##

**3D PRINTER**

*Additive Manufacturing*

## Scope

This document is intended to estimate potential human health and environmental risks posed by current and potential future conditions at **State Library of Queensland (State Library) Fabrication Lab** Facility. The risk assessment describes the approach to the risk assessment and facilitates appropriate ways to evaluate current and future risks.

Refer to the **Safe Operating Procedures** (**SOP**) for information regarding the safe usage and check list for this equipment.

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| Plant/Equipment Description: **Prusa i3 MK2 3D Printer** |
| Leaders:  **Daniel Flood** |
| Locations:  **The Edge Fabrication Lab – 3D print room** |
| Assessment Date:  **02/03/2020** | Review Date:  **02/03/2021** |

*N.B. This assessment can remain active for up to 5 years. However, an annual monitoring and review process should be undertaken and recorded – refer to the last page of this document.*

*Below are the details of the manufacturing or production processes attributed to this item of equipment categorised by their assessed inherent risk levels (refer to the Equipment/Process Risk Matrix). The actions required for approval for each level of inherent risk are mandatory.*

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| **Inherent Risk Level** | **Details of Processes** |  **Action Required/Approval** |
| 🗹 | **Low** | * + - * Computer numerical control (CNC) machining makes certain manufacturing processes easier by automating complex commands and speeding up the rate at which the equipment completes machining tasks.
* The range of programming commands typically includes the accurate vector control of an extrusion printing head with PLA plastic filament material heated for the purpose of “fused deposition modelling”. The extrusion process uses an electrically element within the printer head - (temperatures approx. 230-270ºC)
* The head travel mechanism contains slow moving directional drive components.
* Scaffold material is typically removed by hand or by using a variety of hand tools (e.g. side cutters, paint scraper or tweezers, etc.)
 | * Manage through regular planning processes
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Minimum standards

| Minimum qualifications and experience *Listed below are the general “minimum” recommendations for the management of this Plant/Equipment.*🗹 *Indicate the minimum management controls.*  |
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| X State Library staff member with experience, ability and competency in the safe use of this plant/equipment  *(indicate one or more of the following):*[ ]  Specific knowledge of the safe and correct use of this plant/equipment (i.e. Industry training)X Experience (i.e. previous involvement and familiarity) in the safe use of this plant/equipmentX Demonstrated expertise, ability and competency with this plant/equipment[ ]  Documented qualifications relating to the use of this plant/equipment (i.e. Trade Certificate or manufacturers formal training) **OR**X A Contractor, other than a State Library staff member, with:X Expertise in the safe and correct use of this plant/equipment (i.e. Industry training)[ ]  Documented qualifications that demonstrate experience, ability and competency in the safe use of this plant/equipment. (i.e. Trade Certificate or manufacturers service representative.) |
|  X Will members be operating this plant/equipment?If yes, state how the member use of this plant/equipment will be managed (e.g. Workshop Safety Induction)Give details:  **Safety induction required before use of equipment.** |
|  Further information if required: **Members will load file and start the print. At completion members will remove bed and hand remove object by flexing the bed. (No tooling required) All other operations will be over seen or performed by a trained and experienced supervisor.**  |
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|  Minimum control requirements  |
|  Supporting documentation available in the school on this plant/equipment includes: X Operators ManualX Safe Operating Procedures (SOP)X Equipment Maintenance Records (EMR)X A process for recording members safety induction e.g. member induction register X A process for recording staff training and experience, e.g. Staff induction register |
|  X All guards are in place and in good working order for this plant/equipment  |
|  N/A Safe Working Zones are defined for this plant/equipment (e.g. yellow lines and/or appropriate signage)  |
|  X Suitable personal protective equipment (PPE) is available to be used by all operators |
|  X This plant/equipment complies with relevant safety standards |
|  Further information if required: **3D printers are housed in purpose build cabinets (No safe working Zones required) SOP and risk assessment available to view.**  |

Hazards and control measures

*Listed below are indicative hazards/risks and suggested control measures. These are by no means exhaustive lists. Add details of any other hazards/risks or additional controls you intend to implement.*

🗹 *Indicate the control measures adopted. Detail their implementation and any additional controls required.*

| **Hazards/Risks** | **Hierarchy of Recommended** **Control Measures** | **Yes** | **No** | **Details of how this will be implemented***(and any additional controls)* |
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|  **Exposure to Rotating** **or Moving Parts:*** **Entanglement and**

**Entrapment**Could hair, clothing, ties, jewellery or other materials become entangled with moving parts of the equipment?* **Impact and Striking**

Could anyone be struck by the unexpected or uncontrolled movement of the equipment?**Note:** CNC robotics may move in a direction not anticipated or planned, at high speed in linear or rotary directions.The CNC may also eject work-pieces, off-cuts or molten metal. Workers are at risk from being hit by the robotics or parts of the work piece. | 1. Where possible, potentially hazardous 3D Printer equipment is substituted or replaced with less hazardous alternatives.
 | X | [ ]  | **Monitoring of potentially hazardous and actioning as required**  |
| 1. All necessary 3D Printer safety guarding and constraints are in place protecting members from all internal moving parts, hot surfaces and possible toxic fumes.
 | X | [ ]  | **Printers are contained in cabinet to minimise moving parts access. Fumes are extracted with ventilation system.**  |
| 1. Staff and member training is provided to minimise exposure to these hazards and risks.
 | X | [ ]  | **Safety induction training** |
| 1. Safe operating procedures (SOPs) are available and clearly displayed.
 | X | [ ]  | **On display in 3D print room** |
| 1. Warning “Danger” tags (or similar) are affixed to the 3D Printer when under repair or maintenance preventing workers from using the equipment.
 | X | [ ]  | **Lock out tags used when out of service** |
| 1. “Safe Working Zones” are clearly defined in all workspaces where the 3D Printer is to be used.
 | [ ]  | X | **Printers contained in cabinets** |
| 1. All approved personal protective equipment (PPE) is used where required.
 | X | [ ]  | **All PPE equipment provided** |
| **Slips, Trips, Falls** **and Abrasions:**Can anyone using the plant or in the vicinity of the plant, slip, trip or fall due to the working environment or other factors?e.g. Poor housekeeping, slippery or uneven work surfaces, power cables across work areas causing injuries and abrasions? | 1. Regular checks are made for unsafe wear and damage. Inspections are made for any power leads, etc.
 | X | [ ]  | **Regular maintenance & servicing** |
| 1. Procedures are in place for the disposal of all waste materials around all work spaces where 3D Printer activities are to be performed.
 | X | [ ]  | **Plastics waste bin provided** |
| 1. Staff and member training is provided to minimise exposure to these hazards.
 | X | [ ]  | **Safety induction**  |
| **Environmental:*** **Dust, Fumes and Vapours**

Is it likely there will be airborne dust particles, toxic fumes or volatile vapours produced and therefore be present in the workspace? | 1. 3D Printer equipment is regularly maintained to help minimise the risk of exposures to these hazards.
 | X | [ ]  | **Monthly maintenance**  |
| 1. All 3D Printer maintenance is documented in an EMR.
 | X | [ ]  | **EMR folder** |
| 1. Staff and member training is provided to minimise exposure to these hazards.
 | X | [ ]  | **Safety inductions** |
| 1. Sufficient natural ventilation is provided to the work area around the 3D Printer.
 | X | [ ]  | **Ventilation by extraction System**  |
| 1. All approved personal protective equipment (PPE) is used where required.
 | X | [ ]  | **All PPE provided** |
| **Electrical:**Can members be injured by electrical shock due to working near or contacting with damaged or poorly maintained live electrical conductors such as power outlets, extension leads, safety switches, starters and isolators or casual water on the floor near the equipment?  | 1. Visual checks are made of the power leads, switches and plugs on the 3D Printer. Internal electrical wiring and/or switches should be isolated and guarded.
 | X | [ ]  | **Daily start up procedures** |
| 1. Electrical safety inspections, testing and tagging, etc. are completed regularly as per guidelines for all corded power equipment.
 | X | [ ]  | **As per Australian standards** |
| 1. Warning “Danger” tags (or similar) are affixed when the 3D Printer equipment under repair or maintenance preventing workers from using it.
 | X | [ ]  | **Lock out tags** |
| 1. 3D Printer electrical maintenance is documented in an EMR.
 | X | [ ]  | **If manufacturer servicing is required** |
|  **Exposure:*** **Heat, Burns and** **Scalds**

Could the operator be exposed to heated elements or hot surfaces, exposed flame, molten material or hot fluids likely to cause scalding or burning? * **Toxic Gases, Fumes and Smoke**

Is it likely that the operator or others nearby could be exposed to hazardous or toxic chemicals such as volatile gases or airborne particulates such as dusts, smoke and fumes?  | 1. 3D Printers are regularly cleaned and maintained to help minimise the risk of exposures to these hazards.
 | X | [ ]  | **Daily start up procedures** |
| 1. Hazardous substance risk assessments are completed for potentially toxic moulded plastic materials and for any toxic gasses and fumes resulting from the heating process.
 | X | [ ]  | **Extraction system installed** |
| 1. Staff and member training is provided to minimise exposure to these hazards.
 | X | [ ]  | **Safety induction** |
|  **Ergonomics and** **Manual Handling:**Can the plant be safely operated, in a suitable location, providing clear and unobstructed access and preventing awkward postures?  | 1. The CNC 3D Printer and work bench is planned and adjusted to a comfortable work height (where possible) thus minimising any unsafe or excessively strenuous manual tasks.
 | X | [ ]  | **Desks/cabinets are at Australian standard heights**  |
| 1. Staff training is provided with regard to manual handling techniques and procedures to minimise exposure to these hazards.
 | X | [ ]  | **Safety induction** |

| **Other Hazards/Risks** | **Additional Control Measures***These would relate to the specific student needs, locations and conditions in which you are conducting your activity.* |
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| **Approval** |
| Submitted by: Simon McKellar | Date: 02/03/2020 |
| **[ ]**  | Approved as submitted. |
| **[ ]**  | Approved with the following condition(s):      |
| **[ ]**  | Not Approved for the following reason(s):      |
| By:       | Designation:       |
| Signed: | Date:        |

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| Staff members involved in the use of this risk assessment and the associated plant and equipment: |
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 | *Signature:*  ……………………………….. *Date:**Signature:*  ……………………………….. *Date:* *Signature:*  ……………………………….. *Date:* *Signature:*  ……………………………….. *Date:* *Signature:*  ……………………………….. *Date:* *Signature:*  ……………………………….. *Date:* *Signature:*  ……………………………….. *Date:* *Signature:*  ……………………………….. *Date:*  |

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| **Monitoring and Review***This Plant and Equipment Risk Assessment is to be monitored and reviewed annually for a further four (4) years.* |

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| **Review 1:** | **Yes**  | **No** |
| * Are allocated risk levels and “Actions required” unchanged over the past 12 months?
* Are Minimum Standards and Recommended Control Measures unchanged over 12 months?
* Staffing details have remained unchanged over the past 12 months?
 | [ ] [ ] [ ]  | [ ] [ ] [ ]  |
| If the responses are “NO” for any question, record current details here, and list all staff changes *(with signatures)* |
| Reviewed by:  | Designation:  |
| Signed: | Review Date :  |

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| **Review 2:** | **Yes**  | **No** |
| * Are allocated risk levels and “Actions required” unchanged over the past 12 months?
* Are Minimum Standards and Recommended Control Measures unchanged over 12 months?
* Staffing details have remained unchanged over the past 12 months?
 | [ ] [ ] [ ]  | [ ] [ ] [ ]  |
| If the responses are “NO” for any question, record current details here, and list all staff changes *(with signatures)* |
| Reviewed by:  | Designation:  |
| Signed: | Review Date :  |

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| **Review 3:** | **Yes**  | **No** |
| * Are allocated risk levels and “Actions required” unchanged over the past 12 months?
* Are Minimum Standards and Recommended Control Measures unchanged over 12 months?
* Staffing details have remained unchanged over the past 12 months?
 | [ ] [ ] [ ]  | [ ] [ ] [ ]  |
| If the responses are “NO” for any question, record current details here, and list all staff changes *(with signatures)* |
| Reviewed by:  | Designation:  |
| Signed: | Review Date :  |

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| **Review 4:** | **Yes**  | **No** |
| * Are allocated risk levels and “Actions required” unchanged over the past 12 months?
* Are Minimum Standards and Recommended Control Measures unchanged over 12 months?
* Staffing details have remained unchanged over the past 12 months?
 | [ ] [ ] [ ]  | [ ] [ ] [ ]  |
| If the responses are “NO” for any question, record current details here, and list all staff changes *(with signatures)* |
| Reviewed by:  | Designation:  |
| Signed: | Review Date :  |

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