

Occupational Health and Safety Plant Safety Risk Assessment Report

ROBAVO ROBOTICS

156 Highbury Road, Burwood VIC 3125

Date: 24th May 2024

Inspection Report No: Robavo240524

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CLIENT: Robavo Robotics

DATES OF INSPECTION: 24th May 2024

DATES OF REPORT: 25th May 2024

MACHINE INSPECTED: Identified Shelfbot System

LOCATION OF PLANT: 156 Highbury Road
Burwood VIC 3125

PURPOSE OF VISIT: Plant safety risk assessment in accordance with the requirements of the Occupational Health and Safety (Plant) Regulations to ensure compliance with AS 4024.1-2019 Safety of machinery and similar ISO/IEC/EN Standards

CONFERRED WITH: Rob O'Dea

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INDEPENDENT INSPECTION SERVICES

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EXECUTIVE SUMMARY

EXECUTIVE SUMMARY

A plant risk assessment was carried out on the Robavo Robotics Shelfbot system at Burwood site, VIC on Friday 24th May 2024.

The focus of this assessment is on the safety of machinery for compliance with the recommendations of AS/NZS 4024 Safety of Machinery where reasonably practicable to meet the requirement of the OHS Act in the provision of safe plant. This assessment does not include a review of the safe systems of work such as the provision of information, instructions, training, and supervision. This process involved a walk-through inspection of the machines and consultation with relevant personnel. No validation tests of the safety system were carried out in this assessment. Hence, regular tests of the safety systems are recommended.

The assessment includes a review of the safety related parts of control systems to select appropriate category of controls for interlocked guards, emergency stop controls and photograph-electric guards. The safety integrity of these guards is only appropriate for “minor intervention” access by operators such as for the purpose of clearing jammed parts or loading product. They are not intended to replace isolation lock-out, tag-out procedures. The appropriate categories of controls are listed in the risk assessment worksheets where applicable.

In general, the Shelfbot system is well guarded but further improvements are recommended to ensure compliance with AS 4024 and relevant Standards to minimise the risk of injury.

The following is a summary list of findings following this review –

1. Ensure gaps in the guarding is minimised to meet the anthropometric data of AS/NZS4024.1801 to minimise risk of injury.
2. Assessment of the safety related parts of control systems (SRP/CS) revealed S2F1P2 for operator access to an automated machine system in production mode. Hence a Category 2-3 control system is applicable in accordance with AS/NZS4024.1501. This is equivalent to Performance Level d in accordance with AS/NZS4024.1503 (adopted from ISO/EN 13849) or equivalent SIL 2 in accordance with AS62061 (adopted from IEC/EN 62061).
3. Ensure records of tests of the safety functions are provided and kept post any upgrades or modification.

The comments and recommendations for improvements are contained in the risk assessment worksheets attached to this report. The risk ranking associated with each identified hazard and recommendations provides a guide to the prioritisation of the implementation of the recommended improvements.

During the course of this part-day walk-through assessment, it is not possible to identify all potential risks. Whilst all effort is made to identify the normal and reasonably foreseeable abnormal conditions that may arise in the use of the plant, some additional hazards may not be identified if the abnormal conditions that may arise are not advised by operations and maintenance personnel during this assessment. It is therefore necessary for site to continually review the risk assessment and monitor the controls to minimise the risk of injury. The risk assessments should be reviewed before alterations to the plant, changes in systems of work, relocation of plant, and if new or additional information about the hazard becomes available.

INSPECTION REPORT

1. SCOPE

To carry out risk assessment in accordance with the requirements of the Occupational Health and Safety (Plant) Regulations.

To assess the safety related parts of control systems, i.e., emergency stop controls and interlocked guards to select the appropriate Category/PL/SIL of control system to be implemented for compliance with AS 4024.1-2019 Safety of Machinery series of Standards.

The focus of this assessment is on the provision of safe plant and does not include the provision of safe systems of work, such as the provision of information, instructions, training, and supervision.

2. STATUTORY REQUIREMENTS OVERVIEW

2.1. Occupational Health and Safety Act & Regulations

The OHS legislation requires the person conducting a business or undertaking (PCBU) or employer to ensure the health and safety of workers, so far as is reasonably practicable.

The OHS Act sets out specific duties which a PCBU/employer must comply with as part of their general duties so far as is reasonably practicable. These duties include:

- Providing and maintaining plant, structure and systems of work that are safe and do not pose health risks (e.g., providing effective guards on machines and regulating the pace and frequency of work)
- Providing workers with information, instruction, training, or supervision needed for them to work safely and without risks to their health.
- Etc...

2.2. Australian Standard AS/NZS 4024.1-1 2019 Safety of Machinery

AS/NZS 4024 Safety of Machinery is a published technical standard referenced in the Code of Practice as providing guidance on the design, manufacture, and use of certain types of plant. AS/NZS 4024.1-2019 is based on several international (ISO/IEC/EN) Standards.

AS/NZS 4024.1501 provides guidance for the selection of the appropriate Category of control system and AS/NZS 4024.1503 provide guidance in the application of appropriate Performance Levels Required (PL_r) for the safety related parts of control systems. AS62061 provides guidance in the application of the appropriate SIL for functional safety systems when using safety PLC.

AS/NZS4024.1604 provides guidance for the design of emergency stops and AS/NZS4024.1801 provides guidance for the anthropometric data for guarding of machines. AS/NZS4024.1204 provides guidance for the electrical equipment of machines.

3. RISK ASSESSMENT

The focus of this risk assessment is on the risk control measures necessary to minimise risks from exposure to the hazards associated with the operation and maintenance of the plant and an assessment of the safety related parts of control systems such as the interlocked guards.

The principles of hazard management are hazard identification, risk assessment and application of appropriate risk control measures to eliminate the hazard or if this is not practicable, to minimise the risks as far as is practicable.

3.1. Hazard Identification

Hazard identification is the process of identifying all situations or events that could give rise to the potential of injury or illness. In this instance, the hazard identification process involves the physical inspection of the plant and consultation with the relevant personnel.

3.2. Risk Assessment

Risk assessment is the process of determining whether there are any risks associated with the hazards identified and the level of risks involved. This generally involves:

- Severity (S) of the injury or illness if the hazard occurs.
- Frequency (F) and /or duration of exposure
- Probability or likelihood (L) of occurrence; and
- Possibility (P) of avoidance.

When determining the likelihood of hazard occurring, the assessment considers the adequacy of current risk controls in place for existing plant.

The assessment of risk is carried out using a tree structure model. This risk model is selected because it provides more elements of risks to consider and is consistent with current International Standard ISO 14121 and examples of risk assessment provided in AS/NZS 4024.1303.

The risk model and risk rating worksheets are attached in Appendix 1. A separate risk matrix is used for the assessment of the safety related parts of control systems as specified in AS 4024.1-1996 (ISO 13849-1:1999 or EN 954.1:1996). This risk model is retained in AS/NZS 4024.1501.2019 series of standards.

For assessment of safety related parts of control systems and selection of controls, use the S/F/P elements of risk. S2 matrix is equivalent to S2 and S3 of risk ranking matrix.

3.3. Risk Control and recommendations

The “hierarchy of risk control” methods (involving Elimination, Substitution, Engineering, Administration and Personal Protective Equipment) are taken into consideration together with “practicable” considerations when assessing or recommending risk controls.

The application of safeguarding, being an Engineering control also considers the practicability of applying the various types of guards such as fixed, interlocked or presence sensing systems. The comments and recommendations are contained in the risk assessment worksheets attached. The risk ranking should be used as a guide in the prioritisation of the implementation of the recommendations.

4. REFERENCES

The following references were used in the preparation of this report –

Occupational Health and Safety Act 2004 (Victoria)

Occupational Health and Safety (Plant) Regulation 2017 (Victoria)

Code of Practice for Plant

AS4024.1–2019 *Safeguarding of Machinery, Part 1: General Principles*

AS 4024.2801:2017 *Safeguarding of machinery, Part 2801 – Positioning of safeguards with respect to the approach speeds of parts of the human body*

AS 4024.3802:2017 *Safeguarding of machinery, Part 2802: Application of protective equipment to detect presence of persons*

AS /NZS 4024.1204:2019 *Safety of machinery – Electrical equipment of machines*

AS/NZS 3000-2018 *Wiring Rules*

APPENDIX 1 RISK ASSESSMENT MODEL & WORKSHEET

LOCATION	ASSESSORS	J Lim	REVIEWED BY	
Burwood, VIC	DATES OF ASSESSMENT	24 th May 2024	REVIEW DATES	

Nos.	1 Hazard Description	2 Risk Rating S/F/L/P = Risk Score	3 Cat. & PLr Control System Required	4 Current Risk Control	5 Comments / Recommended Improvements	6 Status
Plant: Shelfbot						
1	Limits of the intended machines use.	S2/F1/L2/P1 = 5 (Med)	-	G, A, I	<ul style="list-style-type: none"> The Shelfbot system is intended to be a customer facing pick and put semi-automated system. As there are hazards associated with the pick and put system which are safeguarded by fixed and interlocked guards risk assessment should be carried out to capture the environment as part of commissioning/installation and prior to operation. 	
2	Transport and storage of the machine.	S2/F1/L2P1 = 5 (Med)	-	G, A, I	<ul style="list-style-type: none"> Ensure only trained and authorised personnel carry out the loading and unloading process associated with transport and storage of the machine and with use of: <ul style="list-style-type: none"> Visual inspection of the machine to ensure all loose items are removed from the machine prior to carrying out a lift. Using appropriately rated lifting equipment. Lifting is carried out within the specified maximum load lifting devices. 	

Nos.	1 Hazard Description	2 Risk Rating S/F/L/P = Risk Score	3 Cat. & PLr Control System Required	4 Current Risk Control	5 Comments / Recommended Improvements	6 Status
					<ul style="list-style-type: none"> ○ Only qualified personnel should carry out transport and installation. ○ Use approved tools, materials, hoisting- and lifting equipment. ○ Use tools and materials that meet the measurement and weight of the parts. ○ Use hoisting and lifting equipment that meets the dimensions and weight of the parts. ○ Ensure that nothing can move unexpectedly. ○ Ensure personnel wear appropriate personal protective equipment (PPE). ○ Ensure that no utilities are connected to prevent unexpected start-up of a machine or machine parts. ○ Switch off the machine and lock the switch with a padlock to prevent the machine from switching on accidentally. ○ The installation area needs to be marked, to block the entrance for not qualified visitors. General warning signs need to be placed. ○ Segregation of the working area to keep pedestrians away from a potential suspended load. ○ Prohibition of any personnel to work near or under a suspended load during a lift, loading or unloading process. ○ Consideration to be given to the centre of gravity when loaded onto transportation to ensure no possibility of tipping load and crushing against fixed parts. ○ Ensuring the load is appropriately secured. 	

Nos.	1 Hazard Description	2 Risk Rating S/F/L/P = Risk Score	3 Cat. & PLr Control System Required	4 Current Risk Control	5 Comments / Recommended Improvements	6 Status
3	Isolation of plant.	S2/F1/L2/P1 = 5 (Med)	-	G, A, I	<ul style="list-style-type: none"> • Recommend providing clear labelling of the main electrical isolation point including where the power is supplied from. See photograph 1. 	
4	Access to emergency stop controls.	S2/F1/L2/P1 = 5 (Med)	-	G, A, I	<ul style="list-style-type: none"> • Red mushroom head latching emergency stop switches are provided with yellow background, clearly and durably marked. Yellow shrouds have been provided to the emergency stop controls on the front of the electrical control cabinets however, the emergency stop controls remain operable by the palm of the hand. • Emergency stop controls are provided at the following locations: <ul style="list-style-type: none"> ○ On the main electrical control cabinet at a height of approx. 1690mm above the floor. ○ One on the inside of the safeguarded space behind the interlocked guard. ○ One at the back of the Shelfbot system. • The emergency stop controls are designed as a Cat. 0 stop function. • All emergency stop controls will stop the entire Shelfbot zone (which can consist of multiple isles). • Actuation of the emergency stop control releases the locking interlocked door switches. • Consider providing labelling at the internal emergency stop control to require actuation for emergency egress. See photograph 2. 	

Nos.	1 Hazard Description	2 Risk Rating S/F/L/P = Risk Score	3 Cat. & PLr Control System Required	4 Current Risk Control	5 Comments / Recommended Improvements	6 Status
5	Assessment of the safety related parts of control system.	S2/F1/L2/P2 = 6 (Med)	S2/F1/P2 = Cat.2-3/ PL d	G, A, I	<ul style="list-style-type: none"> Review of the electrical cabinet revealed use of dual channel emergency stop controls, Sick safety relay, Omron G9S Safety Controller and dual ABB Contacts. See photograph 3. 	
6	Electrical safety.	S2/F1/L2/P1 = 5 (Med)	-	G, A, I	<ul style="list-style-type: none"> Ensure an electrical safety certificate is provided for new installation in accordance with AS/NZS 3000 Wiring Rules. RCD protection has been provided for the power outlets provided inside of the electrical control cabinet. Fit electrical safety warning symbol on the front of each electrical control cabinet in accordance with AS4024.1204. 	
7	Access through the interlocked guard for the purpose of picking items.	S2/F1/L1/P2 = 4 (Low)	S2/F1/P2 = Cat.2-3/ PL d	G, A, I	<ul style="list-style-type: none"> Currently safeguarded by fixed and interlocked guards. The lower interlocked guard is only able to be opened once the emergency stop switch has been actuated. Actuation of the emergency stop switch will stop all of the pickers in the zone hence, it is not possible to climb from one picker bay into another picker bay. See photograph 4. 	

Nos.	1 Hazard Description	2 Risk Rating S/F/L/P = Risk Score	3 Cat. & PLr Control System Required	4 Current Risk Control	5 Comments / Recommended Improvements	6 Status
8	Finger reach between openings to prevent access to striking or pinch hazards.	S2/F1/L2/P1 = 5 (Med)	-	G, A, I	<ul style="list-style-type: none"> Ensure the slot and square openings are minimised to prevent finger reach to the moving platform. See photograph 5 and 6. 	
9	Whole bodily access into the safeguarded space through the top interlocked door whilst the other isles are still in operation.	S2/F2/L1/P1 = 5 (Med)	S2/F2/P1 = Cat.3/ PL d	G, A, I	<ul style="list-style-type: none"> Currently safeguarded by fixed and interlocked guards. There is fixed mesh provided inside of the picking station to a height of approx. 1520mm which is considered difficult to defeat. See photograph 7. 	
10	Overloading and dropping of the picker station.	S2/F1/L1/P2 = 4 (Low)	-	G, A, I	<ul style="list-style-type: none"> The picker station interlocked guard is only able to be opened when the picker is in the lowered position at the interlocked guard. The load capacity of the bin is 20kg. The intention is to provide weight sensors to prevent overloading of the bins. The braked motors are rated to 32N whilst the strapping is rated to approx. 500kg per strap (4 straps are provided per picker). See photograph 8. Recommend providing signage to indicate the load limit of the bins. See photograph 9. 	
11	Safe working load limits of the racking system.	S2/F1/L1/P1 = 3 (Low)	-	G, A, I	<ul style="list-style-type: none"> Ensure signage of the safe working load limits for the pallet racking system are provided. See photograph 10. Provide the signage at the ends of the isle. 	

Nos.	1 Hazard Description	2 Risk Rating S/F/L/P = Risk Score	3 Cat. & PLr Control System Required	4 Current Risk Control	5 Comments / Recommended Improvements	6 Status
					<ul style="list-style-type: none"> Ensure periodic inspection is carried out to ensure the structural integrity of the pallet racking in accordance with AS4084. 	
12	External physical guarding of the system.	S2/F1/L1/P2 = 4 (Low)	-	G, A, I	<ul style="list-style-type: none"> The Shelfbot system is externally guarded with fixed mesh and polycarbonate guards to prevent access into the safeguarded space. See photograph 11. 	
13	Manual handling and ergonomics.	S2/F1/L2/P2 = 6 (Med)	S2/F1/P2 = Cat. 2-3/ PL d	G, A, I	<ul style="list-style-type: none"> Ergonomics and manual handling should be considered in the end use environment to capture weight of product, repetition of lifting and placing of items in the bin. 	
14	Access inside the isles to clear jammed product.	S2/F2/L2/P1 = 7 (Med)	S2/F2/P1 = Cat.3/ PL d	G, A, I	<ul style="list-style-type: none"> Access for clearing of jams will be carried out by Shelfbot supplier. First course of clearing a jam is by use of manual controls outside of the safeguarded space. Clearing of jams is to be carried out under full power isolation. Intention for personnel to access by use of a 4.8m ladder which is able to be positioned at a 4 to 1 ratio. The ladder would then be anchored at the top prior to adjusting product. If safe access is not able to be achieved, use of a vertical lift is possible between the isles. 	

Nos.	1 Hazard Description	2 Risk Rating S/F/L/P = Risk Score	3 Cat. & PLr Control System Required	4 Current Risk Control	5 Comments / Recommended Improvements	6 Status
15	Storage of dangerous or hazardous items in the system.	S2/F1/L2/P1 = 5 (Med)	-	G, A, I	<ul style="list-style-type: none"> Review and ensure a list of specified/prohibited items is considered and provided to ensure flammable or hazardous materials are not stored on the Shelfbot system. 	
16	Setup and programming of the machine.	S2/F1/L2/P1 = 5 (Med)	-	G, A, I	<ul style="list-style-type: none"> Currently safeguarded by fixed and interlocked guards. To be carried out by trained and authorised personnel with all the safeguards to the machine in the operational state. Setup and programming to be carried out in accordance with the operation manual. 	
17	Commissioning equipment: Various potential nip, shear, and crush hazards.	S2/F1/L2/P1 = 5 (Med)	-	G, A, I	<ul style="list-style-type: none"> Ensure all fixed, interlocked, and light guards are secured prior to providing power to the machine. Use of approved safety equipment i.e., ladders, vertical lift EWP. Ensure the machine is isolated for any adjustments requiring use of tools. 	
18	Cleaning of the machine: Nip, shear, crush, and electrical hazards.	S2/F1/L2/P1 = 5 (Med)	-	G, A, I	<ul style="list-style-type: none"> To be carried out in accordance with the manufacturer's operational manual. Ensure all the machine's energy sources are isolated (electrical and gravitational). Ensure use of appropriate PPE as required. 	

Nos.	1 Hazard Description	2 Risk Rating S/F/L/P = Risk Score	3 Cat. & PLr Control System Required	4 Current Risk Control	5 Comments / Recommended Improvements	6 Status
19	Prevention of unexpected start-up of machinery. Various potential nip, shear and crushing hazards.	S2/F1/L1/P2 = 4 (Low)	S2/F1/P2 = Cat.2-3/ PL d	G, A, I	<ul style="list-style-type: none"> Currently safeguarded by fixed and interlocked guards. There is low foreseeability of resetting and restating the machine with personnel inside the safeguarded space due to use of transparent guards and location of reset switches within clear view of the safeguarded space. 	
20	Lighting and illumination at the operator pick station.	S2/F1/L2/P1 = 5 (Med)	-	G, A, I	<ul style="list-style-type: none"> Lighting has been provided at the operator pick station. Consider lighting requirements at each installation location to review if visibility is provided/considered down the isle. 	
21	Disassembly of the Shelfbot machine: Mechanical (striking, shear and crush) and electrical hazards.	S2/F1/L2/P1 = 5 (Med)	-	G, A, I	<ul style="list-style-type: none"> Segregate the machine by use of mechanical barriers to control unauthorised personnel from entering the area during disassembly. Ensure all power sources are removed from the machine and all energy sources are exhausted prior to disassembling any parts of the machine. Ensure use of approved access equipment are used when accessing the top of the machine i.e., ladders, vertical lift. 	

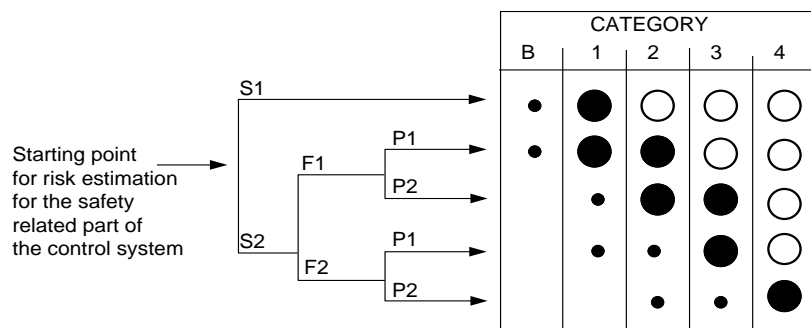
Nos.	1 Hazard Description	2 Risk Rating S/F/L/P = Risk Score	3 Cat. & PLr Control System Required	4 Current Risk Control	5 Comments / Recommended Improvements	6 Status
Plant: Temporary setup of the Shelfbot System						
1	Toppling of the shelfbot storage/racking system.	S2/F1/L2/P1 = 5 (Med)	-	G, A, I	<ul style="list-style-type: none"> The display model of the Shelfbot system is intended to be no taller than 2metres for the Shelfbot. As the unit may not be able to be secured to the ground. Ensure bracing is provided across the isles to prevent ability of the unit toppling. 	
2	Finger or hand reach to any nip and crush hazards.	S2/F1/L2/P1 = 5 (Med)	-	G, A, I	<ul style="list-style-type: none"> Ensure the entire system is enclosed with openings of no greater than 20mm slot or square openings with a safety distance of 120mm. 	
3	Testing of the unit for display.	S2/F1/L2/P2 = 6 (Med)	S2/F1/P2 = Cat. 2- 3/ PL d	G, A, I	<ul style="list-style-type: none"> Ensure the safety system is verified and tested upon installation to ensure the emergency stop and interlocked guards are functioning correctly prior to customer display. 	

1. Hazard description may use AS4024.1201, Annex B, Table B1 as hazard identification checklist, or RiskPlant checklist Possible causes should include “foreseeable misuse” or “foreseeable abnormal conditions”.
2. Risk rating is based on current risk controls. The risk rating is derived from the risk path - Severity (S) / Frequency (F) / Likelihood (L) / Possibility of avoidance (P) as shown in the risk matrix attached.
3. Category of control system for safety related parts based on S/F/P and referring to risk matrix specified in AS 4024.1501.
4. Current Risk controls in place for existing machine E=Engineering, G=Guarding, I=Isolation, A=Administrative, PPE=Personal protective equipment
5. Recommended improvements, having regard to the hierarchy of risk control methods.
6. Status of implementation of recommended risk controls. This should be filled in by the risk control planner, having regard to the Initial Risk (2) and the practicability of implementation program.

***= Highest priority, **= Medium, *= Longer term, C=Completed

Selection/Assessment of Safety Related Parts of Control Systems in Accordance with AS/NZS 4024.1501-2014

PLANT	Shelfbot	ASSESSORS	J Lim	REVIEWED BY	
LOCATION	Burwood, VIC	DATES OF ASSESSMENT	24 th May 2024	REVIEW DATES	



LEGEND

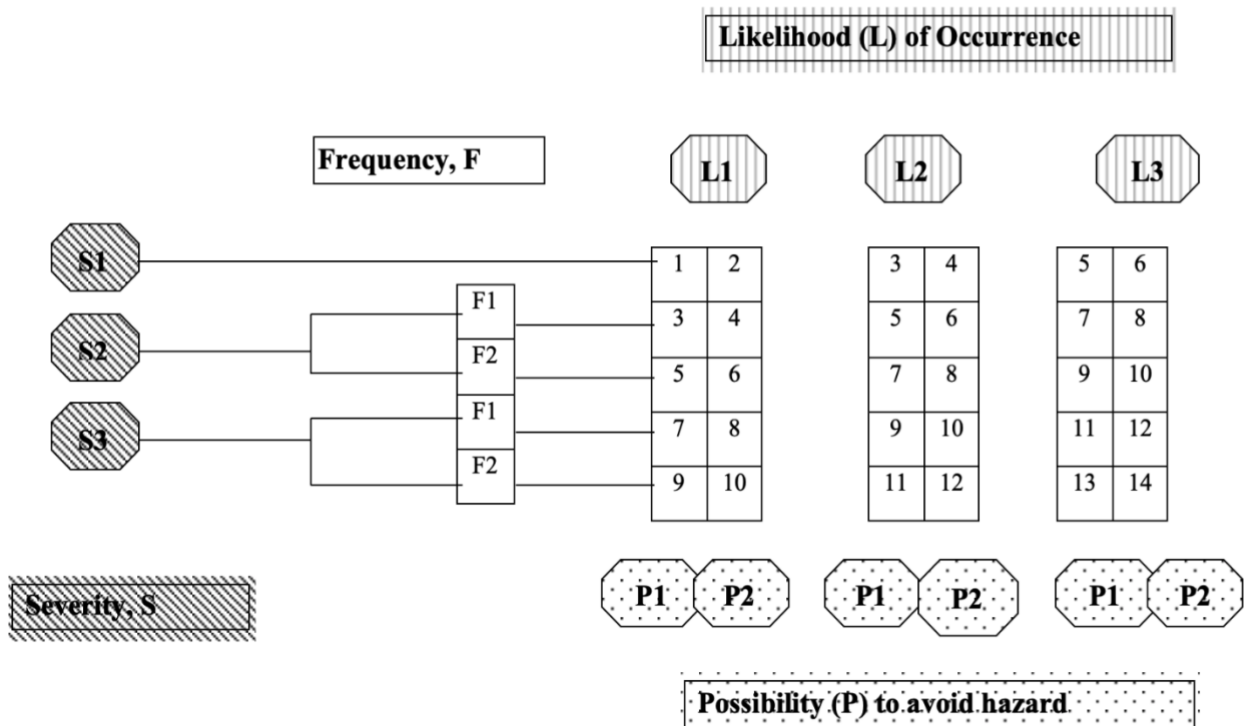
- S** Severity of injury
 S1, Slight (normally reversible) injury
 S2, Serious (normally irreversible) injury, including death.
- F** Frequency of exposure and/or exposure time to the hazard
 F1, seldom to quite often and/or the exposure time is short.
 F2, Frequent to continuous and/or the exposure time is long.
- P** Possibility of avoiding the hazard
 P1, Possible under specific conditions
 P2, scarcely possible
- B, 1 - 4**, categories for safety related parts of control systems
 (See AS/NZS4024.1501-2014 for details)

- Preferred
- Possible categories which require additional measures
- Over dimensioned

ITEM	HAZARD DESCRIPTION	SEVERITY S1 OR S2	FREQUENCY F1 OR F2	PROBABILITY P1 OR P2	CATEGORY B, 1-4	COMMENTS / ACTION / RECOMMENDATIONS (In accordance with AS/NZS4024.1501-2014)
1	Safety integrity of interlocked guards and emergency stop control.	S2	F1	P1	1-2	The applicable categories of control system recommended is listed against each identified hazard in the risk assessment worksheets.
		S2	F1	P2	2-3	
		S2	F2	P1	3	
		S2	F2	P2	4	

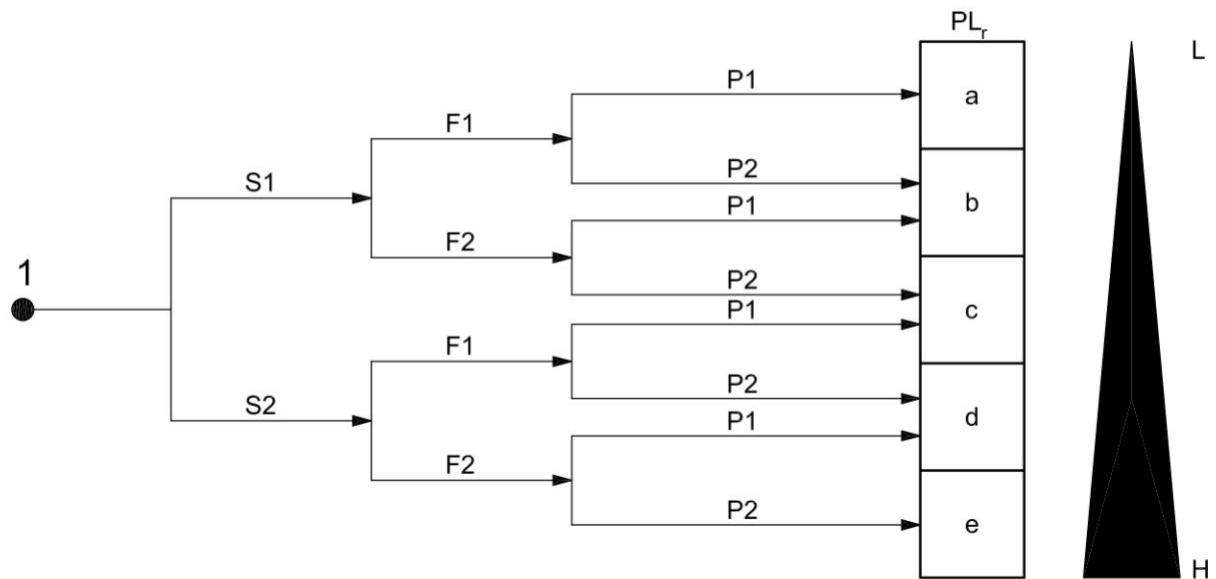
Risk Assessment Model

This risk assessment model considers all the elements of risks specified in AS/NZS4024.1303.



LEGEND	
Severity, S :	1. Minor injury or damage to health 2. Serious injury or damage to health 3. Death
Frequency (F) and/or duration :	1. Rarely ... fairly often 2. Regularly ... continuously
Likelihood (L) of occurrence :	1. Low 2. Medium 3. High
Possibility (P) to avoid hazard :	1. Possible in certain conditions 2. Rarely possible
Risk rating -	Low risk : 1...4 Medium risk : 5...7 High risk : 8...10 Very high risk : 11...14
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Risk Graph for Determining Required PL_r for Safety Function in accordance with AS/NZS 4024.1503:2014



Key

- 1 starting point for evaluation of safety function's contribution to risk reduction
- L low contribution to risk reduction
- H high contribution to risk reduction
- PL_r required performance level

Risk parameters:

- S severity of injury
- S1 slight (normally reversible injury)
- S2 serious (normally irreversible injury or death)
- F frequency and/or exposure to hazard
- F1 seldom-to-less-often and/or exposure time is short
- F2 frequent-to-continuous and/or exposure time is long
- P possibility of avoiding hazard or limiting harm
- P1 possible under specific conditions
- P2 scarcely possible

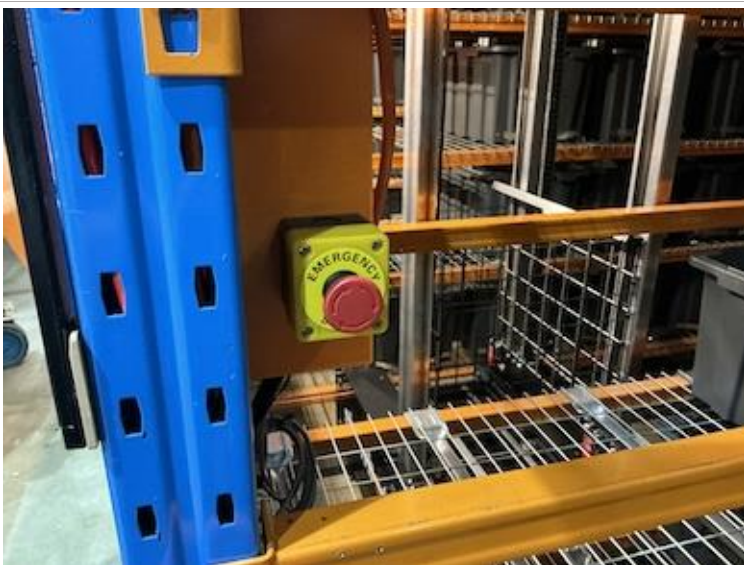
Figure A.1 — Risk graph for determining required PL_r for safety function

APPENDIX 2 PHOTOGRAPHS



Photograph 1

Recommend providing clear labelling of the main electrical isolation point including where the power is supplied from.



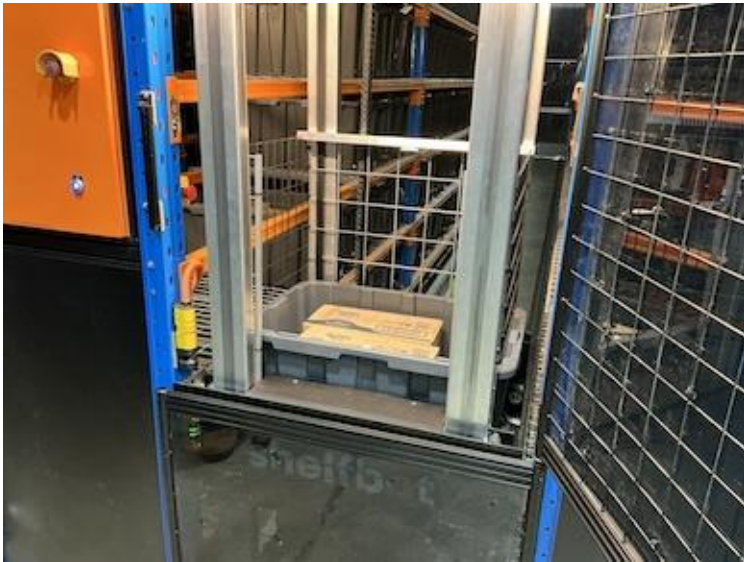
Photograph 2

Consider providing labelling at the internal emergency stop control to require actuation for emergency egress.



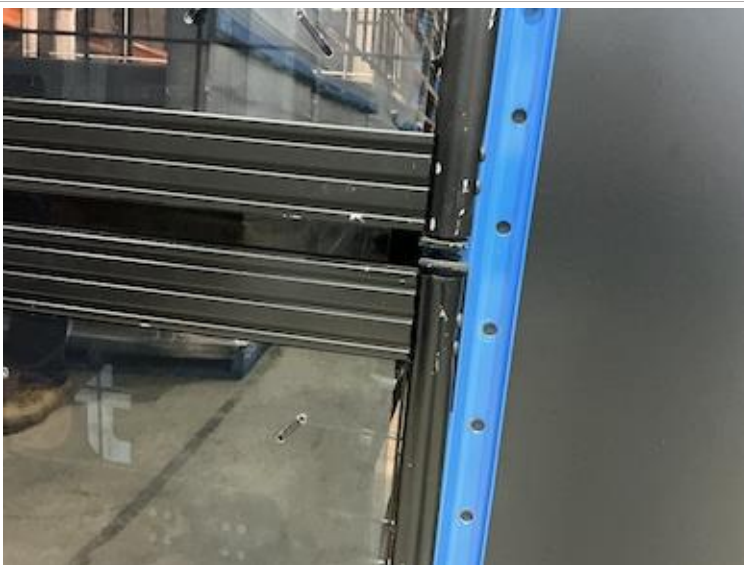
Photograph 3

Review of the electrical cabinet revealed use of dual channel emergency stop controls, Sick safety relay, Omron G9S Safety Controller and dual ABB Contacts.



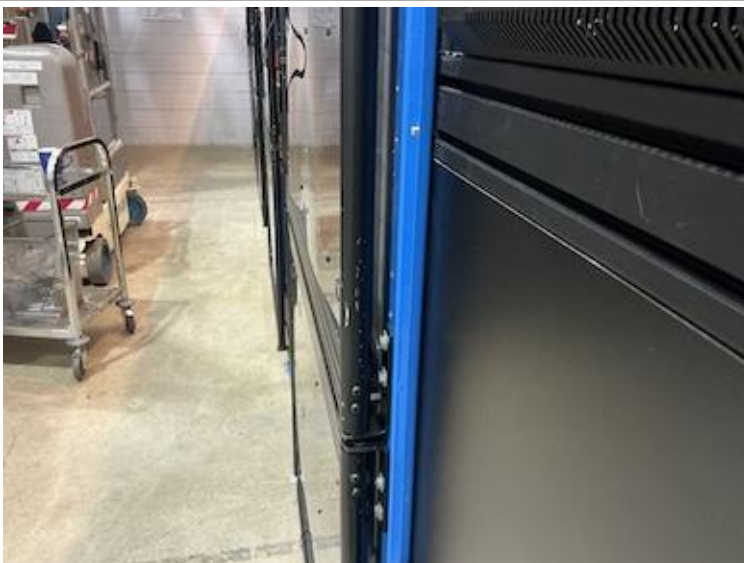
Photograph 4

The lower interlocked guard is only able to be opened once the emergency stop switch has been actuated. Actuation of the emergency stop switch will stop all of the pickers in the zone hence, it is not possible to climb from one picker bay into another picker bay.



Photograph 5

Ensure the slot and square openings are minimised to prevent finger reach to the moving platform.



Photograph 6

Ensure the slot and square openings are minimised to prevent finger reach to the moving platform.



Photograph 7

There is fixed mesh provided inside of the picking station to a height of approx. 1520mm which is considered difficult to defeat.



Photograph 8

The braked motors are rated to 32N whilst the strapping is rated to approx. 500kg per strap (4 straps are provided per picker).



Photograph 9

Recommend providing signage to indicate the load limit of the bins.



Photograph 10

Ensure signage of the safe working load limits for the pallet racking system are provided.



Photograph 11

The Shelfbot system is externally guarded with fixed mesh and polycarbonate guards to prevent access into the safeguarded space.

APPENDIX 3 DATA EXTRACT FROM AS4024.1-2019 SAFETY OF MACHINERY

5.2 Reaching upwards (see Figure 1)

5.2.1 Low risk

If there is a low risk from the danger zone, then the height of the danger zone h shall be 2500 mm or more.

5.2.2 High risk

If there is a high risk (see Clause 5.1.2) from the danger zone, then—

- either the height of the danger zone h shall be 2700 mm or more; or
- other safety measures shall be used.

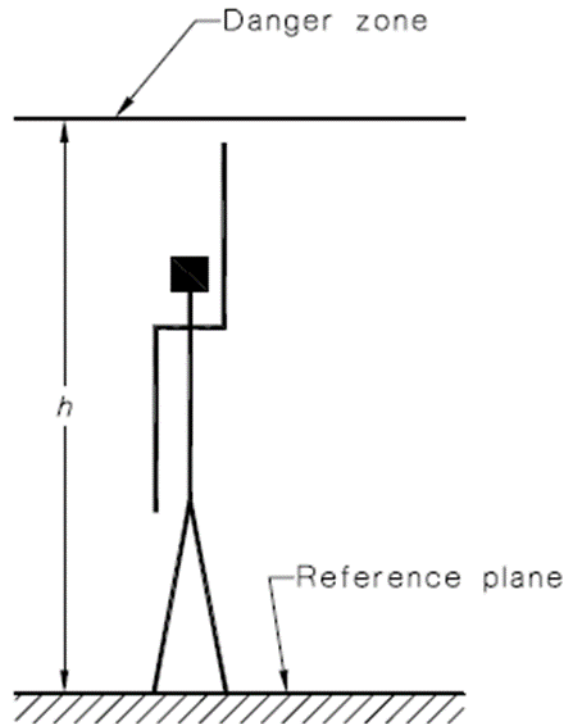


FIGURE 1 REACHING UPWARDS

5.3 Reaching over protective structures

5.3.1 General

There is a relationship between the height of a protective structure, the height of a danger zone and the horizontal distance to the danger zone from the protective structure.

This relationship is shown in Figure 2, and used in Table 1 and Table 2 to determine the appropriate safety distances.

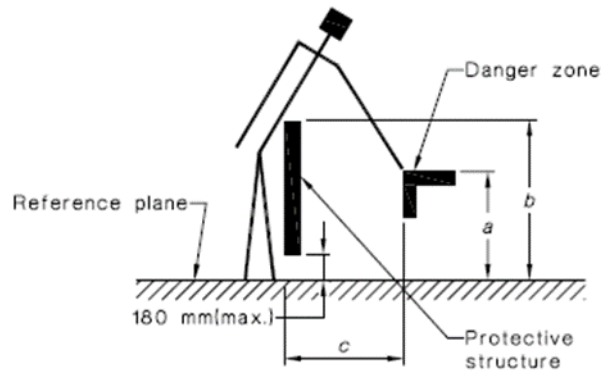


Table 2 — Reaching over protective structures — High risk

Dimension in millimetres

Height of hazard zone ^c <i>a</i>	Height of protective structure ^{a, b} <i>b</i>									
	1 000	1 200	1 400	1 600	1 800	2 000	2 200	2 400	2 500	2 700
Horizontal safety distance to hazard zone, <i>c</i>										
2 700	0	0	0	0	0	0	0	0	0	0
2 600	900	800	700	600	600	500	400	300	100	0
2 400	1 100	1 000	900	800	700	600	400	300	100	0
2 200	1 300	1 200	1 000	900	800	600	400	300	0	0
2 000	1 400	1 300	1 100	900	800	600	400	0	0	0
1 800	1 500	1 400	1 100	900	800	600	0	0	0	0
1 600	1 500	1 400	1 100	900	800	500	0	0	0	0
1 400	1 500	1 400	1 100	900	800	0	0	0	0	0
1 200	1 500	1 400	1 100	900	700	0	0	0	0	0
1 000	1 500	1 400	1 000	800	0	0	0	0	0	0
800	1 500	1 300	900	600	0	0	0	0	0	0
600	1 400	1 300	800	0	0	0	0	0	0	0
400	1 400	1 200	400	0	0	0	0	0	0	0
200	1 200	900	0	0	0	0	0	0	0	0
0	1 100	500	0	0	0	0	0	0	0	0

^a Protective structures less than 1 000 mm in height are not included because they do not sufficiently restrict movement of the body.
^b Protective structures lower than 1 400 mm should not be used without additional safety measures.
^c For hazard zones above 2 700 mm, refer to 4.2.1.

TABLE 3
REACHING AROUND OPENINGS

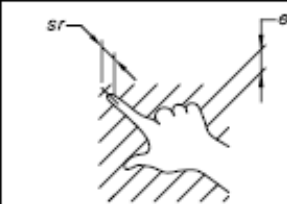
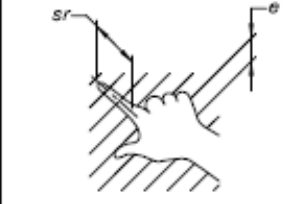
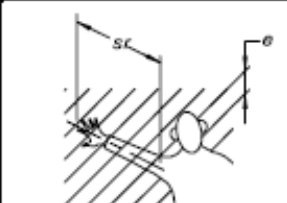
		millimetres
Limitation of movement	Safety distance, (<i>sr</i>)	Illustration
Limitation of movement only at shoulder and armpit	≥ 850	
Arm supported up to elbow	≥ 550	
Arm supported up to wrist	≥ 230	
Arm and hand supported up to knuckle joint	≥ 130	

LEGEND:

A – range of the movement of the arm.

e – either the diameter of a round opening, the side of square opening or the width of a slot opening.

TABLE 4
REACHING THROUGH OPENINGS FOR >14 YEAR OLD

Part of body	Illustration	Opening	Safety distance (s_r)		
			Slot	Square	Round
Finger tip		$e \leq 4$	≥ 2	≥ 2	≥ 2
		$4 < e \leq 6$	≥ 10	≥ 5	≥ 5
Finger up to knuckle joint or hand		$6 < e \leq 8$	≥ 20	≥ 15	≥ 5
		$8 < e \leq 10$	≥ 80	≥ 25	≥ 20
		$10 < e \leq 12$	≥ 100	≥ 80	≥ 80
		$12 < e \leq 20$	≥ 120	≥ 120	≥ 120
		$20 < e \leq 30$	≥ 850 (see note)	≥ 120	≥ 120
Arm up to junction with shoulder		$30 < e \leq 40$	≥ 850	≥ 200	≥ 120
		$40 < e \leq 120$	≥ 850	≥ 850	≥ 850

**MINIMUM GAPS TO AVOID CRUSHING OF A BODY
IN THE ORIENTATION SHOWN**

millimetres		
Part of body	Minimum gap, <i>a</i>	Illustration
Body	500	
Head (least favourable position)	300	
Leg	180	
Foot	120	
Toes	50	
Arm	120	
Hand Wrist Fist	100	
Finger	25	