

# TECHNICAL INFORMATION



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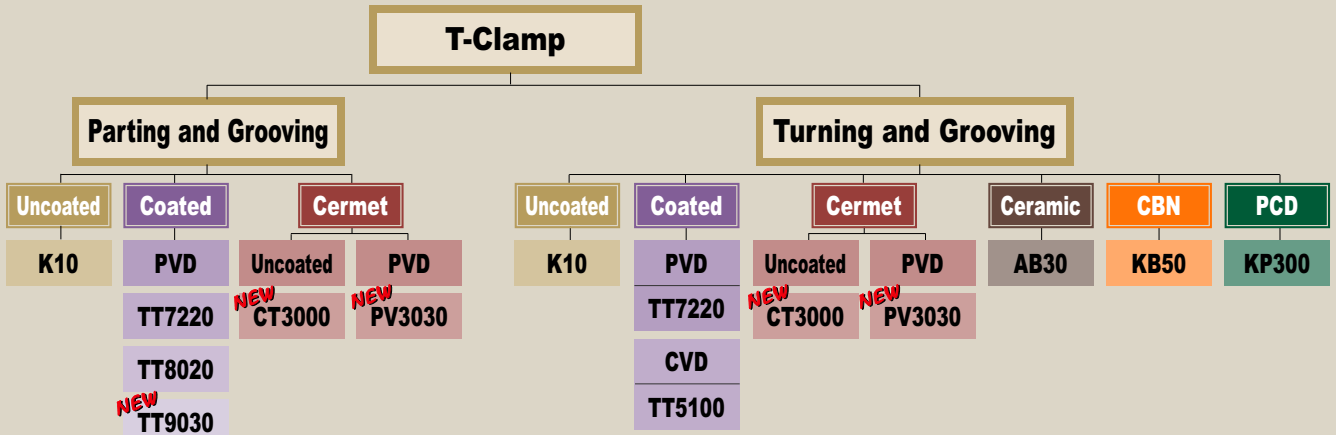
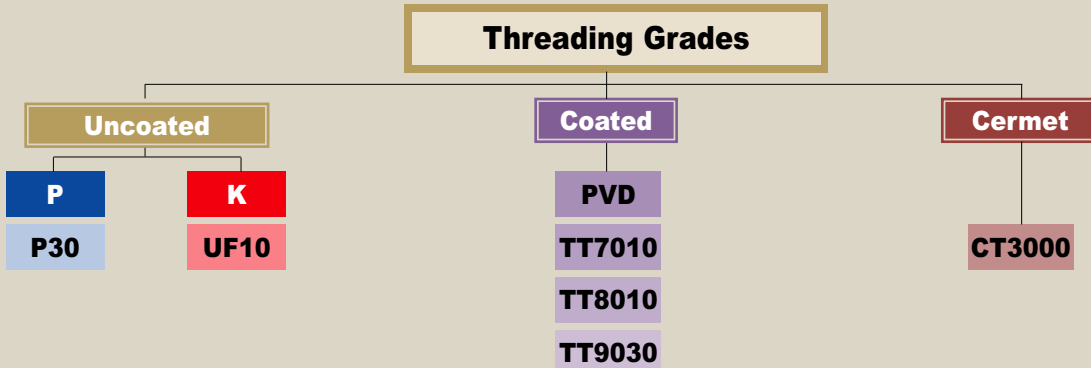
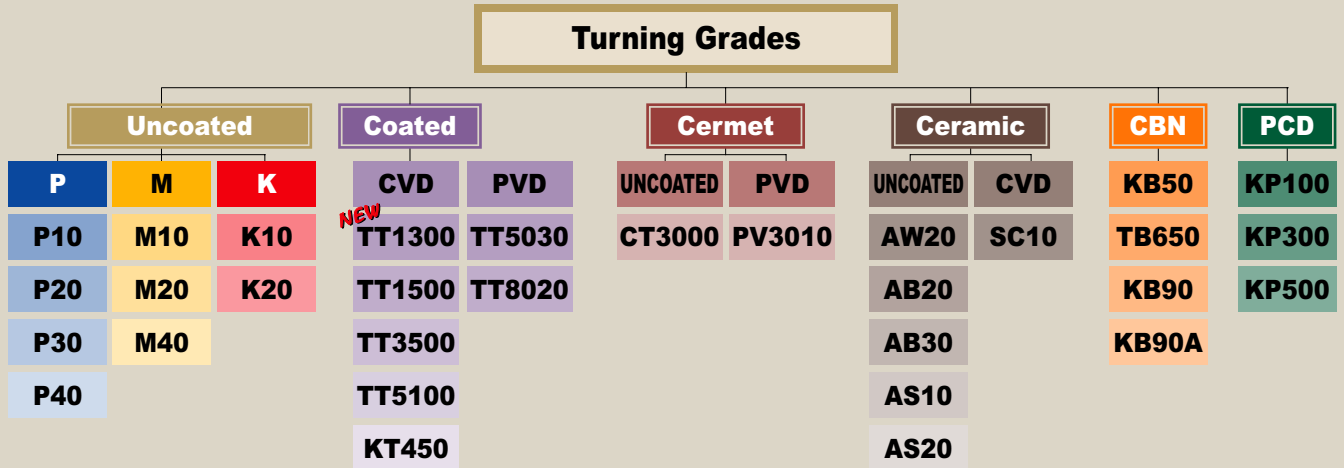
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## GRADES - GRADE CLASSIFICATION

TAEGUline cutting tool grades are classified according to application and type of materials.

There are uncoated P.M.K types based on ISO classification, coated grades for high efficiency cutting, cermets for finishing to medium cutting, ceramics, CBN & PCD for high speed cutting.

The ideal choice of grade depends on the workpiece materials, cutting condition, insert geometry and the machine.



## GRADES - GRADE RECOMMENDATION

### For Turning

Materials	Carbon Steel, Alloy Steel, Mild Steel						Cast Iron				
	Finish-Light		Medium	Rough			High Speed	Finish	Medium		
	P01	P10	P20	P30	P40	P50		K01	K10	K20	K30
Coated	TT1500		TT3500			TT5100			TT1300 <sup>NEW</sup>		
Coated	PV3010		KT450			TT8020			TT1500		
Cermet	CT3000								CT3000		
Uncoated	P10		P20	P30	P40				K10 K20		
Coated									SC10		
Ceramic						AW20			AB30		
									AS10		
CBN						KB90			KB90A		
PCD											

Materials	Hardened Steel		Stainless Steel		Heat Resistant Alloy		Non-Ferrous	
	Finish	Medium	Finish Light	Medium	Finish	Medium	Finish	Medium
Coated			TT5030		TT5030			
			TT5100		TT5100			
			TT8020		TT8020			
Coated			PV3010					
Cermet			CT3000					
Uncoated							K10	
Coated								
Ceramic	AW20				AS20			
	AB20							
	AB30							
CBN	KB50				KB90			
	TB650				KB90A			
PCD							KP100	
							KP300	
							KP500	

# GRADES - GRADE RECOMMENDATION

## For Threading

Materials	Carbon Steel, Alloy Steel, Mild Steel					Cast Iron					
	Cutting Condition	High Speed	Finish-Light		Medium	Rough		High Speed	Finish	Medium	
			ISO	P01	P10	P20	P30		P40	K01	K10
Coated				TT7010			TT8010				
				TT9030					TT9030		
Cermet			CT3000								
Uncoated					P30				UF10		

Materials	Hardened Steel		Stainless Steel		Heat Resistance Alloy		Non-Ferrous			
	Cutting Condition	Finish	Medium	Finish Light	Medium	Finish	Medium	Finish	Medium	
Coated			TT7010		TT9030		TT9030		TT9030	
			TT9030							
Cermet				CT3000						
Uncoated						UF10			UF10	

## For T-Clamp

Materials	Carbon Steel, Alloy Steel, Mild Steel							Cast Iron				
	Cutting Condition	High Speed	Finish-Light		Medium	Rough		High Speed	Finish	Medium		
			ISO / ANSI	P01	P10	P20	P30		P40	P50	K01	K10
Coated					TT9030						TT9030	
					TT7220							
					TT5100							
						TT8020						
Coated			PV3030					PV3030				
Cermet			CT3000					CT3000				
Uncoated									K10			
Ceramic								AB30				
CBN												
PCD												

Materials	Hardened Steel		Stainless Steel		Heat Resistance Alloy		Non-Ferrous		
	Cutting Condition	Finish	Medium	Finish Light	Medium	Finish	Medium	Finish	Medium
Coated				TT9030		TT9030			
				TT5100		TT5100			
					TT8020		TT8020		
Coated				PV3030					
Cermet				CT3000					
Uncoated						K10			K10
Coated									
Ceramic			AB30						
CBN		KB50							
PCD								KP300	

## GRADES - PVD COATED

### PVD Coatings

Ingersoll's TAEGUline has 8 coated grades produced with the Physical Vapor Deposition (PVD) process.

These products are coated with TiN, TiCN or TiAlN on the specially manufactured substrate at relatively low temperature. This process has less reaction between coating layer and substrate and less thermal stress. This dramatically improves edge strength.

TaeguTec Grade	ISO	Characteristics	Application
<b>TT5030</b> PVD Coated	<b>S05</b> – <b>S20</b> <b>M05</b> – <b>M20</b>	<ul style="list-style-type: none"> <li>For a wide range of turning of high-temp alloys</li> <li>For high speed machining of stainless steel</li> <li>Very hard submicron substrate with good fracture toughness</li> </ul>	Turning
<b>TT7010</b>	<b>P20</b> – <b>P30</b>	<ul style="list-style-type: none"> <li>For threading steel</li> <li>TiCN/TiN</li> </ul>	Threading
<b>TT7220</b> PVD Coated	<b>P20</b> – <b>P35</b>	<ul style="list-style-type: none"> <li>For semi-roughing and medium cutting of steel</li> <li>TiCN</li> </ul>	Parting, Grooving and Turning
<b>TT8010</b>	<b>M30</b> – <b>M40</b> <b>S30</b> – <b>S40</b> <b>P30</b> – <b>P45</b>	<ul style="list-style-type: none"> <li>For a wide range of threading on stainless steel &amp; exotic materials</li> <li>Toughest grade in threading product line</li> </ul>	Threading
<b>TT8020</b> PVD Coated	<b>M30</b> – <b>M40</b> <b>S30</b> – <b>S40</b> <b>P30</b> – <b>P45</b>	<ul style="list-style-type: none"> <li>For medium to low speed turning of stainless steel, exotic alloys &amp; low carbon steel</li> <li>Toughest grade in turning product line</li> <li>First choice for interrupted cutting on stainless steel &amp; exotic alloys</li> </ul>	Turning, Parting and Grooving
<b>PV3010</b> PVD Coated Cermet	<b>P05</b> – <b>P15</b> <b>K05</b> – <b>K15</b> <b>M05</b> – <b>M15</b>	<ul style="list-style-type: none"> <li>Greatly improved cutting performance in wet conditions especially where the thermal stability is needed</li> <li>Combining TiN coating layer having low affinity with cutting material and special substrate with improved toughness result in long tool life and superior cutting performance</li> <li>TiN</li> </ul>	Turning
<b>PV3030</b> PVD Coated Cermet	<b>P01</b> – <b>P15</b> <b>M01</b> – <b>M25</b> <b>K01</b> – <b>K15</b>	<ul style="list-style-type: none"> <li>Better Surface Roughness, longer tool life</li> <li>For high speed machining</li> <li>TiAlN coated on cermet</li> </ul>	Parting and Grooving
<b>TT9030</b>	<b>P15</b> – <b>P35</b> <b>M10</b> – <b>M30</b>	<ul style="list-style-type: none"> <li>For semi-roughing and medium cutting on all kinds of materials</li> <li>High mechanical shock resistance</li> <li>TiAlN coated on sub-micron substrate</li> </ul>	Parting and Grooving, Threading

## ■ GRADES - CVD COATED

### ■ CVD Coatings

Ingersoll's TAEGUline has 6 coated grades produced with the Chemical Vapor Deposition (CVD) process.

These coated products are metallurgically coated with multi-layer substrate applicable to every work material and machining condition.

TaeguTec Grade	ISO	Characteristics	Application
<b>TT1300</b> CVD Coated	<b>K05</b> – <b>K15</b> <b>P05</b> – <b>P15</b>	<ul style="list-style-type: none"> <li>For high speed turning of cast iron and steel</li> <li>Coated with alumina on a highly wear resistant substrate</li> <li>TiCN-Al<sub>2</sub>O<sub>3</sub></li> </ul>	Turning
<b>TT1500</b> CVD Coated	<b>K10</b> – <b>K20</b> <b>P10</b> – <b>P25</b>	<ul style="list-style-type: none"> <li>For medium to high speed turning of steel, ductile cast iron and cast iron</li> <li>High wear resistance and heat resistance</li> <li>TiN - TiCN - TiC - Al<sub>2</sub>O<sub>3</sub> - TiN</li> </ul>	Turning
<b>TT3500</b> CVD Coated	<b>P15</b> – <b>P35</b>	<ul style="list-style-type: none"> <li>For general turning of steel</li> <li>Strengthened chipping resistance and breakage resistance</li> <li>TiN - TiCN - Al<sub>2</sub>O<sub>3</sub> - TiN</li> </ul>	Turning
<b>TT5100</b> CVD Coated	<b>P20</b> – <b>P40</b> <b>M15</b> – <b>M35</b> <b>S15</b> – <b>S35</b>	<ul style="list-style-type: none"> <li>For general turning of stainless steel</li> <li>Excellent chipping resistance and adhesion resistance</li> <li>TiN - TiCN - Al<sub>2</sub>O<sub>3</sub> - TiN</li> </ul>	Turning and Grooving
<b>KT450</b> CVD Coated	<b>P25</b> – <b>P45</b> <b>M20</b> – <b>M40</b>	<ul style="list-style-type: none"> <li>For roughing or interrupted cuts of steel</li> <li>High toughness grade</li> <li>TiN - TiCN - TiC - TiCN - TiN</li> </ul>	Turning
<b>SC10</b> CVD Coated Ceramic	<b>K01</b> – <b>K10</b>	<ul style="list-style-type: none"> <li>High speed turning of cast iron</li> <li>Multi-layer coating on AS10</li> <li>Al<sub>2</sub>O<sub>3</sub> - TiN</li> </ul>	Turning

## GRADES - CERMETS

### Cermets

Cermets are very hard grades made of solid Titanium Carbide or Carbon Nitride, providing longer tool life at higher speed than coated tungsten carbide inserts.

### Features

- High speed cutting through high hardness at high temperatures.
- Long tool life due to excellent anti-oxidation characteristics.
- Excellent surface finish.

### Physical Properties

Grade	Properties	Density (g/cm <sup>3</sup> )	Hardness (HRA)	T.R.S (kg/mm <sup>2</sup> )
CT3000		6.7	93.0	160

### Application

TaeguTec Grade	Cutting Methods	Application
<b>CT3000</b> <b>P05</b> – <b>P15</b> <b>M05</b> – <b>M15</b> <b>K05</b> – <b>K15</b>	Finishing Semi-finishing General turning	Suitable for finishing to semi-finishing of steel, cast iron and stainless steel. General turning and grooving of steel

## GRADES - UNCOATED GRADE P.M.K

### Features

- Very hard at normal temperature.
- Hardness can be maintained at high temperature.
- High compressive strength compared with steel.

### Application

ISO class	TaeguTec grade	Materials	Cutting Methods	Application	Composition	Features
<b>P</b>	<b>P10</b>	Steel Cast Steel	Threading Turning	Medium-high speed	WC + Co + TiC + TaC	TiC & TaC is added for improving heat & crater resistance
	<b>P20</b>			General cutting		
	<b>P30</b>			Low-medium speed Roughing		
<b>M</b>	<b>M10</b>	Steel Cast Iron Stainless Steel	Turning	Medium speed	WC + Co + TiC + TaC	Less TiC and TaC is added. Better wear and shock resistance, but less heat and crater resistance than P grades.
	<b>M20</b>			Low speed		
	<b>M40</b>			Heavy cutting		
<b>K</b>	<b>K10</b>	Cast iron Hardened Steel Nonferrous Materials Non-Metallics	Turning Grooving	Finishing	WC + Co	No TiC or TaC. Excellent mechanical wear resistance and shock resistance.
	<b>K20</b>			Medium speed		

### Mechanical and Physical Properties

ISO class	TaeguTec Grade	Hardness (HRA)	Transverse Rupture Strength (kg/mm <sup>2</sup> )	Young's modulus (10 <sup>3</sup> kg/mm <sup>2</sup> )	Thermal conductivity (cal/cm•sec•K)	Compressive strength (kg/mm <sup>2</sup> )	Thermal expansion coefficient (10 <sup>-6</sup> /°C)
<b>P</b>	<b>P10</b>	92.7	> 200	53	0.07	460	6.5
	<b>P20</b>	92.5	> 210	54	0.08	480	6.0
	<b>P30</b>	91.2	> 250	57	0.10	480	5.5
<b>M</b>	<b>M10</b>	92.8	> 200	58	0.12	500	5.5
	<b>M20</b>	92.1	> 250	57	0.15	490	5.5
	<b>M40</b>	89.1	> 330	54	0.14	440	5.5
<b>K</b>	<b>K10</b>	92.7	> 240	64	0.19	620	4.7
	<b>K20</b>	92.1	> 260	62	0.19	530	5.0

# GRADES - GRADE COMPARISON TABLE

## Coated Grade

Materials	TAEGUline	SANDVIK	KENAMETAL	Valenite	MITSUBISHI	SUMITOMO	TOSHIBA	KYOCERA	SECO	Korloy	ISCAR	
<b>P M K</b>	<b>TT1300</b>	GC3205 GC3210	KC9315	SV510 SV305	UC5105 UC5015 UC5115	AC300G	T5010	CA4010	TX1000 TP1000 TP100	NC305K NC6010	IC9007 IC4028 IC428	
	<b>TT1500</b>	GC4005 GC4015 GC3025	KC9325 KC9110	SV515 SV310 SV525 SV315 SV405	UE6005 UC6010 UE6010	AC500G AC400G AC1000	T5020 T9005 T7005 T9015 TD905 T715X T7020 T9025 T725X	CA5515 CR7015 CA5025 CA4115	TX2000 TP2000 TP200	NC315K NC310	IC9015 IC9025	
	<b>TT3500</b>	GC4025	KC9125	SV320 SV410 SV325	UE6020 UC6025	AC2000	EH10Z EH510Z	CA5525 CR7025 CA225	TP3000 TP300			IC8048 IC907
	<b>TT5030</b>	GC1025 GC2015	KC5410 KC5010 KC5025	VC929 VC901	VP05RT VP15TF US7020	EH10Z EH510Z	AH110 AH120 T6020	CA6015	CP200		NC325S NC320	
	<b>TT5100</b>	GC2025		SV415		EH520Z AC304	T6030	CR9025 PR630			NC330	IC656
	<b>KT450</b>	GC4035	KC9040	SV230 SV330 SV235	UE6035 UP20M	AC3000	T930 TD930	PR660	TP400 TP40		PC9030	
	<b>TT8020</b>	GC2035	KC9240 KC9245		US735		AH140		CP50			IC3028
	<b>TT7010</b>											IC250
	<b>TT7220</b>	GC4025 GC1025	KC810 KC850		AP25N UP35N	T2000Z T130Z	UX30	PR630 CR9025 TW60M	T25M S25M			IC354
	<b>TT8010</b>	GC2135 GC235	KC850		US735			PR660	T25M			IC358
	<b>TT9030</b>	GC1020 GC4125						PV30 PV60	CP50			IC520N

## GRADES - GRADE COMPARISON TABLE

### Uncoated Grade

ISO Classification	TAEGLINE	SANDVIK	SECO	SUMITOMO	MITSUBISHI	TOSHIBA	ISCAR
<b>P</b>	<b>P01</b>	CT3000	S1P	F1F		NS530	IC20N
	<b>P10</b>	P10	S10T	S1F, S10M	ST10P	ST10T TX10D TX10S	
	<b>P20</b>	P20	SMA	S25M	ST20E	ST120 TX20 TX25 UX25	IC70
	<b>P30</b>	P30	S30 SM30	375 S35M	A30N A30	TX30 UX30	IC50M
	<b>P40</b>	P40	S6 R4, SMA	S60M	ST40E	TX40	IC54
<b>M</b>	<b>M10</b>	M10	S1P, H10A	SM10	U10E	TU10	IC70
	<b>M20</b>	M20	H13A	HX, S25M	U2	UT120T TU20/UX25	IC08
	<b>M30</b>		H10F	HX, S35M	A30, A30N	UT120T UX30	
	<b>M40</b>	M40	R4	S60M	A40	TU40	IC28
<b>K</b>	<b>K01</b>	UF1	H1P		H2	HT105T TH03	IC07
	<b>K10</b>	K10	HM H10, H10A	HX	H1 EH10	HT110 G1F H10T TH10	IC20
	<b>K20</b>	K20	H13A	H15 HK 883	EH20 G10E	HT120T G2F KS20 G2	IC10
	<b>K30</b>	K30			G3		

### Cermet Grade

ISO Classification	TAEGLINE	SANDVIK	KYOCERA	SUMITOMO	MITSUBISHI	TOSHIBA	DIJET	KENAMETAL	HITACHI	ISCAR
<b>P</b>	<b>P01</b>	PV3010 PV3030 CT3000	CT5005 CT5015	TN30 PV30	T110A	NX1010 AP25N	NS520 AT520 GT520	LN10 CX50	KT125 CH350	IC20N
	<b>P10</b>	PV3010 PV3030 CT3000	CT5015	TN60 PV60 TN6020 PV7020	T1200A T2000Z	NX1010 NX2525 AP25N UP35N	NS520 AT520 AT530	LN10 CX50 NIT CX75	KT315 KT175 HT2 CH350 CH550 CH7030 CZ1025	IC20N
	<b>P20</b>	PV3010 CT3000 CT5000	GC1525	TN6020 TN90 TN100M PV90 PV7020	T1200A T2000Z T3000Z	NX2525 NX4545 UP35N	NS530 AT530 GT530	CX50 CX75 CX90 NAT	PS5 CH7030 CH7035 CZ1025 CZ25	IC20N IC30N
	<b>P30</b>	CT5000	CT530		T130A T3000Z	NX4545	NS530 NS540 NS740	CX90 CX99 SUZ	CH7035 CZ25	IC30N
<b>M</b>	<b>M10</b>	PV3010 PV3030 CT3000	CT525	TN60 PV60 TN6020 PV7020	T1200A T2000Z	NX2525	NS520 AT530 GT530	LN10	KT315 KT125 CH550 CH7030 CZ1025	IC20N
	<b>M20</b>	PV3010 PV3030 CT3000 CT5000	GC1525		T1200A T2000Z T3000Z	NX2525	NS530	CX50 CX75 NIT	KT175 HT2 PS5 CH7030 CH7035 CZ1025 CZ25	IC20N IC30N
	<b>M30</b>	CT5000	CT530	TN30 PV30		NX4545	NS540 NS740	CX75 CX90 CX99 SUZ	CH7035 CZ25	IC30N
<b>K</b>	<b>K01</b>	PV3010 PV3030 CT3000	CT5015 CT515		T110A	NX1010 AP25N	NS520 AT520 GT520	LN10	CH550	IC20N
	<b>K10</b>	PV3030 CT3000		PN60 PV60 TN6020 PV7020	T110A	NX2525 AP25N	NS530 AT530 GT530	LN10	KT315 HTX CH7030 CH7035 CZ1025 CZ25	IC20N
	<b>K20</b>	CT5000				NX2525 AP25N		NIT	KT315 CH7035 CZ25	

**TAEGLINE**

## GRADES - GRADE COMPARISON TABLE

### Ceramic Grade

Application	TAEGUline	ISCAR	KENAMETAL	KYOCERA	NTK	SANDVIK	SUMITOMO	TUNGALOY	
Cast Iron	Finishing	AW20	IN11	KW80	KA30	HW2 HC1	CC620	-	-
	General	AB30	IN23	KY1615	A65	HC2 HC5 HC6	CC650	NB90S NB90M	LX21
	Roughing	AS10 SC10	IS8 IS80	KY1310 KY3000 KY3500 KY3400	KS500 KS6000	SX1 SX8 SP2	CC690 CC6090 GC1690	NS260 NS260C	FX105 CX710
Hardened Steel	AB20	IN22	KY4300	A66N	HC4 ZC4	CC650	NB100C	LX11	
Heat Resistant Alloy	AS20	IS9	KY2000 KY2100 KY1540	-	WA1	CC670	-	WG300	

### CBN

Application	TAEGUline	KENAMETAL	KYOCERA	NTK	SANDVIK	SECO	SUMITOMO	TUNGALOY	
Cast Iron	Finishing	TB650	KD120	KBN65B	B20	CB7050	CBN20	BN500	BX930
	General	KB90 KB90A	KD120	KBN410 KBN900	B22	CB50	CBN300	BN600 BN700	BX950
Hardened Steel	Finishing	KB50	KD050 KD120 KB1615	KBN10B KBN10N	B24	CB7020	CBN100	BNX10 BNC80 BNC150	BX310
	General	TB650	KB1340 KB5625	KBN25B KBN525 KBN25N	B26	CB20	CBN150 CBN200	BNX20 BN250 BNX25 BN300 BN350 BNC200 BNC300	BX330 BX360 BX380 BXC50

### PCD

Grade	TAEGUline	KENAMETAL	KYOCERA	NTK	SANDVIK	SECO	SUMITOMO	TOSHIBA
Fine	KP100	PD100	KPD001			PD10	DA2200 DA90	DX180
Medium	KP300	KD100	KPD010	PD1	CD10	PD20	DA150	DX160 DX140
Coarse	KP500	KD1415	KPD025			PD30	DA200	DX120

# CHIPBREAKER COMPARISON TABLE



TAEGUline	Sandvik	Kennametal	Seco	Walter	Valenite	Mitsubishi	Sumitomo	Toshiba	Kyocera	Korloy	Iscar
<b>NEGATIVE</b>											
<b>FA</b>		FF FS	FF1		LF,PF	FH FS	FL,FA		GP DP	HU	SF
<b>FG</b>	PF	FP	MF2				LU	ZF			
<b>SF</b>	QF	FN		NF3	MF,GF	SH	SU	ZM,TS,NS	HQ	HF,GF	NF
<b>VF,FS</b>	MF	LF		NF4	C2,UF,LC	SA	SX	27,NM	GU,CQ,XP		
	K		95			ES	GX	S	ST		
<b>ML</b>		GP-K,MS- MS GP	MF1	NS4 NS5,NS6,G1	1W,2W SR	FJ		CB,17	XP	HA	12 PP
	NGP					MJ	UP				
<b>MP</b>	23 MM QM	P	MF3	NM4		MS	EX		HU SU	HS,GS	TF VL
<b>MC</b>	SM	MN	MR3		RM SL	MV		AS	CS,GS	HC	
<b>MT</b>	PM KF	MP	M3	NM6 NS8	MM,LM,TM HF	MH MA	GU UX,UG	TM	PS HS	HM,GM	GN
<b>MG-</b>	KM			MG-		MG-	UZ	38 DM,MG- 33,37	MG- C	B20,B25	MG-
<b>RT</b>	MR PR KR	RP UM RN,MG-	M5 MR7	NR4 NM5,NM7 NM9	UM,RH GM,M8 GR	GJ GH HAS,HDS	MU,MX		XS ZS,GC GT HT	HR GR	TNM NR
<b>RH</b>	PR QR MR	RM	R6,RR9 R4,37	NR5,NR6 NR7	UR,HS	HZ HA HH	MP HG			GH	RP NM
	HR	RH	R8,56,57 R7		R4	HX,HBS HV,HDS,HXD	HP	57 TU 65		HH B40	
<b>WS</b>	WF	FW	W-MF2			SW	LUW	AFW	WP		
<b>WT</b>	WM	MW	W-M3			MW	GUW	ASW	WQ	HW	WG
<b>POSITIVE</b>											
<b>FA</b>	PF,UF	UF,11,GM	FF1	PF4 PF5	FL	FV	LU FP		CF DP	HFP	38,PF
<b>FG</b>	PM,UM	LF	F1	PS4 PS5	PM3 FH		FK SU	PF	GP,XP DP,XQ,HQ	HMP,C05	SM 16,GT-
			F2	PM5 MT-	PM2,FF	SQ,SV	SC,SK				14,17 19,MT-
<b>MT</b>	PR,UR	MF		MT-	PM4,FR	MQ,MV	SF,MU	PM	MT-	C25	
<b>PMR-</b>	PMR-	PMR-		PMR-	FM				GP,HQ G,PMR-		
<b>FL</b>	AL	HP	AL	PM2			AG	AL	AH	AK	AF,AS
<b>WT</b>	WM	MW	W-M3			MW					WG
TAEGUline	Sandvik	Kennametal	Seco	Walter	Valenite	Mitsubishi	Sumitomo	Toshiba	Kyocera	Korloy	Iscar

**TAEGUline**

# HARDNESS COMPARISON TABLE

VICKERS 50kg HV	BRINELL HB10mm BALL LOAD 3000kgf		ROCKWELL				SHORE'S HS	TENSILE STRENGTH N/mm <sup>2</sup> (kgf/mm <sup>2</sup> )	VICKERS 50kg HV	BRINELL HB10mm BALL LOAD 3000kgf		ROCKWELL				SHORE'S HS	TENSILE STRENGTH N/mm <sup>2</sup> (kgf/mm <sup>2</sup> )
	STANDARD BALL	TUNGSTEN CARBIDE BALL	A SCALE 60kgf Diamond brale HRA	B SCALE 100kgf 1/16in BALL HRB	C SCALE 150kgf Diamond brale HRC	D SCALE 100kgf Diamond brale HRD				STANDARD BALL	TUNGSTEN CARBIDE BALL	A SCALE 60kgf Diamond brale HRA	B SCALE 100kgf 1/16in BALL HRB	C SCALE 150kgf Diamond brale HRC	D SCALE 100kgf Diamond brale HRD		
1900			93.1		80.5			470	441	442	74.1		46.9	60.7		1570(160)	
1800			92.6		79.2			460	433	433	73.6		46.1	60.1	62	1530(156)	
1700			91.9		77.9			450	425	425	73.3		45.3	59.4		1459(153)	
1600			91.3		76.6			440	415	415	72.8		44.5	58.8	59	1460(149)	
1500			90.5		75.3			430	405	405	72.3		43.6	58.2		1410(144)	
1450			90.1		74.6			420	397	397	71.8		42.7	57.5	57	1370(140)	
1400			89.6		74.0			410	388	388	71.4		41.8	56.8		1330(136)	
1350			89.1		73.4			400	379	379	70.8		40.8	56.0	55	1290(131)	
1300			88.7		72.7			390	369	369	70.3		39.8	55.2		1240(127)	
1250			88.3		72.1			380	360	360	69.8	(110.0)	38.8	54.4	52	1250(123)	
1200			87.9		71.5			370	350	350	69.2		37.7	53.6		1170(120)	
1150			87.5		70.9			360	341	341	68.7	(109.0)	36.6	52.8	50	1130(115)	
1100			87.1		70.3			350	331	331	68.1		35.5	51.9		1095(112)	
1050			86.6		69.6			340	322	322	67.6	(108.0)	34.4	51.1	47	1070(109)	
1000			86.2		68.9			330	313	313	67.0		33.3	50.2		1035(105)	
940			85.6		68.0	76.9	97	320	303	303	66.4	(107.0)	32.2	49.4	45	1005(103)	
920			85.3		67.5	76.5	96	310	294	294	65.8		31.0	48.4		980(100)	
900			85.0		67.0	76.1	95	300	284	284	65.2	(105.5)	29.8	47.5	42	950(97)	
880		(767)	84.7		66.4	75.7	93	295	280	280	64.8		29.2	47.1		935(96)	
860		(757)	84.4		65.9	75.3	92	290	275	275	64.5	(104.5)	28.5	46.5	41	915(94)	
840		(745)	84.1		65.3	74.8	91	285	270	270	64.2		27.8	46.0		905(92)	
820		(733)	83.8		64.7	74.3	90	280	265	265	63.8	(103.5)	27.1	45.3	40	890(91)	
800		(722)	83.4		64.0	74.8	88	275	261	261	63.5		26.4	44.9		875(89)	
780		(710)	83.0		63.3	73.3	87	270	256	256	63.1	(102.0)	25.6	44.3	38	855(87)	
760		(698)	82.6		62.5	72.6	86	265	252	252	62.7		24.8	43.7		840(86)	
740		(684)	82.2		61.8	72.1	84	260	247	247	62.4	(101.0)	24.0	43.1	37	825(84)	
720		(670)	81.8		61.0	71.5	83	255	243	243	62.0		23.1	42.2		805(82)	
700		(656)	81.3		60.1	70.8	81	250	238	238	61.6	99.5	22.2	41.7	36	795(81)	
690		(647)	81.1		59.7	70.5		245	233	233	61.2		21.3	41.1		780(79)	
680		(638)	80.8		59.2	70.1	80	240	228	228	60.7	98.1	20.3	40.3	34	765(78)	
670			630	80.6	58.8	69.8		230	219	219		96.7	(18.0)		33	730(75)	
660			620	80.3	58.3	69.4	79	220	209	209		95.0	(15.7)		32	695(71)	
650			611	80.0	57.8	69.0		210	200	200		93.4	(13.4)		30	670(68)	
640			601	79.8	57.3	68.7	77	200	190	190		91.5	(11.0)		29	635(65)	
630			591	79.5	56.8	68.3		190	181	181		89.5	(8.5)		28	605(62)	
620			582	79.2	56.3	67.9	75	180	171	171		87.1	(6.0)		26	580(59)	
610			573	78.9	55.7	67.5		170	162	162		85.0	(3.0)		25	545(56)	
600			564	78.6	55.2	67.0	74	160	152	152		81.7	(0.0)		24	515(53)	
590			554	78.4	54.7	66.7		150	143	143		78.7			22	490(50)	
580			515	78.0	54.1	66.2	72	140	133	133		75.0			21	455(45)	
570			535	77.8	53.6	65.8		130	124	124		71.2			20	425(44)	
560			525	77.4	53.0	65.4	71	127	121			69.8			19	(42)	
550	(505)		517	77.0	52.3	64.8		122	116			67.6			18	(41)	
540	(496)		507	76.7	51.7	64.4	69	117	111			65.7			15	(39)	
530	(488)		497	76.4	51.1	66.2											
520	(480)		488	76.1	50.5	63.5	67										
510	(473)		479	75.7	49.8	62.9											
500	(465)		471	75.3	49.1	62.2	66										
490	(456)		460	74.9	48.4	61.6											
480	488	452	74.5		47.7	61.3	64										

Note: Gothic figures come from ASTM E 140 Table.(calculated by SAE-ASM-ASTM together)

## MATERIAL CONVERSION TABLE

France	Germany	Italy	Japan	Country Spain	Sweden	U.K	USA	Korea
AFNOR	DIN	UNI	JIS	Standard UNF	SS	BS	AISI/SAE	KS
<b>Carbon Steel</b>								
S250	1.0175	CF9Mn28	SUM22	11SMn28	1912	230M07	1213	SUM22
CC12	1.0301			F.111			1010	SM10C
XC12	1.0401	C15C16	S15C		1350	080M15	1015	SM15C
CC20	1.0402	C20C21	S20C	F.112	1450	050A20	1020	SM20C
	1.0406		S25C				1025	SM25C
CC35	1.0501	C35	S35C	F.113	1550	060A35	1035	SM35C
CC45	1.0503	C45	S45C	F.114	1650	080M46	1045	SM45C
XC55	1.0535	C55	S55C	C55K	1655	070M55	1055	SM55C
XC60	1.0601	C60	S58C		1678	080A62	1060	SM58C
<b>Alloy Steel</b>								
12C3	1.7015	16MnCr5	SCr415	16MnCr5	2511	523M15	5115	SCr415
	1.7027		SCr420				5120	SCr420
32C4	1.7033	34Cr4(KB)	SCr430	35Cr4		530A32	5132	SCr430
42C4	1.7035	41Cr4	SCr440	43Cr4		530M40	5140	SCr440
14NC11	1.5732	16NiCr11	SNC415	15NiCr11			3115	SNC415
	1.5736		SNC631				3130	SNC631
	1.5736		SNC236			640A35	3135	SNC236
12CD4	1.7262		SCM415	12CrMo4	2216		4115	SCM415
	1.7264		SCM420				4120	SCM420
	1.7220		SCM430				4130	SCM430
42CD4	1.7225	42CrMo4	SCM440	42CrMo4	2244	708M40	4140	SCM440
20NCD2	1.6523	20NiCrMo2	SNCM220	20NiCrMo2	2506	805M20	8620	SNCM220
		SNCM240				8640	SNCM240	
	1.6657		SNCM415				4315	SNCM415
	1.6571		SNCM420				4320	SNCM420
			SNCM439				4340	SNCM439
			SMn420				1520	SMn420
	1.1157		SMn443				1547	SMn443
	1.1133		SMnC420					SMnC420
	1.2067		SUJ2				52100	STB2
<b>Tool Steel</b>								
			SK3			WI-10	STC3	
Y105V	1.2833		SKS43			BW2	W2	STS43
Z200C12	1.2080	X210Cr13KU	SKD11	X210Cr12		BD3	D3	STD11
Z40CDV5	1.2344	X35CrMoV05KU	SKD61	X40CrMoV5	2242	BH13	H13	STD61
Z80WKCV	1.3255	X78WCo1805KU	SKH3	HS18-1-1-5		BT4	T4	SKH3
Z85WDCV	1.3343	X82WMo0605KU	SKH9	HS6-5-2	2722	BM2	M2	SKH51

# INDERSOLL

## HARDNESS COMPARISON TABLE

France	Germany	Italy	Japan	Country Spain	Sweden	U.K	USA	Korea
AFNOR	DIN	UNI	JIS	Standard	SS	BS	AISI/SAE	KS
<b>Stainless Steel</b>								
			SUS201				201	STS201
			SUS202				202	STS202
			SUS301				301	STS301
			SUS302				302	STS302
Z6CN18.09	1.4301	X5CrNi18-10	SUS304	F.3551	2332	304S15	304	STS304
	1.4303		SUS304L		2333	304C12	304L	STS304L
Z6CND17.11	1.4401	X5CrNiMo17-12	SUS316	F.3543	2347	316S16	316	STS316
	1.4404		SUS316L				316L	STS316L
Z6CNNb18.10	1.4550	X6CrNiNb18-10	SUS347	F.3552	2338	347S17	347	STS347
Z10C13	1.4000	X6CrAl13	SUS405			405S17	405	STS405
Z8C17	1.4016	X6Cr17	SUS430	F.3113	2320	430S15	430	STS430
	1.4006		SUS403	F.3110	2301	403S17	403	STS403
Z15CrNi6.02	1.4057	X16CrNi16	SUS431	F.3427	2321	431S29	431	STS431
<b>Malleable Cast Iron</b>								
			SUH31					STR31
Z12NCS35.16	1.4864		SUH330				330	STR330
Z10CAS24	1.4749		SUH446		2322		446	STR446
			SUH616				616	STR616
<b>Gray Cast Iron</b>								
F110D	0.6010	G10	FC100		0110		No 20B	GC100
F115D	0.6015	G14	FC150		0115	Grade 150	No 25B	GC150
F120D	0.6020	G20	GC200		0120	Grade 220	No 30B	GC200
F125D	0.6025	G25	FC250		0125	Grade 260	No 35B	GC250
F130D	0.6030	G30	FC300		0130	Grade 300	No 45B	GC300
F135D	0.6035	G35	FC350		0135	Grade 350	No 50B	GC350
<b>Nodular Cast Iron</b>								
FGS 400-12	0.7040	GS400/12	FCD400		0717-02	SNG 420/12	60-40-18	GCD400
FGS 500-7	0.7050	GS500/7	FCD500		0727-02	SNG 500/7	80-55-06	GCD500
FGS 600-3	0.7060	GS600/3	FCD600		0732-03	SNG 600/3		GCD600
FGS 700-2	0.7070	GS700/2	FCD700		0737-01	SNG 700/2	100-70-03	GCD700
<b>Heat Resistant Steel</b>								
MN 35-10	0.8135				0815	B 340/12	32510	BMC340
	0.8145				0852	P 440/7	40010	PMC440
MP 50-5	0.8155				0854	P 510/4	50005	PMC540
MP 60-3	0.8165				0858	P 570/3	70003	
<b>Aluminum Alloy</b>								
	3.2982				4247		A413.0	
	3.2162				4250	LM24	A380.1	
	3.2583				4260	LM20	A413.1	
	3.2581				4261	LM6	A413.2	
	3.2383				4253	LM9	A360.2	