



RA310 HD LSR

JCB Tracked Excavator



Operator's Manual

Part no. RAJCB310TCOPS-001
Issue 1 - 4 May 2020
Original Instructions (English)

	CONTENTS	Page
1	Introduction.....	6
2	Description and Intended Use.....	7
3	Limitations	7
4	Manuals.....	8
5	Decal Legend	9
6	Safety Rules	10
6.1	General.....	10
6.2	PPE	10
6.3	Electrocution Hazards	11
6.4	Travel Hazards	12
6.5	Tip-over Hazards	13
6.6	Fall Hazards.....	13
6.7	Collision Hazards.....	13
6.8	Crushing Hazards	13
6.9	Explosion and Fire Hazards	14
6.10	Burn Hazards.....	14
6.11	Bodily Injury Hazards	14
6.12	Lifting Hazard.....	15
6.13	Damaged or Malfunctioning Machine Hazards.....	15
6.14	Component Damage Hazards.....	15
7	Rail Safety	16
7.1	General.....	16
7.2	On/Off Track	16
7.3	Travelling on the Rail	16
8	Boom Safety	18
8.1	Requirements	18
8.2	General.....	18
8.3	Residual Risks	19
8.4	Before Operating.....	20
8.5	During Operation.....	20
8.5.1	Safe Working Distances	21
8.5.2	Load Handling.....	21
9	On/Off-Tracking the Machine.....	23
9.1	General.....	23
9.2	Access Points	23
10	Emergency Operations	24
10.1	Recovery Options	24
10.1.1	Machine Engine	24
10.1.2	Battery Driven Pump	24
10.1.3	Full Electrical or Manual Over-ride Latches	25
10.2	Battery Driven Pump.....	25
10.3	On-Rail Recovery.....	25
10.3.1	Towing	25
10.3.2	Electrical Power	26
10.4	Emergency Off-tracking	26
10.4.1	Preparation	26
10.4.2	Procedure	26
11	Machine Overview	28
12	Control Layout	29
12.1	Cab Controls.....	29
12.2	RCI Supervisor Key Switch	30
12.3	Emergency Stop	31
12.4	Auxiliary Interface Controls	32
12.5	Controls Interface (Optional Lever Grips - NOX Tilt Rotators)	33

12.6	RCI Display	34
12.6.1	Screen Surround	34
12.6.2	Travel Control.....	34
12.6.3	Axle-Lock	34
12.6.4	Park Brake	35
12.6.5	Service Brake.....	35
12.6.6	Rail Axle Control	36
12.6.7	Axle Selection	36
12.6.8	Axle Control.....	36
12.6.9	Travel Mode Gauge Locks	37
12.6.10	Data Logger	37
12.6.11	Trailer Brake Control	37
13	On-Tracking and Coupling.....	39
13.1	Air Connections.....	39
13.2	Multiple Trailers.....	39
14	Towing Procedures.....	40
14.1	Brake Status	40
14.2	Trailer Break Away Detection.....	41
15	Coupling and Uncoupling.....	42
15.1	Coupling/Re-Coupling - Towing Adapter to Auto-Couplings	42
15.2	Coupling/Re-Coupling – Drawbars to Auto-Couplings.....	44
15.3	Coupling - All	44
15.4	Uncoupling.....	45
15.5	Uncoupling and Off-tracking.....	45
16	Emergency Recovery	46
17	Pre-Operation Actions	47
17.1	Requirements	47
17.2	General.....	47
17.3	Inspection	47
17.4	Completion.....	48
18	Routine Maintenance.....	49
18.1	Requirements	49
18.2	General.....	49
18.3	Engine Oil Level.....	49
18.4	Hydraulic Oil Level.....	49
18.5	Batteries	49
18.6	Rail Wheels and Profiles	50
18.7	Fuel Leaks	50
18.8	Completion.....	50
19	Function Tests.....	51
19.1	Requirements	51
19.2	General.....	51
19.3	From the Machine Cab.....	51
19.3.1	Emergency Stop.....	51
19.3.2	Horn	51
19.3.3	RCI Sounder	51
19.3.4	RCI Blue Light.....	52
19.3.5	RCI Motion Cuts.....	52
19.3.6	Crawler Drive Braking	52
19.3.7	Rail Gear Deployment.....	52
19.3.8	Rail Drive and Rail Braking.....	52
19.4	Completion.....	53
20	Workplace Assessment	54
20.1	Requirements	54
20.2	General.....	54
20.3	Assessment	54

20.4	Completion.....	55
21	Operating Instructions.....	56
21.1	Requirements	56
21.2	General.....	56
21.3	Emergency Stop	56
21.4	Deploying the Rail Gear	56
21.5	Drive on Rail	57
21.6	Road Mode	57
21.7	Work Lights.....	57
21.8	Restricting the Operating Envelopes [OPTIONAL FEATURE].....	57
21.8.1	General	57
21.8.2	Boom.....	58
21.9	Load Handling.....	58
21.9.1	General	58
21.9.2	Lifting Moment Limiting Device.....	58
21.9.3	Manoeuvres of the boom.....	58
21.9.4	Stow.....	58
21.10	After Each Use.....	58
21.11	On and Off-tracking.....	59
22	Transportation	61
22.1	General.....	61
22.2	Loading.....	61
22.3	Machine	61
22.4	Transit.....	61
23	Auxiliary Counterweight Handling	63
23.1	General.....	63
24	Attachment Handling	64
24.1	General.....	64
24.2	Detaching.....	64
24.3	Lifting.....	64
25	Decals	65
26	Specifications	69
27	Serial Plate	70
28	Diagrams.....	71
28.1	Outline Drawings - Principle Dimensions	71
28.2	Principle Dimensions	73
28.3	OTP and W6A Gauge Points	75

TABLES

Page

Table 1 - Minimum Safe Working Distances.....	21
---	----

FIGURES

Page

Figure 1 - Safe Distance (metres) from Power Lines in excess of 33kV on Steel Towers	11
Figure 2 - Safe Distance (metres) from Power Lines up to 33kV on Wooden Poles.....	11
Figure 3 - Safety and Protection Devices	20
Figure 4 - Load Handling Examples.....	22
Figure 5 - Engine and Hydraulic Bays - Over-ride Key Locations	24
Figure 6 - Location of Machine Components	28
Figure 7 - In-Cab Controls	29
Figure 8 - In-Cab Emergency Stop Button.....	31
Figure 9 - In-Cab Auxiliary Controls.....	32
Figure 10 - Left Hand Lever.....	33

Figure 11 - Right Hand Lever	33
Figure 12 – Controls Symbols	33
Figure 13 - Screen Surround	34
Figure 14 - Base Machine - Front Nearside Isometric View	66
Figure 15 - Base Machine - Rear Offside Isometric View.....	67
Figure 16 - Base Machine - Front View	68
Figure 17 - Road Mode.....	71
Figure 18 - Rail Travel Mode	72
Figure 19 - Swing Radius	73
Figure 20 - Swing Radius with Aux Counterweight	74
Figure 21 - OTP Gauge	75
Figure 22 - W6A Gauge (without RRV road crawler allowance).....	76

1 Introduction

This Operator's Manual has been compiled for the purposes of safe operation, maintenance and servicing of Rail-Ability components and systems.

For other operating details (e.g. machine, Boom, Road Rail Operations, Rail Gear, etc.) refer to the publications listed in paragraph 4.

Left or right are to be with the reader sitting in the driver's seat in the cab facing forwards, looking over the front floating axle unless otherwise stated.

IMPORTANT

READ, UNDERSTAND AND OBEY THE CONTENTS OF THIS OPERATOR'S MANUAL BEFORE THE OPERATION OF THIS MACHINE.

ONLY TRAINED AND AUTHORISED PERSONNEL SHALL BE PERMITTED TO OPERATE THIS MACHINE.

THIS MACHINE IS VERY COMPLEX AND POTENTIALLY DANGEROUS. IT IS IMPORTANT THAT BEFORE ANY USE OF THE MACHINE OCCURS, EXCEPT TRANSPORTATION AND ATTACHMENT HANDLING, THE FOLLOWING ACTIVITIES HAVE ALL BEEN PERFORMED AND CARRIED OUT IN THE ORDER STATED:

1. Pre-Operation Actions
2. Routine Maintenance as determined by the Pre-Operation Actions
3. Function Tests
4. Workplace Assessment
5. Operating Instructions.

THIS MANUAL SHOULD BE CONSIDERED A PERMANENT PART OF THIS MACHINE AND SHOULD REMAIN WITH THE MACHINE AT ALL TIMES.

Should you have any questions, contact Rail-Ability Ltd:

Rail-Ability Ltd
Tollgate Drive
Tollgate Industrial Estate
Stafford
Staffordshire
ST163HS
England

Tel: (01785) 214747
Fax: (01785) 214717
E-Mail: mail@railability.co.uk

The Rail-Ability web site is www.railability.co.uk.

2 Description and Intended Use

The Rail-Ability RA310 machine consists of a road-going tracked excavator ridged chassis, modified for use on rail by Rail-Ability Ltd as detailed in paragraph 4. The chassis is fitted with rail gear front and rear to enable rail work. Various attachments can be mounted onto the boom and these are dealt with collectively. For further information concerning attachments, see the manuals detailed in paragraph 4.

The RA310 is intended for use on and off-track and/or rail wheels to enable operators and personnel to undertake maintenance work underneath overhead lines and structures forming part of the rail infrastructure.

The RA310 complies with the provisions of the following EC Council Directives:

- **Electromagnetic Compatibility (EMC)** **2014/30/EC**
- **Noise Emission in the Environment by Equipment for use Outdoors** **2000/14/EC.**

3 Limitations

The use of this machine is limited to its intended use, as described above. If additional or special applications or uses are required which are not covered by this Operator's Manual, carefully analyse the situation and refer to Rail-Ability Ltd for advice before proceeding.

Operational and environmental limitations of the equipment are described in the Specifications paragraph of this manual.







4 Manuals

Title	Part No
Rail-Ability RA310 Tracked Excavator Operator's Manual (this manual) Issue 1 - March 2020 - Original Instructions (English)	RAJCB310TCOPS-001
Rail-Ability RA310 Tracked Excavator Approved Maintenance Instruction Issue 1 - March 2020	RAJCB310TAMI001
Rail-Ability RA310 Tracked Excavator Parts Manual 1st Edition	TBA
The Operator instructions for the Rated Capacity Indicator fitted to the excavator	Rail-Ability RCI+L Display Operation Manual, RACD-10000141 RAI-18-TDPD, Issue 1, dated April 2018
S60 Quick Hitch User Manual	Steel Wrist User and Installation Manual Symmetrical Quick Couplers with Front pin lock S40-S70 Doc No: 700277ENA
The Test instructions of the BMAIR Cab Filtered Pressurisation System	BMAIR Filter Pressurisation System TAC(S) Instruction Card ITACEN3
NOX Tilt Rotators Operator Instructions	TR14 - 11.09.2017
NOX CONTROLLER Operator Instructions	NOXPROP – 15.05.2017
Safety handbook	194079333 – March 2015
HOST MACHINE: INFORMATION:	
Excavator	JCB JZ140 / 141 HDLSR
Operator's Manual	9831/4300_377010
Service Manual	9813/6300_371816
Service inspection check list	11/477_468342
Auto Lube Greasing System	Lincoln Quicklub pump and distributors Operating Instructions 203DC 810-55168-1J & 810-55174-1J

Be sure the Operator's and Safety manuals are complete, legible and located with the machine.

5 Decal Legend

The decals on this machine use symbols, colour coding and signal words to identify the following:

	Red with safety alert symbol - used to indicate the presence of an imminently hazardous situation which, if not avoided, will result in death or serious injury.
	Safety alert symbol - used to alert personnel to potential personal injury hazards. Obey all safety messages that follow this symbol to avoid possible injury or death.
	Orange with safety alert symbol - used to indicate the presence of a potentially hazardous situation which, if not avoided, could result in death or serious injury.
	Yellow with safety alert symbol - used to indicate the presence of a potentially hazardous situation which, if not avoided, may cause minor or moderate injury.
	Yellow without safety alert symbol - used to indicate the presence of a potentially hazardous situation which, if not avoided, may result in property damage.
	Green - used to indicate operation or maintenance information.

These symbols are also used in this manual as an appropriate visual indication and their meaning is as detailed above.

Be sure all decals, including those shown in the Decals Paragraph of this manual, are in place and legible.

6 Safety Rules



DANGER: FAILURE TO OBEY THE INSTRUCTIONS AND SAFETY RULES IN THIS MANUAL MAY RESULT IN DEATH OR SERIOUS INJURY.

6.1 General

- Read, understand and obey all applicable governmental regulations.
- Read, understand and obey the employer's safety rules and worksite regulations.
- Comply with the employer's, job site and governmental rules regarding use of personal protective equipment.
- Read, understand and obey the manufacturer's instructions and safety rules, safety and operator's manuals and machine decals.
- Learn and practice the principles of safe machine operation contained in this operator's manual.
- Be properly trained to safely operate the machine.
- The machine must only be operated from the seated position in the cab with the seat belt fastened
- Always obey national traffic regulations while driving the machine on roads. Be aware of the machine's overall length, width and height.
- Avoid hazardous situations.
- The lack of maintenance may cause damage or hurt people.
- **Know and understand the safety rules before going on to the next items:**
 - Prior to use:
 - Always perform Pre-Operation Actions
 - Always perform Function Tests
 - Always perform a Workplace Inspection.
 - Only use the machine as it was intended
 - Do not engage in stunt driving or misbehave while operating the machine.

6.2 PPE

Under normal use, the following Personal Protective Equipment (PPE) is required:

- Toe Protector Safety Boots
- Full Hi Viz Orange overalls
- Gloves (not required in the cab)
- Hard Hat (not required in the cab).

Risk assessments of specific site conditions may mandate additional PPE.

Note: This machine is normally equipped with a filtered air pressurised cab system to eliminate dust ingress. When the machine is in dusty environments, this system can be used instead of a dust mask while operating from the cab, providing that the machine doors and windows remain shut.

6.3 Electrocuting Hazards

- This machine is **NOT** electrically insulated and will **NOT** provide protection from contact with or proximity to electrical current.
- When in operation maintain the minimum safe distances from electrical power lines and apparatus in accordance with the applicable governmental regulations and Figures 1 and 2 below.

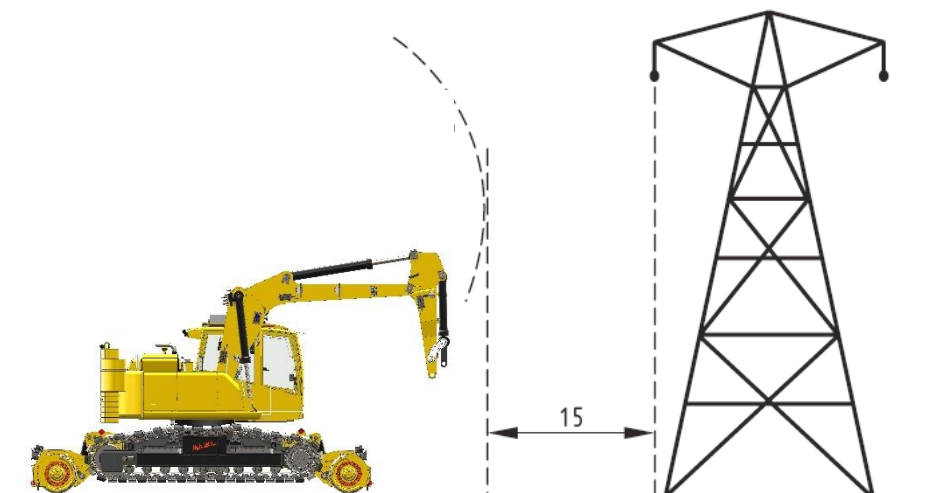


Figure 1 - Safe Distance (metres) from Power Lines in excess of 33kV on Steel Towers

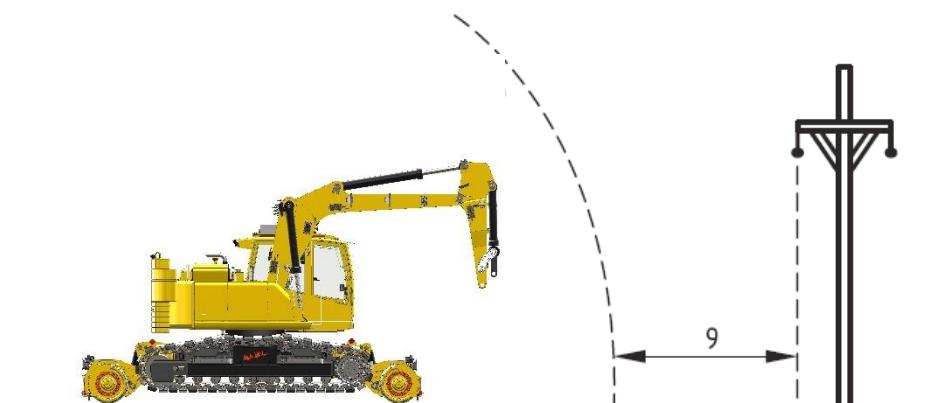


Figure 2 - Safe Distance (metres) from Power Lines up to 33kV on Wooden Poles

- Personnel must carefully evaluate the danger of electrocution before moving. If closer than 10 metres from the boom, the machine, the load or the electric line, move at least 10 metres away, by shuffling away with small steps, in order to minimize the chance of getting a high voltage difference between the feet.
- OLE lines on rail are 25kV and require a minimum safe approach distance of 2.75 metres.
- Allow for boom movement, electrical line sway or sag.
- **Keep away from the machine if it contacts energised power lines. Personnel on the ground or in the cab must NOT touch or operate the machine until energised power lines are shut off:**
 - Do not attempt to assist someone in direct or indirect contact with the power line before the power has been disabled as you run the risk of being electrocuted yourself.
 - Warn others to stay away.
 - Call for help.

- Contact the power company to de-energize the line.
- If you are in the machine cabin, stay inside without touching the machine body because it's extremely hazardous to go out before the line is de-energised.
- Help the electrocuted person if you know the first-aid procedures, otherwise wait for the paramedics to arrive.
- Do not operate the machine during lightning or storms.
- **Refer to Engineering Acceptance Certificate for live OLE limitations.**
- Inspect daily for damaged cables and wires. Replace damaged items before operating.
- Avoid contact with electrical terminals.
- Earth bonding straps:
 - Straps must be in place at all times and securely fastened.
 - Inspect the straps daily.
 - Replace straps immediately if there are any signs of burning or damage.
 - Replace damaged straps before operating.
 - Check impedance levels after refitting any straps.
 - Earth bonding straps are fitted on the machine in the following positions:
 - Between front rail axle and chassis
 - Between machine upper structure and continuously along the boom
 - Between second stage boom and arm.
- Avoid electrical shock from contact with battery terminals. Remove all rings, watches and other jewellery.
- Ensure a C Form has been obtained before on-tracking the machine in OLE areas.

6.4 Travel Hazards

- Observe and use colour-coded direction arrows on the machine for drive functions.
- Be aware of limited sight distance and blind spots when driving. Use a banksman or machine controller when required.
- Limit travel speed according to conditions, slope, location of personnel, and any other factors which may cause collision.
- If a hook protrudes outside the edge of the machine, it must be removed before travelling.
- Take care while travelling on rail, especially when the boom is elevated.
- Beware of slippery and limited traction conditions on rail. Braking distance can increase significantly in wet or icy conditions.
- The machine does not have direct view in reverse so the rear and side camera, in cab display are provided to enhance operator visibility by reducing blind spots and should be used accordingly.
- The machine is to proceed at walking speed and ground staff control the movement in reverse until the superstructure can be slewed to face direction of travel.
- The machine does not have a load area and should not be used to carry loads on any part of the structure other than in the bucket or attachment if appropriate.

6.5 Tip-over Hazards

- Do not alter or disable the safety switches (e.g. limit and proximity switches).
- Do not alter or disable machine components that in any way affect safety and stability.
- Do not replace items critical to machine stability with items of different weight or specification. If in doubt, contact Rail-Ability Ltd.
- Do not modify or alter this machine without prior written permission from Rail-Ability Ltd.
- Ensure that all tracks are in good condition, track nuts (including rail wheels) are properly tightened (see Manuals listed in paragraph 4 of this manual).
- Do not drive the machine on temporary track, uneven or unstable track or other hazardous conditions with the boom raised.
- Do not use the machine while mounted on another moving surface of a machine.
- The RCI should be in Lifting Mode at all times unless the safe system of work allows for otherwise.

6.6 Fall Hazards

- Always sit in the seat and fasten the seat-belt when operating the cab controls.
- Always use the steps and handholds provided when accessing and exiting the machine bonnet or cab. Never climb onto the rear by other means or jump from the cab onto the ground.
- Machine deck:
 - Take care when on the deck (when performing inspection or maintenance), particularly in wet or icy conditions.
 - Remove or secure any loose equipment or tools that could fall off during transit or present a trip hazard.
 - Clean up any oil or other fluid spillages on the deck which could create a slippery surface.
 - Keep the deck clean and tidy.

6.7 Collision Hazards

- Check the work area for overhead obstructions or other possible hazards.
- Do not operate the machine in the path of any boom or other moving machinery unless the controls of that machinery have been locked out and/or precautions have been taken to prevent any potential collision. Use a banksman or machine controller to alert the operator/driver when required.
- Boom:
 - Be aware of limited sight distance and blind spots when operating the boom. Use a banksman or machine controller when required.
 - Be aware of boom position and tail-swing when slewing.
 - Do not lower the boom unless the area below is clear of personnel and obstructions.

6.8 Crushing Hazards

- Keep hands and limbs away from moving parts of the machinery.
- Maintain safe distances between the operator, the machine and fixed objects.

- Use common sense and planning when operating the machine with a banksman or controller from the ground.

6.9 Explosion and Fire Hazards

- Do not start the engine if you smell or detect diesel fuel or other explosive substances.
- Do not refuel the tank(s) when the engine is running.
- Refuel the tank(s) and charge the battery only in an open, well-ventilated area away from sparks, flames and lighted tobacco.
- Do not operate the machine in hazardous locations or locations where potentially flammable or explosive gases or particles may be present.
- Do not spray ether into engines equipped with glow plugs.
- Keep sparks, flames and lighted tobacco away from the batteries as batteries emit an explosive gas.
- Do not contact the battery terminals or the cable clamps with tools that may cause sparks.

6.10 Burn Hazards

- As batteries contain acid, always wear protective clothing and eye wear when working with batteries.
- Avoid spilling or contacting battery acid.
- Neutralise battery acid spills with baking soda and water.
- Do not expose batteries to water or rain.

6.11 Bodily Injury Hazards

- Be aware of Crushing Hazards when grasping any part of the boom or chassis frame.
- Personnel are not permitted between moving machines.
- Maintain safe distances between ground personnel and the machine.
- Do not operate a machine with a hydraulic oil or air leak as a hydraulic leak can penetrate and/or burn skin and air which enters the body can cause death or serious injury.
- Improper contact with components under any cover will cause serious injury. Only trained maintenance personnel should access compartments. Access by the operator is only advised when performing a pre-operation inspection.
- All compartments must remain closed and secured during operation.
- Always operate the machine in a well-ventilated area to avoid carbon monoxide poisoning.
- The machine is not intended for passenger or freight transport.
- The machine is approved to travel with a maximum of 2 personnel and they are to be seated in the cab only.
- While entering and exiting the cab, maintain 3 points of contact with the machine at all times. Grab rails, foot steps and hand holds are painted white to identify them.

- The warning systems provided on the machine are based on the assumption that staff on and around the machine have periodical medical checks to ensure normal hearing ability.
- For information on the required training and competency certification for operator and ground staff to work with this machine, consult the rail infrastructure manager.

6.12 Lifting Hazard

- Use the appropriate number of people and proper lifting techniques when lifting:
 - batteries
 - drawbars
 - tools
 - other removable items.

6.13 Damaged or Malfunctioning Machine Hazards

- Do not use a damaged or malfunctioning machine.
- Tag and remove from service a damaged or malfunctioning machine.

6.14 Component Damage Hazards

- Do not use any battery or charger greater than 24V to jump-start the host machine OEM engine detailed in paragraph 4.

7 Rail Safety



DANGER: FAILURE TO OBEY THE INSTRUCTIONS AND SAFETY RULES IN THIS MANUAL MAY RESULT IN DEATH OR SERIOUS INJURY.

Failure to comply with these requirements may result in severe damage to the machine and/or the rail infrastructure.

7.1 General

- All work on or near the railway infrastructure must be carried out strictly in accordance with railway regulations.
- Always observe Network Rail codes of practice.
- Work must be carried out in accordance with rulebook GE/RT 8000 and all safety precautions must be followed at all times.
- Attention must be paid to Railway Group Standards and all safety precautions must be followed at all times.
- All staff must be fully trained and certified as competent to use this piece of equipment on railway infrastructure by the owner/operator.
- When working on electrically operated routes, be sure to observe official regulations. Always observe minimum clearance from overhead wires.
- Ensure a relevant C Form is obtained.
- Never use in 3rd and 4th rail areas.
- Never use on track without a possession.
- Never use on track under live OLE.
- Never use on track when trains are running.
- Never On/Off-Track in areas with close proximity hazards such as in station platforms under/on bridges, in tunnels or in areas with low overhead structures or line side structures.

See the Network Rail V.A.B. Engineering Acceptance Certificate and EC Type Examination Certificate for additional, specific machine limitations of use.

7.2 On/Off Track

- Always utilise an approved On/Off-Tracking method.
- Never On/Off-Track in areas with any cable connections to the rail.
- Never On/Off-Track in areas with ATP loop cables either in the rail web or in the “four foot”.
- Never On/Off-Track in areas with any cables cleated to the top surfaces of sleepers.
- Never On/Off -rack in areas with any signalling equipment fitted in the “four foot”.

7.3 Travelling on the Rail

Before travel commences, ensure the following:

- Crowd ram fully extended so that bucket is fully crowded round.
- Dipper ram fully extended so that the dipper is fully in.

- Tab second stage arm rams fully retracted so that second stage is fully out.
- Main lift ram set so that the bucket is approximately 300mm above the rail head so that the arm is positioned below the highest point of the cab.
- Rail Gear deployed fully.

WARNINGS:

(1) **TO ENSURE THE MACHINE IS COMPLYING WITH THE W6A GAUGE REQUIREMENT, BEFORE TRAVELLING ON RAIL, IT IS ESSENTIAL THAT THE MACHINE IS SLEWED SO THAT THE UPPER STRUCTURE IS PARALLEL TO THE LOWER STRUCTURE AND THAT THE CAB DOOR IS SHUT TO ENSURE THIS IS MAINTAINED. IT IS ALSO ESSENTIAL THAT THE ARM IS POSITIONED LOWER OR EQUAL TO THE HEIGHT OF THE CAB. THIS IS TO ENSURE OVERHEAD STRUCTURES ARE NOT STRUCK. THE RCI HEIGHT AND SLEW GAUGE LIMITER FITTED TO THE MACHINE CAN THEN BE SET AND ACTIVATED TO MAINTAIN THIS POSITION.**

(2) **EXTRA CARE AND OBSERVATION OF LINE SIDE AND OVERHEAD STRUCTURES IS REQUIRED WHEN THE MACHINE IS FITTED WITH AN ATTACHMENT THAT IS OUTSIDE THE W6A TRAVEL GAUGE IN ANY WAY.**

(3) **FAILURE TO COMPLY WITH THESE REQUIREMENTS MAY RESULT IN SEVERE DAMAGE TO THE MACHINE AND/OR THE RAIL INFRASTRUCTURE.**

8 Boom Safety

8.1 Requirements

- The machine operator shall be held directly responsible for the correct operation of the boom including any requirements of the site conditions.

8.2 General

Items in this paragraph must be adhered to in order to avoid possible accidents while operating the boom.

- **Do not interfere with the safety and protection devices.** Note that interference with the check-valves and removal of the lead seal removes and invalidates the Manufacturer's warranty.
- Only authorized persons are allowed to operate the boom.
- The machine must be used on firm ground.
- Check that the machine brake is on and that the tracks are locked.
- Before every operation make sure that:
 - no-one is within the working area of the boom
 - the safety devices are in place and operative
 - the minimum safe working distances from power lines are observed
 - the load is correctly slung and hooked.
- Stabilize the machine by making sure that the rail wheels are properly positioned on the track.
- Use the boom in accordance with the use and maintenance manual, making sure that:
 - the load and radius are within the maximum limits shown on the load chart
 - the boom is used progressively, avoiding sudden load movements
 - swinging or dragging of the load is avoided
 - the load is lifted before rotating.
- When using implements, set up an exclusion zone.
- The machine is not left unless the load is on the ground.
- Before driving the machine make sure that the boom is in the folded position.
- The use of the boom is reserved for authorized personnel, instructed in advance, who must conform to the safety norms and instructions contained in the manual supplied with the boom (see norms ISO 9926-1).
- It is prohibited to walk or stop under a suspended load.
- It is prohibited for unauthorized persons to be within the working area.
- Warning, Instruction and Operation plates must be replaced when no longer readable or missing. Contact Rail-Ability to replace any missing plates.
- When transporting the machine, to avoid hitting bridges or tunnels know the overall height of the boom in the folded position or in laid position in the body. Always respect and pay proper attention to road signs placed in proximity of such obstacles.

8.3 Residual Risks

It is forbidden to use the boom without having read and understood the manual for use and maintenance and without having being previously instructed by experienced personnel on all aspects of safe boom operation.

Risk evaluation shall be followed by adequate provisions in order to avoid risks and damage to people and objects.

- **Overturn:** the boom can overturn, thus hurting people and damaging objects especially in the following conditions:
 - not correctly railised
 - moment limiting device disabled
 - ground conditions at the site not stable enough
 - excessive speed.
- **Moment limiting device:** never try to bypass or tamper with the moment limiting device and the various safety systems installed on the boom. Understand the alarm messages generated by the "moment limiting device" and act accordingly.
- **Control position:** before operating the controls the operator shall make sure that they are safe from hazards.

From the control position the operator shall be able to visually inspect the whole working area at all times. If it is not possible, they shall team up with a co-worker able to control the whole area and who can see all potential hazards clearly at all times.

- **Load rigging:** carefully inspect the load rigging. The operator shall make sure that the load is properly attached and balanced and that all unexpected movements are not allowed. Be careful not to hit any potential impediments during the boom movements.
- **Overload and/or fatigue:** the boom can break down due to fatigue or overload:
 - if it is misused (with cycles, loads or pump oil flow not pertinent to the boom class)
 - if it is used for improper tasks (side, oblique or reversal pull)
 - if it is used in poor sites (corrosive environment, too high or too low temperature, foundry - see Workplace Assessment)
 - if the load exceeds the rated capacity indicated on the relevant plates.
- **Wrong manoeuvring:** the boom can fall, break or overturn if the operator performs a wrong manoeuvre due to the lack of familiarity with the operation procedures or due to inadequate psychophysical conditions. There are directives and rail regulations in force that impose suitable training of the personnel before using these types of machines and they require an adequate psychophysical condition to operate safely a lifting device that implies an inherent danger when lifting a load.
- **Weather conditions:** too high or too low temperatures may damage the components of the hydraulic and electric circuits. Do not operate the machine during a storm with lightning hazards, and if these condition occur it is recommended that the boom is folded down and put to rest.
- **Shearing, entrapment:** the boom has a lot of parts in movement that it is impossible to protect, therefore the operator shall always be aware of this residual risk and keep clear from the parts in movement, particularly from the load. The operator is held responsible not only for themselves but also for those working in proximity of the boom including any that are not authorized.
- **Electrocution:** the boom is not eclectically insulated and therefore it is not equipped to work with conductors, including if a contact is accidental. Be compliant with the minimum clearance prescribed by the national directives in force. Generally speaking the clearance from electric lines of 33kV should be at least 9 metres. Above 33kV, the distance should be at least 15m and

be verified in each case by competent technicians and with respect to the environment conditions.

- **Attachment overload:** attachments are controlled by the moment limiting device only under the conditions described in this manual.
- **Accessories:** be careful when attaching/detaching any accessories (buckets, grabs, etc). First verify the weight, the quick hitch and the instructions. Then appraise their centres of gravity and avoid sudden movements.
- **Breakdown of some sensors:** the moment limiting device is always monitored during operation. The system, after having activated the various circuits, checks the presence of all the inputs and then continuously monitors the operation and the efficiency of the limiting device.

8.4 Before Operating



Figure 3 - Safety and Protection Devices

- **WARNING: Before boom use check that safety and protection devices shown in Figure 3 and detailed below are fitted and active:**
 - Check-valve for boom rams
 - Check-valve for dipper ram
 - Check-valve for cab ram
 - Rotation limiting device
 - Check-valves for rotation control (flow regulators)
 - Lifting moment limiting device.
- Keep the steps and the work areas clean.
- Check that the working area is adequate and properly illuminated.
- Carefully inspect the condition of ropes or chains if present.

8.5 During Operation

- Do not run the engine in an indoor area without first making sure there is adequate ventilation.

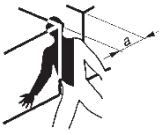

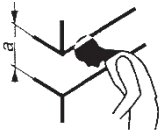

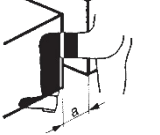
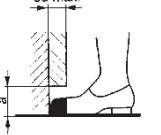

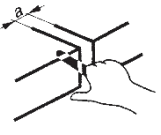
- If there is inadequate ventilation, take the machine fumes away from the working area by fitting an extension tube of a suitable diameter and of sufficient length to the exhaust system.
- Make sure that no one is within the working area of the boom.

8.5.1 Safe Working Distances

- Avoid swinging the load above working and transit areas, any hidden danger situation must be audibly alarmed.
- Avoid all those situations which may result in crushing during machine stabilization, boom movement and load handling.

Avoid crushing parts of the body by following the minimum safe working distances detailed in Table 1 (see EN 349 standard for further guidance). Table 1 indicates the minimum safe working distances concerning the various parts of the body, and each figure illustrate circumstances which may turn out to be dangerous if you fail to respect the minimum safe distances.

Table 1 - Minimum Safe Working Distances

Part of body	Minimum safe working distance (mm)	Figure	Part of body	Minimum safe working distance (mm)	Figure
Whole body	500		Foot	120	
Head	300		Hand/wrist/fist	100	
Leg	180		Toe	50	
Arm	120		Finger	25	

8.5.2 Load Handling

- Examples of good and poor practices are shown in Figure 4.
- Hook up the load, checking that it does not exceed the capacity indicated on the lifting diagram specific to each load configuration.
- Make sure that the lifted load is balanced.
- Avoid swinging the load above the control station. In cases where the load is too close, the boom must be operated from the opposite side.

- Do not operate with sudden movements. Activate the controls with slow and progressive movements and rotate slowly and with care paying attention to the stability of the machine.
- With vertical lift, rotate slowly in order to avoid side-skidding.
- Only move the machine when the boom is in transport position.
- **The machine must not be left unless the load is on the ground and the booms are folded and laid on a solid base.**


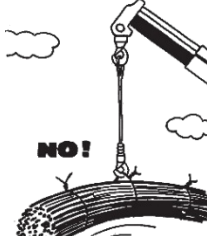
<p>Carefully inspect the load rigging. Ensure you follow good practice, such as that shown on the right.</p>	
<p>This item on the right shows poor practice and must not be used.</p> <p>Do not utilize the boom for push/pull, lateral or sideways operations.</p> <p>Crushing or push manoeuvres are not permitted.</p>	

Figure 4 - Load Handling Examples

9 On/Off-Tracking the Machine



9.1 General

- Refer to the manuals detailed in paragraph 4 and adhere to all instructions before commencing on/off-tracking.
- Cant - not to exceed 150mm.
- Adequately prepared Access Point installed.
- Ballast shoulder - high/low identified.
- Deep cess/soft cess identified and avoided.
- Drainage routes, troughing routes and other services/cables identified and avoided.
- Care should be taken when on/off-tracking not to damage the railhead, suitable rail shields should be used.
- OHLE power cables acknowledged.
- Switches and Crossings avoided.
- Overhead and close proximity structures and infrastructure observed.
- All work on or near the railway infrastructure must be carried out in accordance with railway regulations.
- Work must be carried out in accordance with rulebook GE/RT 8000 and all safety precautions must be followed at all times.
- When working on electrically operated routes, be sure to observe official regulations. Always observe minimum clearance from overhead wires.
- Never install TAS or on-track the machine without a possession.
- All staff must be fully trained and certified as competent to use this piece of equipment on railway infrastructure by the owner/operator.

NOTE: DO NOT ATTEMPT TO MANOEUVRE THE MACHINE WITH THE CRAWLER TRACKS, WHEN THE RAIL GEAR IS SEMI/FULLY DEPLOYED.

9.2 Access Points

- On/Off-Track the machine only at an approved access point.
- An approved access point is one of the following:
 - Hard paved level crossing
 - Yard where surface is level with the top of the rail
 - Proprietary approved track access system with inbuilt rail shields
 - Consolidated ballast to at least the underside of the railhead with rail shields.

10 Emergency Operations

10.1 Recovery Options

The normal method of recovery is available when the machine engine is driving the hydraulic pump and the cab controls are available. Follow the instructions in this manual for normal operations, detailed depending upon which mode of operation is being used.

If the electrical systems have failed, or the engine has failed (e.g. run out of fuel) then the boom may only be returned to its stowed position using the Battery Driven Pump.

There are 2 methods of emergency recovery of the machine both of which use the cab controls. In order of preference these are:

- Machine Engine (Allow 20 minutes to return to Gauge)
- Battery Driven Pump. (Allow 45 minutes to return to Gauge)

To use these systems, the safety systems must be overridden using the RCI Over-ride key switch in the systems bay highlighted in Red on Figure 5.



Figure 5 - Engine and Hydraulic Bays - Over-ride Key Locations

10.1.1 Machine Engine

Using the cab controls:

- Operate the RCI Over-ride key switch in the systems bay highlighted in Red on Figure 5..
- Utilise the Machine Engine.

10.1.2 Battery Driven Pump

Where the machine engine has failed, using the cab controls:

- Fit the motion cut over-ride latches in the motion control bay highlighted in Green on Figure 5.
- Turn pilot isolate tap and utilise the Battery Powered Pump.
- Reset pilot isolate tap and remove the motion cut over-ride latches in the motion control bay once recovery is complete.

10.1.3 Full Electrical or Manual Over-ride Latches

In the event of an emergency, loss of power or RCI system failure an over-ride is fitted to this machine to enable the booms to be slewed, retracted and lowered to their stowed positions. This is used in conjunction with various power sources and control mechanisms as detailed above.

The over-ride key is located in the Hydraulics Bay.

Ensure that all personnel, either operating or working alongside this machine, are aware of the location and operation of each of these systems.

NOTICE

THESE OVER-RIDE FEATURES MUST ONLY BE EMPLOYED IN THE EVENT OF AN EMERGENCY, LOSS OF POWER OR RCI FAILURE. THEY ARE NOT CONSIDERED SUITABLE FOR NORMAL USE.

The over-ride key, when activated, allows the operator to bypass the following safety interlock systems on the boom:

- Over-tilt (cant) in both directions
- Motion cuts
- Load sensing system
- Moment sensing system
- Gauge lock restriction.

During an over-ride situation all audible or visual warnings associated with any of the above interlocks will continue to actuate. An additional buzzer will sound whenever an over-ride is active to indicate that the over-ride feature is being activated. Once the over-ride system is activated the data logger will monitor the system.

Note that it is possible to overstress and overturn the machine while the safety systems are overridden. The operator should prioritise the use of the Radius-in function wherever possible to assist in correcting the situation.

Once the booms have been lowered to a stowed position, after the over-ride key has been activated, the blue LED strip will be off indicating that the machine is overridden. The machine must be inspected and reset by Rail-Ability Ltd prior to being put back into service.

10.2 Battery Driven Pump

The battery driven hydraulic pump is activated via the isolator switch located in the Pump bay highlighted in blue on Figure 5.

The electric pump should not be run if the main pumps are operating or if the batteries are discharged below 21 volts.

10.3 On-Rail Recovery

10.3.1 Towing

- Refer to the manuals detailed in paragraph 4 and adhere to all instructions before commencing towing.
- For performing recovery towing of another failed machine, this machine is limited to towing one other machine of equal or less mass only.
- Ensure that the towing machine is connected with the tow bar before the rail brakes are released via hub disengagement, to enable towing to commence:
 - A Network Rail pattern tow bar is located at the rear of the machine
 - Only use the rigid tow bar provided
 - Tow eyes and pins are fitted to the front and rear of the machine.

- Do not exceed 10 km/h (6 mph).
- Use the appropriate number of people and proper lifting techniques when lifting the tow bar.
- The tow bar must remain with the machine at all times and must never be removed unless when actually towing.

If the main hydraulic pump is not functioning, use the Electric Power option as detailed below.

10.3.2 Electrical Power

In case of failure of the main hydraulic pump or engine failure:

- Raise the rail gear using the Battery Driven Pump with cab Levers detailed previously.
- Use the Rail Gear Recovery Controls in order to Off-Track the machine.

10.4 Emergency Off-tracking

EMERGENCY ON-TRACKING IS NOT COVERED IN THIS MANUAL AS THERE IS NO OCCASION WHEN THIS PROCEDURE WOULD NORMALLY BE CONDONED.

Emergency Off-Tracking however may be necessary at some point. It must be stressed that this is an **Emergency Procedure Only** and should **NOT** be used for normal operation. If you are asked to Off-Track using this method (at an unprepared location) without suitable justification you should report to your On-call Manager and ask their advice before attempting this manoeuvre.

Carry out the preparation below, then the procedure.

10.4.1 Preparation

If there is real cause to use this method there are still certain procedures that must be followed:

- The Off-Tracking area must be inspected for its suitability as normal.
- An area where there are no obstructions should be selected. For example, there should be no conductor rail present, no high ballast shoulders and no obvious hazards.
- Emergency Off-Tracking must not be carried out on a cant.
- Emergency Off-Tracking must not be undertaken with attachments other than a bucket.

10.4.2 Procedure

This procedure requires 2 trained and competent personnel and may take 15 minutes to execute on average under normal circumstances.

In the event of a real emergency the procedure for Emergency Off-Tracking is as follows:

- Ensure the machine is configured for travel (boom fully stowed).
- Approach the Off-Tracking area at a safe speed.
- Sound the horn to alert personnel at the Off-Tracking area as you approach.
- Raise the front and rear rail gear fully.
- Turn the machine keeping the tracks on the railhead.
- Manoeuvre the machine on the railhead until the machine is perpendicular to the rail.
- Slowly track the machine clear of the running rail.
- Move the machine at least 3 metres from the closest rail.

When carrying out this operation always follow any hand signals given by a banksman or machine controller and carry out all movements smoothly and at a safe speed. The machine is fitted with an offset boom and the arm must be centred to avoid causing instability or a possible tip-over situation occurring.

Ensure you are clear of all obstructions.

Ensure the machine is configured to travel to avoid causing instability or a possible tip over situation occurring.

THIS MANOEUVRE IS DANGEROUS AND MUST ONLY BE CARRIED OUT IN A REAL EMERGENCY.

When Off-Tracking, care must be taken when the machine manoeuvres off the railhead. Make certain that the rail bogies are raised up to the maximum height for travel.

If the machine tips or tilts forward severely onto the track while climbing off the rail head and the weight of the machine is exerted excessively onto the track components, severe damage to the infrastructure may result.

'Grounding out' the machine, while the machine is travelling off rail may result in severe damage to the machine and/or infrastructure.

11 Machine Overview

Details of the machine's main components are shown in Figure 6.

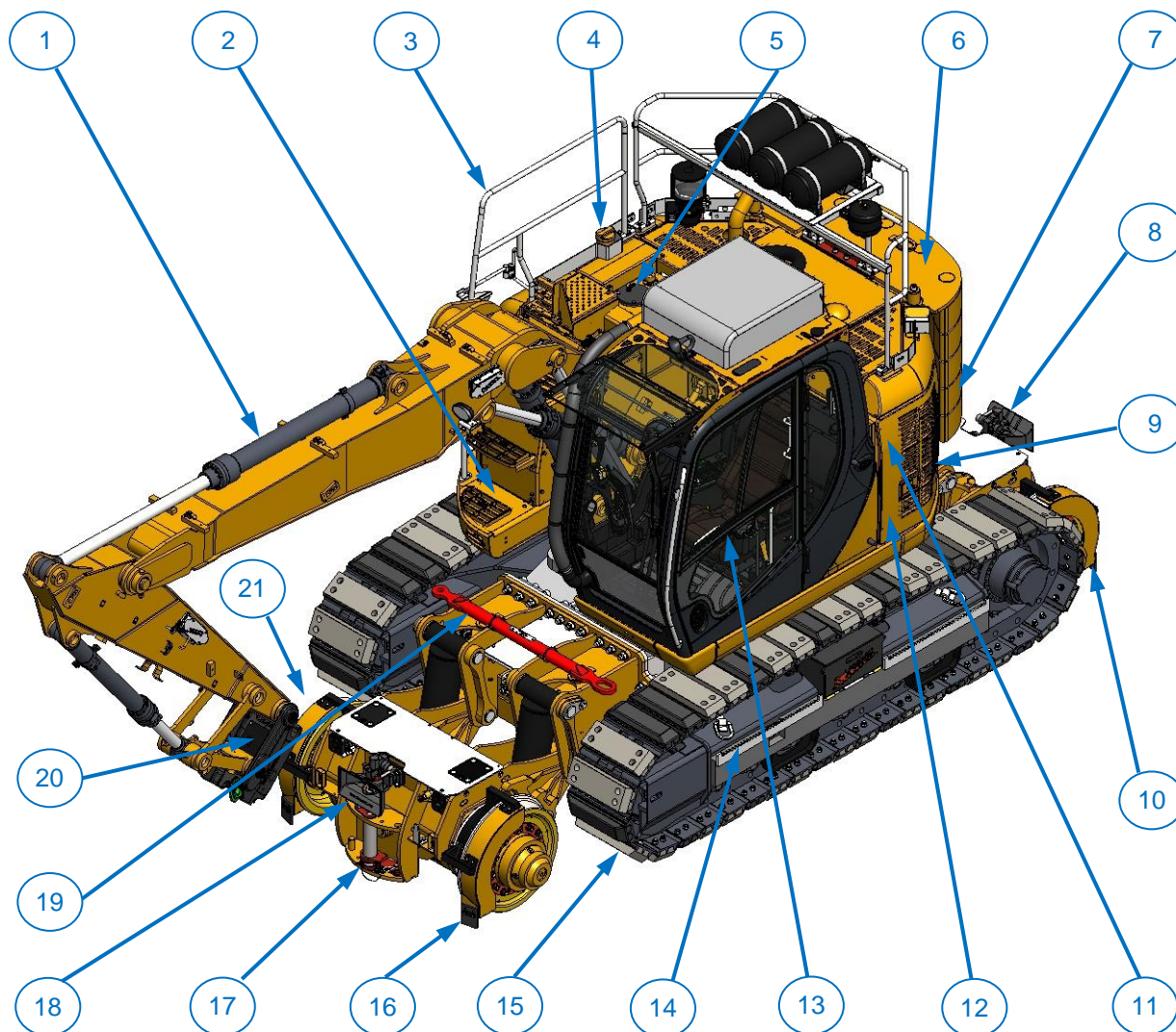


Figure 6 - Location of Machine Components

- | | | |
|----------------------------|----------------------|--------------------------|
| 1. Boom | 8. Rear Tow Coupling | 15. Tracks |
| 2. Top Deck Access Steps | 9. Rear Draw Bar | 16. Track Sweepers |
| 3. Top Deck Handrails | 10. Rear Rail Gear | 17. Front Towing Adapter |
| 4. Fuel Filler | 11. Engine | 18. Front Tow Coupling |
| 5. Hydraulic Oil Filler | 12. Batteries | 19. Front Draw Bar |
| 6. Counterweight | 13. Cab | 20. Quick Hitch |
| 7. Auxiliary Counterweight | 14. Cab Access Step | 21. Front Rail Gear |

12 Control Layout

There is one set of normal (non-emergency) controls on this machine in the cab and one set of manually operated emergency recovery controls for the rail gear outside the cab.

12.1 Cab Controls

Within the cab there are controls and displays which are detailed in Figure 7 and the following paragraphs.

- NOTES:
1. The machine engine should not be running when grabs/attachments hydraulics are connected and disconnected.
 2. For all other functions - refer to the JCB JZ140/141 operator handbook.



Figure 7 - In-Cab Controls

Quick Hitch Release Button

This button must be used in conjunction with the supervisor key switch.

NOTE: The attachment must be landed to release the quick hitch.

Refer to the RCI Operator's Manual for further information.

RCI Supervisor Key Switch

This switch is for changing between different machine modes and configurations.

The key can be removed to lock the machine into a set mode/configuration if required.

Refer to the RCI Operator's Manual for further information.

Rail Axle Deploy Lever (opposite side of the operator's seat)

This is referred to as the dozer blade lever in the JCB Operator manual.

This Lever must be used in conjunction with the RCI rail axle selector screen.

NOTE: The Machine must be slewed over one chassis end or the other to deploy/retract the rail axles.

Refer to the RCI Operator's Manual for further information.

Function Release Button

This button must be used in conjunction with the supervisor key switch.

This button must be used with caution. It overrides the stub boom down motion cut when the dipper nose pin is above the stub boom turret pin. This override therefore has the potential to allow the operator to increase the machine overturning moment and therefore should only be used in extreme circumstances when the machine load radius cannot be reduced with the motion cuts active but the load must be lowered to the ground.

NOTE: The effects of the use of this in the scenario should be calculated and understood prior to use. On MLD compliant machines, this button also has additional functionality.

Refer to the RCI Operator's Manual for further information.

12.2 RCI Supervisor Key Switch

This switch can be utilised in conjunction with the RCI screen menus to select and lock the machine mode to ensure the Safe system of work is maintained while the machine is operating. It is also utilised to change the machine from one mode into another mode. Modes changes are instantaneous that are interlocked by this switch:

- Working mode / Travel mode (Gauge Limits Unlock)
- Single Lift mode / Tandem Lift mode
- Lifting mode (System Startup Default) / Dig mode
- Attachment Change mode (Quick Hitch Operation)
- Stub Boom Release Override mode.

See RCI Manual for further details.

In accordance with statutory legislation, the RCI must be operational in the correct lifting mode during lifting operations.

IT IS AGAINST THE LAW TO UNDERTAKE LIFTING OPERATIONS WITH THE RCI OVERRIDDEN OR IN DIG MODE AND OPERATORS CAN BE PROSECUTED IN THE EVENT OF AN ACCIDENT.

Dig mode must only be used for digging. When on rail the force that can be exerted by the machine is varied depending on the slew position and correct backward stability of the machine. This may limit the break out force available but maintains the machine stability and assists in reducing the risk of derailment and overturning.

Dig mode also facilitates the dig depth assist feature if the optional bucket linkage sensor is fitted to the machine. The operator can set a depth below the current running surface and a tolerance for the accuracy of this depth, and the system with the aid of the visual depth indicator on the RCI display and the option of the motion cut system will assist the operator to maintain the correct dig depth.

Note: the correct bucket dimensions must be entered into the RCI for this system to guide the operator correctly.

12.3 Emergency Stop

Disables all rail control functions and stops machine movements, see Figure 8.



Figure 8 - In-Cab Emergency Stop Button

This button is accessible from both seated positions in the cab.

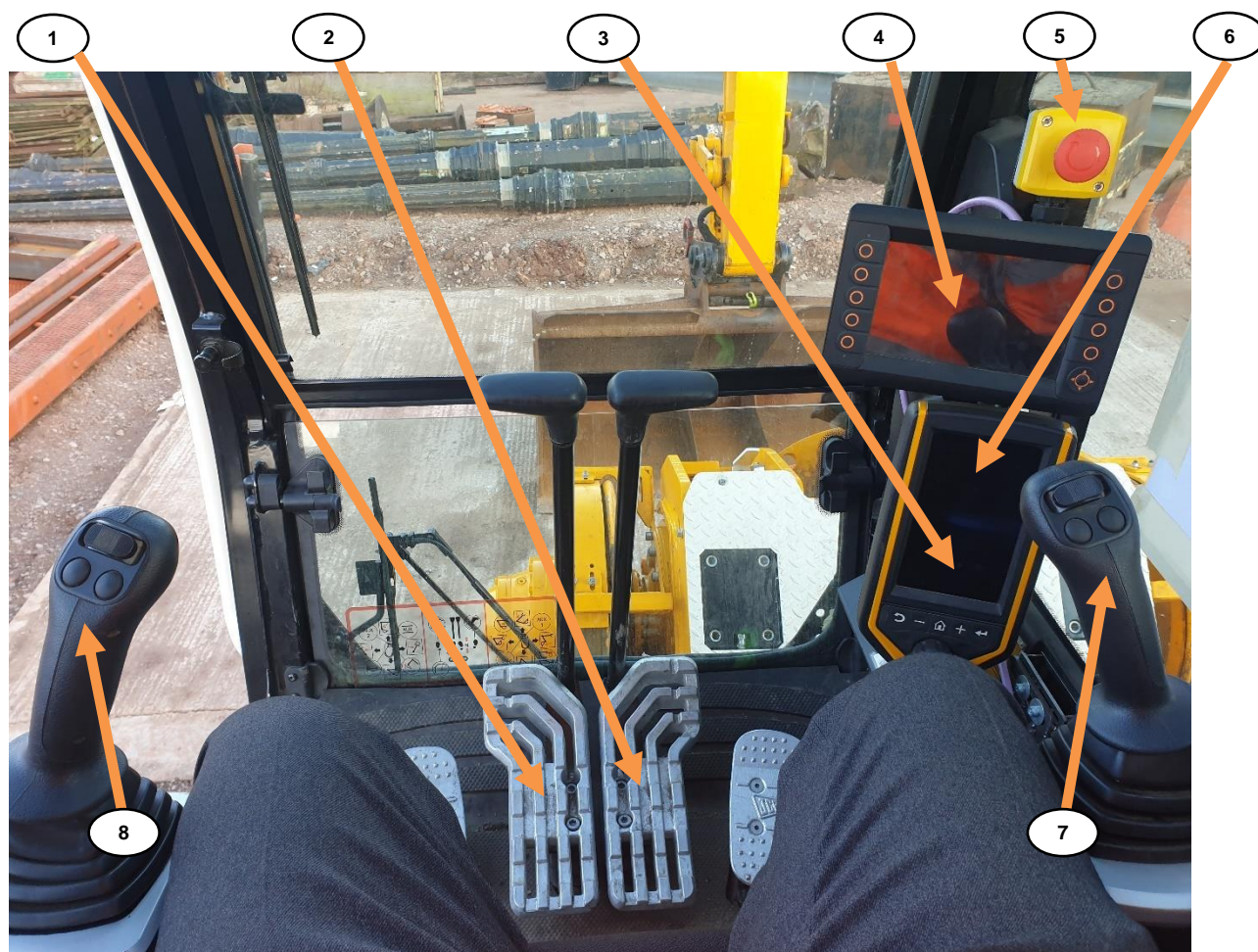
The emergency stop button must not be used for stopping the machine under normal circumstances as the machine will stop very abruptly which is uncomfortable for the operator and may cause a free hanging load on hook or attachment to swing.

The functions inhibited by operation of the emergency stopping are as follows, and the engine will continue to run as normal:

- All boom functions
- Slew functions
- Slew brake release
- High flow attachment functions
- Travel on road and rail
- Rail Axle deploy functions
- Axle Unlock
- Emergency brake release
- Emergency trailer brake release
- Quick Hitch release.

12.4 Auxiliary Interface Controls

Details of the machine's Auxiliary Interface Controls are shown in Figure 9. To adjust the operator's seat position and height, see the JCB OEM Operator manual.



- | | |
|--|--------------------------|
| 1. Left hand track pedal | 5. ESTOP |
| 2. Right hand track pedal | 6. JCB Machine Interface |
| 3. Side and Rear blind spot Camera Interface | 7. Right hand lever |
| 4. Rail-Ability RCI Display Rail Systems Interface | 8. Left hand lever |

Figure 9 - In-Cab Auxiliary Controls

The extra tilt rotator/extend functions are operated using optional levers with 4 auxiliary rollers on top of the left and right-hand levers (see Figure 10 and Figure 11).

For other auxiliary functions, refer to the NOX Tilt Rotators operator handbook.

The Rail-Ability RCI instructions are given in the Rail-Ability RCI operator handbook.

Rail Travel, Rail Braking and Rail Trailer Braking are all operated utilising the drive and brake pedal to exactly match the road mode travel controls as described in the JCB Operator handbook.

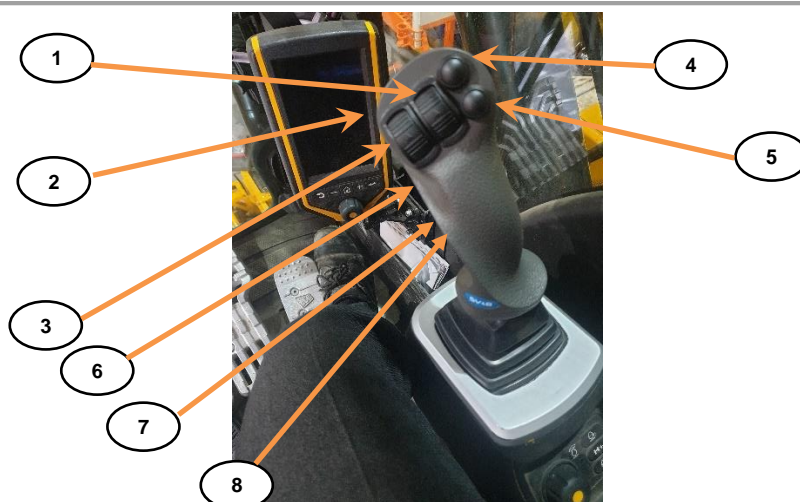
To activate the trailer brake systems, see the RCI Manual for further details.

12.5 Controls Interface (Optional Lever Grips - NOX Tilt Rotators)



- | | |
|---|--|
| 1. Boom/Slew priority | 6. AUX 1 [TILT ROTATOR] (Front Roller) |
| 2. Horn | 7. Rail Axle Lock Toggle |
| 3. High Flow Auxiliary | 8. Bucket/Grab Diverter Toggle |
| 4. Constant Pump Flow Auxiliary Hold (Front button) | |
| 5. Tilt Roller [TILT ROTATOR] | |

Figure 10 - Left Hand Lever



- | | |
|--|--|
| 1. Low flow auxiliary | 5. Engine revs idle |
| 2. Power Boost (Front button) | 6. AUX 2 [TILT ROTATOR] (Front Roller) |
| 3. Rotate Roller [TILT ROTATOR] | 7. RCI 'OK' Button |
| 4. Quick Hitch Coupler attachment change | 8. Spare |

Figure 11 - Right Hand Lever

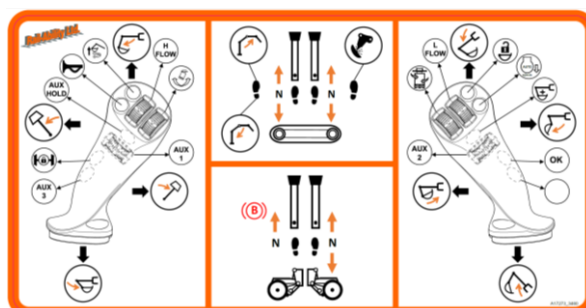


Figure 12 – Controls Symbols

12.6 RCI Display

NOTE: All the operating controls for the excavator arm are the same for rail use as construction site use, refer to the JCB JZ140 / 141 operator handbook.

Once the screen (Figure 13) has booted up, the display changes to the Initial Screen Pages.

12.6.1 Screen Surround



Figure 13 - Screen Surround

The round buttons are required in some instances, as detailed in the RCI Operator Manual.

NOTE:

- After the Display has finished booting, the main screen page will display.
- As this is the initial page of the system, the access to “Axles” (for rail axle control functions) and “Menu” can only be obtained when this page is displayed, using the RCI Screen.
- It is only on this page that it is possible to control the Axle lock and parking brake components of the system using the function keys on the front of the display.

The horn icon shows if the horn is muted or not (a red cross is added when muted).

12.6.2 Travel Control

Tortoise/hare travel speed is also given on this page, along with a speedometer.

See RCI Manual for further details.

The speedometer numerically displays the current speed of the machine in miles per hour, and fills the gauge from green to red over 12 increments as the speed increases.

12.6.3 Axle-Lock

All travel on rail track must be carried out with the axle unlocked.

By operating the A-Lock (axle lock) button the axle can be locked; this will provide greater stability while carrying out stationary rail-mounted operations.

In Rail Mode, the RCI is able to control the axle locks automatically. The axle locks will be applied when stationary and unlock when the drive pedal is pressed. If the load on hook / radius is low enough to enable the axles to safely unlock, the RCI will unlock the axles and enable travel. If not the axles will remain locked and travel will be disabled.

In road mode the axle locks remain manually controlled.

See RCI Manual for further details.

12.6.4 Park Brake

NOTE: ALWAYS APPLY THE PARK BRAKE BEFORE LEAVING THE CAB.

All travel on rail track must be carried out with the park brake off, by operating the Park brake (Emergency brake) button the brake can be activated while stationary or while moving on rail; this will provide greater braking capability in an emergency while carrying out travelling rail-mounted operations.

The rail park brakes should be tested on a regular basis in accordance with the vehicle maintenance instruction. If there is any doubt about the performance of the rail park brakes or reason to believe the brake performance may have changed a torque test must be undertaken prior to using the machine. This is undertaken with an appropriate torque wrench and torque multiplier, as well as the Rail-Ability torque adaptor for the wheel hub. The torque with the service foot brake released for each rail wheel with the park brakes applied must exceed **2150Nm**.

A target torque of 3000Nm is achievable in optimum condition.

3600Nm shall NOT BE EXCEEDED or brake pack damage may occur.

12.6.5 Service Brake

The foot brake provides a dynamic brake in rail mode.

This rail service brakes should be tested on a regular basis in accordance with the vehicle maintenance instruction. If there is any doubt about the performance of the rail foot brakes or reason to believe the brake performance may have changed, a torque test must be undertaken prior to using the machine. This is undertaken with an appropriate torque wrench and torque multiplier, as well as the Rail-Ability torque adaptor for the wheel hub. The torque with the emergency park brake released for each rail wheel with the service foot brakes applied must exceed **3300Nm**.

A target torque of 4200Nm is achievable in optimum condition.

WARNING: The Torque testing process and the equipment used must be risk assessed to determine safe use. The torques involved generate a large amount of stored energy. This can be very dangerous if any of the equipment and/or procedure used fails. The equipment test procedure, calibration, safe use must be suitable, and personnel involved must be competent and be trained in all aspects.

Expected Stopping Distances with Bucket and Auxiliary Counterweight fitted in dry conditions on flat level rail:

Speed (mph)	Distance (m)
3	< 2
7	< 5.5
9	< 8
10	< 10

12.6.6 Rail Axle Control

See RCI Manual for further details.

Having selected the Rail Axles option from the main screen page, the screen will display the "Rail Axle Select" page. The "Home" function is activated by the top left button, and will return the system to the main screen page when utilised.

To allow the machine to travel in rail mode or return to road travel mode, the rail axles must be deployed or retracted respectively. As each axle can only be operated independently, select the front or rear axle use the "left" button to select the front, and the "right" button to select the rear. Once the required axle is selected, hold the button to allow the vertical movement of the chosen axle.

The current status of the axles is displayed on the main screen page, the "Rail Axle Select" page, and "Front/Rear Rail Axle Control" page:

- The axles will be shown as UP when they are sensed by the system as up, and will be coloured yellow.
- The axles will be shown as MID POSITION when they are no longer sensed by the system as up nor down, and will be coloured red.
- The axles will be shown as DOWN and coloured green when the system's sensors have indicated they are down.

12.6.7 Axle Selection

See RCI Manual for further details.

Upon selecting the required rail axle, the other half of the machine will become hidden, and the screen will display as either of the two states shown.

12.6.8 Axle Control

See RCI Manual for further details.

After selecting the required axle, while holding the button the screen will change to the control pages. The current status of the axles is described next to the images of the machine. The icon of two arrows next to the axles indicates that the system is ready and primed for their movement up or down.

To raise or lower the axles, press the rail axle control button to select the axle you wish to operate, then operate the dozer up/down lever, forwards to lower the rail axle or backwards to raise it. To raise/lower the other axle press the rail axle control switch into the alternative position then operate the blade lever in the same way.

NOTE: TO ENABLE THE RAIL AXLES TO BE DEPLOYED OR RETRACTED THE MACHINE MUST BE SLEWED OVER ONE CHASSIS END OR THE OTHER.

THE RCI IS AN INHERENT AND INTEGRAL SYSTEM WITHIN THE RAIL-ABILITY SAFETY SYSTEMS ON THE MACHINE. COMPLETE FAMILIARITY WITH THE RCI OPERATION MANUAL IS VITAL IN COMBINATION WITH THIS MANUAL TO HAVE A COMPLETE UNDERSTANDING OF THE MACHINES SAFETY FEATURES AND OPERATIONAL INTERLOCKS.

See RCI Manual for further details.

The machine will not travel on rail if both axles are not fully deployed, confirmed green.

The machine is still operated by forward/reverse lever as on a construction site. However, when travelling on rail only the right-hand drive lever/pedal is required to be pushed in the direction of travel required to travel the machine under normal conditions. This is reversed each time the machine is slewed 180°. If the left-hand lever is pushed the system will ignore it.

12.6.9 Travel Mode Gauge Locks

See RCI Manual for further details.

From the RCI main screen page, the screen will display the “Rail Gauge Tunnel” when the machine is in a position that complies with the travel mode gauge requirements. The display will show the tunnel graphic in green indicating that the machine is safe to travel on railway infrastructure.

The padlock symbols around the tunnel graphic can then be utilised to lock the slew left and slew right and/or boom height functions into the gauge envelope to prevent the machine exceeding these limits for travel mode. These will only activate if the gauge compliance at the machine extremities and the tunnel graphic is green accordingly. Once the padlocks show as locked, the slew brake is permanently applied, and the slew and or boom functions are motion cut interlocked respectively.

This provides a high-performance gauge lock and the machine can be travelled next to open lines and under live OLE in this configuration. This machine is suitable for travel under the live OLE when used in conjunction with a safe system of work determined and authorised in accordance with the requirements of GE/RT8024.

It is recommended that while working under isolated OLE and low structures that the gauge height padlock remains locked.

NOTE: The machine MUST NOT be worked ALO nor under Live OLE as the system is not approved to do this.

NOTE: Attachments may be out of gauge even when the machine RCI indicates that the machine is green within gauge dependent on the attachment dimensions. This must always be accounted for by the machine operator and the safe system of work. If adjacent lines are open to traffic, this machine shall be used only if a safe system of work has been adopted to take account of the extra gauge exceedance caused by attachments.

To unlock the Gauge locks, press the padlocks again, while simultaneously activating the supervisor key switch.

NOTE: The cab door is out of gauge when open and this is not monitored or interlocked by the system. If this side of the machine is adjacent to an open running line, the cab can only be exited via the front windscreen in an emergency and climb down the opposite side of the machine undercarriage. Maintain 3 points of contact with the machine at all times. Never infringe a line open to passing traffic.

Although egress from the machine is possible through the opening front windscreen in an emergency, where access is limited to the machine cab door only, the Use of Plant Safety Plan shall state ‘The machine may only operate with the access adjacent to a cess or a line closed to all train movements or the documented safe system of work must take account of adequate safe clearances to adjacent lines’.

12.6.10 Data Logger

The RCI system is equipped with a data logger and GPS+GSM communications.

See RCI Manual for further details.

Where a data logging system is found not to be operational then the machine shall not be used until the machine is repaired and fully confirmed as operational. This requirement applies irrespective of whether starting or part-way through an operation.

12.6.11 Trailer Brake Control

See RCI Manual for further details.

Having selected the Trailer Brakes option from the main screen page, the screen will display the “Rail Rail Trailer Icon” in green.

This will charge the trailer air systems on the machine with air from the reservoirs on the machine and initiate the trailer brake control. The park brakes on the trailers are now be released and applied with this button and the trailer brake away monitoring is activated. The machines dynamic foot brake pedal will now also charge the trailer brake service air connectors to operate the trailer service brakes simultaneously with the machine dynamic rail brakes.

Safe system of work for coupling and uncoupling:

1. Lift the trailer onto the track at a suitable access point.
2. For on and off-tracking, a site-specific plan shall be used taking account of the requirements of the applicable module of Network Rail specification NR/PLANT/0200 in the UK.
3. Ensure brakes are working effectively by pulling the trailer with the chains. The trailer brakes should resist movement: the wheels should not rotate.
4. Connect drawbar to trailer before attaching to the towing vehicle.
5. Only connect the brake hose to the trailer after fitting drawbar.

NOTE: The machine does not have a trailer light control system so it can only be used with trailers that have automatic self-contained directional marker lighting systems.

6. Switch lights on at master switch on the trailer once trailer is positioned on the track.
7. Check the brakes release allowing the wheels to roll when starting to travel.

GROUNDING OUT, FORCING OR STRIKING THE TRAILER WHILE THE MACHINE IS CARRYING IT OFF RAIL MAY RESULT IN SEVERE DAMAGE.

13 On-Tracking and Coupling

It is assumed that the trailer will be delivered to the trackside by lorry. Care must be taken when transferring the trailer from delivery vehicle to the track. The trailer must only be lifted onto the track by a machine that is standing on sound level ground. Particular care should be exercised if this takes place under live OLE. No items of equipment should be placed on the trailer bed during this operation.

Ensure that the lifting machine has adequate capacity at required radius to safety lift, with its rated capacity indicator/safe working load indicator switched on.

Place trailer onto the line with oscillating axle toward the towing machine. A machine/crane controller must be available to guide rail wheels onto track.

Ensure that all personnel not involved with control and manoeuvres are outside the operating range of the machine and that all others are in view and remain safely away from vehicle during these operations.

When on-tracking a trailer, ensure the park brake is functioning by:

- Using the lifting machine, push/pull the trailer along the track a small distance using the lifting chains. All wheels should skid and not rotate.

If the trailer moves freely because wheels rotate, remove from use and investigate the cause. **THE TRAILER MUST NOT BE USED.**

Connect the trailer tow bar to the towing machine (but not the brake hoses). Undertake a pull test and check the trailer the trailer resists the movement.

Note: If the trailer is already on line undertake a pull test and check the trailer resists the movement.

Note: If trailers are interconnected with those of other manufacturers, the braking requirements of the complete system should be checked for compatibility.

13.1 Air Connections

Warning - Compressed Air can be dangerous. Ensure all systems are depressurised before attempting to connect or disconnect components / hoses

Wear Site safety PPE and Long sleeves, Gloves, and Eye protection.

Apply towing machine parking brake, and then couple the red pneumatic hose connections using supplied hoses.

Ensure that the park brake line blanking plugs/caps are fitted on opposite end of trailer to that being coupled.

Remove blanking plugs from red park brake connections on trailer and towing vehicle at connecting end. Connect park brake hose.

Connect the yellow service brake hose to the trailer and towing vehicle at connecting end.

RED couplings serve the Park Brake Circuit, and should be BSAU138A-1980 **female** 'C' without self-sealing valve, located on the host vehicle and trailers. The corresponding male 'C' couplings are fitted on each end of the connecting hose.

YELLOW couplings serve the Service Brake Circuit, and should be BSA138A-1980 **male** 'C' with self-sealing valve, located on the host vehicle and trailers. The corresponding female 'C' couplings with operating sleeve are fitted on each end of the connecting hose.

13.2 Multiple Trailers

If connecting a second trailer, ensure that the correct hose is used, after first removing the dummy blanking plugs on each trailer. It is important to remember to re-fit these blanking plugs when the hoses are subsequently removed.

If trailers are interconnected with those of other manufacturers, the braking requirements of the complete system should be checked for compatibility. Ensure total towed load does not exceed that permitted for the towing vehicle.

Release park brake and move trailers to establish that the park brakes have released.

The service brakes will be applied when the road-rail vehicle brake pedal is depressed. Light pedal pressure results in low pressure in the trailer brakes, high pedal pressure increases pressure to the trailer brakes and may cause the wheels to lock.

The combined outfit is now ready for use.

Apply parking brake and stop engine before disconnecting brake hoses.

Air Reservoirs:

1. Trailers fitted with air tanks can be used with the host machine approved for towing within the limitations of the machine towing capability.
2. Trailers without air tanks fitted usually require 25 litres of air reservoir capacity each from the host machine supply. In this case 75 litres of air capacity is required from the host machine, so it has air reservoir capacity for trailer brakes, on up to 3 trailers that do not have air reservoirs fitted and additional trailers that do have air reservoirs.

[WARNING] BRAKE LINES ON TOWING MACHINES WITHOUT AIR RESERVOIRS WILL PHYSICALLY INTERCONNECT TO TRAILERS WITHOUT AIR RESERVOIRS! THIS MUST NEVER BE DONE. THE BRAKING SYSTEMS, IN PARTICULAR THE SERVICE BRAKING SYSTEM, WILL NOT FUNCTION PROPERLY AND BRAKE PERFORMANCE WILL BE SEVERELY IMPAIRED.

14 Towing Procedures

1. When towing only travel at 10mph / 16km/h or below.
2. Ensure that the trailer is never overloaded
3. Ensure the towing vehicle is approved for towing the trailer type required.
4. Ensure the load the machine is certified to tow is not exceeded. Never exceed the accepted towing weight limit.
5. Make sure that loads are secure.
6. Total combined weight of trailer(s) and load(s) should not exceed the allowable maximum trailing specified on the machine's engineering acceptance certificate. This must not exceed three trailers if the trailers are not fitted with their own onboard air reservoirs.

[WARNING] EXTRA CARE AND OBSERVATION OF LINE SIDE AND OVERHEAD STRUCTURES IS REQUIRED WHEN THE TRAILER IS CARRYING A LOAD THAT IS OUTSIDE THE TRAVEL GAUGE IN ANY WAY.

14.1 Brake Status

Confirm that the park brakes are released before travel along the track. Trailer brakes will take different amounts of time to release depending on the trailer braking systems and number of trailers.

14.2 Trailer Break Away Detection

The towing vehicle has park brake air flow sensing break away detection systems fitted.

15 Coupling and Uncoupling

WARNING

- The operator is responsible for all coupling/uncoupling procedures. The machine/crane controller must be present to verify that each procedure has been carried out correctly.
- Only trained and assessed competent staff are allowed to undertake coupling/uncoupling procedures for these vehicles.
- In DC electrified line areas (3rd and 4th rail), and in addition to the possession, a DC isolation must be in place at all times while a trailer is on the line.
- When not in use, all trailers must be off-tracked to a safe position.
- Whenever a rail trailer is placed on track, a test of the brakes must be carried out.
- Ensure that the trailer brake pressure range and towing machine brake pressure range is compatible.
- NOTE: THE MACHINE ENGINE SHOULD NOT BE RUNNING WHEN THE TRAILER BRAKES ARE CONNECTED AND DISCONNECTED AND THE HYDRAULIC AIR PRESSURE GAUGE ON THE RCI SHOULD READ ZERO BAR IN BOTH CASES TO ENSURE THE TRAILER BRAKES APPLY FULLY.

15.1 Coupling/Re-Coupling - Towing Adapter to Auto-Couplings

Rail-Ability have designed the rail gear with a built-in towing adapter to close couple the trailer and eliminate the risk by fully removing the requirement for the crane controller to be in the crush zone between machine and trailer whilst the RRV is moved.



1. The Tow adapter is stored in its housing on the rail gear.



2. The tow adapter is swiveled out from the machine, adjusted to hitch height then secured in place by the winged grub screw.

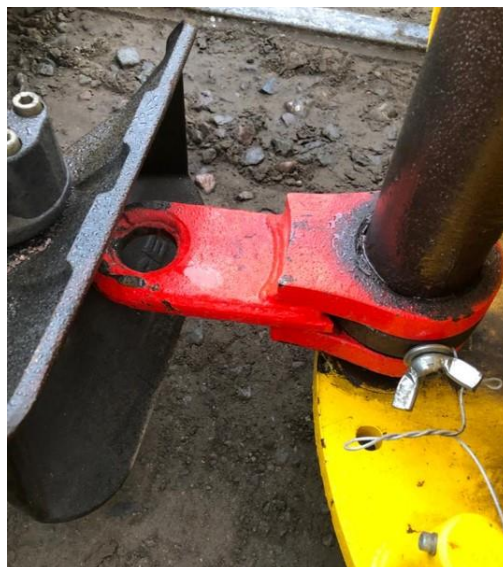


3. The Jost/Rockinger hitch on the trailer is latched open.



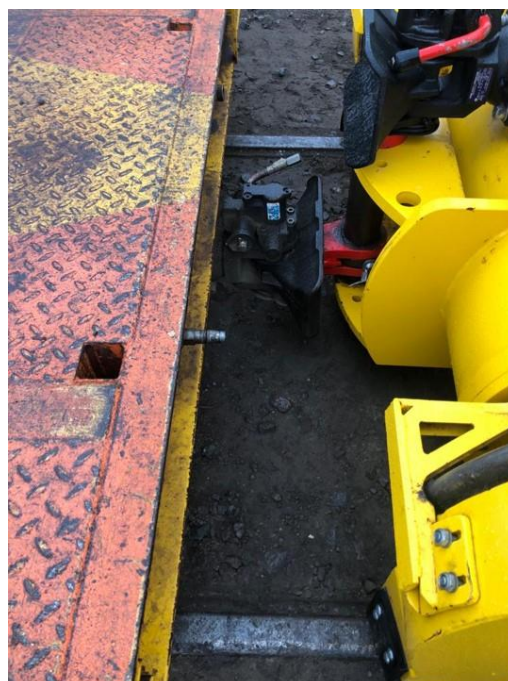
4. Then once everyone is clear from the crush zone the RRV is driven into location to engage the trailer auto coupling.

CAUTION - Ensure that the trailer auto coupling pin has fully deployed.



5. Loosen the Grub Bolt to allow the tow adapter to float on the shaft.

WARNING – Failure to loosen the Grub Screw may cause the trailer to derail.



15.2 Coupling/Re-Coupling – Drawbars to Auto-Couplings

Connect the trailer tow bar to the RRV towing coupling. Then allow the machine to approach the trailer automatic coupling end. The drawbar will automatically operate the coupler on the trailer as the drawbar eye end enters the coupler funnel.

15.3 Coupling - All

WARNING - Never attempt to connect a towing jaw end of a vehicle to another towing jaw end of a vehicle, unless following emergency recovery procedures.

Carry out a test pull. The trailer brakes should resist movement: none of the wheels should rotate.

Connect up the brake hose, release the trailer parking brake from the machine and repeat the test pull, allowing for any time delay in the system operation. The trailer should now move freely.

WARNING - Only if the above brake tests are satisfactory should the trailer be used.

If the brakes are found to be ineffective, the trailer must be off-tracked.

If the trailer cannot be lifted off track in one operation while the host machine is in rail mode, then the end of the trailer nearer the host machine must be carefully derailed in order to prevent runaway.

At all times, the trailer must be secured to prevent runaway.

15.4 Uncoupling

The vehicles should be brought to a stop; the towing vehicle's parking brake applied and the engine stopped (where necessary). Follow the manufacturer's procedure for ensuring that the brake pressure has been released. Note that after stopping the engine there is usually a delay before line pressure decays.

Disconnect the brake hose and restart the engine (where necessary).

Use the towing vehicle to carry out a test pull. The trailer brakes should resist movement: none of the wheels should rotate.

WARNING - If brakes are found to be ineffective, the trailer must be off-tracked.

If the trailer cannot be lifted off track in one operation while the host machine is in rail mode, then the end of the trailer nearer the host machine must be carefully derailed in order to prevent runaway.

At all times, the trailer must be secured to prevent runaway.

FAILURE TO COMPLY WITH ANY OF THE REQUIREMENTS STATED IN THIS DOCUMENT MAY RESULT IN DAMAGE TO THE MACHINERY AND/OR THE RAIL INFRASTRUCTURE AND MAY RESULT IN SEVERE INJURY OR DEATH TO PERSONNEL.

15.5 Uncoupling and Off-tracking

Bring the towing machine to a stop, apply the towing vehicle parking brake and switch off the engine.

Apply towing vehicle parking brake but not service brake. Stop engine. Remove service brake connection first, then the park brake hose.

Disconnect the air brake hoses, and replace the dummy blanking plugs.

Using the towing machine, push/pull the trailer a few feet. Trailer wheels should skid and not rotate.

Providing the brakes have applied uncouple the tow bar/tow adapter.

16 Emergency Recovery

If the machine breaks down in such a position that it is likely to obstruct an adjacent line or cause an accident or damage to the railway infrastructure or any other vehicle, it is important that the machine is placed in a safe position as soon as possible. For this reason, the excavator has been fitted with an electro-hydraulic power system and tow bar by which another machine can tow it to safety.

Under normal conditions, with 2 trained and competent personnel, this process usually takes around 30 minutes to undertake on average.

Instructions on how the auxiliary system works are described below. Read and understand these instructions so that in the event of a machine failure you and the machine can be put in a safe position:

- Slew the machine so that the arm is parallel to and clear of any adjacent line with the counterweight facing the vehicle that is to be used for towing.
- Lower the boom so that the highest point is no higher than the top of the cab.
- Connect the failed machine and recovery vehicle together with the approved tow bar.
- Release the axle lock stabilisers of the failed machine.
- **ONLY RELEASE THE FINAL DRIVE SHAFT SPLINES ON THE FAILED MACHINE ONCE THE TOW BAR HAS BEEN CONNECTED TO THE RECOVERY VEHICLE OTHERWISE THE MACHINE MIGHT RUN AWAY.**
- Ensure that towing is carried out at approximately 2 mph as the recovery vehicle has to brake for both vehicles and at a higher speed braking distance would be greatly increased.
- Switch on machine ignition switch.
- Switch RCI on and place in override for duration of the recovery. When the recovery pump is running the auxiliary valve block on the machine is operational and this provides the following essential functions for recovery:
 - Raise and lower of main arm lift ram
 - Slew left and right
 - Arm knuckle left and right
 - Raise front rail gear/blade trolley
 - Raise the rear rail gear.
- If the functions do not operate, an electrical failure is present. In this case the second person must hold the momentary mechanical overrides on the RCI motion cut valve block functions to enable each function that is required in turn while the operator controls the machine.
- Operate the machine controls in the usual way to bring the machine into travel gauge to prepare for towing.

WARNING: TO ENSURE THE MACHINE IS COMPLYING WITH THE W6A GAUGE REQUIREMENT BEFORE TRAVELLING ON RAIL IT IS ESSENTIAL THAT THE MACHINE IS SLEWED SO THAT THE UPPER STRUCTURE IS PARALLEL TO THE LOWER STRUCTURE/RAIL AND THAT THE CAB DOOR IS SHUT.

WARNING: TO GUARANTEE THE MACHINE IS COMPLYING WITH THE W6A GAUGE REQUIREMENT BEFORE TRAVELLING ON RAIL IT IS ALSO ESSENTIAL THAT THE ARM IS POSITIONED LOWER OR EQUAL TO THE HEIGHT OF THE CAB. THIS IS TO ENSURE OVERHEAD STRUCTURES ARE NOT STRUCK. THE HEIGHT LIMITER FITTED TO THE MACHINE CAN THEN BE SET AND ACTIVATED TO MAINTAIN THIS POSITION.

Failure to comply with these requirements may result in severe damage to the machine and/or the rail infrastructure.

17 Pre-Operation Actions

17.1 Requirements

It is the responsibility of the operator to perform a pre-operation inspection and routine maintenance.

Scheduled maintenance inspections shall be performed by qualified service technicians, according to the manufacturer's specifications, governmental regulations and the requirements listed in the Service Manual.

Repairs to the machine may only be made by a qualified service technician, according to the manufacturer's specifications. After repairs are completed, the operator must perform a pre-operation inspection again before going on to the function tests. If in doubt, contact Rail-Ability Ltd.

17.2 General

- Learn and practice the principles of safe machine operation contained in the manuals referenced in Para. 4 and this operator's manual before carrying out these inspections.
- Avoid hazardous situations.
- Always perform a pre-operation inspection prior to use.
- Only use the machine as it was intended.

The pre-operation inspection is a visual inspection performed by the operator prior to each work shift. The inspection is designed to discover if anything is apparently wrong with a machine before the operator performs the function tests.

The pre-operation inspection also serves to determine if routine maintenance procedures are required. Only routine maintenance items specified in this manual may be performed by the operator.

If damage or any unauthorised variation from factory delivered condition is discovered, the machine must be tagged and removed from service.

Refer to the list in the Inspection paragraph below and check each of the items in turn.

17.3 Inspection

- ☐ Ensure that the Operator's and Service manuals are complete, legible and in the storage, container located in the cab.
- ☐ Ensure that all decals are legible and in place. See Decals paragraph.
- ☐ Ensure gear shift lever is in neutral.
- ☐ Check engine and related components (e.g. radiator, alternator, belts, etc.). See Manual detailed in paragraph 4.
- ☐ Check for engine oil leaks and proper oil level. Add oil if needed. See Service Manuals.
- ☐ Check for hydraulic oil leaks and proper oil levels. Add oil if needed. See Maintenance paragraph.
- ☐ Check condition of axles, transmission and track.
- ☐ Check operation of service and parking brake. See Manual detailed in paragraph 4.
- ☐ Check operation of the road and rail lights and warning beacons.
- ☐ Check for battery fluid leaks. See Service Manuals.

- ☐ Check cab windscreen and wipers.
- ☐ Check all electrical plugs are connected and hydraulic connections are coupled.

Check the following components and areas for damage, improperly installed, loose or missing parts and unauthorised modifications:

- ☐ Electrical components, wiring, electrical cables and earth straps.
- ☐ Hydraulic power unit, tank, hoses, pipes, fittings, cylinders and manifolds.
- ☐ Batteries and connections.
- ☐ Fuel and hydraulic tanks.
- ☐ Turntable drive motor.
- ☐ Boom wear bushes.
- ☐ Proximity switches, alarms and horns.
- ☐ Nuts, bolts, pins and other fasteners.
- ☐ Lubrication points.
- ☐ Tow bar.
- ☐ Fire extinguisher.
- ☐ Rail wheel hubs, treads, flanges and rail sweepers.
- ☐ Ladders, steps and hand rails.
- ☐ Guards and covers.

Check the entire machine for:

- ☐ Cracks in welds or structural components.
- ☐ Dents or damage to machine.
- ☐ Excessive wear, rust, corrosion or oxidation.

Ensure that all structural and other critical components are present and all associated fasteners and pins are in place and properly tightened.

- ☐ Following inspection, ensure that all compartment covers are in place and latched.

17.4 Completion

If any routine maintenance has been identified in these pre-operation actions, carry it out as specified in the Routine Maintenance paragraph of this manual.

If no routine maintenance is required, carry out the Function Tests detailed in this manual.

18 Routine Maintenance

18.1 Requirements

It is the responsibility of the operator to perform routine maintenance as required by the pre-operation inspection.

Scheduled maintenance inspections shall be completed by qualified service technicians, according to the manufacturer's specifications, governmental regulations and the requirements specified in the Service Manual.

18.2 General

- Only routine maintenance items specified in this manual shall be performed by the operator.
- Use only manufacturer's original replacement parts. Contact Rail-Ability Ltd if in doubt.
- Machines that have been out of service for more than three months must receive at least the Quarterly Inspection before they are put back into service (see Service Manual in paragraph 4).

Carry out the maintenance below as required by the Pre-operation Actions.

18.3 Engine Oil Level

Maintaining the proper engine oil level is essential to good engine performance and service life. Operating the machine with an improper oil level can damage engine components.

NOTICE Check the oil level with the engine off.

Refer to the OEM manuals detailed in paragraph 4.

18.4 Hydraulic Oil Level

Maintaining the hydraulic oil at the proper level is essential to machine operation. Improper hydraulic oil levels can damage hydraulic components.

Daily checks allow the inspector to identify changes in oil level that might indicate the presence of hydraulic system problems.

NOTICE Perform this procedure with the boom in the stowed position.

1. Visually inspect the oil level in the hydraulic tank. The sight gauge is located on the side of the hydraulic oil tank (right hand side of machine cab). With the boom in its stowed position, the hydraulic oil level should be half way up the sight gauge.
2. Add oil if necessary using Hydraulic oil type ISO 46 Grade. Do not overfill.

18.5 Batteries

Proper battery condition is essential to good engine performance and operational safety. Damaged cables and connections can result in engine component damage and hazardous conditions.



Electrocutation hazard.

Contact with hot or live circuits may result in death or serious injury. Remove all rings, watches and other jewellery.



Bodily injury hazard.

Batteries contain acid. Avoid spilling or contacting battery acid. Neutralise battery acid spills with baking soda and water.

1. Put on protective clothing and eye wear.
2. Be sure that the battery cable connections are tight and free of corrosion.
3. Be sure that the battery retaining fasteners are in place and secure.

18.6 Rail Wheels and Profiles

Maintaining the rail wheels in good condition is essential to safe operation and good performance. Excessive flange and/or tread wear could result in machine derailment and tip-over. Component damage may also result if problems are not discovered and repaired in a timely fashion.



Bodily injury hazard.

Excessively worn rail wheels can develop sharp burrs due to material migration.



Tip-over hazard.

Do not attempt to re-machine and/or re-apply heat treatment to the rail wheels.

1. Check rail wheels friction drive hubs for missing or loose bolts.
2. Check condition of rail wheel treads and flanges for pitting scoring, bruising, flat spots or other damage.
3. Check that no cracks, flats or scoring are visible.

Refer to Service Manual listed in paragraph 4 for further checks and limits.

18.7 Fuel Leaks

Failure to detect and correct fuel leaks will result in an unsafe condition. An explosion or fire resulting from a fuel leak may cause death or serious injury.



Explosion and fire hazard

Engine fuels are combustible. Inspect the machine in an open, well-ventilated area away from heaters, sparks, flames and lighted tobacco. Always have an approved fire extinguisher within easy reach (one is also fitted inside the machine cab).

1. Perform a visual inspection in the areas surrounding the fuel tanks, hoses and fittings, fuel pump, fuel filter, fuel injection pumps and fuel injectors.



Explosion and fire hazard.

If a fuel leak is discovered, keep any additional personnel from entering the area and do not operate the machine. Repair the leak immediately.

18.8 Completion

Carry out the Function Tests detailed in this manual.

19 Function Tests



19.1 Requirements

It is the responsibility of the operator to perform Function Tests following Pre-operation Inspection.

19.2 General

The Function Tests are designed to discover any malfunctions before the machine is put into service.

- A malfunctioning machine must never be used. If malfunctions are discovered, the machine must be tagged and removed from service.
- Repairs to the machine may only be made by a qualified service technician, according to the manufacturer's specifications.
- After repairs are completed, the operator must perform a Pre-operation Inspection and carry out the Function Tests again before putting the machine into service. If in doubt, contact Rail-Ability Ltd.

Refer to the paragraphs below and carry out each of the items in turn.

19.3 From the Machine Cab

1. Turn the ignition key in the cab to position 'two'.
2. Wait for the display to show the immobiliser PIN code entry interface.
3. Enter the correct immobiliser PIN code.
4. Enter the 8 digit sentinel PTS operator number. Ensure that this is correct.

19.3.1 Emergency Stop

5. Press the emergency stop button in the cab.
 - Result: The display will show Emergency Stop Active. The engine will still run.
6. Reset the emergency stop by twisting the button.

19.3.2 Horn

7. Push the horn button (1) on the left hand lever (Figure 10).
 - Result: The machine horn should sound.

19.3.3 RCI Sounder

8. The RCI will boot up at ignition on. It will run a siren self-test for the operator to acknowledge and confirm.
 - Result: The RCI Sounder should sound.

19.3.4 RCI Blue Light

9. The RCI will boot up at ignition on. It will run a blue light self-test for the operator to acknowledge and confirm.
 - Result: The Blue light should be illuminated.

19.3.5 RCI Motion Cuts

10. The RCI will boot up at ignition on. It will run a motion cut self-test for the operator to acknowledge and confirm.
 - Result: None of the machine functions should operate until they are unlocked.

19.3.6 Crawler Drive Braking



THE BRAKES MUST BE ABLE TO HOLD THE MACHINE ON ANY SLOPE IT IS ABLE TO CLIMB.

11. Select low gear and drive forwards slowly.
12. Stop.
 - Result: The machine should stop promptly and firmly.

19.3.7 Rail Gear Deployment

13. When instructed it is safe to do so by the machine controller, inspect the On-Tracking access point and ensure that it is suitably prepared.
14. When instructed it is safe to do so by the machine controller, drive the machine to the On-Tracking point and align the machine over the track.
15. Enable lifting mode on the RCI.
16. Following the instructions in the **Rail Axle Control paragraph**, press the rail axle control button to select the rear axle, then operate the dozer up/down lever, backwards to raise the rail axle.
 - Result: The rail gear should not lower.
17. Disable lift mode on the RCI.
18. Following the instructions in the **Rail Axle Control paragraph**, press the rail axle control button to select the rear axle, then operate the dozer up/down lever, forwards to lower the rail axle or backwards to raise it. Move the front rail gear raise/lower lever down.
 - Result: The front rail gear will lower onto the rails and lift the machine off the ground.
 - Result: The display will indicate when the front rail gear is fully deployed (Green rail wheel).
19. Repeat for the rear rail gear using the previous lever.
20. Move the rear rail gear raise/lower lever down.
 - Result: The rear rail gear will fully lift the machine.
 - Result: The display will indicate when the rear rail gear is fully deployed (Green rail wheel).

19.3.8 Rail Drive and Rail Braking

21. Select tortoise gear. Push the right travel lever forward to travel forwards slowly.
 - Result: The machine should move forwards.
22. Release the lever.
 - Result: The machine should stop promptly and firmly.
23. Press the park brake button.

NOTICE

THE BRAKES MUST BE ABLE TO HOLD THE MACHINE ON ANY SLOPE IT IS ABLE TO CLIMB.

24. Always close the cab door.

19.4 Completion

If the machine is to be used, carry out the Workplace Assessment detailed in this manual.

20 Workplace Assessment



20.1 Requirements

It is the responsibility of the operator to perform Workplace Assessment following Function Tests.

20.2 General

The workplace assessment helps determine if the workplace is suitable for safe machine operation. It should be performed by the operator prior to moving the machine to the workplace.

20.3 Assessment

Assess for the following potential obstacles and hazardous situations as they may hurt people, damage both the machine and the boom, and cause the machine to overturn:

- Hazardous locations.
- OHLE power cables.
- Overhead and high voltage conductors.
- Obstructions, including:
 - Building walls
 - Balconies
 - Eaves
 - Scaffoldings
 - Tree branches.
- Any items that may lift the machine.
- Other machines.
- Inadequate surface support to withstand all load forces imposed by the machine.
- Wind and weather conditions.
- The presence of unauthorised personnel.
- Any possible unsafe conditions.
- Cant - not to exceed 150mm.
- Ballast shoulder - not too high or too low.
- Deep cess or soft cess.
- Drainage routes, troughing routes and other services/cables.

Make sure that there is no risk of elements falling on the operator or on the boom and take the right precautions to prevent it.

Ensure any items assessed as hazardous above are addressed before the machine can be used.

20.4 Completion

If the machine is to be used, carry out the Operating Instructions detailed in this manual.

21 Operating Instructions



21.1 Requirements

It is the operator's responsibility to follow all the safety rules and instructions in this Operator's Manual and all the other documents listed in paragraph 4 of this manual.

Only trained and authorised personnel should be permitted to operate the machine.

If more than one operator is expected to use a machine at different times in the same work shift, they must all be qualified operators and are all expected to follow all safety rules and instructions in this Operator's Manual and all the other documents listed in paragraph 4 of this manual.

21.2 General

A malfunctioning machine must never be used. If malfunctions are discovered, the machine must be tagged and removed from service.

Prior to use, ensure the following:

1. Learn and practice the principles of safe machine operation contained in this operator's manual.
2. Perform Pre-operation Actions.
3. Perform Function Tests.
4. Carry out a Workplace Assessment.

These Operating Instructions detail each aspect of machine operation.

21.3 Emergency Stop

Ensure that all personnel, either operating or working alongside this machine, are aware of the locations and function of the emergency stop button.

The emergency stop button is located in the machine cab.

The emergency stop function provides a facility to isolate machine functions in the event of an emergency situation.

- To stop all functions push the Red emergency stop button to the 'OFF' position.

An Icon on the RCI Screen will illuminate when the emergency stop button has been depressed. The engine will continue to run when the emergency stop button has been pressed.

Repair any function that operates when any of the emergency stop buttons are depressed.

- To reset all functions, pull out the Red emergency stop button that has been depressed.

21.4 Deploying the Rail Gear

The rail gear can only be deployed using the controls located in the machine cab as detailed in the Rail Axle Control paragraph of this manual.

21.5 Drive on Rail



PRIOR TO DRIVING ON RAIL, ENSURE THAT THE AREA OF RAIL IN FRONT AND BEHIND YOU IS CLEAR OF ANY OBSTRUCTIONS OR PERSONNEL. SOUND THE HORN AND USE A MACHINE CONTROLLER OR BANKSMAN IF NECESSARY.

When on rail, with the front and rear rail gear fully deployed, the machine can be driven forwards and backwards using the cab rail drive controls. If the boom is fully stowed, 1st, and 2nd gears are available.

- The right hand drive lever must be used to travel and enable drive.
- To move the entire machine forwards, select tortoise on the display. Gently press the lever in the forward direction to reach the desired speed. Higher speeds can be obtained by further selecting rabbit on the display and press the accelerator if required.
- To move the entire machine backwards, select tortoise on the display. Gently press the lever in the rearward direction to reach the desired speed. Higher speeds can be obtained by further selecting rabbit on the display and press the accelerator if required.

21.6 Road Mode

Once the boom has been fully stowed and both front and rear rail gear have been fully raised, the machine will shut down the rail lights and rail mode systems and activate the road lighting systems automatically.

The machine is now in road mode and can be driven using the cab controls. Follow the Off-Tracking procedure described in this manual and the relevant Rail-Ability manual.

21.7 Work Lights

The work lights on the booms can be switched on and off by using the pushbutton in the cab.

- To switch the work lights ON, push the button in the cab.
- To switch the work lights OFF, push the button in the cab.



LED working lights have been fitted to the Boom and Cab to keep the current requirements low at 24 volts. Under no circumstances can these be replaced, exchanged or have additional lights added with standard filament type bulbs.

21.8 Restricting the Operating Envelopes [OPTIONAL FEATURE]

21.8.1 General

It may be necessary to use the boom height or slew restriction if the machine is working under OLE, in a tunnel or alongside a rail line which is still in service. If enabled, this feature prevents the boom from accidentally being slewed over the adjacent track and therefore presenting a significant collision hazard. The slew restriction must be used in these circumstances as follows:

- To set the virtual wall over the left-hand side of the machine, with the machine within the W6A gauge limits, lock and set the parameters in the machine cab utilising the virtual wall menu screen on the RCI display.
- To set the virtual wall over the right-hand side of the machine, with the machine within the W6A gauge limits, lock and set the parameters in the machine cab utilising the virtual wall menu screen on the RCI display.

The slew limiters are classified as a lateral limit of work device, with a low performance.

- To set the virtual ceiling above the machine, with the machine within the W6A gauge limits, lock and set the parameters in the machine cab utilising the virtual wall menu screen on the dashboard display.

The height limiter is classified as a vertical limit of work device, with a low performance.

See the RCI Operator's Manual for further details.

Refer to the manual listed in Paragraph 4 for operation of the boom.

21.8.2 Boom



ENSURE THAT THIS FUNCTION IS TESTED FOR CORRECT OPERATION PRIOR TO RELYING ON IT.

The Boom will not work to the exact virtual wall setting and instead is restricted to slew limited sectors. As such, the boom operations on the related side of the machine will be disabled from the centre line of the machine due to unknown load size parameters. This limitation is implemented in relation to ORR defined best practice guidance.

21.9 Load Handling

21.9.1 General



Before manoeuvring the load, verify that the working area is suitable for the boom.

The lifting curves of the capacity plate indicate the maximum load that the boom can lift at a certain radius and at a certain height. During load handling, do not exceed the reach limits given, or the load indicated on the above mentioned charts. If the limits are exceeded, the limiting device will be activated.

21.9.2 Lifting Moment Limiting Device

A characteristic which permits the classification of booms is their lifting capacity or maximum lifting moment. The moment is defined by the value obtained from the weight of the load to be lifted (**kg**) by its distance (**metres**) from the centreline of the boom rotation.

The "lifting moment limiting device" preserves the boom structure from overloads, as it prevents any movement which increases the value of the moment up to the maximum established value.

21.9.3 Manoeuvres of the boom

During load handling with the boom, in a vertical configuration or close to, the operator must refer to the loads indicated on the capacity plates since the limiting device is not particularly sensitive with vertical lifts.

21.9.4 Stow

Press the stow button. All of the incorrect functions and movements will then be disabled to assist the operator.

21.10 After Each Use

Perform the following steps at the end of every work shift.

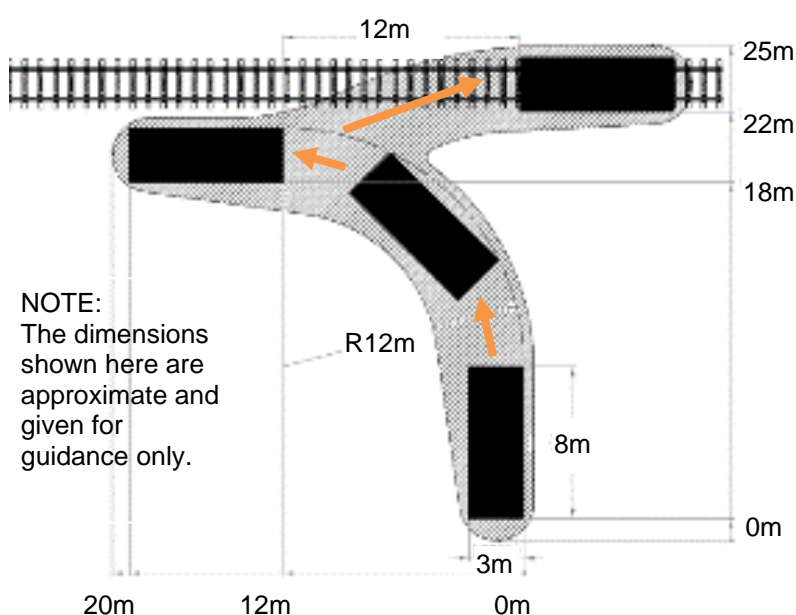
1. Ensure the boom is fully stowed.

2. Off-Track the machine.
3. Park the machine on a firm level surface, clear of obstruction and traffic at least 3 metres away from the nearest railway lines.
4. Turn off the ignition, remove the keys and lock both cab doors to secure from unauthorised use.

21.11 On and Off-tracking



Carry out the following in the order shown.



1. Drive forwards and align the machine parallel to the track.
2. Reverse the machine at 30° to the track from the parallel position to traverse the track.
3. Track Access Ramps are provided on the machine and should be deployed at the positions that the tracks will contact the rails.
4. Straddle the track and align the rear rail axle with the track.
5. Deploy the rear rail axle to only just lift the rear tracks slightly clear of the sleeper ends.
6. Manoeuvre the machine to align the front rail axle with the track.
7. Deploy the rear rail axle then deploy the front rail axle in stages to keep the machine relatively level as it raises.

NOTE: DO NOT ATTEMPT TO MANOEUVRE THE MACHINE WITH THE CRAWLER TRACKS, WHEN THE RAIL GEAR IS SEMI/FULLY DEPLOYED.

WARNINGS (1) WHEN ON-TRACKING, CARE MUST BE TAKEN WHEN LOWERING THE BOGIE ONTO THE RAIL HEAD TO ENSURE ALL FOUR WHEELS CONTACT

THE RAIL BEFORE THE WEIGHT OF THE MACHINE IS EXERTED ONTO THE TRACK. IF THE MACHINE IS NOT PERPENDICULAR TO THE RAIL WITHIN THE RAIL WHEEL FLANGE TOLERANCE OF THE RAIL AXLES, SEVERE DAMAGE TO THE TRACK MAY RESULT.

- (2) ENSURE THAT THE FRONT TRACK IDLERS ARE CORRECTLY SET TO GIVE ADEQUATE TRACK GAUGE CLEARANCE. 150MM OF CLEARANCE FROM THE UNDERSIDE OF THE TRACK PADS TO THE RAIL HEAD IS REQUIRED TO CLEAR INFRASTRUCTURE (DO NOT OVER TIGHTEN THE TRACKS)**

Note: The rail lights will automatically illuminate, the drive travel Joystick will become active and the speedometer will recalibrate for rail mode.

22 Transportation



22.1 General

- ✓ Never lift the machine with a boom.
- ✓ The transport machine must be parked on a level surface.
- ✓ The transport machine must be secured to prevent rolling while the machine is being loaded.
- ✓ Be sure the transport machine capacity, loading surfaces and chains or straps are sufficient to withstand the machine weight. See the serial plate on the machine for the machine weight or the Specification paragraph in this manual.

Towing the machine is not recommended. If the machine must be towed due to failure on track, do not exceed 6 mph.

22.2 Loading

- ✓ Do not drive the machine on a slope that exceeds the slope rating.
- ✓ If the slope of the transport machine bed exceeds the maximum slope rating, the machine must not be loaded and a suitable transport machine must be obtained.

After the machine is loaded:

1. Ensure that the rail gear remains raised after loading. Only the tracks must be contacting the deck of the transport machine.
2. Ensure that the machine slew brake is applied.
3. Never leave the machine engine running.

22.3 Machine

- ✓ Fold the boom.
- ✓ If the booms are to be laid on the body or on the load, they must be suitably blocked to prevent possible sideways movements.
- ✓ Make sure that the indications about the overall dimensions are respected.
- ✓ NOTE: Implements can be left mounted on the boom only if the overall dimensions are respected; they must be suitably blocked to prevent possible sideways movements.
- ✓ If an accessory is mounted, it must be tied down at all times during transport.
- ✓ Make sure that the rams are within the overall width of the machine and locked by the safety devices.

22.4 Transit

- ✓ Turn the machine ignition key switch to the off position, remove the key and lock the cab doors before transporting.

- ✓ Inspect the entire machine for loose or unsecured items.
- ✓ Use securing chains of ample load capacity and opposing 45° angles.
- ✓ Use a minimum of 2 chains per side.
- ✓ Adjust the position to prevent damage to the chains and machine.
- ✓ Never chain over the boom, cab or dipper.
- ✓ Only chain to the dedicated identified chaining-down eyes.

23 Auxiliary Counterweight Handling



23.1 General

- ✓ Wear Site safety PPE, and Gloves.
- ✓ Removal and installation of the auxiliary counterweight must be risk assessed and suitable lifting equipment specified and used.
- ✓ Do not demount removable counterweights or the attachment when on a slope.
- ✓ Only demount removable counterweights without accessories attached to the arm.
- ✓ Do not demount removable counterweights when in Rail mode.
- ✓ Be careful of the exhaust when securing and releasing the counterweight – Ensure that the engine is off and that the exhaust has had sufficient time to cool.
- ✓ Do not attempt to install or remove the counterweight under live OLE or near live Conductor Rails
- ✓ Tag lines should be used to control the auxiliary counterweight by at least one trained slinger to align the counterweight with the machine from a safe distance.
- ✓ Never attempt to put any part of your body between the counterweight and the machine

24 Attachment Handling



24.1 General

- ✓ Wear Site safety PPE and Long sleeves, Hard Hat, Gloves, and Eye protection.
- ✓ Never lift the entire machine with a boom.
- ✓ The machine must be parked on a level surface.
- ✓ The machine must be secured to prevent rolling while the attachment is being demounted.
- ✓ If the attachment is being lifted off, be sure the boom machine capacity, and lifting chains or straps are sufficient to withstand the attachment weight. See the serial plate on the machine for the attachment weight or the Specification paragraph in this manual.
- ✓ Never demount the attachment with the booms out of the lowered to ground position.
- ✓ Always fully stow the attachment before disengaging the quick hitch.
- ✓ Always recheck the quick hitch.
- ✓ Always recheck the attachment is fastened securely.
- ✓ The RCI should be in Lifting Mode when any attachment is fitted, unless the safe system of work allows for otherwise.

24.2 Detaching

After the machine has been stabilised on flat level ground:

1. Release residual pressure from the attachment by pressing the engine stop button in the menu screen on the RCI (this will keep all the attachment functions enabled to allow actuation of the controls without the engine running to vent the pressures).
2. Disengage the hydraulic, air and electrical connections to the host machine.
3. Disengage the quick hitch via the RCI Controls and confirm.

See RCI Manual for further details.

NOTE: The quick hitch will only release if the RCI load on hook is minimised, to prevent dropping the attachment. This is done by supporting the attachment on the ground or lorry deck etc.

24.3 Lifting

Never lift the machine.

25 Decals

Part No.	Description	Quantity
A0617 (not shown on decal)	DANGER OVERHEAD LIVE WIRES (3 in cab)	14
A1719	Pressurised Vessel (all in chassis, between tracks)	3
A2236	No access under live O.L.E.	1
A2380	Data panel (1 in cab)	3
A2896	Tow Bar	2
A3778	Trailer Park Brake - Air	2
A3779	Trailer Service Brake - Air	2
A3973	Engineering Acceptance Certificate	2
A4281	Maintain 3 points of contact	2
215LCSR ISO 06.2012	Transparent instruction sheet (in cab)	1
28161C	Crush Hazard	4
28164 116C	Hazardous materials (in cab)	1
28171 E	No smoking (in cab)	1
4931628 - 03.2000	Oil volume and pressure (in cab)	1
52475C	Lifting Eye	4
6037330	100 dB warning	1
6062086	STOP sign	2
6075288	Welding prohibition (in cab)	1
6093600 02.2006	Disabled excavator (in cab)	1
6114314	Crush Hazard	1
6114315	Swing boom hazard	2
6115086	Slew locking (inside cab)	1
6133691	Data Panel	1
6155511_en	Non Sulphur Fuel	1

For other decals fitted which are marked '817/.....' refer to the OEM Manuals referred to in paragraph 4.

Refer to Figure 14, Figure 15 and Figure 16 to verify that all decals are legible and in place.

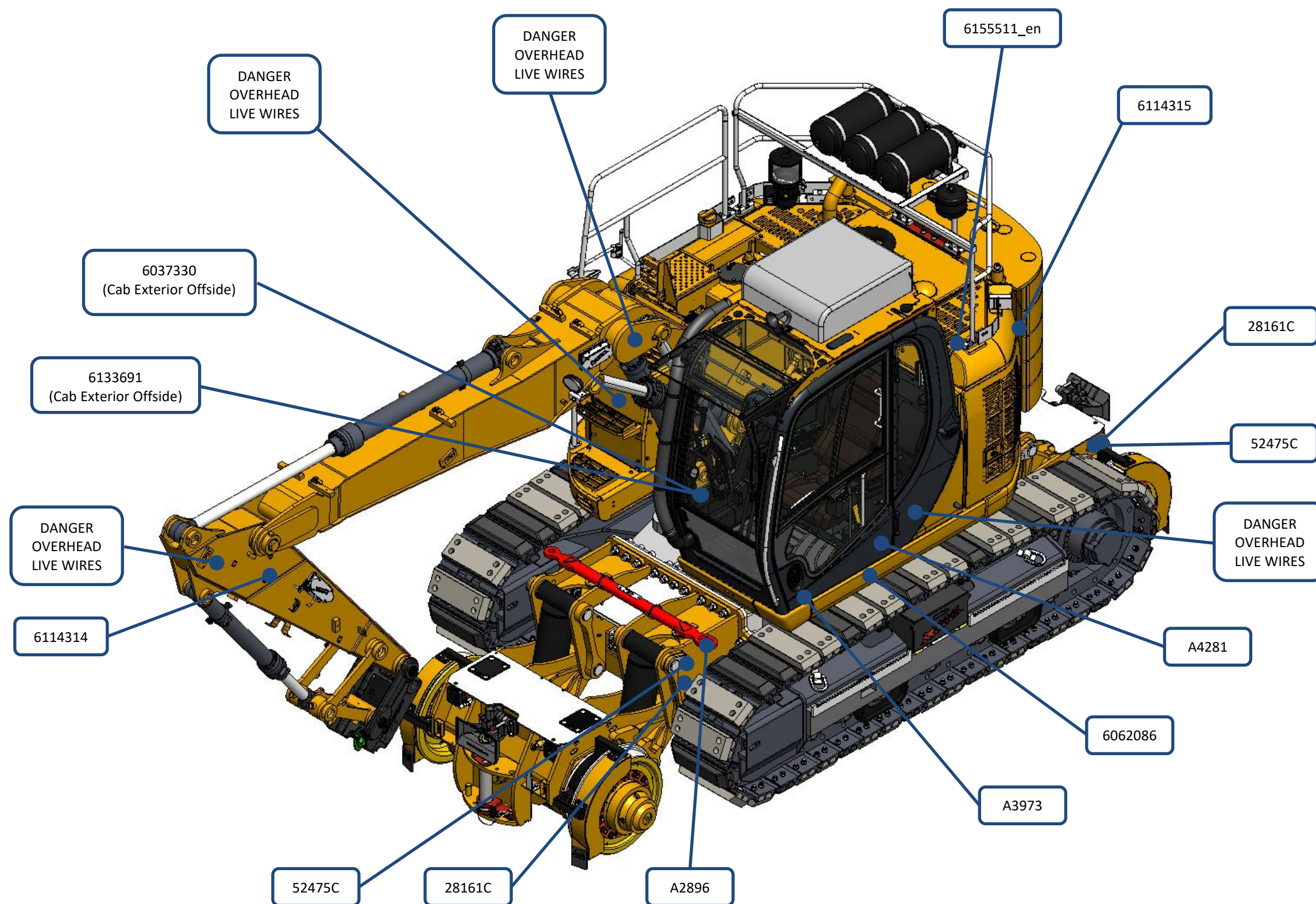


Figure 14 - Base Machine - Front Nearside Isometric View

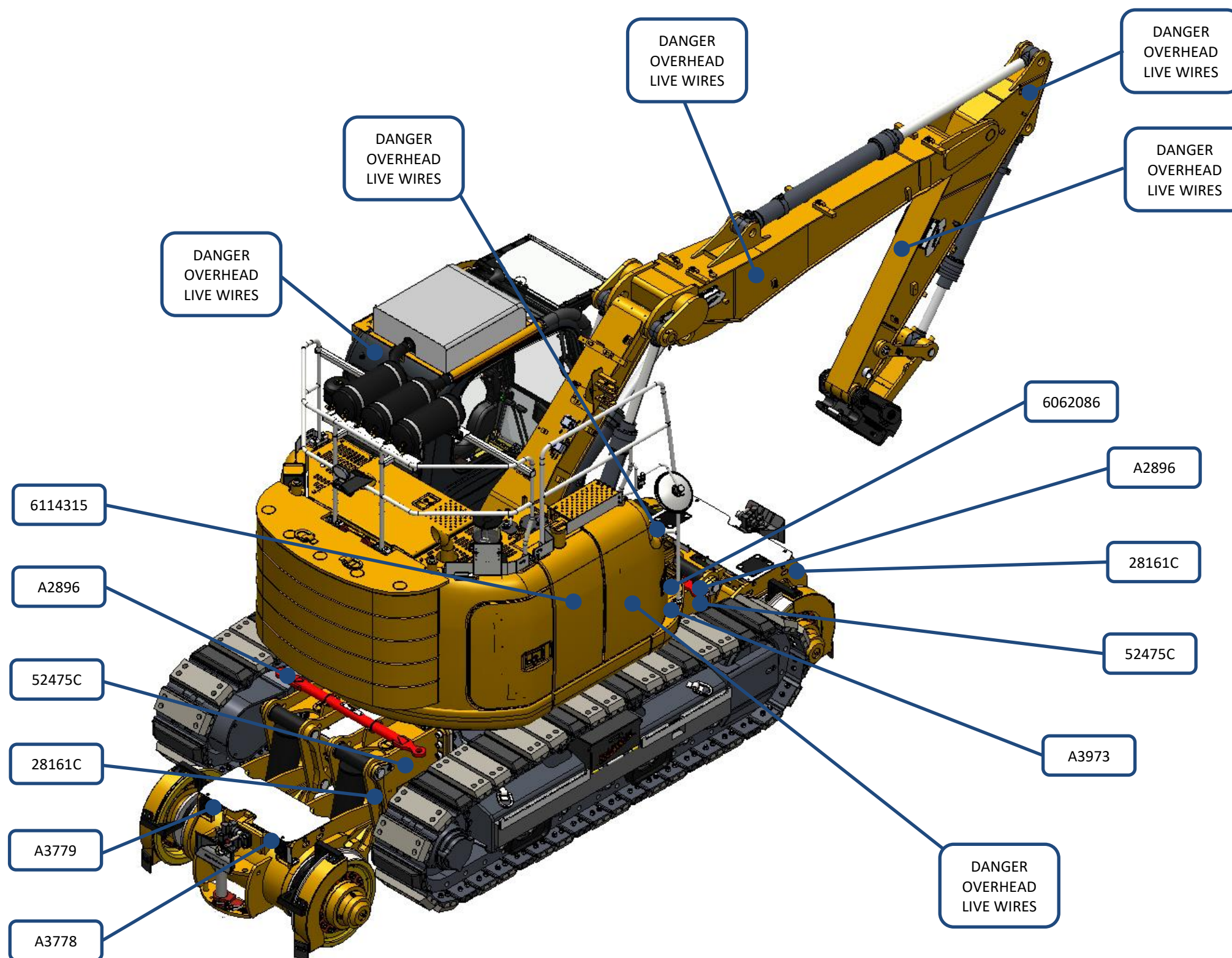


Figure 15 - Base Machine - Rear Offside Isometric View

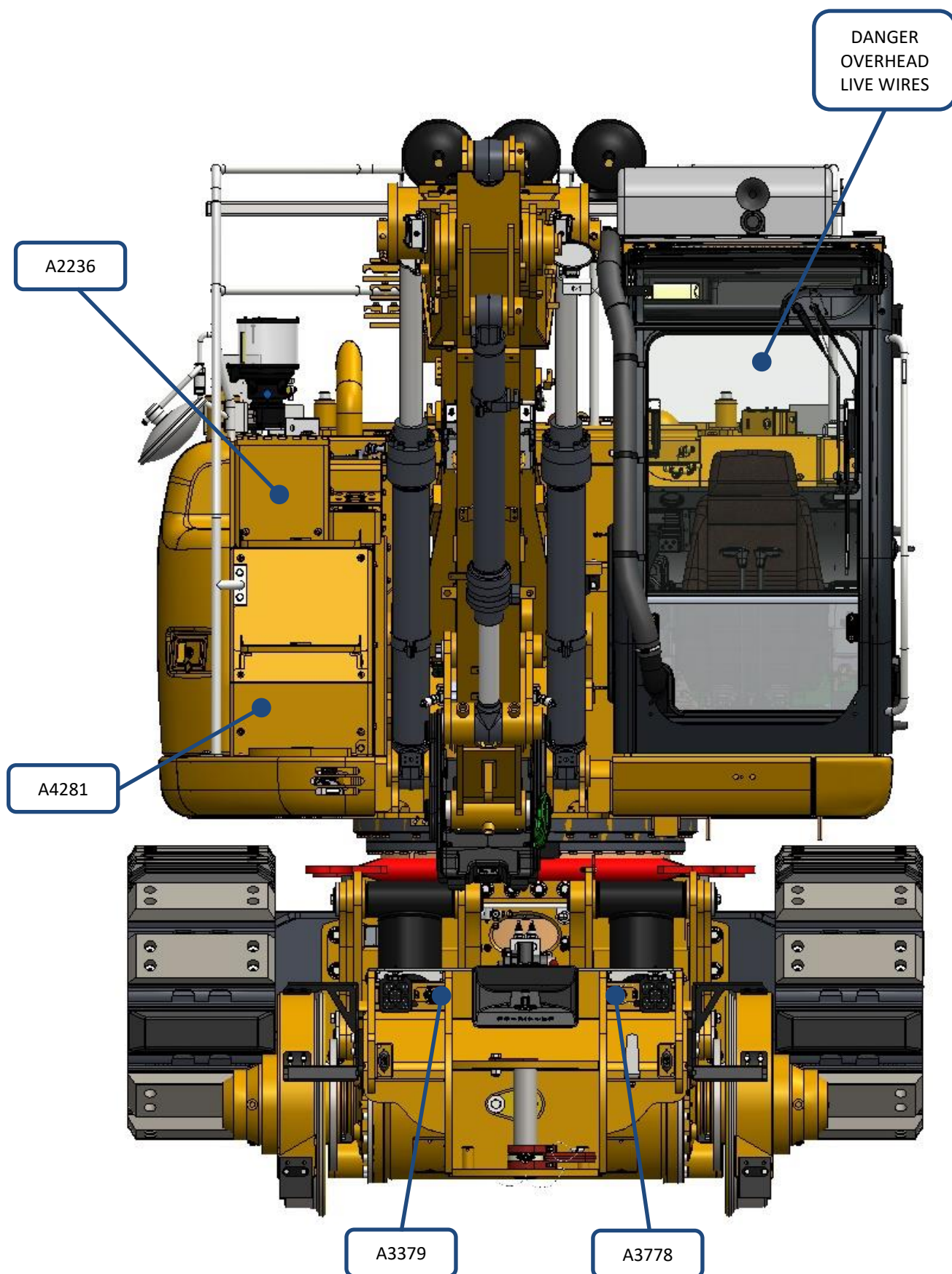


Figure 16 - Base Machine - Front View

26 Specifications

Dimensions	
Maximum height (on rail)	≈ 9.5 m
Horizontal reach	7.5 m
Maximum rated capacity	20,000kg
Overall height, stowed (road)	≈ 3.5 m
Overall width, stowed	2.7 m
Overall length, stowed	≈ 9 m
Rail Wheelbase	4565 m
Approach angle (road)	22°
Departure angle (road)	26°
Turning radius (road)	≈ 6m
Minimum Track Curve Radius	60 m
Ground clearance (rail)	≈ 175mm
Ground clearance (road)	300mm
Tail swing	1485mm
Tail swing with Aux Counterweight	1785mm
Power supply	
Power Source	24 volt D.C.
Batteries	2 x 12v
Controls	Proportional
24 Volt DC outlet at dipper	Standard
Maximum hydraulic pressure	400 bar
Hydraulic tank	160 litres
Fuel tank	203 litres

Weights	
Overall weight	31 t
Gross Weight with Aux Counterweight Fitted	34 t
Max Rail Wheel loading in working mode	≈ 23 tonnes
Max Towing Capacity (rail)	69,000 kg (69 tonnes at either one end of the machine or divided between both ends)

The machine rail wheel loadings are with the maximums for use on light rail systems

Environmental data and limits	
Sound power level (machine engine)	L _{WA} 101 dB
Sound pressure level in Cab (A-weighted) (windows doors open)	L _{PA} 75 dB
Whole body Vibration	0.25 m/s ²
Hand-Arm Vibration	<2.5 m/s ²
Engine Exhaust Emissions	Tier 4(i)/(f) dependent on variant
Operating temperature	-5 °C to + 30 °C
Maximum Gradient (rail)	1 in 25
Maximum rail Cant (travelling)	200mm
Maximum rail Cant (working)	200mm
Maximum gradeability rating, on tracks – dig mode	35.0°
Maximum gradeability rating, on tracks with aux counterweight fitted – travel mode	20.0°

The machine is not suitable for operation of spring loaded points

27 Serial Plate

<div> <div>99709</div> <div>911***</div> <div>-</div> <div>*</div> </div>			
Manufacturer/Converter	SN:	JCBJZ14*****	Owner
Rail-Ability Ltd 01785 214747		A P WEBB PLANT HIRE 01785 241335	
Maximum Travelling Speed	15 mph	Maximum On/Off Track Gradient	01:25
Maximum Working Speed	10 mph	Maximum On/Off Track Cant	150mm
Maximum Travelling Speed Through Switches and Crossings	5 mph	May Be Used Under LIVE Overhead Lines	NO
Maximum Travelling Speed Through Raised Checkrails	5 mph	May Be Used On LIVE 3 Or 4 Rail Lines	NO
Maximum Working Cant	200mm	May Be Used On ISOLATED 3 Or 4 Rail Lines	YES
Maximum Travelling Cant	200mm	May Be Used Adjacent To Running Line	NO
Maximum Working Gradient	01:25	Minimum 1300mm Height Clearance On Out Of Gauge Tail Swing	YES
Minimum Track Radius	80m	GROSS MACHINE WEIGHT	31t
Maximum AIR or Hydraulic Non Service Braked Towed Load	RECOVERY ONLY - 34t	AUX COUNTERWEIGHT IF FITTED	+3.1t
Maximum AIR Service Braked Towed Load	69t	THIS MACHINE MUST NOT TRAVEL OUTSIDE OF A POSSESSION - Refer to Engineering Acceptance Certificate for specific limitations.	
Equipped with RCI Tandem Lifting Mode	YES		

28 Diagrams

28.1 Outline Drawings - Principle Dimensions

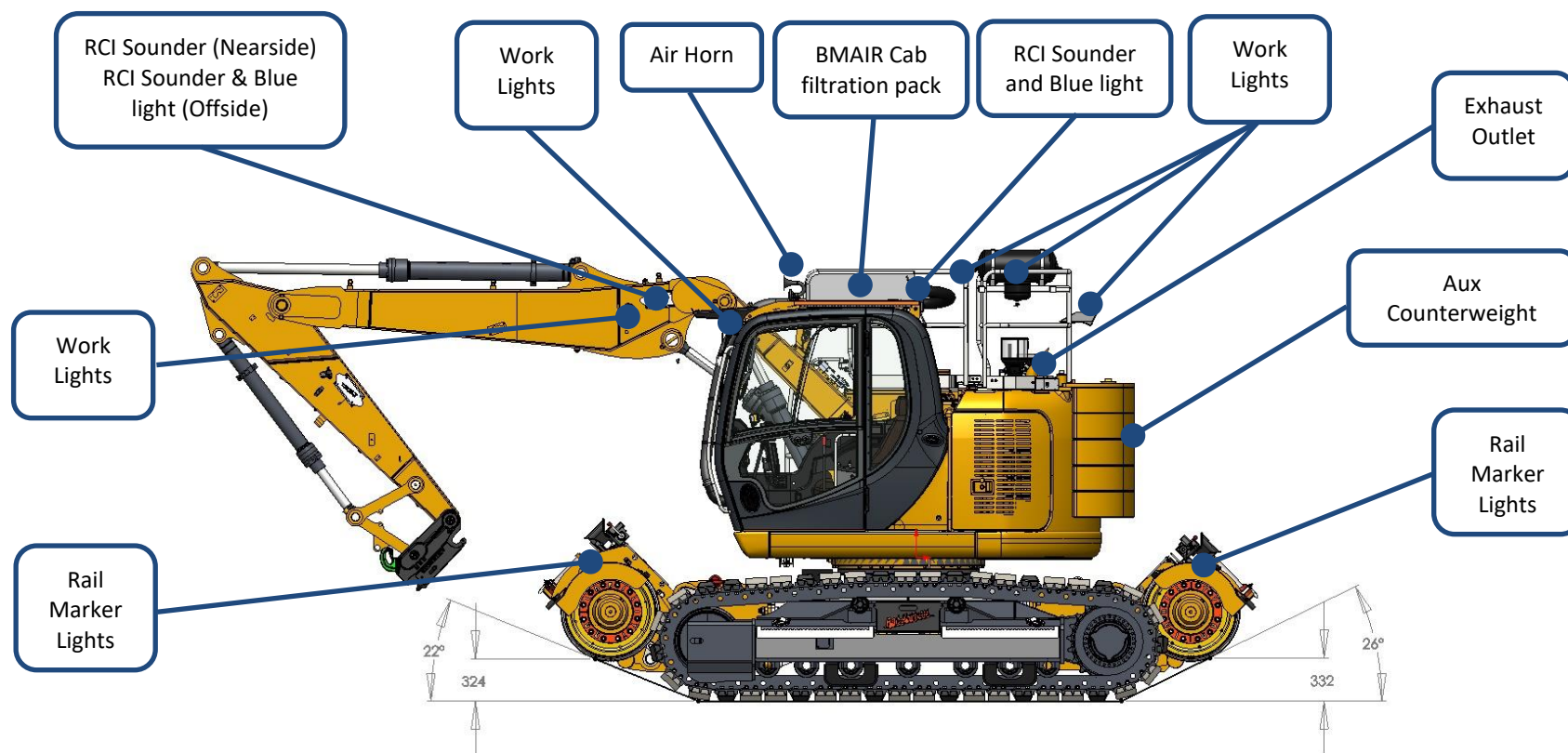


Figure 17 - Road Mode

Position of the centre(s) of gravity are dependent on load on hook, slew position and boom positions, so these are omitted for risk of being misleading.

Both road axles are powered.

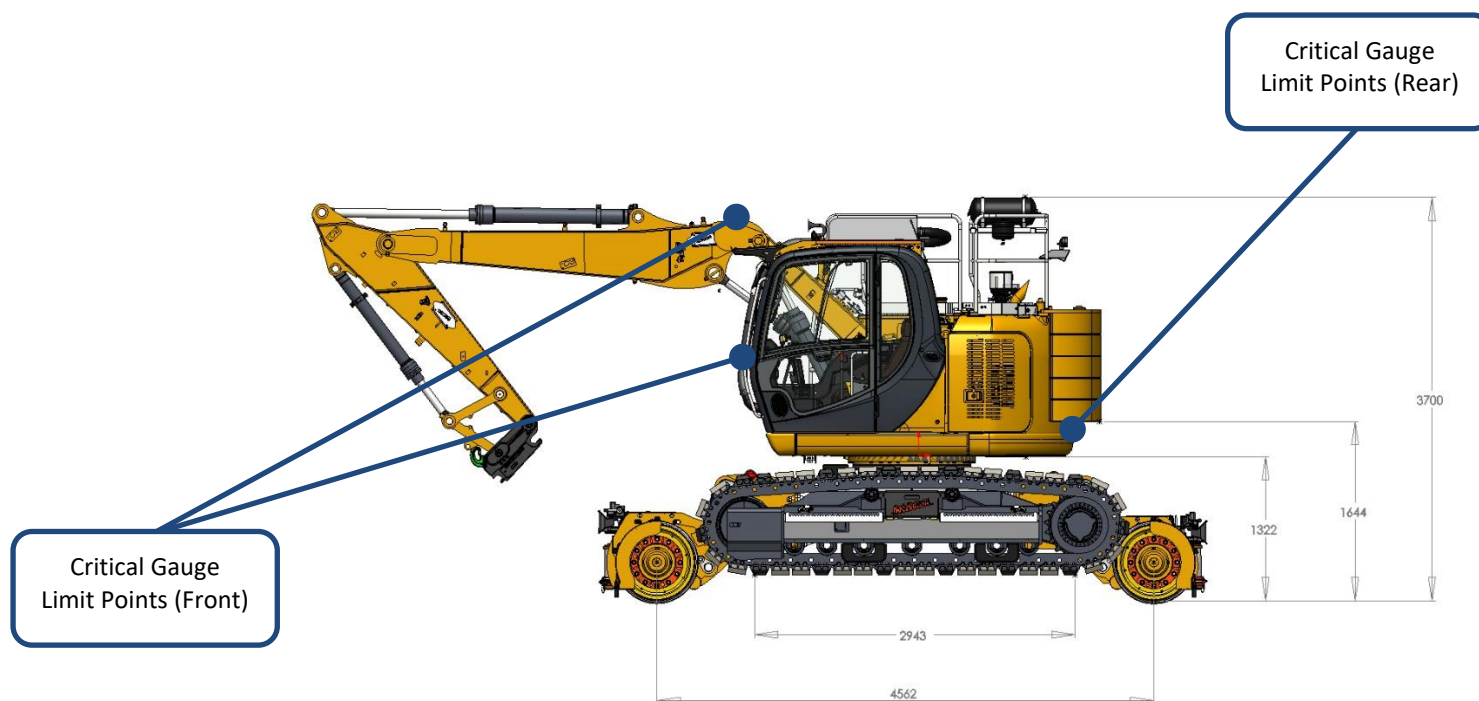


Figure 18 - Rail Travel Mode

Boom stowed position.

Gauge Limit points must be visually checked when approaching and passing lineside structures.

No lateral exceedances are allowed on track curves.

Both rail axles are powered with an independent hydraulic motor, gearbox, service brake, and fail-safe emergency park brake to each wheel.

28.2 Principle Dimensions

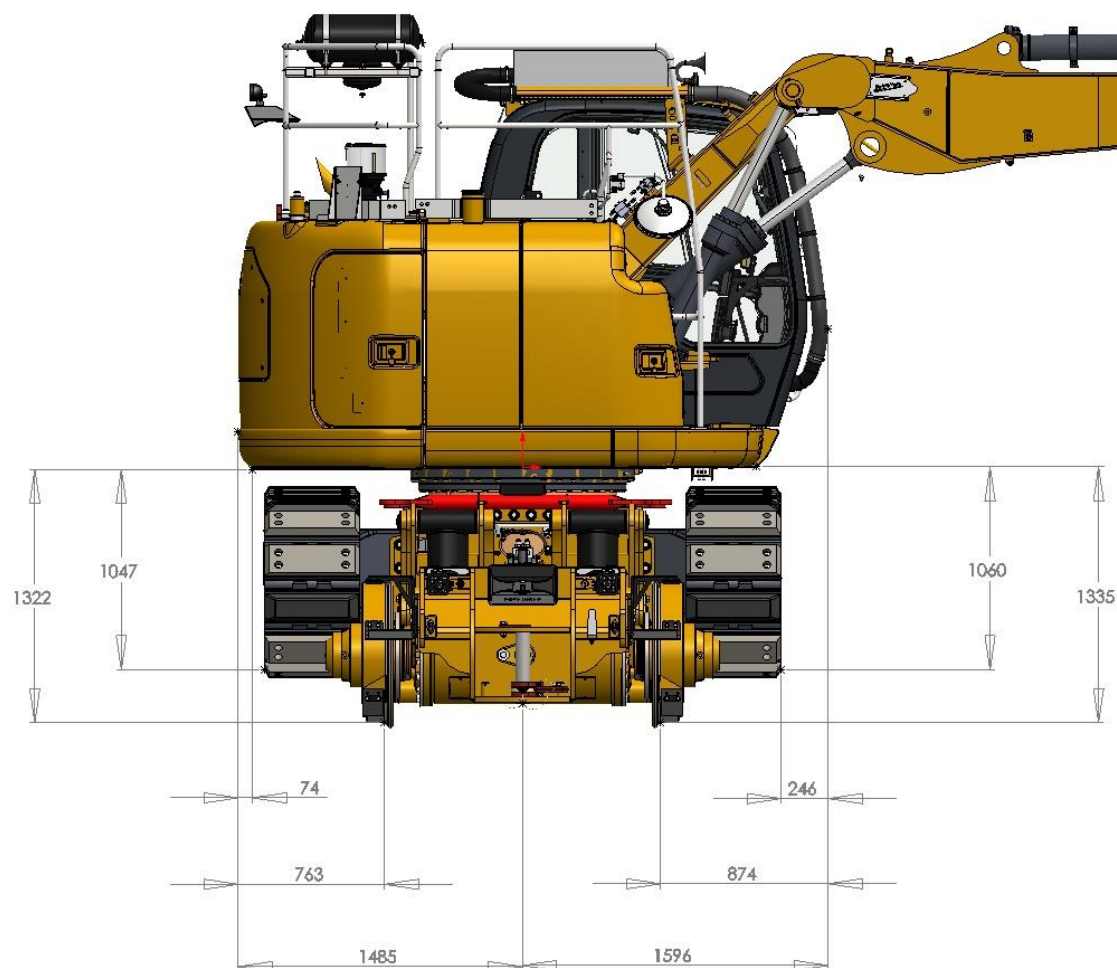


Figure 19 - Swing Radius

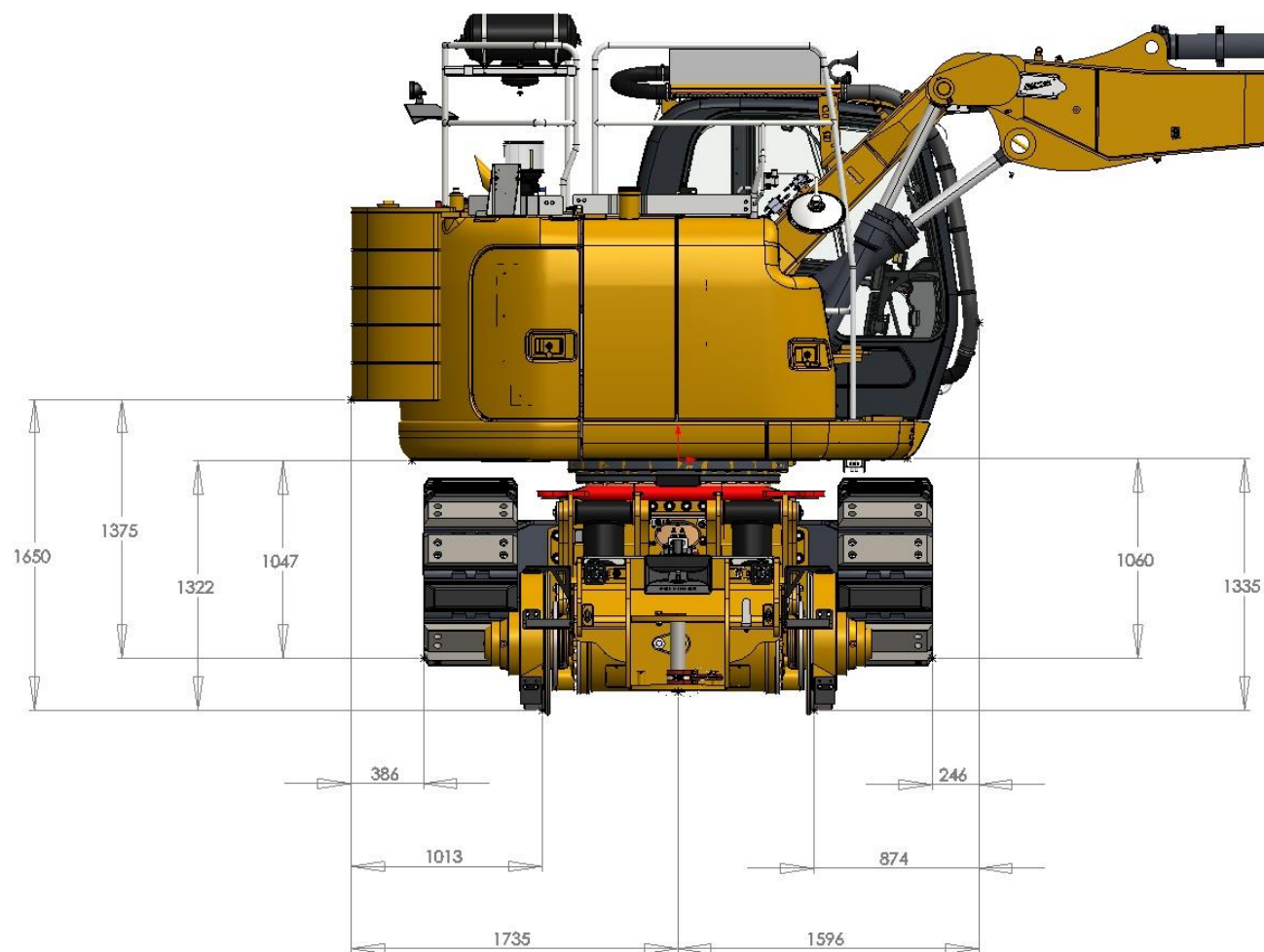


Figure 20 - Swing Radius with Aux Counterweight

28.3 OTP and W6A Gauge Points

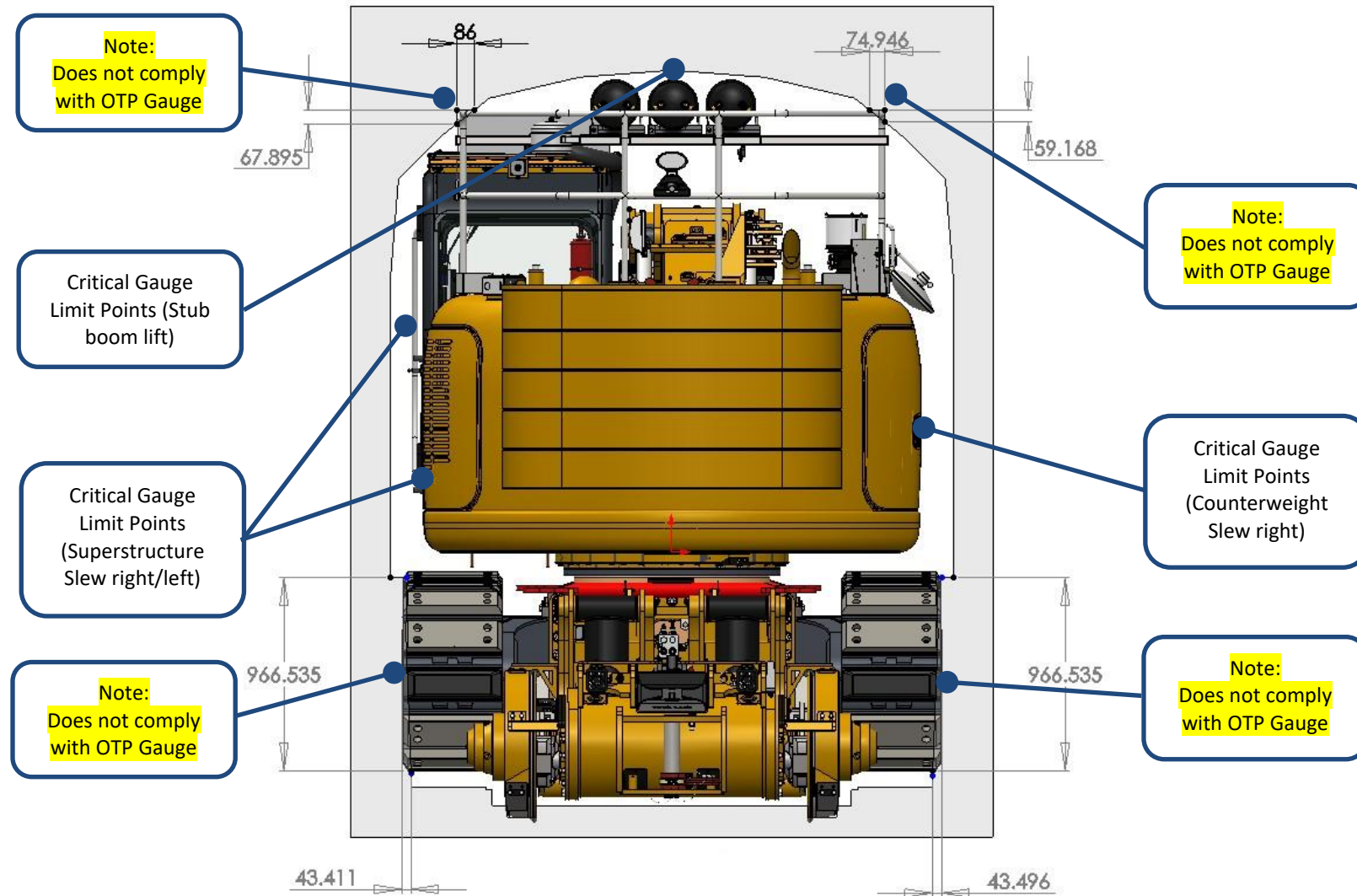


Figure 21 - OTP Gauge

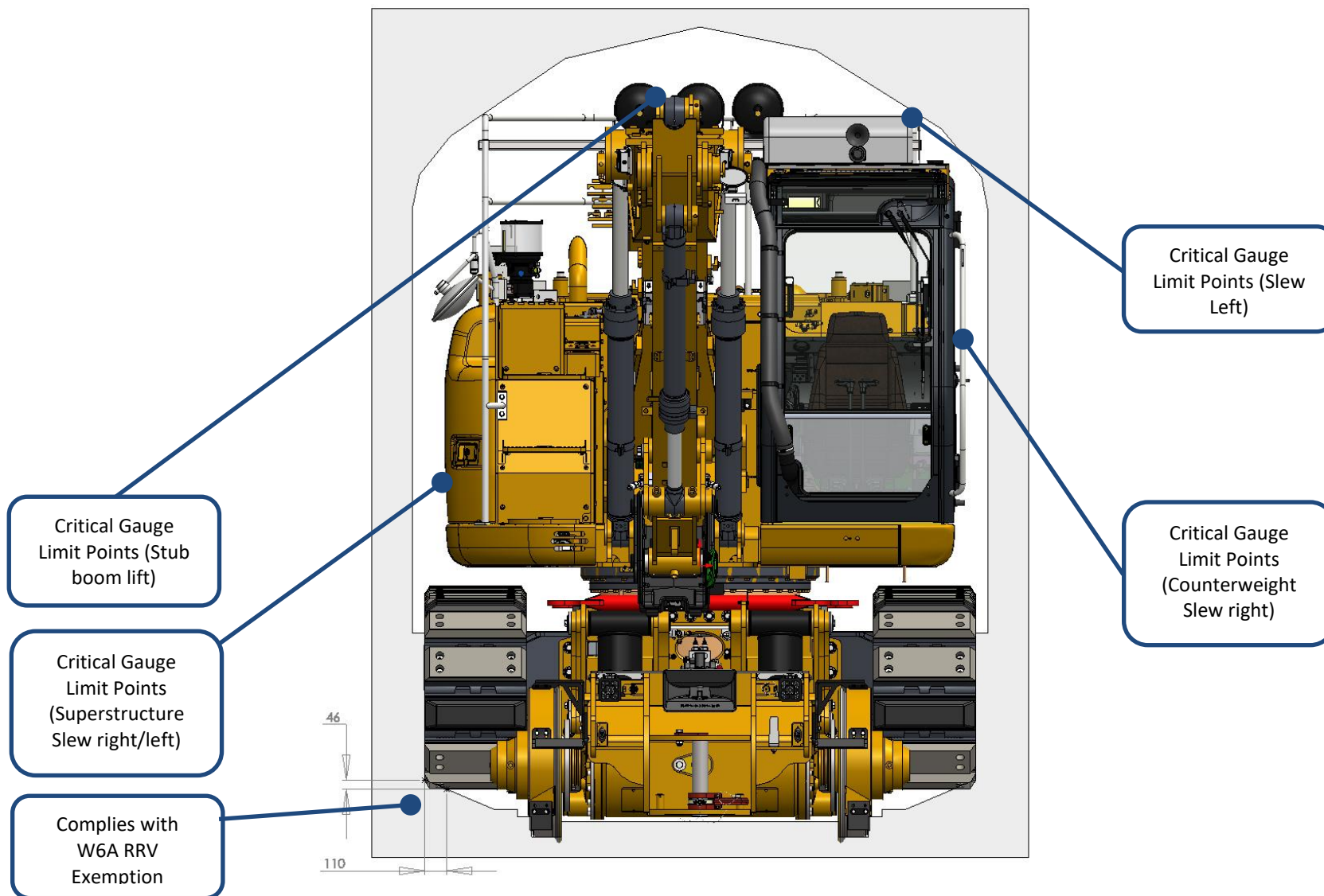


Figure 22 - W6A Gauge (without RRV road crawler allowance)