



PRESTO INTERNATIONAL UK LTD

TRAINING MANUAL

Part 1

MATERIALS

Drills, End Mills, Taps, Reamers

The majority of cutting tools, including drills, end mills, taps and reamers are made from High Speed Steel, Carbide or Carbon Steel.

High Speed Steel was developed to allow cutting tools to last longer at higher cutting speeds than lower quality carbon steel tools. Machining at higher speeds creates more heat, which, in turn, can dull the tool more quickly.

This makes High Speed Steel ideal for production applications. Carbon Steel tools are generally used for maintenance work where only a few parts need to be produced.

Carbide materials are extremely hard, approaching the hardness of diamond, providing the tool with a much longer wear life for high production applications. Because of their high resistance to heat, Carbide tools can run as much as five times faster than those made from High Speed Steel.

Most High Speed Steel tools are made from a general purpose grade of raw material such as M2. This grade provides a grade balance of:-

Resistance to the heat created by high speed machining.
Toughness to prevent the tool from chipping or breaking
High hardness for long life

M2 is the most common grade in use for High Speed Steel.

Tools made from this grade of material are normally marked "HS" or "HSS"

TOOL STEELS & CARBIDES

A cutting edge needs the following properties:-

HARDNESS

TOUGHNESS (SHOCK RESISTANCE)

WEAR RESISTANCE

HEAT RESISTANCE (GENERALLY)

HEAT RESISTANCE is necessary to cope with frictional heat generated by the passing of the cutting edge through the metal, particularly when the cutting action is continuous. Application of a coolant removes a proportion of the heat, but even so, high temperatures are still achieved at the point.

Various grades of tool steel and carbide provide the necessary degrees of heat resistance, the more common examples being:-

CARBON STEEL	230C
HIGH SPEED STEEL	520C
COBALT STEEL	650C
TUNGSTEN CARBIDE	1000C

The above temperatures indicate the point at which each material begins to soften and lose its cutting edge, and is referred to as the RED HARDNESS of the material.

The main advantage of a high RED HARDNESS is that the cutting speed can be proportionally higher as frictional heat increases with speed.

CARBIDE tools and inserts are moulded from powdered metals by a "sintering" process, which means they can be fashioned in to many shapes and incorporate different geometries.

Inserts are generally held place by clamping in special toolholders. The insert can be turned over when worn to allow a new cutting edge to be used.

Drills, End Mills, Taps, Reamers

Premium grade High Speed Steels are generally used for special purpose or high performance when machining extremely tough, hard or highly abrasive material which cause rapid dulling of the cutting edge.

It is important that more care be taken when using premium grade tools. They are generally harder and more brittle, making them more prone to chipping and breaking.

Premium grade M series of steel such as M35 or M42 contain Cobalt. These grades have what is known as "high hot hardness" - this is the ability of the tool to remain hard at high cutting temperatures. Very often Cobalt grade tools are marked "Co" or "HSCo". Some manufacturers apply a straw or bronze finish to the tool for easier identification.

Other premium grades of steel include a range which are generally named "PMC" grades. These are materials made by a slightly different process and are generally known as Powder

Metallurgically Compacted steels. These steels have a high resistance to chipping and consequently are expensive.

Examples are:-

ASP23 No Cobalt often used in taps

ASP30/60 With Cobalt often used in End Mills.

Carbide is an extremely hard material with a very high resistance to heat and abrasion.

Carbide is also very brittle, making it very easy to chip and break. Because of their brittleness, carbide tools are generally used in machines that are very accurate.

The high heat resistance of carbide allows carbide tools to be run at much higher speeds than High Speed Steels, making them ideal for high production applications where high machine speeds are available.

Carbide tools generally run many times faster than High Speed Steel tools.

STEEL GRADES

SOFT/TOUGH



BRITTLE/HARD

M2 PMC23
No Cobalt

K945
2.5% Cobalt

M35
5% Cobalt

M42 PMC30
8%/8.5% Cobalt

CARBON STEEL:-

Is NOT used for drills or milling cutters.

Carbon Steel is much softer and less brittle than High Speed Steel and therefore is ideal for the manufacture of:-

Cut thread Taps

Dies

Dienuts

These tools are only used in hand operations and substantial heat is not generated.

Within the PRESTO range of cutting tools the following grades can be found.

M2	High Speed Steel	Standard Drills Jobber, Stub, Long Series, Taper Shank Standard ISO Taps Standard Reamers - Hand & Machine HSS Milling Cutters
PMC	3.1% Vanadium	DIN Std Taps
M42	8% Cobalt	Heavy Duty Drills Jobber, Stub, Long Series, Taper Shank Cobalt Milling Cutters.
M35	5% Cobalt	Jobber Drills
4241 / 4341	High Speed Steel	Jobber Drills