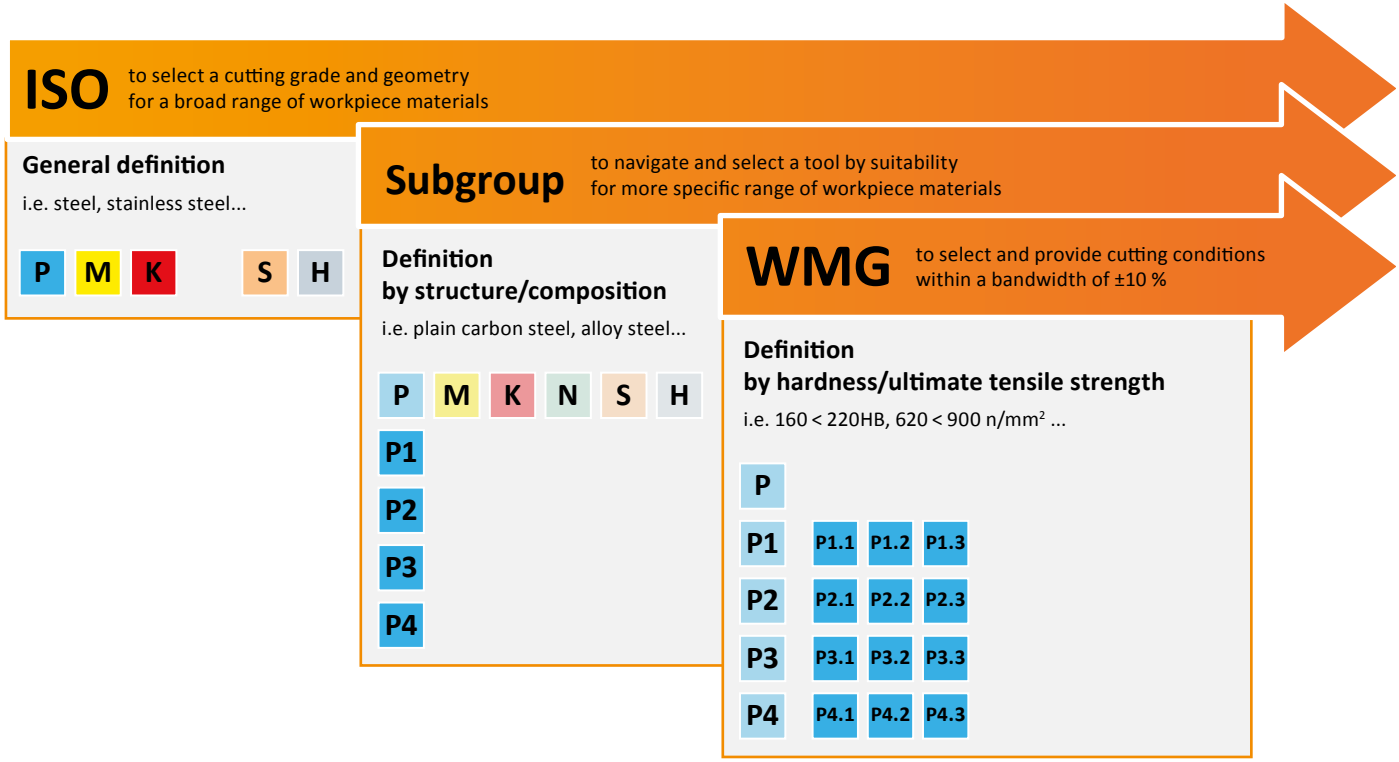
WORKPIECE MATERIAL GROUPS (WMG)



ABOUT DORMER PRAMET'S WORKPIECE MATERIAL CLASSIFICATION

Workpiece material groups ("WMG") are used to support easy and reliable selection of the right cutting tool and starting values for machining conditions in particular applications.

Dormer Pramet classifies workpiece materials into six differently coloured groups;

- **Blue**: Steel and cast steel (P-group)
- **Yellow**: Stainless steel (M-group)
- **Red**: Cast iron (K-group)
- **Green**: Non-ferrous metals (N-group)
- **Orange**: High-temperature alloys (S-group)
- **Grey**: Hardened materials (H-group)

Each of these are divided into subgroups on the basis of their structure and/or composition. For example, P-group steel and cast steel is split into four subgroups, namely;

- P1 – **Free machining steel**
- P2 – **Plain carbon steel**
- P3 – **Alloy steel**
- P4 – **Tool steel**

A final division includes material properties, such as hardness and ultimate tensile strength. This is to provide our customers with a complete tool recommendation, including starting values for cutting speed and feed.

The table on the next page includes a description of each workpiece material group, as well as examples of commonly used designations

ISO			WMG (Workpiece Material Groups)	Ultimate tensile strength Mpa [N/mm²]	Old Dormer AMG	Old Pramet ISO
P	P1	P1.1	Free machining sulfurized carbon steel with a hardness of < 220 HB	≤ 760	1.1	P1
		P1.2	Free machining sulfurized and phosphorized carbon steel with a hardness of < 180 HB	≤ 620	1.1	P1
		P1.3	Free machining sulfurized/phosphorized and leaded carbon steel with a hardness of < 160 HB	≤ 550	1.1	P1
	P2	P2.1	Plain low carbon steel containing < 0.25%C with a hardness of < 180 HB	≤ 620	1.2	P2
		P2.2	Plain medium carbon steel containing < 0.55%C with a hardness of < 240 HB	≤ 830	1.3	P2
		P2.3	Plain high carbon steel containing > 0.55%C, with a hardness of < 300 HB	≤ 1030	1.5	P3
	P3	P3.1	Alloy steel with a hardness of < 180 HB	≤ 620	1.4	P3
		P3.2	Alloy steel with a hardness of 180 – 260 HB	> 620 ≤ 900	1.4	P3
		P3.3	Alloy steel with a hardness of 260 – 360 HB	> 900 ≤ 1240	1.5	P4
	P4	P4.1	Tool steel with a hardness of < 26 HRC	≤ 900	1.4	P3
		P4.2	Tool steel with a hardness of 26 – 39 RC	> 900 ≤ 1240	1.5	P4
		P4.3	Tool steel with a hardness of 39 – 45 HRC	> 1250 ≤ 1450	1.6	H1
M	M1	M1.1	Stainless steel, ferritic with a hardness of < 160 HB	≤ 520	2.1	M1
		M1.2	Stainless steel, ferritic with a hardness of 160 – 220 HB	> 520 ≤ 700	2.1	M1
	M2	M2.1	Stainless steel, martensitic with a hardness of < 200 HB	≤ 670	2.3	M2
		M2.2	Stainless steel, martensitic with a hardness of 200 – 280 HB	> 670 ≤ 950	2.3	M2
		M2.3	Stainless steel, martensitic with a hardness of 280 – 380 HB	> 950 ≤ 1300	2.4	M2
	M3	M3.1	Stainless steel, austenitic with a hardness of < 200 HB	≤ 750	2.2	M3
		M3.2	Stainless steel, austenitic with a hardness of 200 – 260 HB	>750 ≤ 870	2.2	M3
		M3.3	Stainless steel, austenitic with a hardness of 260 – 300 HB	> 870 ≤ 1040	2.2	M3
	M4	M4.1	Stainless steel, austenitic-ferritic or super-austenitic with a hardness of < 300 HB	≤ 990	2.3	M4
		M4.2	Stainless steel, precipitation hardening austenitic with a hardness of 300 – 380 HB	≤ 1320	2.4	M4
K	K1	K1.1	Gray iron, ferritic or ferritic-pearlitic with a hardness of < 180 HB	≤ 190	3.1	K1
		K1.2	Gray iron, ferritic-pearlitic or pearlitic with a hardness of 180 – 240 HB	> 190 ≤ 310	3.2	K1
		K1.3	Gray iron, pearlitic with a hardness of 240 – 280 HB	>310 ≤ 390	3.2	K1
	K2	K2.1	Malleable iron, ferritic with a hardness of < 160 HB	≤ 400	3.3	K2
		K2.2	Malleable iron, ferritic or pearlitic with a hardness of 160 – 200 HB	> 400 ≤ 550	3.3	K2
		K2.3	Malleable iron, pearlitic with a hardness of 200 – 240 HB	> 550 ≤ 660	3.4	K2
	K3	K3.1	Ductile (nodular/spheriodal) iron, ferritic with a hardness of < 180 HB	≤ 560	3.3	K3
		K3.2	Ductile (nodular/spheriodal) iron, ferritic or pearlitic with a hardness of 180 – 220 HB	> 560 ≤ 680	3.3	K4
		K3.3	Ductile (nodular/spheriodal) iron, pearlitic with a hardness of 220 – 260 HB	> 680 ≤ 800	3.4	K4
	K4	K4.1	Austenitic cast iron with a hardness of < 180 HB	≤ 610		
		K4.2	Austenitic cast iron with a hardness of 180 – 240HB	> 610 ≤ 840		
		K4.3	Austempered ductile iron with a hardness of 240 – 280 HB	> 840 ≤ 980		
		K4.4	Austempered ductile iron with a hardness of 280 – 320 HB	> 980 ≤ 1130		
		K4.5	Austempered ductile iron with a hardness of 320 – 360 HB	> 1130 ≤ 1280		
	K5	K5.1	Vermicular, compacted graphite iron with a hardness of < 180 HB			
		K5.2	Vermicular, compacted graphite iron with a hardness of 180 – 220 HB			
		K5.3	Vermicular, compacted graphite iron with a hardness of 220 – 260 HB			
N	N1	N1.1	Pure aluminium and wrought aluminium alloys with a hardness of < 60 HB	≤ 240	7.1	N1
		N1.2	Wrought aluminium alloys with a hardness of 60 – 100 HB	> 240 ≤ 400	7.1	N1
		N1.3	Wrought aluminium alloys with a hardness of 100 – 150 HB	> 400 ≤ 590	7.2	N2
	N2	N2.1	Cast aluminium alloys with a hardness of < 75 HB	≤ 240	7.3	N1
		N2.2	Cast aluminium alloys with a hardness of 75 – 90 HB	> 240 ≤ 270	7.3	N1
		N2.3	Cast aluminium alloys with a hardness of 90 < 140 HB	> 270 ≤ 440	7.3	N2
	N3	N3.1	Free-cutting copper-alloys materials with excellent machining properties		6.3	N3
		N3.2	Short-chip copper-alloys with good to moderate machining properties		6.2	N3
		N3.3	Electrolytic copper and long-chip copper-alloys with moderate to poor machining properties		6.1	N4
	N4	N4.1	Thermoplastic polymers		8.1	
		N4.2	Thermosetting polymers		8.2	
		N4.3	Reinforced polymers or composites		8.3	
	N5	N5.1	Graphite			
S	S1	S1.1	Titanium or titanium alloys, with a hardness of < 200 HB	≤ 660	4.1	S1
		S1.2	Titanium alloys, with a hardness of 200 – 280 HB	> 660 ≤ 950	4.2	S1
		S1.3	Titanium alloys, a hardness of 280 – 360 HB	> 950 ≤ 1200	4.3	S1
	S2	S2.1	High-temperature Fe-based alloys with a hardness of < 200 HB	≤ 690		S2
		S2.2	High-temperature Fe-based alloys with a hardness of 200 – 280 HB	> 690 ≤ 970		S2
	S3	S3.1	High-temperature Ni-based alloys with a hardness of < 280 HB	≤ 940	5.2	S3
		S3.2	High-temperature Ni-based alloys with a hardness of 280 – 360 HB	> 940 ≤ 1200	5.3	S3
	S4	S4.1	High-temperature Co-based alloys with a hardness of < 240HB	≤ 800		S4
		S4.2	High-temperature Co-based alloys with a hardness of 240 – 320 HB	> 800 ≤ 1070		S4
H	H1	H1.1	Chilled cast iron with a hardness of < 400 HB			
	H2	H2.1	Hardened cast iron with a hardness < 55 HRC			H2
		H2.2	Hardened cast iron with a hardness > 55 HRC			H2
	H3	H3.1	Hardened steel with a hardness of < 51 HRC		1.7	H3
		H3.2	Hardened steel with a hardness of 51 – 55 HRC		1.7	H3
	H4	H4.1	Hardened steel with a hardness of 55 – 59 HRC		1.8	H4
		H4.2	Hardened steel with a hardness of > 59 HRC		1.8	H4