INTERNATIONAL STANDARD 513

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Application of carbides for machining by chip removal — Designation of the main groups of chip removal and groups of application

Application des carbures métalliques pour usinage par enlèvement de copeaux — Désignation des groupes principaux d'enlèvement de copeaux et des groupes d'application

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FOREWORD

ISO (the International Organization for Standardization) is a worldwide federation of national standards institutes (ISO Member Bodies). The work of developing International Standards is carried out through ISO Technical Committees. Every Member Body interested in a subject for which a Technical Committee has been set up has the right to be represented on that Committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work.

Draft International Standards adopted by the Technical Committees are circulated to the Member Bodies for approval before their acceptance as International Standards by the ISO Council.

Prior to 1972, the results of the work of the Technical Committees were published as ISO Recommendations; these documents are now in the process of being transformed into International Standards. As part of this process, Technical Committee ISO/TC 29 has reviewed ISO Recommendation R 513 and found it technically suitable for transformation. International Standard ISO 513 therefore replaces ISO Recommendation R 513-1966 to which it is technically identical.

ISO Recommendation R 513 was approved by the Member Bodies of the following countries :

Australia	Greece	South Africa, Rep. of
Austria	Hungary	Spain
Belgium	India	Sweden
Brazil	Italy	Switzerland
Chile	Japan	Turkey
Colombia	Korea, Rep. of	United Kingdom
Czechoslovakia	Netherlands	U.S.S.R.
Denmark	New Zealand	Yugoslavia
France	Poland	
Germany	Portugal	

The Member Bodies of the following countries expressed disapproval of the Recommendation on technical grounds :

Canada
U.S.A.

The Member Bodies of the following countries disapproved the transformation of ISO/R 513 into an International Standard :

Austria
Switzerland
United Kingdom
U.S.A.

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0 INTRODUCTION

The variety of ways in which different manufacturers produce carbides with differing characteristics makes it impossible at the present time to standardize carbides graded in accordance with these characteristics.

This International Standard is therefore limited to a classification of carbides based on their application and to a method of designation (colour marking and distinguishing symbols) for the main types of chip removal and the groups of application which constitute this classification.

1 SCOPE AND FIELD OF APPLICATION

This International Standard relates to the application of carbides for machining by chip removal.

All other uses (such as, for example, mining and other percussion tools, wire drawing dies, tools operating by deformation of the metal, comparator contact tips, etc.) are outside the scope of this International Standard.

2 REFERENCE

ISO 504, *Turning tools with carbide tips — Designation and marking.*

3 CLASSIFICATION

Carbides are classified in the table, according to their application, in main groups of chip removal and these groups are subdivided into groups of application.

The groups of application are designated by a letter (*P*, *M* or *K*) indicating the relevant main group followed by a distinguishing number and these groupings define the fields of application within which carbide manufacturers may classify their own particular grades of carbides.

The letters *P*, *M* and *K* are thus intended exclusively for the general classification of carbides and should never be used, either separately or in conjunction with another letter, as a commercial designation for a particular grade.

3.1 Main groups of chip removal

This International Standard provides for three main groups of chip removal, based on three broad classes of material to be machined, as indicated in the table, which are designated by the letters *P*, *M* and *K* respectively.

These letters are purely conventional and have no other significance in themselves; they are not the initials of particular words.

Each of these groups has a corresponding distinctive colour marking, blue, yellow or red.[1)]

3.2 Groups of application

Each main group is subdivided into groups of application based on the working conditions in which it is used.

These working conditions are expressed in the table in very general terms and carbide manufacturers may possibly describe them, for their own purposes, in terms more directly related to the fields of use for the carbides which they manufacture.

The groups of application are designated by the letter for the main group to which they belong, followed by a distinguishing number.

The higher the number within each main group, the lower is the wear resistance and the greater the toughness of the carbide.

Where there is a real need for an intermediate group of application, it should be designated by an intermediate number, for example *K 15* between *K 10* and *K 20*, but there should never be more than one group interpolated between two of the tabulated groups of application; there is no point in introducing such a group unless the carbide so classified differs appreciably from the neighbouring groups and this would not be the case if too many further interpolations were adopted.

In the particular case of the *P 01* group of application, however, this group may be subdivided by using the decimal designations *P 01.1*, *P 01.2*, *P 01.3* etc., if necessary, to distinguish the different degrees of wear resistance and toughness in the finishing operations on materials with long chips which constitute this group of application.

1) The references given in the table for these colours are those of the RAL colour register issued by the Deutscher Normenausschuss Committee for delivery and quality specifications, "Ausschuss für Lieferbedingungen und Gütesicherung".

TABLE – **Classification of carbides according to use**

Main groups of chip removal			Groups of application			Direction of increase in characteristic	
Symbol	Broad categories of material to be machined	Distinguishing colours	Designation	Material to be machined	Use and working conditions	of cut	of carbide
P	**Ferrous metals with long chips**	*BLUE*	*P 01*	Steel, steel castings	Finish turning and boring; high cutting speeds, small chip section, accuracy of dimensions and fine finish, vibration-free operation.	↑ Increasing speed ↓ Increasing feed	↑ Wear resistance ↓ Toughness
			P 10	Steel, steel castings	Turning, copying, threading and milling, high cutting speeds, small or medium chip sections.		
			P 20	Steel, steel castings Malleable cast iron with long chips	Turning, copying, milling, medium cutting speeds and chip sections, planing with small chip sections		
			P 30	Steel, steel castings Malleable cast iron with long chips	Turning, milling, planing, medium or low cutting speeds, medium or large chip sections, and machining in unfavourable conditions.*		
			P 40	Steel Steel castings with sand inclusion and cavities	Turning, planing, slotting, low cutting speeds, large chip sections with the possibility of large cutting angles for machining in unfavourable conditions * and work on automatic machines.		
			P 50	Steel Steel castings of medium or low tensile strength, with sand inclusion and cavities	For operations demanding very tough carbide: turning, planing, slotting, low cutting speeds, large chip sections, with the possibility of large cutting angles for machining in unfavourable conditions * and work on automatic machines.		
M	**Ferrous metals with long or short chips and non-ferrous metals**	*YELLOW*	*M 10*	Steel, steel castings, manganese steel Grey cast iron, alloy cast iron	Turning, medium or high cutting speeds. Small or medium chip sections.	↑ Increasing speed ↓ Increasing feed	↑ Wear resistance ↓ Toughness
			M 20	Steel, steel castings, austenitic or manganese steel, grey cast iron	Turning, milling. Medium cutting speeds and chip sections.		
			M 30	Steel, steel castings, austenitic steel, grey cast iron, high temperature resistant alloys	Turning, milling, planing. Medium cutting speeds, medium or large chip sections.		
			M 40	Mild free cutting steel, low tensile steel Non-ferrous metals and light alloys	Turning, parting off, particularly on automatic machines.		
K	**Ferrous metals with short chips, non-ferrous metals and non-metallic materials**	*RED*	*K 01*	Very hard grey cast iron, chilled castings of over 85 Shore, high silicon aluminium alloys, hardened steel, highly abrasive plastics, hard cardboard, ceramics	Turning, finish turning, boring, milling, scraping.	↑ Increasing speed ↓ Increasing feed	↑ Wear resistance ↓ Toughness
			K 10	Grey cast iron over 220 Brinell, malleable cast iron with short chips, hardened steel, silicon aluminium alloys, copper alloys, plastics, glass, hard rubber, hard cardboard, porcelain, stone.	Turning, milling, drilling, boring, broaching, scraping.		
			K 20	Grey cast iron up to 220 Brinell, non-ferrous metals: copper, brass, aluminium	Turning, milling, planing, boring, broaching, demanding very tough carbide.		
			K 30	Low hardness grey cast iron, low tensile steel, compressed wood	Turning, milling, planing, slotting, for machining in unfavourable conditions * and with the possibility of large cutting angles.		
			K 40	Soft wood or hard wood Non-ferrous metals	Turning, milling, planing, slotting, for machining in unfavourable conditions * and with the possibility of large cutting angles.		

* Raw material or components in shapes which are awkward to machine : casting or forging skins, variable hardness etc., variable depth of cut, interrupted cut, work subject to vibrations.

4 IMPORTANT NOTES

4.1 Particular attention is drawn to the fact that a group of application is not a grade of carbide and should not be confused with the latter. It only defines the extent of the field of use and the working conditions and the manufacturers are responsible for classifying their carbides within the group. Grades classified in the same group of application by different manufacturers may differ from one another as far as their properties for machining by chip removal are concerned; for this reason, no combination of groups of application and grades of carbide can be regarded as representing "a comparative table of carbide grades".

This is why the letters *P*, *M* and *K*, intended exclusively for the general classification of the main groups of chip removal, should never be used, either separately or in conjunction with another letter, as a commercial designation for a particular grade; the groups of application which are essentially designated by these letters cannot, in fact, be identified with grades of carbide and the latter therefore cannot have the same designations.

4.2 The practice of distinguishing grades of carbides by colours as well as by symbols has, up till now, given rise to more inconvenience than simplification, but only because the multiplicity of grades led to the simultaneous use of a number of colours.

This practice should be abandoned, and the use of colours in accordance with this International Standard reserved solely for the indication of the main groups of chip removal.

The symbols and distinguishing colours shall be used for the marking of tools in accordance with the requiremets of ISO 504.

4.3 On lathe tools, the symbols and colour markings shall be applied as specified in ISO 504.