 Risk Assessment

Risk Matrix and Rating Guidance:

The assessor shall assign values for the hazard severity **(a)** and likelihood of occurrence **(b)** (taking into account the frequency and duration of exposure) on a scale of 1 to 5, then multiply them together to give the rating band:

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| Hazard Severity (a) | Likelihood of Occurrence (b) |
|
| 1 – Trivial (e.g. discomfort, slight bruising, self-help recovery) **2 – Minor** (e.g. small cut, abrasion, basic first aid need)  **3 – Moderate** (e.g. strain, sprain, incapacitation > 3 days)  **4 – Serious** (e.g. fracture, hospitalisation >24 hrs, incapacitation >4 weeks)  **5 – Fatal** (single or multiple) | **1 – Remote** (almost never)  **2 – Unlikely** (occurs rarely)  **3 – Possible** (could occur, but uncommon)  **4 – Likely** (recurrent but not frequent)  **5 – Very likely** (occurs frequently) |

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| **Risk Assessment Matrix** | | | | | |  | **Risk Rating Bands (A x B)** | | |
| **(B)🡳 (A)🡲** | **Trivial** | **Minor** | **Moderate** | **Serious** | **Fatal** |  | **LOW RISK**  **(1 – 8)** | **MEDIUM RISK**  **(9 - 12)** | **HIGH RISK**  **(15 - 25)** |
| **Remote** | **1** | **2** | **3** | **4** | **5** |  |  |  |  |
| **Unlikely** | **2** | **4** | **6** | **8** | **10** |  | Continue,  but review periodically to ensure controls remain effective | Continue,  but implement additional reasonably practicable controls where possible and monitor regularly | **STOP THE ACTIVITY**  Identify new controls. Activity must not proceed until risks are reduced to a low or medium level |
| **Possible** | **3** | **6** | **9** | **12** | **15** |  |
| **Likely** | **4** | **8** | **12** | **16** | **20** |  |
| **Very likely** | **5** | **10** | **15** | **20** | **25** |  |

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| Risk Assessment Record | | |
| Risk Assessment Title:  Final Year Project - Robotic 3D printing for Complex Geometries | Date Produced:  05/02/2024 | Review Date: |
| Overview/Description of Activity:  Modifying an ABB IRB 120 robotic arm for the purpose of 3D printing | Duration/Frequency of Activity:  12 week final year project | |
| Location of Activity:  4E 2.53 | Generic or Specific Assessment:  Generic risk assessment | |

| # | Hazard(s) identified | Who might be affected and how | Existing controls & measures | Severity (a) | Likelihood (b) | Risk Rating  (a x b) | Additional control/action required |
| --- | --- | --- | --- | --- | --- | --- | --- |
| 1 | High Voltage power to the machine | Operator may be electrocuted | * Arm power limited to 0.24kW * Control unit and arm undergoes regular PAT electrical safety tests and displays a label indicating the date of the most recent test * Control unit and arm, connectors, wires and plugs are insulated against high voltages and are regularly tested by the instrumentation team * Control unit and arm, connectors, wires and plugs are inspected for damage before use * Emergency stops on control unit and teach pendant * Control unit is switched off before work commences on the arm * Control unit is switched off when not in use * Lab is to remain locked when not in use, and no unauthorised personnel are to be let in | 5 | 1 | 5 |  |
| 2 | Moving mechanical parts | Operator may suffer bodily harm if in contact with the robot while it is moving. This can include:   * Pinching between robots joins   Crushing under force of movement | * Cage in place around arm. Designated safe area is outside the cage * Operator and teach pendant to remain outside the * Force limited to 265N * Emergency stops on control unit and teach pendant * Control unit is switched off before work commences on the arm * Arm is not left unsupervised when in a powered on state * Lab is to remain locked when not in use, and no unauthorised personnel are to be let in | 4 | 1 | 4 |  |
| 3 | Hot extruder | * Risk of burns to the operator | * Ensure the hot end is cool before performing work on the hot end * Do not leave the heated extruder unsupervised * Use heat resistant gloves to handle heated hot end if required | 2 | 2 | 4 |  |
| 4 | Plastic fumes | Respiratory damage to anyone in the lab | * Use only non-toxic filaments that are rated safe for indoor printing, such as PLA * Ensure the lab is well ventilated, and the windows are open * Leave the lab occasionally for fresh air as required | 4 | 1 | 4 |  |

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| Assessor signature:  A close-up of a handwritten word  Description automatically generated | Print name:  **Louis Huygens** | **Date:**  **12/02/2024** |

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| Risk Assessment Action Plan | | | | | |
| Hazard No. | Action to be taken | By whom | Target date | Review date | Outcome at review date |
| 1 | - |  |  |  |  |
| 2 | - |  |  |  |  |
| 3 | - |  |  |  |  |
| 4 | - |  |  |  |  |
| A close-up of a sign  Description automatically generatedResponsible manager’s signature:  Print name: Runan Zhang  Date: 12/02/2024 | | | | | Responsible manager’s signature: A close-up of a sign  Description automatically generated  Print name: Runan Zhang  Date: 12/02/2024 |

Risk Assessment Sign-On Sheet

**Sign on Sheet to acknowledge understanding of Risk Assessment:**

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| **Names and Signatures of other workers/researchers/PG/UG students**  *All others undertaking the process described must signify that they understand the hazards and risks.* | | |
| Print name: | Signature: | Date: |
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