

# Bristol Hackspace Risk Assessment: Laser Cutter

Place of assessment: BV studios room G10

Date and time of assessment: 2015-08-31 20:00

Assessors: John Willis, Joe Eggar

## Caveat:

The assessment was done on a best endeavours basis by a unpaid volunteers who have not had formal training for machine tool and workshop risk assessment.

This assessment is advisory and the assessors will not accept liability for errors or omissions.

Nothing in this assessment should be taken as permission or instruction to work in an unsafe manner.

This assessment does not replace or reduce a Laser Cutter user's common law duty of care to work in a way that does not endanger others.

## Assessment Background:

A Just Add Sharkes A0 laser cutter was prchased and installed on 2015-08-23.

## Risk Assessment

Risk	Description	Recommendation
Electric Shock	Extension leads are used extensively. A poor earth connection could go unnoticed for a considerable time.	Install sufficient 13 amp sockets to remove the need for extension leads for normal working.  Perform regular electrical tests on the equipment  Make members aware of the need for a fully charged mobile phone for emergency use.

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		<p>Put an electric shock poster on the wall.</p> <p>Consider arranging a first aid organisation such as the St Johns Ambulance to run skill share sessions.</p>
Fire	<p>Laser cutters do catch fire. Statistics could not be found but two examples include  <a href="http://msraynsford.blogspot.co.uk/2012/03/fire-in-laser-cutter.html">http://msraynsford.blogspot.co.uk/2012/03/fire-in-laser-cutter.html</a> - Caught fire while the operator was in the room.</p> <p>verbal example given by JAS during installation that one of their personal cuttrs caught fire while the operator went to the toilet.</p> <p>Every set of rules for using laser cutters that have been looked at ( around 10 ) include a statement that laser cutters must be supervised while running and this includes the Hackspace user agreement for the old ( Laurens ) laser cutter.</p> <p>The old laser cutter was seen running unattended on several occasions. So often that the assessor was surprised to find the requirement in both the user agreement and equipment manual.</p> <p>There is a view that the problem will be solved by the faster speed but this is incorrect. It can cut panels four times the area of the old cutter while just over twice as fast so the longest job on this cutter will take around 1.5 times as long as the longest job on he old one.</p> <p>The Chiller and extract fan make the environment noisier that it was for the old machine so there is more incentive to leave the</p>	<p>Include a rule that the laser cutter operator must supervise ( stand by ) the laser cutter while it is running.</p> <p>Include a rule that the user must check that the CO2 fire extinguisher is available and ok before using the laser cutter.</p> <p>Reinforce these rules in the Laser cutter induction and point out that everyone has a duty under UK common law to work in a way that does not put others at risk. A fire would put all occupants of the building at risk.</p> <p>Pass a resolution at the next AGM to enforce Hackspace rules, by expulsion if necessary, and that Botlab may take legal action.</p> <p>Consider a security camera for the laser cutter.</p> <p>Consider a heat detection shut off device for the laser cutter.</p> <p>Check the conductivity of the flexible pipe. replace with metal if it does not conduct, and earth the duct.</p>

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	<p>cutter unattended.</p> <p>There is poor compliance with Hackspace rules which are sufficient to provide a clean and safe workshop, and no sign that the committee are prepared to enforce them.</p> <p>Laser cutter fire safety requires a culture change. A project manager I was discussing this problem with put it rather succinctly " Yes technical problems are easy its the culture change that comes back to bite you on the bum"</p> <p>Static build up in the extract vent could cause a fire. This is a low risk due to the volume of extract air.</p>	
Breathing Airborne contaminants	<p>The higher power laser will generate more fume than the old one.</p> <p>The extract fan is more powerful but noisy and can be turned off or disconnected at the extension block.</p> <p>The extract vent could become damaged and ineffective</p> <p>The extract vent is not fastened to the laser cutter</p>	<p>Locate the power block inside the laser cutter in a way that is only accessible through a locked panel.</p> <p>Fit jubilee clips or similar to fasten the vent tube at both ends.</p>
Injury or damage when the cutter moves.	<p>The laser cutter is on wheels and easily moved when the brakes are off or the fixed feet are raised. Unintentional movement could result in damage to the laser cutter, other equipment, or injury to people.</p> <p>The Laser cutter is near the room entry door and might have to be moved to allow installation of other equipment by people not</p>	<p>Make sure the fixed feet are screwed down when the cutter is in use.</p> <p>If it has to be moved put the brakes on when not actually moving it.</p> <p>Treat all movement of the machine as a maintenance task with</p>

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	<p>aware of this risk.</p>	<p>a requirement for at least one laser cutter maintainer to be present whenever it is moved, even if movement is incidental to other work in the space.</p>
<p>Injury or damage from Infrared radiation</p>	<p>The laser is class 4 if any of the panels are removed.</p> <p>Most panels have key locks but not operational interlocks.</p> <p>The interlock for the main lid is actuated by a magnet so easily bypassed.</p> <p>It is usual to carry out mirror alignment with the lid interlock bypassed.</p> <p>There are slits in some panels and thin gaps round others that might pass radiation in unusual circumstances</p> <p>Two narrow panels are removable to allow feed in of cloth or large sheets of materials. The front removable panel is th one with slots in it. In normal use the laser beam is not directed towards these removable slots but it is possible that reflections could.</p> <p>A child could look into the slot while the machine is operational.</p>	<p>Put a laser safety sticker on all removable panels.</p> <p>Cover all slots and gaps around the panels.</p> <p>Limit operational use to A0 panel size until the large material mode has been assessed for risk.</p> <p>Have an explicit user rule that the machine is not to be used without all panels in place and the lid down. Rinforce this with a clear notice by the machne.</p> <p>Have an explicit user rule that the machine is only to be adjusted by the maintenance team.</p> <p>Provide Co2 laser safe eye protection for the maintenace team.</p> <p>Agree a procedure with other tenants that gives exclusive access to G10 by the maintenance team for laser cutter maintenance.</p> <p>Provide a Hazardous maintenance, No entry sign for the door and treat ignoring it as a serious breach of safety rules by Hackspace members.</p> <p>Include this in members, G10, and Laser cutter inductions.</p>

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		<p>Make it clear to maintainers that it is ok to work in a safe way by either closing the lid for adjustment tests or wearing safety spectacles.</p> <p>Make it clear to laser cutter users putting pressure on maintainers to fix it quickly will be considered a serious breach of safety rules that will probably result in expulsion.</p>
<p>Injury or damage to the cutter by moving other items</p>	<p>The laser cutter is on a corner near the door. All materials and equipment must be moved past it.</p> <p>The laser cutter backs on to the metalwork bench workspace. Bumping into the laser cutter could result in injury or damage to the machine.</p> <p>Large items are frequently moved around G10.</p>	<p>Reinforce the need to think before you act in the G10 induction and add the need to think about what could go wrong and how to react when it does.</p> <p>Erect a barrier between the rear of the laser cutter and the metalwork bench working area to protect the machine from bumps and kicks.</p>
<p>Trips and falls</p>	<p>Wires, pipes and ancillary equipment could pose a trip hazard</p>	<p>Erect a barrier between the rear of the laser cutter and the metalwork bench and build a housing for the ancillary equipment in the adjacent workbench.</p>
<p>Injury or electric shock from associated equipment</p>	<p>The emergency stop button may not be accessible to someone working at the rear of the machine, and may not power down accessories.</p>	<p>Install adequate 13 amp power sockets.</p> <p>Consider fitting a contactor with multiple emergency stop buttons e.g. Chint NC6 contactor 8.07 each <a href="https://www.expertelectrical.co.uk/motor-control-gear/chint-nc6-contactors">https://www.expertelectrical.co.uk/motor-control-gear/chint-nc6-contactors</a> This could probably be fitted in the existing cabinet and could be turned on by the key card unit or a keyswitch.</p> <p>Chint emergency stop switch £8.88 each</p>

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		<p><a href="https://www.expertelectrical.co.uk/push-buttons-led-indicators/chint-1nc-enclosed-emergency-stop-unit">https://www.expertelectrical.co.uk/push-buttons-led-indicators/chint-1nc-enclosed-emergency-stop-unit</a></p> <p>These are given as cost indicators, the system would need to be designed and contacts e.g. chock block needed for the on / off switches and possibly a housing.</p>
<p>Damage to the laser cutter by airborne contaminants</p>	<p>Many activities in G10 produce dust and some produce organic and inorganic vapour. These include but are not limited to:</p> <p>Hydrochloric acid from the bubble etch</p> <p>Flammable solvents from painting, glueing, cleaning and fibreglass layup.</p> <p>Chlorinated solvents from cleaning</p> <p>Wood dust</p> <p>Metal dust</p> <p>Paint and metal oxide dust</p> <p>These could corrode the metal work or form a dirt layer over the mirrors and lenses that could scratch the optics when being cleaned, and could be a fire hazard.</p>	<p>Use Ammonium persulphate etch instead of ferric chloride</p> <p>Use mechanical agitation in the etch bath instead of bubbles</p> <p>Instruct operators not to use the laser cutter if inflammable solvents can be detected by smell.</p> <p>Turn on the room filter which directs clean air over the laser cutter when using the laser cutter.</p> <p>Consider going into partnership with Nic to set up an extracted booth.</p> <p>Consider ducting outside air into the laser cutter.</p>
<p>Impairing the relationship with the landlord with possible</p>	<p>The Landlord has agreed materials that can be machined in the old laser cutter.</p>	<p>Limit materials to those on the list published on the Hackspace Wiki: wood, acrylic, paper and leather.</p>

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loss of tenancy	Use of additional materials without the landlords permission may result in Hackspace loosing their tenancy of both G10 & G11.	Additional materials are to be submitted to the committee or their named representative for approval. The approval process will include discussions with the Landlord
Injury from associated equipment falling from shelves	The extract fan is not fixed to the shelf, which is above head height.  There is already considerable pressure form members to use the Laser cutter.	Check that all equipment associated with the laser cutter is installed safely before making the machine operationa.