Precision engineering
Plasma, water jet, CNC, and laser cutting machines
Computer numeric control (CNC) cutting machines are encountered in a range of engineering businesses as part of a manufacturing process or to supplement traditional metalworking machinery. Use of CNC lathes and milling machines is increasingly common in precision engineering workshops. CNC machines are unlikely to involve the use of any highly flammable liquids but may contain machine oils, hydraulic oils and metalworking fluid.

CNC machines are computer controlled. Typically, computer aided design (CAD) and computer aided manufacturing (CAM) programs will produce a file that is loaded onto the CNC machine, which then produces the required component.

Plasma cutting works by sending an electric arc through a gas, such as nitrogen, argon or oxygen, which in turn passes through a constricted opening. The temperature of the gas rises so that it enters a fourth state of matter called plasma. The plasma conducts electricity from the torch to the work piece, heating the work piece and melting the metal. The high velocity stream of ionised gas blows the molten metal away thus creating the cut.

Traditional oxy-fuel cutting by burning the metal can only be carried out on material that supports the oxidising process, such as steel and other ferrous metals. As plasma cutting does not rely on oxidation, it can cut aluminium, stainless steel and any other conductive metal.

This is the process of cutting materials using a very high pressure jet of water. Where harder materials are the subject of water jet cutting, as is the case with metal or granite, abrasives can be added to the water to ensure the force is great enough to achieve the cut. This method of cutting can be preferred when the material being cut is sensitive to high temperatures. It is also often used during the fabrication of machine parts.

Four and five axis cutting heads are now available that can produce very intricate components. These machines are unlikely to involve the use of any highly flammable liquids but may contain hydraulic oils.

A highly accurate method of cutting with excellent cut quality, laser cutting makes it possible to cut very intricate shapes and small holes. A very high energy laser light beam is directed on to the material. A focusing lens then concentrates all of the energy in to a small point causing rapid localised melting and part vapourisation of the material. An assist or cutting gas, such as oxygen or nitrogen, is then directed through the nozzle to expel the molten material.
Risk Features

Business Interruption

There are a range of CNC machines in the market, with machinery manufacturers having locations worldwide. Investment in a new CNC machine or plasma/laser/water jet cutting machine is usually significant for any company, and new CNC machines can cost several hundred thousand pounds or more.

Some machines may be available ‘off the shelf’ but lead times of several months or longer can be expected depending on the complexity of the machine, which creates the potential for significant business interruption claims.

It can also be both costly and lengthy for modern parts to be retrofitted to any older or obsolete machinery in the event of partial damage.

As with many other manufacturing trades, brokers will be interested in their client’s machinery dependency, process bottlenecks, any outsourcing potential and the availability of replacement machinery and parts. All of these factors will influence the indemnity period, along with wider business interruption considerations.

Employer’s Liability

All precision engineering manufacturing processes carry the potential for injury to employees. Metal engineering is generally a noisy process, and chemicals used in the production process present both respiratory and dermatological hazards. COSHH and noise assessments are important for any business to identify, eliminate or mitigate the injury or disease potential from everyday processes.

Most accidents involving machinery happen when operators are loading or unloading components, removing swarf or taking measurements and making adjustments. Fixed and interlocking guards play a critical role in ensuring employees are protected from dangerous machine controlled movement. Ensuring that there are safe means to remove swarf and adjust coolant will also mitigate injury potential.

Plasma arc cutting operations provide clean cuts at fast cutting speeds and can be used to cut any metal. There is greater potential for increased levels of fume, noise and radiation when compared with oxy-fuel cutting processes. Fume levels do however depend on many factors such as the arc current, cutting speed, the material being cut and the plasma gas used.

Laser cutting operations generally involve fine cutting with gas, and generated fume levels are likely to be lower than those associated with oxy-fuel gas cutting and plasma arc cutting. Noise levels also via this method are generally lower. Additional risks associated with operation, setting and maintaining the laser and associated equipment will be introduced and need to be controlled.

Accidents involving CNC controlled machines can occur when trapped items or blockages need clearing, and during fault finding, setting and repair and maintenance of the machine itself. Provision of guarding, work zone enclosures, enclosing guards to control noise and dust emissions and containment of vision panels to prevent ejection of parts from the machine will all help to protect employees from workplace injury.

Typically this type of machinery is of a more modern design and fitted with the necessary interlocked guarding and or light guards. CNC machinery continues to become more advanced, with many injuries noted on such machines occurring during resetting, maintenance and cleaning operations rather than when being operated.
Material Damage

One of the attractions of CNC machines is their ability to operate unattended and/or out of business hours for long periods. This reduces labour costs against more traditional manufacturing methods, requiring significantly less manual operation of machines and delivering high tolerances of accuracy. Machines can operate unattended when a particular job requires many hours of machining or if the machine is fitted with an automatic bar feed for example where new material can be automatically fed into the machine throughout the unattended period.

Unattended running of machinery is generally not an attractive feature for insurers. Safety cut out systems may fail to operate or not be present at all so a small fault in an unattended machine can quickly escalate to a major problem when no one is in attendance to spot and correct the issue quickly. Plasma/laser/water jet cutting machines are less likely to operate unattended or outside business hours.

Spark erosion/EDM is used when intricate detail needs to be achieved as part of the machining process, which isn’t always possible with other processes. The process involves both the metal workpiece and the tool being connected to a direct current which produces a spark. Where the spark contacts the surface of the workpiece, it is heated to a high temperature and the resulting molten metal evaporates creating the desired indent, with synthetic fluid controlling the temperature of the process.

Public Liability

Products manufactured may be component parts or completed items. Consideration of risk will relate to the end usage of the product and its functionality. It is important to understand the client’s position in the ultimate chain of supply and also whether they provide any design function.

Products with a safety critical function or those ultimately intended for the North American market can represent additional risks that require a robust risk management approach.

Defects in batches of products may arise if there is a fault in the metal structure of a component part. Issues can manifest as brittle fractures and latent cracks which could eventually result in the failure or unsuitability of the product supplied.

Quality control measures play an important role in mitigating this risk, particularly if materials are sourced from the Far East. Imports from the Far East have increased primarily as a result of lower labour prices and greater investment in modern technology. Whilst statutory controls apply to imported goods, certification does not always guarantee the quality of materials and workmanship and it is important that material sourced from overseas meets the client’s standards.

Where import is involved, it is important that the client retains full traceability for the materials and any parts supplied to them.

Good quality control measures include ongoing reviews of the design and formulation of products, product testing, identification and recording of product distribution, controls on packaging and labelling and formulating a recall plan.
The tables below highlight some specific hazards present in engineering and metal workers, along with those associated precautions which will help prevent major loss of physical property. Generic risks resulting from arson, electrical sources and waste are not mentioned here.

### Material Damage and Business Interruption Hazards

#### Features always present

<table>
<thead>
<tr>
<th>Hazard</th>
<th>Control</th>
</tr>
</thead>
<tbody>
<tr>
<td>Risk of ignition as a result of heat being generated by the friction between the cutting tool and workpiece.</td>
<td>▪ Regular maintenance of machinery.</td>
</tr>
<tr>
<td>Sparks generated by the cutting process.</td>
<td>▪ Ensure working areas are clear of combustible materials and adequate fire extinguishers are provided.</td>
</tr>
</tbody>
</table>

#### Features sometimes present

<table>
<thead>
<tr>
<th>Hazard</th>
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</tr>
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<tr>
<td>Unattended operation – blown film line is an automated process.</td>
<td>▪ Should not be run unattended</td>
</tr>
<tr>
<td>Severe material damage can occur if a fault arises during unattended operations.</td>
<td>▪ Regular maintenance of machinery.</td>
</tr>
<tr>
<td></td>
<td>▪ Fitting of fire detection and fire suppression systems to individual machines.</td>
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<td></td>
<td>▪ Fail safe modes to ensure machines switch off in the event of a recognised fault, e.g. broken tool.</td>
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<tr>
<td></td>
<td>▪ *Please note that not all unattended processes will be deemed acceptable to underwriters irrespective of the controls in place.</td>
</tr>
<tr>
<td>Risk of contamination from use of minerals, cutting oils and the generation of mist.</td>
<td>▪ Regular cleaning of surfaces in an environment that is well ventilated will reduce the risk of contamination.</td>
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<tr>
<td>Machining of exotic or combustible materials (e.g. titanium, magnesium) or non-metal materials such as plastic increases the fire load, particularly when these are in a finely divided state as waste. There are also certain spontaneous combustion risks associated with exotic materials e.g. machining of cadmium and magnesium.</td>
<td>▪ Good housekeeping and regular removal/containment of waste.</td>
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<tr>
<td>Increased potential for theft where non-ferrous materials are present.</td>
<td>▪ Good physical security should be supplemented by approved intruder alarm protection with police response.</td>
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<tr>
<td>There is an associated water and/or corrosion damage risk with machinery.</td>
<td>▪ Where relevant, stock or finished goods should be stored off the floor on pallets or in racking.</td>
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<tr>
<td>Increased disruption in the event of replacing specialised equipment.</td>
<td>▪ A Business Continuity Plan should be formulated and regularly tested.</td>
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<td></td>
<td>▪ Important data (designs and drawings, customer orders etc.) should be backed up off site.</td>
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<tr>
<td></td>
<td>▪ Opportunities for the client to source the finished product or sub-contract production from a third party in the event of a disruption should be explored.</td>
</tr>
</tbody>
</table>
Employer's Liability, Public and Products Liability

The table below highlights some specific hazards present in engineering and metalworking environments, along with the associated controls to help prevent significant injury or third party property damage. Generic risks arising from manual handling, warehousing or any work away from the premises are not mentioned here.

**Liability Hazards**

<table>
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<tbody>
<tr>
<td>Cuts and burns to the skin can be incurred from the ejection of parts and/or associated waste.</td>
<td>Training of operatives in correct safe process and operation. Implementation of guarding systems and regular checks. Provision of relevant PPE such as safety glasses with signed records. Formal communication of risk assessments and safe operating systems on a signed and receipted basis. Regular planned and predictive maintenance.</td>
</tr>
</tbody>
</table>
| Range of Occupational Health issues including:  
  - Respiratory illness  
  - Noise induced hearing loss  
  - Eyesight damage  
  - Vibration exposure. | Formal noise risk assessment by competent and trained person required. Reduce noise levels via engineering control. Ensure all machinery is fitted with appropriate fixed or interlocking guarding which remains maintained. Containment of vision panels to prevent ejection of parts from the machine. Workplace health screening. Correct selection of machinery and layout of process to achieve good segregation. Use of good safe systems of work for maintenance activities. Provision of PPE as very last line of defence. Monitoring of employees to ensure PPE being worn. PPE issue and sign off records. |
| Failure of products due to defect. | Routine and robust quality control procedures with particular emphasis on safety critical or high potential liability components manufactured. Quality control inspections could include visual inspection batch testing, thickness measurements and defect detection systems which can include surface and embedded techniques. Records of products testing together with calibration of testing equipment needs to be maintained. Full traceability should also be maintained in respect of products or parts supplied. |
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- We don’t outsource our Risk Management service meaning our specialist surveyors build strong relationships with you and your clients.
- AXA qualified engineers can review business continuity plans and offer additional supporting tools where appropriate.
- We have more than 50 experienced specialist surveyor experts carrying out site inspections throughout the UK.
- We have one of the most qualified loss prevention teams of any UK insurer with over 850 years of combined experience in the manufacturing sector.

Get in touch

To find out more about our mid-market AXA Vantage proposition please visit AXA Connect, where you will find all our mid-market proposition guides along with all your local mid-market contacts.