

Health and Safety Training in Design and Technology Design and Technology Association

Specialist Level: Secondary Materials Health and Safety (SMHS)

Forename:	Surname:	 	
School / College/ Institution		 	
Course date: / /	RDTHSC:	 	

Colleagues must demonstrate their theoretical and practical knowledge, skills and understanding of the use of moulding processes and equipment in school workshops by completing the following assessment tasks

Please tick in the appropriate column to confirm your knowledge and understanding and that you have completed the practical tasks set

Assessment Task 1 Hazards and Control Measures

Hazards	Safe system of working (control measures)	Tick
Fumes	 Appropriate materials should only be used, in order to reduce the production of fumes, by reference to material data sheets Where harmful fumes are released, a risk assessment should be carried out to determine if LEV should be provided Equipment should never be left unattended when plastics are being heated Hot wire cutters should only be used to cut expanded polystyrene When using ovens, only thermostatically controlled electric ovens should be used to heat plastics materials. The temperature controller should include a heat limit facility set to 250°C to 300°C. Fan circulated ovens should be used if practicable 	
Burns	 Overheated plastics can cause burns or a fire Appropriate personal protective equipment, (e.g. heat resistant gloves or gauntlets) should be worn when handling hot plastics Surfaces should be allowed to cool before handling Guarding should be provided if practicable or if the risk of causing burns is high, e.g. heater systems should be shielded or guarded against accidental contact Injection and extrusion moulding machines should be fitted with safety guards around the nozzle area to provide protection in all directions from possible ejection of hot material. Split moulds should be clamped prior to injection of plastics On vacuum forming machines, it should be possible to regulate the output from the heater system. If ceramic heaters are used, a mechanical interlock with the platen mechanism should be provided to prevent accidental elevation of a mould into the heaters. Moving heater systems should be mechanically attached to machines On strip heaters and line bending heaters, simple heat output controls should be provided as well as an adjustable work support to control the distance between the heat source and the material 	





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Hazards	Safe system of working (control measures)	Tick
Electric shock	 If the machine is permanently fixed, it should have an electrical isolator on or adjacent to the equipment (preferably a fused switched-disconnector) 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 Cables should be regularly inspected for wear and damage and to ensure that they are in good condition Line bending heaters with heated tensioned resistance wire should be of separated extralow voltage (SELV) type and should have a transformer designed to protect against mains voltage breakdown to the secondary windings 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 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 	
Cutting blades/discs	 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' Hands should be kept well away from blades when holding and removing material 	
Foreign bodies	Suitable eye protection should be available near to all equipmentEye protection should be worn at all times	
Absorption of moisture by hygroscopic material	 Certain plastics materials (especially nylon) absorb moisture. These should be stored in airtight drums, and dried in accordance with manufacturers' data sheets WARNING: absorbed moisture in plastics can form steam that can cause hot material to eject from injection moulding machines 	
Compressed air	A risk assessment should be completed to cover the use of compressed air	
Flooring	See BS 4163:2014 Section 6 Working Area Environment	
Lighting	See BS 4163:2014 Section 6 Working Area Environment	





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Teaching Strategies

 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 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 A competent person should carry out portable appliance tests at least every 12 months and records of inspections and test results should be kept Learners should be aware of the hazards associated with the equipment and precautions that should be taken during use Before using the equipment, learners should be trained and assessed as competent, and a record of their training should be kept Learners should be supervised at all times by a trained, competent person Health and safety rules should be available and observed for all pieces of equipment 	
 Demonstration of each piece of equipment to learners should highlight safe working procedures For example in relation to injection moulding machines: The position and use of all controls How to switch heaters on and choose heating levels How to attach dies and clamp securely in place How to load the hopper or plastic reservoir How to operate the injection of plastic – manually or automatically How to open dies and extract components correctly 	
 In relation to vacuum formers: The position and use of all controls How to switch heaters on and choose heating levels How to raise and lower the table How to clamp the plastic How to apply heat How to use the timer Procedure for making a forming 	
 In relation to strip heaters: The position and use of all controls How to switch on the heater and choose appropriate heating levels How to raise and lower the height of the work support How to mark on material the position of the bends How to apply heat evenly by turning over and heating both sides How to plan for a sequence of bends and allow for radius How to handle hot plastics and the use of gloves How to use a simple jig to aid accuracy/consistency 	
 Preferably one learner should operate the equipment at a time. Risk assessment should identify exceptional circumstances where this is not be the case If fumes are produced by heated materials, the machine should be switched off, the room evacuated as necessary and ventilated Equipment should not be left unattended when heating plastics 	





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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





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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 forming	after	
 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		

