

TECHNICAL REPORT

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Applicability of hard cutting materials for machining by chip removal — Information additional to ISO 513 designation

Application des matériaux durs de coupe pour usinage par enlèvement de copeaux — Informations complémentaires à la désignation ISO 513



Reference number
ISO/TR 11255:1994(E)

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.

The main task of technical committees is to prepare International Standards, but in exceptional circumstances a technical committee may propose the publication of a Technical Report of one of the following types:

- type 1, when the required support cannot be obtained for the publication of an International Standard, despite repeated efforts;
- type 2, when the subject is still under technical development or where for any other reason there is the future but not immediate possibility of an agreement on an International Standard;
- type 3, when a technical committee has collected data of a different kind from that which is normally published as an International Standard ("state of the art", for example).

Technical Reports of types 1 and 2 are subject to review within three years of publication, to decide whether they can be transformed into International Standards. Technical Reports of type 3 do not necessarily have to be reviewed until the data they provide are considered to be no longer valid or useful.

ISO/TR 11255, which is a Technical Report of type 3, was prepared by Technical Committee ISO/TC 29, *Small tools*, Subcommittee SC 9, *Tools with cutting edges made of hard cutting materials*.

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Applicability of hard cutting materials for machining by chip removal — Information additional to ISO 513 designation

1 Scope

For the case when additional information to the designation according to ISO 513 about workpiece materials to be machined, as well as toughness characteristics and performance data of the hard cutting material is considered to be useful, this Technical Report establishes how to provide this information.

2 References

ISO 513 Application of hard cutting materials for machining by chip removal - Designation of the main groups of chip removal and groups of application.

3 Materials to be machined

Workpiece materials to be machined are classified in ISO 513 according to the application groups P01 to P50, M10 to M40 and K01 to K40 of the hard cutting material.

If considered to be useful, more detailed information about the application groups M.. and K.. may be given by adding to the designation of the hard cutting material according to ISO 513, the letter symbol N, S or H according to the table below.

Letter symbol	More detailed information about materials to be machined with hard cutting materials of the application groups M.. and K..
N	Aluminium and other non-ferrous metals. Non metallic materials.
S	Special nickel or cobalt-based materials. Titanium and titanium alloys. High alloy steels with poor machinability.
H	Hardened steel, hardened or chilled iron castings.

Example:

DP-K05N

4 Toughness characteristics

ISO 513 gives in its main table only the direction of increase in the toughness of hard cutting materials, for the number symbols designating the group of application within one main group of chip removal.

For more detailed information, this Technical Report may help to choose the required toughness of the hard cutting material for particular machining operation depending on the range of cutting conditions and the feed rate. The basis for the ranges of cutting conditions (clause 4.1) and the toughness in connection with the number symbol of the group of application according to ISO 513 (clause 4.2) is turning. Other chip removal operations should be considered accordingly.

4.1 Ranges of cutting conditions

Cutting conditions are influenced by several factors and are indicated in the table below. The dynamic load on the cutting edge can be estimated by choosing one of the four ranges A, B, C or D. The ranges A to D show increasing dynamic load on the cutting edge.

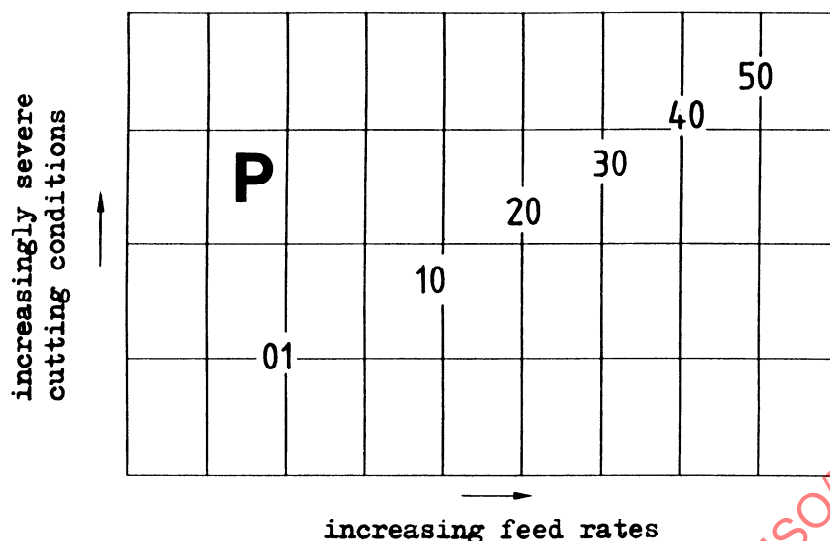
Stability of the machine tool, fixture and workpiece	excellent	good	poor
Type of cut			
smooth cut surface machined	A	A	B
surface forged/cast, variable depth of cut, flashes	B	B	C
light interruptions	B	C	D
severe interruptions	C	D	D

4.2 Number symbols of the group of application

Number symbols of the group of application for the main groups of chip removal P, M and K according to ISO 513, shown in the following diagrams, depend on the feed rate and the range of cutting conditions determined according to clause 4.1.

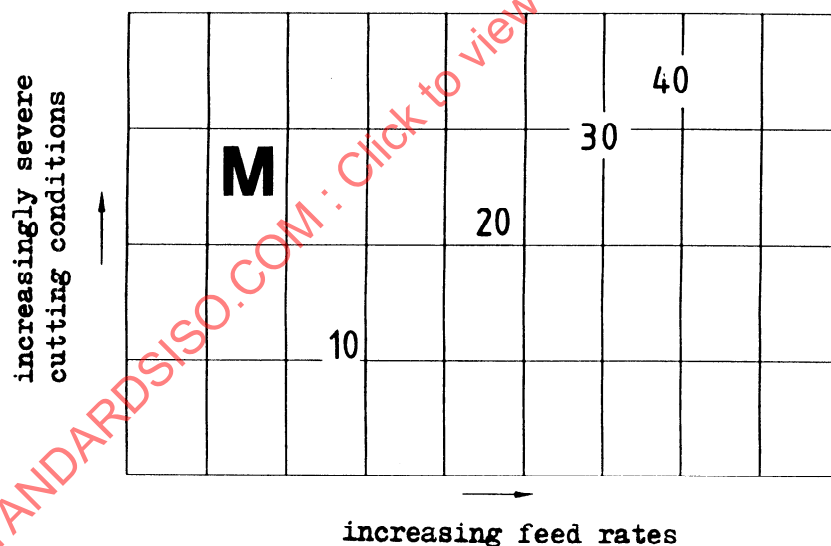
The higher the number, the greater the resistance against dynamic load.

4.2.1 Main group of chip removal P



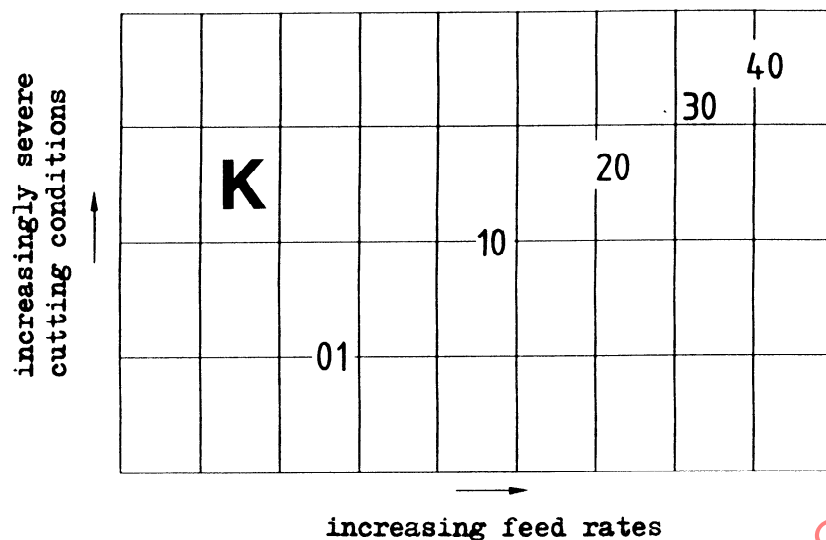
The number symbols 01 to 50 of the group of application vary according to feeds and cutting conditions. For example, for an application using a feed of 0,06 mm/rev. in conjunction with favourable cutting conditions the number symbol 01 would be chosen. On the other hand, for an application using a feed of 1,2 mm/rev. in conjunction with unfavourable cutting conditions the number symbol 50 would be chosen.

4.2.2 Main group of chip removal M



The number symbols 10 to 40 of the group of application vary according to feeds and cutting conditions. For example, for an application using a feed of 0,08 mm/rev. in conjunction with favourable cutting conditions the number symbol 10 would be chosen. On the other hand, for an application using a feed of 0,7 mm/rev. in conjunction with unfavourable conditions the number symbol 40 would be chosen.

4.2.3 Main group of chip removal K



The number symbols 01 to 40 of the group of application vary according to feeds and cutting conditions. For example, for an application using a feed of 0,10 mm/rev. in conjunction with favourable cutting conditions the number symbol 01 would be chosen. On the other hand, for an application using a feed of 1,20 mm/rev. in conjunction with unfavourable cutting conditions the number symbol 40 would be chosen.

5 Special applicability for milling

The specifications of this Technical Report are generally based on turning operations. If a particular hard cutting material is especially developed for milling, this may be mentioned by an optional letter symbol M after a dash, following the designation of the hard cutting material (with or without the detailed information about the material to be machined).

Example:

HW-P25-M.

6 Designation

The standard designation of the application of a hard cutting material is prescribed in ISO 513.

If a hard cutting material is intended for use in more than one group of application, the two digit number symbol in the standard designation refers to the main application.

The designation of additional information is optional. It may include the letter symbol N, S or H for the workpiece material to be machined (clause 3) and/or, after a dash, the letter symbol M for hard cutting material developed for milling (clause 5).

If the hard cutting material is intended for machining materials from more than one group of workpiece materials, the letter symbol refers to the main application.

Examples (see also clause 7):

Designation according to ISO 513:

CA-K05

Optional designation according to ISO/TR 11 255, including additional information:

DP-K05N

HW-P25-M

CN-K10S-M

7 Table of hard cutting material grades

For comparison and selection, the manufacturer may represent hard cutting materials in a table as shown below (examples).

Manufacturer's designation	Designation according to ISO 513 (main application)	Number symbol of the group of application (clause 4.2) for the main group of chip removal			Additional information on materials to be machined with the main groups of chip removal M and K (clause 3)				Optional designation according to ISO/TR 11 255 with symbols for additional information (main application)
		P	M	K	non ferrous metals N non-metallic materials	S special alloys	H hard metallic materials	Special applicability for milling (clause 5)	
X 01	HW-P20	20	20						
X 02	HW-P25	25						-M	HW-P25-M
X 03	HW-M15	15	15	15					
X 04	HC-P10	05-20	10-20						
X 05	CA-K05	10		05			H		
X 06	CN-K10			10		S			CN-K10S
X 07	DP-K05			05	N				DP-K05N
X 08	BN-K10			10			H		BN-K10H
Note: The letter symbol HW for uncoated tungsten carbides is optional.									

8 Performance charts

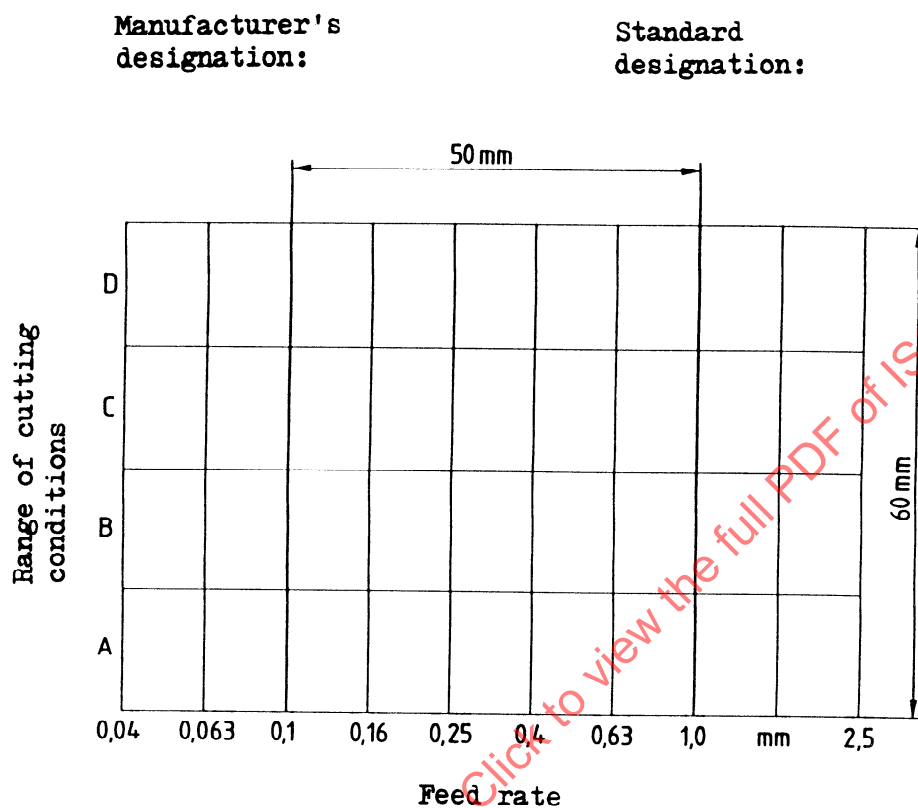
The performance of particular grades of hard cutting materials may be described in a set of two charts:

- the toughness performance chart (see clause 8.1), referring to the toughness characteristics
- the wear performance chart (see clause 8.2), referring to wear resistance.

Note: The presentation of performance charts is at the manufacturer's option, but if specified, the charts shall have for better comparability the form and scale as shown in clause 8.1 and 8.2.

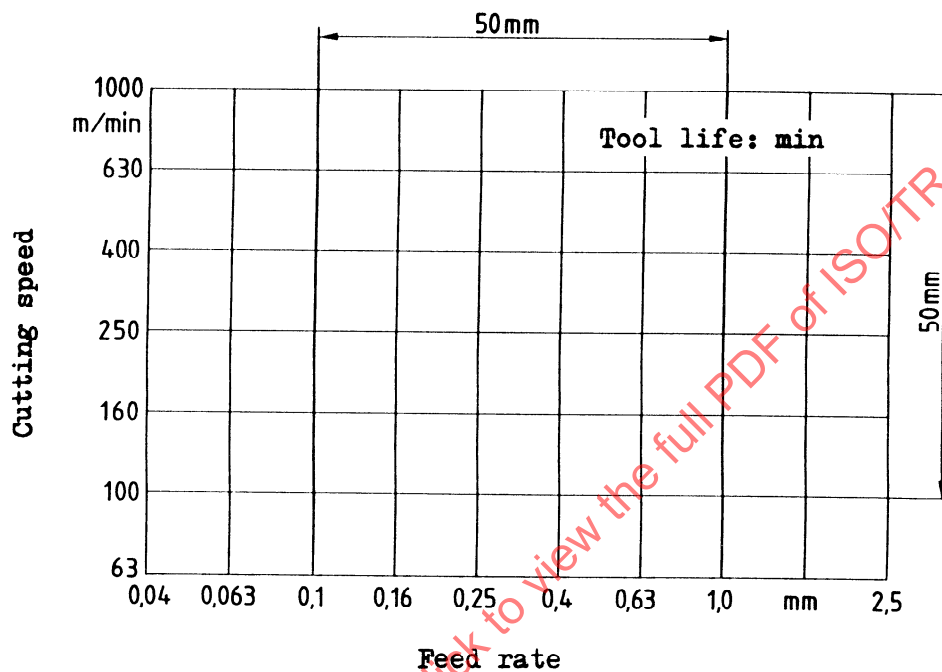
8.1 Toughness performance chart

The toughness performance chart represents the field of application according to the range of cutting conditions and to the feed rate as mentioned in clause 4.2. Being of considerable influence, the machined material and the insert geometry should be noted on the chart (see Annex). Standard workpiece materials for general comparison are steel C45N (group P) or cast iron GG 25 (group K).



8.2 Wear performance chart

The wear performance chart shows the field of application according to the cutting speed and the feed rate. The range of the field being dependent on tool life, it should be noted on the chart (see Annex).



Material machined:
Insert geometry: