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**Classification and application of  
hard cutting materials for metal  
removal with defined cutting edges —  
Designation of the main groups and  
groups of application**

*Classification et application des matériaux durs de coupe pour  
enlèvement de métal avec arêtes coupantes définies — Définition des  
groupes principaux et des groupes d'application*





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# Contents

Page

<b>Foreword</b> .....	<b>iv</b>
<b>Introduction</b> .....	<b>v</b>
<b>1 Scope</b> .....	<b>1</b>
<b>2 Designation</b> .....	<b>1</b>
<b>3 Classification</b> .....	<b>4</b>
3.1 Main groups of application.....	4
3.2 Groups of application.....	4
<b>4 Important remarks</b> .....	<b>4</b>

## Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established 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. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

ISO 513 was prepared by Technical Committee ISO/TC 29, *Small tools*, Subcommittee SC 9, *Tools with cutting edges made of hard cutting materials*.

This fourth edition cancels and replaces the third edition (ISO 513:2004), which has been technically revised.

## Introduction

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

This International Standard is, therefore, limited to a classification of hard cutting materials based on their application and to a method of designation (colour marking and distinguishing symbols) for the main groups of application and the groups of application which constitute this classification.



# Classification and application of hard cutting materials for metal removal with defined cutting edges — Designation of the main groups and groups of application

## 1 Scope

This International Standard specifies the classification and application of hard cutting materials, including hardmetals, ceramics, diamond and boron nitride, for machining by chip removal, and establishes their application.

It is not applicable to other uses (mining and other percussion tools, wire drawing dies, tools operating by deformation of the metal and comparator contact tips, etc.).

## 2 Designation

The designation of groups of application for hard cutting materials includes the letter symbols in accordance with Tables 1 to 4, followed by a dash and the designation of the main group of chip removal and of the group of application, as specified in Clause 4.

**Table 1 — Carbides**

Identification letters	Material group
<b>HW</b>	Uncoated carbide, main content tungsten carbide (WC) with grain size $\geq 1 \mu\text{m}$
<b>HF</b>	Uncoated carbide, main content tungsten carbide (WC) with grain size $< 1 \mu\text{m}$
<b>HT<sup>a</sup></b>	Uncoated carbide, main content TiC or TiN or both
<b>HC</b>	Carbides as above-mentioned, but coated
<sup>a</sup> These grades are also called "Cermets".	

**Table 2 — Ceramics**

Identification letters	Material group
<b>CA</b>	Ceramic, main content $\text{Al}_2\text{O}_3$
<b>CR</b>	Ceramic, main content $\text{Al}_2\text{O}_3$ , reinforced
<b>CM</b>	Mixed ceramic, main content $\text{Al}_2\text{O}_3$ plus components other than oxides
<b>CN</b>	Silicon nitride ceramic, main content $\text{Si}_3\text{N}_4$
<b>CC</b>	Ceramics as above-mentioned, but coated

Table 3 — Diamond

Identification letters	Material group
<b>DM</b>	Monocrystalline diamond
<b>DD</b>	Polycrystalline diamond without binder
<b>DP</b>	Polycrystalline diamond with binder

Table 4 — Boron nitride

Identification letters	Material group
<b>BL</b>	Cubic crystalline boron nitride with low content of cubic boron nitride
<b>BH</b>	Cubic crystalline boron nitride with high content of cubic boron nitride
<b>BC</b>	Cubic crystalline boron nitride as above-mentioned, but coated

EXAMPLE

HW - P10

HC - K20

CA - K10



Table 5 — Application and classification of hard cutting materials

Main groups of application			Group of application			
Identifica- tion letter	Identifica- tion colour	Materials to be machined	Hard cutting materials		-	
P	blue	<b>Steel:</b> all kinds of steel and cast steel except stainless steel with an aus- tenitic structure.	P01 P10 P20 P30 P40 P50	P05 P15 P25 P35 P45	↑ <sup>a</sup>	↓ <sup>b</sup>
M	yellow	<b>Stainless steel:</b> stainless austenitic and austenitic/ ferritic steel and cast steel.	M01 M10 M20 M30 M40	M05 M15 M25 M35	↑ <sup>a</sup>	↓ <sup>b</sup>
K	red	<b>Cast iron:</b> grey cast iron, cast iron with spher- oidal graphite, malleable cast iron.	K01 K10 K20 K30 K40	K05 K15 K25 K35	↑ <sup>a</sup>	↓ <sup>b</sup>
N	green	<b>Non-ferrous metals:</b> aluminium and other non-ferrous metals, non-metallic materials.	N01 N10 N20 N30	N05 N15 N25	↑ <sup>a</sup>	↓ <sup>b</sup>
S	brown	<b>Superalloys and titanium:</b> heat-resistant special alloys based on iron, nickel and cobalt, titanium and titanium alloys.	S01 S10 S20 S30	S05 S15 S25	↑ <sup>a</sup>	↓ <sup>b</sup>
H	grey	<b>Hard materials:</b> hardened steel, hardened cast iron materials, chilled cast iron.	H01 H10 H20 H30	H05 H15 H25	↑ <sup>a</sup>	↓ <sup>b</sup>
<sup>a</sup> Increasing speed, increasing wear resistance of cutting material (see Table 6). <sup>b</sup> Increasing feed, increasing toughness of cutting material (see Table 6).						

Table 6 — Area of use chart

Wear resistance ← → Toughness											
	01	05	10	15	20	25	30	35	40	45	50
P											
M										X	X
K										X	X
N								X	X	X	X
S								X	X	X	X
H								X	X	X	X

### 3 Classification

#### 3.1 Main groups of application

There are six main groups of application (see Table 5). They are divided according to the different workpiece materials which are to be machined. They are identified by a capital letter and an identifying colour.

#### 3.2 Groups of application

Each main group of application is divided into application groups. The application groups are designated by the letter for the main group and a classification number.

The manufacturers of cutting material arrange in proper order their grades into the application group system according to the relative wear resistance and toughness of the grades (see Table 6).

Table 6 shows that, according to this International Standard, only “P” grades are thought to operate under conditions sufficiently arduous as to justify wear/toughness classification numbers 45 and 50. “M” and “K” grades may have classification numbers up to 40 and the remaining groups (N, S and H) may be allocated wear/toughness classification numbers no greater than 30. Manufacturers may assign any available application code to a specified cutting tool material with qualifying composition.

### 4 Important remarks

A group of application is not identical to a cutting material grade. Grades from different manufacturers which are in the same application group could be different as far as application range and performance level are concerned. Within an application group, a designation (eg “P01”) is not identical to a cutting material grade. Grades from different manufacturers with the same designation within an application group can be different as far as composition, properties, application range and performance level are concerned. This International Standard, consequently, does not provide data for grade comparison charts.



