



Hazards	Safe system of working (control measures)	Tick
Electric shock	<ul style="list-style-type: none"> <li>If the machine is permanently fixed, it should have an electrical isolator on or adjacent to the equipment (preferably a fused switched-disconnector)</li> <li>If the machine is portable, the mains socket should be protected by a residual current device. The operational effectiveness of the unit should be verified and recorded on a frequent basis, in accordance with the manufacturer's instructions. Plugs should be removed when the equipment is not in use</li> <li>Cables should be regularly inspected for wear and damage and to ensure that they are in good condition</li> <li>Line bending heaters with heated tensioned resistance wire should be of separated extra-low voltage (SELV) type and should have a transformer designed to protect against mains voltage breakdown to the secondary windings</li> <li>The electrical supply to the cutting wire on hot wire cutters should not exceed 25V and should be supplied from a separated extra-low voltage (SELV) source. The voltage should be adjustable to a level that does not produce fumes at typical cutting speeds. If possible, a 'push to make' foot or pressure operated switch should be provided to control the power supply to the cutting wire</li> <li>Moulding trimming machines must be controlled by a starter incorporating overload protection and no-volt release and have a conveniently positioned, mushroom-headed stop button</li> </ul>	<input type="checkbox"/>
Cutting blades/discs	<ul style="list-style-type: none"> <li>On moulding trimming machines, drive mechanisms should provide with fixed guarding that requires a tool for removal, and interlocked guards and cutter guards where practicable. Adjustable fences or guides should be provided if there is a risk of 'snatching'</li> <li>Hands should be kept well away from blades when holding and removing material</li> </ul>	<input type="checkbox"/>
Foreign bodies	<ul style="list-style-type: none"> <li>Suitable eye protection should be available near to all equipment</li> <li>Eye protection should be worn at all times</li> </ul>	<input type="checkbox"/>
Absorption of moisture by hygroscopic material	<ul style="list-style-type: none"> <li>Certain plastics materials (especially nylon) absorb moisture. These should be stored in airtight drums, and dried in accordance with manufacturers' data sheets</li> <li>WARNING: absorbed moisture in plastics can form steam that can cause hot material to eject from injection moulding machines</li> </ul>	<input type="checkbox"/>
Compressed air	<ul style="list-style-type: none"> <li>A risk assessment should be completed to cover the use of compressed air</li> </ul>	<input type="checkbox"/>
Flooring	<ul style="list-style-type: none"> <li>See BS 4163:2014 Section 6 Working Area Environment</li> </ul>	<input type="checkbox"/>
Lighting	<ul style="list-style-type: none"> <li>See BS 4163:2014 Section 6 Working Area Environment</li> </ul>	<input type="checkbox"/>

**Teaching Strategies**

<ul style="list-style-type: none"> <li>• It is essential that risk assessments are completed to cover the use of each piece of equipment by learners and colleagues. This will normally involve the adoption and adaptation of model risk assessments, e.g. BS4163:2014</li> <li>• It is essential that a regular maintenance programme is put into operation and that a maintenance log is kept. This should involve daily, weekly and termly checks, covering general maintenance and identifying any faults that require repairs</li> <li>• A competent person should carry out portable appliance tests at least every 12 months and records of inspections and test results should be kept</li> <li>• Learners should be aware of the hazards associated with the equipment and precautions that should be taken during use</li> <li>• Before using the equipment, learners should be trained and assessed as competent, and a record of their training should be kept</li> <li>• Learners should be supervised at all times by a trained, competent person</li> <li>• Health and safety rules should be available and observed for all pieces of equipment</li> </ul>	<input type="checkbox"/>
<p><b>Demonstration of each piece of equipment to learners should highlight safe working procedures</b></p> <ul style="list-style-type: none"> <li>• For example in relation to injection moulding machines:           <ul style="list-style-type: none"> <li>• The position and use of all controls</li> <li>• How to switch heaters on and choose heating levels</li> <li>• How to attach dies and clamp securely in place</li> <li>• How to load the hopper or plastic reservoir</li> <li>• How to operate the injection of plastic – manually or automatically</li> <li>• How to open dies and extract components correctly</li> </ul> </li> </ul>	<input type="checkbox"/>
<ul style="list-style-type: none"> <li>• In relation to vacuum formers:           <ul style="list-style-type: none"> <li>• The position and use of all controls</li> <li>• How to switch heaters on and choose heating levels</li> <li>• How to raise and lower the table</li> <li>• How to clamp the plastic</li> <li>• How to apply heat</li> <li>• How to use the timer</li> <li>• Procedure for making a forming</li> </ul> </li> </ul>	<input type="checkbox"/>
<ul style="list-style-type: none"> <li>• In relation to strip heaters:           <ul style="list-style-type: none"> <li>• The position and use of all controls</li> <li>• How to switch on the heater and choose appropriate heating levels</li> <li>• How to raise and lower the height of the work support</li> <li>• How to mark on material the position of the bends</li> <li>• How to apply heat evenly by turning over and heating both sides</li> <li>• How to plan for a sequence of bends and allow for radius</li> <li>• How to handle hot plastics and the use of gloves</li> <li>• How to use a simple jig to aid accuracy/consistency</li> </ul> </li> </ul>	<input type="checkbox"/>
<ul style="list-style-type: none"> <li>• Preferably one learner should operate the equipment at a time. Risk assessment should identify exceptional circumstances where this is not be the case</li> <li>• If fumes are produced by heated materials, the machine should be switched off, the room evacuated as necessary and ventilated</li> <li>• Equipment should not be left unattended when heating plastics</li> </ul>	<input type="checkbox"/>

**Assessment Task 2  
 Practical Skills**

**Machine operation:**

**Demonstrate use of the following moulding processes and equipment as required, highlighting:**

- Safe and appropriate positioning of the equipment
- Safe and correct working procedures
  
- Injection and extrusion moulding machines
- Moulding trimming machines
- Vacuum forming machines
- Hot wire cutters
- Strip heaters and line bending heaters
- Ovens
- Blow moulders

**Exemplar tasks suitable for training using strip heaters and vacuum formers are detailed below**

**Strip heaters and line bending machines**

**Line bend thin plastic (such as HIPS) to a simple U shape, to demonstrate:**

- Marking the position of the bend on the edges where possible
- Correct adjustment of the height of the work rest
- Selecting the temperature and allowing the heater sufficient time to reach operating temperature
- Observing and testing the readiness of the plastic type and thickness for bending
- Adjusting temperatures where uneven heating occurs

**Line bending thick plastic (such as 6mm acrylic) to a 90 degree angle, to demonstrate:**

- That it is easier and safer to drill and shape the plastic before bending is carried out
- That it is easier and safer to finish the edges of the plastic with wet or dry abrasive and then buff to a shine before bending
- Marking the position of the bend on the edges where possible
- Turning frequently to soften the plastic from both surfaces in order to avoid overheating and blistering
- Correct adjustment of the height of the table rest
- Selecting the temperature and allowing the heater sufficient time to reach operating temperature
- Observing and testing the readiness of the plastic type and thickness for bending
- Adjusting temperatures where uneven heating occurs
- Using gloves to handle the hot plastic
- Using a suitable former to shape the bend to 90 degrees

**Vacuum forming machines****Vacuum form thin plastic (such as PET, the type often used for packaging), to demonstrate:**

- Correct adjustment of the clamps for the material thickness
- Selecting the temperature and allowing the heaters sufficient time to reach operating temperature
- Observing and testing the readiness of the plastic type and thickness for moulding
- Adjusting zone temperatures where uneven heating occurs
- Making a forming
- Removing the vacuum to release the mould

**Vacuum form a thicker plastic to that above (typically HIPS), to demonstrate:**

- Correct adjustment of the clamps for the material thickness
- Selecting the temperature and allowing the heaters sufficient time to reach operating temperature
- Observing and testing the readiness of the plastic type and thickness for moulding
- Adjusting zone temperatures where uneven heating occurs
- Making a forming
- Removing the vacuum to release the mould

**Identify good design features on a vacuum forming mould, to demonstrate:**

- Properties of the materials that are used
- Curved edges to reduce creasing of the plastic
- Draft (slope at least 10 degrees) applied to the sides of the mould to allow it to be removed from the plastic easily after forming
- Surface finish and the affect on the quality of the finished moulding
- Creating rigid moulding through the use of a base and the principle of 'shell structures'
- Strategic drilling of fine air holes in the mould to improve fine detail when moulding
- Identify the typical causes of creasing and poorly defined mouldings

