Melvelle Equipment Corp Pty Ltd

"Proud Australian Manufacturers"

FP-192 ELECTRIC QUADRICYCLE

GEN3

Operation, Training & Maintenance Manual

Patent pending or patents granted in AUS/USA/UK/CA/Asia

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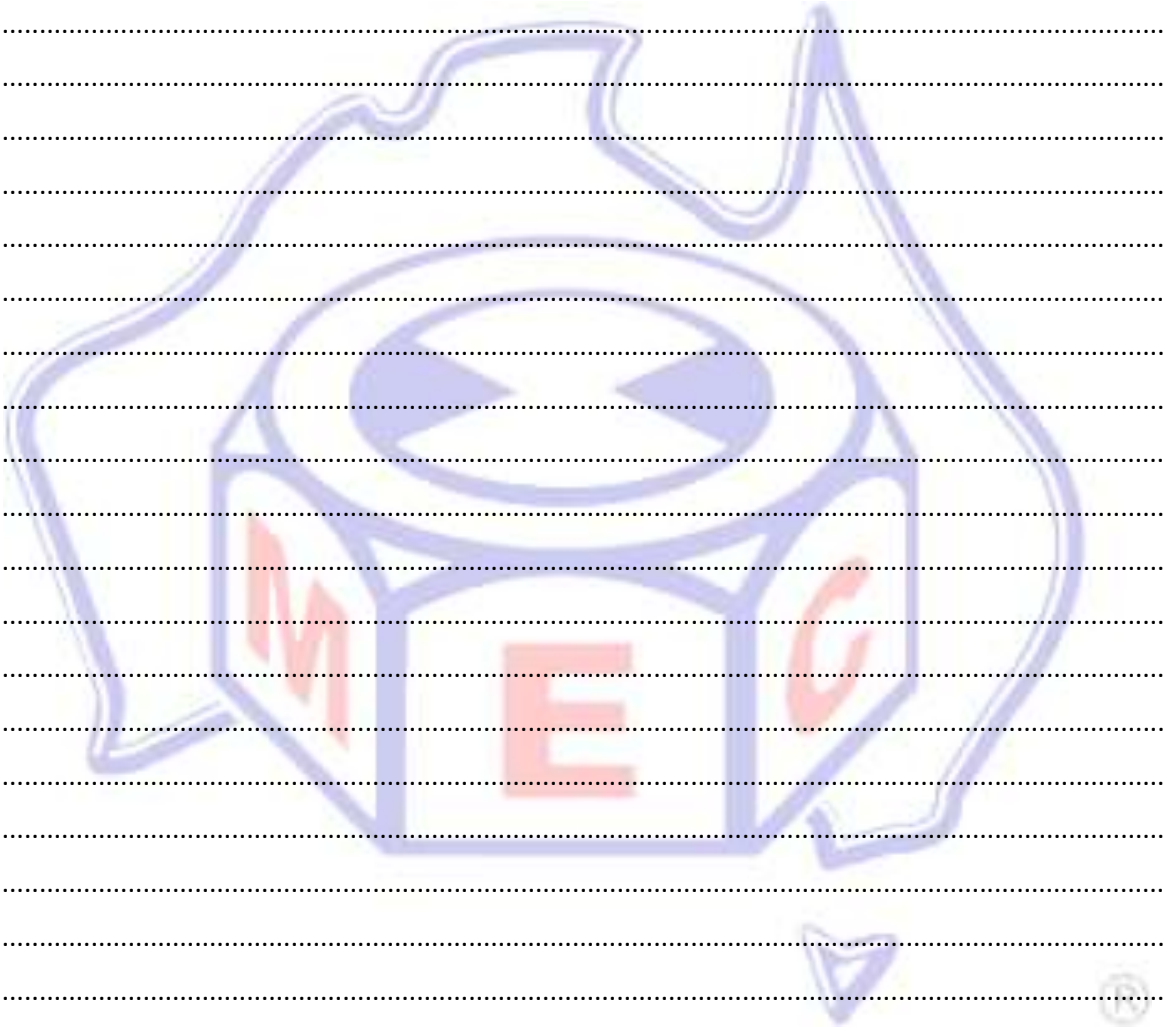

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Table of Contents

1. Preface

Every attempt has been made to present accurate and current information within this manual. However, as product development on the quadricycle and components used within is continuous, the information contained herein may be subject to change without notice, and without incurring obligation.

The information provided within this manual is the sole property of Melvelle Equipment Corporation Pty Ltd (MEC) and as such, reproduction or replication of any material contained within is not allowed without the written consent of MEC.

Information provided within this manual assumes:

- The person(s) operating the machinery have read and understand this manual and other manuals provided for specific components
- The person(s) operating are properly trained and equipped to safely and professionally operate this machinery
- The person(s) operating utilise the correct attachments and/or tools, and are trained and equipped to use them safely and professionally

For the purposes of this manual, information specific to the EMERGENCY RESPONSE DECK versions will be presented, although the chassis, wheel, battery, and control components are common between trolley variants.

SERVICING THE FP-192 ELECTRIC QUADRICYCLE

This manual contains safety, operation and periodic maintenance instructions. MEC recommends that servicing of equipment, other than periodic maintenance, be performed by MEC or certified and authorised dealer. Please read the following warning.

SERIOUS INJURY OR DEATH COULD RESULT FROM THE IMPROPER REPAIR OR SERVICE OF THIS EQUIPMENT.

REPAIRS AND / OR SERVICE OF THIS EQUIPMENT MUST ONLY BE PERFORMED BY MELVELLE EQUIPMENT CORP. PTY LTD. OR CERTIFIED AND AUTHORISED DEALER.

THE USER SHALL NOT MODIFY THE DESIGN OR CONFIGURATION OF EQUIPMENT WITHOUT CONSULTING MEC

2. Safety Information

This operation and training manual is intended to complement existing site procedures.

The following site documentation must be reviewed by the trainee before commencing training:

- Safe Work Procedures (SWP)
- Isolation Procedures

If this training package information conflicts with existing site documentation, then the authorised site and/or end user is to consult with MEC in regard to any possible amendments or modifications required.

The following practices and procedures must be adhered to:

- Always complete pre-operation checks prior to use and report any defects if found.
- Only connect equipment with compatible MEC equipment.
- Only operate the equipment for its intended purpose.
- Personal protective equipment as a minimum should be worn at all times according to this manual and as per site specifications.
- Ensure Isolation Procedures are followed prior to carrying out any maintenance.
- If any faults or damage to this machine are found during pre-operation checks or operation, tag the machine “out-of-service” and follow site procedures.

Following the above mentioned and the information contained within this manual will ensure safe, efficient operation of the equipment.

It is recommended that the following personal protective equipment be worn during assembly, operation and disassembly of the quadricycle: eye protection, hard hat, gloves, steel-capped work boots, hard hat, high-vis long-sleeved shirt and eye protection.

3. Safety Symbols

The safety symbols and signal words, as shown below, are used to emphasise all operator, maintenance and repair actions which, if not strictly followed, could result in a life-threatening situation, bodily injury or damage to the equipment.

3.1. Safety Symbols & Signal Words

	**This safety alert and signal word indicates a hazardous situation which, if not avoided, will result in death or serious injury.**
	**This safety alert and signal word indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.**
	**This safety alert and signal word indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury.**
	**This signal word indicates a potentially hazardous situation which, if not avoided, may result in property damage.**
	**This signal word indicates a situation which, if not avoided, will result in damage to the equipment.**
	**This signal word indicates a situation which, if not avoided, may result in damage to the equipment.**

3.2. Hazard Warning Signs

	**This is the safety alert symbol. It is used to alert you to potential personal injury hazards. Obey all instructions to avoid possible injury or death.**
	**This is the fire risk symbol. It is used to alert you to the potential of a fire starting if ignition sources are present.**
	**This is the explosive risk symbols. It is used to alert you to the potential of an explosion /explosive substances present.**
	**This is the toxic hazard symbol. It is used to alert you to the presence of toxic substances.**
	**This is the corrosive risk symbol. It is used to alert you to the presence of corrosive substances.**
	**This is the electric shock risk symbols. It is used to alert you to the presence of an electrical supply.**
	**This is the battery symbol. It is used to alert you to the potential hazard of electrical supply, battery acid and leaking batteries.**

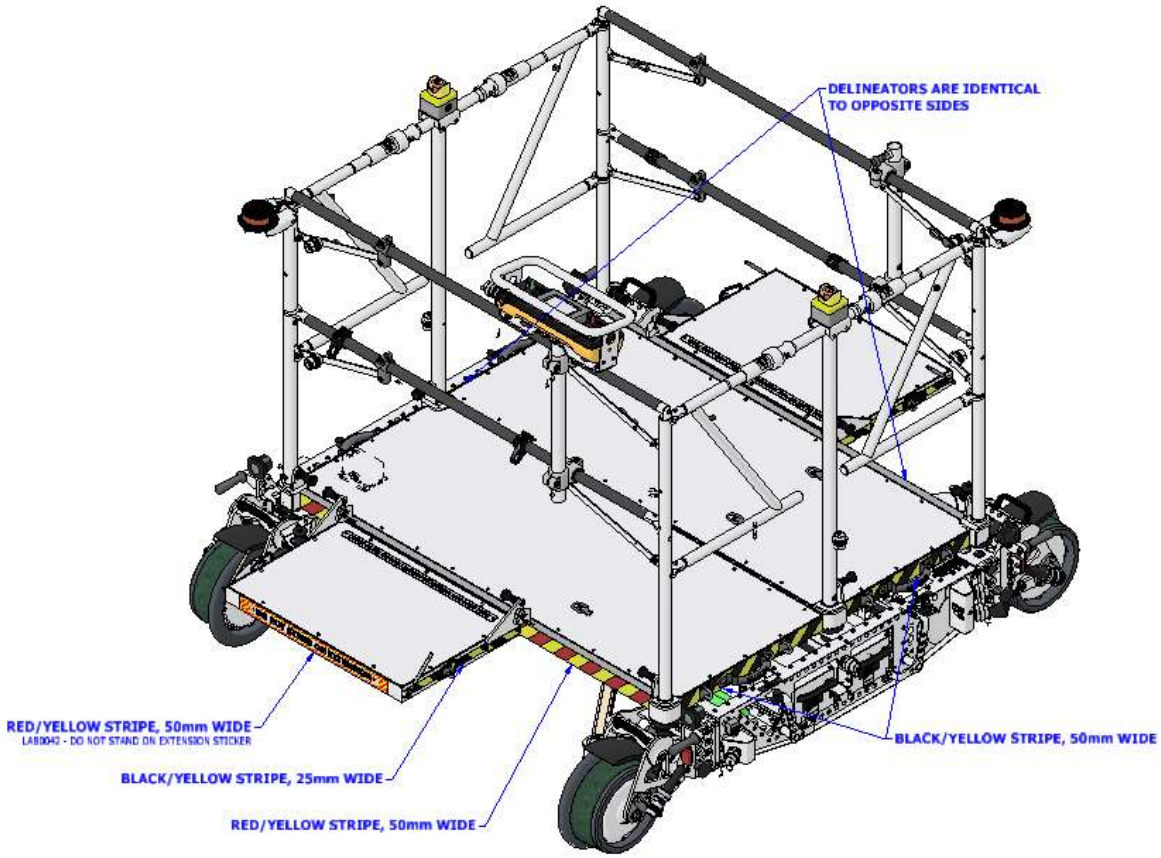
	**This is the hot surface symbol. It is used to alert you that the surfaces may be hot.**
	**This is the dangerous gases symbol. It is used to alert you to the presence of dangerous gases.**
	**This is the fluid under pressure symbol. It is used to alert you that there are fluids under pressure in this machinery.**
	**This is the sharp edges symbol. It is used to alert you to the presence of sharp edges or cutting hazard.**
	**This is the keep hands clear symbol. It is used to warn you to keep hands clear as there are pinch points present.**
	**This is the rotating parts symbols. It is used to warn you of rotating parts on the machinery. Keep clear of rotating parts.**

3.3. Personal Protection Symbols

	**This is the eye protection symbol. It is used when eye protection must be worn.**
	**This is the hearing protection symbol. It is used when hearing protection must be worn.**
	**This is the head protection symbol. It is used when head protection must be worn.**
	**This is the hand protection symbol. It is used when hand protection must be worn.**
	**This is the foot protection symbol. It is used when feet protection must be worn.**
	**This is the protective body clothing symbol. It is used when protective clothing must be worn.**

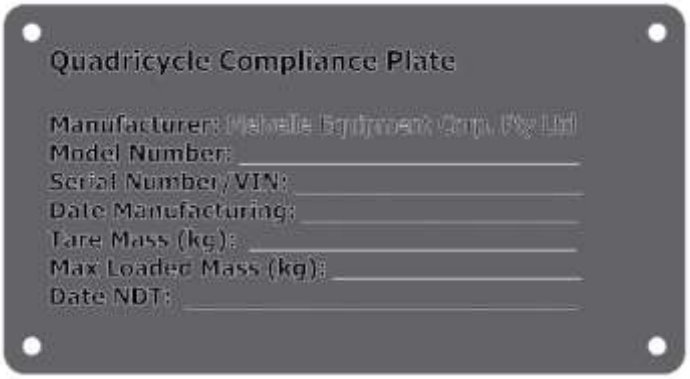
4. Equipment Labels and Delineators

4.1. Delineators



4.2. Stickers and Tags

Below are the stickers and tags utilised on this equipment.



IDTAG20 – Inspection Trolley Compliance Plate

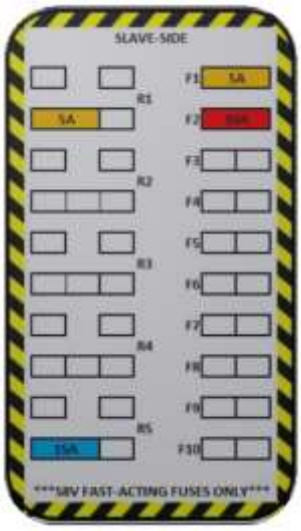
IDTAG26 – Subassembly Serial Tag

IDTAG29 – Close Gates Before Loading Extension Tag

LAB0042 – Do Not Stand On Extension Sticker

LAB0068 – E Stop Round Label – 25MM

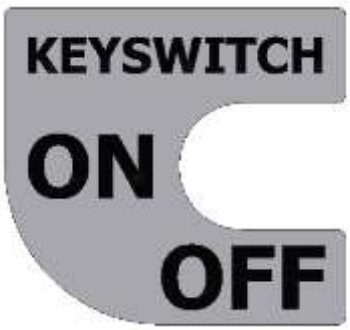
LAB0075 – Fuse Holder, Master, Sticker



LAB0076 – Fuse Holder Slave Sticker

LAB0077 – Accessory Socket, Master, Sticker

LAB0078 – Accessory Socket, Slave, Sticker



LAB0079 – Keyswitch Sticker

LAB0084 – Lock – Release Label

LAB0092 – Power Cube Serial Tag, 52V, 20.8AH

5. Emergency Stop

Important information about the Emergency Stop:

There are two emergency stops located on this quadricycle that allow operators to safely stop movement of the vehicle in the event of an emergency.

The following outlines the emergency stop activation and reset procedure:

1. To activate the emergency stop while the vehicle is in motion, press one of the two emergency stop buttons.

   The vehicle will now proceed to decelerate to a stop. The trolley will now remain immobilised until the operator has acknowledged the emergency stop event, and has confirmed it is now safe to continue. The screen will display "Emergency Stop Active".

2. To reset the emergency stop, de-latch the knob by twisting in the indicated direction (ensure both e-stops are de-latched), then follow the on-screen instructions to acknowledge.

6. Introduction

Melvelle Equipment has developed a flexible, modular self-propelled rail quadricycle to meet a variety of needs in the rail industry such as track inspections and emergency response.

The general concept (patent pending) is a common multigauge lightweight chassis with programmable drivetrain which seamlessly integrates with a range of tailored enclosed decks.

The components and modules have been designed and manufactured to be as lightweight as possible in order to reduce the effort and number of personnel required to assemble and disassemble the unit without the use of tools.

This quadricycle features a fully interlocked system, ensuring all physical and electrical connections have been made before the vehicle can proceed. These systems interlock the deck, chassis, and drivetrain components. Incorporated is an intuitive and feature-packed display with useful monitors such as battery status, interlock status, vehicle speed and diagnostic information accessible via a series of menus.

The drivetrain includes brushless motors which also dynamically-brake, as well as additional fail-safe spring-applied brakes. This ensures smooth service braking and reliable emergency braking.

Power is supplied to the unit through (up to) four lithium-ion battery modules. The wheel motors also provide regenerative braking, charging the batteries when decelerating, helping to maximize range.

Ancillary components of the trolley include headlight/taillights, a horn, 2x 12-volt accessory outlets, a white noise in-motion buzzer (optional) and safety warning beacons.

The unit is highly adaptable. By simply changing the type of deck/handrails used, the quadricycle can be adapted to different rail gauges and personnel/equipment carrying situations.

7. Specifications

7.1. General

Nominal battery voltage	52 volts
Battery capacity (per module)	20.8 Ah
Charging voltage	56.0 volts
Battery charge time (from discharged state) using 10.3A charger	4 hours (2 batteries), 8 hours (4 batteries) (approx.)
Range	Up to 70km* (approx.)
ER deck maximum payload	550 kg
Maximum payload per deck extension	75 kg
Maximum vehicle speed	10 km/h**
Peak motor torque	139.7 Nm
Peak motor braking torque	139.7 Nm
Park brake nominal holding torque	100 Nm

*** when using 4x batteries**
**** typical network requirement**

7.2. Approximate weights

	1067 ER (kg)	1435 ER (kg)	1600 ER (kg)	1067 AA (kg)	1435 AA (kg)	1600 AA (kg)	1600 CL (kg)
Chassis mass	52.5						
Driven wheel mass	20.5						
Braked wheel mass	20.5						
Deck half mass	15	17	18	TBA	12	TBA	18
Handrail (one side) mass	12.5	13	13.5	TBA	13	13.5	13.5
Power Cube mass	7						
Pendant controller mass	4						
Lifting Beam	12						

ER – Emergency Response Version
AA – Inspection Version
CL – Crane Lift Version

8. Operation

Before use of the equipment, be aware of the operating environment and conditions for which the equipment is to be used. Ensure all users are trained to operate the machinery before operation.

8.1. Operating Conditions

The following outlines the duties and conditions for which the equipment is intended to be operated:

- Used on the intended rail line (gauge)
- Two-person operation
- Maximum of four people on trolley
- Maximum load for inspection deck is 550kg
- Maximum load for emergency response deck is 700kg

8.2. Pre-Operation Checks

IMPORTANT

General Inspection

1. Inspect wheels and wheel brackets for damage.
2. Wheel treads should be within acceptable wear limits.
3. Check deck pin receptacles for foreign objects and or debris prior to insertion of the pins.
4. Battery slides should be clean.
5. Telescoping beam reflective tape should be fitted and free from damage (if applicable).
6. All gate couplings should slide freely and be free of debris.
7. Check for wear on deck extension support cables.
8. Lock-out pin for wheels and handrails should engage and disengage fully.
9. If any components of the trolley are damaged, DO NOT USE. Contact MEC for repairs.

Electrical connections

1. Visually inspect connections on wheels brackets, decks and chassis.
2. Visually inspect battery connections on battery modules and chassis connectors.
3. Ensure there is no damage.
4. If damaged, DO NOT use machinery. Replace before use.

Decals/Tags

1. Inspect all decals/tags are in place and secure.
2. Ensure there is no damage .
3. If damaged, DO NOT USE. Replace before use.

8.3. Assembly/Setup Procedures

8.3.1. Manual Lift

1. Lower one side of the chassis over a rail, and then deploy the corresponding set of rail catches by releasing the lock pins and rotating the rail catch levers down.

2. Lift both chassis locking pins and drag the free side of the chassis to the opposite rail.

The telescoping beam snap button will lock into gauge.

Deploy the side 2 rail catches by releasing the lock pins and rotating the rail catch levers down.

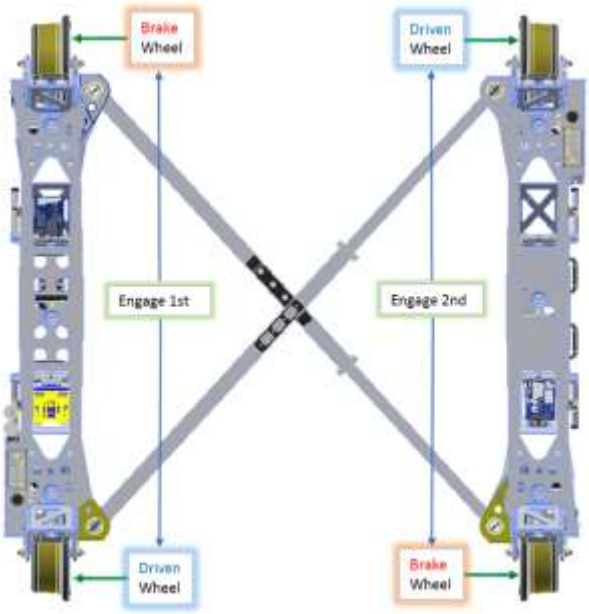
3. To install a wheel, feed the wheel assembly into the chassis such that the trunnions locate into the hooks (1).

   With one hand grip the wheel handle, then rotate the wheel into the chassis until the pin locks (2).

Note: Always position wheel wedge towards inside of chassis.

Fit wheels on one side of the chassis and connect electrical plugs.

Move to the opposite chassis side, fit the remaining two wheels and connect electrical plugs.



4. Place the 2 decks onto the chassis.

5. Fit handrails by pushing through deck bosses into the chassis.

NOTICE

Push each side of the handrail down evenly to prevent binding.

Connect electrical plugs.

6. Lock the handrails by releasing the bottom pins.

7. The position of the deck extensions can be changed by releasing the 2 spring-loaded locking pins.

When the extensions are to be used, fold them to the flat position, allowing the cables to provide support. Connect lanyards to loops on knee rail via the carabiner clips.

8. Push the batteries firmly into the chassis until the front face of the battery is flush with the outside of the chassis.

9. Retain the battery modules by rotating the rail catches until locked.

   <u>Note:</u> This also raises the forks from the rail head releasing the chassis.

10. Raise the two warning beacons.

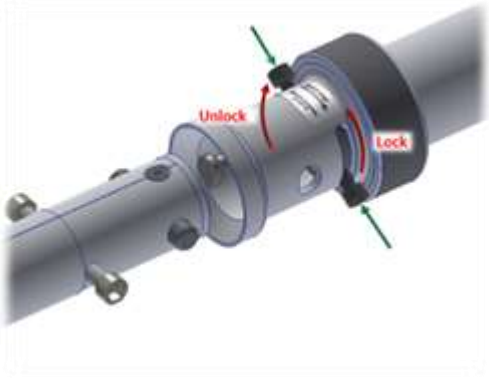
11. Unfasten the stowage tonneau from the gates.

    Swing the gates closed.

    Ensure the coupling lock is in the “RELEASE” position – rotate the coupling lock by gripping the two exposed screws and twisting.

    Slide the coupling out until the 2 snap buttons engage with the coupling.

    Rotate the coupling lock into the “LOCK” position.



12. Fit the pendant controller and connect electrical plug.

8.4. Operation Procedure

8.4.1. Pendant Controller

Button Information

Use the 4 ⊙ buttons or 4 ⊙ buttons surrounding the display to make selections in menus and operate features.

Use the ⌂ button to return to the home screen from any menu.

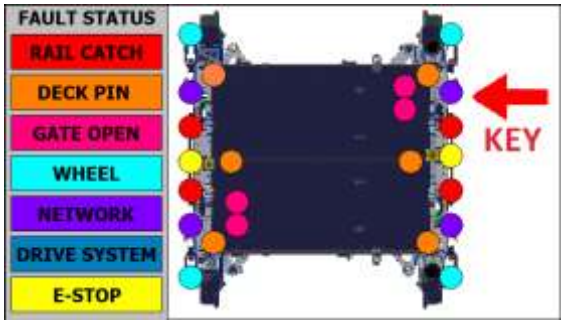
Use the ⊕ or ⊖ buttons to raise or lower parameter values.

Home Screen

The home screen provides general running information at a glance.

1. Key side battery remaining capacity
2. Non-key side battery remaining capacity
3. Fast speed mode
4. Slow speed mode
5. Horn
6. Monitor information
7. Vehicle speed
8. Interlock, brake release, communication system, range and hour meter information

Interlock Information

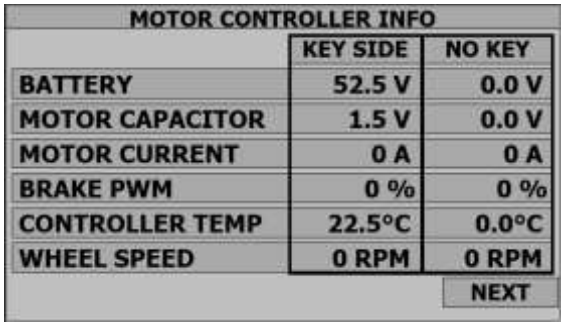


The interlock information screen will display when any of the following interlocks are open:

1. Wheels
2. Gates
3. Rail catches
4. Deck pins

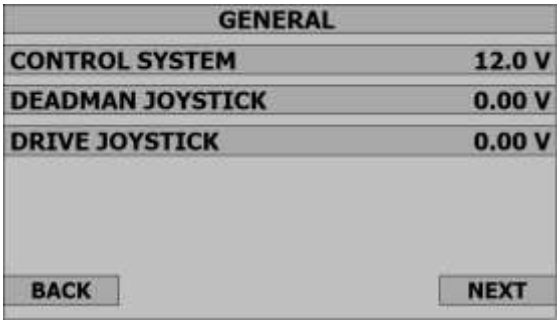
Fix any open interlocks on the quadricycle to clear the screen and resume operation.

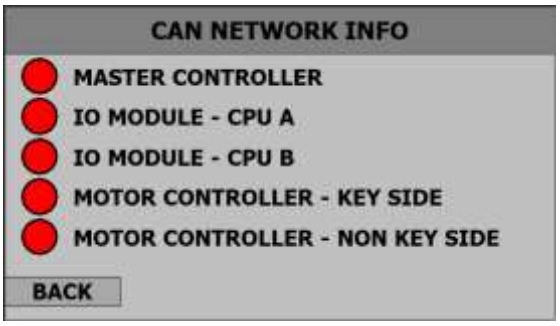
Diagnostic Information



Diagnostic information screen is accessed by pressing the ⓘ button from the home screen.

Motor controller information, general system voltages and CANbus controller statuses can be viewed within these menus.


GENERAL
CONTROL SYSTEM
12.0 V
DEADMAN JOYSTICK
0.00 V
DRIVE JOYSTICK
0.00 V
BACK
NEXT

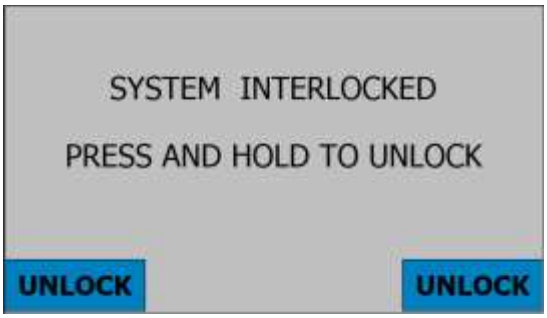

CAN NETWORK INFO
MASTER CONTROLLER
IO MODULE - CPU A
IO MODULE - CPU B
MOTOR CONTROLLER - KEY SIDE
MOTOR CONTROLLER - NON KEY SIDE
BACK

8.4.2. Quadricycle Operation

After following the steps in section 8.3 the machine is now ready for operation as follows.

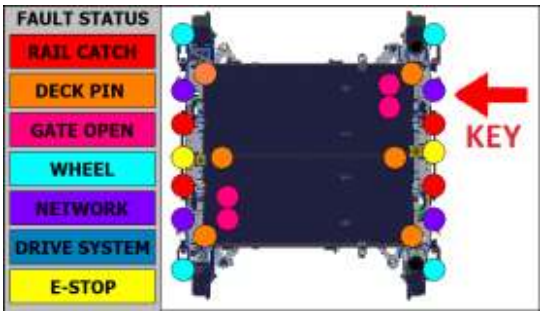
1. Rotate the keyswitch to the “ON” position.

2. Wait for the system to boot and unlock using the ⊙ and ⊙ buttons when prompted.

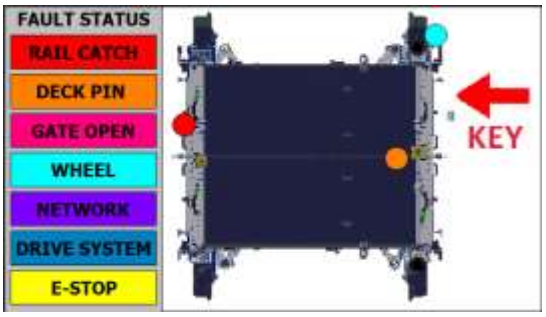


3. Fix any open interlocks if necessary.

   Interlock numbers are counted clockwise around the quadricycle starting from the key corner.



   The example screen to the right shows open interlocks for:
   - Wheel 1
   - Deck 2
   - Rail Catch 4



4. Select the desired speed mode using the ⦿ buttons.

   Approximately 10km/h* maximum

   Approximately 5km/h* maximum

   *Depending on network requirements.

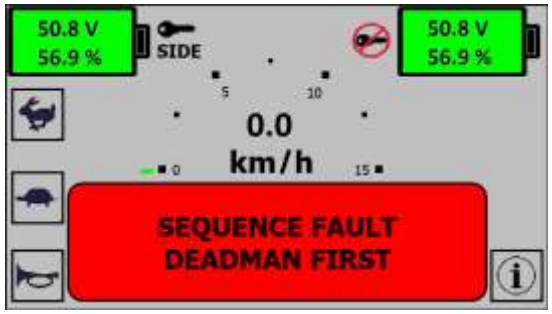
5. To move the vehicle:

   Push or pull the red “1” joystick first and hold.

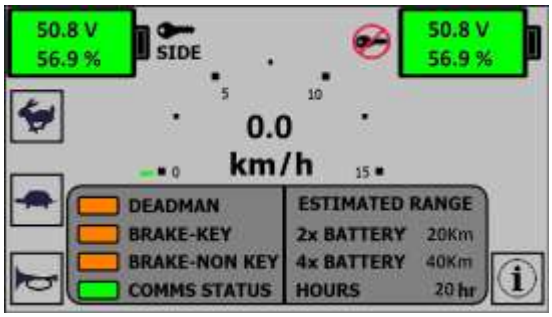
   Slowly push the green “2” joystick forward, or pull back to reverse.

   If the “2” joystick is pushed before the “1” joystick, the following error will be displayed.

   Release both joysticks, then apply the “1” joystick first.



6. Press and hold the button to activate the horn.



7. Refer to section 5 for emergency stop information.

8.5. Disassembly Procedures

Disassembly procedures for this trolley are the reversal of the assembly procedures.

9. Equipment Protection & Care

NOTICE

In addition to the Safety Precautions found in this manual and the supporting tool and parts manuals, observe the following for equipment protection and care

- Make sure all structural and electrical connections are wiped clean and are dry before joining.
- Always store the quadricycle in a clean dry space, safe from damage or pilferage.
- Always replace components with parts recommended by MEC.
- Always keep critical tool markings such as warning stickers and tags legible. Replace if damaged.
- Repairs and/or service work must only be performed by MEC or a certified and authorised dealer.

10. Maintenance

WARNING

Before any maintenance are performed, ensure all 4 battery modules are removed to eliminate risk of arcing and electric shock.

Tools Required to Complete Maintenance

Below are initial tools required to complete general maintenance tasks. Additional tools may be required.

• Metric hex wrenches – 2mm, 2.5mm, 3mm, 4mm, 5mm, 6mm	
• Combination wrenches – 5.5mm, 8mm, 10mm, 12mm, 13mm, 14mm, 16mm, 17mm, 19mm	
• Adjustable wrench	
• Metric socket set - 5.5mm, 8mm, 10mm, 12mm, 13mm, 14mm, 16mm, 17mm, 19mm	

• Pin punch set – 8mm, 10mm	
• Ball pein hammer	
• Soft face mallet	
• Laser measuring device	
• Phillip head screwdriver	
• Flat blade screwdriver	
• Multimeter	
• Calibrated torque wrench	
• Park brake torque testing jig	

10.1. Maintenance Period

IMPORTANT

REGULAR SERVICE PERIOD* Perform at every indicated month or operating hour interval, whichever comes first. ITEM		Each use	Every 3 months or 50hrs	Every 6 months or 250hrs	Every year or 500hrs	Every 10 years
Battery chargers	• Visual inspection for damage • Check connector for damage, ensure pins are seated correctly • Ensure target charging voltage is being maintained	X				
Brakes	• Prepare the quadricycle for operation as per section 8.4.2 • Drive the quadricycle a short distance forward and reverse and check dynamic braking is functional	X				
Carbon fibre tubing	• Visual check for damage • Replace if required	X				
Chassis/deck/telescoping beam/wheel structure	• Visual check for obvious structural defects • Inspect rail guidance structure for misalignment and/or structural damage • Inspect telescoping beams lock into correct gauge and are free from damage	X				
Emergency stop	• Test for operation • Visual check for damage • Consult OEM if required	X				
Flashing beacons	• Test for operation • Check electrical connectors • Replace if required	X				
Head lights/tail lights	• Test function of head lights ○ Prepare the quadricycle for operation as per section 8.4.2 ○ Head lights will illuminate in the direction the green joystick is pushed • Test function of tail lights ○ Prepare the quadricycle for operation as per section 8.4.2	X				

	• Tail lights will illuminate opposite the direction the green joystick is pushed					
Horn	• Test for operation • Replace if required	X				
Signage	• Ensure labels tags and reflective delineators are fitted and free from damage	X				
Batteries	• Check connector for damage, ensure pins are seated correctly • **Capacity test batteries using a compatible load tester every three months from three years of cell pack manufacture** • Replace if required		X*		X	
Chassis fasteners	• Check all chassis fitting and fasteners • Replace if necessary		X			
Nylon wheel and supporting drive/braking structure	• Visually inspect for damage • Replace component(s) if required	X				
Nylon wheel	• Inspect wheel geometry • Replace if required			X		
Wheel fasteners	• Check for tightness			X		
Extension panel support cables	• Check for fraying and signs of damage • Ensure turnbuckles are tight and adjust if necessary • Replace if required			X		
Chassis frame	• Visual check for cracks and signs of failure • Replace/consult OEM for rectification				X	
Conductivity Test	• Test for resistance across wheels • Consult OEM if necessary				X	
Electrical connections and plugs	• Check for corrosion • Clean/replace if required				X	
Labels, tags and reflective delineators	• Replace if damaged or missing ○ Refer to section 4.1 for delineator deails ○ Refer to section 4.2 for equipment label information				X	
Park brake	• Test for static holding ability • Service as required				X	
Telescoping beams	• Visual inspection for defects • Replace if damaged				X	
Telescopic beam plastic inserts	• Check for wear and excessive lateral movement • Replace if necessary				X	

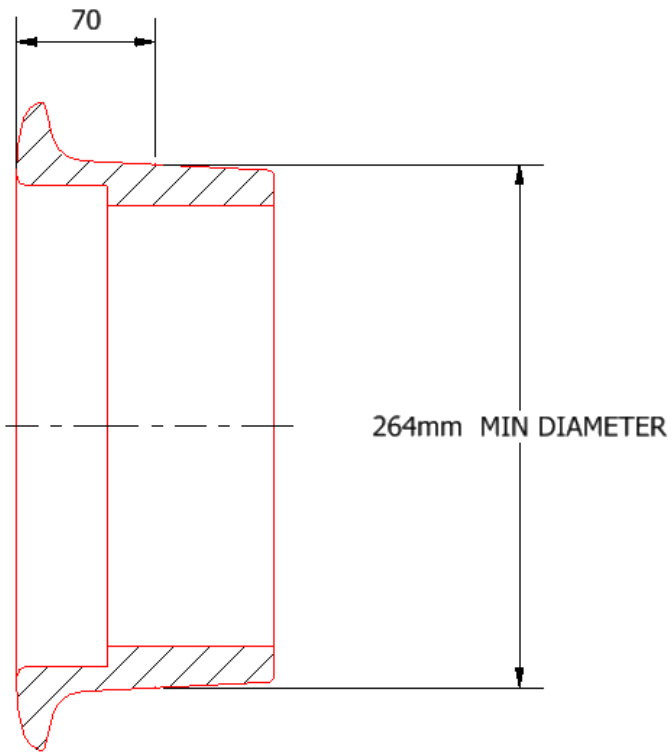
Wheel bearings	• Check for excessive movement • Perform “rumble” test • Replace if required				X	
Chassis frame	• Non-destructive testing of aluminium frame structure (dye penetrant testing) • Contact MEC for repairs if required					X

***Only after 3 years from date of cell pack manufacture.**

10.2. Wheel Wear Limits

Shown below is the minimum diameter (condemned limit) for the wheel prior to requiring replacement.

New wheel diameter 272mm.



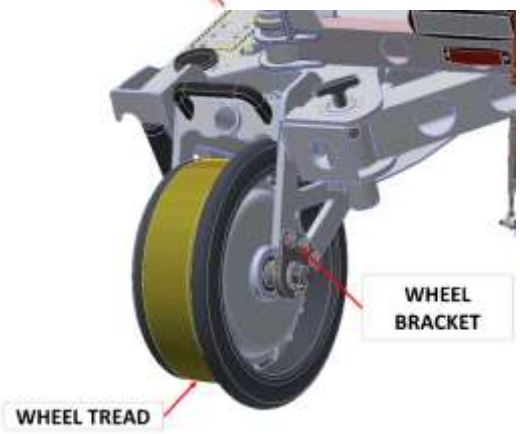
Wheels shall be inspected to ensure they remain within the allowable wear and defect limits. Refer to ESR 0330 *Wheel Defect Manual* for wheel defect limits.

10.3. Conductivity Test

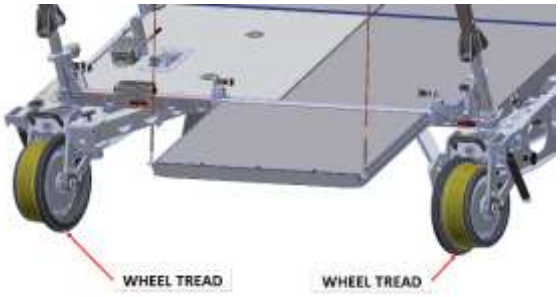
The quadricycle should be tested for isolation purposes after all other maintenance has been performed. The wheels are made of a material that electrically isolates the wheel from the frame. If the wheel diameter is above the limits specified above in section 10.2 isolation will occur. To confirm this, check electrical resistance as per the procedure below:

1. Using a multimeter (capable of reading MΩ), connect the 2 leads together and check the meter displays less than 1Ω.

2. Connect 1 lead to the outer of the wheel and another to the wheel bracket.
3. The measured resistance should be at least 5MΩ.
4. Repeat for the remaining three (3) wheels.



5. The conductivity between the wheels must also be checked. Touch 1 lead to one of the wheels and the other lead to the opposite wheel as shown.
6. The measured resistance should be at least 5MΩ.
7. Repeat for the remaining 2 wheels.



10.4. Spare Parts

The following table outlines spare parts recommended by MEC. Please contact MEC sales if you would like to make a purchase or enquire about any of the parts listed.

Part Number	Description	Additional Details
1920011_LH	**POWER CUBE BATTERY, LITHIUM ION, 52V, 20Ah, LH**	Common to all MEC quadricycles.
1920011_RH	**POWER CUBE BATTERY, LITHIUM ION, 52V, 20Ah, RH**	Common to all MEC quadricycles.
1920069	**WHEEL TREAD DRIVEN**	Compatible with driven wheels.
1920073	**WHEEL TREAD BRAKED**	Compatible with braked wheels.
1920095	**MOTOR ASSEMBLY, SUITS DRIVEN WHEEL**	Compatible with driven wheels.
1920015	**STANCHION TIP**	Located at the bottom of handrail posts.
ELECT182	**LED WORKLIGHT, 9-80V DC, 500LM**	Located on chassis.
ELECT357	**BEACON, AMBER, LED, 10-30V, SAE CLASS 1**	Located on chassis.
ELECT395	**LED CLEARANCE LIGHT, RED, 10-30V, 50X25MM**	Located on chassis.
TONNEAU-LOOP-90	**TONNEAU LOOP 90mm BUNGEE CORD WITH RIVET HOLE**	Located on handrails.
TONNEAU-BUTTON-17	**TONNEAU BUTTON DIA. 17mm HEIGHT 14mm**	Located on gates.
1920020	**INDEXING PLUNGER, CHASSIS, MODIFIED**	Located in chassis ends.
PIN-INDEX-PMT101-M16	**INDEXING PLUNGER WITH REST POSITION**	Located on decks and extensions.
SENS001	**INTERLOCK SENSOR, TYPE 1**	For driven and braked wheel brackets.
SENS002	**INTERLOCK SENSOR, TYPE 2**	For all sensor locations except driven and braked wheels.

10.5. Park Brake testing

The FP-192 trolley's park brake wheels should hold a minimum torque setting of **80Nm** for holding the machine on gradients up to **1 in 24** at gross vehicle mass.

Note: Two wheels fitted to the unit are park brake wheels while the other two wheels are drive/regen wheels. During normal operation the drive wheels will dynamically brake the unit back to a rest before the park brakes are activated.

To test park brake torque settings, grip the wheel with a MEC supplied brake test tool and begin to load the wheel until the wheel turns. Record the reading in both directions. Both readings must be above 80Nm.

11. Troubleshooting

PROBLEM	POSSIBLE CAUSE	CORRECTION
Pendant display reports open wheel interlock **Refer to section 8.4.2 step 3 for further details.**	Wheel is unplugged	Plug wheel in corresponding to the number displayed.
	Wheel not fitted correctly	Remove wheel and refit. Ensure pin is fully seated and electrical connector is plugged in.
Pendant controller display reports open rail catch interlock **Refer to section 8.4.2 step 3 for further details.**	Rail catch is not fully in the locked position	Rotate rail catch so that the lockout pin is engaged and the end of the catch is over the interlock sensor.
Pendant controller display reports open deck pin interlock **Refer to section 8.4.2 step 3 for further details.**	Deck pins are not fully seated	Pull up pins and check for debris, then clear and re-engage pin fully.
Pendant controller display reports open gate interlock **Refer to section 8.4.2 step 3 for further details.**	Gate lock not fully set	Ensure snap buttons in gate coupling are fully engaged and lock is fully set in the “LOCK” position.
	Gate(s) are open	Close gate and engage lock.
	Debris in lock not allowing full engagement	Clear debris and engage lock.
No drive	Keyswitch in the “OFF” position	Rotate keyswitch to the “ON” position.
	Batteries are drained	Check remaining battery capacity on the pendant controller display and charge if necessary.
	Emergency stop is activated	De-latch both emergency stop buttons and acknowledge emergency stop on pendant controller to resume drive.
	System controller not sensing inputs	Cycle the keyswitch and check display on pendant controller.
	Deadman/throttle sequence is incorrect	Ensure deadman joystick is pushed forward before using throttle. Pendant controller display will show ”SEQUENCE FAULT” if this is the case.
	Electrical plugs not inserted fully	Ensure all electrical connectors are plugged in. Cycle the keyswitch and check pendant controller display.
	Wires broken	Visual check for wire breakages. Use a multimeter to check for continuity and voltage.

	Blown fuse	Check fuses in both fuse holders in the chassis.
	Water in electrical connectors	Dry (air or di-electric spray) electrical connections. Special consideration to deck and wheel plugs that are often disconnected. Check fuses are not blown. Replace corroded or broken contacts.
Noisy drive/brake components	Worn wheel bearings	Inspect and replace worn components.
	Debris rubbing on components in wheel assembly.	Check wheel assembly for debris and foreign material. Remove and clean.
Difficulty when assembling on track	Order of operations not followed	Follow setup procedure in manual and training documentation.
	Rail catches not being used during setup	Lower rail catches on one side of machine, then pull chassis out as per setup procedure.
	Telescoping beams contaminated	Clean telescopic beams and apply a dry lubricant (dry PTFE recommended)
	Telescoping beam pins not engaged	Adjust chassis/beams such that telescoping beam snap button clicks into the gauge hole.
	Contamination in gate couplings	Clean gate coupling mechanism and remove debris. Apply a dry lubricant to the coupling mechanism (dry PTFE recommended).
Park brakes not releasing	Electrical plug not inserted fully	Ensure all electrical connectors are plugged in. Cycle the keyswitch and check pendant controller display.
	Safety interlocks are not closed	Check deck, gates, wheels, rail catches are closed – refer to pendant controller display for open interlock information
	Deadman/throttle sequence is incorrect	Ensure deadman joystick is pushed forward before using throttle. Pendant controller display will show ”SEQUENCE FAULT” if this is the case.
	Internal failure	Failure of internal structural and/or electrical components. Disassemble/replace.
	Wiring failure	
Park brakes not applying	Internal failure	Failure of internal structural components. Disassemble/replace.

		Remove quadricycle from service until repair has been completed.
Overheating	Overloaded capacity	Check GVM
	Internal braked wheel failure	Failure of internal structural components. Disassemble/replace.
	Internal driven wheel failure	Failure of internal structural components. Disassemble/replace.
	Internal battery failure	Check battery voltages
	Wiring failure	Check wiring for breakages and repair/replace as necessary. Check correct fuse ratings have been fitted.
Short battery life	Battery not fully charged	Charge battery fully and confirm battery charge level on pendant controller display and/or by referring to display on charger. Test and check charger output.
	Battery experienced too high of voltage due to faulty battery charger	Test battery charger output voltage. Repair/replace if necessary.
	Battery cells are at end of useful life.	Capacity test battery pack and repair/replace if necessary. Contact MEC for replacement.

11.1. Quadricycle Operational Risk Assessment

	Machine: FP-192-ER-G3 – Quadricycle (includes FP-192-ER-G3-**-CL)**						Form No.: :	
	ABN						Issue Date	31/08/2022
	WORKPLACE GENERIC HIRARC FORM						Version:	0
Company	**MELVELLE EQUIPMENT CORP**	**Department / Workplace:**	**Melvelle Offices / MMS**	**Date of Assessment 31/08/2022**	**Commenced:**	9am	**Completed:**	12md
Scope of Assessment: Identify the hazards, risks and controls associated with the operation of the FP-192 electric quadricycle								
Names of Risk Assessment Team: Bryce Bower, Jason Casboult				**Names of additional personnel consulted during Risk Assessment:**			**Identified limitations of risk assessment: Only applies to risks identified as part of the operation of the machine.**	
							Information Sources / References: AS4024.1-2006 Safety of Machinery	

RISK ASSESSMENT MATRIX

Potential Consequences			Likelihood				
			Almost Certain	**Likely**	**Possible**	**Unlikely**	**Rare**
Keyword	**Description Safety Health & Hygiene**	**Description Environmental**	*Expected to occur*	*Will occur occasionally*	*May Occur*	*Not expected to occur*	*Requires unusual chain of events*
Minor	First Aid Injury	On-site release immediately contained with business unit resources	**Medium 8**	**Medium 7**	**Low 3**	**Low 2**	**Low 1**
Significant	Medical Treated Injury or illness	On-site release or offsite release immediately contained with smelter resources	**High 14**	**Medium 10**	**Medium 9**	**Low 5**	**Low 4**
Serious	Lost Time Injury or illness	Off-site release causing nuisance or community complaint. Breach of license condition	**High 16**	**High 15**	**Medium 12**	**Medium 11**	**Low 6**
Severe	Fatality or Permanently disabling injury of illness	Off-site release with detrimental impact to environment or community. Repeated breach of license conditions	**Extreme 24**	**Extreme 22**	**High 20**	**High 18**	**Medium 13**
Disastrous	Multiple Fatalities or work-related fatal diseases	Toxic release off-site with detrimental impact to environment or community	**Extreme 25**	**Extreme 23**	**Extreme 21**	**High 19**	**High 17**

LEGEND	**ACTION REQUIRED**	**NOTIFY**
LOW 1-6	Tolerable - Manage by Routine Procedures	
MEDIUM 7-13	Risk reduction required to "As low as Reasonably Practicable" ALARP	Design Team/Engineer
HIGH 14-20	Immediate action required to reduce risk. Authorisation required before proceeding on task	CEO
EXTREME 21-25	Intolerable. Cease activity until controls in place to reduce risk. Immediate & urgent Senior Management Team action required	CEO

MANAGEMENT ACTIONS

Comments	Refer to Action Plan
Risk Assessment Referred to:	Design Team
Risk Assessment Accepted by:	Andrew Melvelle
Risk Assessment findings recorded in the Project Design Folder	Design Team
Risk Assessment Findings communicated to:	Design Team, Melvelle Equipment Corp.

		Raw Risk Rating (no controls)				Residual Risk Rating (after controls)					
Ref no	Description / hazard / risk	Consequence	Likelihood	Risk Level & Score	Controls	Consequence	Likelihood	Risk Level & Score	Is Risk Tolerable Y/N	Additional Controls Req	Action By / Name & date required
	Manual lifting of segments	Serious	Possible	12	Use designated lifting points/handles and follow guidelines of 1 and 2 person lifts. Machine disassembles into manageable pieces.	Serious	Rare	6	Y	Disassemble unit, and follow standard lifting guidelines	
	Fall from unit	Serious	Possible	12	Handrails provided around the perimeter. Operator training to hold onto handrails during travelling. Operators must maintain one point of contact with a handrail at all times. Ensure handrails and knee rails are fitted securely and are not damaged.	Serious	Rare	6	Y	Operator training	
	Crash into stationary object	Serious	Possible	12	Training of control and stopping distances required at speeds and loading situations.	Serious	Rare	6	Y	Operator training	
	Crushing injury through uncontrolled/unexpected movement of quadricycle, ability to slow/stop/immobilise, trapped between moving parts	Serious	Possible	12	On-site risk assessment and induction performed prior to commencing operation. Visual inspection of surroundings prior to movement of unit. Team training in operation of quadricycle.	Serious	Rare	6	Y	Site induction, operator training	
	Derailment	Serious	Possible	12	Visual inspection of track during driving of unit. Constantly scanning forward of the track for defects/danger is a must. Training is required before operation of unit.	Serious	Rare	6	Y	Operator training	
	Pinch points	Minor	Almost Certain	8	Operator to wear gloves during assembly and disassembly. Safety warning decals poster.	Minor	Possible	3	Y	PPE, operator training	
	Electric shock	Serious	Possible	12	Machine fitted with electrical covers, and all exposed terminals are covered. Using handles should not expose operators to danger.	Serious	Rare	6	Y	Familiarisation of manual	

	Power failure - may lead to inoperability of quadricycle or deployment	Significant	Possible	9	Spare batteries remain on maintenance charge ready for deployment. Batteries have a low self-discharge. Battery condition is monitored via charger displays. Crane has manual pivot and manual chain hoist making the quadricycle deployable in power failure situations.	Significant	Rare	4	Y	Maintenance of batteries and crane	
	Lighting failure - low to no visibility when driving quadricycle	Serious	Unlikely	11	Lighting is tested and inspected during routine maintenance of quadricycle.	Serious	Rare	6	Y	Maintenance and testing of quadricycle	
	Signage/decals - visibility of quadricycle to operators and track personnel	Serious	Unlikely	11	Ensure all reflective tape is fitted to quadricycle and free from damage. Ensure amber beacons are fitted and functional. Safety warning decals poster (e.g. pinch points, cation and hazards)	Serious	Rare	6	Y	Operator training. Maintenance and testing of quadricycle.	
	Trip hazard through ballast and loose items on railway	Significant	Likely	10	Ensure all operators have had the appropriate level of training required to access and work in the rail corridor.	Significant	Rare	4	Y	Rail workers card	
	Slip hazard during entry/exit	Significant	Likely	10	Hold onto fixed handrail during entry and exit. Do not stand on componentry not meant for standing. Safety warning decals poster (e.g. pinch points, cation and hazards)	Significant	Rare	4	Y	Operator training	
	Impact from pivoting/moving gates and components	Minor	Likely	7	Ensure gates are retained to handrails with elastic restraints during assembly/disassembly.	Minor	Rare	1	Y	Operator training	
	Crushing injury from carrying components. Specifically but not limited to wheels.	Minor	Likely	7	Ensure components are carried using designated handles and lifting points.	Minor	Rare	1	Y	Operator training	
	Impact from quadricycle or crane components while lifting	Serious	Possible	12	Stand clear of trolley while it is being lifted by the crane, Never stand under a load being lifted. Have correct training for using of lifting devices.	Serious	Rare	6	Y	Crane operation training	
	Back strain or injury from operation of manual crane	Serious	Possible	12	Operators to perform warm-up stretches prior to manual handling of equipment. Follow crane manufacturer process for operation. Keep body parts clear of potential crush points during quadricycle deployment onto track.	Serious	Rare	6	Y	Crane operation training	

	Hand injury or repetitive strain injury resulting from operation of quadricycle pendant controls	Minor	Unlikely	2	Rest palms against pendant controller frame and position finger grip onto joystick controls in a comfortable manner. Joystick controls are positioned ergonomically as to minimize operator fatigue. Joystick is interchangeable to the direction of travel.	Minor	Rare	1	Y	Operator training	
	Chemical burns from lithium ion electrolyte leakage	Serious	Unlikely	11	Ensure battery enclosures are free from damage, and battery health is monitored via charging displays (check battery voltage). Leaks or residue found during inspection of batteries should be reported and managed appropriately.	Serious	Rare	6	Y	Maintenance and inspections	
	Skin irritation due to damaged carbon fibre tubing	Minor	Possible	3	Inspect carbon fibre tubing for damage and frayed fibres. Operators and passengers to wear PPE (gloves)	Significant	Rare	4	Y	Maintenance, inspections and PPE	
	Electrocution from damaged AC wiring to battery enclosure	Severe	Unlikely	18	Periodically inspect infrastructure wiring for damage and repair as necessary. Ensure wiring is tested and tagged. Isolation available to room power.	Severe	Rare	13	Y	Maintenance and inspections	
	Uncontrolled/unexpected movement of unit	Significant	Likely	10	Dead-man functions, safety device, speed restricted, audible visual warning devices fitted. E-stop buttons mounted to the top handrail on either side.	Significant	Rare	4	Y	Maintenance and inspections	
	Sighting obstructed when travelling	Significant	Possible	9	Joystick is interchangeable to the direction of travel.	Significant	Rare	4	Y	Operator training	
	Sudden catastrophic wheel failure during motion. This could result from static overload, fatigue failure, fastening failure. This could lead to de-railment.	Significant	Possible	**9**	Independent review/analysis via chartered proffessional Engineer Appropriate safety factors and designed for worst case loading in line with current design standards Built-in redundancy in fastener retaining methods. Eg, the use of torque prevailing nuts + disklock washers, The use of shrink fit + surpluss mechanical fasteners + chemical retrainer (threadlocker) Material certificates for load critical components	Significant	Rare	**4**	Y	Nil	

	Structural failure of nylon/polyurethane wheel/tread	Significant	Possible	**9**	Inspect wheel body and tread for signs of damage including cracks, delamination and deformation as per section 10.1.	Significant	Rare	**4**	Y	Nil	
	Failure due to exceeding wear limits. This could lead to derailment	Significant	Possible	**9**	Analysed in the fully worn state Appropriate safety factors Wear limits and maintenance schedules clearly outlined in operation and maintenance manual	Significant	Rare	**4**	Y	Nil	
	Electrical failure/shorting. This could lead to electricution, fire, vehicle breakdown, track signal inteferance.	Significant	Possible	**9**	Vehicle to operate at low voltage only (52V nominal) All circuits to be protected against short circuit with fuse or circuit breaker Brushless motors to be used to reduce maintenance/breakdown risk. Brakes to be failsafe (spring appled, electrically released)	Significant	Rare	**4**	Y	Nil	
	Failure due to lack of maintenance. This could lead to a siezed or malfunctioning wheel.	Minor	Possible	**3**	Use of greased, sealed for life, maintenance free rolling element bearings Use of brushless (maintenance-free) DC motors	Significant	Rare	**1**	Y	Nil	
	Damage to track	Significant	Unlikely	**5**	Ensure minimum diameter requirments are met (>250mm) Ensure P/D requirments are met (<12.66 t/m) Ensure an approved profile is used (ANZR-1)	Significant	Rare	**4**	Y	Nil	
	Unstable motion on track	Significant	Unlikely	**5**	Used approved profile (ANZR-1)	Significant	Rare	**4**	Y	Nil	

					Meet wheelset back to back requirements (1357-1360mm)						