 B, Class 45 B, Class 50 B
	17	Nodular cast iron	GGG	FE		160	Class 50 B, Grade 60-40-18, Grade 65-45-12
	18			PE		250	Grade 80-55-06, Grade 100-70-03, Grade 120-90-02
	19	Malleable irons GTS / GTW		FE		130	Grade 22010, 32510
	20			PE		230	GTW-35-04, GTS-55-04, GTS-65-02
N	21	Wrought aluminum			NAG	60	6061, 2014-T6, 2011-T3, 2024-T4, A2, 7075, 1000, AlMg 1, AlCuMg 1, AlMgSiPb, AlMgSi 1
	22			AG		100	6061, 2014-T6, 2011-T3, 2024-T4, A2, 7075, 1000, AlMg 1, AlCuMg 1, AlMgSiPb, AlMgSi 1
	23	Cast iron alloys		NAG		75	A380-1, A280, A390-1, G-AlSi 10 Mg, G-AlSi12, G-AlCu 5 Si 3, G-AlSi 17, G-AlSi 23
	24			AG		90	A380-1, A280, A390-1, G-AlSi 10 Mg, G-AlSi12, G-AlCu 5 Si 3, G-AlSi 17, G-AlSi 23
	25					130	A380-1, A280, A390-1, G-AlSi 10 Mg, G-AlSi12, G-AlCu 5 Si 3, G-AlSi 17, G-AlSi 23
	26	Copper / Copper alloys				110	Free cutting brass, CuNi 18 Zn 19 Pb
	27					90	Brass, Red brass, CuZn33, CuZn-/CuSnZn-alloys
	28					100	Bronze, Electrolytic copper, CuNi 3 Si, CuSn-alloys
	29	Nonmetals					Thermosetting plastics, FVK, Fiber reinforced plastics, Bakelit
	30						Hard rubber
S	31	High-temperature alloys	Fe-Basis/base	G		200	A-286, 321, 321 H, 330, 409, EV 9, EV11, HNV3
	32		Ni-/Co Basis/base	AG		280	A-286, 321, 321 H, 330, 409, EV 9, EV11, HNV3
	33			G		250	Inconel 601/617/625/700/706/718, Nimonic 80 A, Hasteloy, Udimet, Haynes 25, Waspaloy, Rene41, Stellite
	34			AG		350	Inconel 601/617/625/700/706/718, Nimonic 80 A, Hasteloy, Udimet, Haynes 25, Waspaloy, Rene41, Stellite
	35			GO		320	Inconel 601/617/625/700/706/718, Nimonic 80 A, Hasteloy, Udimet, Haynes 25, Waspaloy, Rene41, Stellite
	36	Titanium, titanium alloys	pure titanium		400		Titanium
	37		alpha / beta alloys	AG	1050		TiAl64V
H	38.1	Steel		H		45 HRC	90 MnV 8, Hardox 400
	38.2			H		55 HRC	Hardox 500
	39.1			H		60 HRC	HSS, 90 MnV 8
	39.2			H		>62 HRC	HSS, 90 MnV 8
	40.1	Chill cast iron		GO		400	G-X 260 Cr 27, G-X 260 NiCr 42, G-X 300 CrNiSi 9 5 2, G-X 330 NiCr 42
	40.2			GO		>440	G-X 260 Cr 27, G-X 260 NiCr 42, G-X 300 CrNiSi 9 5 2, G-X 330 NiCr 42
	41.1	Cast iron		H		55 HRC	G-X 300 NiMo 3 Mg
	41.2			H		>57 HRC	G-X 300 NiMo 3 Mg

Condition Codes

AG — Aged	AU — Austenitic	DU — Duplex (austenitic/ferritic)	FE — Ferritic
G — Annealed (soft, solution)	GO — Cast	H — Hardened	MA — Martensitic
NAG — Non age hardenable, not aged	PE — Pearlitic	PH — Precipitation hardened	S-AU — Super austenitic
			V — Quenched and tempered

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