Nuova Simat Srl
High Technology Maintenance

EFCO

Grinding and Lapping Compound Overview

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Packaging unit / minimum order value

Type	Packaging unit
Abrasive (Paper / Film / Fabric)	100 pieces
Abrasive (EFCO-SIT)	25 pieces
Grinding Sheets	1 piece
KS-6 grinding circular blank	1 piece
Grinding sleeve, conical	1 piece
Lapping paste	100g / 500g / 1000g
Lapping spindles	1 Set (3 pieces) / 1 Set (6 pieces)
Lapping discs smooth	1 piece
GSS – grinding spindles	1 Set (6 pieces)
GSS – grinding cups / grinding wheel / grinding cone	1 piece

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- Minimum order value for all consumables is 80,- EURO.

  All standard dimensions and grains are available at short notice.
  Further dimensions or grains can be supplied upon request.

Grinding

Grinding is a machining process during which every grain which comes into contact with the material rips a minute chip out of the material.
According to DIN 8580, this process is a cutting process.

Grinding is used for:

- grinding tools to sharpen the cutting edges of tools, e.g. drill bits, saws, lathe tools, milling cutters, either manually or by machine.
- smoothing surfaces (metal and glass can be ground to a mirror finish, and a dimensional accuracy of 2.5 micrometres can be achieved).
- finishing of hardened surfaces, e.g. **sealing faces**, gauges, bearing faces, by means of cylindrical grinding, surface grinding, profile grinding.

Using the latest finishing methods, workpieces can be produced which are almost as **smooth and dimensionally accurate** as with lapping.
Grinding achieves higher removal rates which means that grinding is more economical.

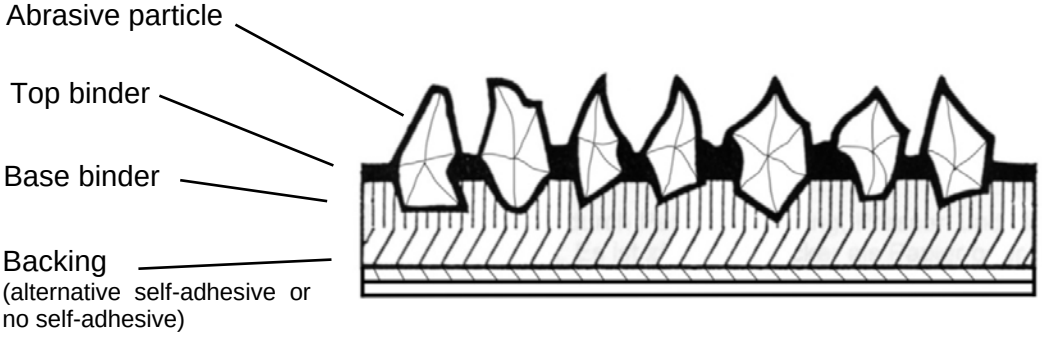
Abrasives on a substrate

Abrasives are those grains of hard material which are used to achieve the material removal and are usually bound to grinding tools (abrasive paper).
The following basic requirements apply to all **abrasives**.
The abrasive should be:

- very hard and as tough as possible so that the material is removed from the workpiece and so that the cutting edges keep their sharpness for a reasonable length of time;
- resistant to thermal cycling so that the grain can withstand high machining temperatures as well as rapid temperature changes;
- chemically resistant so that no chemical compounds are formed which might weaken the grain, even during higher pressures and temperatures in conjunction with air, cutting oils or workpiece material.

A large part of grinding tasks during manufacturing is the machining of workpieces with abrasives on a substrate. These cover a wide range of applications which range from rough machining via fine machining to polishing.

The most important components of grinding tools are:



Abrasive

The abrasive is the actual cutting element.
Abrasives are distinguished with regard to size, various grain mixtures and static distribution of grain diameters according to **macro** (P 12…P 220) and **micro graining** (P 240…P1200). The letter **P** in front of the grain number shows that the grain size of abrasives on a backing is as per standard.
The letter **P** stands for **particle size**.

Particle size comparison

P	P80	P280	P500	P1000	P1200, P1500, P1800
µ	200µ	60µ	30µ	15µ	9µ

Abrasives can be divided into:

- **natural abrasives** (e.g. diamond, natural alumina, garnet, emery, quartz)
- **synthetic abrasives** (e.g. synthetic diamond, cubic crystalline boron nitride (CBN), fused alumina, zirconium oxide, silicon carbide).

Today, the synthetic abrasives, such as fused alumina, silicon carbide, zirconium oxide, cubic crystalline boron nitride and diamond, are almost the only ones of technical importance.

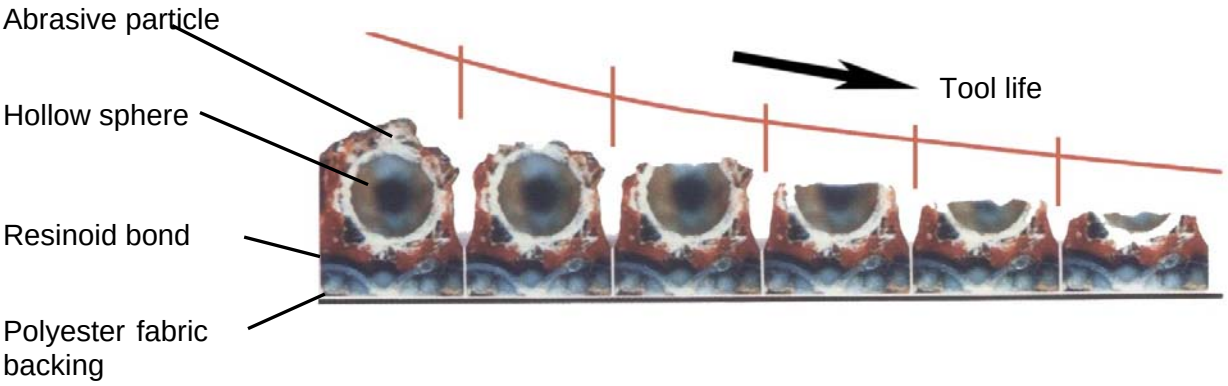
Aluminium oxide (Al_2O_3):
A very tough synthetic mineral of high strength.
The ideal abrasive particle for almost all grinding tasks.

Silicon carbide (SiC):
A particularly hard synthetic abrasive particle with a very high cutting efficiency.
Particularly well suited for cast iron, non-iron metals, paints, glass, plastics, porcelain and vulcanite.

Zirconium oxide (ZrO_2):
An extremely hard synthetic abrasive particle with high compressive strength for all grinding work which requires large chip removal (steel, titanium).

Abrasives with ceramic bonded hollow sphere (EFCOSIT)

Synthetic resin bonded grinding belt with ceramically bonded hollow spheres on a heavy polyester fabric backing (particularly tear resistant).
The hollow spheres which break up and are thus self-sharpening provide a longer tool life compared to comparable abrasives of the same grain size.
Chips flow away more easily. The abrasive surface does not clog so that a uniform surface roughness is obtained.



Binder

Binders for abrasives must hold the abrasive grains on the backing up to the end of the tool life.
As a rule, two binder layers are required for this.
The **base binder** fixes the abrasives particles distributed over the backing in their position.
The **top binder** which is then applied provides safe support of the abrasive particles.
Natural glues, synthetic resins and varnishes are used for this purpose.

Backing (for abrasive particles)

The backing is a flexible substrate to which the abrasive particles are anchored.
The backing material which is used for the abrasives features various characteristics like elasticity, flexibility and tightness.
Distinguish between the following backing material:

Paper (self-adhesive *)

Paper with different surface weights is normally used as backing. Paper with a special waterproof impregnation is used for wet grinding. Thin paper is generally suitable for manual grinding, and thicker paper is required for mechanical grinding. Paper is the most widely used backing because it meets requirements in the majority of usage cases.
Grinding materials with paper backing have a good price/performance ratio.

Fabric / linen (self-adhesive * or no self-adhesive)

In cases where greater demands are made of the strength and flexibility of the grinding material, backing made from cotton, polyester or blended fabric can be used. Fabric backing is more durable than paper and provides better tear resistance and extremely good elasticity.
These abrasive grit carriers can be either non-waterproof or waterproofed by means of impregnation.
A distinction is made between light/flexible fabric, heavy fabric with good tear resistance and average flexibility, and fabric with an extremely heavy and stable backing.

Film (self-adhesive *)

Plastic film provides extremely consistent material thickness and water resistance when it used as a carrier material. A great number of grinding tasks are in the micro-finishing area, where extreme precision is required (when grinding ***safety valves***, for example). The “hard” backing provides a uniform finish.

* temperature-resistant und waterproof

EFCO-GSS – Grinding Tools (CBN)

The EFCO GSS grinding tools are coated with cubic crystalline boron nitride (CBN) of grain size B252 with a galvanic bond.

CBN – cubic crystalline boron nitride

CBN is highly suitable for the machining of long-chipping materials, such as **tool steel, HSS, high-alloy steels etc., hardened to at least 45 HRC.**
The good thermal stability of CBN in combination with its high hardness is what makes economical grinding at the higher machining temperatures of these steels possible.

CBN as an abrasive is distinguished in particular by:

- thermally stable up to about 600°C (1112°F)
- resistant against chemicals, steam and other aggressive media
- grinds stellites, steels, cast iron and bronze aggressively
- excellent for the removal of scale layer
- consistent machining over the whole tool life
- can also be used on hard faced sealing faces

Galvanic bond

The abrasive CBN particle is bonded to a nickel layer which has been bonded to the carrier using a galvanic process.
This bond is very open, grinds very aggressively and is suitable for the grinding of steel, carbide, plastics, etc., if the correct grain size is chosen.
The galvanic bond is generally applied in a single layer, i.e. the thickness of the layer corresponds approximately to the grain size and can thus not be dressed or re-profiled on wear.

Lapping

Lapping is a machining process to **smooth surfaces** whilst maintaining close tolerances and flatness.

An abrasive embedded in a lubricant is used for lapping. In contrast to grinding where the abrasive is anchored to the backing material lapping works with a moving (rolling) grain.

DIN 8589 divides lapping into two groups:

- Lapping with lapping paste
- Lapping with lapping liquid

Lapping with lapping paste

Lapping plates / lapping spindles of grey iron are used for lapping.
Lapping pastes can be applied to the sealing face or lapping plate / lapping spindle constantly as required.
After lapping, sealing face and lapping plate must be degreased and cleaned to 100 %.

Lapping with lapping liquid

Selection of the correct lapping agent

- Aluminium oxide Al_2O_3
  For machining semiconductor materials (e.g. silicone and germanium), light alloys and non-ferrous metals, coal, plastics, soft steel, cast iron, etc.
- Silicon carbide SiC
  For the machining of grey iron, steel (soft, hardened, alloyed), stellite, ceramics, glass, plastics, titanium, carbide, etc.
- Boron carbide B_4C
  For the machining of carbide, ceramics, etc.

Grain size

Guideline values for achievable roughnesses depending on the lapping powder are shown in the table on the following page. If the same lapping grain is used, hard materials have better surface characteristics than soft materials.

Lapping agent

The machining tasks are determined not only by the type of lapping powder, but also by the mixing ratio of grain to carrier.

The carrier is usually a lapping oil or a water-based agent. EFCO recommends lapping oil as carrier.

One criterion for the quality of a lapping agent (grain + carrier) is, amongst other things, its miscibility (no agglomeration, no early separation).

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Grinding- and lapping recommendation

Material to be machined, Valves to be machined \ Recommended grinding and lapping compound	GSS (cubic boron nitride) B252	Silicon carbide (SiC) On paper self-adhesive P80, P280, P500	special fused aluminium oxide (Al_2O_3) on paper self-adhesive P80, P280, P500	special fused aluminium oxide (Al_2O_3) on folio self-adhesive P80, P280, P500, P1000	Semi-fused aluminium oxide (Al_2O_3) on fabric P100, P280	zircon aluminium abrasive (ZrO_2+ Al_2O_3) on fabric self-adhesive P80	EFCOSIT (Al_2O_3) corundum hollow balls on fabric self-adhesive P120	EFCOBOR (lapping paste) P80, P120, P220, P400, P800, P1000, P1200, P1500
Ordinary steel, unalloyed and alloyed (unexpired))	-	o	+	+	+	+	o	o
Iron / cast iron	o	+	+	+	+	+	o	+
Bronze, red bronze, brass	-	o	+	+	+	+	o	o
Cobalt hard-facing (Stellite)	++	+	+	+	o	+	o	+
Nickel hard-facing	++	+	+	+	o	+	o	+
Tempered steel, tool steel over 45 HRC, high-speed steel	++	+	+	+	o	+	o	+
Chrome- and chrome-nickel steel (rust-resistant steel) heat resistant nickel-alloy	-	o	+	+	o	+	+	o
Safety valves (for highest precision and even surfaces)	-	o	o	+	o	o	-	+
Hot valves (fort he use with high temperatures)	++	-	-	-	o	o	o	o
Strong tinder	++	+	o	o	o	o	o	o

++ = optimal
+ = particularly suitable
o = partially suitable
- = non suitable

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