TECHNICAL INFORMATION

TROUBLE SHOOTING - TURNING/MILLING

PVD GRADES - TURNING/MILLING

CVD GRADES - TURNING/MILLING

CUTTING SPEED FORMULAS - TURNING/MILLING

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INSERT TROUBLE SHOOTING

COMMON PROBLEMS AND CORRECTIVE ACTIONS

TURNING

Common Problems	Corrective Action: Reduce Speed (SFM)	Increase Speed (SFM)	Reduce Feed Rate	Increase Feed Rate	Reduce Depth of Cut (DOC)	Increase Depth of Cut (DOC)	Use Higher Wear Resistant (Harder) Grade	Use Tougher Grade	Check Rigidity of System
★Flank and notch wear	■			■			■		■
Cratering	■		■		■		■		
Chipping		■	■		■			■	■
Plastic deformation	■		■		■		■		
Built-up-edge (BUE)		■		■					
Thermal cracking	■		■		■			■	
Insert breakage			■		■			■	■
Curling of long chips	■			■		■			
Chattering (Vibration)	■			■	■				■
Poor surface finish		■	■		■				

MILLING

Common Problems	Corrective Action: Reduce Speed (SFM)	Increase Speed (SFM)	Reduce Feed/Tooth	Increase Feed/Tooth	Reduce Depth of Cut (DOC)	Use Higher Wear Resistant (Harder) Grade	Use Tougher Grade	Use Coarse Pitch Cutter	Change the Cutter Position	Do Not Use Coolant
★Flank and notch wear	■			■		■				
Cratering	■		■		■	■				
Chipping		■	■				■			
Built-up-edge (BUE)		■		■	■	■				■
Insert breakage			■				■		■	
Chattering (Vibration)				■	■			■	■	
Poor surface finish	■		■		■	■				

NOTE

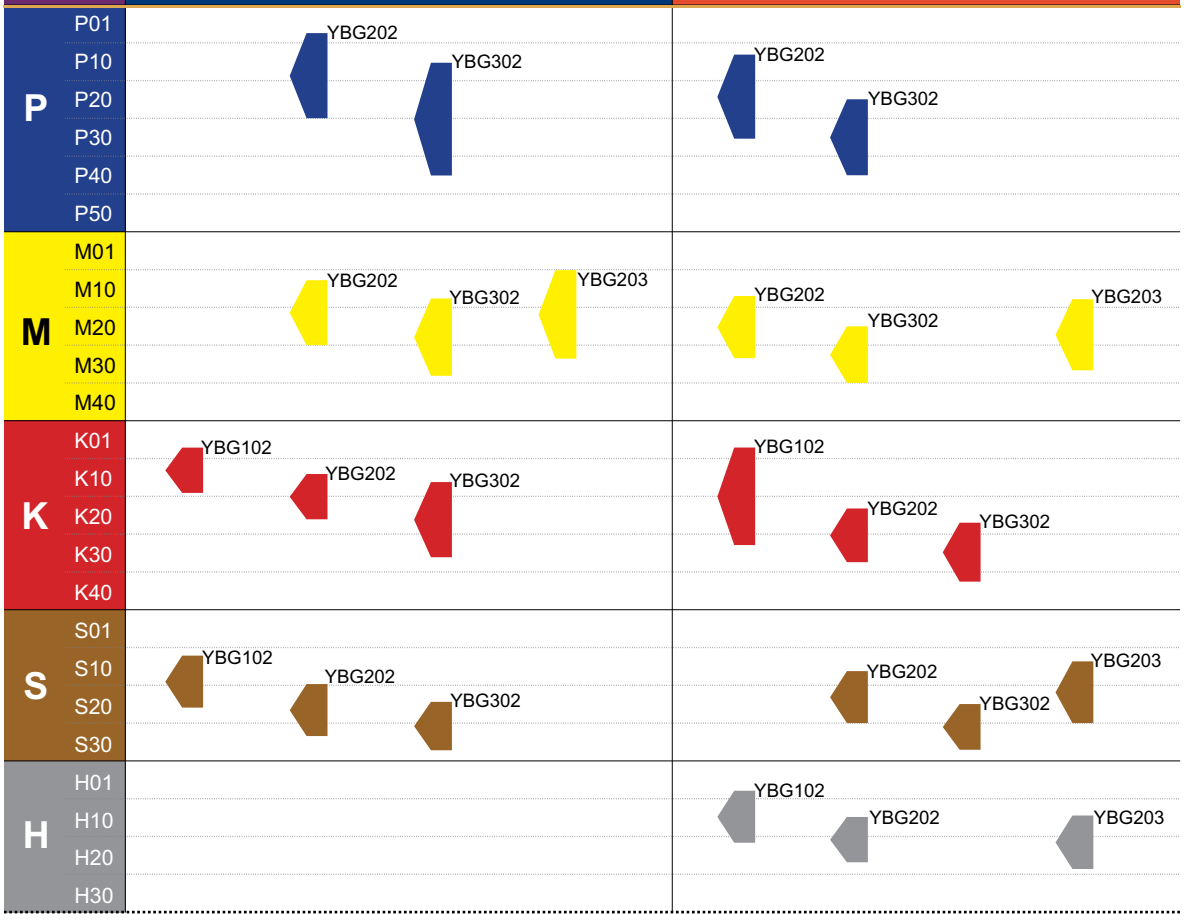
★*A uniform flank wear is the optimum type of insert wear. Generally, inserts should be indexed when 0.030" (0.7 mm) flank wear is reached. For finishing operations, index at 0.016" (0.4 mm) flank wear or sooner.*

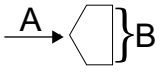
PVD GRADE APPLICATION

TURNING				
ISO	Grade			
	YBG102	YBG202	YBG203	YBG302
	SFM ft/min			
K01-K10	984-**1148**-1476			
S10-S20	98-**197**-295			
P01-P20		656-**918**-1181		
M10-M20		492-**722**-918		
K10-K20		820-**984**-1148		
S20-S30		148-**197**-246		
M10-M30			590-**853**-1050	
P10-P40				590-**787**-984
M10-M30				459-**656**-853
K20-K40				787-**918**-1050
S20-S30				82-**131**-180

MILLING				
ISO	Grade			
	YBG102	YBG202	YBG203	YBG302
	SFM ft/min			
K01-K20	787-**918**-1050			
H01-H10	131-**164**-197			
P01-P30		558-**722**-886		
M10-M30		590-**754**-918		
K20-K30		656-**787**-918		
S10-S20		164-**197**-230		
H10-H20		131-**148**-164		
M10-M30			590-**787**-918	
S10-S20			164-**197**-230	
H10-H20			131-**148**-164	
P20-P40				492-**656**-820
M20-M30				525-**689**-853
K20-K40				590-**722**-853
S20-S30				115-**131**-148

P M K S H





CVD GRADE APPLICATION

P M K S H

TURNING						
ISO	CVD Grade					
	YBC151	YBC251	YBC351	YBM151	YBM251	YBM351
	SFM ft/min					
P05-P35	900-**1200**-1500					
P10-P35		850-**1100**-1300				
M20-M40		390-**600**-850				
P15-P35			720-**900**-1100			
M20-M40			390-**500**-780			
P20-P30				820-**1000**-1150		
M10-M25				520-**720**-900		
P25-P40					720-**900**-1050	
M15-M35					390-**600**-780	
M25-M40						520-**750**-900

TURNING								
ISO	CVD Grade					Cermet	PCBN	PCD
	YBD102	YBD151	YBD152	YD101	YD201	YNG151	YCB011/2	YCD011
	SFM ft/min							
K10-K25	650-**1000**-1300							
K05-K25		520-**750**-900						
K10-K30			590-**800**-980		650-**1300**-2600			
K05-K20				490-**3300**-6500				
P05-P15						1050-**1300**-1500		
M10-M20						520-**720**-900		
K05-K15						520-**700**-850		
K01-K10							650-**1300**-2600	2000-**6000**-8200

MILLING						
ISO	CVD Grade				Uncoated	Cermet
	YBC301	YBC401	YBM251	YBD151	YD201	YNG151
	SFM ft/min					
P25-P45	520-**750**-980					
M25-M40	390-**520**-780					
P25-P50		520-**650**-780				
K30-K40		500-**600**-750				
P25-P40			720-**900**-1050			
M15-M40			390-**600**-780			
K02-K15				300-**600**-900		
K20-K30					150-**210**-280	
P05-P15						1050-**1300**-1500
M10-M20						520-**720**-900
K05-K15						520-**700**-850

BASIC TURNING AND MILLING FORMULAS

Parameters	Units	Description
d	in	Workpiece diameter or cutter diameter in inches
D.O.C. or ap	in	Depth of Cut in inches
W.O.C.	in	Width of Cut in inches
L	in	Machined length in inches
t	min	Cutting time
N		Number of effective inserts
IPM or Feed Rate	ipm = in/min	Feed rate in inches per minute
IPR or apr	ipr = in/rev	Inches of cutter advance every revolution
IPT or apt	ipt = in/tooth	Inches of cutter advance for each effective insert every revolution
RPM	rev/min	Revolutions per minute
SFM	ft/min	Cutting speed in surface feet per minute
Q	in3/min	Metal removal rate in cubic inches per minute
HP_S	HP_S	Horsepower required at the machine spindle
k★		k★ factors are available from reference books

TURNING			
	Find	Units	Given
Cutting Speed	SFM = 0.262 x d x RPM	ft/min	d, RPM
Spindle Speed	RPM = 3.82 x (SFM/d)	rev/min	d, SFM
Feed Rate	IPM = IPR x RPM	in/min	IPR, RPM
Metal Removal Rate	Q = 12 x ap x IPR x SFM	in3/min	SFM, ap, IPR
Cutting Time	t = L/(IPR x RPM)	min	
Power Requirement	HP_S = Q x k★	HP_S	

MILLING			
	Find	Units	Given
Cutting Speed	SFM = 0.262 x d x RPM	ft/min	d, RPM
Spindle Speed	RPM = 3.82 x (SFM/d)	rev/min	d, SFM
Feed Rate	IPM = IPR x RPM	in/min	IPR, RPM
	IPM = IPT x N x RPM	in/min	RPM, N, IPT
Inches per Revolution	IPR = IPM/RPM	in/rev	IPM, RPM
Spindle Speed	RPM = IPM/IPR	rev/min	IPM, IPR
Spindle Speed	RPM = IPM/(N x IPT)	rev/min	IPM, N, IPT
Number of Effective Inserts	N = IPM/(RPM x IPT)		IPM, RPM, IPT
Inches per Tooth	IPT = IPM/(RPM x N)	in/tooth	IPM, N, RPM
Metal Removal Rate	Q = D.O.C. x W.O.C. x IPM		
Horsepower	HP = Q x k★	HP	Q, k★