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| Health and Safety Document Type | Robot Risk Assessment Form |
| Document Title | Bmade Robot Risk Assessment Form V3 |
| Issue date and version | October 2016 V3 |
| Risk Assessment Form Review | Annually or sooner if required. |
| Form Author | Vincent Huyghe |

**General Risk Assessment Form**

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| Vicente Soler |

Name of Assessor:

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| --- |
| RC4 RoboJenga Workshop |

Project/Task Title:

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| --- |
| RC4 |

Unit:

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| --- |
| IRB1600 floor |

Robot:

Project Description:

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| Pick and place of 54 rectangular wood blocks (180x60x45) over a 1400x800 base, stacking them to create different structures. Optitrack cameras are used to track the position of the blocks. Pneumatic parallel gripper is used as end effector. |
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| RC4 students involved in the workshop. |

Primary groups of people at risk:

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| Users of the robot room. |

Other groups of people at risk:

Hazards (click inside boxes to select):

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| --- | --- |
| Substances (including chemicals) | Any off-site work |
| Biological materials | Significant noise levels (>75db) |
| Manual handling | Other machinery |
| Compressed gases | Grippers |
| Electrical equipment | Extruders |
| Process generating sprays or  Aerosols |  |

Robot health and safety rules

General

Robots are dangerous industrial machines, any imprudent behaviour will result in a suspension of your access to robots.

A signed risk assessment form is required for any robotic project, if any changes are made to the process a new RA form is required.

Robots must always be supervised by someone who has completed the induction for the appropriate robot and has signed the risk assessment form.

When using a robot that isn’t equipped with a laser fence, a perimeter sized larger than the robot reach must be setup with temporary barriers.

Robot operation

When the robot is moving in manual mode only the operator (person holding the pendant) can be in the enclosure or perimeter.

Manual full speed or T2 is strictly prohibited.

It is forbidden to use automatic mode if anybody is inside the enclosure or perimeter, explicit permission from bMade staff is required before using automatic mode.

Electronics

The robots needs to be turned off when connecting and disconnecting the IO.

Max 24V 10A for any electronics in end effector.

When leaving the robot room all end effector electronics must be powered down.

**When in doubt ask bMade staff**

Neglecting any of these rules will result in a suspension of your access to robots!

**To find the risk score, decide how severe (S) you think an outcome will be (minor to fatal) and note the score. Then decide the probability (P) of it occurring (from very unlikely to likely) and enter these in the risk assessment drop down boxes. A risk score will then be calculated. The raw (uncontrolled risk) will probably be high, but after you have considered the control measures, the residual risk should fall.**

These tables are designed to help you gauge whether your risks are low or high. However, there are many factors that affect one’s judgement of risk - for example, you may not have all the information you need to make a realistic assessment. Lack of space, lack of training, working to deadlines and working late and alone could all act as risk increasing factors.

Your assessment of risk will always be subjective, as it depends on not only your knowledge and experience, but also the information you have available. The more information you have, the more accurate the assessment will be. Remember, any effective appropriate control measures will lower risk.

**If in doubt seek advice!**

**Severity**

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| --- | --- | --- |
| **Category** | **Examples** | **Score** |
| Minor | Superficial injuries - cuts, bruises, mild skin irritation, mild aches and pains  requiring first aid only. Minor property damage. | 1 |
| Serious | More serious injuries or ill-health, requiring time off work or study or a hospital visit, e.g. burns, sprains, strains and short-term musculoskeletal disorders, cuts requiring stitches, back injuries, fractures to fingers or toes. More serious property damage. | 2 |
| Major | Broken limbs, amputations, long-term health problems resulting from work, or acute illness requiring medical treatment, loss of consciousness, serious electric shock, loss of sight. Major property damage. | 3 |
| Fatal | Injury or ill-health which leads to death either at the time or soon after the incident, or eventually, as in the case of certain occupational diseases, such as asbestos-related cancers. | 4 |

**Probability**

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| **Category** | **Examples** | **Score** |
| Very unlikely | Good control measures are in place. Controls do not rely on a person using  them (i.e. personal compliance). Controls are very unlikely to break down. People are very rarely in this area or very rarely engage in this activity. | 1 |
| Unlikely | Reasonable control measures are in place but they do rely on a person using  them (some room for human error). Controls unlikely to breakdown. People are not often in this area / do not often engage in this activity / this situation is unlikely. | 2 |
| Possible | Inadequate controls are in place, or likely to breakdown if not maintained.  Controls rely on personal compliance. People are sometimes in this area or  sometimes engage in this activity / this situation sometimes arises | 3 |
| Likely | Poor or no controls in place. Heavy reliance on personal compliance (lots of  room for human error). People are often in this area / engage in this activity on  a regular basis / this situation often arises. | 4 |

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| Low risk: | Score between 1 and 3 |
| Medium risk: | Score between 4 and 6 |
| High risk: | Score between 7 and 8 |
| Very high risk: | Score between 9 and 16 |

If the risk score is high look into measures to reduce the risk.

If the score is very high the process should not be carried out, review and reassess.

**If in doubt seek advice!**

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| Briefly describe each hazard and harm  that could happen in the boxes below: | S | P | R | Now describe the control measures | S | P | R |
| Entanglement in any of the 6 rotating joints.  Entrapment between joints or joints and the environment (floor, wall, workpiece).  Bruising, sprain, bone fracture or penetration of skin due to stroke from the manipulator. | 4 | 3 | 12 | In manual mode, only the operator holding the enabling device can be inside the robot cell. No loose clothing or jewellery, long hair tied up. In automatic mode, no one is permitted inside the robot cell. | 4 | 2 | 8 |
| Tripping from mounted cables and airlines. | 2 | 2 | 4 | Cables and airlines are routed so that they don't present a trip hazard. | 2 | 1 | 2 |
| Entrapment between jaws and gripper body. Entrapment between gripper fingers. | 2 | 3 | 6 | Keep a safe distance when gripper is operational. No loose clothing or jewellery, long hair tied up. Disconnect from air supply before handling. | 2 | 2 | 4 |
| Gripped objects might fall or be ejected during operation. Unsecured gripper might fall or be ejected during operation. | 2 | 3 | 6 | Don't stand underneath the payload. If it's necessary to stand inside the cell while in operation, stand away from the possible ejection path. | 2 | 2 | 4 |
| Bruising from pressurized airline moving erratically. | 1 | 2 | 2 | Close air supply valve before handling gripper and airlines. | 1 | 1 | 1 |
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**Assessor(s):**

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| Name: |  | Signature: |  |
| Name: |  | Signature: |  |
| Name: |  | Signature: |  |
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| **Approver:** |  |  |  |
| Name: |  | Signature: |  |
| Date: |  |  |  |