



## MACHINING OF MAGNESIUM

### 2.2 SWARF HANDLING

#### **SWARF HANDLING**

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Chips should be cleared regularly during machining to avoid accumulations on floors and machines. Chip sweepings should be placed in closed drums and kept dry. Regular frequent inspection and cleaning as necessary of all areas where Mg is machined should be conducted. Attention must be paid to ledges, roof rafters and electrical equipment. Swarf should be stored in appropriate containers.

It is important to segregate swarf. Magnesium chips rasping and turning should never be mixed with chips from other types of materials. Segregation of swarf is crucial if any value is to be retained from recycling. Fluid and chips ideally should be separated as soon as possible after machining. Use of a centrifuge, hydroclone, compaction or briquetting machine would help to reduce the danger associated with the storage and handling of wet magnesium chips. Many large companies have centrifuge, cyclonic or briquetting facilities on site.

#### **SWARF STORAGE**

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Swarf should never be stored in sacks. Examples of suitable storage equipment are type IA2 UN approved steel drums with removable lids. Storage buildings should be non-combustible or have explosion proof venting. Outdoor storage is preferred for wet and oily chips.

#### ***Dry chips, turnings and swarf***

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These should be placed in dry, tightly closed, non-combustible containers such as UN approved steel drums. Safely stored, kept dry and clearly labelled. Storage should be in a dry atmosphere and in isolation from flammable materials. Chips covered in mineral oil can be stored the same way as dry chips.

#### ***Wet chips, turnings and swarf***

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These should be placed in covered but well ventilated non-combustible containers such as UN approved steel drums. Vents should allow hydrogen gas to escape and reduce the chance of a build up of pressure. The containers must be clearly labelled and stored in a remote location away from sources of ignition. Drums should not be stacked. The area must be well ventilated in order to avoid the build up of hydrogen gas. Covered outdoor storage is preferred. This allows hydrogen gas to dissipate. Disposal of wet swarf should be frequent as partially dry chips may ignite spontaneously.

## FIRE PRECAUTIONS

Magnesium must be heated to its melting point before it can burn. Therefore, magnesium components will not ignite easily. Magnesium swarf can be ignited, but simple precautions and good housekeeping can help to avoid the risk. The finer the particles of Mg become the more easily they are ignited, so special care needs to be exercised with fine swarf. The following points should be considered in order to minimise the production of swarf and to avoid its accumulation.

- 1 Keep cutting tools sharp with large relief angles. Fires may be started by friction producing dust at the cutting and trailing edges of the tools.
- 2 Use heavy feeds where possible to produce coarse chips which reduce the risk of ignition. Try to avoid fine feeds that increase heat from friction.
- 3 Do not allow tools to dwell and rub on the work piece after the cut.
- 4 Use compressed air to cool tool tip and work piece as well as to control swarf.
- 5 Use appropriate mineral oil or inhibited emulsion when necessary.
- 6 Collect turnings frequently and store in the correct way.
- 7 Do not allow turnings to accumulate by keeping the floor and all machines dry and free from swarf.
- 8 Keep suitable fire extinguishing media to hand (see Table 1).

Should a fire occur, dry turnings will burn slowly and evenly but can flare up if disturbed. Fine swarf will burn more quickly and vigorously. The principle for dealing with burning magnesium swarf is to conduct the heat away and to exclude air. The way to tackle a magnesium fire is to cover and suppress rather than disturb the swarf. Blasting with extinguishing media can cause the burning swarf to spread and will greatly intensify the fire.

The presence of water will greatly intensify and accelerate combustion as it will dissociate to form oxygen and hydrogen. Hydrogen is explosive therefore water should not be used to extinguish magnesium swarf fires.

The best extinguisher is sodium chloride extinguisher or graphite metal-base powder both of which quickly smother flames without damaging either machinery or the unburnt swarf. Examples are Met-L-X or G-I powders. Although dry sand could be used, care should be taken as water may be present from the atmosphere. If sand is to be used, it is recommended that the sand is kept in moisture proof containers.

Argon can be used if applied by a purge system so that the fire is not disturbed or aggravated by high pressure gas bursts. However, its use is limited to enclosed spaces so that a large concentration of gas over a long period of time is maintained. Magnesium will continue to burn even when covered by nitrogen gas or carbon dioxide. The latter will form toxic carbon monoxide gas. Therefore N<sub>2</sub> and CO<sub>2</sub> should not be used to extinguish magnesium fires.

Table 1 – FIRE EXTINGUISHERS

| Recommended   | Do Not Use   |
|---|--|
| Type D fire extinguisher<br>e.g. Met-L-X / G-I powder<br>DRY Sand<br>Cast Iron chips (Dry)<br>Argon gas | Water<br>Foam<br>A, B, C fire extinguishers<br>Carbon dioxide,<br>Nitrogen |

Although magnesium is machined safely worldwide, some companies appear to have used the new European Directive 98/37/EC as a way to market fire suppression systems.

There is actually no specific mention of magnesium in this document but the following paragraph has been highlighted.

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### EUROPEAN DIRECTIVE 98/37/EC MECHANICAL EQUIPMENT – MACHINERY

#### 1.5.6. Fire

Machinery must be designed and constructed to avoid all risk of fire or overheating posed by the machinery itself or by gases, liquids, dust, vapours or other substances produced or used by the machinery.

### SWARF TRANSPORT

Magnesium swarf is classified by the United Nations Committee of Experts on the Transport of Dangerous Goods. Transport of magnesium chips, turnings and rasping should be in UN approved drums type IA2, steel with removable lids.

### SWARF DISPOSAL AND RECYCLING

Magnesium swarf and turnings should be handled with caution and disposed of using an approved route. Magnesium Elektron are committed to recycling magnesium metal containing products arising from the metals industry. Chips, swarf and turnings may be accepted for recycling in the modern purpose built facility in Manchester, UK.

The value of material will be dependent on the alloy, condition and the presence of contaminants. Further details are available in Magnesium Elektron Datasheet No. 258.

† The information contained within is meant as a guideline only

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