



Forename: _____ Surname: _____

School / College / Institution: _____

Course date: _____

These Training and Accreditation Guidelines are based on, and should be used in conjunction with the following essential publications:

- Health and Safety Training Standards in Design and Technology: D&T Association.
- BS 4163:2021+A1:2022 Health and safety for design and technology in educational and similar establishments – Code of practice.
- Model Risk Assessments for D&T in Secondary Schools and Colleges: CLEAPSS.

Summary Overview**Please tick the boxes below to confirm the sections that you have completed in this document:**

1. Requirements relating to laser cutting/engraving.	☐
2. Practical Assessment – skills when laser cutting/engraving.	☐

The RDTHSC/Trainer will sign and date this form on completion.

RDTHSC/Trainer signature: _____

Date: _____

Delegate signature: _____

Date: _____

Please tick the individual requirements listed in the following sections to confirm your knowledge, skills and understanding, and that you have completed the Practical Assessments:

Assessment Task 1a Requirements Relating to <u>Laser Cutting/Engraving</u>– what you should know and understand:		
Hazards	Safe system of working (control measures)	
Laser light.	- All CO2 laser tubes used in laser cutters are rated as Class 4 and can cause severe burns to the skin. The beam emitted is an invisible infrared frequency, plus a visible red dot pointer for the origin location. - If a Class 4 laser makes direct or reflected contact with skin or an eye, severe damage, burning or blindness can be caused.	☐
Supply and fit.	- In order to be used in a school or college, a Class 4 laser has to be fully enclosed in a case. The machine must have an interlock that prevents the laser tube from operating when the lid is opened. The enclosure of the laser makes the system a Class 1 device for use in schools or colleges. - The laser cutter must be sited in a room with adequate ventilation and working space, ideally a classroom. It is recommended that small storerooms or internal offices not be used, as supervision is more difficult and ventilation is often limited. - The laser cutter should not be placed in a dusty environment, as this will cause poor performance, and frequent cleaning of the optics will be required. The dust will also shorten the life of filter units.	☐
Electric shock.	- Only lasers meeting UK electrical safety guidelines, conforming to BS 4163:2021+A1:2022 and supplied for use in educational establishments by reputable educational suppliers, should be used in schools. - Trailing leads should be in good condition and positioned to avoid risks of snagging/tripping. - As a mains-powered device that is, or could be moved, this would therefore be subject to regular appropriate PAT testing and visual condition checks. - Larger laser cutters may require a power supply greater than a 13 Amp plug can supply, and it may be necessary to provide a 16 Amp supply or even an isolator connection.	☐
Fire.	Minimise the risk of fire: - Never leave a laser cutter unattended when it is operating. - Select an appropriate power level for the material being cut (use manufacturer's instructions). If in doubt, start at low power settings and/or higher speeds until the correct setting is established to cut the material cleanly. Do not use more power than required. - Ensure the air-assist flow is functioning correctly. The air-assist helps reduce material combustion and provides a more consistent edge finish. - Frequently clean the bed and enclosure of waste material. - It is advisable to have a CO2 gas fire extinguisher located by the machine.	☐
Unsafe materials and chemical/fumes.	- It is preferable to buy materials specified for laser cutting, e.g. laser ply. - Different materials will produce different amounts of fume and particles e.g. a correctly lasered acrylic sheet will produce 90% Methyl Methacrylate and 10% particles. The materials you laser will determine which filter combination to select. - Schools should ensure that they have a copy of the manufacturer's COSHH or MSDS hazards sheets for all materials used in the laser cutter. They should follow the instructions for use and be aware that some materials may pose additional health risks not present in non-laser equivalents (e.g., laser plywood hazard sheets from some suppliers warn of a marginally increased risk of skin rashes).	☐
	- PVC and Polyurethane must never be processed. PVC gives off toxic and corrosive fumes (including Chlorine), and Polyurethane can produce Hydrogen Cyanide, which can be lethal and can ruin the machine, voiding any warranty. - Some fabrics may contain small amounts of PVC. If the material is unknown, and if in any doubt, do not use it. Extreme caution should be used if testing small pieces. - The vapourisation of materials in laser cutting can produce unpleasant smells and fumes. Exposure limits can be found in HSE EH40/2005 Workplace Exposure Limits. 'Gassing off' can continue long after the initial gassing-off e.g. MDF emit fumes for up to 2 weeks after laser cutting.	☐
Chemical fumes and particles.	When cutting and engraving, hazardous fumes and particles are generated. A professionally specified LEV system must be connected and always used.	☐

	- Fumes and particles from laser processing can be extracted from the laser cabinet by either: - Capturing Fumes and Particles in a purpose-built laser fume filtration system using activated charcoal filters, e.g. BOFA / Purex. - Or extracted to the atmosphere using a suitable fan with the exhaust located outside the building and discharging the fumes at 3m above roof level. - LEV that exhausts externally should be provided, regardless of the method used.	
	- Some suppliers recommend Extract to Atmosphere (ETA) as there should be no chance of fumes entering the classroom with a professionally designed and maintained system that takes the exhaust well above the eaves of the building. When using ETA, you must ensure that adequate make-up air can enter the room, e.g. air bricks. - You will need to be aware of the Local Environmental Agency's limits on air pollutants. - Laser extraction should be subject to the same 14-monthly inspections and efficiency checks as other LEV. Any filters should be changed as recommended by the extraction unit supplier. - If a re-circulatory filtration system is used, the filters must be changed when they start to become ineffective. Good fume filtration devices incorporate a display that indicates the percentage full and a warning if blocked. The latest devices may also include a VOC alarm that warns when the charcoal filter becomes saturated.	☐
Maintenance.	- Ventilation – Ensure that the vent holes and slots are not obstructed. - Cleaning – The Honeycomb or bed supports must be regularly cleaned to prevent the risk of fire and fumes from the burning of leftover material stuck to the surface. Debris that falls below the bed must not accumulate, as any buildup can also ignite. - Cleaning the lens and mirrors – Some materials will leave a deposit on the lens or mirrors, which will need to be cleaned off to maintain the laser's efficiency. A well-adjusted air assist system will significantly reduce the frequency of cleaning required.	☐
	- Maintenance and service records. As with all other workshop equipment, a record must be maintained of all servicing, repairs and maintenance. - The interlock should be tested weekly to ensure it is operational. - Technical servicing and repairs should be carried out by qualified specialists. - Laser cooling and calibration – The manufacturer's instructions must be followed to ensure the laser is properly cooled, calibrated and focused. Water-cooled lasers frequently require a maintenance programme for the water cooler. - During routine maintenance, the laser cannot be operated because of the interlock. Only trained laser engineers should carry out any work involving firing of the laser while the case is open, e.g. beam alignment that requires internal adjustment.	☐
	- Laser extraction should be subject to the same 14-monthly inspections and efficiency checks as other LEV. This should include checks on the pipework and any mesh filters protecting the fan intake. - Filters should be changed as recommended by the extraction unit supplier. Some filter manufacturers recommend wearing gloves, long sleeves, goggles and even a facemask when changing filters. Dispose of used filters in the manner prescribed by your local waste authority through their 'contaminated waste' procedures. - LEV Filters should only be purchased when they are required for use. The chemicals in the active filters deteriorate over time and become less effective and have a shorter effective life. This deterioration is more rapid when the active filters are open to air. They should be kept fully sealed before use.	☐

Teaching Strategies

- It is essential that a risk assessment is completed to cover the use of this machine by learners and colleagues. This will normally involve the adoption and adaptation of model risk assessments, e.g. BS 4163:2021+A1:2022.
- 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.
- Learners should be aware of the hazards associated with the equipment and the precautions that should be taken.
- Before using the equipment, learners should be trained and assessed as competent, and a record of their training should be kept.
- Health and safety rules should be available and observed.
- Learners should be familiar with the actions necessary in case of accidents.
- Only trained staff and students should use the laser cutter.
- Students must be properly trained in the correct and safe use of the machine, and a record of their training must be kept.
- Clear instructions for the use of the laser cutter should be readily available near the laser machine. It may include:
 - power and feed rates for the materials.
 - a clear list of materials not to be used on the laser cutter.

- the required run-off period for your system before the laser cabin can be opened.
- The overrun for the extraction should ensure there is sufficient time to allow for an initial gassing-off from the cut or etched components and that there is sufficient time to ensure that this is fully extracted from the cabin and from all the pipework and filter cabinet before ending. Where this is not interlocked, clear instructions must be given to control opening.
- Any larger quantities of laser-cut parts must be stored in a larger, ventilated space. This is due to low levels of gassing-off continuing for some time after the cut / etch has been completed, which would accumulate in a small store area or box and may pose a fume/VOC risk on entering this space or opening the box.
- There are some additional risks from laser-specified materials; follow the guidance from the MSDS sheets. If using mirrored acrylic, it is recommended that the material be cut on the back surface to prevent any risk of a reflected beam damaging the lens.
- At no time should the laser light be looked into as it can permanently damage sight. Where there is a danger of a reflected laser beam coming into view of those nearby, a cover should be placed over the laser cutting area of the laser cabin.
- Some schools have reported that after cutting polypropylene, even using the correct settings, their lens had been permanently damaged and required expensive replacement.

Assessment Task 2a Practical Assessment – what you should be able to demonstrate when Laser Cutting/Engraving



Correctly set up and produce (using whatever CAD program the school has available for laser working an item or items) that involves:

- Cutting – including tessellating the components to be cut to minimise waste.
- An engraved element.

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The practical activity should include the following elements:

- Set up the laser cutter, including:
 - Cleaning the lens (as necessary).
 - Calibrating and focusing the laser cutter as required by the manufacturer's guidance.
 - Checking/setting an appropriate overrun time for extraction (if applicable).
- Select and place the correct material for use in the correct position (to minimize travel and processing time).

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- For manual focusing devices – focus the beam for the thickness of material using the manufacturer's specified procedure, and when the material is not flat or is not of a consistent thickness.
- Check the LEV is connected and switched on / ready.
- Check the air assist pump is working / Check the water coolant system is operational.
- Select appropriate power settings and speed/feed rates either through the software or laser cutter controls.

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- Set power and speed/feed rate to vaporise without producing too much smoke or any flames.
- Complete the laser cut and engraving.
- NB: high-speed engraving can cause an "over limit" error signal on some machines, especially if the work piece is too close to the limit switches. It may be more appropriate to place the material nearer the centre of the X axis to allow for acceleration and deceleration of the focus carriage.

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- Allow necessary runoff extraction before opening the cabin.
- Extract completed item and store appropriately.
- Clean down and remove waste as necessary.

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Supplementary materials:

The following references provide additional notes and guidance to support training sessions:

[HSE EH40/2005 Workplace Exposure Limits](#)

[HSE RR797 Investigation of potential exposure to carcinogens and respiratory sensitisers during thermal processing of plastics](#)