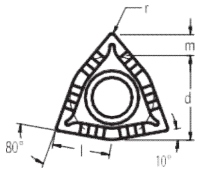
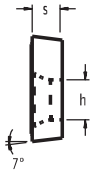
JEMX





Dimensions for WCMT							
Size	d mm	l mm	s mm	r mm	m mm	m_1 mm	h mm
030208	5.56	3.8	2.38	0.8	1.2		2.8
040208	6.35	4.3	2.38	0.8	1.6		3.0
050308	7.94	5.4	3.18	0.8	1.8		3.4
060408	9,53	6,52	3,97	0,80	2,20	-	3.70
080508	12.7	8.7	4.76	0.8	3.1		4.3
080412	12.7	8.7	4.76	1.2	3.1		4.3

F Geometry

Grades	CVD COATED							PVD COATED						UNCOATED		
	A250	A05040	A04030	A0706	A0400	A01519	A037	751	750	752	750S	4064	ST100	PH21	PH1	PH2
ISO GRADE DESIGNATION	HC	HC	HC	HC	HC	HC	HC	HC	HC	HC	HC	HC	HC	HW	HF	HF
Part Number ISO																
JEMX030208F							◆						◆			
JEMX040208F							◆						◆			
JEMX050308F							◆						◆			
JEMX060408F							◆						◆			
JEMX080508F							◆						◆			
JEMX080412F							◆						◆			

Indicates stocked item and material application range.

Star Guide — Key to Recommended Inserts

	Material Designations							
	P	Unalloyed Steels	M	Stainless Steels	K	Cast Irons	S	High Temp. Alloys
	P	Alloyed Steels	M	PH Stainless	N	Aluminium & Alloys	H	Hard Materials

A new range of indexable-insert drills has been introduced by H.BILZ for the efficient production of holes from 13.5mm to 63mm diameter in ductile, long chipping materials such as stainless steels.

Called Posidrill Plus™, it is intended for producing short holes up to three times (optionally four times) diameter. The system is ideal for drilling stacked material, as the positioning of the inserts in the body renders all the machined material to chips, allowing a smooth transition from plate to plate by avoiding the formation of slugs that would otherwise impede the drill.

The drills use JEMX-style inserts with three cutting edges in four sizes, with up to 4 inserts loaded on alternate flutes to cover the range of diameters. The inserts are available in grade ST100 , a wear resistant, micrograin structure combining hardness and toughness. It has a titanium-aluminium-nitride PVD coating offering high lubricity and hence low friction cutting. Both carbide structure and coating process are proprietary to H . B I L Z .

The sharp, positive top rake of the -60 geometry affords a high density of carbide grains at the cutting edge where it is most needed for cutting strong, abrasive, ductile materials. Identical inserts may be used on the inner and outer positions of the drill body, as toughness for cutting the hole centre is combined with wear resistance for cutting the periphery.

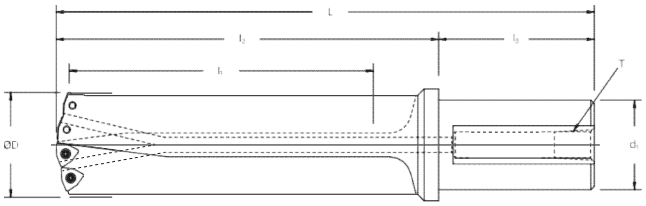
In each flute of larger diameter drills, multiple inserts may be used to break the cut into smaller sections, creating more manageable, easily evacuated chips.

Another benefit is a reduction in power consumption of the machine tool, which is already reduced owing to the positive geometry, irrespective of whether one is drilling on a lathe or a mill.

For example, when machining a 316 stainless steel valve body on a machining centre at 135 m/min surface speed using a 25 mm diameter drill, power consumption is only 10.4kW. During comparative tests on the valve, drilling an 18 mm diameter hole to a depth of 27 mm, Stellram was able to increase feed rate by 50 per cent and surface speed by 84 per cent compared with the incumbent tool used for the application. The resulting cycle time reduction from 28.4 to 9.5 seconds represented a three-fold saving.

An integral round shank is standard on Posidrill Plus™, although special connections such as ABS and HSK are available.

The new Posidrill Plus™ indexable-insert drilling system from H.BILZ is ideal for machining stacked stainless steel plates.



Drill Bodies

		Dimensions (mm)								
EDP	Part Number	øD	d_1	L	l_1	l_2	l_3	T	No of inserts	JEMX Size
029571	**P69003JEMX1350W040**	13,5	20,0	109,3	40,5	57,5	50,0	1/8" NPT	2	JEMX0302..F
*029572	**P69003JEMX1400W042**	14,0	20,0	110,9	42,0	59,0	50,0	1/8" NPT	2	JEMX0302..F
*029573	**P69003JEMX1450W043**	14,5	20,0	112,5	43,5	60,5	50,0	1/8" NPT	2	JEMX0302..F
029574	**P69003JEMX1500W045**	15,0	20,0	114,1	45,0	62,0	50,0	1/8" NPT	2	JEMX0302..F
*029575	**P69003JEMX1550W046**	15,5	20,0	115,7	46,5	63,5	50,0	1/8" NPT	2	JEMX0302..F
029576	**P69003JEMX1600W048**	16,0	20,0	117,2	48,0	65,0	50,0	1/8" NPT	2	JEMX0302..F
*029577	**P69003JEMX1650W049**	16,5	20,0	118,8	49,5	66,5	50,0	1/8" NPT	2	JEMX0302..F
029578	**P69003JEMX1700W051**	17,0	20,0	120,4	51,0	68,0	50,0	1/8" NPT	2	JEMX0302..F
029579	**P69004JEMX1750W052**	17,5	20,0	124,8	52,5	72,5	50,0	1/8" NPT	2	JEMX0402..F
029580	**P69004JEMX1800W053**	18,0	20,0	126,3	54,0	74,0	50,0	1/8" NPT	2	JEMX0402..F
029581	**P69004JEMX1850W055**	18,5	20,0	127,9	55,5	75,5	50,0	1/8" NPT	2	JEMX0402..F
029582	**P69004JEMX1900W057**	19,0	20,0	129,6	57,0	77,0	50,0	1/8" NPT	2	JEMX0402..F
029583	**P69004JEMX1950W058**	19,5	20,0	131,1	58,5	78,5	50,0	1/8" NPT	2	JEMX0402..F
029584	**P69004JEMX2000W060**	20,0	20,0	132,7	60,0	80,0	50,0	1/8" NPT	2	JEMX0402..F
029585	**P69004JEMX2050W061**	20,5	20,0	134,3	61,5	81,5	50,0	1/8" NPT	2	JEMX0402..F
029586	**P69004JEMX2100W063**	21,0	20,0	135,8	63,0	83,0	50,0	1/8" NPT	2	JEMX0402..F
029587	**P69004JEMX2150W064**	21,5	20,0	137,4	64,5	84,5	50,0	1/8" NPT	2	JEMX0402..F
029588	**P69005JEMX2200W066**	22,0	25,0	145,3	66,0	86,0	56,0	1/8" NPT	2	JEMX0503..F
029589	**P69005JEMX2250W067**	22,5	25,0	146,9	67,5	87,5	56,0	1/8" NPT	2	JEMX0503..F
029590	**P69005JEMX2300W069**	23,0	25,0	148,4	69,0	89,0	56,0	1/8" NPT	2	JEMX0503..F
029591	**P69005JEMX2350W070**	23,5	25,0	150.0	70,5	90,5	56,0	1/8" NPT	2	JEMX0503..F
029592	**P69005JEMX2400W072**	24,0	25,0	151,6	72,0	92,0	56,0	1/8" NPT	2	JEMX0503..F
029593	**P69005JEMX2450W073**	24,5	25,0	153,1	73,5	93,5	56,0	1/8" NPT	2	JEMX0503..F
029594	**P69005JEMX2500W075**	25,0	25,0	154,7	75,0	95,0	56,0	1/8" NPT	2	JEMX0503..F
029595	**P69005JEMX2550W076**	25,5	25,0	156,2	76,5	96,5	56,0	1/8" NPT	2	JEMX0503..F
029596	**P69005JEMX2600W078**	26,0	25,0	157,8	78,0	98,0	56,0	1/8" NPT	2	JEMX0503..F
029597	**P69005JEMX2650W079**	26,5	25,0	159,4	79,5	99,5	56,0	1/8" NPT	2	JEMX0503..F
029598	**P69005JEMX2700W081**	27,0	25,0	160,9	81,0	101,0	56,0	1/8" NPT	2	JEMX0503..F
029599	**P69005JEMX2800W084**	28,0	25,0	164,1	84,0	104,0	56,0	1/8" NPT	2	JEMX0503..F
029600	**P69005JEMX2900W087**	29,0	25,0	167,2	87,0	107,0	56,0	1/8" NPT	2	JEMX0503..F
029601	**P69006JEMX3000W090**	30,0	32,0	174,3	90,0	110,0	60,0	1/4" NPT	2	JEMX0604..F
029602	**P69006JEMX3100W093**	31,0	32,0	177,4	93,0	113,0	60,0	1/4" NPT	2	JEMX0604..F
029603	**P69006JEMX3200W096**	32,0	32,0	180,6	96,0	116,0	60,0	1/4" NPT	2	JEMX0604..F
029604	**P69006JEMX3300W099**	33,0	32,0	183,7	99,0	119,0	60,0	1/4" NPT	2	JEMX0604..F
029605	**P69006JEMX3400W102**	34,0	32,0	186,8	102,0	122,0	60,0	1/4" NPT	2	JEMX0604..F
029606	**P69006JEMX3500W105**	35,0	32,0	189,9	105,0	125,0	60,0	1/4" NPT	2	JEMX0604..F
029607	**P69006JEMX3600W108**	36,0	32,0	193,1	108,0	128,0	60,0	1/4" NPT	2	JEMX0604..F
029608	**P69006JEMX3700W111**	37,0	32,0	196,1	111,0	131,0	60,0	1/4" NPT	2	JEMX0604..F
029609	**P69006JEMX3800W114**	38,0	32,0	199,2	114,0	134,0	60,0	1/4" NPT	2	JEMX0604..F
029610	**P69006JEMX3900W117**	39,0	32,0	207,3	117,0	142,0	60,0	1/4" NPT	2	JEMX0604..F

Drill Bodies

		Dimensions (mm)								
EDP	Part Number	øD	d_1	L	l_1	l_2	l_3	T	No of inserts	JEMX Size
029611	**P69005JEMX4000W120**	40,0	40,0	220,3	120,0	145,0	70,0	1/4" NPT	3	JEMX0503..F
*029612	**P69005JEMX4100W123**	41,0	40,0	223,4	123,0	148,0	70,0	1/4" NPT	3	JEMX0503..F
*029613	**P69005JEMX4200W126**	42,0	40,0	226,5	126,0	151,0	70,0	1/4" NPT	3	JEMX0503..F
*029614	**P69005JEMX4300W129**	43,0	40,0	229,6	129,0	154,0	70,0	1/4" NPT	3	JEMX0503..F
*029615	**P69005JEMX4400W132**	44,0	40,0	237,7	132,0	162,0	70,0	1/4" NPT	4	JEMX0503..F
029616	**P69005JEMX4500W135**	45,0	40,0	240,9	135,0	165,0	70,0	1/4" NPT	4	JEMX0503..F
*029617	**P69005JEMX4600W138**	46,0	40,0	243,8	138,0	168,0	70,0	1/4" NPT	4	JEMX0503..F
*029618	**P69005JEMX4700W141**	47,0	40,0	246,9	141,0	171,0	70,0	1/4" NPT	4	JEMX0503..F
*029619	**P69005JEMX4800W144**	48,0	40,0	250,2	144,0	174,0	70,0	1/4" NPT	4	JEMX0503..F
*029620	**P69005JEMX4900W147**	49,0	40,0	253,6	147,0	177,0	70,0	1/4" NPT	4	JEMX0503..F
029621	**P69005JEMX5000W150**	50,0	40,0	256,6	150,0	180,0	70,0	1/4" NPT	4	JEMX0503..F
*029622	**P69005JEMX5100W153**	51,0	50,0	269,8	153,0	183,0	80,0	1/4" NPT	4	JEMX0503..F
*029623	**P69006JEMX5200W156**	52,0	50,0	274,6	156,0	188,0	80,0	1/4" NPT	4	JEMX0604..F
*029624	**P69006JEMX5300W159**	53,0	50,0	277,8	159,0	191,0	80,0	1/4" NPT	4	JEMX0604..F
*029625	**P69006JEMX5400W162**	54,0	50,0	280,8	162,0	194,0	80,0	1/4" NPT	4	JEMX0604..F
*029626	**P69006JEMX5500W165**	55,0	50,0	283,9	165,0	197,0	80,0	1/4" NPT	4	JEMX0604..F
*029627	**P69006JEMX5600W168**	56,0	50,0	287,2	168,0	200,0	80,0	1/4" NPT	4	JEMX0604..F
*029628	**P69006JEMX5700W171**	57,0	50,0	290,1	171,0	203,0	80,0	1/4" NPT	4	JEMX0604..F
*029629	**P69006JEMX5800W174**	58,0	50,0	293,2	174,0	206,0	80,0	1/4" NPT	4	JEMX0604..F
*029630	**P69006JEMX5900W177**	59,0	50,0	296,4	177,0	209,0	80,0	1/4" NPT	4	JEMX0604..F
*029631	**P69006JEMX6000W180**	60,0	50,0	302,7	180,0	215,0	80,0	1/4" NPT	4	JEMX0604..F
*029632	**P69006JEMX6100W183**	61,0	50,0	305,7	183,0	218,0	80,0	1/4" NPT	4	JEMX0604..F
*029633	**P69006JEMX6200W186**	62,0	50,0	308,9	186,0	221,0	80,0	1/4" NPT	4	JEMX0604..F
*029634	**P69006JEMX6300W189**	63,0	50,0	311,9	189,0	224,0	80,0	1/4" NPT	4	JEMX0604..F

EDP# = Internal Item Number: Please quote this number when ordering
* Delivery 4 – 6 weeks and minimum order quantity 2 pieces.
Check local pricelist for stock availability

Note: Intermediate sizes are available on request

Special length-to-diameter ratios, up to 4 x diameter, are available upon request.
ABS, HSK and other special shanks are also available upon request.

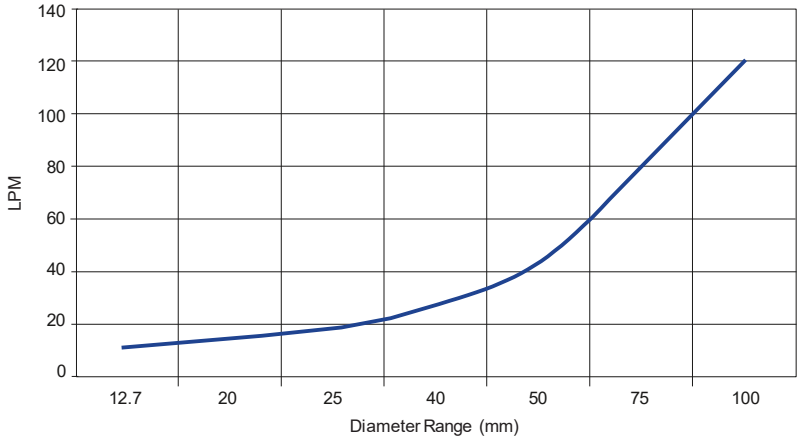
Inserts

EDP	Description	Grade	EDP	Screw		Screw Driver
029354	JEMX 030204F	ST100	029341	F2004TP		T6
029355	JEMX 030208F	ST100	029341	F2004TP		T6
029356	JEMX 040204F	ST100	015061	F2507T		T7
029357	JEMX 040208F	ST100	015061	F2507T		T7
029358	JEMX 050308F	ST100	015063	F3008T		T9
029359	JEMX 060408F	ST100	029460	D3509T		T10
029360	JEMX 080508F	ST100	029460	D4011T		T15
029361	JEMX 080412F	ST100	029460	D4011T		T15

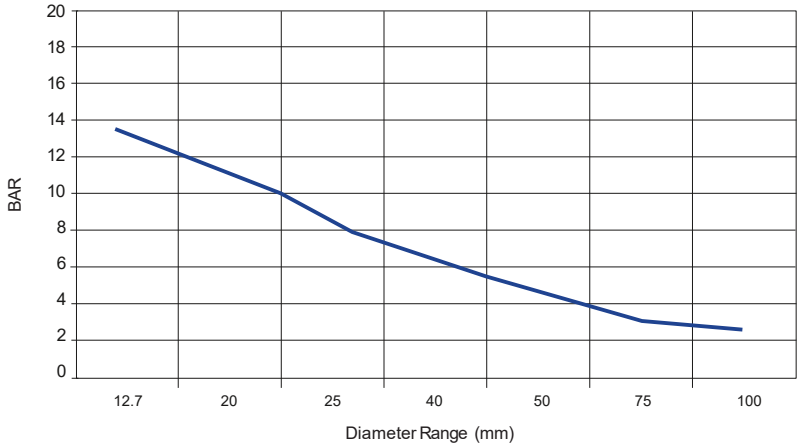
Star Guide Key to Recommended Inserts

	Material Designations							
P	Unalloyed Steels	M	Stainless Steels	K	Cast Irons	S	High Temp. Alloys
P	Alloyed Steels	M	PH Stainless	N	Aluminium & Alloys	H	Hard Materials

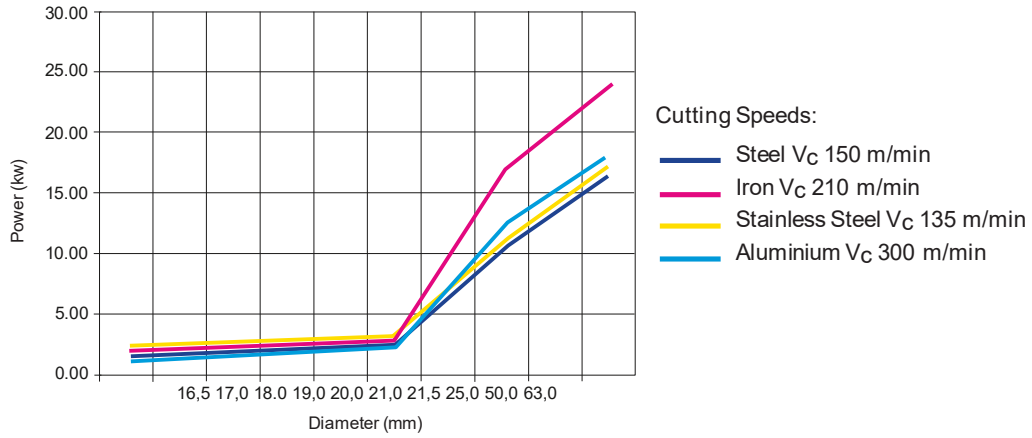
Coolant Flow – Litres per minute (LPM) by diameter

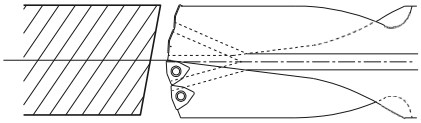


Coolant Pressure – kg/cm² (BAR) by diameter

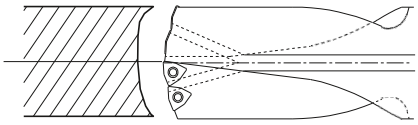


Power Consumption Guidelines

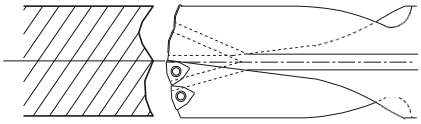




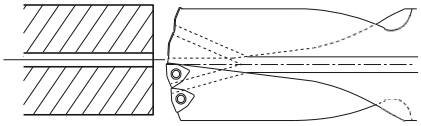
Drilled surfaces should be flat whenever possible.
If the surface angle exceeds 2°, reduce feed by 1/3.



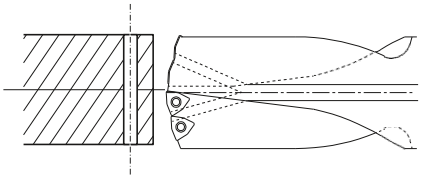
Reduce feed by 1/3 when drilling a concave surface.



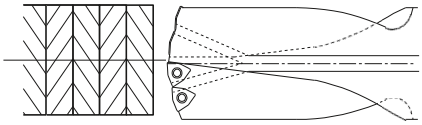
Reduce feed on irregular surfaces to prevent insert chipping. This may also be the case when breaking through the back end of the hole.



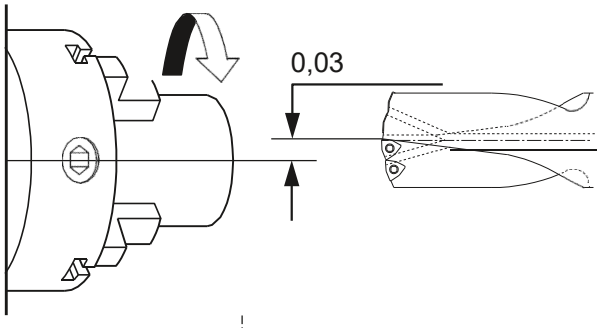
Drill deflection may occur if a predrilled hole exists larger than 1/4 of the finished hole.



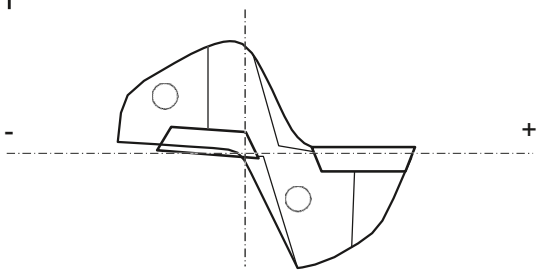
Reduce the feed when passing through a cross-drilled hole larger than 1/4 of the drill diameter.



Stacked plates and welded assemblies can be drilled with Posidrill Plus™.



For best results, a runout of 0,03mm between the the workpiece and drill centerline should not be exceeded.



The peripheral insert should be parallel to the machine's axis of transverse movement when mounting the drill.

Posidrill Plus™ Trouble Shooting Chart

PROBLEM	Long unmanageable chips	Chips jamming in the hole	Excessive wear on outer insert	Outer insert chipping	Inner insert chipping	Hole oversize	Hole undersize	Drill body rubbing in hole	Bad surface finish	Drill back cutting on retraction	SOLUTION
	SYMPTOM										
Incorrect cutting conditions	■		■	■	■				■	■	Check recommended speeds and feeds and adjust accordingly
Insufficient coolant pressure	■	■	■						■		Check coolant lines for leaks. Increase pump pressure
Inferior coolant quality			■						■		Check emulsion; should be strongest recommended by supplier. Do not use synthetic coolant when drilling stainless steels
Drill off center			■	■	■	■	■	■	■	■	Check alignment; maximum allowable with stationary drills is +/- 0.03mm per 25mm in X and Y axis. Maximum allowable with rotating drill is 0.13mm T.I.R.
Deflection				■				■	■	■	Reduce feed. Check alignment
Vibration			■	■	■				■		Check rigidity of workpiece. Reduce speed. Increase feed
Recutting chips				■	■				■		Increase coolant pressure. Check speed and feed
Feed rate too high		■		■	■					■	Reduce feed
Feed rate too low	■	■									Increase feed
Speed too high			■								Reduce speed
Drill incorrectly located			■	■	■	■	■	■	■	■	Check shank and toolholder for damage, clean thoroughly and replace
Inserts incorrectly located			■	■	■	■	■	■	■	■	Check pocket and screw for damage, clean thoroughly and replace

GEOMETRY F *Grade ST100*

Micrograin carbide with TiAlN PVD coating and lubricity layer ST100 offers excellent wear resistance due to its micrograin substrate. Its lubricity layer offers a lower coefficient of friction, especially in softer materials. The F geometry offers excellent chip control in softer materials.

Star Guide Key to Recommended Inserts

	Material Designations							
	P	Unalloyed Steels	M	Stainless Steels	K	Cast Irons	S	High Temp. Alloys
	P	Alloyed Steels	M	PH Stainless	N	Aluminium & Alloys	H	Hard Materials

Feed per diameter range

ISO	Material	Rmand Hardness	Fn= Feed per revolution mm/rev: min. & max.					
			Diameter range inserts (mm)					
			13,5 - 17,0	17,5 - 21,5	22,0 - 29.0	30.0 - 40,0	41,0 - 51,0	52,0 - 63,0
P	Unalloyed Steels	<600 N/mm² <180HBN	0,038 - 0,051	0,064 - 0,076	0,064 - 0,089	0,064 - 0,102	0,064 - 0,089	0,064 - 0,102
		<950 N/mm² <280HBN	0,038 - 0,051	0,064 - 0,076	0,064 - 0,089	0,064 - 0,102	0,064 - 0,089	0,064 - 0,102
	Alloyed Steels	700-950 N/mm² 200-280 HBN	0,051 - 0,076	0,051 - 0,127	0,076 - 0,152	0,102 - 0,178	0,076 - 0,152	0,102 - 0,178
		950-1200 N/mm² 280-355 HBN	0,038 - 0,064	0,038 - 0,102	0,064 - 0,127	0,076 - 0,152	0,064 - 0,127	0,076 - 0,152
		1200-1400 N/mm² 355-415 HBN	0,025 - 0,051	0,051 - 0,076	0,051 - 0,102	0,064 - 0,127	0,051 - 0,102	0,064 - 0,127
M	Stainless Steels	Austenitic + Ferritic 300 series	0,038 - 0,064	0,051 - 0,102	0,076 - 0,102	0,089 - 0,127	0,076 - 0,102	0,089 - 0,127
		Martensitic 400 series	0,038 - 0,056	0,051 - 0,089	0,076 - 0,089	0,089 - 0,114	0,076 - 0,089	0,089 - 0,114
		Refractory P.H.	-	-	-	-	-	-
K	Cast Irons	Grey GG-Ft	0,038 - 0,089	0,064 - 0,152	0,076 - 0,178	0,076 - 0,203	0,076 - 0,178	0,076 - 0,203
		Spheroidal-Ductile GGG-FGS	0,038 - 0,076	0,051 - 0,152	0,076 - 0,178	0,076 - 0,191	0,076 - 0,178	0,076 - 0,191
		Malleable GTS - MN/MP	0,038 - 0,064	0,051 - 0,127	0,076 - 0,152	0,076 - 0,152	0,076 - 0,152	0,076 - 0,152
N	Aluminium & Alloys	< 16% Si116HBN	0,051 - 0,102	0,076 - 0,152	0,076 - 0,191	0,076 - 0,229	0,076 - 0,191	0,076 - 0,229
		> 16% Si92HBN	0,051 - 0,076	0,076 - 0,127	0,076 - 0,152	0,076 - 0,178	0,076 - 0,152	0,076 - 0,178
S	High Temperature Alloys	Iron Based	-	-	-	-	-	-
		Cobalt Based	-	-	-	-	-	-
		Nickel Based	-	-	-	-	-	-
		Titanium Based	0,051 - 0,089	0,064 - 0,102	0,051 - 0,114	0,064 - 0,127	0,051 - 0,114	0,064 - 0,127
H	Hard Steel	>1400 N/mm² >415 HBN	-	-	-	-	-	-
	Chilled Cast Iron	1400 N/mm² 400 HBN	-	-	-	-	-	-

Star Guide Key to Recommended Inserts

	Material Designations							
	P	Unalloyed Steels	M	Stainless Steels	K	Cast Irons	S	High Temp. Alloys
	P	Alloyed Steels	M	PH Stainless	N	Aluminium & Alloys	H	Hard Materials

Cutting Speed (V_c) metres/minute

			ST100
ISO	Material	Rmand Hardness	Speed (V_c) m/min max – min
P	Unalloyed Steels	<600 N/mm² <180HBN	180 - 290
		<950 N/mm² <280HBN	180 - 275
	Alloyed Steels	700-950 N/mm² 200-280 HBN	120 - 245
		950-1200 N/mm² 280-355 HBN	105 - 200
		1200-1400 N/mm² 355-415 HBN	65 - 135
M	Stainless Steels	Austenitic + Ferritic 300 series	120 - 215
		Martensitic 400 series	125 - 220
		Refractory P.H.	-
K	Cast Irons	Grey GG-Ft	120 - 335
		Spheroidal-Ductile GGG-FGS	120 - 275
		Malleable GTS - MN/MP	105 - 180
N	Aluminium & Alloys	< 16% Si 116HBN	245 - 520
		> 16% Si 92HBN	150 - 305
S	High Temperature Alloys	Iron Based	-
		Cobalt Based	-
		Nickel Based	-
		Titanium Based	20 - 45
H	Hard Materials (52-56 HRC)	Hard Materials (52-56 HRC)	-

Star Guide Key to Recommended Inserts

	Material Designations							
P	Unalloyed Steels	M	Stainless Steels	K	Cast Irons	S	High Temp. Alloys
P	Alloyed Steels	M	PH Stainless	N	Aluminium & Alloys	H	Hard Materials

Materials Cross Reference Chart

Material Group	Country/Standard							
	Rm (N/mm²)	Allvac Designation	Allegheny Ludlum Designation	GERMANY/ITALY		U.K.	FRANCE	USA
				W.-Nr.	DIN	BS	AFNOR	AIS/SAE
Free cutting steel	390-710			1.0722	10SPb20		10PbF2	
Free cutting steel	410-710			1.0715	9SMn28	230M07	S250	1213
Free cutting steel	410-710			1.0718	9SMnPb28		S250Pb	12L13
Free cutting steel	430-740			1.0736	9SMn36	240M07	S300	1215
Free cutting steel	430-740			1.0737	9SMnPb36		S300Pb	12L14
Heat treatable steel	500-650			1.0402	C22	050A20	CC20	1020
Heat treatable steel	500-650			1.1158	Ck25			1025
Free cutting steel	510-740			1.0726	35S20	212M36	35MF4	1140
Superficial hardening steel	540-730			1.1183	Cf35	060A35	XC38TS	1035
Heat treatable steel	550-750			1.0501	C35	060A35	CC35	1035
Case hardening steel	590-780			1.0401	C15	080M15	CC12	1015
Case hardening steel	590-780			1.1141	Ck15	080M15	XC12	1015
Heat treatable steel	630-800			1.0503	C45	080M46	CC45	1045
Heat treatable steel	630-800			1.1191	Ck45	080M46	XC42	1045
Superficial hardening steel	640-830			1.1213	Cf53	060A52	XC48TS	1050
Carbon tool steel	640-830			1.1545	C105W1		Y1105	W.110
Heat treatable steel	640-840			1.1170	28Mn6	160M28	20M5	1330
Heat treatable steel	640-880			1.1167	36Mn5		40M5	1335
Heat treatable steel	690-930			1.1157	40Mn4	150M36	35M5	1039
Carbon tool steel	650-750			1.1663	C125W		Y2120	W.112
Heat treatable steel	700-900			1.0535	C55	070M55	1055	
Heat treatable steel	700-900			1.1203	Ck55	070M55	XC55	1055
Heat treatable steel	750-900			1.0601	C60	080A62	CC55	1060
Heat treatable steel	750-950			1.1221	Ck60	080A62	XC60	1060
Spring steel	1000-1100			1.1274	Ck101	060A96		1095
High temp. constructional steel	440-570			1.5415	15Mo3	1501-240	15D3	ASTM A20Gr. A
High temp. constructional steel	440-590			1.7335	13CrMo4 4	1501-620Gr.27	15CD3.5	ASTM A182
High temp. constructional steel	440-590			1.7380	10CrMo9 10	1501-622	12CD9;10	ASTM A182
High temp. constructional steel	450-590			1.5423	16Mo5	1503-245-420		4520
Tough at sub zero	490-640			1.5622	14Ni6		16N6	ASTM A350LF 5
High temp. constructional steel	490-640			1.7715	14MoV6 3	1503-660-440		
Tough at sub zero	510-710			1.5680	12Ni19		Z18N5	2515
Case hardening steel	640-1080			1.7131	16MnCr5	(527M20)	16MC5	5115
Case hardening steel	640-1080			1.7262	15CrMo5		12CD4	
Cold work tool steel	640-670		O1					O1
Hot / cold tool steel	640-720		S7					S7
Tough at sub zero	640-840			1.5662	X8Ni9	1501-509;510		ASTM A353
Ball and roller bearing steel	650-750			1.3505	100Cr6	534A99	100C6	52100
Heat treatable steel	650-950			1.7218	25CrMo4	1717CDS 110	25CD4	4130
Case hardening steel	690-1080			1.6523	21NiCrMo2	805M20	20NCD2	8620
Case hardening steel	690-880			1.7015	15Cr3	523M15	12C3	5015
Heat treatable steel	690-930			1.5710	36NiCr6	640A35	35NC6	3135
Superficial hardening steel	700-750			1.7045	42Cr4			5140

Star Guide Key to Recommended Inserts

	Material Designations							
	P	Unalloyed Steels	M	Stainless Steels	K	Cast Irons	S	High Temp. Alloys
	P	Alloyed Steels	M	PH Stainless	N	Aluminium & Alloys	H	Hard Materials

Materials Cross Reference Chart

Material Group	Country/Standard							
	Rm (N/mm²)	Allvac Designation	Allegheny Ludlum Designation	GERMANY/ITALY		U.K.	FRANCE	USA
				W.-Nr.	DIN	BS	AFNOR	AIS/SAE
Heat treatable steel	700-950			1.7033	34Cr4	530A32	32C4	5132
Cold work tool steel	720-775		A6					A6
Superficial hardening steel	740-1080			1.7223	41CrMo4	708M40	42CD4TS	4140;4142
Heat treatable steel	750-1100			1.7220	34CrMo4	708A37	35CD4	4137;4135
Cold work tool steel	750-775		O7					O7
Cold work tool steel	750-800			1.2542	45WSCrV7	BS1		S1
Cold work tool steel	750-850			1.2067	100Cr6	BL3	Y100C6	L3
Cold work tool steel	750-850		A2	1.2363	X100CrMoV51	BA2	Z100CDV5	A2
Cold work tool steel	750-850			1.2419	105WCr6		105WC13	
Cold work tool steel	750-850			1.2833	100V1	BW2	Y1105V	W210
High speed steel	775-990		M2	1.3343	S 6-5-2	BM2	Z85WDCV 06-05-04-02	M2
High speed steel	775-990			1.3348	S 2-9-2		Z100WCWV 09-04-02-02	M7
Heat treatable steel	780-1080			1.3401	X120Mn12	Z120M12	Z120M12	
Superficial hardening steel	780-1180			1.8159	50CrV4	735A50	50CV4	6150
High speed steel	795-870		M3					M3
Cold work tool steel	795-910		A7					A7
High speed steel	800-1050			1.3355	S 18-0-1	BT1	Z80WCV 18-04-01	T1
Heat treatable steel	800-1100			1.6511	36CrNiMo4	816M40	40NCD3	9840
Heat treatable steel	800-1100			1.7035	41Cr4	530M40	42C4	5140
Heat treatable steel	800-1200			1.7225	42CrMo4	708M40	42CD4	4140
Cold work tool steel	800-850			1.2713	55NiCrMoV6		55NCDV7	L6
High speed steel	820-1050			1.3243	S 6-5-2-5		Z85WDKCV 06-05-05-04-02	
High speed steel	820-1050			1.3255	S 18-1-2-5	BT4	Z80WKCV 18-05-04-01	T4
Case hardening steel	830-1180			1.5732	14NiCr10		14NC11	3415
Cold work tool steel	850-900		D2	1.2379	X155CrVMo12-1	BD2	Z160CDV12	D2
Cold work tool steel	850-900			1.2080	X210Cr12	BD3	Z200Cr12	D3
Cold work tool steel	850-900			1.2436	X210CrW12			
Cold work tool steel	850-900			1.2601	X165CrMoV12			
Case hardening steel	880-1230			1.5752	14NiCr14	655M13	12NC15	3415
Heat treatable steel	900-1200	Nickelvac 4340		1.6582	34CrNiMo6	817M40	35NCD6	4340
Nitriding steel	950-1000			1.8509	41CrAlMo7	905M39	40CAD6, 12	
Spring steel	950-1050			1.0904	55Si7	250A53	55S7	9255
Case hardening steel	980-1320			1.6587	17CrNiMo6	820A16	18NCD6	
Heat treatable steel	980-1420			1.7361	32CrMo12	722M24	30CD12	
Spring steel	1050-1100			1.7176	55Cr3	527A60	55C3	5155
Spring steel	1050-1100			1.0961	60SiCr7		60SC7	9262
Nitriding steel	1080-1270			1.2606	39CrMoV13 9	BH12		H12
Hot work tool steel	1180-1570			1.2343		BH11		H11
Hot work tool steel	1180-1670			1.2365		BH10		H10
Hot work tool steel	1180-1770		H13	1.2344	X40CrMoV51	BH13	Z40CDV5	H13
Hot work tool steel	1180-1770			1.2581	X30WCrV9 3	BH21	Z30WCV9	H21
Hot work tool steel	1270-1670			1.2678		BH19		H19

Star Guide Key to Recommended Inserts

Material Designations							
P	Unalloyed Steels	M	Stainless Steels	K	Cast Irons	S	High Temp. Alloys
P	Alloyed Steels	M	PH Stainless	N	Aluminium & Alloys	H	Hard Materials

Materials Cross Reference Chart

Material Group	Country/Standard							
	Rm (N/mm²)	Allvac Designation	Allegheny Ludlum Designation	GERMANY/ITALY		U.K.	FRANCE	USA
				W.-Nr.	DIN		AFNOR	AMS
Stainless steel	400-600	Nickelvac 410 / 403	AL 403	1.4000	X6Cr13	403S17	Z6C13	403
Heat resistant steel casting	400-600			1.4865	G-X40NiCrSi38 18	330C11		
Stainless steel casting	440-640			1.4308	G-X6CrNi18 9	304C15	Z6CN18.10M	
Stainless steel casting	440-640			1.4408	G-X6CrNiMo18 10	316C16		
Stainless steel casting	440-640			1.4581	G-X7CrNiMoNb18 10	318C17	Z4CNNDNb18 12M	
Heat resistant steel	450-650		AL 405	1.4724	X10CrAl13	403S17	Z10C13	405
Stainless steel	450-650	Nickelvac 410 / 403	AL 410	1.4006	X10Cr13	410S21	Z10C14	410
Stainless steel	450-650		AL 430	1.4016	X6Cr17	430S15	Z8C17	430
Stainless steel	450-650		AL 434	1.4113	X6CrMo17	434S17	Z8CD17.01	434
Stainless steel	460-680		AL 304L	1.4306	X2CrNi19 11	304S12	Z3CN18.10	304L
Stainless steel	490-690		AL 305	1.4303	X5CrNi18 12			305
Stainless steel	490-690	Allvac 316 L	AL 316L	1.4435	X2CrNiMo18 12	316S12	Z2CND17.13	316L
Stainless steel	490-690		AL 317L	1.4438	X2CrNiMo18 16	317S12	Z2CND19.15	317L
Stainless steel	490-740			1.4583	X10CrNiMoNb18 12		Z6CNDNb17 13B	318
Stainless steel	500-550		E-Brite Alloy					ASTM A240
Stainless steel	500-700		AL 303	1.4305	X10CrNiS18 9	303S21	Z10CNF 18.09	303
Stainless steel	500-700		AL 304	1.4301	X5CrNi18 10	304S15	Z6CN18.09	304
Stainless steel	500-730		AL 321	1.4541	X6CrNiTi18 10	2337	Z6CNT18.10	321
Stainless steel	500-730			1.4571	X6CrNiMoTi17 12 2	320S17	Z6NDT17.12	316Ti
Heat resistant steel	500-750		AL 309	1.4828	X15CrNiSi20 12	309S24	Z15CNS20.12	309
Heat resistant steel	500-750		AL 310S	1.4845	X12CrNi25 21	310S24	Z12CN25 20	310S
Stainless steel	500-750		AL 904L	1.4539				ASTM B625
Heat resistant steel	500-750			1.4878	X12CrNiTi18 9	321S320	Z6CNT18.12B	
Stainless steel	510-710		AL 316	1.4401	X5CrNiMo18 10	316S16	Z6CND17.11	316
Stainless steel	510-740		AL 347	1.4550	X6CrNiNb18 10	347S17	Z6CNNb18.10	347
Heat resistant steel	520-720			1.4762	X10CrAl 24		Z10CAS24	446
Stainless steel	550-760			1.4311	X2CrNiN18 10	304S62	Z2CN18.10	304LN
Heat resistant steel	550-800			1.4841	X15CrNiSi25 20			310
Heat resistant steel	550-800			1.4864	X12NiCrSi36 16		Z12NCS35.16	330
Stainless steel	580-800		AL 316LXN	1.4429	X2CrNiMoN17 13 3		Z2CND17.13	316LN
Stainless steel	590-780		AL 416	1.4005	X12CrS13			416
Stainless steel	640-840			1.4104	X12CrMoS17		Z10CF17	430F
Stainless steel	640-900			1.4460	X8CrNiMo27 5			329
Stainless steel	700-800			1.4034	X45Cr13	420S45	Z40CM Z38C13M	
Stainless steel	700-950		AL 301	1.4310	X12CrNi17 7		Z12CN17.07	301
Stainless steel	750-800			1.4027	G-X20Cr14	420C29	Z20C13M	
Stainless steel	750-950		AL 420	1.4021	X20Cr13			420
Stainless steel casting	760-960			1.4313	X5CrNi13 4	425C11	Z4CND13.4M	
Stainless steel	800-900		AL 2205					ASTM A240
Stainless steel	850-950			1.4057	X20CrNi172	431S29	Z15CNi6.02	431
Stainless steel	1100-1200		AM 350					ASTM A693
Precipitation hardening stainless			AL 13-8					13-8 PH
Precipitation hardening stainless		Nickelvac 15-5 PH	AL 15-5	1.4540	X4CrNiCuNb164		Z6CNU15.05	15-5 PH
Precipitation hardening stainless			AL 15-7	1.4532	X7CrNiMoAl157		Z8CNDA15.07	15-7 PH
Precipitation hardening stainless		Nickelvac 17-4 PH	AL 17-4	1.4542	X5CrNiCuNb174		Z6CNU17.04	17-4 PH
Precipitation hardening stainless			AL 17-7	1.4568	X7CrNiAl177		Z8CNA17.07	17-7 PH

Star Guide Key to Recommended Inserts

	Material Designations							
	P	Unalloyed Steels	M	Stainless Steels	K	Cast Irons	S	High Temp. Alloys
	P	Alloyed Steels	M	PH Stainless	N	Aluminium & Alloys	H	Hard Materials

Materials Cross Reference Chart

Cr	Ni	C	Mn	Si	P	S	Mo	Cu	Ti	Others
12.0		0.15	0.5	0.50	0.02	0.01				
18.8	38.0	0.4	1.0	1.75	0.045	0.03				W 4.75
19.0	10.0	0.07	1.5	2.0	0.045	0.03				
19.0	11.0	0.07	1.5	1.5	0.045	0.03	2.5			
19.0	11.5	0.06	1.5	1.5	0.045	0.03	2.25			
12.0		0.08	1.0	0.50	0.04	0.03				Al 0.10-0.30
12.0		0.15	0.5	0.50	0.02	0.01	0.5	0.5		
16.0		0.08	1.0	1.0	0.04	0.03				
17.0		0.08					0.75			
19.0	10.0	0.015	1.0	0.5	0.023	0.015				
18.0	11.5	0.12	2.0	1.0	0.04	0.03				
17.0	12.0	0.015	1.0	0.5	0.023	0.015	2.5			
19.0	13.0	0.015	1.0	1.0	0.023	0.015	3.5			
18.0	14.0	0.08	2.0				2.0			
26		0.003					1			
19.5	10.5	0.16	1.5	2.0	0.04	0.3	0.6			
19.5	9.0	0.08	1.5	2.0	0.04	0.04				
18.0	9.5	0.08	2.0	1.0	0.04	0.03			0.40	
17.5	12.0	0.08	2.0	1.0	0.045	0.03	2.25		5.0	
23.5	14.0	0.20	1.5	2.0	0.04	0.04				
25.0	20.5	0.15	2.0	0.75	0.045	0.03				
20.5							4.5	1.5		
18.0	10.5	0.12	2.0	1.0	0.045	0.03			0.40	Al 0.40
17.0	13.0	0.08	2.0	0.75	0.04	0.03	1.5	0.50		
18.0	11.0	0.08	2.0	1.0	0.045	0.03				
25.0		0.12	1.0	1.0	0.04	0.03				Al 1.50
18.0	10.0	0.03	2.0	1.0	0.045	0.03				N 0.16
24.5	20.5	0.18	2.0	1.5	0.04	0.03	0.5	0.5		
15.0	35.0	0.15	1.0	2.5	0.04	0.04				
17.5	13.0	0.03	2.0	1.0	0.045	0.025	2.75			N 0.16
13.0		0.15	1.25	1.0	0.07	0.07	0.60			
17.0		0.12	1.25	1.0	0.06	0.15	0.5			
25.5	3.5	0.1			0.04	0.03	1.0			
13.5		0.5	1.0	1.0	0.045	0.03				
17.0	7.0	0.14	2.0	1.0	0.045	0.03				
13.5	1.0	0.2	1.0	1.0	0.045	0.03				
12.5		0.20	1.0	1.0	0.04	0.04				
13.0	4.5	0.07	1.5	1.0	0.035	0.025	0.7			
22	5.5						3			N 0.16
16.0	2.0	0.20	1.0	1.0	0.04	0.03				
16.5	4.3	0.08					2.8			
13	8						2.2			Al 1.2
14.8	4.5	0.03	0.5	0.5	0.02	0.015		3.5		Cb 0.3
15.0	7.0	0.045	0.5	0.5	0.02	0.015	2.5			Al 1.15
16.3	4.0	0.035	0.5	0.5	0.02	0.015		4.0		Cb 0.3
17.0	7.0	0.045	0.5	0.5	0.02	0.02				Al 1.15

Star Guide Key to Recommended Inserts

	Material Designations							
P	Unalloyed Steels	M	Stainless Steels	K	Cast Irons	S	High Temp. Alloys
P	Alloyed Steels	M	PH Stainless	N	Aluminium & Alloys	H	Hard Materials

Materials Cross Reference Chart

Material Group	Country/Standard							
	HBN	Allvac Designation	Allegheny Ludlum Designation	GERMANY/ITALY		U.K.	FRANCE	USA
				W.-Nr.	DIN	BS	AFNOR	ASTM/SAE
Grey cast iron	175			0.6010	GG 10	Grade 100	Ft 10 D	No 20 B
Grey cast iron	185			0.6015	GG 15	Grade 150	Ft 15 D	No 25 B
Grey cast iron	205			0.6020	GG 20	Grade 220	Ft 20 D	No 30 B
Grey cast iron	220			0.6025	GG 25	Grade 260	Ft 25 D	No 35 B
Grey cast iron	230			0.6030	GG 30	Grade 300	R 30 D	No 45 B
Grey cast iron	235			0.6035	GG 35	Grade 350	Ft 35 D	No 50 B
Grey cast iron	250			0.6040	GG 40	Grade 400	Ft 40 D	No 55 B
Spheroidal / nodular/ ductile cast iron	150-180				GGG 35.3	350/22	FGS 350-22	60-40-18
Spheroidal / nodular/ ductile cast iron	155-220			0717-02	GGG 40	420/12		65-45-12
Spheroidal / nodular/ ductile cast iron	190-255			0727-02	GGG 50	500/7	FGS 500-7	80-55-06
Spheroidal / nodular/ ductile cast iron	200-260			0732-03	GGG 60	600/3	FGS 600-3	80-60-03
Spheroidal / nodular/ ductile cast iron	240-300			0737-01	GGG 70	700/2	FGS 700-2	100-70-03
Spheroidal / nodular/ ductile cast iron	265-300				GGG 80	900/2	FGS 900-2	120-90-02
Malleable cast iron	150				GTS-35-10	B 340/12	MN 35-1	32510
Malleable cast iron	175			0.8145	GTS-45-06	P 440/7		40010
Malleable cast iron	205			0.8155	GTS-55-04	P 510/4	MP 50-5	50005
Malleable cast iron	230			0.8165	GTS-65-02	P 570/3	Mn 650-3	A220-70003
Malleable cast iron	265			0.8170	GTS-70-02	P 690/2	Mn 700-2	A220-80002
Aluminium alloys				3.0255	Al99,9	1B	A5	1050
Aluminium alloys				3.0515	AlMn	N3		
Aluminium alloys				3.0615	AlMgSiPb			
Aluminium alloys				3.1325	AlCuMg1		A-U4G	2017
Aluminium alloys				3.1355	AlCuMg2	L97	A-U4G1	2024
Aluminium alloys				3.1645	AlCuMgPb			
Aluminium alloys				3.1655	AlCuBiPb	FC1	A-U5PbBi	2011
Aluminium alloys				3.2245	AlSi5			
Aluminium alloys				3.2305	AlRMgSi			
Aluminium alloys				3.2315	AlMgSi1	H30		6351
Aluminium alloys				3.3206	AlMgSi0,5	H9		6063
Aluminium alloys				3.3309	AlRMg0,5			
Aluminium alloys				3.3315	AlMg1	N41	A-G0,6	5005
Aluminium alloys				3.3316	AlMg1,5	3L44	A-G1,5	5050
Aluminium alloys				3.3319	AlRMg1			
Aluminium alloys				3.3523	AlMg2,5	2L56	A-G2,5C	5052
Aluminium alloys				3.3535	AlMg3	N5	A-G3M	5754
Aluminium alloys				3.3545	AlMg4Mn		A-G4MC	5086
Aluminium alloys				3.3547	AlSiMg4,5Mn	N8	A-G4,5MC	5083
Aluminium alloys				3.3549	AlMg5	N6		5056
Aluminium alloys				3.4365	AlZnMgCu1,5	DTD5074	A-Z5GU	7075
Aluminium alloys					AlZnMg1			7005
Aluminium alloys					AlMg2,5Mn	N51	A-G2,5MC	5454
Aluminium alloys					AlSi3,5			

Star Guide Key to Recommended Inserts

	Material Designations							
	P	Unalloyed Steels	M	Stainless Steels	K	Cast Irons	S	High Temp. Alloys
	P	Alloyed Steels	M	PH Stainless	N	Aluminium & Alloys	H	Hard Materials

Si	Fe	Cu	Mn	Mg	Cr	Zn	Ti			
0.25	0.4	0.05	0.05	0.05		0.07	0.05			
0.5	0.7	0.1	1.2	0.3	0.1	0.2	0.1			
1.0	0.5	0.1	0.7	0.9	0.3	0.3	0.2			
0.5	0.7	4.0	0.7	0.7	0.1	0.25				
0.5	0.5	4.3	0.6	1.5	0.1	0.25	0.15			
0.8	0.8	4.0	0.75	1.1	0.1	0.8	0.2			
0.4	0.7	5.5				0.3				
5.0	0.4	0.05	0.1	0.1		0.2	0.25			
0.55	0.15	0.02		0.45		0.15				
1.0	0.5	0.1	0.6	0.9	0.25	0.2	0.1			
0.45	0.15	0.1	0.1	0.45	0.05	0.15	0.1			
0.01	0.008			0.35		0.01	0.008			
0.3	0.45	0.05	0.15	0.9	0.1	0.2				
0.4	0.45	0.05	0.15	1.5	0.1	0.2				
0.1	0.008			1.00		0.01	0.008			
0.25	0.4	0.1	0.1	2.5	0.2	0.1				
0.4	0.4	0.1	0.5	3.1	0.3	0.2	0.15			
0.4	0.5	0.1	0.45	4.0	0.15	0.25	0.15			
0.4	0.4	0.1	0.7	4.5	0.15	0.25	0.15			
0.2	0.35	0.15	0.35	4.5	0.1	0.25	0.1			
0.4	0.5	1.6	0.3	2.5	0.23	5.5	0.2			
0.35	0.4	0.1	0.45	1.4	0.13	4.5	0.03			
0.4	0.4	0.05	0.75	2.7	0.1	0.1	0.15			
4.5				0.04						

Star Guide Key to Recommended Inserts

	Material Designations							
	P	Unalloyed Steels	M	Stainless Steels	K	Cast Irons	S	High Temp. Alloys
	P	Alloyed Steels	M	PH Stainless	N	Aluminium & Alloys	H	Hard Materials

Materials Cross Reference Chart

Material Group	Country/Standard							
	Commercial Designation	Allvac Designation	Allegheny Ludlum Designation	GERMANY/ITALY		U.K.	FRANCE	USA
				W.-Nr.	DIN		AFNOR	AMS
Iron based alloys	VascoMax C-250	VascoMax C-250						6501, 6512, 6520
Iron based alloys	VascoMax C-350	VascoMax C-350						
Iron based alloys	VascoMax C-200	VascoMax C-200						
Iron based alloys	VascoMax C-300	VascoMax C-300						6514
Iron based alloys	VascoMax T-200	VascoMax T-200						
Iron based alloys	VascoMax T-250	VascoMax T-250						6518, 6519, 6591
Iron based alloys	Greek Ascoloy		AL 418					5508
Iron based alloys	Jethete M-152						Z12 CND 12	5718, 5719
Iron based alloys	Haynes 556				X12CrCoNi2120			5768
Iron based alloys	N 155						Z12 CNKDW 20	5768
Iron based alloys	S 590				X40CoCrNi2020		Z42 CKNDW	5533
Iron based alloys	Crucible A286		ALTEMP A 286	1.4980		HR 5152	Z06 NCT 25	ASTM 368
Iron based alloys	Discaloy 16/25/6						Z3 NCT 25	5725
Iron based alloys	AL-6XN Alloy		AL-6XN Alloy					ASTM SB688
Iron based alloys	Discaloy 24						Z3 NCT 25	ASTM A638
Iron based alloys	Armco 18							
Iron based alloys	Incoloy 801				G-X50CrNi3030			5552
Iron based alloys	Incoloy 800	Nickelvac 800	AL 800		X10NiCrAlTi3220	3082-76	25 NC 3520	ASME SB 409
Iron based alloys	Incoloy 802							
Iron based alloys	N 156							
Iron based alloys	20CB-3		AL 20					ASTM B463
Iron based alloys	Sanicro 30				X2NiCrAlTi3220			
Iron based alloys	Incoloy 803							
Iron based alloys	Allvac 330	Allvac 330						5592, 5716
Iron based alloys	AL 36		AL 36					ASTM F1684
Iron based alloys	Incoloy DS				X12NiCrSi3616	3072-76		
Iron based alloys	AL 42		AL 42					ASTM F30
Iron based alloys	Armco 20-45-5							
Iron based alloys	AL 4750		AL 4750					ASTM B753
Iron based alloys	ALLOY 21-6-9		ALLOY 21-6-9					ASTM A666
Iron based alloys	Vasco 13-8 Mo	Vasco 13-8 Mo						5629

Material Group	Country/Standard							
	Commercial Designation	Allvac Designation	Allegheny Ludlum Designation	GERMANY/ITALY		U.K.	FRANCE	USA
				W.-Nr.	DIN		AFNOR	AMS
Cobalt based alloys	MP35N	Allvac 35N						
Cobalt based alloys	L 605	Nickelvac L-605			CoCr20W15Ni		KC 20 WN	5759
Cobalt based alloys	Nickelvac TJA- 1537	Nickelvac TJA- 1537						ASTM F1537
Cobalt based alloys	Altemp S 816				CoCr20Ni20W			5534
Cobalt based alloys	HS 21				CoCr28Mo	3531		ASTM F-75
Cobalt based alloys	HS 25				CoCr20W15Ni		KC 20 WN	AISI 670
Cobalt based alloys	HS 30				CoCr26Ni14Mo			
Cobalt based alloys	HS 31				CoCr25NiW	3146	KC 25 NW	ASTM A567
Cobalt based alloys	HS 36				CoCr19W14NiB			
Cobalt based alloys	Jetalloy 209							
Cobalt based alloys	L 251							
Cobalt based alloys	M 203							

Star Guide Key to Recommended Inserts

	Material Designations							
	P	Unalloyed Steels	M	Stainless Steels	K	Cast Irons	S	High Temp. Alloys
	P	Alloyed Steels	M	PH Stainless	N	Aluminium & Alloys	H	Hard Materials

Materials Cross Reference Chart

Ni	Co	Cr	Mo	W	Si	Mn	C	Al	Ti	P	S	Others
18.5	7.8		4.8		0.05	0.05	0.02	0.1	0.4	0.005	0.005	
18.5	12.0		4.8		0.05	0.05	0.02	0.1	1.4	0.005	0.005	
18.5	8.5		3.25		0.05	0.05	0.01		0.2	0.005	0.005	
18.5	8.8		4.8		0.05	0.05	0.02	0.1	0.73	0.005	0.005	
18.5			3.0		0.05	0.05	0.01		0.7	0.005	0.005	
18.5			3.0		0.03	0.05	0.02	0.1	1.4	0.005	0.005	
2		12		2.5			0.19					
2.5		12	1.7				0.15					V0.3
20	20	21	3	2.5			0.1					Nb + Ta
20	20	21	3	2.5	0.5	1.5	0.15					Nb 1.0
20	20	21	4	4			0.43					
25		14	1.3		0.5	1.3	0.05	0.2	2.1			
25		16	6		0.7	1.35	0.12		0.3			Nb 0.4
25		20.5	6.5				0.02					N 0.2
26		13.5	2.7		0.8	0.9	0.04	0.1	1.7			
3.7		17.2			0.47	12.5	0.06					
32		20.5			0.5	0.8	0.05		1.1			
32.5		21.0			0.5	0.75	0.05	0.37	0.37		0.007	Cu 0.37
32.5		21.5			0.4	0.8	0.4					
33	24	17	3	2			0.33					
33		20	2.2									Cu 3.3
34		22			0.55	0.55	0.03	0.3	0.5			Cu 0.1
35		25					0.08	0.15	0.15			
35.5		18.5			1.13	1.0	0.04			0.01	0.01	Cu 0.5
36												
37		18			2.3	1.0	0.06					
41												
46		20	2.3		1.0	5	0.08					Nb 0.4
49												
6.5		21				6.0						No 0.3
8.0		12.8	2.3		0.05	0.10	0.03	1.05		0.005	0.004	

Ni	Fe	Cr	Mo	W	Si	Mn	C	Al	Ti	P	S	Others
35		20	9.8				0.013					
10	0.5	20		15		1.7	0.1					
0.2	0.25	28	6		0.5	0.5	0.06					N 0.2
20	4	20	4	4	0.4	1.2			0.38			
3	1	27	5		0.6	0.6			0.25			
10	3	20		15	2	1.5			0.1			
16	1	24	6		0.6	0.6			0.4			
10	1.5	25		8	0.75	0.6			0.4			
10	2	18		15		1.5			0.4			
10	1	20		15				2.0	0.02			
10	1	19		14					0.4			
24.5	1	19.5		12	1	0.8	2.15	24.5	0.07			

Star Guide Key to Recommended Inserts

	Material Designations							
	P	Unalloyed Steels	M	Stainless Steels	K	Cast Irons	S	High Temp. Alloys
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Materials Cross Reference Chart

Material Group	Country/Standard							
	Commercial Designation	Allvac Designation	Allegheny Ludlum Designation	GERMANY/ITALY		U.K.	FRANCE	USA
				W.-Nr.	DIN		AFNOR	AMS
Cobalt based alloys	M 204							
Cobalt based alloys	M 205							
Cobalt based alloys	MAR-M 302				CoCrW10TaZrB			
Cobalt based alloys	MAR-M 322				CoCr22W9TaZrNb			
Cobalt based alloys	MAR-M 509				CoCr24Ni10WtaZrB	3146-3		
Cobalt based alloys	MAR-M 905							
Cobalt based alloys	MAR-M 918				CoCr20Ni20Ta			
Cobalt based alloys	Stellite 1						KC 33 W13	
Cobalt based alloys	Stellite 6						KC 26 NW	
Cobalt based alloys	Stellite 12						KC 28 W8	
Cobalt based alloys	V-36				CoCr25Ni20M0WNb			
Cobalt based alloys	WI-52				CoCr21Mo11W			
Cobalt based alloys	X 40				CoCr25NiW	3146-2		ASTM A567
Cobalt based alloys	X 45							
Cobalt based alloys	X 50							

Material Group	Country/Standard							
	Commercial Designation	Allvac Designation	Allegheny Ludlum Designation	GERMANY/ITALY		U.K.	FRANCE	USA
				W.-Nr.	DIN		AFNOR	AMS
Nickel based alloys	AL 22		AL 22					ASME SB575
Nickel based alloys	Allcor	Allvac Allcorr						
Nickel based alloys	Astroloy	Allvac Astroloy						
Nickel based alloys	Duranickel 310							
Nickel based alloys	GMR 235							AISI:686
Nickel based alloys	GMR 235-D				NiCr16MoAl			
Nickel based alloys	Hastelloy B	Nickelvac H-B			S-NiMo30		ND27FeV	5396A
Nickel based alloys	Hastelloy B-2	Nickelvac H-B-2						
Nickel based alloys	Hastelloy C				NiCr17Mo17FeW		NC17DWY	5388C
Nickel based alloys	Hastelloy D							
Nickel based alloys	Hastelloy N	Nickelvac H-N						
Nickel based alloys	Hastelloy R235							
Nickel based alloys	Hastelloy W	Nickelvac H-W						
Nickel based alloys	Hastelloy X	Nickelvac H-X	ALTEMP HX	2.4665	NiCr22FeMo	HR6,204	NC22FeD	5536
Nickel based alloys	Haynes 75							
Nickel based alloys	HS 27				NiCo32Cr26Mo		KC20WN	
Nickel based alloys	IN 100				NiCo15Cr10MoAlTi		NK15CAT	5397
Nickel based alloys	IN 713							
Nickel based alloys	Incoloy 020			2.4660				ASME SB463
Nickel based alloys	Incoloy 804							
Nickel based alloys	Incoloy 825	Nickelvac 825	AL 825	2.4858	NiCr21Mo	3072-76	NC21FeDU	ASME SB424
Nickel based alloys	Incoloy 901				NiFe35Cr14MoTi		Z8NCDT42	5660
Nickel based alloys	Incoloy 903							
Nickel based alloys	Incoloy 925							
Nickel based alloys	Inconel 600	Nickelvac 600	AL 600	2.4816	NiCr15Fe	3072-76	NC15Fe	5540
Nickel based alloys	Inconel 601	Nickelvac 601	AL 601	2.4851				5715
Nickel based alloys	Inconel 617	Nickelvac 617		2.4663				
Nickel based alloys	Inconel 622			2.4602				
Nickel based alloys	Inconel 625	Nickelvac 625	ALTEMP 625	2.4856	NiCr22Mo9Nb		NC22FeDNB	ASME SB443

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Materials Cross Reference Chart

Ni	Fe	Cr	Mo	W	Si	Mn	C	Al	Ti	P	S	Others
24.5		18.5		12	1	1			0.07			
24.5		18.5		12			2.75		0.07			
		21.5		10					0.85			Ta9.0
		21.5		9	0.1	0.1		0.75	1.0			Ta4.5, Zr2.25
10	1	23.5		7	0.1	0.1		0.2	0.6			Ta3.5, Zr0.5
20		20						0.5	0.05			Ta7.5, Zr0.1
20	0.4	20			0.1	0.1			0.05			Ta7.5, Zr0.1
		33		13			2.5					
		26		5			1.0					Nb 6.0
		29		9			1.8					
20	3	25	4	2	0.4	1			0.26			Nb 2.0
1	2	21		11	0.25				0.45			Nb 2.0
10.5	1.5	25.5		7.5	0.75	0.75			0.5			
10.5	2	25.5		7		0.7			0.25			B 0.01
20.5	4	22.5		12					0.75			

Fe	Co	Cr	Mo	W	Si	Mn	C	Al	Ti	P	S	Others
2.5		20.6	13.9	2.65								
		31.0	10.0	2.0			0.02	0.25	0.25			Nb 0.4
	17.0	15.0	5.0				0.04	4.0	3.5			B 0.025
0.6			0.5		1.0	0.5		4.4	0.6			
10.0		15.5	5.2		0.4	0.2	0.15	3.0	2.0			
4.5		15.5	5.0				0.15	3.5	2.5			B0.05
5.0	2.0	1.5	28.0		0.05	0.5	0.02					V 0.4
1.0	0.5	0.5	16.0		0.05	0.5	0.01			0.02	0.015	
6.0	2.0	15.0	17.0	5			0.04					
2.0		1.0			9.0	1.0	0.1					Cu 3.0
4.0		7.0	16.5				0.02					
10.0	2.5	15.5	5.5				0.15	2	2.5			
4.0		5.0	24.5				0.02					
18	1.5	22	9.0	0.6			0.1					
5.0		20.0					0.12	0.25	0.4			Cu 0.5
2.0	31.5	26.0	6.0				0.4					
	15.0	10.0	3.0				0.18	5.5	4.7			V 1.0
2.5		13.0	4.6		0.4	0.2	0.18	6.0	0.8			Nb 2.6
37		20	2.5									Nb 0.6 Cu 3.5
25.4		29.5			0.5	0.75	0.06	0.25	0.6			Cu 0.4
30		21.5		3.0	0.5	0.65	0.03	0.2	0.9			Cu 2.25
35.3		13.45	6.20		0.22	0.48	0.05		2.5			
42.0	15.0							0.7	1.4			Nb3.0
28		21	3					0.3	2.1			Cu 1.8
8.0		15.5					0.075					
14.0		23.0			0.2	0.5	0.05	1.3			0.008	Cu 0.5
	12.5	22	9.0				0.07	1.0				
2.3		20.5	14.2	3.2								
2.5		21.5	9.0				0.05	0.3	0.3			Cb 3.7

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	P	Alloyed Steels	M	PH Stainless	N	Aluminium & Alloys	H	Hard Materials

Materials Cross Reference Chart

Material Group	Country/Standard							
	Commercial Designation	Allvac Designation	Allegheny Ludlum Designation	GERMANY/ITALY		U.K.	FRANCE	USA
				W.-Nr.	DIN		AFNOR	AMS
Nickel based alloys	Inconel 690	Nickelvac 690		2.4642				
Nickel based alloys	Inconel 700				NiCo28Cr15MoAlTi		NK27CADT	
Nickel based alloys	Inconel 702							5550
Nickel based alloys	Inconel 706	Allvac 706						57-2
Nickel based alloys	Inconel 713				G-NiCr13Al16MoNb	3146.3	NC13AD	5391
Nickel based alloys	Inconel 718	Allvac 718	ALTEMP 718	2.4668	NiCr19Fe19NbMo	HR8	NC19FeNb	5383
Nickel based alloys	Inconel 718-OP	Allvac 718-OP						
Nickel based alloys	Inconel 720	Allvac 720						
Nickel based alloys	Inconel 721							
Nickel based alloys	Inconel 722	Nickelvac W-722			NiCr16FeTi		NC16Feti	5541
Nickel based alloys	Inconel 725							
Nickel based alloys	Inconel 751	Nickelvac X-751		2.4694				
Nickel based alloys	Inconel X-750	Nickelvac X-750	ALTEMP 750	2.4669	NiCr16FetTi		NC15FeTNb	5542
Nickel based alloys	Jessop G 81				NiCr20Co18Ti			
Nickel based alloys	Jethete M-252	Allvac M-252			G-NiCr19Co			5551
Nickel based alloys	MAR-M 200				NiW13Co10Cr9AlTi		NKW10CATaHf	
Nickel based alloys	MAR-M 246				NiCo10W10Cr9AlTi			
Nickel based alloys	MAR-M 421				NiCr16Co10WalTi			
Nickel based alloys	MAR-M 432				NiCo20Cr16WAlTi			
Nickel based alloys	Monel 400	Nickelvac 400	AL 400	2.4360	NiCu30Fe	3072-76	NU30	4544
Nickel based alloys	Monel K 500	Nickelvac K-500		2.4375	NiCu30Al	3072-76		4676
Nickel based alloys	Monel R 405							4674
Nickel based alloys	Nimocast 713				G-NiCr13A16MoNb	HC203	NC13AD	5391A
Nickel based alloys	Nimocast PD 16				NiFe33Cr17Mo			
Nickel based alloys	Nimocast PE 10					HC202	NC20N13	
Nickel based alloys	Nimonic 105			2.4634	NiCo20Cr15MoAlTi	HR3	NCKD20ATV	
Nickel based alloys	Nimonic 115			2.4636	NiCo15Cr15MoAlTi	HR401, 601	NCVK15ATD	
Nickel based alloys	Nimonic 75			2.4630	NiCr20Ti	HR5, 203-4	NC20T	
Nickel based alloys	Nimonic 80A	Nickelvac 80 A		2.4631	NiCr20TiAl	HR401, 601	NC20TA	
Nickel based alloys	Nimonic 86							
Nickel based alloys	Nimonic 90	Nickelvac N-90		2.4632	NiCr20Co18Ti	HR2,202	NCK20TA	
Nickel based alloys	Nimonic 901	Nickelvac 901		2.4662	NiCr15MoTi		Z8NCDT42	5660, 5661
Nickel based alloys	Nimonic 95							
Nickel based alloys	Nimonic C-22	Nickelvac C-22						
Nickel based alloys	Nimonic C-263	Nickelvac C-263	ALTEMP 263	2.4650	NiCr20CoMoTi	HR10	NCK20D	
Nickel based alloys	Nimonic C-276	Nickelvac C-276	AL 276	2.4819				ASME SB575
Nickel based alloys	Nimonic PE 13				NiCr22Fe18Mo	HR6,204	NC22FeD	5536E
Nickel based alloys	Nimonic PE 16				NiFe33Cr17Mo	HR207	NW11AC	
Nickel based alloys	Nimonic PK 25						NKCD20ATU	5751A
Nickel based alloys	Nimonic PK 31							
Nickel based alloys	Nimonic PK 33				NiCr20Co16MoTi	5057	NC19KDU/V	
Nickel based alloys	R-235							
Nickel based alloys	Refractaloy 26						Z6NKCDT38	AISI:690
Nickel based alloys	René 100				NiCo15Cr10MoAlTi			
Nickel based alloys	René 125							
Nickel based alloys	René 41	Rene 41			NiCr19Co11MoTi	NC19KDT		5712, 5713
Nickel based alloys	René 63							

Star Guide Key to Recommended Inserts

	Material Designations							
	P	Unalloyed Steels	M	Stainless Steels	K	Cast Irons	S	High Temp. Alloys
	P	Alloyed Steels	M	PH Stainless	N	Aluminium & Alloys	H	Hard Materials

Fe	Co	Cr	Mo	W	Si	Mn	C	Al	Ti	P	S	Others
9.0		29.0			0.2	0.2	0.25				0.007	Cu 0.2
0.7	28.5	15	3.7		0.3	0.1	0.12	3.0	2.2			
0.4		15.6			0.2	0.05	0.04	3.4	0.7			
		16.0					0.03		1.8			Cb 2.9
		12	4.5				0.13	6	0.6			
17.2		19.0	3.1				0.02	0.5	0.9			Cb 5.2
17.2		19.0	3.1				0.02	0.5	0.9			Cb 5.2
	14.7	18	3	1.25				2.5	5			
8.0		16			0.15	2.25	0.07	0.1	3.0			Cu0.2
7.0		15.5					0.04	0.7	2.4			
7.5		21	8					0.3	1.5			Nb 3.5
7.0		15.5			0.2	0.5	0.05	1.2	2.3		0.005	Cb 1.1, Cu 0.2
7.0		15.5					0.04	0.7	2.5			Cb 0.95
0.5	16.9	20.6			0.2	0.5	0.08	1.5	2.5			
2.5	10.0	19.0	9.75				0.15	1.0	2.5			B 0.007
	10.0	9.0		12.5			0.15	5.0	2.0			Nb1.0
	10.0	9.0	2.5	10.0			0.15	5.5	1.5			Ta1.5
	10.0	15.5	1.7	3.5			0.15	4.25	1.75			Nb1.75
	20.0	15.5		3			0.15	2.5	4.3			Nb2.0
1.2					0.25		0.15				0.01	
1.0					0.25	0.7	0.1	2.7	0.6		0.01	
1.25					0.25	1.0	0.15					Cu31.5
		13.5	4.5				0.12	6.0	0.9			
34.0		16.5	3.3				0.06	1.2	1.2			
3.0		20.0	6.0	2.5			0.03					
0.5	20	14.75	5		0.5	0.5	0.1	4.7	1.2			Cu
	13.2	14.2	4				0.16	5	4			Zr
4		20			0.45	0.45	0.45	0.1	0.35			Cu+S
0.55		19.5			0.2	0.55	0.08	1.4	2.4			Cu+S
		25	10									Ce 0.03
0.3	18.0	19.5					0.065	1.4	2.4			
35.0		12.5	6.0				0.05		2.8			B 0.015
5.0	18.0	19.5			1.0	1.0	0.1	2.0	3.5			
4.0	1.2	21.2	13.5	3.0	0.04	0.2	0.07			0.01		V 0.17
	20.0	20.0	5.85				0.06	0.45	2.15			
5.0	0.5	15.5	16.0	3.5			0.01					
18.5	1.5	21.75	9	0.6	0.5	0.5	0.1					
1.2		16.5	3.5				0.05	1.2	1.2			
	19.5	19	4		0.75	0.75	0.08	2.9	2.9			B 0.01
	14	20	4.5					0.4	2.3			Nb5
0.5	14	18	7		0.25	0.25	0.05	2.1	2			
10.0	1.15	15.0	5.5		0.3	0.1	0.12	20	2.5			
16.0	20.0	18.0	3.2		1.0	0.8	0.03	0.2	2.8			
	15.0	10.0	3.0				0.18	5.5	4.7			V1.0
	10.0	8.9	2.0	7.0			0.1	4.7	2.5			Hf1.05, Ta3.0
3.0	11.0	19.0	9.75				0.06	1.6	2.5			B 0.007
3.5	15.0	14.0	6.0	3.5	0.2	0.1	0.05	3.8	2.5			

Star Guide Key to Recommended Inserts

	Material Designations							
	P	Unalloyed Steels	M	Stainless Steels	K	Cast Irons	S	High Temp. Alloys
	P	Alloyed Steels	M	PH Stainless	N	Aluminium & Alloys	H	Hard Materials

Materials Cross Reference Chart

Material Group	Country/Standard							
	Commercial Designation	Allvac Designation	Allegheny Ludlum Designation	GERMANY/ITALY		U.K.	FRANCE	USA
				W.-Nr.	DIN		AFNOR	AMS
Nickel based alloys	René 77							
Nickel based alloys	René 80							
Nickel based alloys	René 95						NC14K8	
Nickel based alloys	TRW VIA				NiTa9Co8W6CrAl			
Nickel based alloys	Udimet 500				NiCr18CoMoAlTi		NCK19DAT	AISI:684
Nickel based alloys	Udimet 520	Allvac 520						
Nickel based alloys	Udimet 630				NiCr19NbMo			
Nickel based alloys	Udimet 700				NiCo15Cr15MoAlTi		NCKD20AT	AISI:687
Nickel based alloys	Udimet 710						NCK18TDA	
Nickel based alloys	Udimet 718				NiCr19Fe19NbMo	HR8	NC19FeNb	5583
Nickel based alloys	Waspaloy	Allvac Waspaloy		2.4654	NiCr20Co14MoTi		NC20K14	5544

Material Group	Country/Standard							
	Commercial Designation	Allvac Designation	Allegheny Ludlum Designation	GERMANY/ITALY		U.K.	FRANCE	USA
				W.-Nr.	DIN		AFNOR	AMS
Alpha Titanium alloys	Ti-5Al-2.5Sn	Allvac 5-2.5			TiAl5Sn2	TA 14,17	T-A5E	ASTM: B 265
Alpha Titanium alloys	Ti-7Al-4Mo				TiAl7Mo4			ASTM: B 381
Alpha Titanium alloys	Ti-8Al-1Mo-1V	Allvac 8-1-1			TiAl8Mo1V1			4915, 4933, 4972
Alpha Titanium alloys	Ti-6Al-4Zr-2Mo-2Sn	Allvac 6-2-4-2			TiAl6Zr4Mo2Sn2			4919, 4975, 4976
Alpha Beta Titanium alloys	Ti-6Al-4V	Allvac 6-4			TiAl6V4	TA 10-13 TA 28	T-A6V	4906, 4920,4928, 4965, 4967
Alpha Beta Titanium alloys	Ti-6Al-6V-2Sn	Allvac 6-6-2			TiAl6V6Sn2			4971
Alpha Beta Titanium alloys	Ti-4Al-4Mo-2Sn-0.5Si	Allvac 4-4-2			TiAl4Mo4Sn2Si0.5	5103	T-A4DE	
Alpha Beta Titanium alloys	Ti-4Al-4Mo-4Sn-0.5Si				TiAl4Mo4Sn4Si0.5	5203		
Alpha Beta Titanium alloys	Ti-7Al-4Mo				TiAl7Mo4			ASTM: B 381
Alpha Beta Titanium alloys	Ti-6Al-5Zr-0.5Mo- 0.25Si				TiA6Zr5Mo0.5Si0.25		T-AGZ-50	
Alpha Beta Titanium alloys	Ti-6Al-5Zr-4Mo-Cu- 0.2Si				TiAl6Zr5Mo4CuSi0.2	M201		
Alpha Beta Titanium alloys	Allvac 3-2.5	Allvac 3-2.5						4943, 4944
Alpha Beta Titanium alloys	Allvac 6-4ELI	Allvac 6-4ELI						4907, 4930, 4931
Alpha Beta Titanium alloys	Allvac 6-2-4-6	Allvac 6-2-4-6						4981
Alpha Beta Titanium alloys	Allvac Ti-17	Allvac Ti-17						4995
Beta Titanium alloys	Ti-13V-11Cr-3Al	Allvac 13-11-3			TiV13Cr11Al3			4917
Beta Titanium alloys	Ti-8Mo-8V-2Fe-3Al							
Beta Titanium alloys	Ti-3Al-8V-6Cr-4Mo-4Zr	Allvac 38-644						
Beta Titanium alloys	Ti-11.5Mo-6Zr-4.5Sn							
Pure Titanium	Ti 99.5	Allvac 70, Ti CP-4			Ti 99.5	TA 6	AIR: 9182 T60	ASTM: B381F4
Pure Titanium	Ti 99.6	Allvac 55, Ti CP-3			Ti 99.6		AIR: 9182 T50	ASTM: B381F3
Pure Titanium	Ti 99.7	Allvac 40, Ti CP-2			Ti 99.7a	TA 2-5	AIR: 9182 T40	ASTM: B381F2
Pure Titanium	Ti 99.8	Allvac 30, Ti CP-1			Ti 99.8	TA 1	AIR: 9182 T35	ASTM: B381F1
Austempered ductile iron	269-321				EN-GJS-800-8			125/80/10 (grade 1)
Austempered ductile iron	269-321				EN-JS1100			850/550/10 (grade 1)
Austempered ductile iron	302-363				EN-GJS-1000-5			150/100/7 (grade 2)
Austempered ductile iron	302-363				EN-JS1110			1050/700/7 (grade 2)
Austempered ductile iron	341-444				EN-GJS-1200-2			175/125/4 (grade 3)
Austempered ductile iron	341-444				EN-JS1120			1200/850/4 (grade 4)
Austempered ductile iron	444-555				EN-GJS-1400-1			230/185/--- (grade 5)
Austempered ductile iron	444-555				EN-JS-1130			1600/1300/-- (grade 5)

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Fe	Co	Cr	Mo	W	Si	Mn	C	Al	Ti	P	S	Others
0.4	15.0	15.0	4.2		0.1	0.1	0.07	4.3	3.3			
	9.5	14.0	4.0	4.0			0.17	3.0	5.0			
	8.0	14.0	3.5	3.5			0.15	3.5	2.5			Nb3.5
	7.5	6.0	2.0	5.8			0.13	5.4	1.0			Nb0.5, Ta9.0
	19.0		4.0		0.1	0.1	0.07	3.0	3.0			
	12	19	6	1				2	3			
18.0	18.0		3.0				0.03	0.5	1.0			Nb6.5
	16.5	15.0	5.0				0.07	4.4	3.4			
	15.0	18.0	3.0	1.5			0.07	2.5	5.0			
18.0		18.0	3.0				0.05	0.6	1.0			Nb+Ta5.2
	13.0	19.5	4.3				0.05	1.40	3.0			Zr .07

Al	Sn	Mo	V	Zr	Si							Others
5.0	2.5											
7.0		4.0										
8.0		1.0	1.0									
6.0	2.0	2.0		4.0								
6.0			4.0									
5.5	2.0		5.5									
4.0	2.0	4.0			0.55							
4.0	4.0	4.0			0.5							
7.0		4.0										Fe 0.3
6.0		0.5		5.0	0.25							
6.0		4.0		5.0	0.2							Cu 1.0
3.0			2.5									Fe 0.13
6.0												Fe 0.2
6.0	2.0	6.0		4.0								Fe 0.10
5.0	2.0	4.0		2.0								Cr 4.0
3.0			13.0									Cr 11.0
3.0		8.0	8.0									
3.0		4.0	8.0	4.0								Cr 6.0
	4.5	11.5		6.0								

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