OPERATION AND MAINTENANCE INSTRUCTION

ART 17 T - ART 17 TH - ART 17 THM

RAIL PRODUCTS

Designed for	MANITOU
Type	160 ATJ +
Date	12-04-2019
Version	6.9
Valid	From serial numbers 0043120
Manufacturer	Rail Products UK
Project number	P301

This machine can be delivered with the following railwheel profiles:

- ANZR G5 (Australia)
- S1002 (Europe)
- MX Profile (Local Track NL)
- C1 Profile (Local Track SUI)
- OS Profile (Local Track NO)
- E1 Profile (New Zealand)

Railwheels can be either insulated or not.

For a drawing of an insulated railwheel see page 98.

Mountcairn
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Document history

Version	Date	Author	Comments
0.1	30-01-2014	SKL	Issued for internal review
1.0	31-01-2014	SKL	Issued for certifier review
1.1	21-02-2014	SKL	Issued for internal review (2nd)
2.0	21-02-2014	SKL	Issued for certifier review (2nd)
2.1	27-02-2014	BCL	Chapter 7 Maintenance revised and adapted to RIS1530
3.0	03-03-2014	BCL	Issued for certifier review
4.0	06-03-2014	BCL	Review comments incorporated. Issued for certifier review (2nd)
4.1	11-03-2014	BCL	Small changes on remarks NWR. Maintenance job No SS07 and ES06 added.
4.2	26-05-2014	BCL	Changed: Definition Work mode; Track on procedure Added: Automatic rail lights; Data logger, Travelling over the side, Access position. *Significant changes are marked in the left margin.*
4.3	25-06-2014	BCL	Turret straight signal lamp blinking with travel over the side function enabled
4.4	22-07-2014	BCL	VAB amendment: Function name “travelling over the side” changed into “working over the side”
5.0	25-07-2014	BCL	Added: Adjacent Line Open limiting device (NWR approval MLD/L054) Changed: chapter 7 renumbered
5.1	30-07-2014	BCL	VAB review: 3.2.4 Data panel changed.
6.0	30-10-2014	IdW	Change in counterweight and increase cant from 50 mm to 120 mm.
6.1	02-12-2014	JV	Amendment type ART 17 TH: change counterweight, full reach till 120 mm., change travel over the side 90 degrees, reach 6.35 m.
6.2	16-04-2015	JV	Changed jobdescription Job BA04 steelcables added. Changed description item ‘6.3.8 Towing ART 17 T on rail’. Added example of data panel including ALO (adjacent line open).
6.3	24-06-2015	JV	Datapanel changed, (optional). Added item 6.3.8.1 towing with RPU trailer on rail.
6.4	08-12-2016	JV	Updated to reflect the changes within RIS 1530-PLT-Issue 6.
6.5	07-12-2017	JV	Updated to reflect the option Load visualisation.
6.6.	19-01-2018		Integration of the ART THM.
6.7	12-07-2018	JV	Integration of the 360 ALO, High Performance MLD.
6.8	20-08-2018	JV	Added Operation Handling: “Lock basket 360 - Restricted height”.
6.9	12-04-2019	JV	Integration Version 2.0 (T / TH) 3.6 version braking software. New on/off tracking procedures. Added rail wheel profiles. Added drawing insulated rail wheel. Added Tri-gauge frame.

Table of contents

Foreword

This instruction manual contains the necessary information for implementation, maintaining and proper use of the Road Rail Mobile Elevated Work Platform ART 17 T(H). The ART 17 T(H)(HM) are MANITOU based machines, type: 160ATJ + mobile elevating work platform, extended with the equipment for rail applications in a variety of gauges the single instruction for changing the gauge within the ART 17 THM range (read changing the software) has been described in the operating and instruction manual THM version 1.1 attached in annex 4 of this manual.

This manual informs you, as a operator or service mechanic, how to work safely with the ART 17 T(H)(HM). Users of this manual remain responsible for supervision and compliance with this document. The ART 17 T has a full reach upto 50 mm (2 degrees) cant. The ART 17 T(H) has an extra counterweight and a full reach upto 120 mm (4,8 degrees) cant, travel over the side reach 6.35 m. (90 degrees). Same for the ART 17 THM at narrow gauge upto 100 mm. The ART 17 THM has a variety of multi-gauge rail axles, able to work on gauges between 1000 and 1668 mm.

The following multi-gauge axles can be supplied:
- Multi-gauge (MG1) mechanical frame adjustable from 1000 - 1067 - 1435 mm.
- Multi-gauge (MG2) mechanical frame adjustable from 1435 - 1520 - 1600 mm.
- Tri-gauge (TG) mechanical frame adjustable from 1067 - 1435 - 1520 - 1600 mm.
- Hydraulic Adjustable frame from 1000 - 1067 - 1435 mm.

Read this manual carefully before using the ART 17 T(H)(HM). Make sure that you have read and understood all safety warnings, recommendations and precautions.

As a Manufacturer we strongly recommend to:
- Contact the Manufacturer when safety issues occur or for urgent questions on the operation.
- Keep the manual in a dry place and available at all times for the machine operator. In the basket a black box is provided to store documentation.
- Keep all security marks on the machine legible; replace them if necessary.

This manual only applies to the “Rail related” application, and does not describe the complete “MANITOU mobile elevating work platform”!

For user instructions of the Manitou we refer to the Manitou Instructions Manual (see chapter 1).

Abbreviations and definitions

Abbreviations used in this manual:

ALO	Any Line Open
CSV	Comma Separated Values
LED	Light Emitting Diode
MEWP	Mobile Elevating Work Platform
OLE	Overhead Line Equipment
PCB	Printed Circuit Board
RRAP	Road-Rail Access Point

Definitions used in this manual:

Road mode	Mode in which the MEWP hydraulic system is driving the road wheels
Rail mode	Mode in which the MEWP hydraulic system is driving the rail wheels. Rail mode can only be selected when fixed and oscillating rail bogies are fully down (vehicle on rails).
Transport mode	**Road mode** Mode in which the MEWP can drive at low speed (turtle) or high speed (hare). Transport mode is only active when the articulated boom is in resting position and the telescope arm is fully retracted. High speed (hare) cannot be selected when 4-wheel steering is selected. **Rail mode** Additionally the *Turret must be straight with the machine* to travel in travel mode.
Work mode	Work mode is active when the articulated boom is not fully down or the telescopic arm is not fully retracted. In work mode the MEWP can only drive at working speed. **Rail mode** The MEWP can only move at working speed when the *telescope is retracted* completely and *the turret is within a restricted angle* with the machine.

Forward/reverse movement

Reverse movement

Black arrow indication.

Rail oscillating bogie side.

Road fixed axle side.

Forward movement

White arrow indication.

Rail fixed bogie side.

Road oscillating axle side.

1. Relevant documents

1.1. Manufacturer

Code	Document	Document
	ART 17T(H)	ART 17THM
	Functional description ART - 1720130925	Functional description
	Hydraulic diagram	Hydraulic diagram
	Mechanical schematic	Mechanical schematic
	Electrical diagrams	Electrical diagrams
	I/O list box 101, 102, 103, 104, 105	Decoder IFM A 100, A 200, A 300
	User Manual 6.9 MEWP ART 17 T(H)(M)	User Manual 6.9 MEWP ART 17 T(H)(M)

1.2. Suppliers

Code	Document	Document
	ART 17T(H)	ART 17THM
	Manitou - 547408 EN Instructions manual	Manitou - 547408 EN Instructions manual
	Manitou - 647254 EN Hydraulic diagram	Manitou - 647254 EN Hydraulic diagram
	Manitou - 647254 EN Electricity - Schematic Drawing	Manitou - 647254 EN Electricity - Schematic Drawing
	Bosch Rexroth CDL2 manual	Bosch Rexroth CDL2 manual
	Sick Flexisoft hardware manual	IFM CR 7021 Controller
	Poclain MS motor manual	Poclain MS motor manual

2. Manufacturers information

Manufacturer: Rail Products UK
Mountcairn
22 Cairneymount Road
Carluke
South Lanarkshire
ML8 4EN

Phone: (0044) 1555 773 027
(0044) 7788 924 848 (mob.)

Email: derek@railproducts.uk.com

Internet: www.railproducts.uk.com

Support: support@railproducts.uk.com

Parts: parts@railproducts.uk.com

3. Product information

3.1. Product description

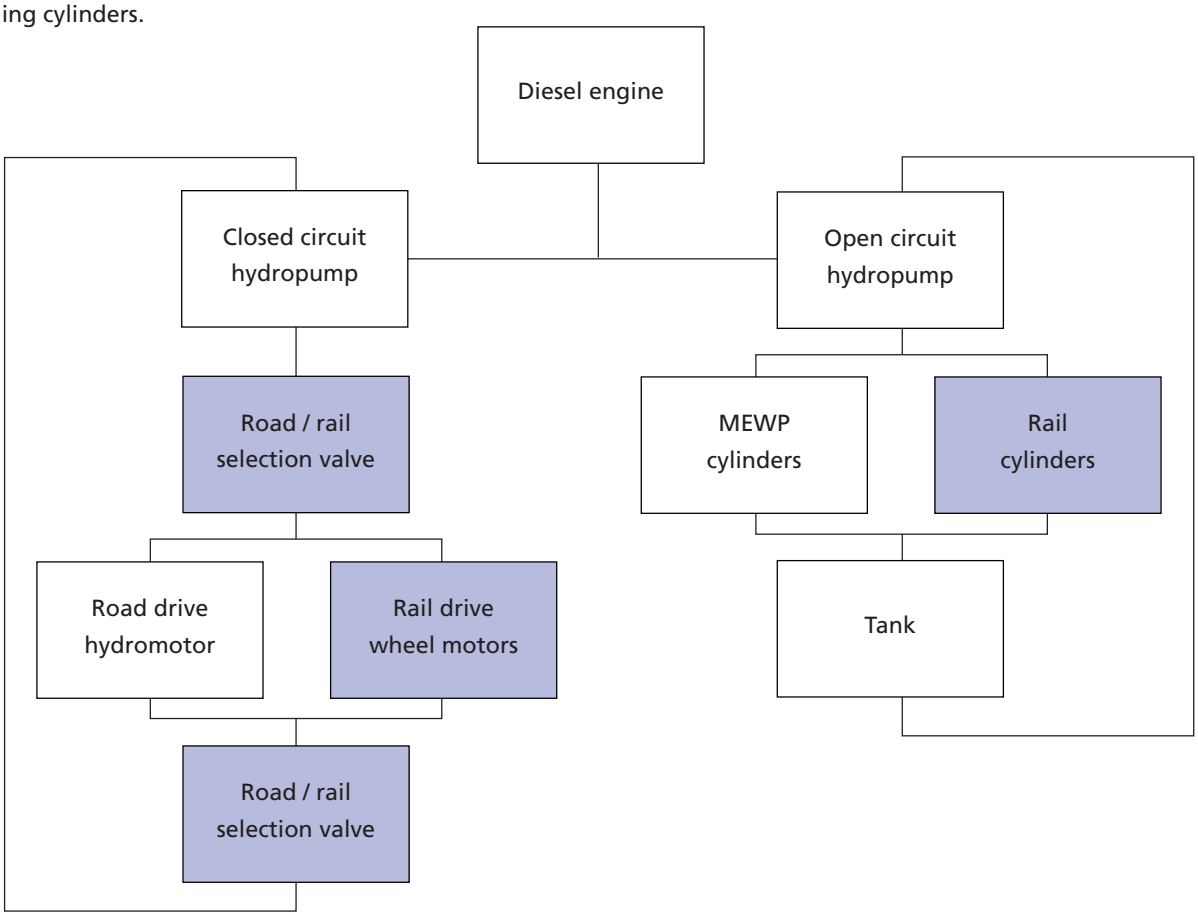
3.1.1. General

The ART 17 T(H)(HM) is a self-powered mobile elevating work platform for road and rail operation. The rail systems enable on and off tracking of the MEWP as well as travelling and operating the MEWP on the rail track.
The ART 17 T range is a MANITOU base machine, a mobile elevating work platform extended with equipment for rail applications. The following rail systems can be defined:

- Two bogies (fixed and oscillating, interconnected by steel torsion bars).
- One hydraulic system.
- One electrical system.
- One control system (safety controllers).

3.1.2. Hydraulic system

The diesel engine is driving two hydro pumps (one closed and one open circuit).
In road mode the closed circuit is operating the road drive hydrostatic motor. By switching the road/rail selection valve the hydro pump is driving the four hydrostatic rail wheel motors for running on track.
The open circuit pump is supplying the platform cylinders, the turret rotation hydro motor and the rail bogie lifting cylinders.

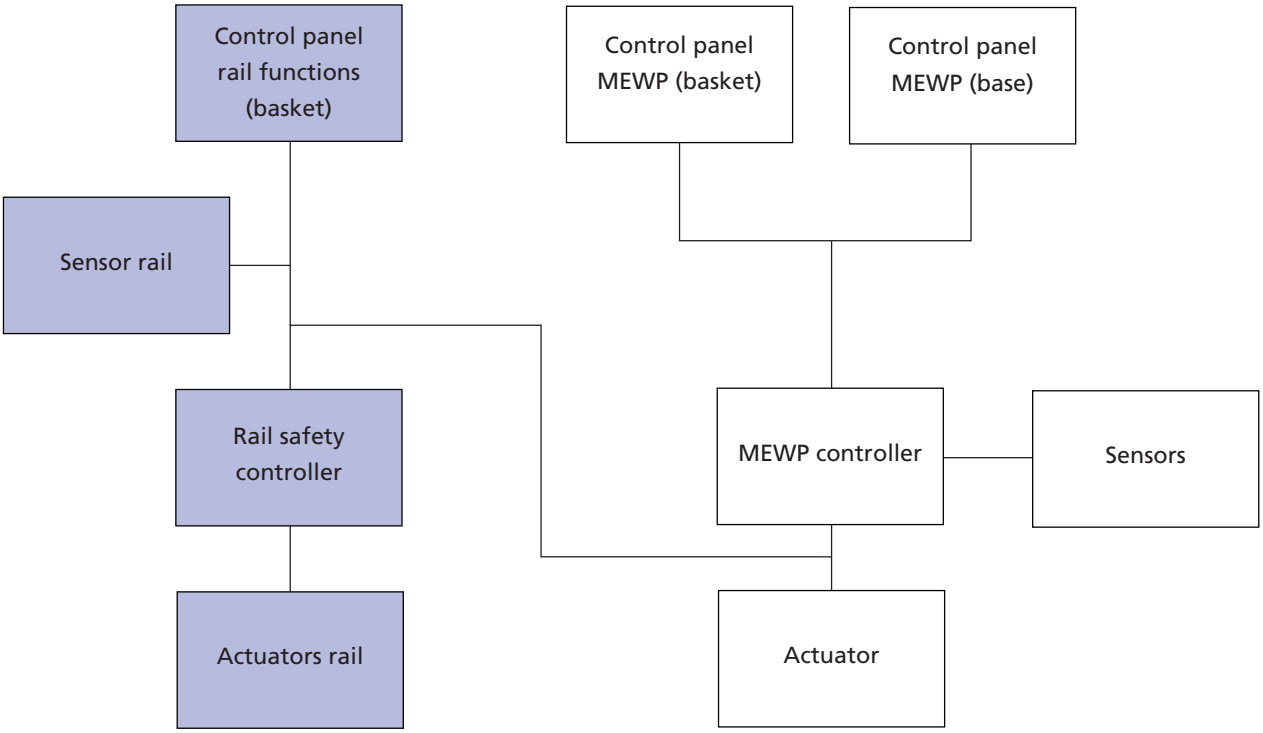


Principle hydraulic schematic (blue parts are added to the standard MANITOU).

For more details about the hydraulic system of the MEWP we refer to the hydraulic drawings, see chapter 1.

3.1.3. Electrical system

The work platform is operated from the control panel in the basket or the base control panel on the turret.
A separate control panel for on and off tracking is provided in the basket. For safe operation additional rail sensors and rail actuators connected to the rail safety controllers are installed. Some signals from the MEWP controller are picked up by the rail safety controller and in certain conditions the signals from the MEWP controller to the actuators are interrupted, for example to block movements or deactivate functions.



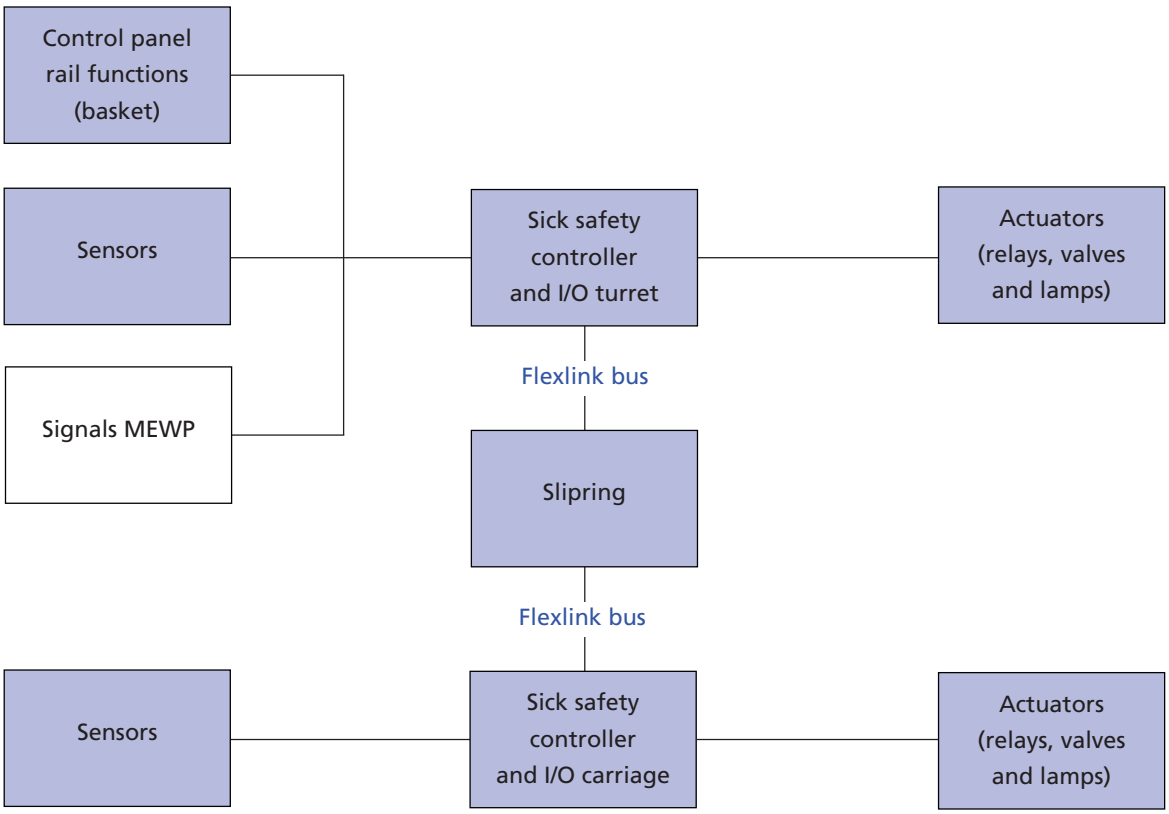
Principle electrical schematic (blue parts are added to the standard MANITOU).

For more details about the electrical system of the MEWP we refer to the electrical drawings, see chapter 1.

3.1.4. Control system

The original MEWP controller remains unchanged. Rail mode is controlled by two safety controllers. The rail safety controllers are controlling the rail functions and blocking some MEWP functions which are not permitted in certain rail mode conditions.

All rail functions can be operated from the rail control panel (separate console in the basket).



Principle control system (blue parts are added to the standard MANITOU).

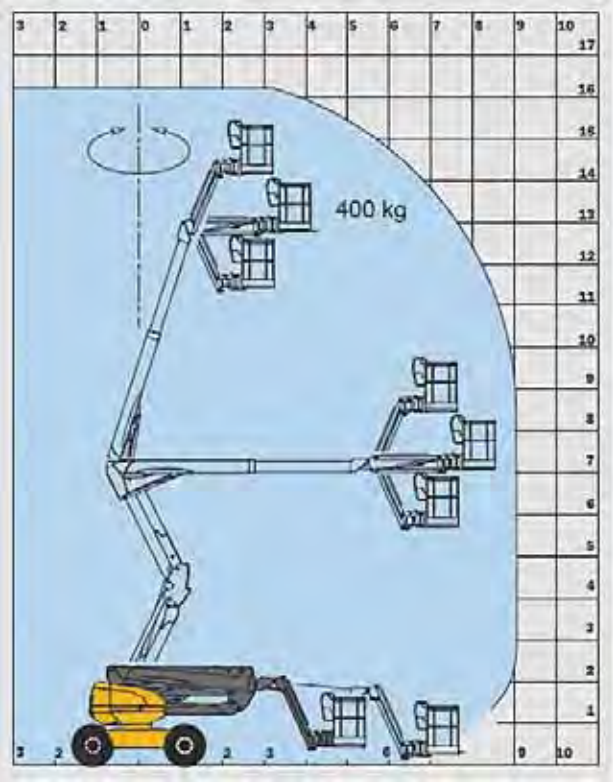
For the ART 17 THM explantion is given in the 1.1 manual in annex 4.

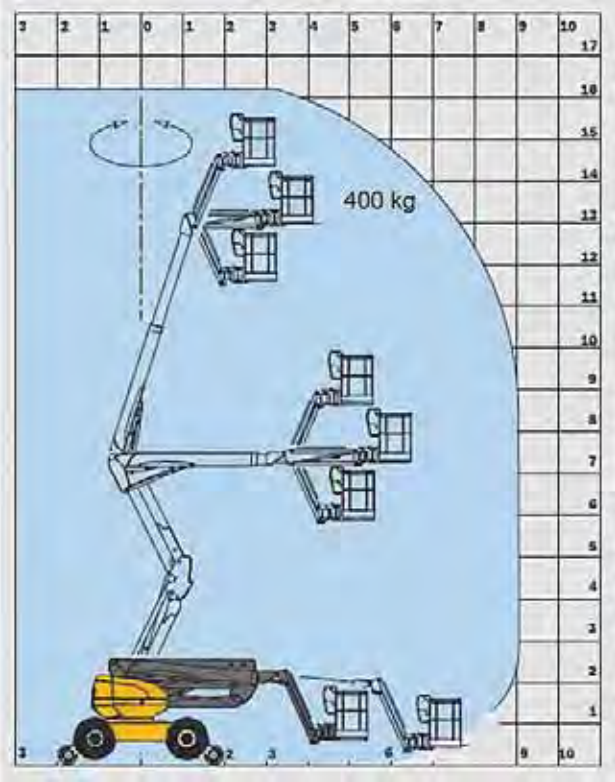
For more details about the control system of the MEWP we refer to the electrical drawings, see chapter 1.

3.2. Specification (technical data)

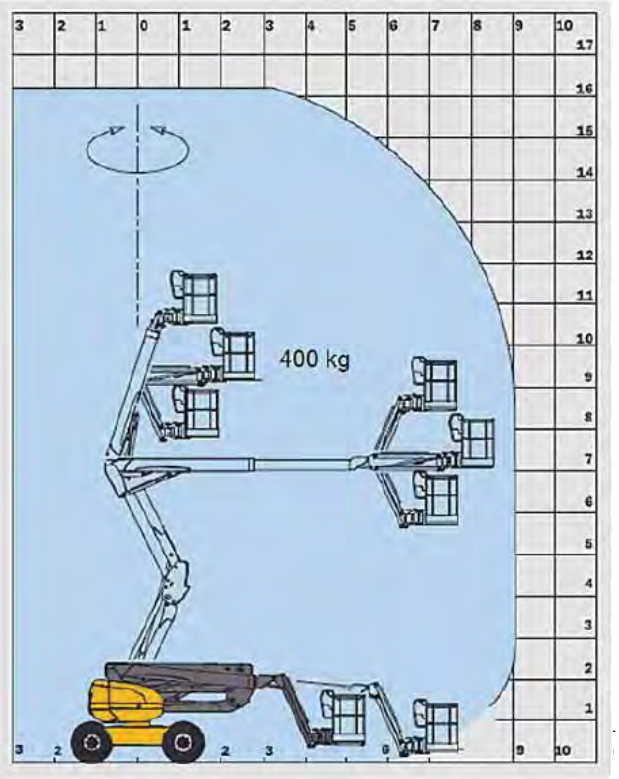
3.2.1. MEWP specification

For MEWP specification we refer to Manitou - 547408 EN Instructions Manual, page 2-15.





Working range diagrams



Remark

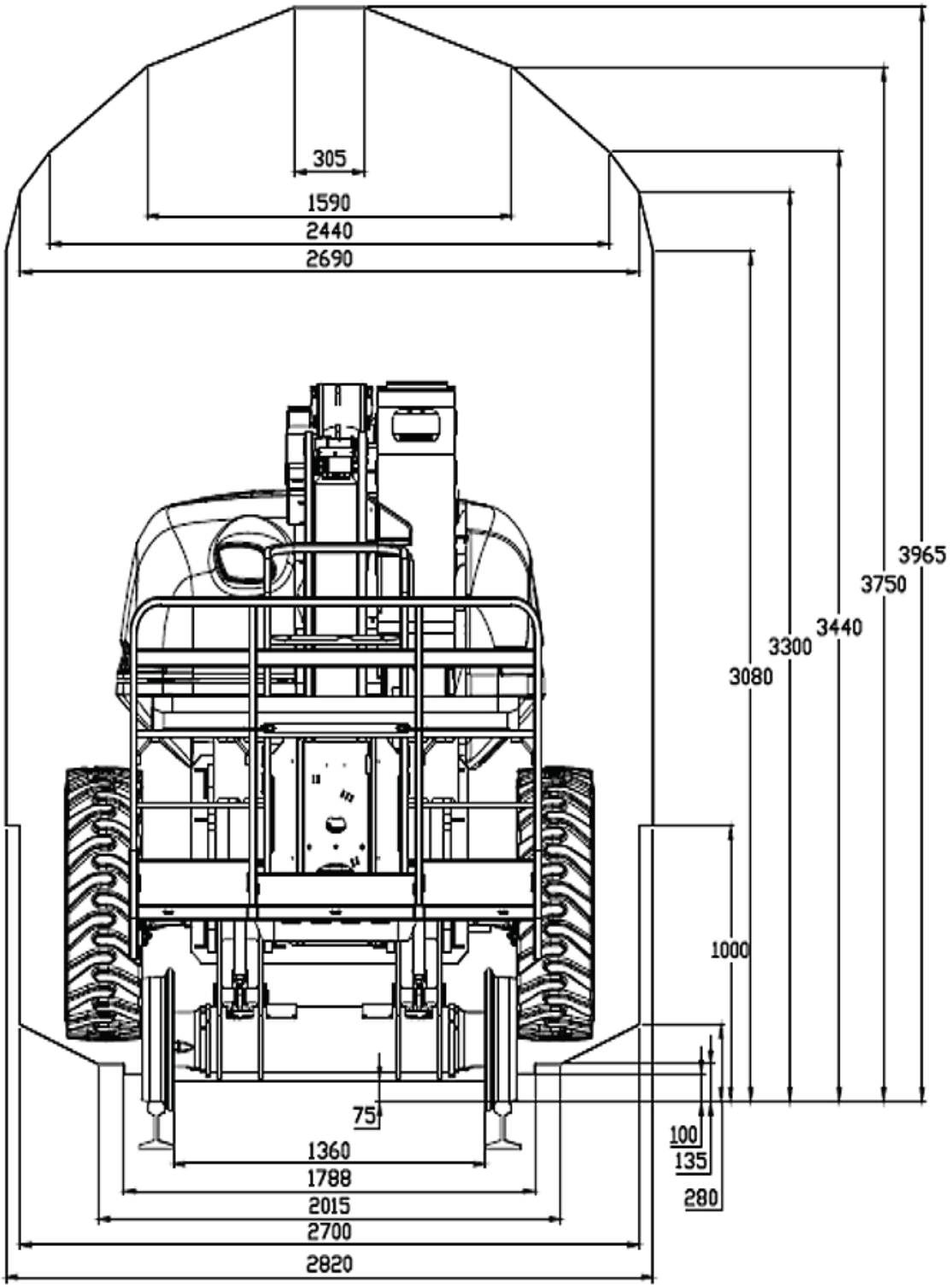
All dimensions in flat situation.

ART 17 T : Above 2° gradient in rail mode, the telescope arm will be blocked, maximum reach above 50 mm. cant is 6.35 m.

ART 17 TH: Above 4,8° gradient in rail mode, the telescope arm will be blocked, maximum reach till 120 mm. cant is 8.65 m. Above 120 mm. cant the reach is 6.35m.

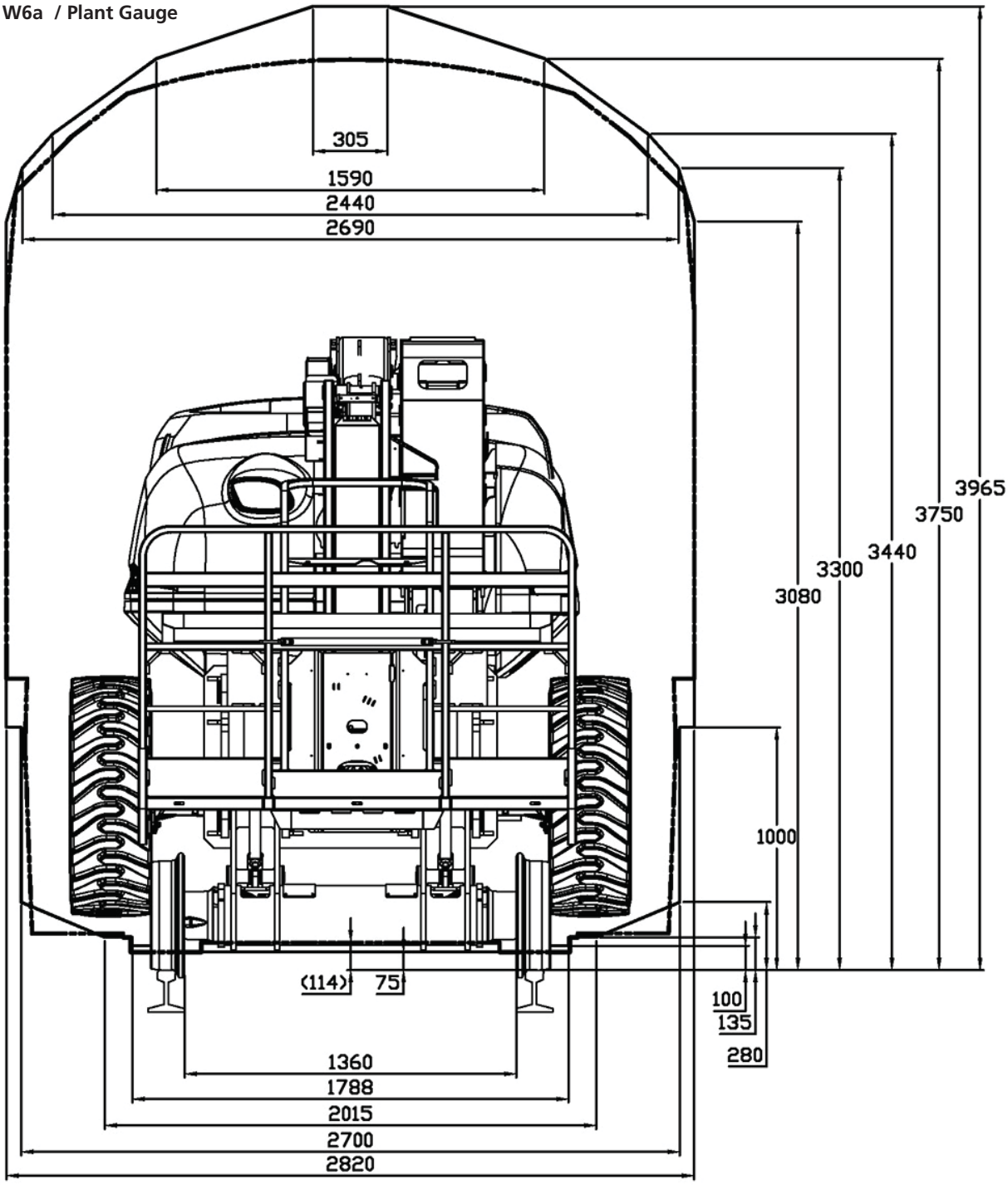
ART 17 THM : Same functionality as ART 17 TH, only at 1.000 mm. gauge till 100 mm. cant. Above 100 mm functions are blocked.

3.2.2. Travelling gauge



W6a Travelling gauge

W6a / Plant Gauge



REMARK

This has the potential to strike some platforms and underbridge girders. A site survey shall be undertaken to assess potential damage to infrastructure equipment prior to use.

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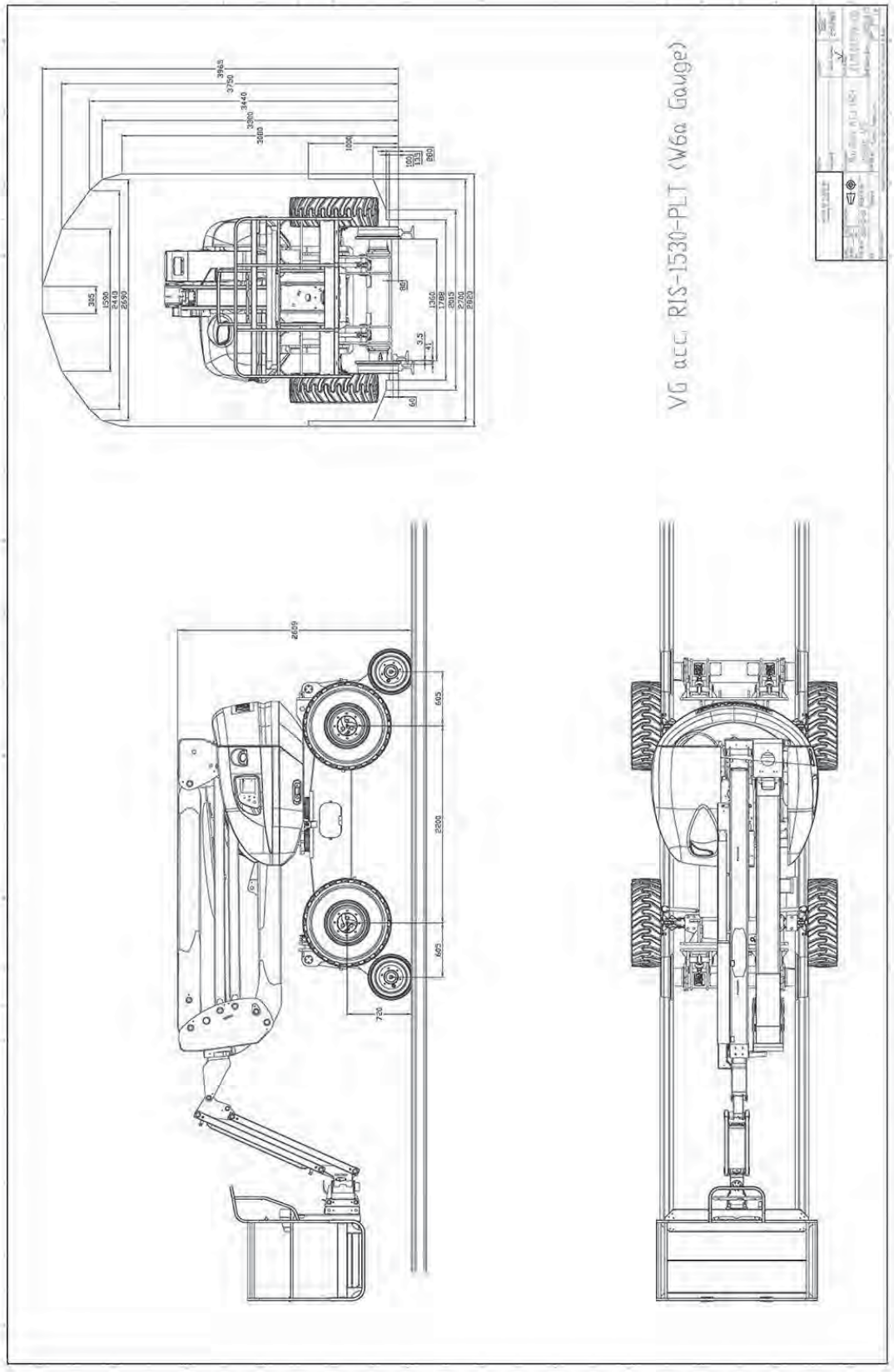
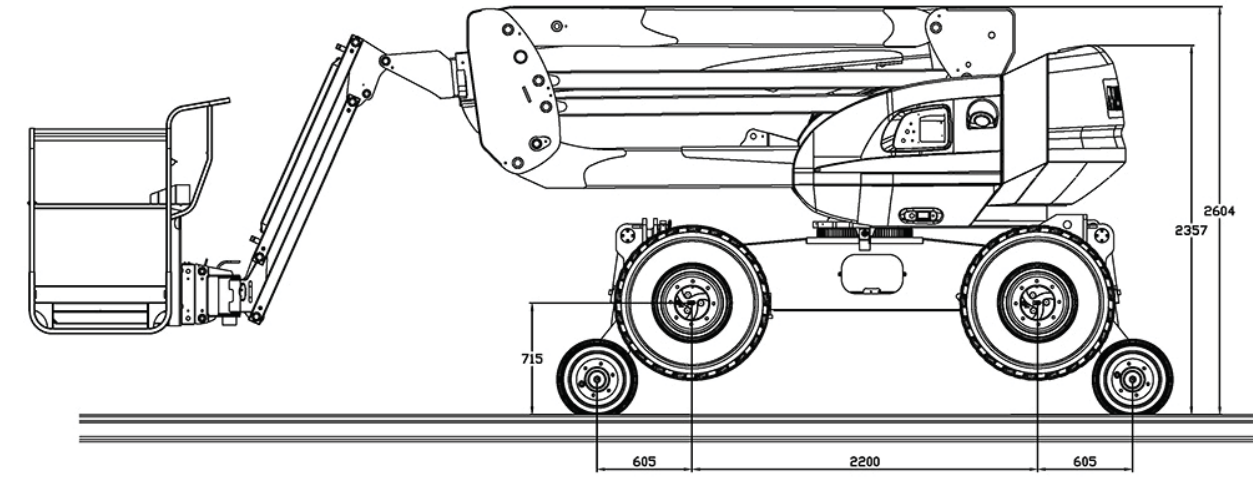
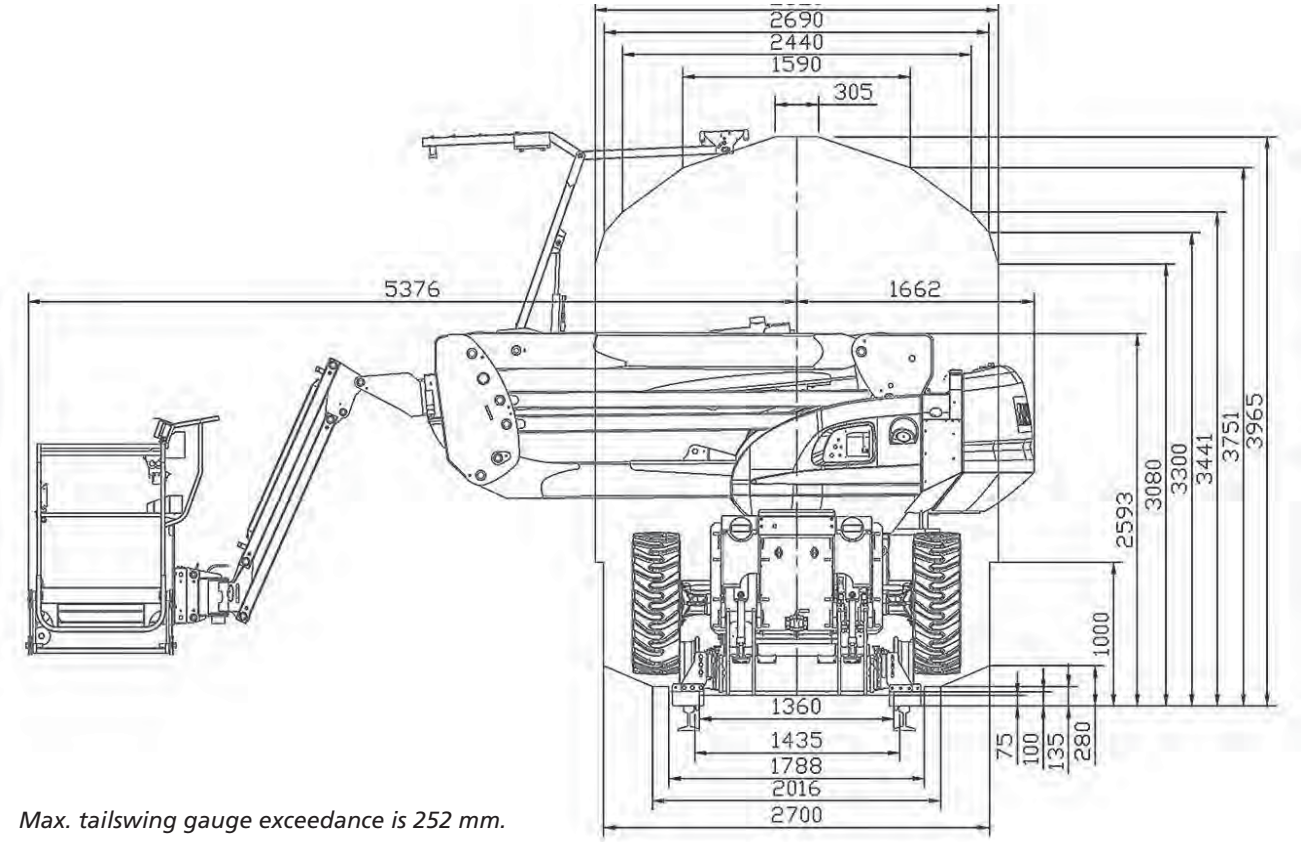

VG acc. RIS-1530-PLT (W6a Gauge)



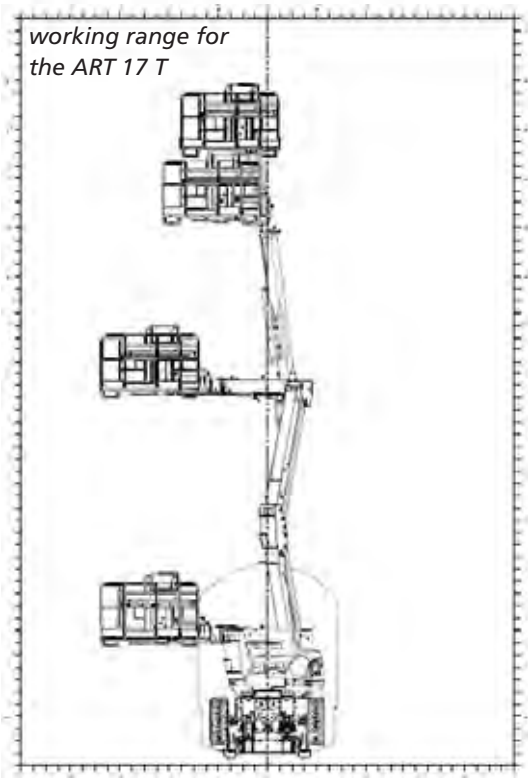
Lights (variety of widths).

Safety stickers

3.2.3. Working range when "Working over the side" (W6a Working gauge)



Max. tailswing gauge exceedance is 252 mm.



working range for the ART 17 T

3.2.4. RRV specification - Data panel

NWR Vehicle nr. 99709 9x2xxx-x				
Manufacturer: Rail Products United Kingdom	07788 924 848		Owner: Ready Power	01923 264 593
Maximum travelling speed	7.5 mph	12 km/h	Maximum on / off track gradient	1:25
Maximum working speed	1 mph	1.6 km/h	Maximum on / off track cant	150 mm
Maximum travelling speed through S&C	2.5 mph	4 km/h	May be used under LIVE overhead lines	NO
Maximum travelling speed through raised check rails	2.5 mph	4 km/h	May travel on LIVE 3 or 4 rail lines	NO
Allowed for shunting	NO		May be used on isolated & bonded ¾ rail lines	YES
Maximum working cant	180 mm		May be used adjacent to running line	NO
Maximum working gradient	1:25		Minimum distance between track centres	3600 mm
Minimum radius	80 m		It is permitted to travel under Live OLE	YES
Maximum non service braked towed load	xx			
Maximum service braked towed load	xx		NOT PERMITTED OUTSIDE A POSSESSION	

Example of data panel.

NWR Vehicle nr. 99709 9x2xxx-x				
Manufacturer: Rail Products United Kingdom	07788 924 848		Owner: Ready Power	01923 264 593
Maximum travelling speed	7.5 mph	12 km/h	Maximum on / off track gradient	1:25
Maximum working speed	1 mph	1.6 km/h	Maximum on / off track cant	150 mm
Maximum travelling speed through S&C	2.5 mph	4 km/h	May be used under LIVE overhead lines	NO
Maximum travelling speed through raised check rails	2.5 mph	4 km/h	May travel on LIVE 3 or 4 rail lines	NO
Allowed for shunting	NO		May be used on isolated & bonded ¾ rail lines	YES
Maximum working cant	180 mm		May be used adjacent to running line	YES
Maximum working gradient	1:25		Minimum distance between track centres	3600 mm
Minimum radius	80 m		It is permitted to travel under Live OLE	YES
Maximum non service braked towed load	xx			
Maximum service braked towed load	xx		NOT PERMITTED OUTSIDE A POSSESSION	

Example of data panel including ALO (Any Line Open).

NWR Vehicle nr. 99709 9x2xxx-x				
Manufacturer: Rail Products United Kingdom	07788 924 848		Owner: Ready Power	01923 264 593
Maximum travelling speed	7.5 mph	12 km/h	Maximum on / off track gradient	1:25
Maximum working speed	1 mph	1.6 km/h	Maximum on / off track cant	150 mm
Maximum travelling speed through S&C	2.5 mph	4 km/h	May be used under LIVE overhead lines	NO
Maximum travelling speed through raised check rails	2.5 mph	4 km/h	May travel on LIVE 3 or 4 rail lines	NO
Allowed for shunting	NO		May be used on isolated & bonded ¾ rail lines	YES
Maximum working cant	180 mm		May be used adjacent to running line	YES
Maximum working gradient	1:25		Minimum distance between track centres	3600 mm
Minimum radius	80 m		It is permitted to travel under Live OLE	YES
Maximum non service braked towed load	520.9 kg		Allowed for towing trailer	YES
Maximum service braked towed load	xx		NOT PERMITTED OUTSIDE A POSSESSION	

Example of data panel ART 17 THM including "non service braked towed load".

3.2.5. Basket capacity in rail mode

400kg including 3 persons.

Maximum permissible horizontal force: 40daN.

3.2.6. Speed in rail mode

Travelling mode

High speed (Hare)	12 km/h (7.5 Mph)
Low speed (Turtle)	4 km/h (2.5 Mph)

Working mode

Operating speed	1,6 km/h (1 Mph)

3.2.7. Hydraulic system rail function

Lifting cylinders (bogies)

Type	Bosch Rexroth CDL2 either Hax Piomet 80-45-250
Max pressure	160 bar
Bore diameter	80 mm
Rod diameter	45 mm
Stroke	250 mm
Full bore area	50,24 cm^2
Rod side area	34,34 cm^2
Push force at max pressure	80380 N
Pull force at max pressure	54950 N

Oscillating axle cylinder

Type	Bosch Rexroth CDL2 either HAX Piomet 100-56-80
Max pressure	160 bar
Bore diameter	100 mm
Rod diameter	56 mm
Stroke	80 mm
Full bore area	78,50 cm^2
Rod side area	53,88 cm^2
Push force at max pressure	125600 N
Pull force at max pressure	86210 N

Wheel motors

Manufacturer	Poclain
Type	MS05-8-113-F05-4720-5789JM
Displacement	376 cm^3/rev
Max pressure	450 bar
Torque	598 Nm @ 100 bar
Power	max 29 kW
Max speed	250 rpm
Brake	Failsafe parking brake

3.3. CE-declaration / CE-identification

3.3.1. Declaration

The original declaration is owned by the customer.

EC DECLARATION
with Machine Directive in accordance with SUB IIA European Guide Line 2006/42/EG

Manufacturer: Rail Products UK Ltd
Manufacturer declares that the product with:
Base: MAN
Chassis: XXXXXX
RA Type: ART 17 T
Serial nr: 42XXX
Weight: 10.500 kg
Year: 2016

Is in conformity with the essential requirements of:
• 2006/42/CE Machine Directive
• EMC: 2004/108/EC
• Noise: EN-ISO11688-1
• Emission: 2004/26/EG

ADDITIONAL rail / crane requirements:
• NEN-EN 15746 -1 Railway applications – Road Rail machines Technical requirements
• NEN-EN 15746 -2 Railway applications – Road Rail machines Safety requirements
• NEN-EN 280 Mobile elevating platforms
• RIS 1530 PLT Issue 6 'Rail Industry Standard for Technical Requirements for On-Track Plant and Their Associated Equipment and Trolleys'

The obligations which are in line with above mentioned directives, and are a result of the Sub section IIA of EN 2006/42/EG have been fulfilled by:
HHC/DRS Inspection BV under certificate nr.:
HHC/DRS_2014_18575_IRP_Issue 3

Rail Products UK Ltd
Derek Hunter Burns
Date: 2016

Rail Products UK Ltd
[illegible]
22 Cairneymount Road
Carluke
South Lanarkshire - ML8 4EN

CE

Example for the ART 17 T

EC DECLARATION
with Machine Directive in accordance with SUB IIA European Guide Line 2006/42/EG

Manufacturer: Rail Products UK Ltd
Manufacturer declares that the product with:
Base: MAN
Chassis: XXXXXX
RA Type: ART 17 TH
Serial nr: 42XXX
Weight: 12.045 kg
Year: 2016

Is in conformity with the essential requirements of:
• 2006/42/CE Machine Directive
• EMC: 2004/108/EC
• Noise: EN-ISO11688-1
• Emission: 2004/26/EG

ADDITIONAL rail / crane requirements:
• NEN-EN 15746 -1 Railway applications – Road Rail machines Technical requirements
• NEN-EN 15746 -2 Railway applications – Road Rail machines Safety requirements
• NEN-EN 280 Mobile elevating platforms
• RIS 1530 PLT Issue 6 'Rail Industry Standard for Technical Requirements for On-Track Plant and Their Associated Equipment and Trolleys'

The obligations which are in line with above mentioned directives, and are a result of the Sub section IIA of EN 2006/42/EG have been fulfilled by:
HHC/DRS Inspection BV under certificate nr.:
• 18689/ISO/2017/EN280/EN/RP.UK/P27204-2/v.1.0

Rail Products UK Ltd
Derek Hunter Burns
Date: 2016

Rail Products UK Ltd
[illegible]
22 Cairneymount Road
Carluke
South Lanarkshire - ML8 4EN

CE

Example for the ART 17 TH

EC DECLARATION
with Machine Directive in accordance with SUB IIA European Guide Line 2006/42/EG

Manufacturer: Rail Products UK Ltd
Manufacturer declares that the product with:
Base: MAN
Chassis: XXXXXX
RA Type: ART 17 THM
Serial nr: 42XXX
Weight: 12.400 kg
Year: 2017

Is in conformity with the essential requirements of:
MACHINE DIRECTIVE:
• 2006/42/CE Machine Directive
• EMC: 2004/108/EC
• Noise: EN-ISO11688-1
• Emission: 2004/26/EG

ADDITIONAL rail / crane requirements:
• NEN-EN 15746 -1 Railway applications – Road Rail machines Technical requirements
• NEN-EN 15746 -2 Railway applications – Road Rail machines Safety requirements
• NEN-EN 280 Mobile elevating platforms
• RIS 1530 PLT Issue 6 Engineering Acceptance of [illegible] - only Rail Vehicles

The obligations which are in line with above mentioned directives, and are a result of the Sub section IIA of EN 2006/42/EG have been fulfilled by:
HHC/DRS Inspection BV under certificate nr.:
• 18689/ISO/2017/EN280/EN/RP.UK/P27566/v.1.0 and
• 18689/ISO/2017/EN15746-1/2/EN/RP.UK/P27566/v.1.0

Rail Products UK Ltd
Derek Hunter Burns
Date: 2017

Rail Products UK Ltd
[illegible]
22 Cairneymount Road
Carluke
South Lanarkshire - ML8 4EN

CE

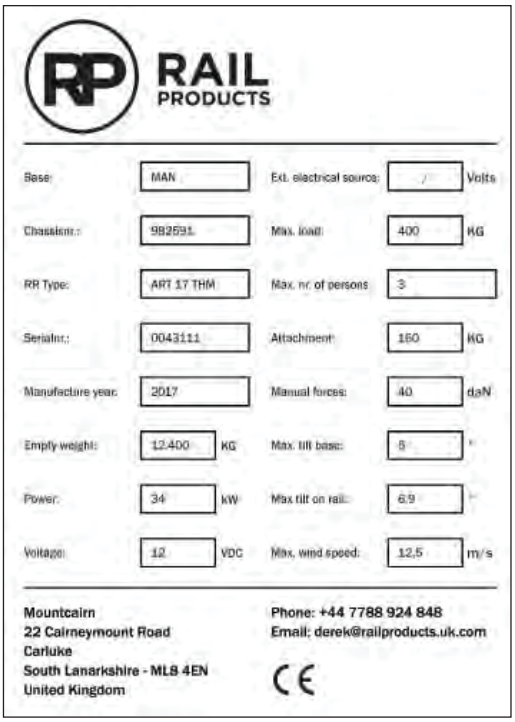
Example for the ART 17 THM

3.3.2. Identification

This product carries a CE-mark. This means that the machine is build and delivered according the fundamental safety and healthy requirements on design, maintenance, operating and adjustment of the machine.

Example for the ART 17 T

Example for the ART 17 TH



Example for the ART 17 THM

4. SAFETY

4.1. General safety

DANGER!
The MEWP shall only operate inside possessions. Night time speed restriction is: 12kph/7.5 mph. Personnel are not permitted between moving machines. The load in the basket must not exceed 400kg, to avoid an overload situation. Maximum noise value 80 dB.

DANGER!
Working under live OLE is prohibited!
The machine may only be operated under isolated and earthed catenaries!
Travelling under live overhead lines is permitted only when the work platform is locked in a position below 1.4 m floor height, in accordance with RIS 1530 PLT Issue 6 Clause 5.18.1.1.

DANGER!
Use of the machine with any lines open to traffic is only permitted when the ALO slew limiter is active and its correct functioning is tested.

DANGER!
The machine may NOT be used with both sides any lines open to traffic (“island” work). The machine shall not work with any adjacent lines open to traffic where the distance between the centre line on which the vehicle is working and the centre line of any open line is less than 3600mm. . The machine is fitted with a lateral movement limiting device, which is not capable of limiting movement on both sides simultaneously.

The machine is not intended for passenger or freight transport.
The machine may not circulate freely or work without restriction on switches, level crossings or other installations.
Restrictions for travelling under live OLE are detailed throughout the document.

For operation under average climatic conditions, i.e. : between -15 °C and + 35 °C, correct levels of lubricants in all the circuits are checked in production. For operation under more severe climatic conditions, before starting up, it is necessary to drain all the circuits, then ensure correct levels of lubricants using lubricants properly suited to the relevant ambient temperatures. It is the same for the cooling liquid.

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.

As a minimum, the following PPE must be worn at all times, whilst operating the MEWP:
Hi-vis trousers and jacket (current specification)
Safety boots (current specification)
Hard hat (current specification)
Harness (valid certification)
Some tasks may involve additonal PPE requirements, as detailed within site specific risk assessment packs.

Please refer to the latest Network Rail Infrastructure Plant Manual (or equivalent national body) for further operational and industry guidance.

4.1.1. Responsibilities for owner and user

Only well **trained** and **qualified** personnel are authorised to operate the machine.

Transportation, installation, inspection, maintenance and dismantling must only be performed by **authorised** and **qualified** personnel. The minimum requirements for maintain this equipment are; NVQ Plant Mechanic (Level 3) and they must be RPA assessed. When working on the rail infrastructure, working on or near the line one must hold a valid PTS card.

Authorised and **qualified** personnel must read and understand the content of this user manual and the referenced documents, before they start working with the machine. Some equipment can contain complicated and potential dangerous equipment, be aware that any actions or decisions taken may not only adversely affect the initial quality of the equipment but also your own safety and that of your colleagues.

Personnel must not be allowed to perform any other proceedings then the ones described in this manual, however, in the event of an emergency then only an authorised person may perform this after consulting the Manufacturer.

If the machine is modified, without prior permission, the warranty and liability for the damage and consequences will void.

The Manufacturer cannot be held responsible for failures or (sequential) damages caused by improper actions or poor use. Personnel will always remain responsible for their actions and the consequential results.

4.1.2. Safety regulations

In order to comply with the law and regulations, the ART 17 T(H)(HM) is designed according the following guidelines:

- 2006/42/CE Machine Directive
- EN 15746-1 Railway applications – Road-rail machines –Technical requirements
- EN 15746-2 Railway applications – Road-rail machines –Safety requirements
- EN 280 Mobile Elevating Work Platforms
- RIS-1530-PLT Issue 6 Engineering Acceptance of Possession-only Rail Vehicles
- EN 13001-2 Crane safety – General design – Part2: Load actions

4.1.3. Safety rules

Always follow the safety rules written by local law and/or defined by the company you are working for.
Local safety rules must always be followed in the first place. Please inform your supervisor in case these contradict to warnings given in this User Manual.

4.2. Risks for personal injury

The risks mentioned below are derived from the risk assessment. Every user must be informed about these risks.

4.2.1. Electrical voltage

Where	When	Precaution	Warning sign
Basket. Both sides of the turret.	Working on track.	Be aware of live wires.	
Basket. Both sides of the turret.	Working on track.	Do not climb onto the machine.	
Basket. Both sides of the turret. On operating panel.	Travelling under live overhead wires.	Lock the basket at a floor height of max. 1.40 m.	THE BASKET MUST BE LOCKED IN LOWERED POSITION FOR TRAVEL UNDER LIVE ELECTRIC WIRES!

4.2.2. Squeezing

Where	When	Precaution	Warning sign
Moving parts	Machine movements.	Keep away from the moving parts when using the machine.	
Covers lifting cylinders	By working with the machine.	Keep away from the cylinders during operation.	

4.2.3. Falling

Where	When	Precaution	Warning sign
Basket	By working at height above 2 meters.	Certificated harness, using the identified anchor points	 

5. Installation

The MEWP ART 17 T(H)(HM) is installed by the manufacturer or a by the manufacturer recommended company.

If something isn't installed correctly, please contact the manufacturer!

6. Operation

The ART 17 T(H)(HM) has an autonomous operating system for rail mode. The following operating functions are present:

- MEWP from road to rail (on tracking).
- High speed running.
- Low speed running.
- MEWP working mode.
- Working over the side.
- Working with one side adjacent to open lines.
- Travelling under live OLE - Restricted height mode.
- MEWP from rail to road (off tracking).

MEWP on tracking
Putting MEWP on rail track. Switch drive system from road wheels to rail wheels.

High speed running
Travelling at high speed in transport position.

Low speed running
Travelling at low speed in transport position.

MEWP working mode

1. Running at restricted working speed with elevated platform not in transport position but with telescope retracted and turret in a limited angle to the machine (See working over the side).
2. Operating the elevated platform, articulated boom, telescope arm and rotate the turret. Running is not possible.
3. For the ART 17 T the telescope arm is blocked over the 2 degrees cant.
   For the ART 17 TH, ART 17 THM (multigauge 1000-1600 mm.) the telescope arm is blocked over the 4,8 degrees cant.

Working over the side
The ART 17 T is moving at restricted speed (walking pace) with the turret rotated in an angle up to 25 degrees over the **fixed bogie** for the inspection of overhead line equipment. This in comparison to the ART 17 TH which has the ability to travel over the side in an angle of 90 degrees. The function is only available in working mode with the telescope arm fully retracted, so the articulate boom needs to be out of the boom rest. Over 2 degrees cant (ART 17 T) and 4,8 degrees cant (ART 17 TH) working over the side is disabled.

Restricted - ALO Working
The slew limiter limits the working envelope for turret rotation to a pre-set range, either the left or right side of the machine, when looking in the forward (white arrow) direction. In this mode the machine may be used adjacent to one side lines open.
The 360 ALO will give you another option (only with Software version V 1803/2017), to working under ALO with a virtual wall either side.

Remark
The ALO slew limiter can be used in combination with Working over the side. In that case Working over the side will only be available in a range from 0 to 90 degrees at one side of the machine.

Travelling under live OLE - Restricted height mode
The work platform is locked in a position below 1.4m basket floor height. The MEWP is then permitted to travel under live electric overhead wires.

MEWP off tracking
Putting MEWP on road wheels. Switch drive system from rail wheels to road wheels.

6.1. Safety features

6.1.1. Emergency stop


Emergency stop

The emergency stop is used to stop all movements of the work platform and driving movements in case of an emergency.

The emergency stop switch is a red knob on a yellow background. Emergency stop(s) are positioned on the base station and control panel in the basket (MEWP).

Remark!
The emergency stop buttons on base station and on control panel in basket remain active in rail mode, shutting down electrical power and hydraulic power when activated.

Lock

- Push the switch; *all movements stop.*

Unlock

- Turn the switch till it pops up; *after resetting the machine will be available again*.

6.1.2. Light signals

A control light mounted on the console in the basket gives a signal in case there is an alarm.

6.1.3. Sound signals

A beeper mounted on the basket sounds in case of an overload.

6.1.4. Restriction telescope

To prevent against overturning, the operation of the telescope arm is limited by a tilt sensor when the MEWP is in rail mode.

6.1.5. Locking road wheel steering (when rail mounted)

Road wheel steering is automatically blocked as soon as the rail wheels are fully deployed (on track). Before lowering the rail wheels, the operator must be aware that road wheels are straight (indicated by two green LEDs on the basket control panel of the Manitou).

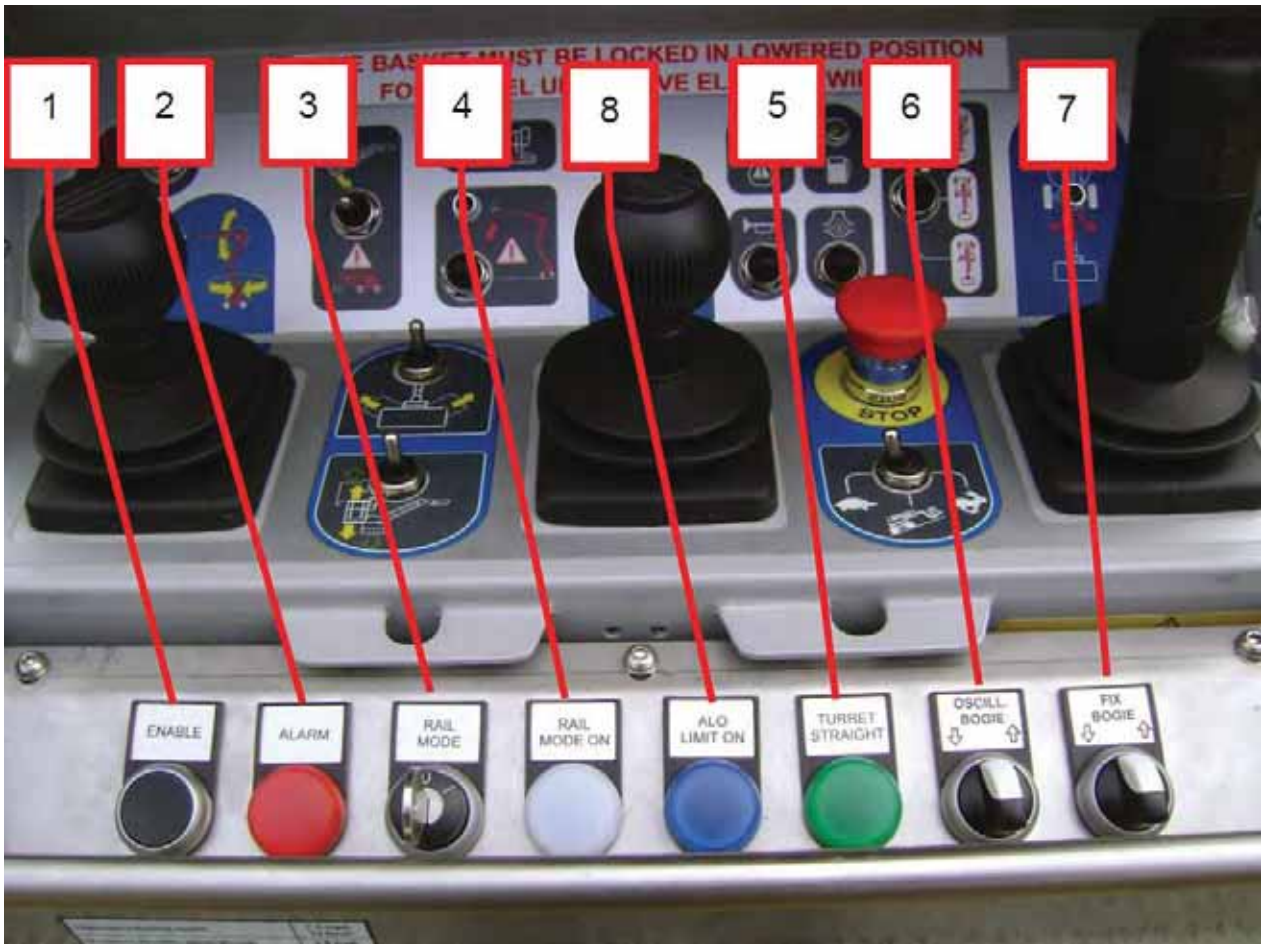
6.1.6 Access and egress points

There are three white tubular sections on the basket, these are allocated access and egress points. Whilst working ALO, ensure that you access and egress the machine from the safe side of the machine and away from the nearest open line.

6.2. Operation panels and buttons

6.2.1. Console in basket

The access position to the basket is the transport position.



Console in basket.

1) ENABLE

Push button to be operated together with Fixed bogie / Oscillating bogie lowering-lifting switches (two-hands operation to avoid unintended operation of the bogie switches).

6) OSCILLATING BOGIE

Switch to operate the lifting cylinders of the fixed bogie; *turn to the left bogies raised*, *turn to right bogies lowered*. Switch to be operated simultaneously with "Enable" pushbutton. To operate the lifting cylinders the MEWP must be in Road mode and Transport position.

7) FIXED BOGIE

Switch to operate the lifting cylinders of the oscillating bogie; *turn to the left bogies raised, turn to the right bogies lowered*. Switch to be operated simultaneously with "Enable" pushbutton. To operate the lifting cylinders the MEWP must be in Road mode and Transport position.

2) ALARM
Red Control light to indicate that a system alarm is present; *alarm when light "Alarm" is continuously on*.
If control light "Alarm" is blinking, some MEWP movements are blocked.

This is the case when
- *Telescope function is disabled in an over 2 degrees cant*
- *All MEWP movements are blocked when bogies are not fully deployed*
- *All MEWP movements are blocked by the height restriction switch.*

3) RAIL MODE
Key switch to activate rail mode.
Rail mode is activated when control light "RAIL MODE ON" is continuously on.

4) RAIL MODE ON
White control light showing that the machine is in rail mode position; *rail mode active when light is continuously on.*
If control light "RAIL MODE ON" is blinking, switching to rail mode has failed. This is the case for example when bogies are not completely down, the machine is driving or machine is not in travel position when switching to rail mode.
After ensuring all conditions are fulfilled, return the key switch 3 to road mode and switch to rail mode again.
When re-starting after a power switch off, rail mode must be selected again by returning the key switch 3 to road mode and switch to rail mode again.

5) TURRET STRAIGHT
Green control light indicating that turret position is straight (in line with track); it is possible to travel at high speed.
The turret is straight when light is on.
Green control light is blinking in rail mode when 'working over the side' is enabled. Moving at working speed.

8) ALO SLEW LIMITING DEVICE ACTIVE
Blue control light indicating that slew limiting device for working with one side to any line open for traffic is activated.
The ALO limiter is active when light is on. The slewing range is limited. It is not possible to cross the track centre-line into the danger zone.

Remark
At power up three signal lights (H1-H2-H3) lit up for about 3 seconds indicating a correct start-up of the controllers.

6.2.2. Base station on turret

The elevated platform can only be operated from the basket. For road mode we refer to the Manitou Instructions Manual (see chapter 1.)

For user instructions of the Manitou we refer to the Manitou Instructions Manual (see chapter 1).

Travelling, bogie lifting and lowering, working with the MEWP is only possible from the basket.

BASKET LOCK KEY SWITCH

Key switch. The work platform is locked in the actual position. Locking is only possible while in rail mode and travel mode. In locked position the key can be removed from the switch for safeguarding.
This key must be removed after locking the basket if you are travelling under live OLE.

Basket lock key switch and Data logger LED's.

ALO LIMITER SELECTION KEY SWITCH

3-Positions key switch to activate ALO slew limiter and 360 ALO.

- In **centre position** the ALO slew limiter is switched OFF.
- With the key in **LEFT position** slewing to the left side of the machine, when looking in the forward (white arrow) direction, is blocked. This selection is to be used for working with left any line open for traffic. The working envelope is thus limited to the right side of the machine.
- With the key in **RIGHT position** slewing to the right side of the machine, when looking in the forward (white arrow) direction, is blocked. This selection is to be used for working with right any line open for traffic. The working envelope is thus limited to the left side of the machine.

In LEFT and RIGHT position the key can be removed from the switch for safeguarding.
Working next to any open line is not allowed if this key is not removed before start of work.

ALO Slew limiter selection is only available while the MEWP is in rail mode.
The steps to be undertaken to work with the 360 degrees ALO can be found in annex 5 of this handbook.

The selection must be made in travel position while the turret is line with the track. When the selection is made while slewed in the range to be blocked, the slewing will be available till the turret crosses the track centreline. From then on the slew limiter starts working and slewing into the selected range will be impossible.
When slew limiter is active the blue LED in the basket is ON.

The slew limiter is not capable of limiting movement over both sides simultaneously. The vehicle is not permitted to work with both sides connected to any line open.
After selection the correct operation of the slew limiter must be tested by trying to slew into the blocked range in both clockwise and anticlockwise rotation. If the test fails the machine may not be used with lines open.

The slew limiter selection remains active after a power shut down.
There is no possibility to manually override the active slew limiter.

DATA LOGGER LEDs
Normal condition the *Green light is continuously ON: Datalogger powered and OK.*
When an event is registered: *Orange LED is flashing*. The orange LED remains flashing, even after power shut down, until a data logger download is made.

DATA LOGGER LEDs LOAD VISUALISATION
Equal like above, please have a look at operating manual V1.0 Load Visualisation.

6.3. Operation handlings

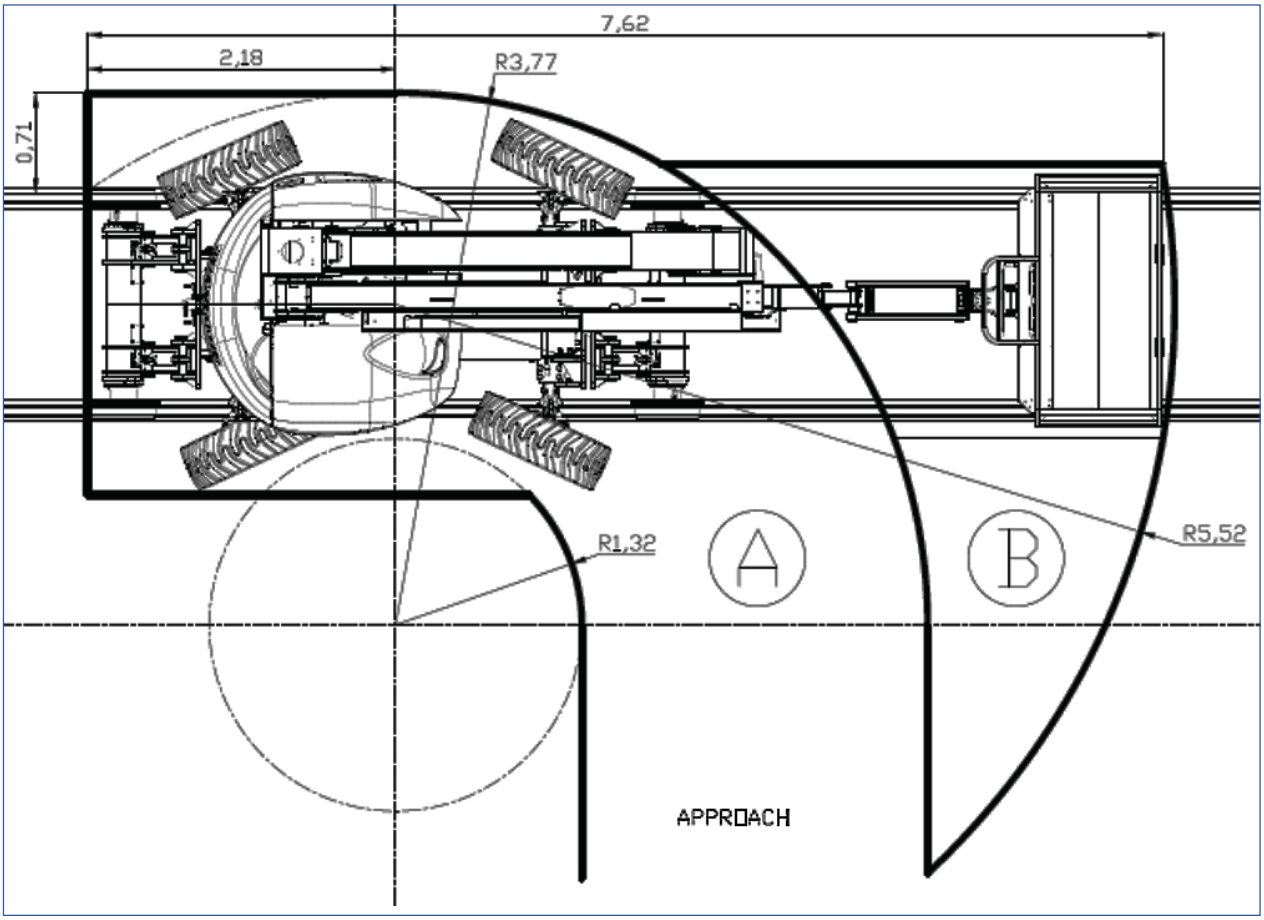
Remark!
Before operating:

- Only competent and authorised personnel shall operate the machine.
- Always check the general condition of the ART 17 T(H)(HM); *correct missing parts (protective guards), damages or leakages*.
- Area is free of personnel.
- Referenced manufacturer's manuals are to be read in conjunction with this document.

6.3.1. MEWP On tracking

On track the machine at a properly prepared road-rail access point (RRAP). The minimum size of the RRAP area to be used is illustrated in diagram below. The ART 17 T range is submitted as a zero tailswing machine as shown below.

Once the trailer has been coupled to the host machine, complete a functional brake test.



Area A is ground level & Area B is above ground level swept area boom (drawing based on the ART 17 T range).

STEP	Action / condition	Reference
1.	**Precondition** MEWP in transport position on road; - telescope arm completely retracted, - upper and lower lifting arms completely lowered, - turret in 0° (180°) position, **Action** • Position MEWP on rail track, • Fine position oscillating (fixed) bogie. Oscillating (fixed) bogie rail wheels are positioned above rails.	Manitou operating manual p. 2-55
2.	**Precondition** MEWP in transport position. Turret in 0° (180°) position Oscillating bogie rail wheels positioned above rails. **Action** Lower oscillating bogie till end of stroke cilinder and rail wheels are in contact with the rail. • Operate switch to lower oscillating bogie together with enable button till wheels mesh with rail; - parking brake on both oscillating (fixed) bogie wheels is hydraulically released, - oscillating lifting cylinders lower oscillating wheel structure, - upper liftings arms, lower lifting arm and telescope are disabled, - bogie not “fully up” is detected. - When lowering oscillating bogie, the brakes of the oscillating axle are released (this might cause the bogie to rotate). Oscillating bogie rail wheels positioned on rails.	
3.	**Precondition** MEWP in travel mode. Turret in 0° (180°) position Rail wheel brakes engaged. Oscillating (fixed) bogie wheels on rail track. **Action** • Operate turret rotation and revolve 180°; MEWP 180° (0°) opposite to (in) transport position Oscillating (fixed) bogie on rail track **Remark** Clear view on fixed bogie.	

STEP	Action / condition	Reference
4.	**Precondition** MEWP 180° (0°) opposite to (in) travel mode. Rail wheel brakes engaged. Oscillating (fixed) bogie on rail track. **Action** • Fine position fixed (oscillating) bogie (using road wheels) Fixed (oscillating) rail wheels positioned above rails.	
5.	**Precondition** MEWP 180° (0°) opposite to (in) travel mode. Rail wheel brakes engaged. Oscillating (fixed) bogie on rail track. Fixed (oscillating) bogie wheels above rails. **Action** Lower oscillating bogie till end of stroke cilinder and rail wheels are in contact with the rail. • Operate switch to lower fixed bogie together with enable button Till rail wheels are in contact with the rail; - parking brake on both fixed bogie wheels is hydraulically released - fixed (oscillating) lifting cylinders lower fixed wheel structure - When lowering oscillating bogie, the oscillating axle is released. - As soon as fixed and oscillating bogie not “fully up” is detected: - flashing beacon is disabled. - road tilt sensor deactived. - in any case misusing the MEWP the brakes are engaged (2.0-3.6 software) Fixed rail wheels positioned on rails. **Action** • Continue operating fixed (oscillating) bogie lifting cylinder till end of stroke; - parking brake on both fixed (oscillating) bogie wheels is hydraulically released. - fixed lifting cylinders lift fixed side of MEWP; fixed wheels rolling over track, oscillating (fixed) wheels braked avoiding the machine to run away. - at end of stroke position is detected. **Action** • Operate the switch to lift fixed (oscillating) bogie lifting cylinder for a short moment, so relieving the pressure in the lifting cylinder. Fixed (oscillating) side fully lifted. Road wheels up. All parking brakes engaged.	

STEP	Action / condition	Reference
6.	**Precondition** MEWP 180° (0°) opposite to (in) travel mode. Fixed (oscillating) side lifted. Rail wheel brakes engaged. **Action** • Operate turret rotation and revolve 180°; turret rotates back to 0° (180°) position. MEWP in travel mode Fixed (oscillating) side lifted Oscillating (fixed) bogie on rail track **Remark** Clear view on oscillating bogie.	
7.	**Precondition** MEWP 180° (0°) opposite to (in) transport position. Fixed (oscillating) side lifted. Rail wheel brakes engaged. **Action** • Put road wheels fixed (oscillating) side in straight position; *green led on basket operating panel Manitou is on*. • Put road wheels oscillating (fixed) side in straight position; *green led on basket operating panel Manitou is on.* Road wheels in straight position (in line with machine).	

STEP	Action / condition	Reference
8.	**Precondition** MEWP in travel mode. Turret in 0° (180°) position Fixed (oscillating) side lifted. Fixed and oscillating bogie brakes engaged. **Action** • Operate oscillating (fixed) bogie lifting cylinder till end of stroke; - parking brake on both oscillating (fixed) wheels is hydraulically released. - oscillating (fixed) lifting cylinders lift oscillating (fixed) side of MEWP; oscillating (fixed) wheels rolling over track, fixed (oscillating) wheels braked avoiding the machine to run away. - at end of stroke position is detected. **Action** • Operate the switch to lift oscillating (fixed) bogie lifting cylinder for a short moment, so relieving the pressure in the lifting cylinder. Vehicle lifted. All parking brakes engaged. 2 Red rail lights on both ends are illuminated automatically.	
9.	**Precondition** MEWP in travel mode. Machine raised. Rail wheel brakes engaged. **Action** • Switch key switch from road to rail operation; - circuit selection valve switched. Road wheel motor disconnected from oil supply. Rail wheel motors connected to oil supply. - working platform released for operation. - upper liftings arms, lower lifting arm and telescope arm are enabled. - Road wheel steering is blocked. - White control light continously ON. MEWP in transport position. Machine raised. **Remark** Road wheel steering is blocked in rail mode to avoid the wheels getting unintended out of the running gauge. It is important to put the road wheels straight (both LEDs on Manitou control panel ON) before switching to rail mode.	

6.3.2. High speed running

STEP	Action / condition	Reference
1.	**Precondition** MEWP on rail wheels on rail track; - lifting cylinders end of stroke detection, - switched to rail operation. MEWP in travel mode; - telescope arm completely retracted, - upper and lower lifting arms completely lowered, - turret in 0° (180°) position. Green signal lamp ON. 2-Wheel steering is selected **Action** • Select high speed (hare); *high speed is selected*. **Remark** Although in rail mode, the road mode condition drive at high speed when 4-wheel steering not selected remains valid. When 4-wheel steering is selected the low speed is automatically selected.	

2.	**Precondition**
	MEWP on rail wheels on rail track;
	- lifting cylinders end of stroke detection,
	- switched to rail operation.
	MEWP in travel mode;
	- telescope arm completely retracted,
	- upper and lower lifting arms completely lowered,
	- turret in 0° (180°) position. Green signal lamp ON.
	- High speed selected.
	
	Action
	• Press and hold Dead Man's pedal and trigger button on joystick
	• Operate translation joystick forward (white arrow direction) or backward (black arrow direction);
	  - The parking brakes are hydraulically released;
	  - the oscillating axle locking cylinders are released,
	  - hydro pump is providing oil to 4 wheel hydromotors,
	  - operating articulated boom, telescope arm, basket rotation, turret rotation and bogie lifting cylinders is not possible,
	  - operating basket pendular arm (jib) remains possible.
	
	MEWP is running in the selected direction at the selected speed.
	Oscillating axle is adapting to track curve.
	2 White rail lights are illuminated in driving direction.
	2 red lights are illuminated on the trailing end of the machine.	

STEP	Action / condition	Reference
3.	**Precondition** MEWP on rail wheels on rail track; - lifting cylinders end of stroke detection, - switched to rail operation. MEWP in travel mode; - telescope arm completely retracted, - upper and lower lifting arms completely lowered, - turret in 0° (180°) position. Green signal lamp ON. - MEWP is running in high speed (hare) modus. **Action** • Move joystick into neutral position. or • Release trigger button. or • Release Dead Man's pedal. or • Combination of describtion above; *hydro pump stops delivering oil to wheel motors*. MEWP comes to a controlled stop. **Remark** To bring the machine to stop without slipping the joystick should be returned smoothly without jerking to the neutral position. The system is then braking on the hydrostatic rail wheel motors.	

STEP	Action / condition	Reference
4.	**Precondition** MEWP on rail wheels on rail track; - lifting cylinders end of stroke detection, - switched to rail operation. MEWP in travel mode; - telescope arm completely retracted, - upper and lower lifting arms completely lowered, - turret in 0° (180°) position. Green signal lamp ON. - MEWP has stopped. **Action** • Automatic, no action needed. - The parking brakes are engaged, - the oscillating axle locking cylinders are locked, - operating articulated boom, telescope arm, basket rotation, turret rotation, basket pendular arm and bogie lifting cylinders is possible. Parking brakes engaged. The oscillating axle locked in current position. 2 Red rail lights on both ends are illuminated.	

6.3.3. Low speed running

STEP	Action / condition	Reference
1.	**Precondition** MEWP on rail wheels on rail track; - lifting cylinders end of stroke detection, - switched to rail operation. MEWP in restricted work position; - turret in 0° (180°) position. Green signal lamp ON. - Upper- and lower lifting arms, pendular arm and telescope may be used. **Action** • Select low speed (tortoise); *low speed selected*.	
2.	**Precondition** MEWP on rail wheels on rail track; - lifting cylinders end of stroke detection, - switched to rail operation. MEWP in restricted work position; - turret in 0° (180°) position. Green signal lamp ON. - Upper- and lower lifting arms, pendular arm and telescope may be used, - Low speed selected. **Action** • Press and hold Dead Man's pedal and trigger button on joystick • Operate direction lever joystick forward (white arrow direction) or backward (black arrow direction); - the parking brakes are hydraulically released, - the oscillating axle locking cylinders are released, - hydro pump is providing oil to 4 wheel hydromotors, - operating turret rotation, telescope arm, basket rotation and lifting cylinders is not possible, - operating articulated boom and basket pendular arm is possible, - high speed selection disabled. MEWP is running in the selected direction at the selected speed. Oscillating axle is adapting to track curve. 2 White rail lights are illuminated in driving direction. 2 red lights are illuminated on the trailing end of the machine. **Remark** Turret rotation is prohibited while driving for stability reasons (tilting).	

STEP	Action / condition	Reference
3.	**Precondition** MEWP on rail wheels on rail track; - lifting cylinders end of stroke detection, - switched to rail operation. MEWP in restricted work position; - turret in 0° (180°) position. Green signal lamp ON. - Upper- and lower lifting arms, pendular arm and telescope may be used, - MEWP running at low speed. **Action** • Return translation joystick into neutral position. or • Release trigger button. or • Release Dead Man's pedal. or • Combination of describtion above; *hydro pump stops delivering oil to wheel motors*. MEWP is slowing down to stop.	Manitou operating manual p2-55
4.	**Precondition** MEWP on rail wheels on rail track; - lifting cylinders end of stroke detection, - switched to rail operation. MEWP in restricted work position; - turret in 0° (180°) position. Green signal lamp ON. - Upper- and lower lifting arms, pendular arm and telescope may be used, MEWP stopped. **Action** • Automatic after the MEWP stopped, no action needed. - The parking brakes are engaged, - the oscillating axle locking cylinders are locked, - operating upper lifting arm, lower lifting arm, telescope arm, basket rotation, turret rotation, basket pendular arm and lifting cylinders is possible, - High speed selection enabled. Parking brakes engaged. The oscillating axle locked in current position. 2 Red rail lights on both ends are illuminated.	

6.3.4. MEWP working mode

STEP	Action / condition	Reference
1.	**Precondition** MEWP on rail wheels on rail track; - lifting cylinders end of stroke detection, - switched to rail operation. MEWP stopped, parking brakes engaged, oscillating axle locked Turret in 0° / 180° position. Working platform might be elevated already. **Action** • Press and hold Dead Man's pedal. • Operate turret rotation; - working platform rotates into working position, - travelling is disabled turret is out of 0° position over the oscillating bogie or rotated more than 25° (90° for the TH version) over the fixed bogie - brakes remain engaged, - oscillation axle remains locked. • Operate articulate boom and telescope - working platform is elevated to working position - travelling is disabled as soon as telescope arm is not fully retracted - brakes remain engaged, - oscillation axle remains locked. MEWP in working position	Manitou operating manual p2-55

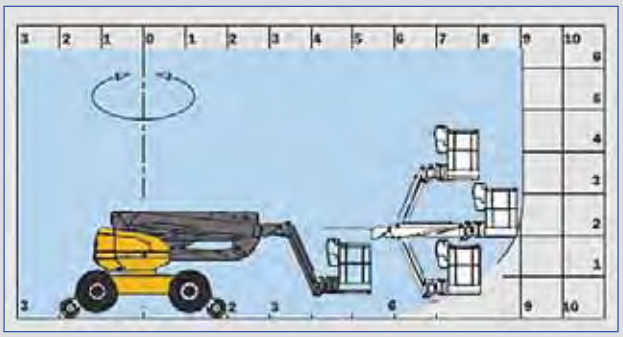
6.3.5. Working over the side

STEP	Action / condition	Reference
1.	**Precondition** MEWP on rail wheels on rail track; - lifting cylinders end of stroke detection, - switched to rail operation. Telescope is fully retracted, **Action** • Press and hold Dead Man's pedal. • Operate turret rotation over the fixed bogie within an angle of 25° (90° for the TH version) to the left or to the right with respect to the machine's centreline; - working platform rotates, - travelling is disabled as soon as turret is out of 0° position over the oscillating bogie or rotated more than 25° (90° for the TH version) over the fixed bogie - brakes remain engaged, - oscillation axle remains locked. • Operate articulate boom - Turret straight signal lamp is blinking - Walking pace speed is selected as soon as boom is lifted out of rest - brakes remain engaged, - oscillation axle remains locked.	Manitou operating manual p2-55
2.	**Action** • Press and hold Dead Man's pedal and trigger button on joystick • Operate translation joystick forward (white arrow direction) or backward (black arrow direction); - the parking brakes are hydraulically released, - the oscillating axle locking cylinders are released, - hydro pump is providing oil to 4 wheel hydromotors, - operating turret rotation, telescope arm, basket rotation and lifting cylinders is not possible, - operating articulated boom and basket pendular arm is possible, - high speed selection disabled.. MEWP in working position **Remark** *Working over the side with live OLE is not allowed.* **Remark** Over 2 degrees cant (TH version 4,8 degrees) working over the side is disabled.	

6.3.6. Travel under live OLE - Restricted height

STEP	Action / condition	Reference
1.	**Precondition** MEWP on rail wheels on rail track; - lifting cylinders end of stroke detection, - switched to rail operation. MEWP in transport position; - telescope arm completely retracted, - upper and lower lifting arms completely lowered, - turret in 0° (180°) position **Action** • Operate the pendular arm to lift the basket to a position below 1.4 m floor height	
2.	**Precondition** MEWP on rail track in a position below 1.4 m floor height. **Action** • Select the blocking key switch on base control unit. • Remove the key from the key switch and give in custody by the rail track supervisor; *The MEWP is locked in a position below the 1.4 m floor height permitting travel under live electric overhead lines.* • *All elevated workplatform operations are blocked. The machine can only travel.*	

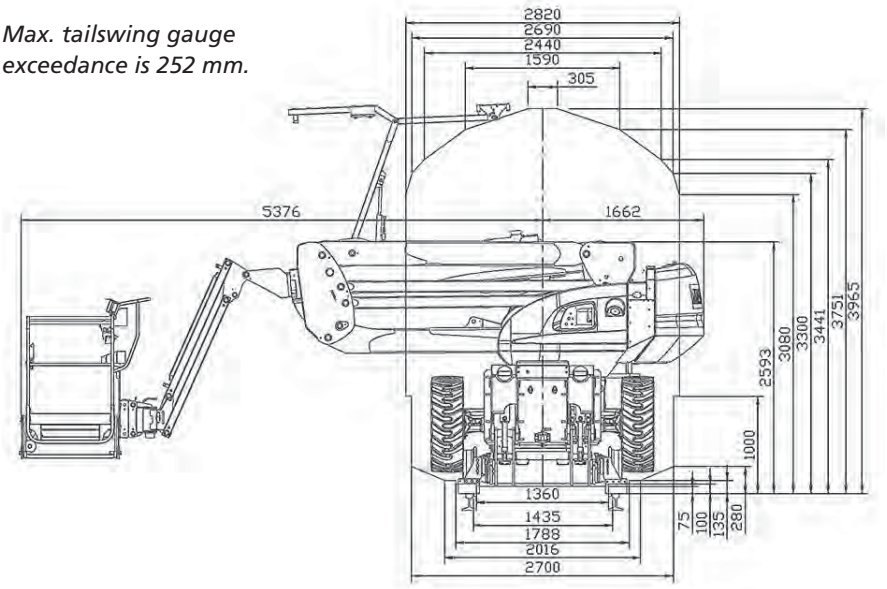
6.3.6.1. Lock basket 360 - Restricted height

STEP	Action / condition	Reference
1.	**Precondition** MEWP on rail wheels on rail track; - lifting cylinders end of stroke detection, - switched to rail operation. MEWP in transport position; - telescope arm completely retracted, - upper and lower lifting arms completely lowered, - turret in 0° (180°) position. **Action** • Operate the pendular arm to lift the basket to a position completely into travelling position.	
2.	**Precondition** MEWP on rail track in a travelling position. **Action** • Select the blocking key switch on base control unit and select the right option, LB 360. • Remove the key from the key switch and give in custody by the rail track supervisor; The MEWP is locked in that position. • *All elevated work platform operations are blocked besides telescope arm, rotation upper structure and jib function. (see working diagram LB 360).*  *Working diagram LB 360.* 	

6.3.7. Working with one side restricted - ALO

STEP	Action / condition	Reference
1.	**Precondition** MEWP on rail wheels on rail track; - lifting cylinders end of stroke detection, - switched to rail operation. MEWP in transport position; - telescope arm completely retracted, - upper and lower lifting arms completely lowered, - turret in 0° (180°) position **Action** • Activate ALO slew limiter by selecting the side adjacent to open lines with the key switch on base control unit. - The blue signal light in the basket "ALO Limit ON" is ON • Remove the key from the key switch and give the key to the identified responsible person on site. **Remark** The slew limiter is not capable of limiting movement over both sides simultaneously. The vehicle is not permitted to work with both sides to any open lines. The machine may NOT be used with both sides any lines open to traffic ("island" work). The machine shall not work with any adjacent lines open to traffic where the distance between the centre line on which the vehicle is working and the centre line of any open line is less than 3600mm. The machine is fitted with a lateral movement limiting device, which is not capable of limiting movement on both sides simultaneously. Power source ALO limiter 12 volts battery, switch by relay.	

Max. tailswing gauge exceedance is 252 mm.

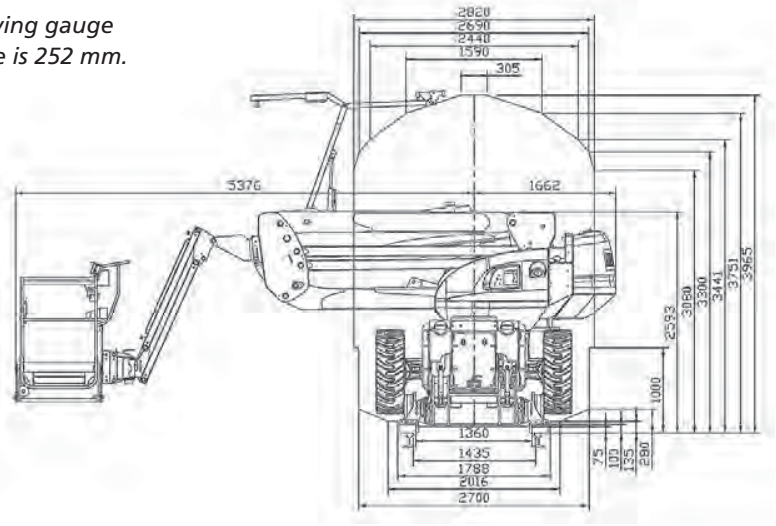


STEP	Action / condition	Reference
2.	**Precondition** MEWP on rail track and ALO slew limiter activated. **Before start working the correct functioning of the ALO slew limiter must be tested.** **Action** • Slew the turret clockwise towards the blocked side. • Check slewing is stopped and blocked automatically when the track centreline is crossed. • Check slewing in the opposite direction is possible. • Slew the turret anticlockwise towards the blocked side. • Check slewing is stopped and blocked automatically when the track centreline is crossed. • Check slewing in the opposite direction is possible. • Press emergency stop button. • Release emergency stop button and restart the machine. • Check the "ALO limit ON" signal light is ON • Check the slewing is blocked to the selected side. *The turret rotation is limited and the MEWP can be used with ALO* **Remark** If the test fails the machine may NOT be used with lines open.	
3.	**Precondition** MEWP on rail track and ALO slew limiter activated. **Each time before slewing verify the blue signal light is ON, meaning ALO slew limiter function is active.**	

6.3.7.1. Working with one side restricted - 360 ALO (High Performance MLD)

STEP	Action / condition	Reference
1.	**Precondition** MEWP on rail wheels on rail track; - lifting cylinders end of stroke detection, - switched to rail operation. MEWP in transport position; - telescope arm completely retracted, - upper and lower lifting arms completely lowered, - turret in 0° (180°) position **Action** • Activate 360 ALO slew limiter by selecting the side adjacent to open lines with the key switch on base control unit. - The blue signal light in the basket "ALO Limit ON" is ON. - Set the values as described in annexe 6 by using the F4 button at seperate display in basket, for example: 20 to 40 degrees. • Remove the key from the key switch and give the key to the identified responsible person on site. **Remark** The slew limiter is not capable of limiting movement over both sides simultaneously. The vehicle is not permitted to work with both sides to any open lines. The machine may NOT be used with both sides any lines open to traffic ("island" work). The machine shall not work with any adjacent lines open to traffic where the distance between the centre line on which the vehicle is working and the centre line of any open line is less than 3600mm. The machine is fitted with a lateral movement limiting device, which is not capable of limiting movement on both sides simultaneously. Power source 360 ALO limiter 12 volts battery, switch by relay.	

Max. tailswing gauge exceedance is 252 mm.

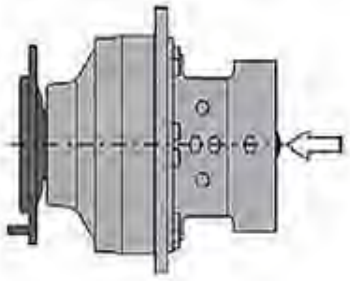


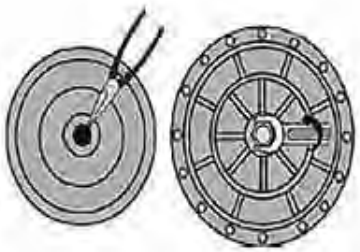
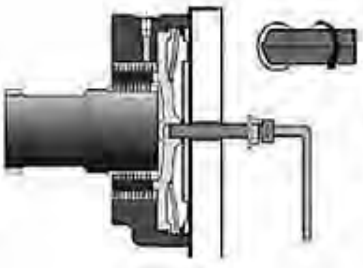
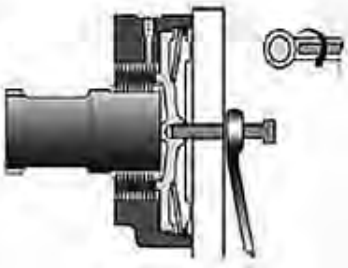
STEP	Action / condition	Reference
2.	**Precondition** MEWP on rail track and 360 ALO slew limiter activated. **Before start working the correct functioning of the 360 ALO slew limiter must be tested.** **Action** • Slew the turret clockwise towards the blocked side. • Check slewing is stopped at the selected grade (for example 20 to 40 degrees) and blocked automatically when the track centreline is crossed. • Check slewing in the opposite direction is possible. • Slew the turret anticlockwise towards the blocked side. • Check slewing is stopped at the selected grade (for example 200 to 240 degrees) and blocked automatically when the track centreline is crossed. • Check slewing in the opposite direction is possible. • Press emergency stop button. • Release emergency stop button and restart the machine. • Check the "ALO limit ON" signal light is ON • Check the slewing is blocked to the selected side. *The turret rotation is limited and the MEWP can be used with ALO* **Remark** If the test fails the machine may NOT be used with lines open.	
3.	**Precondition** MEWP on rail track and 360 ALO slew limiter activated. **Each time before slewing verify the blue signal light is ON, meaning 360 ALO slew limiter function is active.**	

6.3.8. Towing the ART 17 T / ART 17 TH on rail

STEP	Action / condition **FOR EMERGENCY RECOVERY ONLY**	Reference
1.	**Action** • Put the MEWP in travel mode. • Mount tow bar between towing machine and MEWP using the dedicated towing couplings on fixed or oscillating bogie. • Manually release parking brakes of all four rail wheel motors using the dedicated M12 bolt and pull block. • Remove the cover plate of the bogie tube, giving access to the wheel motor brake. • Remove the tools. • Remove the seal plug from the motor brake. • Screw the nut to the bolt head. • Position the pull block on back end of the wheel motor, the outer ends fit into the groove of the motor. • Slide the ring onto the bolt and put the bolt through the pull block. • Screw the bolt into the motor by hand. • Screw the nut against the pull block. See picture A below. • The parking brake is released. • Open needle valve on manifold on both fixed and oscillating bogie for freewheeling of the wheel motors. The MEWP can be towed at low speed. ***Remark:*** *Towing the vehicle to the nearest off tracking location is a last resort.*	

Picture A



Step	1	2	3
Action	Remove the rubber plug from the brake protector. Loosen the metallic plug. 	Tighten to the bottom of the threading without blocking the screw fitted with a nut and washer in the piston. 	Then tighten the nut until the motor shaft turns freely, while holding the screw. 

STEP	Action / condition	Reference
2.	**Action** **Following towing operation BEFORE removing the tow bar** • Close freewheeling needle valve on manifold on both fixed and oscillating bogie. On all wheel motors: • Unscrew the parking brake release nut till the nut is loose. • Remove the bolt from the wheel motor. • Replace the tooling kit in its original position. • Replace the seal plug in the motor brake. • Mount the cover plates. • Now remove the tow bar between towing machine and MEWP • Put the tow bar back on the side of the machine.	

6.3.8.1. Towing with RPU trailer ATR450 on ART 17 T(H) (if fitted to machine, only 1 trailer allowed)

STEP	Action / condition	Reference
1.	**Action** • Put the MEWP in transport mode. • Mount tow bar between towing machine and MEWP using the dedicated towing couplings on fixed or oscillating bogie. • Uncouple plug of standard socket, audible warning and blinking green light on either side (see photo page 117). • Couple the trailer on ART 17 T(H) coupling. • Couple the connector of trailer coupling into the socket. • Blinking green light and buzzer will stop. • When coupled to ART 17 T(H) battery is charging. **Uncoupling procedure** Reverse of above steps results in the uncoupling procdure (use the coupling hook for uncoupling). **Please look at the trailer manual for further information.**	

6.3.9. MEWP off tracking

STEP	Action / condition	Reference
1.	**Precondition** MEWP in rail mode. MEWP in transport position. No movement. **Action** • Switch key switch from rail to road operation; - circuit selection valve switched. Road wheel motor connected to oil supply. Rail wheel motors disconnected from oil supply. - All working platform operations blocked. - White control light OFF. MEWP can be towed at low speed.	
2.	**Precondition** MEWP in travel mode. Road mode selected. **Action** • Operate switch to lift fixed (oscillating) bogie together with enable button. - parking brake on both fixed (oscillating) bogie wheels is hydraulically released - fixed (oscillating) lifting cylinders lift fixed (oscillating) wheel structure; fixed (oscillating) wheels rolling over track, oscillating (fixed) wheels braked avoiding the vehicle to run away. - end of stroke position is detected. 2 Red rail lights on both ends are automatically switched off	
3.	**Precondition** MEWP in travel mode. Fixed (oscillating) side on road wheels. **Action** • Operate switch to lift oscillating (fixed) bogie together with enable button. - parking brake on both oscillating (fixed) bogie wheels is hydraulically released. - oscillating (fixed) lifting cylinders lift oscillating (fixed) side of MEWP; oscillating (fixed) wheels rolling over track, fixed (oscillating) wheels braked avoiding the vehicle to run away. - end of stroke position is detected. Vehicle on road wheels. Road MEWP functions are available again. Flashing beacon is active. Road tilt sensor is active.	

6.3.10. Emergency operation

When there is a total breakdown of the machine, it's possible to bring down the MEWP basket by an emergency pump. Estimated time for recovery in case of full failure is approx. 15 minutes. For details we refer to Section 2 chapter RESCUE PROCEDURE page 2-60 of the "Manitou - 547408 EN Instructions manual".

6.3.11. Data logger

The data logger registers the activation of following safety functions:

- Basket overload
- Emergency pump
- ALO error

Every event is logged with date and GMT time stamp.

The Data logger system contains:

- Data logger PCB;
- Wiring;
- LED lights on turret operating panel.

The data logger PCB is mounted behind the Manitou turret control cover. The data logger is continuously powered by the machine battery and wired to Manitou`s overload sensor, Emergency pump and ALO.

Attention: The engine will not start if the data logger wiring is disconnected.

Data logger indication LED lights

Normal condition the *Green light is continuously ON: Data logger powered and OK*.

When an event is registered: *Orange LED is flashing*. The orange LED remains flashing, even after power shut down, until a data logger download is made.

Before using the MEWP in rail applications, ensure that the green LED is ON and the orange LED is OFF. When orange LED is blinking the operations may not be started until a download is made and evaluated by the owner.

Data logger PCB with USB connector.

Remark:

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.

Data read-out:
The data logger will indicate the registration of an event with a flashing orange LED. To remove this warning, or store the history of other events, the event log has to be downloaded from the device. To do so, please follow the instruction below carefully.

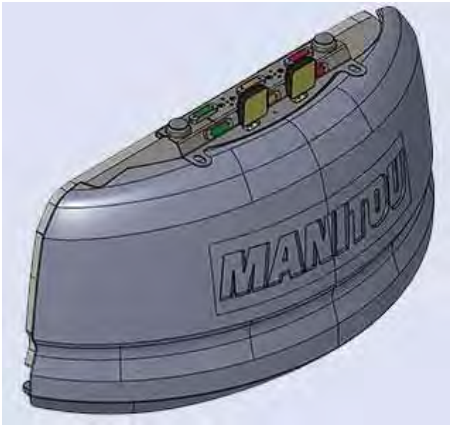
1. Ensure the vehicle power switch is switched off;
2. Remove the protective cover (indicated on picture on page 56) on the PCB and plug in an empty USB memory stick;
3. Switch on the power switch (the Manitou screen will pop-up) ;
4. The download will start automatically
5. Please leave the contact switched on during the process.
6. After a few seconds the green and orange LED will flash for a short time indicating that the download of the event log is made;
7. When the download is finished, the orange LED will be off again. The green LED is on, meaning that the data logger is working successfully;
8. Remove the USB memory stick and put the protective cover back on the USB port of the PCB.
9. On the USB drive a map ``data logger`` is created, containing a CSV file, which can by imported into Microsoft Excel.

6.3.11.1 Datalogger with Load Visualisation (if supplied by manufacturer)
The datalogger registers the activation of following safety functions :

- Basket load
- Engine running
- Overload basket
- Load ok
- Load warning
- Overload
- Emergency pump on
- ALO left open
- ALO right open
- Ole open (lock basket)
- Warning light top open circuit 0=ok 1=false
- Warning light below open circuit 0=ok 1=false
- Ingnition on
- Test light + buzzer
- Load sensor ok
- Box open
- Machine nr.

Every event is logged with date and GMT time stamp. (see annex 3.)

The datalogger load visualisation system contains:
- Datalogger Siemens.
- Electrical wiring loom.
- LED lights on turret operating panel.
- LED lights (red, orange,green) in operating panel basket.
- LED lights 2*3 on counter weight ART 17 TH.

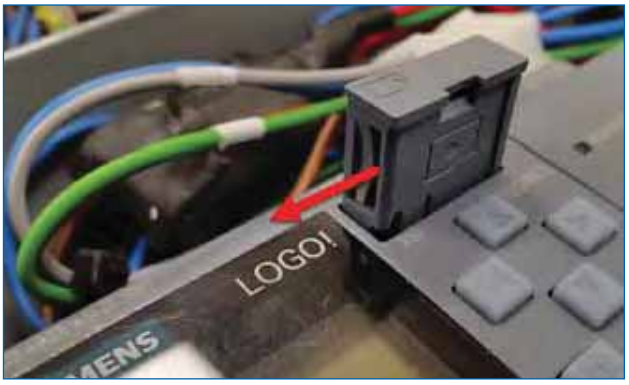


The datalogger LVI is mounted below the Manitou turret control cover. The datalogger is continuously powered by the machine battery and also wired to Manitou's overload sensor, emergency pump and ALO (more covered see annex 3.)

Data logger load visualisation LED lights

Normal condition the green light is continuously on: datalogger powered and ok.
When an event is registered, Orange LED is flashing. The orange LED remains flashing, even after power shut down, until a data logger download is made.
Before using the MEWP in rail applications, ensure that the green LED is ON and the orange LED is OFF.
When orange lED LED is blinking the opreations may not be started until a download is made and evaluated by the owner (see operating manual LVI 1.0)

Where a data logging system is found not 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.



Data read-out

The data logger will indicate the registration of an event with an flashing orange LED. To remove this warning, or store the history of another event, the event log has to be downloaded from the device. To do so, please follow the instruction below carefully.

1. Open the datalogger box
2. Open the SD-Card tray.
3. Place the SD-card in the tray (gold pins up) and press the SD-card into the slot.
4. Insert the SD-card in a computer.
5. Open the excel programm: ART 17 Datalog Programm final V1.0.
6. Open the excel file from the SD Card.
7. Insert the data from SD card in the excel file Load visualisation tab “data”.
8. Make a copy of colum A.
9. Paste this in colum A, in tab “data” (excel file Load visualisation V1.0).
10. Press “split data” in tab “info” (excel file Load visualisation V1.0).
11. Press tab “results”.
12. Select the values which you want in the pdf.
13. Save results tab to pdf.
14. Open the SD-card tray.
15. Place the SD card in tray (gold pins up).
16. Close the Sd-card cassette.
17. Close the datlogger box.

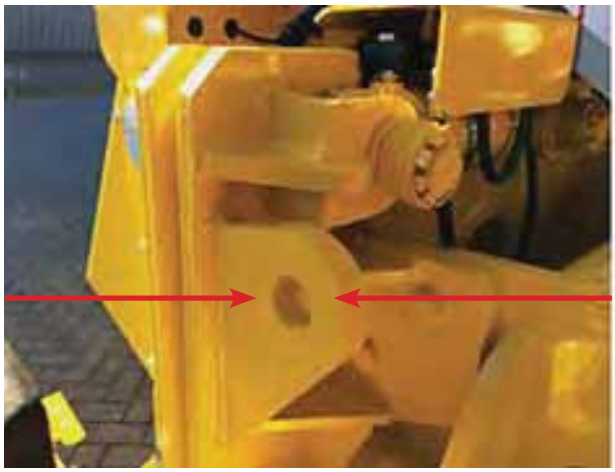
* For additional information please have a look at operating manual Load visualisation V 1.0.

6.3.12. Lifting the MEWP

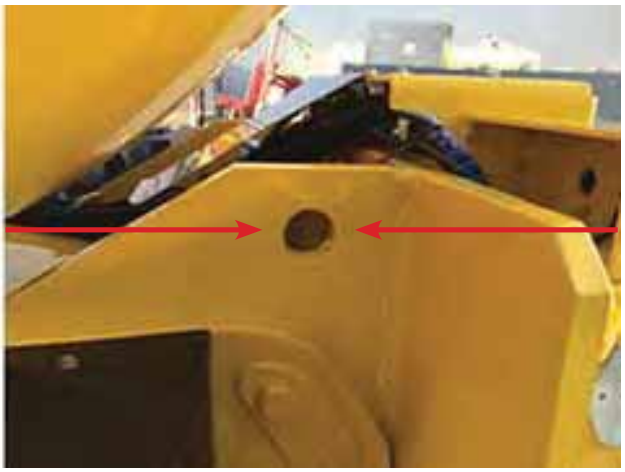
Remark
Never lift the MEWP if the machine is manned, loaded or connected to a towing vehicle.

For lifting the MEWP we refer to Manitou - 547408 EN Instructions Manual, page 3-39.

As from machine number 0043003 (ART 17 T and ART 17 TH) onwards the lifting lugs (SWL 5 ton) on fixed and oscillating bogie are to be used for lifting operations.



Oscillating bogie lifting lug



Fixed bogie lifting lug

6.3.13. Safety instructions for stabling

Park the machine on stable, solid ground away from the running line and OLE infrastructure. MEWP basket to be left in the air, machine isolated and keys removed.

7. Maintenance

To guarantee a good working and safe machine with an acceptable lifetime, manufacturer strongly recommends to carrying out preventive maintenance on the parts written below conform standard RIS-1530_PLT. All maintenance activities must be logged in a maintenance log (annex 1).

REMARKS
Only **competent** and **qualified** personnel, is authorized to operate the installation.

Maintenance must only be performed by **authorised** and **qualified** personnel.
All personnel must read safety- and operating instructions in the user manual before operating the installation or completing any routine maintenance.

Be sure that the machine **never starts up unintentionally** during maintenance; ensure that you securely de-mobilize the machine in the necessary manner.

Other documents:

- Refer to Manitou - 547408 EN Instructions manual, section 3 for maintenance of the lift platform.

Auditable records of maintenance to this manual shall be kept in accordance with RIS-1530-PLT. This should include traceability to the vehicle concerned, date, location and personnel who carried out the maintenance. The vehicle log book is to be updated with the date and examination type of the last maintenance carried out.

In order for this document to remain compliant to the current industry standards this manual must be reviewed on an annual basis by a competent Engineer. All relevant new legislation, Letters of instruction, Industry Standards & National Incident Reports (NIRs) must be reviewed & the manual must be updated accordingly.

Document Review
The following Maintenance Program specified on the appropriate Plant Assessment Body (PAB) certification for each product is reviewed as follows:

1. The Maintenance Program is reviewed on an annual basis to investigate:
    - The potential for improvement.
    - The maintenance activities.
    - The vehicle performance and associated components.
    - National Incident Reports (NIR's).
    - Changes in use and/or operating environment.
    - Manufacturer's advice.
    - Directives from Network Rail.
    - The vehicle's seven-year review.
2. A record of any decisions taken at this review is retained.
3. Always confirm with manufacturer to ensure the latest issue of this document is being used.

Prior to Commencing Maintenance Work You Must:

- Read and fully understand the enclosed working instructions.
- Ensure that any required safety precautions have been taken.
- Adhere to safety notices contained within this manual.

- Fully understand the risks involved and be competent to perform the work.
- Use only genuine spare parts as replacement items.

Ensure that prior to the vehicle being used, after maintenance work has been completed, all safety checks and tests have been completed.

In accordance with their policy of continuous development Rail Products UK Ltd. reserve the right to amend the specifications of its vehicles without prior notice.

Rail Product UK Ltd. does not accept liability for:

- Vehicles that have been altered or modified without prior written approval from Rail Products UK Ltd.
- Vehicles not maintained in accordance with the conditions of operation and maintenance as specified within this manual.
- Neglect of local or national government regulations.
- Damage or injury (whether direct or consequential) resulting from ignorance or failure to comply with any of the above items.

Please contact Rail Products UK Ltd if you have any queries. It is the owner's/user's responsibility to know and comply with all applicable rules, regulations, laws, codes and any other requirements applicable to the safe use of this equipment.

7.1. Staff Competency

In order to comply with the requirements of RIS-1530-PLT, the following minimum level of staff competence required is:

- For all activities the person leading the task must be able to follow and carry out the instruction detailed in this document.
- All safety critical work must be carried out by persons competent in accordance with:
  - ORR Railway Safety Publication 1 "Developing and Maintaining Staff Competence" March 2007.
- All work relating to the maintenance and overhaul of axle bearings should be carried out by competent persons.
- Staff undertaking this work must have been trained and hold the following certificates of competency:
  - SCWID (Safety Critical Work IDentification)
  - Apprentice trained Craftsman/NVQ Level 3 in plant maintenance.
  - Certificate issued by a CITB/CTA approved body – operation for maintenance purposes only.
  - Re-assessment of competency in accordance with operator's maintenance policy (RPA assessments).
  - Operators working on a PTS site must have an valid PTS medical certificate and comply with site health and safety regulations.

7.2. Facilities

In order to comply with the requirements of RIS-1530-PLT, all work described in section seven shall be carried out using facilities (including those of sub contractors) which as a minimum have the following:

- Clean, dry, covered accommodation for dealing with wheelsets, bearings, mechanical, hydraulic, electrical components and systems.
- Adequate illumination for inspection of components, rail axles and underframes.
- Cleaning facilities that will not cause damage to the components.
- Handling facilities for removal and refitting of components such as rail axles and engines.
- Protection from the weather of vulnerable areas of the vehicle and its components.
- A suitable length of straight level rail track for carrying out brake tests.

These maintenance activities may be carried out at any location, where the work area is correctly protected, sufficient clearance is available around the vehicle and movements will not present risks to other staff and the vehicle is correctly secured against movement. Ensure all oil, grease and other fluid containers or contaminated materials are stored or disposed of as per the relevant procedures. Any specific requirements over and above those listed will be identified in the applicable job descriptions or section seven.

Auditable records of maintenance to this manual shall be kept in accordance with RIS-1530-PLT.

7.3. Definitions

Term	Definition
Adjust	Correct to defined limits.
Change	Remove the original, and fit a new or overhauled part or assembly in its place.
Check	Determine a particular nominal condition before, during or after repair, e.g. completeness, security and position.
Clean	Take off all dirt and deposits.
Defect / Defective	Any fault or faults in a component or assembly that prevent it from fulfilling its designed purpose.
Dismantle	Take to pieces.
Examine	Determine general condition before repair, e.g. wear, cracks, splits, leaks, scoring, corrosion, breaks, distortion and looseness.
Gauge	Determine a nominated dimension by using suitable measuring equipment, for example ruler, micrometer, callipers, feeler gauges or Go/No-Go gauge.
Inspect	Determine conformity to required standards during and after repair.
Overhaul	Do what is necessary to make an assembly or sub-assembly reusable, that is dismantle, strip, clean, examine, fit new parts, repair, reassemble, test and inspect as required.
Paint	Impart colour to a surface.
Reassemble	Put together
Record	Put down in writing the result of any specified examination, test or inspection.
Rectify	To set right (does not include renewal)
Refit	Put back together and reconnect.
Remove	Disconnect and take off.
Renew	Remove and scrap the original part, and provide a new specified part in its place.
Repair	Restore an original part to the required condition e.g. by hand tooling, machining, building up, welding, patching, bending and setting, heat treating, re-securing etc. (Does not include renewal).
Report	Convey to the Supervisor the condition of the item examined.
Strip	Remove covering, that is, paint, polish, fabric.
Test	Prove correct operation by specified trial.

7.4. Technical cleaning

The machine must be cleaned on regular base to extend the lifetime of the machine.

REMARKS
Do not use any aggressive or abrasive cleanings.
Do not use water on or near electrical parts, electrical cables and hydraulic hoses. Please note that water on high pressure as this can potentially lead to damage.

Steelwork must be cleaned with dry cloths. By serious contamination water and soap can be used.
Control panels cabinets must be cleaned with a dry cloth or a vacuum cleaner.

7.5. Safe Working Practice

The following is for general guidance only and is not a definitive list of necessary practices necessary for undertaking the functions described. It is understood that all maintenance and repair work will be undertaken by competent and suitably qualified personnel who will apply suitable practices and judgements. Personnel should be familiar with the task before undertaking any work.

General remarks:

- Place the MEWP in a level working area free of any items and mark off the area. If you cannot comply with these conditions (the lifting platform is on a building site, chock the wheels, mark off the area around the lifting platform and take note of any hazards associated with the surroundings.
- Switch off the MEWP, using the battery cut-out, before embarking on any procedure (unless specifically instructed otherwise).
- As soon as the weight of a component or an assembly exceeds 20kg, the procedure indicates this and it is advisable to use handling equipment for dismantling them, provided that their characteristics (as indicated on the manufacturer's info plates or the tare plates) are suitable for the operation to be performed.
- For cleaning purposes, use appropriately approved, non-flammable solvents.
- When removing or refitting any component, scrupulously follow the procedure stated, step by step; always finish the current step before moving on to the next one.
- If you experience any resistance when removing a component, do not force it. Check that the nuts, screws, and cables have been removed and that no nearby component is interfering with the work.
- The most important factor in preserving the MEWP's service life is to maintain a high level of cleanliness in its vital components.
- Where not stated, the refitting operations consist of performing the removal operations in reverse order.

General mechanical remarks:

- Use screws with the same characteristics as those of the original screws and of an appropriate length.
- When the procedures do not state a value for the tightening torques to be applied to the nuts and bolts, you should use the standard values appropriate for the characteristics of the particular components.

General hydraulics remarks:

- Some of the hydraulic lines are under high pressure, even when the MEWP is not operating. To avoid any accidents:
  - Follow the hydraulic line pressure release procedure before starting to work on one of their components.

- Some cylinders are fitted with valves used for putting the MEWP into safe mode when the movements stop by retaining hydraulic pressure in the cylinder's chambers. This means that a cylinder once removed may still have very high pressure in its chambers. It is therefore advisable to:
  - Follow the pressure release operations for the cylinder to be removed.
  - Eliminate the pressure in the chambers before starting to remove a cylinder.
- Before working on a hydraulic component, clean the immediate surroundings and provide receptacles or cloths for catching any oil likely to escape during the removal procedure and plugs or caps for sealing off the holes and to prevent foreign bodies getting into the circuit.
- The covers, hatches, seals and filters are intended to keep the hydraulic oil pure and prevent any foreign bodies from getting into the circuit. For these parts, therefore, you must periodically:
  - Check that there is no damage.
  - Maintain a correct level of cleanliness.
- Use male and female plugs for sealing off hoses and hydraulic connections.
- Cloudy oil is a sign of a significant proportion of moisture, which will cause oxidisation / corrosion of the circuit's metal parts: purge and clean the whole circuit; then refill the circuit with new oil.
- If the circuit should be contaminated by the presence of foreign bodies (metal, rubber, etc.), purge and clean the whole circuit; then refill the circuit with new oil.
- We do not recommend that you mix different types or different brands of oil in that there is no guarantee that they are of equivalent composition or viscosity.

Before lubrication and maintenance tasks:

- Vehicle must be on firm level ground.
- Ensure the parking brakes are applied (not manually released).
- Stop engine and remove starter key.
- Isolate the Battery.
- Allow engine to cool.
- Chock wheels.

Warning – Fluids

Handle fluids with care. Avoid skin contact with used oil. Protect hands with an effective barrier cream and/or gloves. Fluids under pressure can escape from extremely small holes. Avoid checking for leaks on pressurised systems, approach with extreme caution and NEVER use body parts such as hand or fingers to detect source. Always dispose of waste lubricants and filters in a responsible manner.

Warning-Hydraulic Connections

Ensure all hydraulic connections are tight. Relieve all pressure by moving the hydraulic control levers, venting pressurized tank and allow the system to cool before disconnecting hoses or lines. Unload hydraulic cylinders and similar systems such as brake units before working on any circuit connection where load induced or trapped pressure could be released.

Hydraulic Hoses

Ensure any replacement hydraulic hoses are of an equivalent or superior rating to original fitments and correctly routed. Refer to hydraulic circuit diagrams for specific information regarding pressures in separate parts of the hydraulic system.

Warning - Batteries

Batteries shall be recharged in a well ventilated area free of flame, sparks or other hazards that may cause explosion. Highly explosive hydrogen gas is produced during the charging process. When checking electrolyte levels great care should be taken to protect eyes, skin and clothing. Battery acid is highly corrosive and protective glasses and clothing is recommended. When disconnecting the battery, disconnect the negative terminal before undoing the positive terminal clamp. When connecting the battery, fit and tighten the positive terminal clamp before connecting the negative terminal.

Fasteners

Renewal Policy

All split cotter pins, star washers, locking tabs and spring washers removed during maintenance and repairs MUST BE RENEWED. All other fasteners removed during maintenance and repairs shall be renewed if any part of them is worn or distorted. Where fasteners are renewed, they must be renewed with parts of the same size, grade and finish.

Tightening of Threaded Fasteners

Where torque loading is specified nuts, bolts and screws must only be tightened by means of a calibrated torque wrench wherever practical to do so.

Unless otherwise specified, slotted nuts shall be over tightened if necessary to align the next slot to allow for the insertion of split cotter pins. Under no circumstances shall nuts be eased back.

When prevailing torque nuts are used, at least 1 complete threads of the bolt must protrude through the nut.

7.6. Maintenance frequency

Exam code	Frequency	Working hours
A	Daily or pre-use	10
B	Weekly	50
C	Monthly	200
D	6 monthly	1200
E	Yearly	2500
F	As required	-

7.7. Daily/Pre Use Checklist

Before use each day, or at the beginning of each shift, check the safe condition of the machine by visual inspection including, but not limited to the following:

- Operating and Safety Manuals are available and legible.
- Chassis superstructure for damage.
- Safety harnesses and hard hats.
- Fluid leaks (Check the ground under & around the vehicle).
- Fluid levels.
- All instruction and warning labels are legible.
- All wheels for loose or missing fastenings.
- Emergency stops for correct operation.
- Lights, operational & undamaged.
- Operation of horn.
- Driving controls, functioning correctly & undamaged.
- Check installation of all guards and covers.
- Check for loose, missing or damaged parts.
- Ensure routine maintenance is up to date.

DO NOT OPERATE UNTIL ALL FAULTS HAVE BEEN RECTIFIED

7.8. Task descriptions

For task descriptions of the Manitou base machine refer to the maintenance table in the Manitou - 547408 EN Instructions manual, Section 3, page 3-10.

Job no.	Job title	Activity	Exam Code					
			A	B	C	D	E	F
Rail Bogies								
RB01	Bogie Structure	Check		X	X			
RB02	Bogie Structure	Examine				X	X	
RB03	Oscillating Axle	Check			X	X	X	
RB04	Oscillating Axle	Examine				X	X	
RB05	Bogie Cylinders	Check		X	X	X	X	
RB06	Balance Valve	Test					X	
RB07	Bogie Bushes	Examine				X	X	
RB08	Wheel Motors	Examine			X	X	X	
RB09	Bogies	Lubricate		X	X	X	X	
RB10	Oscillating Axle	Lubricate		X	X	X	X	
RB11	Rail Lights	Check - Clean	X	X	X			
RB12	Rail Lights	Examine				X	X	
RB13	Security Labels	Check	X	X	X	X	X	
RB14	Bogie End Switches	Check	X	X	X	X	X	
RB15	Bogie End Switches	Test			X	X	X	
RB16	Rail Head Scrapers	Examine	X	X	X	X	X	
Wheels								
WH01	Rail Wheels	Check		X	X			
WH02	Rail Wheels	Examine				X	X	
WH03	Rail Wheel Back to Back	Gauge				X	X	
Chassis								
CH01	Tension Rods	Check	X	X	X	X	X	
CH02	Tension Rods	Examine			X	X	X	
CH03	Chassis Structure	Examine				X	X	
CH04	Turret Position Switches	Examine			X	X	X	
CH05	Tow Bar	Check		X	X	X	X	
CH06	Safety Labels	Check	X	X	X	X	X	

Job no.	Job title	Activity	Exam Code					
			A	B	C	D	E	F
Superstructure								
SS01	Operation of Horn	Check	X	X	X	X	X	
SS02	Operation of Horn	Test					X	
SS03	Boom Down Switch	Check			X	X	X	
SS04	Telescope Retracted Switch	Check			X	X	X	
SS05	Manual Lock Turret	Check	X	X	X	X	X	
SS06	Access Panels	Check	X	X	X	X	X	
SS07	Boom condition	Check			X	X	X	
Basket								
BA01	Guards	Check	X	X	X	X	X	
BA02	Anchor Points	Check	X	X	X	X	X	
BA03	Safety Labels	Check	X	X	X	X	X	
BA04	Basket Structure	Examine		X	X	X	X	
BA05	Overload Detection	Test				X	X	
BA06	Data Logger	Check		X	X			
BA07	Data Logger	Examine				X	X	
Hydraulic System								
HS01	Hydraulic Leaks	Check	X	X	X	X	X	
HS02	Hydraulic Hoses and Fittings	Examine			X	X	X	
HS03	Hydraulic Valves	Examine					X	
Brakes								
BR01	Wheel Motor Brakes	Check	X	X	X			(1)
BR02	Wheel Motor Brakes	Examine				X	X	
BR03	Brake	Test					X	
BR04	Slewing motor brake	Test				X	X	
BR05	Trailer brakeaway	Test				X	X	
Electrical Systems								
ES01	Emergency Stop Buttons	Test	X	X	X	X	X	
ES02	Control Panel	Check	X	X	X	X	X	
ES03	Wiring and Connectors	Examine			X	X	X	
ES04	Earth Connections	Check	X	X	X	X	X	(2)
ES05	Basket Lock Switch	Test			X	X	X	(3)
ES06	Emergency recovery pump	Test		X	X	X	X	
ES07	ALO slew limiter	Test			X	X	X	(4)
ES08	Slewing position switches	Test			X	X	X	
Statutory Examination								
SE01	LOLER Examination	Test				X	X	

(1) After every emergency stop (dynamic braking) the performance of the disc brakes must be checked.
(2) Before travelling under live overhead lines the earth bounding connections must be checked.
(3) Before travelling under live overhead lines the correct operation of the basket lock must be tested.
(4) Before start of work with any lines open the correct functioning of the ALO slew limiter must be tested.

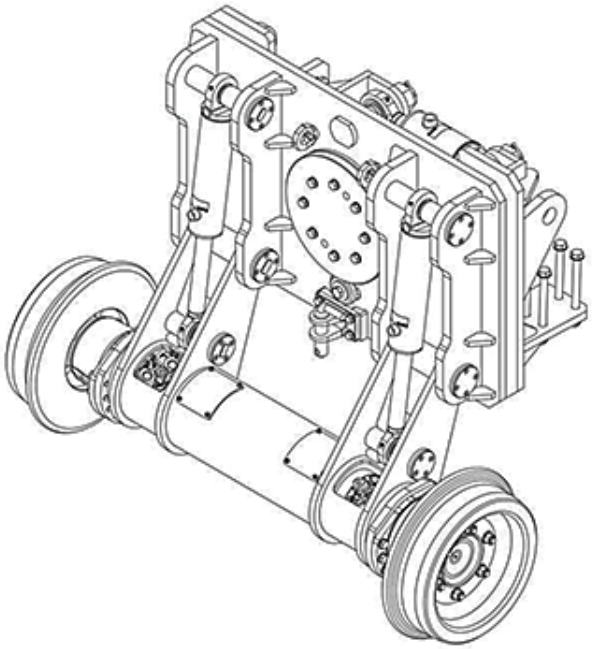
Scheduled Work is that mandatory work which should be undertaken at the prescribed examination intervals.

Arising Work is that work that is to be done to rectify the defects found in the course of carrying out Scheduled Work.
The item numbers of the two parts correspond. i.e. the work to be done to rectify a defect in item 1 of scheduled work will be found in item 1 of arising work.

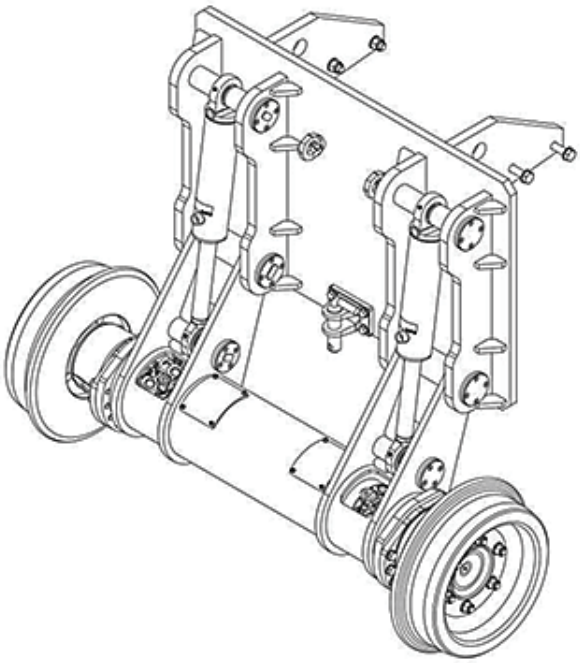
7.9. Maintenance instructions Rail Bogies

7.9.1. Bogies – Check

Job no. RB01



Oscillating axle bogie



Fixed axle bogie

Purpose

On and off tracking of the MEWP, travelling, release and block the oscillating axle for stability.

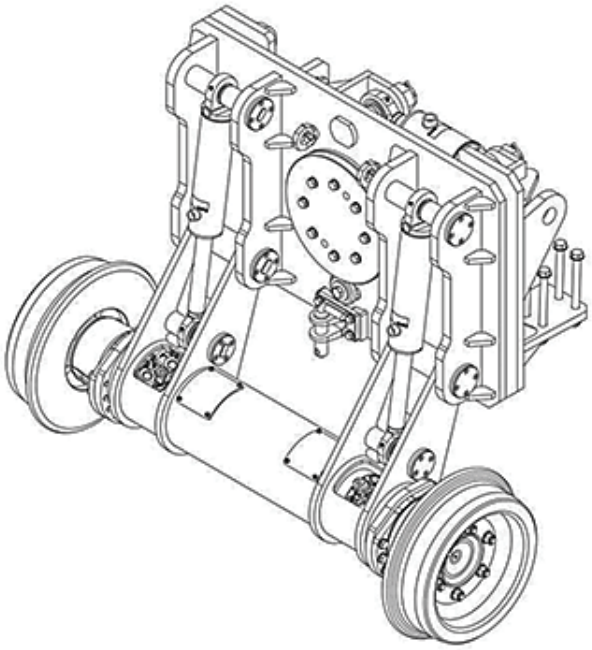
Scheduled work

1. Check general condition; no visual defects (damage, leakage, wear, corrosion, looseness, slack, etc.)
2. Check that there is evidence of surplus grease escaping from all lubricated pins and bushes
3. Put oscillating axle bogie and fixed axle bogie in downward position.
4. Check for abnormal sounds or vibration during operation.
5. Report all observations to the responsible person(s).

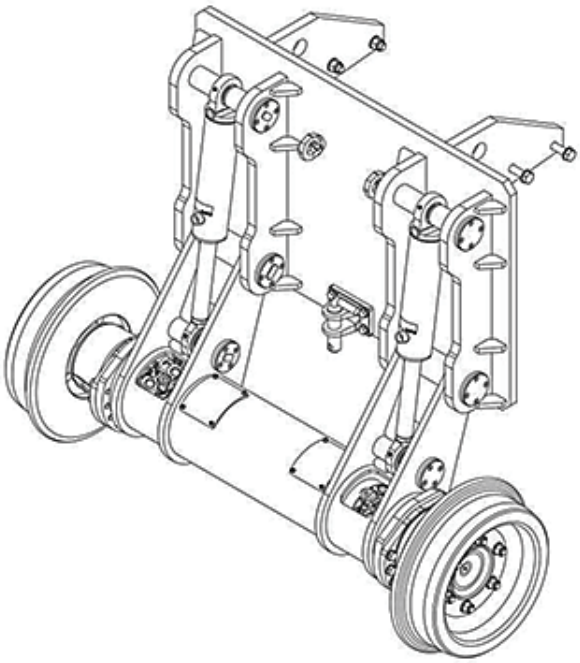
Arising work

1. Carry out Job No. RB02 Bogies - Examine
2. Carry out Job No. RB09 Bogies - Lubricate
4. Renew defective or missing components

7.9.2. Bogies – Examine **Job no. RB02**



Oscillating axle bogie



Fixed axle bogie

Purpose

On and off tracking of the MEWP, travelling, release and block the oscillating axle for stability.

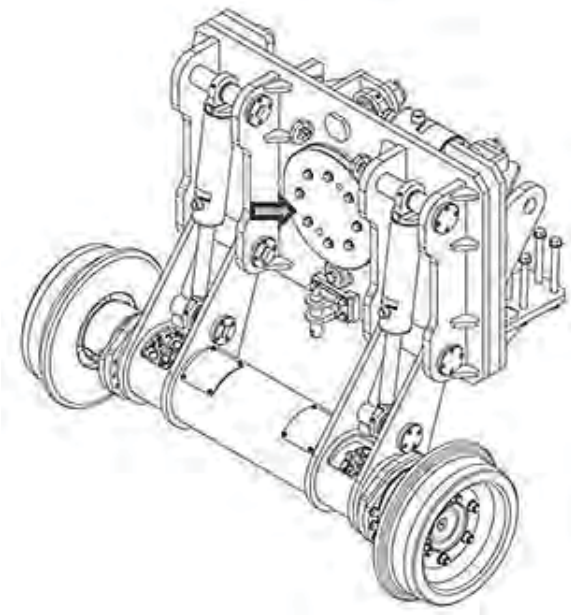
Scheduled work

1. Examine each bogie structure, particularly welded joints for signs of cracks and deformation
2. Examine the bogie mounting nuts and bolts:
   2.1. Check if M20 frame mounting nuts and bolts are tightened to 620 Nm.
   2.2. Check if all other mounting nuts and bolts are fastened.
3. Report all observations to the responsible person(s).

Arising work

1. Repair defects in accordance with procedure prepared by competent body.
2. If any nut/bolt moves more than half a turn renew them all. Examine threads in tapped holes for damage.

7.9.3. Oscillating Axle – Check **Job no. RB03**



Oscillating axle bogie

Purpose

To ensure that all rail wheels remain sufficiently loaded during working/travelling.

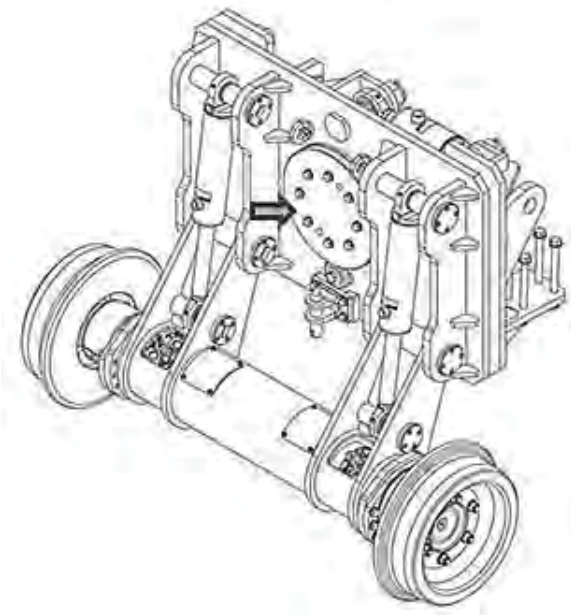
Scheduled work

1. Check general condition; no visual defects (damage, leakage, wear, corrosion, looseness, slack, etc.)
2. Check that there is evidence of surplus grease escaping from oscillating axle
3. Put oscillating axle bogie in downward position.
4. Check the oscillating axle clearance by examining the difference in distance between fix plate and rotating measured at top and bottom of the plates.
5. Report all observations to the responsible person(s).

Arising work

1. Carry out Job No. RB04 Oscillating axle - Examine
3. Carry out Job No. RB10 Oscillating axle - Lubricate
4. Renew the oscillating axle sliding bushes and rings. Contact manufacturer.

7.9.4. Oscillating Axle – Examine **Job no. RB04**



Oscillating axle bogie

Purpose

To ensure that all rail wheels remain sufficiently loaded during travelling and working.

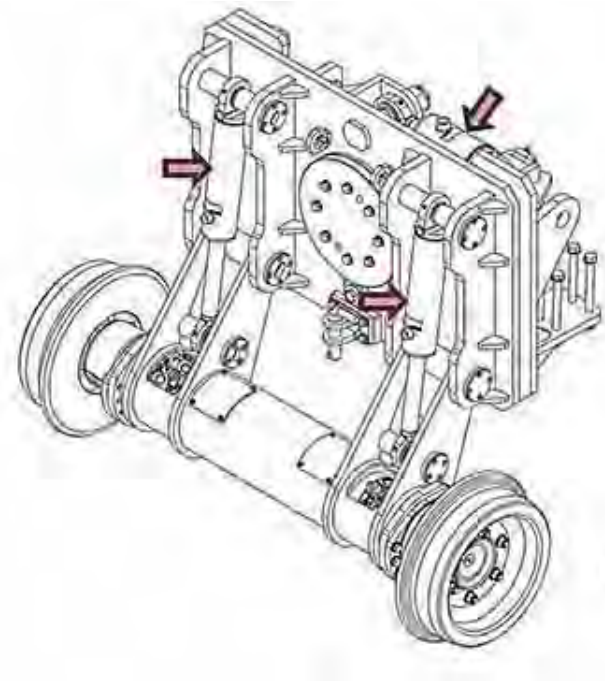
Scheduled work

1. Check if the cover plate mounting bolts are tightened to 300 Nm
2. Examine the structure, particularly the welded joints of the cylinder mounting for any signs of cracks or defamation.
3. Put oscillating axle bogie in downward position.
4. Check the oscillating axle clearance by measuring the difference in distance between fix plate and rotating measured at top and bottom of the plates, tolerance 42-52 mm.
5. Report all observations to the responsible person(s).

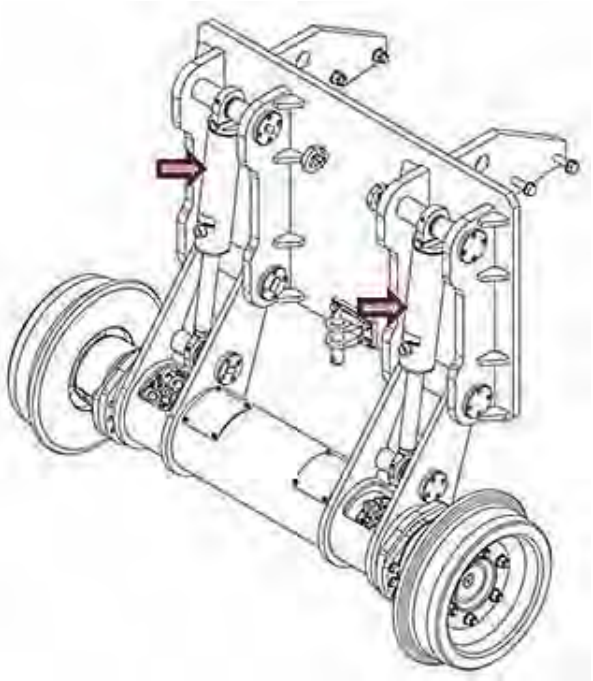
Arising work

1. If any nut/bolt moves more than half a turn renew them all. Examine threads in tapped holes for damage.
2. Repair defective components in accordance with procedure prepared by competent body.
4. Renew the oscillating axle sliding bushes and rings. Contact manufacturer.

7.9.5. Cylinders (Bosch CDL2) – Check **Job no. RB05**



Oscillating axle bogie



Fixed axle bogie

Purpose

Lifting cylinders to operate bogies up and down and one cylinder to lock the oscillating axle.

Position

- Cylinders [2x] oscillating axle bogie (pos. no. 11, drawing no. 21.00.00.004).
- Cylinder [1x] oscillating axle (pos. no. 52, drawing no. 21.00.00.005).
- Cylinders [2x] fixed axle bogie (pos. no. 17, drawing no. 21.00.00.004).

Scheduled work

1. Remove cover plates protecting cylinders.
2. Check general condition; no visual deviations (damage, leakage, wear, corrosion etc.)
3. Examine if piston rod is straight and surface is in good condition.
4. Examine balance valves on all lifting cylinders:
   - 4.1. Mechanical damage
   - 4.2. No leakage
   - 4.3. Firmly tightened on cylinder port
   - 4.4. Hoses and fittings in good condition
5. Examine poppet valves on oscillating axle cylinder:
   - 5.1. Mechanical damage
   - 5.2. No leakage
   - 5.3. Firmly tightened on cylinder port

(RB05 continued)

5.4. Coil not damaged
5.5. Electrical connection not damaged

6. Check oscillating cylinder mounting castle nut and split pin (present, not damaged).
7. Report all observations to the responsible person(s).
8. Check that all protective covers are secured after finishing the job.

Arising work

2 If one or more cylinders are in bad condition, cylinder(s) should be replaced, contact manufacturer.
3 If one or more cylinders are in bad condition, cylinder(s) should be replaced, contact manufacturer.
4.1. Replace balancing valve. Contact manufacturer.
4.2. Replace balancing valve. Contact manufacturer.
4.3. Tighten firmly
4.4. Replace hose by a hose of the same or higher rating
5.1. Replace poppet valve. Contact manufacturer.
5.2. Replace poppet valve. Contact manufacturer.
5.3. Tighten firmly
5.4. Replace coil
5.5. Replace / rewire the connector.
6. Replace nut and/or split pin.

7.9.6. Balancing Valve Lifting Cylinders – Test

Job no. RB06

Location

- On the upper port of all bogie lifting cylinders (4x)
- On the lower port of all bogie lifting cylinders (4x)

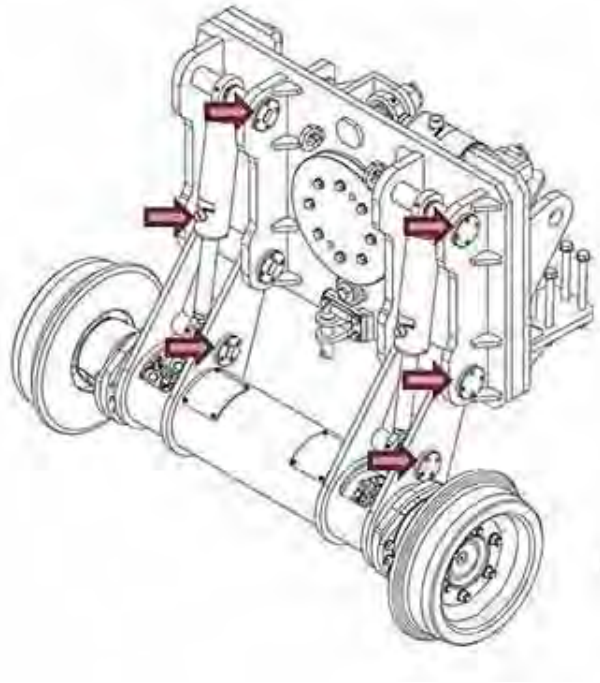
Scheduled work

1. Check moderate operating speed for vehicle lifting and vehicle lowering, without jerking.
2. With the vehicle in rail position, turn off the engine.
3. Measure the lengths of each lifting cylinder rod exposed.
4. Leave the vehicle in this condition for half an hour.
5. Re-measure the exposed cylinder rods.
   Cylinder rods should not have decreased by more than 2 mm.

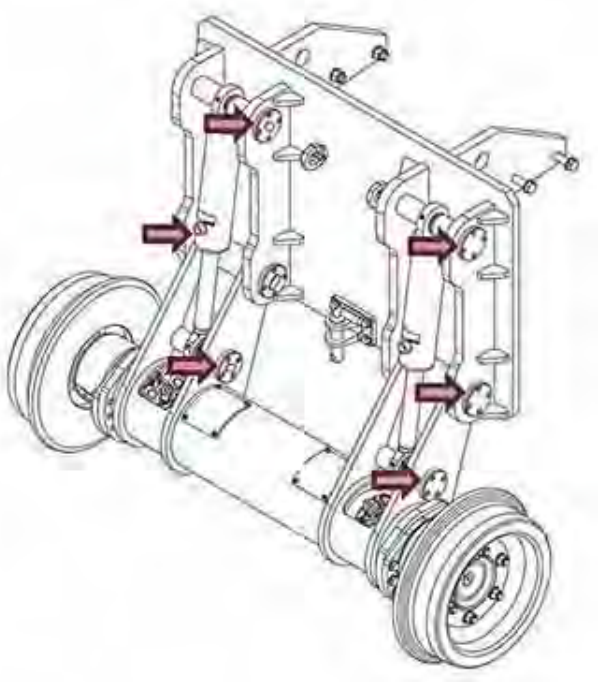
Arising work

5. Replace upper balancing valve. Contact manufacturer.
5. Repeat the test after repairs or adjustments have been made

7.9.7. Bogie Bushes – Examine **Job no. RB07**



Oscillating axle bogie



Fixed axle bogie

Position

- Sliding bushes cylinders [8x] oscillating axle bogie (pos. no 8, drawing no. 21.00.00.012).
- Sliding bushes axle [8x] oscillating axle bogie (pos. no 10, drawing no. 21.00.00.010).
- Sliding bushes axle [8x] fixed axle bogie (pos. no. 3, drawing no. 21.00.00.010).
- Sliding bushes cylinders [8x] fixed axle bogie (pos. no. 5, drawing no. 21.00.00.012).

Scheduled work

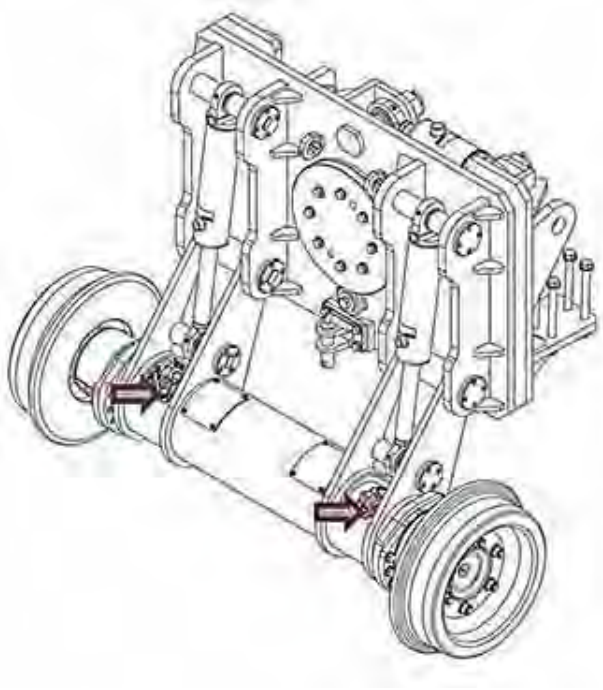
1. Check general condition; no visual deviations (damage, leakage, wear, corrosion etc.)
2. Examine the condition of the sliding bushes (slack on pin)
3. Check if the lock plate mounting bolts are fastened.
4. Check that there is evidence of surplus grease escaping from oscillating axle
5. Report all observations to the responsible person(s).

Arising work

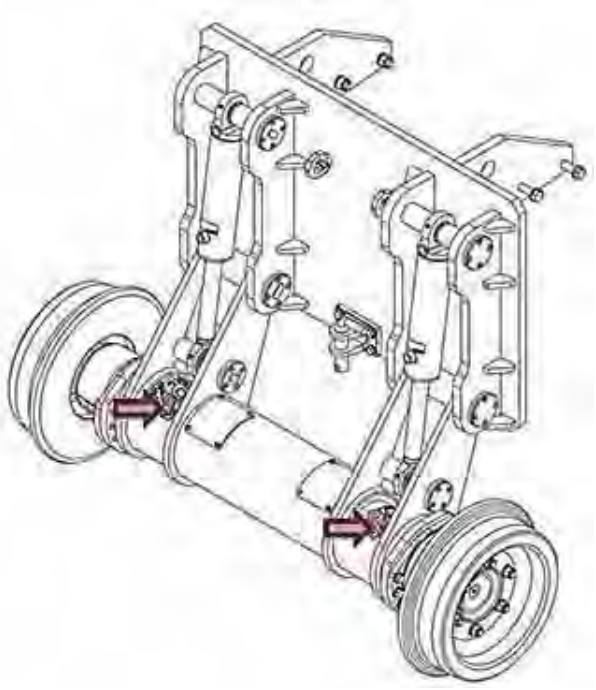
2. Renew the sliding bushes, contact the manufacturer.
4. Carry out Job No. RB10

7.9.8. Hydraulic Wheel Motors - Examine

Job no. RB08



Oscillating axle bogie



Fixed axle bogie

Purpose

Driving the rail wheels.

Position

- Hydraulic motors [2x] for the rail wheels oscillating axle bogie (pos. no. 16, drawing no. 21.00.00.002).
- Hydraulic motors [2x] for the rail wheels fixed axle bogie (pos. no. 15, drawing no. 21.00.00.002).

Scheduled work

1. Check general condition; no visual defects (damage, leakage, wear, corrosion etc.)
2. Check fittings for leaks or damage
3. Check hoses for leaks or damage
4. Check if the mounting bolts of the motor to the frame are tightened to 210Nm
5. Check if the mounting bolts of the wheels to the motor are tightened to 550Nm.
6. Perform running test. Check for abnormal sounds or vibrations during running.
7. Check if tools for manually releasing the parking brake (for towing) are in place and in good condition.
8. Report all observations to the responsible person(s).

Arising work

2. Tighten or replace the fitting
3. Replace hose by a hose of the same or higher rating.
4. Tighten the bolts to the required torque (replace if necessary).
5. Tighten the bolts to the required torque (replace if necessary).
6. Contact manufacturer.
7. Replace any missing or damaged parts.

7.9.9. Bogies – Lubricate

Job no. RB09

Location

- At cylinder axle pivots. Grease points are marked in red.

Scheduled work

1. Grease the axle pivots of the bogies via the grease nipples. Use grease conform requirements DIN 51 502: K3K-30 / ISO 6743-9: CCEA-3 (for example T43/Agrol). Apply until grease can be seen at the joint.
   2 or 3 squirts should be adequate.

7.9.10. Oscillating Axle – Lubricate

Job no. RB10

Location

- 2 grease points in cover plate of pivot. Grease points are marked in red.

Scheduled work

1. Grease the oscillating axle bearing via the grease nipples. Use grease conform requirements DIN 51 502: K3K-30 / ISO 6743-9: CCEA-3 (for example T43/Agrol). Apply until grease can be seen at the bearing. 2 or 3 squirts should be adequate.

Remark:

The ART 17 THM frame has a bolted frame, which can be converted into a multi gauge, shown procedure as above can be followed.

7.9.11. Rail Lights – Check - Clean

Job no. RB11

Location

- 2-colour LED Rail marker light at each bogie cylinder.

Scheduled work

1. Put the vehicle on track. As soon as both bogies are fully deployed the red rail marker lights are automatically switched ON.
2. Check operation of the marker lights.
3. Clean light lenses for good visibility if necessary.

Arising work

2. Investigate fault in wiring or renew the defective light.

7.9.12. Rail Lights – Examine **Job no. RB12**

Location

- 2-colour LED Rail marker light unit at each bogie cylinder.

Scheduled work

1. Examine general condition of the light unit, lenses and casing not damaged, no moisture in the light.
2. Examine the condition of wiring and connectors.
3. Put the vehicle on track. As soon as both bogies are lowered completely the red rail marker lights are automatically switched ON.
4. Check operation of the red marker lights.
5. Travel forward and backward
6. Check the operation of the white marker lights in travel direction
7. Check pressure switches on high pressure hydraulic pump
8. Report all observations to the responsible person(s).

Arising work

1. Replace the damaged light unit.
2. Rewire or replace connectors
4. Investigate fault in wiring or renew the defective light.
6. Investigate fault in wiring or renew the defective light.
7. Replace defective pressure switch.

7.9.13. Security Labels – Examine

Job no. RB13

Location

- Hand crush danger sticker on the cover of each bogie lifting cylinder.

Scheduled work

1. Check labels are in place and are legible.

Arising work

1. Renew labels.

7.9.14. Bogie End Switches – Check

Job no. RB14

Location

- Two end limit switches with corresponding cam on fixed and oscillating bogie.

Scheduled work

1. Check the presence and general condition of the end switches and cam plates (damaged, broken, looseness)
2. Report all observations to the responsible person(s).

Arising work

1. Replace defective parts.

7.9.15. Bogie End Switches – Test

Job no. RB15

Location

- Two end limit switches with corresponding cam on fixed and oscillating bogie.

Scheduled work

1. Whilst in road mode, lower both bogies, without fully deploying them.
2. Test operation of articulated boom and telescope is blocked when both bogies are not in the fully deployed position.
3. Lower one bogie fully into rail position.
4. With the key switch switches to rail mode, the white signal lamp on the rail operation panel is blinking
5. Lower the second bogie fully into rail position
6. Check the rail marker lights are not switching ON before the bogie cylinders are end of stroke. The white signal lamp is continuously ON.
7. Report all observations to the responsible person(s).

Arising work

2. Adjust the road position switches so that they are switching OFF when the lifting cylinders have reached end of stroke, fully retracted.
6. Adjust the rail position switches so that they are switching OFF when the lifting cylinders have reached end of stroke, fully deployed.

7.9.16. Rail Head Scrapers - Examine

Job no. RB16

Location

- All four rail wheels.

Scheduled work

1. Examine the integrity & security of the rail head scrapers.
2. Ensure that they do not exceed the maximum distance from the rail head of 30mm.

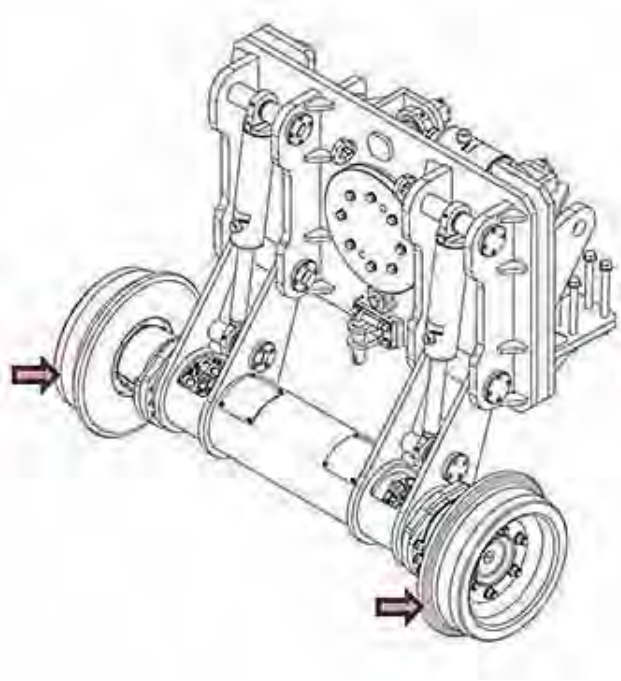
Arising work

1. Straighten & adjust the scrapers or replace the rubber sweeper as required.
2. Straighten & adjust the scrapers or replace the rubber sweeper as required.

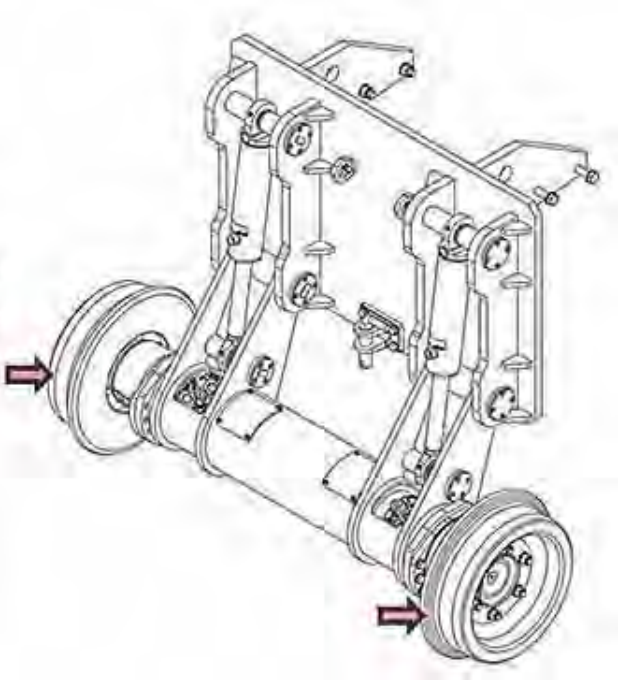
7.10. Maintenance instructions Rail Wheels

7.10.1. Rail Wheels - Check

Job no. WH01



Oscillating axle bogie



Fixed axle bogie

Position

- Wheels [2x] oscillating axle bogie (pos. no. 17, drawing no. 21.00.00.031).
- Wheels [2x] fixed axle bogie (pos. no. 16, drawing no. 21.00.00.031).

Scheduled work

1. Visually check the wheels for signs of pitting, scoring, flat spots or other damage.
2. Report all observations to the responsible person(s).

Arising work

1. Carry out job No WH02 Rail wheels - Examine.

7.10.2. Rail Wheels - Examine **Job no. WH02**

Location

- Wheels [2x] oscillating axle bogie (pos. no. 17, drawing no. 21.00.00.031).
- Wheels [2x] fixed axle bogie (pos. no. 16, drawing no. 21.00.00.031).

Scheduled work

1. Clean the entire wheel flange and tread, removing any grease, corrosion and debris.
2. Examine all surfaces of the wheel, checking for cracks, cavities, metal migration and flats.
   The limits for each will be found on Table on page 88.
   A description of the types of defects will be found in descriptive clauses A, B and C.
3. Use a 1/40th profile gauge to check flange thickness.
   3.1 With face A squarely on the flange back, hold the gauge radially to the wheel and draw it into profile, see figure 1.
   3.2 Acceptable profiles are indicated by the gauge contacting the profile only at the flange.

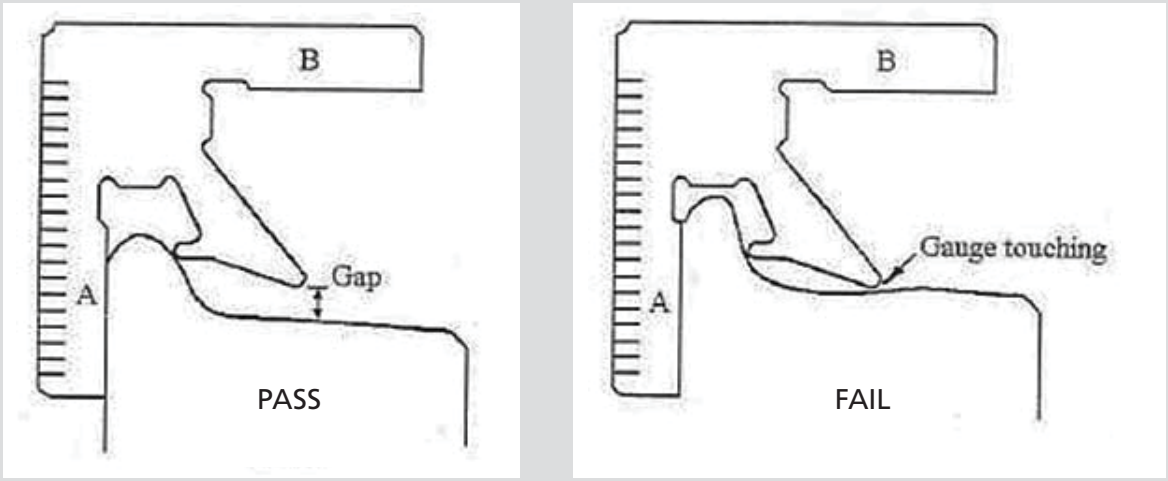
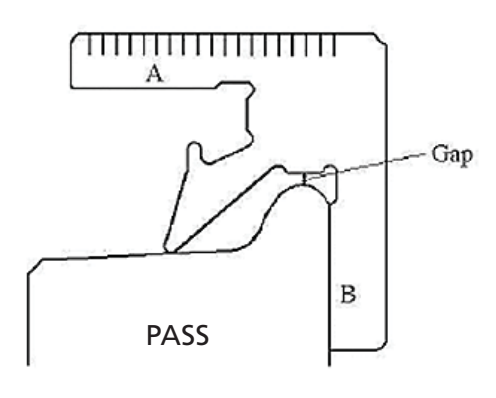


Figure 1: Use of GO / No-Go flange thickness gauge.

4. Use a 1/40th profile gauge to check flange height.
   4.1 With face B squarely on the flange back, hold the gauge radially to the wheel and draw it on to profile, see figure 2.
   4.2 Acceptable profiles are indicated by the gauge contacting the profile only at the tread.

(WH02 continued)



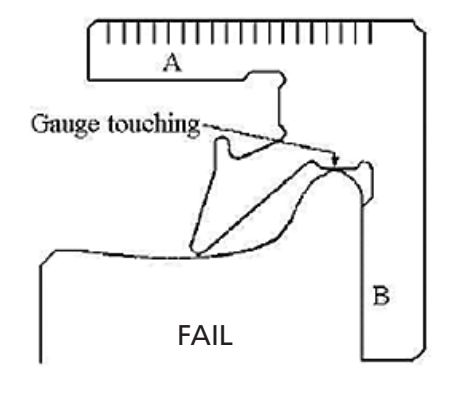


Figure 2: Use of GO / No-Go flange height gauge.

5. Report all observations to the responsible person(s).

Arising work

2 Assess amount of metal to be turned off to remove defect(s).
If wheels will not be turned below minimum diameter of 440 mm arrange for wheels to be re-profiled, otherwise renew wheels as a pair.

3 Assess amount of metal to be turned off to remove defect(s).
If wheels will not be turned below minimum diameter of 440 mm arrange for wheels to be re-profiled, otherwise renew wheels as a pair.

4 Assess amount of metal to be turned off to remove defect(s).
If wheels will not be turned below minimum diameter of 440 mm arrange for wheels to be re-profiled, otherwise renew wheels as a pair.

Vehicle No		Date	
Location		Examiner	
Type of defect	Allowable limit	Record findings here	
		Tick if none found	Record details if found
Cracks *See section 3*	None allowed		
Cavities *See section 4*	15 mm length		
Migration *See section 5*	5 mm tread roll over, otherwise no limit		
Flats	20 mm		

Tick if wear less than limit, or record if amount is over limit

Wear/ defect	Limit (mm)	Front axle		Rear axle	
		LEFT [1]	RIGHT [1]	LEFT [1]	RIGHT [1]
Tread hollow	1.5				
Flange [2]	4 [2]				
Steps	1.5				
False flange	2				
Wheel Ø (450 mm or 470 mm.)	10				
Back to back	1358-1362 Manufactured/re-profiled				
Back to back	1358-1363 In service				

[1]) *Left and Right is defined as standing with one's back to the machine in the normal direction of travel.*

[2]) *Flange thickness new 32.5 mm. worn 28.5 mm.*
Flange height new 32.0 mm. worn 36.0 mm.

Descriptive clauses

A. Cracks

Cracks normally have a jagged saw tooth-type of surface profile with sharp edges.

Cracks will normally form at the tread chamfer in an axial direction (across the thread) see Figure 3.

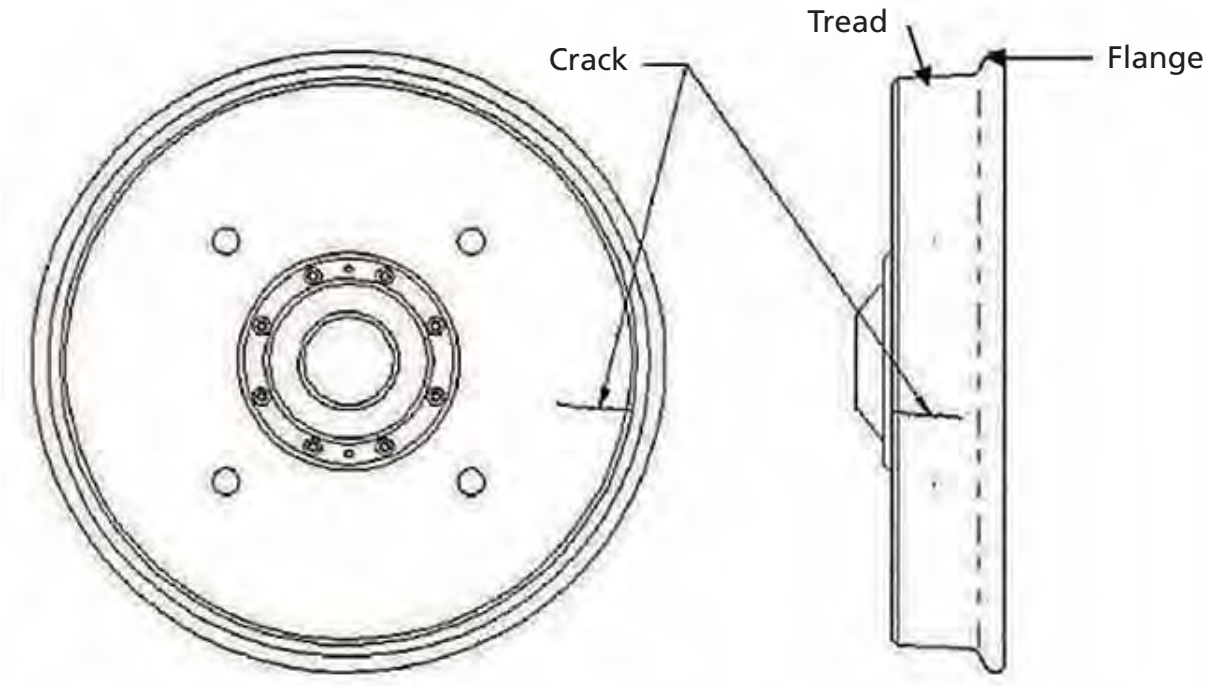


Figure 3: Wheel with crack.

No cracks are permitted, but see clauses B and C overleaf. Renew wheels unless the cracks can be completely removed by re-profiling.

B. Cavities

Rolling contact fatigue causes microscopic subsurface cracks which develop into a localised network. (See Figure 4.)

Figure 4: Microscopic cracks.

Figure 5: Cavities.

Over a long period small sections or spalls break away leaving cavities (see Figure 5). Record the number and length of the cavities. Take action if the length of any cavity exceeds 15 mm, or if two cavities are within 50mm of each other and their combined length exceeds 15 mm. Re-profile wheels to remove cavities and cracks, otherwise renew the wheels.

C. Migration

Material migration results from a rolling action that forces the surface material sideways. This can occur in two places:

C1. Tread Rollover. This forms on the tread chamfer (see Figure 7). The maximum allowable is 5 mm. Associated with this are circumferential cracks (see Figure 6) which do not affect the integrity of the wheel.

Figure 6: Circumferential cracking associated with rollover

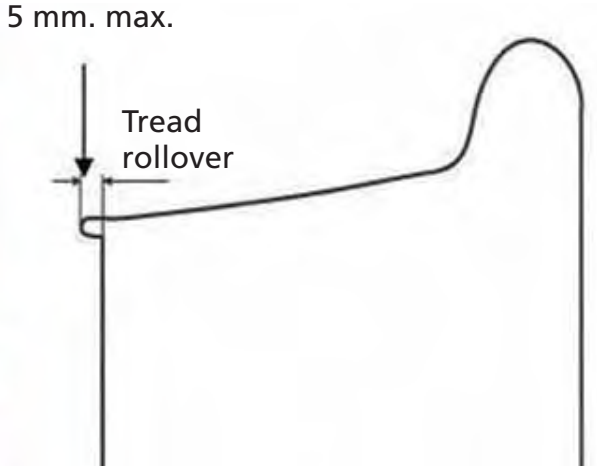
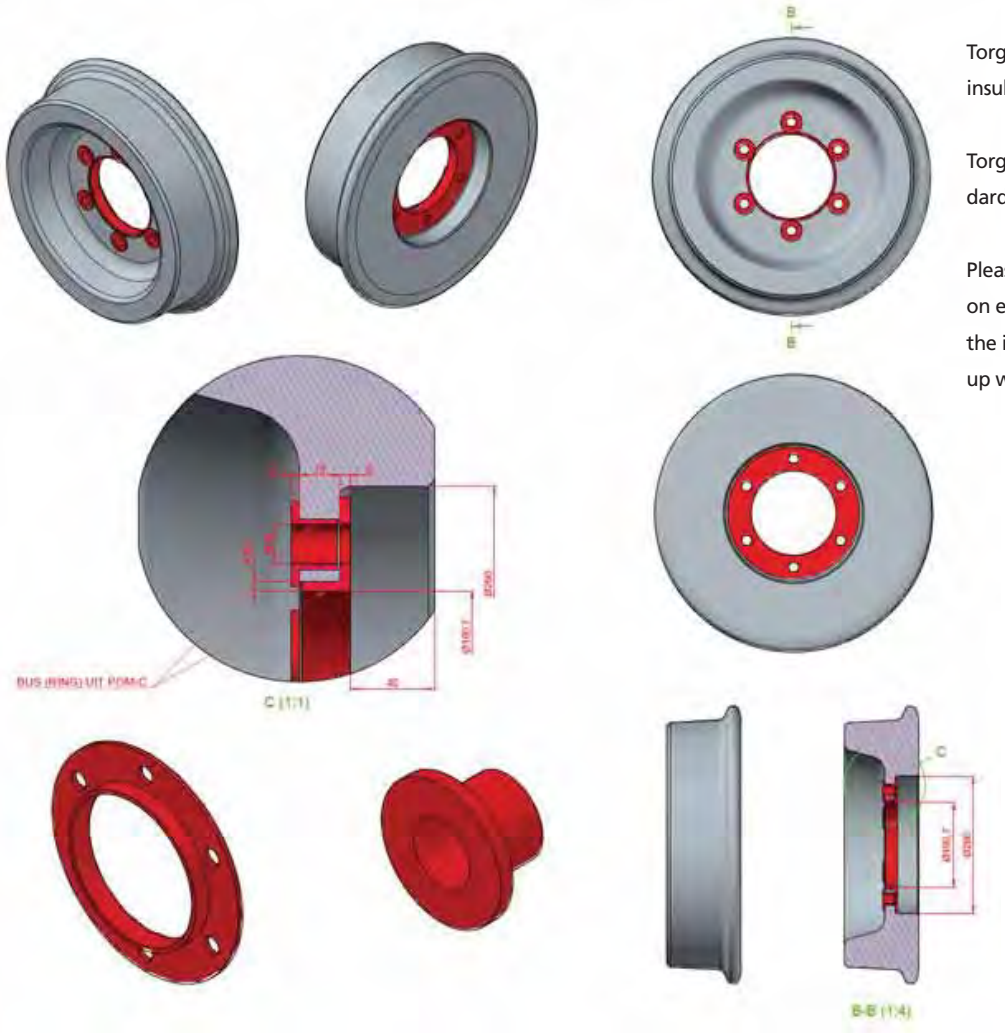


Figure 7: Rollover limit

C2. Migration down the flange, is shown in Figure 8 where the extreme edges have flaked off.

This does not affect the integrity of the wheel. These defects are removed when re-profiling becomes necessary to restore the wheel profile.

Figure 8: Migration down the flange.



Torgue moment wheelnuts insulated: 250 Nm.

Torgue moment wheelnuts standard railwheelnuts: 550 Nm.

Please ensure torgue moment on each individual wheelnut of the insulated side will be built up with steps of 50 Nm.

Drawing: ANZR G5 Insulated Railwheel.

7.10.3. Rail Wheels - Gauge **Job no. WH03**

Scheduled work

1. For both bogies, measure and record the back to back flange spacing at the top and bottom of the rail wheel, while the vehicle is standing on track.
   The measurement should be within tolerance 1358 mm. - 1362 mm. manufactured/re-profiled and
   1358 mm. - 1363 mm. In Service
2. Add 400kg load evenly distributed in the basket.
3. Repeat and record the back to back measurement.

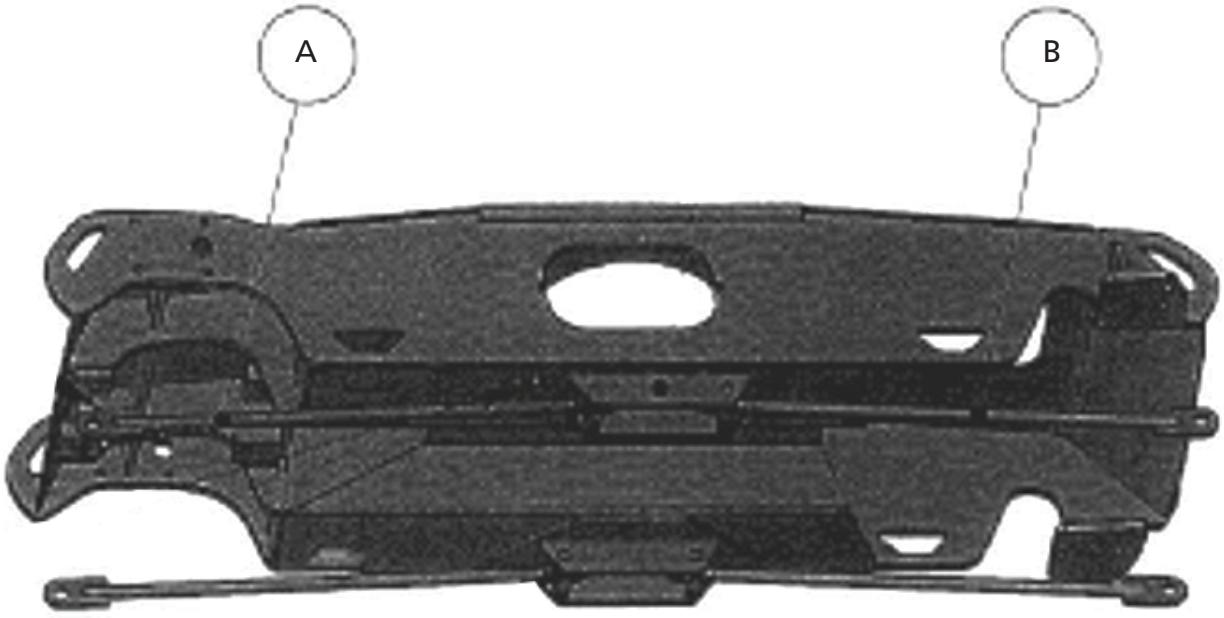
Arising work

1. Check the tightening of the wheel motor and wheel nuts. Refer to Job No. RB08.
3. Check the tightening of the wheel motor and wheel nuts. Refer to Job No. RB08.

7.11. Maintenance instructions Chassis

7.11.1. Tension Rods - Check

Job no. CH01



Position

- 2 tension rods (pos A) between fix axle bogie and vehicle chassis.
- 2 tension rods (pos B) between oscillating axle bogie and vehicle chassis.

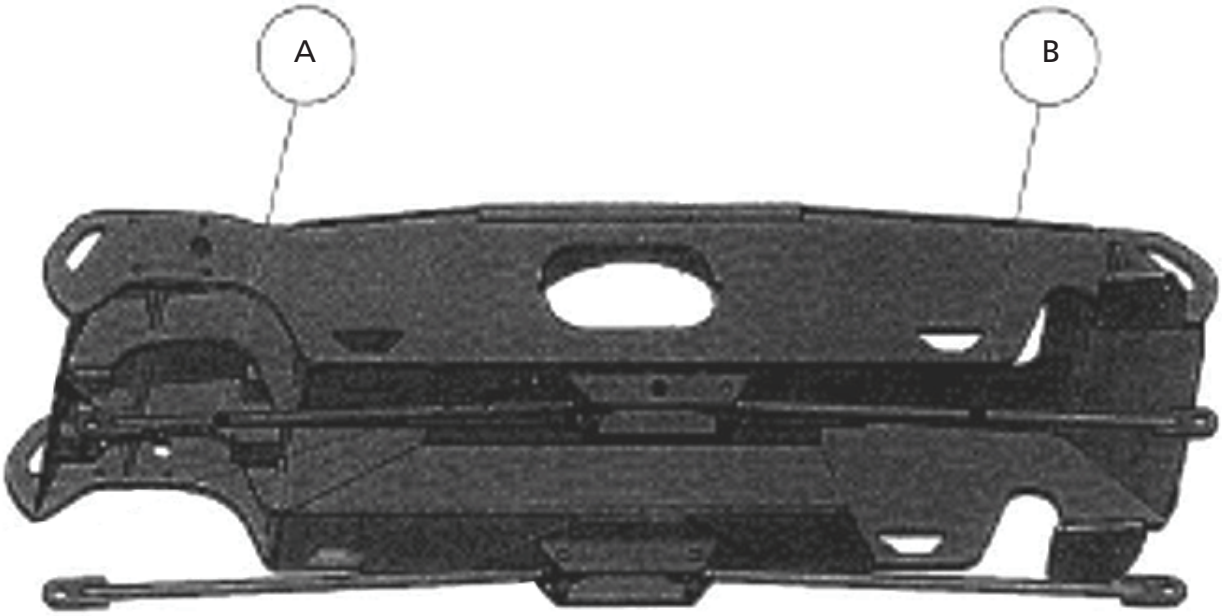
Scheduled work

1. Check general condition; no visual defects (damage, scratched, corrosion, looseness etc.)
2. Examine the tension rods are straight (no collisions occurred)
3. Report all observations to the responsible person(s).

Arising work

1. Carry out job No CH02 Tension rods – examine.
2. Replace the tension rods immediately.

7.11.2. Tension Rods - Examine **Job no. CH02**



Position

- 2 tension rods (pos A) between fix axle bogie and vehicle chassis.
- 2 tension rods (pos B) between oscillating axle bogie and vehicle chassis.

Scheduled work

1. Examine the mounting nuts of the subframe to the vehicle are tightened to 620 Nm.
2. Examine the tension rod M20 nuts are tightened to 200 Nm.
3. Check the counter nuts are fixed.
4. Examine the pins and tension rod lugs, no cracks.
5. Report all remarkable observations to the responsible person(s).

Arising work

1. Re-tighten the bolts.
2. Re-tighten the nuts.
3. Tighten the counter nuts.
4. Replace the tension rod and pin.

7.11.3. Chassis Structure - Examine

Job no. CH03

Scheduled work

1. Check general condition; no visual defects (damage, corrosion, looseness etc.)
2. Examine the chassis structure for fatigue (e.g. stress cracks in paint).
   Special attention to:
   2.1. The material above the cut out for the road axles.
   2.2. The mounting locations of the bogies to the vehicle chassis.
   2.3. The mounting locations of the tension rod subframes.
3. Report all observations to the responsible person(s).

Arising work

1. Correct all defects if found.
2. Contact the manufacturer.

7.11.4. Turret Position Switches – Examine

Job no. CH04

Position

- Three end limit switches with corresponding cam on turret bearing.

Scheduled work

1. On track the machine and switch to rail mode.
2. The green 'turret straight' signal lamp on the rail control panel in the basket is ON.
3. Rotate the turret. After about 3 deg. the green signal lamp is switching OFF.
4. Machine will not travel.
5. Rotate back to the straight position.
6. The green signal lamp is switched ON again.
7. Machine able to travel.
8. Repeat the test by rotating to the other side.

Arising work

2. Check wiring of the switches. Check roller lever of the switches is following the cam track.
3. Check wiring of the switches. Check roller lever of the switches is following the cam track.
4. Check wiring of the switches. Check roller lever of the switches is following the cam track.
5. Check wiring of the switches. Check roller lever of the switches is following the cam track.
6. Check wiring of the switches. Check roller lever of the switches is following the cam track.
7. Check wiring of the switches. Check roller lever of the switches is following the cam track.
8. Check wiring of the switches. Check roller lever of the switches is following the cam track.

7.11.5. Tow Bar – Check

Job no. CH05

Position

- Tow bar on the side of the vehicle chassis.
- Towing coupling at each end of the vehicle, mounted to the bogie structure.

Scheduled work

1. Check the tow bar is present and secure.
2. Check the towing couplings are complete (pin and locking pin).

Arising work

1. Secure the tow bar.
1. Replace the tow bar.
2. Replace the missing parts.

7.11.6. Security Labels – Check

Job no. CH06

Position

- Tow bar indication label above tow bar.

Scheduled work

1. Check labels are in place and are legible.

Arising work

1. Renew labels.

7.12. Maintenance instructions Superstructure

7.12.1. Operation of Horn – Check **Job no. SS01**

Position

- Above the battery.

Scheduled work

1. With the machine engine running, operate the horn from the panel in the basket. The horn should be audible.

Arising work

1. Investigate fault in wiring or renew the defective horn.

7.12.2. Operation of Horn – Test **Job no. SS02**

REMARK
This job will require two people for the results to be effective. Tools required - calibrated sound level meter and metre stick.

Location
- Above the battery.

Scheduled work
1. With the vehicle engine running at mid speed, stand 1m from the corner of the base machine and record the readings you achieve on the calibrated sound level meter. Repeat this process for each corner (4 in total)
2. With the vehicle engine still running at mid speed, operate the horn from the panel in the basket. Hold the calibrated sound level meter at a distance of 1m from the four corners of the base unit. Record all results on an appropriate form.
3. Compare the readings from steps 1 & 2, there should be a minimum of 10dBA greater between them and the horn should reach a minimum of 80dBA.

Arising work
3. Investigate fault in wiring or renew the defective horn, once repairs have been completed repeats the scheduled work above and record the results.

7.12.3. Boom Down Switch – Check

Job no. SS03

Location

- Near the rest of the upper articulated boom arm. Boom down is detected in rail mode by simultaneous signal of 2 proximity switches or by an additional third proximity switch signal).

Scheduled work

1. Check the general condition of the proximity switches and detection plate (damage, looseness, clean, condition of wiring).
2. Operate one of the articulate boom arms.
3. It is not possible to operate the bogie lifting cylinders.
4. Lower all boom arms in resting position.
5. The bogie lifting cylinders can be operated.
6. Report all observations to the responsible person(s).

Arising work

1. Clean detection face
1. Renew damaged parts.
3 If sensor is reacting on metal, adjust the sensing distance. Otherwise investigate fault in wiring or replace the defective proximity switch.
5 If sensor is reacting on metal, adjust the sensing distance. Otherwise investigate fault in wiring or replace the defective proximity switch.

7.12.4. Telescope Retracted Switch – Check

Job no. SS04

Location

- At the back of telescope arm, behind the cover plate. Telescope retracted is detected in rail mode by simultaneous signal of 2 proximity switches or by an additional third proximity switch signal).

Scheduled work

1. Check the general condition of the proximity switches and detection plate (damage, looseness, clean, condition of wiring)
2. Operate the telescope arm.
3. It is not possible to operate the bogie lifting cylinders.
4. Fully retract the telescope arm.
5. The bogie lifting cylinders can be operated.
6. Report all observations to the responsible person(s).

Arising work

1. Clean detection face
1. Renew damaged parts.
3 If sensor is reacting on metal, adjust the sensing distance. Otherwise investigate fault in wiring or replace the defective proximity switch.
5 If sensor is reacting on metal, adjust the sensing distance. Otherwise investigate fault in wiring or replace the defective proximity switch.

7.12.5. Manual Lock Turret – Check

Job no. SS05

Location

- Manual lock on the chassis above the tow bar.

Scheduled work

1. Check the locking pin is complete (pin and locking pin).
2. Check the locking pin is straight and not damaged.

Arising work

1. Replace the missing parts.
2. Replace the locking pin.

7.12.6. Access Panels – Check **Job no. SS06**

Location

- Base machine.

Scheduled work

1. Check all access panels for signs of damage.
2. Check locks & handles are present fully functional.
3. Report all observations to the responsible person(s).

Arising work

1. Repair, where possible & replace where necessary.
2. Repair, where possible & replace where necessary.

7.12.7. Boom condition – Check

Job no. SS07

Location

- Articulated boom, telescope and jib.

Scheduled work

1. Check general condition of all boom parts, look for signs of damage, wear or cracks.
2. Report all observations to the responsible person(s).

Arising work

1. Contact manufacturer.
2. Contact manufacturer.

7.13. Maintenance instructions Basket

7.13.1. Basket Guards – Check

Job no. BA01

Location

- Guard rail around the basket.
- Guard bar in the three basket access points.
- Guard bar on the rail control panel to avoid unintended operation.

Scheduled work

1. Check the guards are present and not damaged.
2. Report all observations to the responsible person(s).

Arising work

1. Restore or replace the guard.

7.13.2. Anchor points – Check

Job no. BA02

Location

- 4 safety hook up points in the basket.

Scheduled work

1. Check the anchor points are in good condition and not damaged.
2. Check the anchor points are labelled.
3. Report all observations to the responsible person(s).

Arising work

1. Repair defective anchor points in accordance with procedure prepared by competent body.
2. Renew labels.

7.13.3. Security Labels – Check

Job no. BA03

Location

- Basket capacity label near operating manual box.
- Rail mode notification sticker near operating manual box.
- Beware Overhead line equipment and Do not climb sticker.
- Travelling under live wire warning text on all basket access points and control panel.
- Anchor points labels.
- Yellow-black stripes on the basket corners.

Scheduled work

1. Check labels are in place and are legible.

Arising work

1. Renew labels.

7.13.4. Basket Structure – Examine **Job no. BA04**

Scheduled work

1. Examine the basket structure, steps and all welded joints for signs of distortion, defects, corrosion or cracks.
2. Check the basket steps retaining strap for cuts and fraying. Check the clamps are secure.
3. Check the basket floor grid panels are secure.
4. Examine the steel cable (6x) for damage or cracks.
5. Report all observations to the responsible person(s).

Arising work

1. Repair defective basket structure in accordance with procedure prepared by competent body.
2. Renew retaining straps. Re-secure loose items, renewing fasteners if damaged or missing.
3. Re-secure floor panels.
4. Repair or replace defective steel cables in accordance with the construction drawing.

7.13.5. Overload Detection – Test

Job no. BA05

Scheduled work

1. Fully stow the machine, lowering all arms and place in travel mode.
2. Place a weight of 420 kg evenly distributed in the basket.
3. The movements for extending the telescope and raising the arms should be blocked (the buzzer is activated continuously in the basket).
4. Remove 20 kg.
5. Check the overload alarm stops.
6. Check data logger function following overload.
7. Report all observations to the responsible person(s).

Arising work

3. Contact the manufacturer.
5. Contact the manufacturer.
6. Contact the manufacturer.

7.13.6. Data Logger - Check

Job no. BA06

Scheduled work

1. Operate the emergency pump and check the data logger to make sure it has registered.
   The orange LED on the base station should be blinking.
2. Download of the data logger. The orange LED is switched off.
3. Report all observations to the responsible person(s).

Arising work

1. Contact the manufacturer.

7.13.7. Data Logger – Examine

Job no. BA07

Scheduled work

1. Download the previous 6 months worth of data from the data logger, send to the office for analysis and retain for future records/audits.
2. Report all observations to the responsible person(s).

Arising work

1. Contact the manufacturer.

7.14. Maintenance instructions Hydraulics

7.14.1. Hydraulic Leaks – Check

Job no. HS01

Location (added rail equipment)

- Bogie manifold, cylinders and wheel motors.
- Hydraulic valve blocks in box on side of chassis.
- Hydraulic swivel in the chassis.

Scheduled work

1. Check around the machine, in the chassis, under the bonnet and on the ground for signs of hydraulic leaks.
2. Report all observations to the responsible person(s).

Arising work

1. Investigate source of leak. Tighten leaking fittings. Renew defective items.

7.14.2. Hydraulic Hoses and Fittings – Examine

Job no. HS02

Location (added rail equipment)

- Bogie manifold, cylinders and wheel motors.
- Hydraulic valve blocks in box on side of chassis.
- Hydraulic swivel in the chassis.

Scheduled work

1. Examine the hydraulic hoses for cracking, cuts and abrasions. If the wire braid or spiral is visible, the hose must be replaced immediately.
2. Examine hose clamps for damage or looseness.
3. Report all observations to the responsible person(s).

Arising work

1. Replace defective hoses with hydraulic hoses of the same or superior rating. Use the same hose length and routing as the original situation.
1. Check the hoses and fittings for leakage after repair.
2. Replace defective clamps.

7.14.3. Hydraulic Valves – Examine

Job no. HS03

Location (added rail equipment)

- Bogie manifold, cylinders and wheel motors.
- Hydraulic valve blocks in box on side of chassis.
- Hydraulic swivel in the chassis.

Scheduled work

1. Examine the general condition of the manifolds and valve blocks (damage, leakage, corrosion, looseness, etc).
2. Examine the condition of the coils.
3. Examine the wiring and connectors to the coils.
4. Report all observations to the responsible person(s).

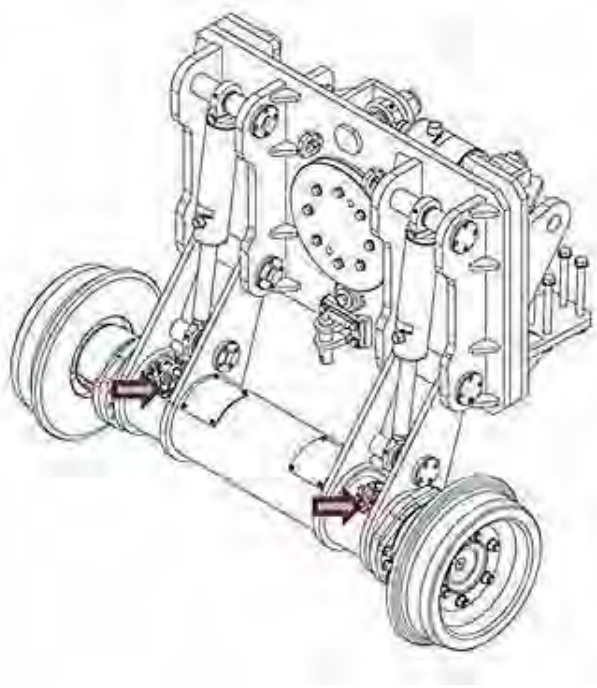
Arising work

1. Repair or replace defective components.
2. Replace coil.
3. Rewire or replace connector to the coil.

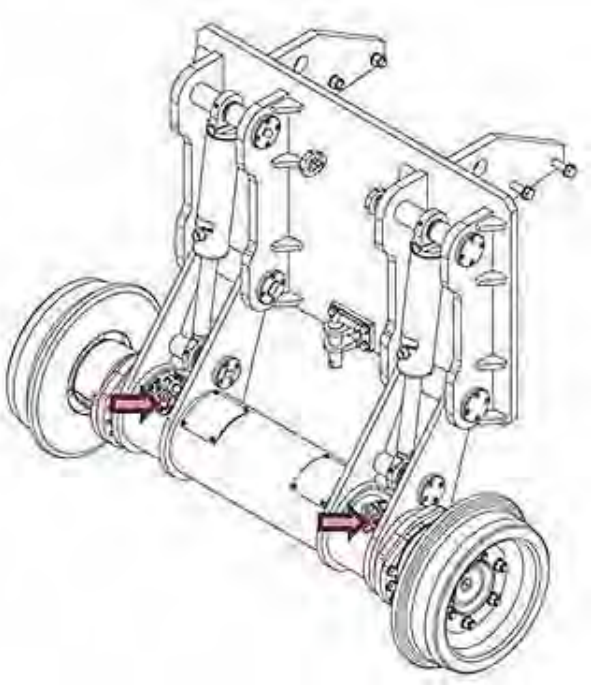
7.15. Maintenance instructions Brakes

7.15.1. Wheel motor brakes – Check

Job no. BR01



Oscillating axle bogie



Fixed axle bogie

Location (added rail equipment)

- Hydraulic motors [2x] for the rail wheels oscillating axle bogie (pos. no. 16, drawing no. 21.00.00.002).
- Hydraulic motors [2x] for the rail wheels fixed axle bogie (pos. no. 15, drawing no. 21.00.00.002).

Dynamic braking is performed hydrostatically on all 4 rail wheel motors.
Additionally the 4 rail wheel motors are equipped with a hydraulically lifted failsafe parking disc brake.

Scheduled work

1. Check the hydraulic drive system for oil leakage.
2. Check the wheel motor disc brakes are NOT mechanically lifted.
3. Lower one bogie till touching the track.
4. While lowering the other bogie, make sure of the rail wheels of the first bogie are braked and the wheels of the bogie which is lowered are released.
5. Check the proper function of the failsafe brakes.
6. Report all observations to the responsible person(s).

Arising work

1. Investigate and repair the source of the hydraulic leak.
2. Unscrew the mechanical lifting bolt from the wheel motor and secure the tools in the dedicated location. Ascertain that the seal is put back on the thread hole of the brake.
4. Carry out job No BR02 Wheel motor brakes - examine.
5. Re-check the proper function of the failsafe brakes.

7.15.2. Wheel Motor Brakes – Examine

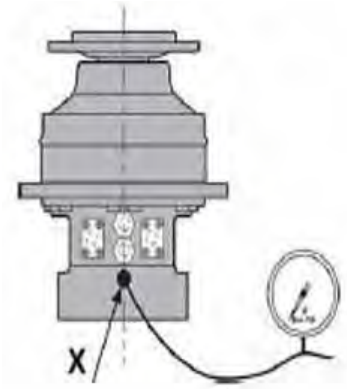
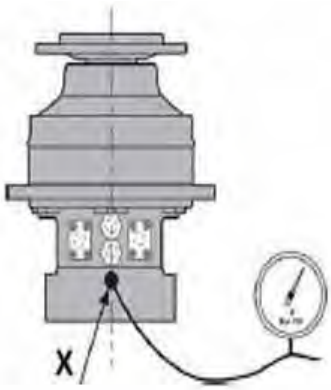
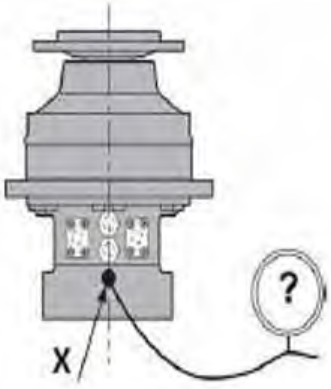
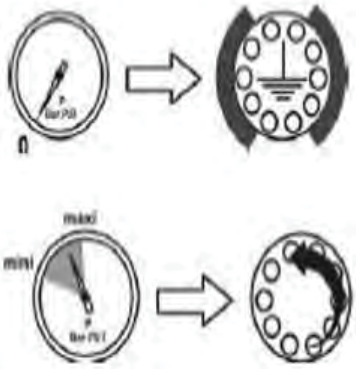
Job no. BR02

Position

- Hydraulic motors [2x] for the rail wheels oscillating axle bogie (pos. no. 16, drawing no. 21.00.00.002).
- Hydraulic motors [2x] for the rail wheels fixed axle bogie (pos. no. 15, drawing no. 21.00.00.002).

Scheduled work

1. Perform the measurement as indicated in procedure below. Minimum brake release pressure is 12 bar, maximum release pressure 30 bar.

Step	1	2
Action	Connect a manometer to the brake's supply port X. 	Progressively increase the brake's supply pressure up to its brake release pressure. 
Step	**3**	**4**
Action	Stop the supply to the brake. 	 Confirm that the residual brake release pressure is near zero. If its close or even over the minimum brake release pressure, check: - the brake shaft seal, - the brake release valve is often at fault.

Do not run-in the multidisc brakes.

2. Re-install original hoses and confirm there is no leakage.
3. Report all observations to the responsible person(s).

Arising work

1. Contact manufacturer when residual brake release pressure is too high.

7.15.3. Brake – Test **Job no. BR03**

Position

- Hydraulic motors [2x] for the rail wheels oscillating axle bogie (pos. no. 16, drawing no. 21.00.00.002).
- Hydraulic motors [2x] for the rail wheels fixed axle bogie (pos. no. 15, drawing no. 21.00.00.002).

Scheduled work

Test to be carried out on clean, dry, level rail.

1. Mark the rail position where the brakes are to be applied.
2. Run the machine until hydraulic oil has reached operating temperature.
3. In travel mode, hare speed, accelerate up to 12 km/h.
4. When the braking point is reached, brake hydrostatically without slipping by returning the running joystick towards neutral position.
5. Measure the distance taken to stop and record in accordance with RIS-1530-PLT.

   The maximum stopping distance on rail at a speed of 12 km/h is 12 m.

6. Repeat the test three times.
7. Record all results on an appropriate form and retain for future reference.
8. Report all observations to the responsible person(s).

   In accordance with RIS-1530-PLT the brake test results must be within 10% of the previous years recorded results.

Arising work

5. Examine the performance of the hydraulic drive system & test the pressures.
7. Repeat the tests & record findings after any adjustments have been made.

7.15.4. Slewing brake – Test

Job no. BR04

Position

- Hydraulic motor on slewing platform of turret.

Scheduled work

1. Put the MEWP in maximum cant with maximum load in basket.
2. Put turret straight (highest force working on brake).
3. Check if slewing motor brake can hold the basket in place without creep for 15 minutes.
4. Slew 180 degrees (turret straight on the other side of machine).
5. Check if slewing motor brake can hold the basket in place without creep for 15 minutes.
6. Report all observations to the responsible person(s).

Arising work

3. Examine system for backpressures, opening counterbalance valves or parking brake. Replace brake or motor valve block when necessary. Repeat the test.
5. Examine system for backpressures, opening counterbalance valves or parking brake. Replace brake or motor valve block when necessary. Repeat the test.

7.15.5. Trailer brakeaway – Test **Job no. BR05**

Position

- In rail mode, straight position.

Scheduled work

1. Uncouple the plug of the ATR 450 out of the socket fixed on the machine either end (by left slight turn).
2. Green light on either side will be blinking, an audible buzz will be heard (non stop).
3. Couple the plug in the remained contra-socket.
4. Green light will be on constantly and audible buzz will disappear.
5. Please record in accordance with RIS-1530-PLT.
6. Repeat the test on the other side.
7. Record all results on an appropriate form and retain for future reference.
8. Report all observations to the responsible person(s).

Arising work

2. Investigate green light/buzzer fault, replace faulty or defective parts.
4. Investigate green light/buzzer fault, replace faulty or defective parts.

7.16. Maintenance instructions Electrical System

7.16.1. Emergency Stop Buttons – Test

Job no. ES01

Location

- Red mushroom button on the basket control panel.
- Red mushroom button on the base control panel in the bonnet.

Scheduled work

1. With the machine switched off, push the emergency stop button.
2. The base control panel display remains dark when operating the battery key switch.
3. Release the emergency button by turning the knob.
4. Start the engine.
5. With the machine engine running, push the emergency stop button
6. The electrical system is switched off, the IC engine and hydraulic pumps are stopped
7. Release the emergency button by turning the knob.
8. The vehicle can be started again.
9. Repeat the test on the other emergency stop button.
10. Report all observations to the responsible person(s).

Arising work

2. Check the emergency stop wiring. Replace defective components.
4. Check the emergency stop wiring. Replace defective components.
6. Check the emergency stop wiring. Replace defective components.
8. Check the emergency stop wiring. Replace defective components.

7.16.2. Rail Control Panel – Check

Job no. ES02

Location

- Rail control panel in the basket.

Scheduled work

1. Check the general condition of the buttons, switches and signal lamps:
   - 1.1 Fixation in the control panel
   - 1.2 Spring return to neutral position of bogie cylinder operating switches
   - 1.3 At start-up all signals lamps are lit for 3 seconds
   - 1.4 Text indication present and legible.
2. Report all observations to the responsible person(s).

Arising work

- 1.1 Secure component in control panel
- 1.2 Replace defective components.
- 1.3 Replace defective components.
- 1.4 Replace missing or unreadable text plates.

7.16.3. Wiring and Connectors – Examine

Job no. ES03

Location

- Throughout the complete machine.

Scheduled work

1. Examine the general condition of the wiring and connectors.
2 Examine the condition of cable ducts.
3. Report all observations to the responsible person(s).

Arising work

1. Replace damaged or defective connectors and wiring.
2. Replace damaged ducts.

7.16.4. Earth Connections – Check Job no. ES04

Location

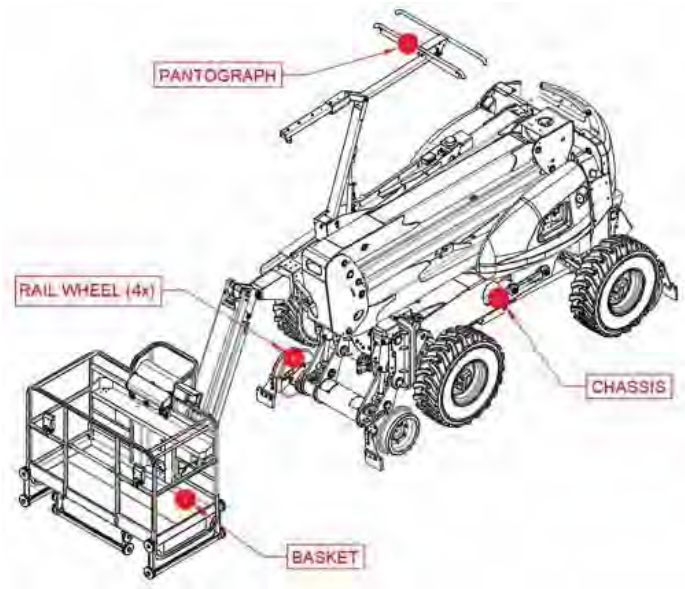
- Basket, boom, chassis and bogies. Earth connections for equipotential bounding are marked red.

Scheduled work

1. Check the general condition of the earth connections (looseness, corrosion, damage).
2 Check the general condition of the earth conductors (cable mantle not cut, damaged).
3. Report all observations to the responsible person(s).

Every 1000 hours: test the equipotential connections with an equipotential measuring device:

1. Perform this test with the **machine on tyres**.
2. Partly remove dirt and paint from rail wheel 1, big enough to make good electrical contact with clamp 1 of the measuring device.
3. Place connection clamp 1 on rail wheel 1 and make sure there is good contact.
4. Place the other clamp on a blank(ed) metal part of each element shown below (red bulb) and check for each, that the electrical resistance is **less than 0.05 Ω at an intensity of 50 A**.
5. Re-test all these elements also for the other 3 rail wheels.
6. Write down all observations and report to the responsible person(s).



Remark

If any of the earth bonds are deemed defective then this machine must not travel under live OLE until the necessary repairs have been completed.

Arising work

1. Replace defective earth connections immediately.
2. Replace damaged earth conductors.

7.16.5. Basket Lock Switch – Test

Job no. ES05

Location

- Base control panel in the bonnet.

Scheduled work

1. Switch the keyswitch in to locking position, while in rail mode and in travel mode.
2 Check the boom and jib movements are blocked.
3. Report all observations to the responsible person(s).

Remark

Travelling under live overhead wires is prohibited until the blocking functionality is restored.

Arising work

2. Check the electrical wiring & repeat the test.

7.16.6. Emergency recovery pump – Test

Job no. ES06

Location

- Electrical emergency recovery pump nearby base control box.

Scheduled work

1. Switch off the engine.
2. Check that the emergency pump is operating correctly by pressing the switch on the side of the base control box or the basket control box.
3. Perform an arm lowering movement.)
4. Report all remarkable observations to the responsible person(s).

Arising work

3. Check the electrical wiring of pump and switch and replace the pump if necessary & repeat the test.

7.16.7. ALO slew limiter – Test

Job no. ES07

Location

- Base control panel in the bonnet.

Scheduled work

1. Switch the ALO limiter key switch to LEFT position, while in rail mode and in transport position.
2. Slew the turret clockwise towards the blocked side.
3. Check slewing is stopped and blocked automatically when the track centreline is crossed.
4. Check slewing in the opposite direction is possible.
5. Slew the turret anticlockwise (180 degrees) towards the blocked side.
6. Check slewing is stopped and blocked automatically when the track centreline is crossed.
7. Check slewing in the opposite direction is possible.
8. Switch the ALO limiter key switch to RIGHT position, while in rail mode and in transport position.
9. Repeat steps 2 to 7
10. Press emergency stop button, with ALO limiter active.
11. Release emergency stop button and restart the machine.
12. Check the “ALO limit ON” signal light is ON
13. Check the slewing is blocked to the selected side.
14. Switch power off, with ALO limiter active.
15. Start up the machine again
16. After switching to rail mode, check the “ALO limit ON” signal light is ON
17. Check the slewing is blocked to the selected side.
18. Report all observations to the responsible person(s).

Remark

Working Any Line Open (ALO) is prohibited until the ALO slewing limiter is restored.

Arising work

3 Contact the manufacturer.
4 Contact the manufacturer.
6 Contact the manufacturer.
7 Contact the manufacturer.
12 Contact the manufacturer.
13 Contact the manufacturer.
16 Contact the manufacturer.
17 Contact the manufacturer.

7.16.7.1. 360 ALO slew limiter (High Performance MLD) – Test **Job no. ES07**

Scheduled work

1. Switch the 360 ALO limiter key switch to LEFT position, while in rail mode and in transport position.
2 Slew the turret clockwise towards the blocked side.
3 Check slewing is stopped and blocked automatically when the angle of degrees has been reached
4 Check slewing in the opposite direction is possible.
5 Slew the turret anticlockwise (chosen amount of degrees) towards the blocked side.
6 Check slewing is stopped and blocked automatically when the track centreline is crossed.
7 Check slewing in the opposite direction is possible.
8 Switch the 360 ALO limiter key switch to RIGHT position, while in rail mode and in transport position.
9 Repeat steps 2 to 7.
10 Press emergency stop button, with ALO limiter active.
11 Release emergency stop button and restart the machine.
12 Check the "ALO limit ON" signal light is ON.
13 Check the slewing is blocked to the selected side.
14 Switch power off, with 360 ALO limiter active.
15 Start up the machine again.
16 After switching to rail mode, check the "ALO limit ON" signal light is ON.
17 Check the slewing is blocked to the selected side.
18 Report all observations to the responsible person(s).

Remark

Working Any Line Open (ALO) is prohibited until the 360 ALO slew limiter is restored.

Arising work

3 Contact the manufacturer.
4 Contact the manufacturer.
6 Contact the manufacturer.
7 Contact the manufacturer.
12 Contact the manufacturer.
13 Contact the manufacturer.
16 Contact the manufacturer.
17 Contact the manufacturer.

7.16.8. Slewing position switches – Test

Job no. ES08

Location

- Inside slewing platform.

Scheduled work

1. Put the turret in line with the track centreline
2 Check whether the "Turret straight" signal light is ON.
3 Slew clockwise till the "Turret straight" signal light switches OFF. This must be at about 3 degrees out of centre.
4 Slew anticlockwise the "Turret straight" signal light switches ON again.
5 Continue slewing anticlockwise till the "Turret straight" signal light switches OFF. This must be at about 3 degrees out of centre.
6 Slew clockwise the "Turret straight" signal light switches ON again.
7 Slew 180 degrees and check the "Turret straight" signal light is NOT switched ON out the turret straight positions + 3 degrees.
8 Repeat steps 1 to 7
9 Report all observations to the responsible person(s).

Arising work

2 Contact the manufacturer.
3 Contact the manufacturer.
4 Contact the manufacturer.
5 Contact the manufacturer.
6 Contact the manufacturer.
7 Contact the manufacturer.
8 Contact the manufacturer.

7.17. Maintenance instructions Statutory Examination

7.17.1. LOLER Examination – Test — Job no. SE01

Location

- Thorough examination of the entire machine, this could be completed internally or you could use an approved third party LOLER Examiner.

Scheduled work

1. Thoroughly inspect the base machine & rail conversion for signs or wear/damage
2 Examine the structural integrity of the machine & look for signs of cracked/deformed welds
3 Test the machine using LOLER 1998 Regulations & ensure a valid certificate is left with the machine and a copy retained for future reference.
5. Report all observations to the responsible person(s).

Remark

If the machine fails a LOLER Examination then it must be removed from service until the necessary repairs have been completed.

Arising work

1. Complete the necessary repairs and re-inspect the machine under LOLER 1998 Regulations.
2. Complete the necessary repairs and re-inspect the machine under LOLER 1998 Regulations.
3. Complete the necessary repairs and re-inspect the machine under LOLER 1998 Regulations.

8. Storage and transport

If the machine is stored for a long period of time, cover the equipment and be sure the place is **dry and clean**.

9. Dismantling and elimination

At the end of the machines life, the machine must be set secure according the safety rules.
Only a specialized company is allowed to dismantle the machine. All contaminated or harmful parts must be disposed in accordance to statutory requirements.

10. Annexes

Content

Annex 1: Wheel load values FOT
Annex 2: Maintenance Log
Annex 3: Datalog file Load visualisation
Annex 4: Operating and instruction manual THM version 1.1
Annex 5: ART 17 THM Changing Rail Gauges version 1.0
Annex 6: Instruction in detail 360 ALO
Annex 7: User comments form

Annex 1: Wheel load values FOT

Wheel loads axle 1	Values FOT	Left FOT	Right FOT
Rail track axle 1	6,68 t	3,6 t	2,7 t
Rail track axle 2	5,77 t	3,0 t	2,9 t

Annex 2: Maintenance Log

Date/time	Performed by	Service type	Adjust next interval	Notes

Annex 3: Datalog file Load visualisation

Machine number:	121	Programma:	87000007
Date:	8-12-2017		
Name:			

RAIL PRODUCTS

Time	Basket load(kg)	Engine running	Overload Basket	Load oke	Load warning	Overload	Emergencie pump on	ALO Left open	ALO Right open	OLE open (Lock basket)	Warning light top open circuit 0=ok 1=false	Warning light below open circuit 0=ok 1=false	Empty (Option)	Ignition on	Test light + Buzzer	Load sensor oke	Box open	Machine series number
	AM03	M1	M2	M3	M4	M5	M6	M7	M8	M9	M10	M11	M12	M13	M14	M15	M16	AM04
6-12-2017 14:35:23	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	121
6-12-2017 14:35:24	0	0	1	0	0	0	0	0	0	0	0	0	0	1	1	0	0	121
6-12-2017 14:35:24	0	0	1	0	0	0	0	0	0	0	0	0	0	1	1	0	1	121
6-12-2017 14:35:24	401	0	1	0	0	1	0	0	0	0	0	0	0	1	1	1	1	121
6-12-2017 14:35:26	401	0	1	0	0	1	0	0	0	0	0	0	0	1	1	1	1	121
6-12-2017 14:35:28	401	0	1	0	0	1	0	0	0	0	0	0	0	1	0	1	1	121
6-12-2017 14:35:30	401	0	1	0	0	1	0	0	0	0	0	0	0	1	0	1	1	121
6-12-2017 14:35:33	0	0	1	0	0	0	0	0	0	0	0	0	0	1	1	0	0	121
6-12-2017 14:35:33	0	0	1	0	0	0	0	0	0	0	0	0	0	1	1	0	1	121
6-12-2017 14:35:33	401	0	1	0	0	1	0	0	0	0	0	0	0	1	1	1	1	121
6-12-2017 14:35:35	401	0	1	0	0	1	0	0	0	0	0	0	0	1	1	1	1	121
6-12-2017 14:35:37	401	0	1	0	0	1	0	0	0	0	0	0	0	1	0	1	1	121
6-12-2017 14:35:39	401	0	1	0	0	1	0	0	0	0	0	0	0	1	0	1	1	121
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Machine number:	121	Programma:	87000007
Date:	8-12-2017		
Name:			

Time	Basket load(kg) AM03	Engine running M1	Overload Basket M2	Load oke M3	Load warning M4	Overload M5	Emergencie pump on M6	ALO Left open M7	ALO Right open M8	OLE open (Lock basket) M9	Warning light top open circuit 0=ok 1=false M10	Warning light below open circuit 0=ok 1=false M11	Empty (Option) M12	Ignition on M13	Test light + Buzzer M14	Load sensor oke M15	Box open M16	Machine series number AM04
6-12-2017 14:36:23	379	0	1	0	1	0	0	0	0	0	0	0	0	1	0	1	1	121
6-12-2017 14:36:25	357	0	0	0	1	0	0	0	0	0	0	0	0	1	0	1	1	121
6-12-2017 14:36:27	353	0	0	0	1	0	0	0	0	0	0	0	0	1	0	1	1	121
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6-12-2017 14:36:35	351	0	0	0	1	0	0	0	0	0	0	0	0	1	0	1	1	121
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0-1-1900 0:00:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0-1-1900 0:00:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0-1-1900 0:00:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0-1-1900 0:00:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0-1-1900 0:00:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0-1-1900 0:00:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0-1-1900 0:00:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0-1-1900 0:00:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0-1-1900 0:00:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0-1-1900 0:00:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0-1-1900 0:00:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

8-12-2017 ART17 Datalog Progam V1.0 2

OPERATION MANUAL

ART 17 THM

This document describes only the differences in relation to the standard ART 17 T(H) machine.

Annex 4: Operating and instruction manual THM version 1.1

RAIL PRODUCTS

Mountcairn
22 Cairneymount Road
Carluke
South Lanarkshire - ML8 4EN

Phone: 0044 1555 773 027
Mobile: 0044 7788 924 848
derek@rail-products.co.uk

Issue record

Issue	Date	Author	Comments
1.0	01-08-2017		Original document
1.1	02-08-2017		Lay out changed

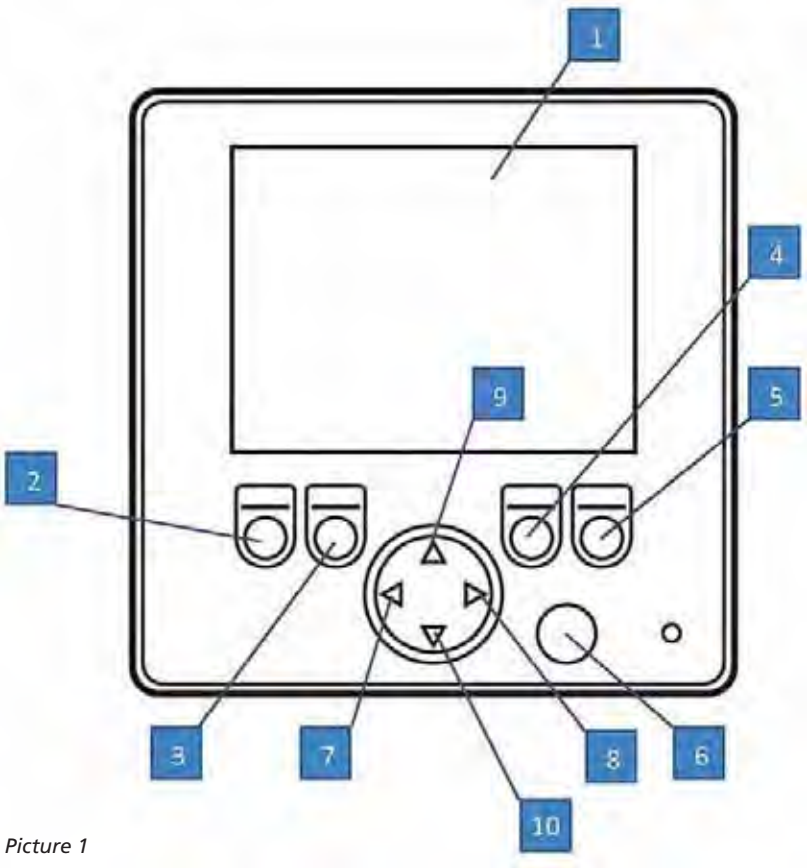
DATE: 02-08-2017

SIGNATURE:

RAIL PRODUCTS
Mountcairn - 22 Cairneymount Road
Carluke - South Lanarkshire - ML8 4EN
Phone: 0044 1555 773 027
Mobile: 0044 7788 924 848
derek@railproducts.uk.com

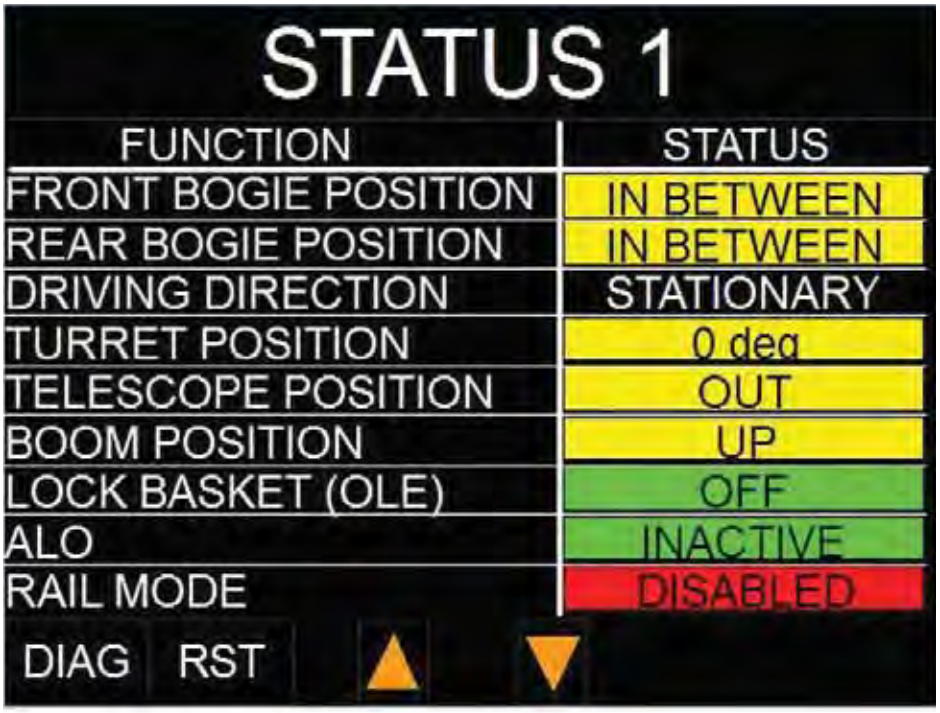
1. Diagnostic Display

Machine has been equipped with a diagnostic panel which can show a variaty of information.

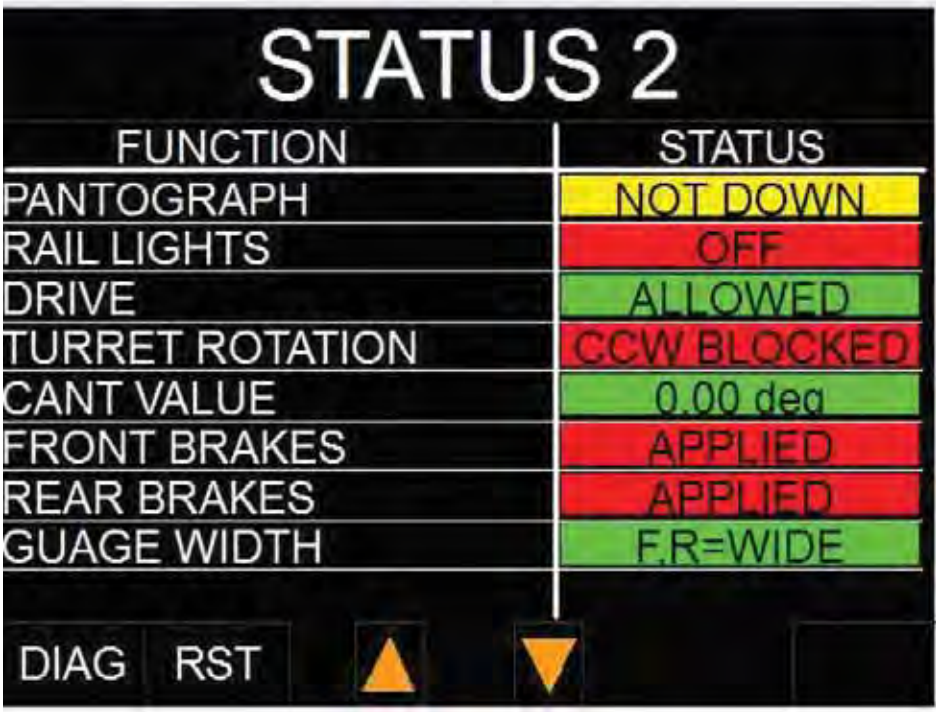


Picture 1

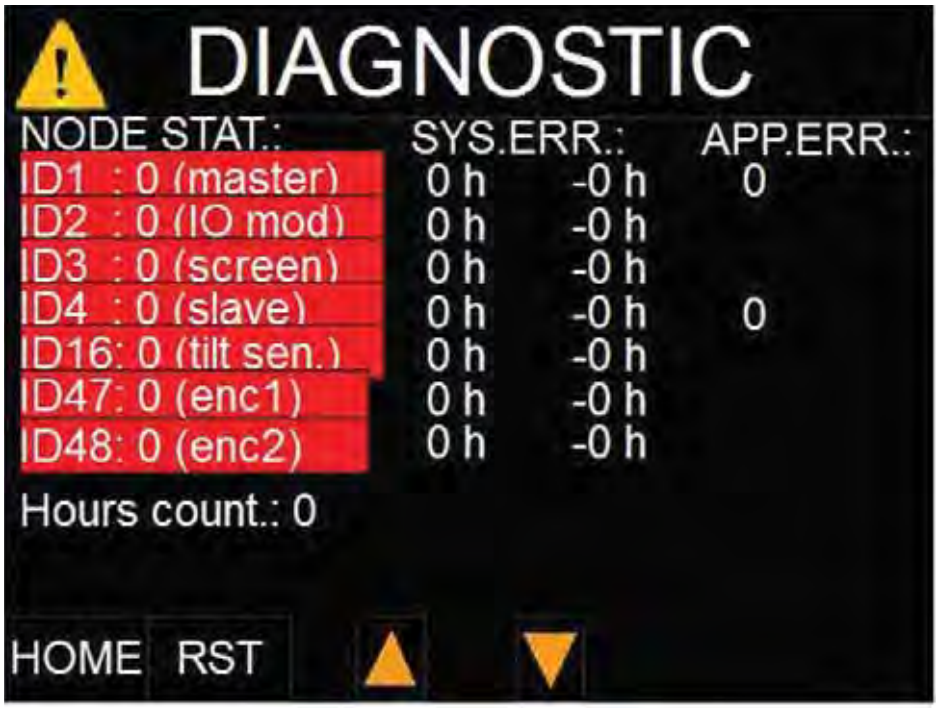
1. DISPLAY
2. F1 Key
3. F2 Key
4. F3 Key
5. F4 Key
6. Ok Key
7. Left Key
8. Right Key
9. Up Key
10. Down Key



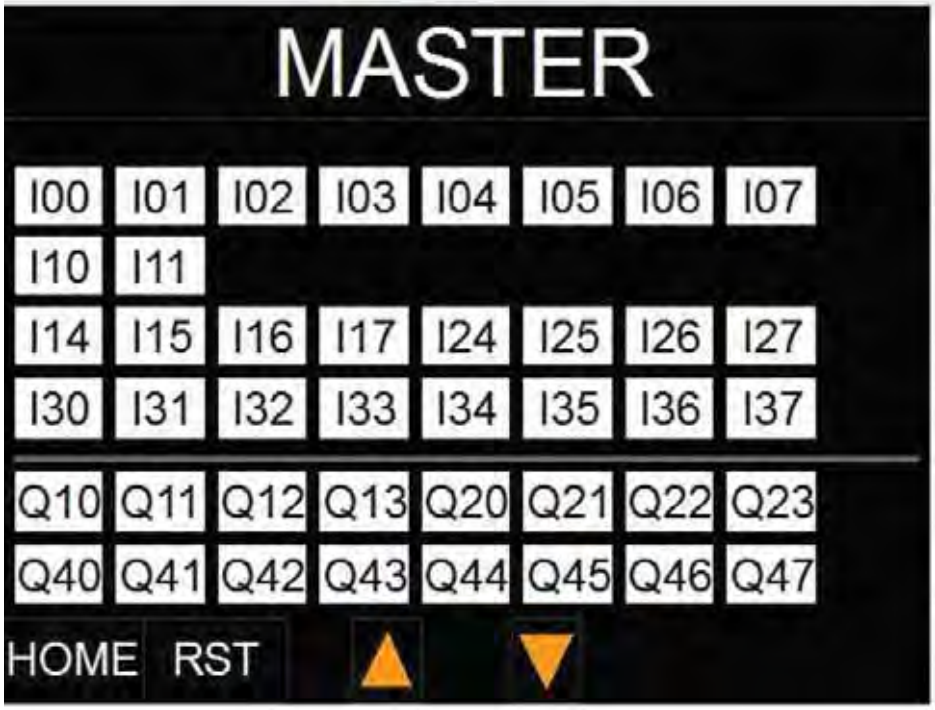
Picture 2



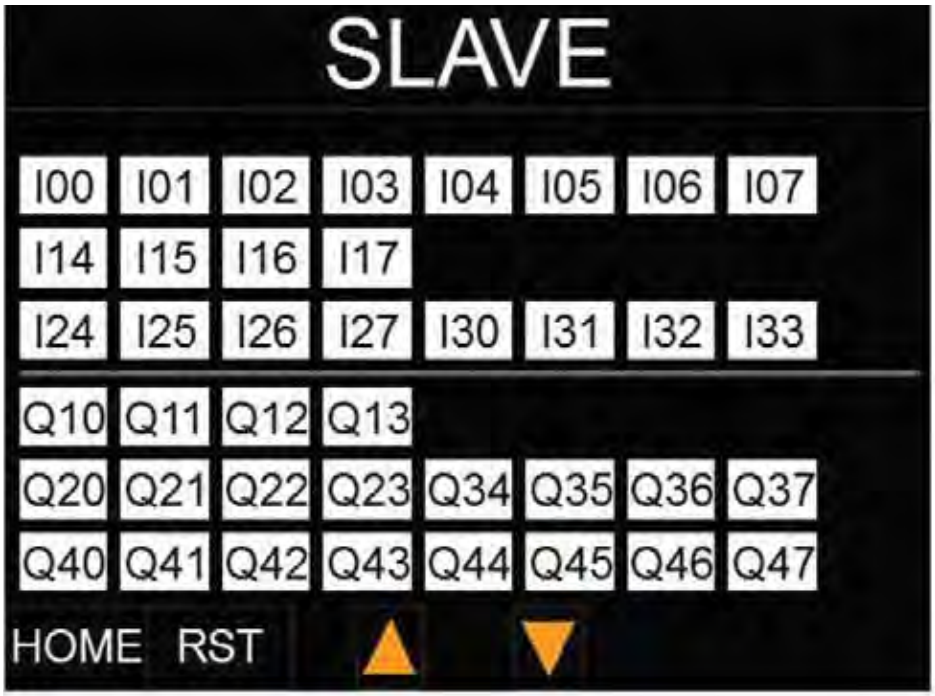
Picture 3



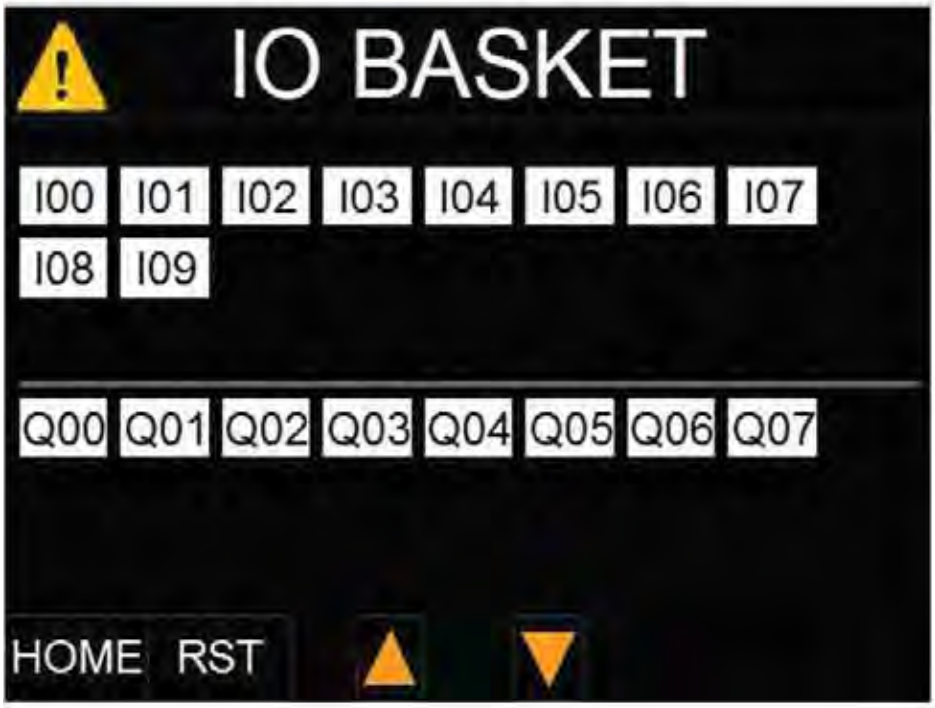
Picture 4



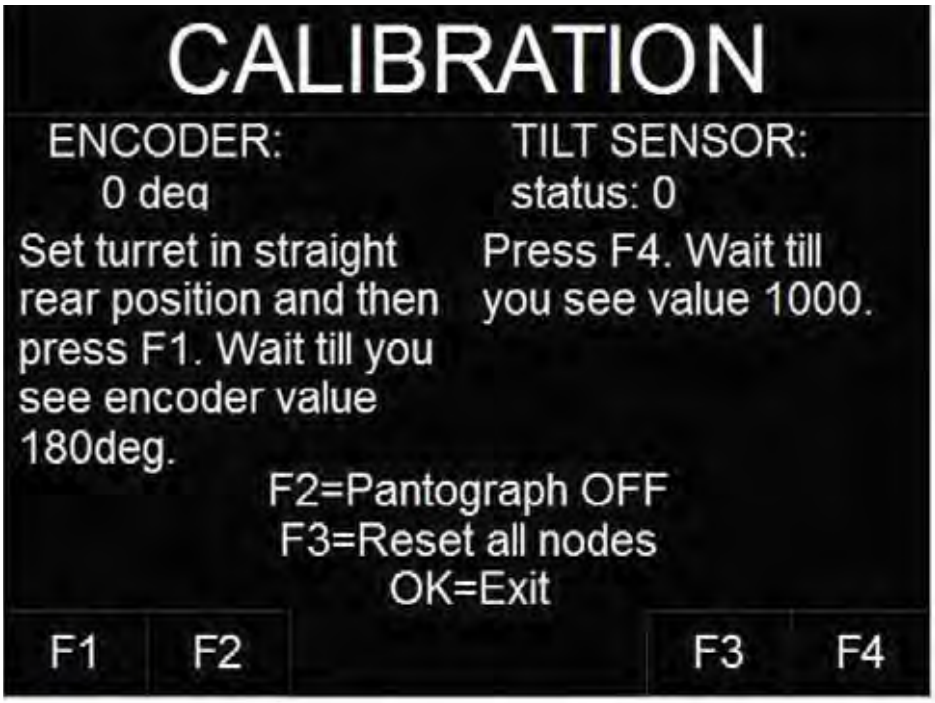
Picture 5



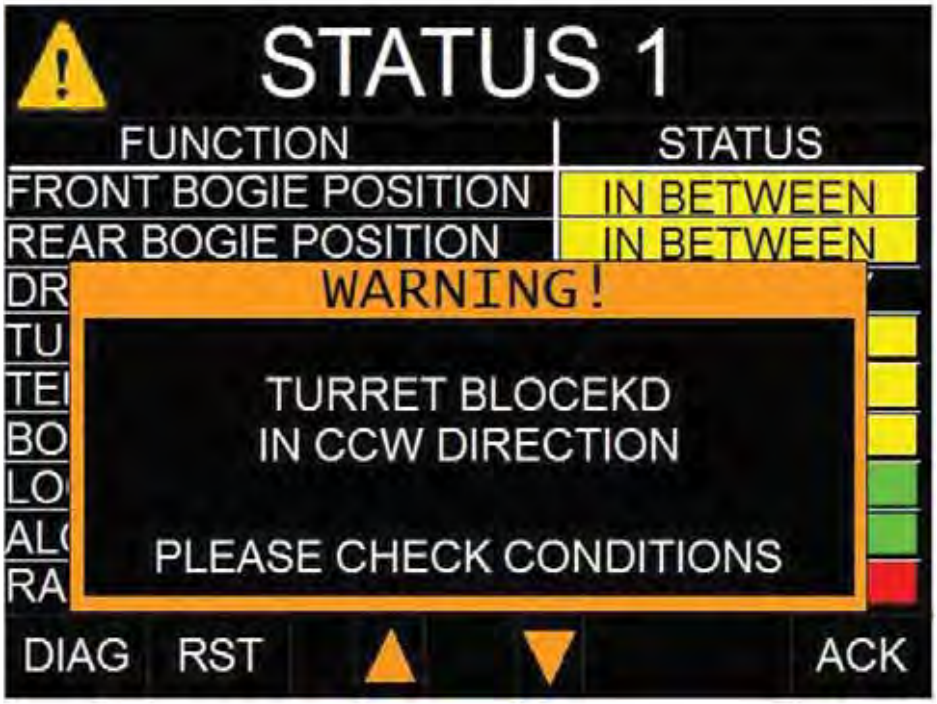
Picture 6



Picture 7



Picture 8



Picture 9

2. Status screens

You can switch between two status screens by using up/down keys. Screens shows all basic information regarding rail configuration of the ART17(MG) machine. (see Picture 2 and Picture 3)
When some functionality is blocked because of unfulfilled conditions "Warning" windows pops up whit relevant description. (see Picture 9) You can close window using ACK (F4 Key). As long as warning is valid you can see blinking exclamation mark in the left upper corner.

3. Diagnostic screens

From home screen (status 1 or status 2 screen) you can switch to **diagnostic** screen using DIAG (F1 key).
Diagnostic screen has 4 pages (see pictures 4, 5, 6 and 7) and you can switch between them by using up/down keys.

Page 1 shows all CAN node statuses, system errors and application errors (only for master and slave controllers). See appendix A for a list of all possible errors.

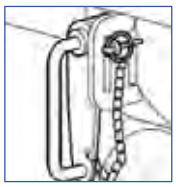
Diagnostic pages 2,3,4 shows status of all relevant inputs/outputs (see appendix B). White background means that input/output is inactive, green background means input/output active, red background means input/output error (wire break or short circuit).
Each time when source of error has been eliminated operator has to press RST (F2 key) in order to reset error.
To go back to home screen (status 1) operator has to press home (F1 key).

4. Calibration screen

ATTENTION !!! DANGER !!!
Calibration screen can be only used by authorized maintenance personnel. Inappropriate use can lead to danger!

To switch to calibration screen you have to be in **diagnostic** screen page 1 (see picture 4) then press together left key and F3 key for approx. 8 seconds, when you see icon  press once F4 key.

Encoder calibration: normally on delivery encoder is calibrated and there is no need to do this unless encoder has been dismounted/damaged or toothed belt has been dismounted/damaged or master controller has been replaced. To calibrate encoder put machine in a safe place, first rotate turret to the straight rear position, check locking pin if fits (see picture 10) and then press F1 key once, when you see encoder value 180 deg then calibration is finished.


Picture 10

Rotate turret fully (360 deg.) two times and observe **turret position** (screen status 1) for correct values:

- basket on the rear 180 deg,
- basket on the front 0 deg,
- basket on the left 90 deg,
- basket on the right 270 deg.

TITL sensor calibration: normally on delivery tilt sensor is calibrated and there is no need to do this unless sensor has been replaced by new one. To calibrate sensor press F4 key once, when you see status value 1000 then calibration is finished.
Pantograph option: if machine is **not equipped** with real pantograph dummy option has to be activated by pressing F2 key (**pantograph ON**).
Nodes Reset: if there are CAN communication problems, all the CAN nodes can be reset and reinitialized by pressing F3 key.

5. Extra functionality

In relation to standard ART 17TH machine extra functionality has been introduced in a new model ART 17THM. Machine has adjustable rail wheels gauge and can be used on the following rail gauges:
1668 mm, 1600 mm, 1520, 1435 mm, 1067 mm, 1000 mm.

When used on narrow gauges (1000mm or 1067mm) following rules applied:

- To lower the bogies machine has to be in transport position with **basket rotated in front position** (over the fixed bogie);
- When rear and front bogies are set on different gauges lowering is blocked and gives alarm;
- Till 100 mm cant there is no turret limitation over the fixed bogie;
- Driving with slow speed with rotated basket is only possible with turret angle over 90 degrees, 6.35 m. outreach;
- **Working height is limited to max. 11 meters:**
  - when telescope is extracted arm 1/2 is blocked;
  - when jib[1] is NOT down arm 1/2 is blocked;
  - when arm 1/2 is NOT down telescope and jib are blocked;

[1]) Pendular arm

Appendix A

Node status:

ID1 (master controller)
0 = boot up
4 = pre-operational and is configured
5 = operational (NORMAL STATE)
127 = pre-operational

ID2 (remote inputs/outputs module)
0 = boot up
4 = pre-operational and is configured
5 = operational (NORMAL STATE)
127 = pre-operational

ID3 (display)
1 = operational (NORMAL STATE)
2 = pre-operational
3 = stopped

ID4 (slave controller)
0 = boot up
4 = pre-operational and is configured
5 = operational (NORMAL STATE)
127 = pre-operational

ID16 (tilt sensor)
0 = boot up
4 = pre-operational and is configured
5 = operational (NORMAL STATE)
127 = pre-operational

ID47 (encoder can interface 1)
0 = boot up
4 = pre-operational and is configured
5 = operational (NORMAL STATE)
127 = pre-operational

ID48 (encoder can interface 2)
0 = boot up
4 = pre-operational and is configured
5 = operational (NORMAL STATE)
127 = pre-operational

Emergency Error code Byte 0 - 1 (hexidecimal)	Classification number (hexidecimal)	Meaning
System errors for MASTER and SLAVE controllers		
8000h	11h	CANx monitoring SYNC error
8100h	11h	CANx warning threshold
8110h	11h	CANx receive buffer overrun
8111h	11h	CANx transmit buffer overrun
8130h	11h	CANx guard/heartbeat error
2100h	03h	Input diagnostic
2300h	03h	Output diagnostics if interruption
2302h	03h	Output diagnostics if short circuit
3100h	05h	Terminal voltage VBBo/VBBs
3300h	05h	Output voltage VBBr
4200h	09h	Excess temperature
6100h	11h	Memory error
System errors for REMOTE I/O MODULE		
8000h	11h	CANx monitoring SYNC error
8100h	11h	CANx warning threshold
8110h	11h	CANx receive buffer overrun
8111h	11h	CANx transmit buffer overrun
8130h	11h	CANx guard/heartbeat error
2100h	03h	Inputs interruption
2108h	03h	Inputs short circuit
2110h	03h	Excess current 4…20mA
2300h	03h	Outputs interruption
2308h	03h	Outputs short circuit
3100h	05h	Power supply VBBs
3300h	05h	Terminal voltage VBBo
3308h	05h	Output voltage VBBr
4200h	09h	Excess temperature
System errors for DISPLAY		
8000h	11h	CANx monitoring SYNC error
8100h	11h	CANx warning threshold
8110h	11h	CANx receive buffer overrun
8111h	11h	CANx transmit buffer overrun
8130h	11h	CANx guard/heartbeat error
3100h	05h	Supply voltage
4200h	09h	Excess temperature
System errors for TILT SENSOR		
4200h	xxh	Temperature error
4000h	xxh	Hardware error
FF00h	xxh	Device specific error

Emergency Error code Byte 0 - 1 (hexidecimal)	Classification number (hexidecimal)	Meaning
System errors for ENCODER		
00xxh	00h	Error Reset or No error
3001h	20h	Input voltage out of range, too low
3002h	05h	Input voltage out of range, too high (> appr. 38V)
3003h	20h	Input voltage out of range, too high (> appr. 43V)
4201h	20h	Hardware error temperature sensor
4202h	20h	Encoder temperature too low (<-45°C)
4203h	05h	Encoder temperature too high (> appr. 75°C)
4204h	20h	Encoder temperature too high (> appr. 83°C)
5001h	10h	CAN address line signal different value after startup
5002h	20h	Hardware runtime failure
5003h	20h	Hardware startup failure
5004h	20h	Sensor error: too low magnetic field strength
5005h	20h	Sensor error: too high magnetic field strength
5006h	20h	Sensor error: communication or data
5007h	20h	Sensor error: ADC saturation, magnetic field or electrical error
5008h	20h	Sensor error: General error
5009h	20h	Master / Slave sensor synchronization exceeded
5011h	20h	CAN address line offset value out of range
5012h	20h	Non-volatile data consistency error
6100h	20h	Internal software: generic error
6101h	20h	Internal software: program flow error
6102h	20h	Internal software
6103h	20h	Internal software
6104h	20h	Contact manufacturer, do not use sensor
6105h	20h	Contact manufacturer, do not use sensor
6106h	20h	CANopen SYNC Rx overrun Next sync messages received before SRDP-CP was sent
6300h	20h	Runtime data inconsistency
8101h	20h	Error ADC
8102h	20h	Error supply voltage monitoring
8103h	20h	Other node in safe state
8110h	10h	CAN overrun (object lost)
8120h	10h	CAN in error passive mode

Application errors for MASTER CONTROLLER

Error code	Description
1	General Error
2	Can1 errorcounter Rx
3	Can1 errorcounter Tx
4	Can1 BusOff
5	Can1 Warning
6	Can1 LastError>0
7	Can1 Busload High
8	Can1 Bit Timing Z.B. ein Teilnehmer sendet mit falscher Baudrate
9	Can1 Bus-Kurzschluss
10	Can1 Unterbrechung CAN Master
11	Can2 errorcounter Rx
12	Can2 errorcounter Tx
13	Can2 BusOff
14	Can2 Warning
15	Can2 LastError>0
16	Can1 Busload High
17	Can1 Bit Timing Z.B. ein Teilnehmer sendet mit falscher Baudrate
18	Can1 Bus-Kurzschluss
19	Can1 Unterbrechung CAN Master
20	CanSafety Error
69	Error: CPU or Instruction time or Memory or Timebase
70	Error Power
71	Error Internal Relais
72	Error Temperature
73	Error VBBr voltage
74	Error Output Wire Break
75	Error Output Short Circuit
76	Error General I/O
77	Error General Inputs
78	Error Encoder: too big difference between two interfaces
79	Error Encoder: interface 1 not operated
80	Error Encoder: interface 2 not operated
81	Error Tilt sensor: not operational
82	Error Tilt sensor: General error (see system error code)
83	Error Remote I/O module: General error (see system error code)
84	Error Encoder CRC
85	Error Two-channel sensors: BOOM IN sensor or ARM 1/2 LOW sensor or JIB down sensor
86	Error Front and Rear axis different width

Application errors for SLAVE CONTROLLER

Error code	Description
1	General Error
2	Can1 errorcounter Rx
3	Can1 errorcounter Tx
4	Can1 BusOff
5	Can1 Warning
6	Can1 LastError>0
7	Can1 Busload High
8	Can1 Bit Timing Z.B. ein Teilnehmer sendet mit falscher Baudrate
9	Can1 Bus-Kurzschluss
10	Can1 Unterbrechung CAN Master
11	Can2 errorcounter Rx
12	Can2 errorcounter Tx
13	Can2 BusOff
14	Can2 Warning
15	Can2 LastError>0
16	Can1 Busload High
17	Can1 Bit Timing Z.B. ein Teilnehmer sendet mit falscher Baudrate
18	Can1 Bus-Kurzschluss
19	Can1 Unterbrechung CAN Master
20	CanSafety Error
69	Error: CPU or Instruction time or Memory or Timebase
70	Error Power
71	Error Internal Relais
72	Error Temperature
73	Error VBBr voltage
74	Error Output Wire Break
75	Error Output Short Circuit
76	Error General I/O
77	Error General Inputs
85	Error Two-channel sensors: front bogie
86	Error Two-channel sensors: rear bogie

Appendix B

Inputs Master CONTROLLER

I00 Sensor BOOM IN channel 1
I01 Sensor ARM 1/2 LOW channel 1
I02 KeySwitch LOCK BASKET
I03 KeySwitch ALO LEFT
I04 KeySwitch ALO RIGHT
I05 Manitou signal: telescope move
I06 Manitou signal: ARM 1/2 move
I07 Manitou signal: ARM 3 move
I10 Manitou signal: Fuel Valve activate
I11 Manitou signal: JIB move up
I14 Manitou signal: Orange beacon On
I15 Manitou signal: Road Tilt sensor On
I16 Manitou signal: Turret Rotation CW
I17 Manitou signal: Turret Rotation CCW
I24 Manitou signal: Safety valve On
I25 DataLogger signal: Fuel valve unblock
I26 Sensor BOOM IN channel 2
I27 Sensor ARM 1/2 LOW channel 2
I30 Pressure switch: run forward
I31 Pressure switch: run backward
I32 Manitou signal: Differential
I33 Manitou signal: Brakes
I34 Manitou signal: Crab
I35 Manitou signal: 4-wheels
I36 Manitou signal: Steer left
I37 Manitou signal: Steer right

Outputs Master CONTROLLER

Q12 Manitou valve: JIB Up
Q13 Manitou valve: Fuel valve
Q20 Manitou valve: Turret rotation CW
Q21 Manitou valve: Turret rotation CCW
Q22 Manitou valve: Telescope move
Q23 Manitou valve: Arm 1/2 move
Q40 Manitou valve: Arm 3 move
Q41 Manitou Orange Beacon
Q42 Manitou Tilt sensor (NO)
Q43 Manitou Tilt sensor (NC)
Q44 Rail: front upper white light (option)
Q45 Rail: rear upper white light (option)
Q46 Rail: AUX VALVE 17
Q47 Manitou valve: Safety valve

Inputs REMOTE I/O Module

I00 Pushbutton: lower rear boogie
I01 Pushbutton: lift rear boogie
I02 Pushbutton: lower front boogie
I03 Pushbutton: lift front boogie
I04 Keyswitch: rail mode on/off
I05 Input from Deadman pedal
I06 Input from trigger
I07 Sensor: pantograph down
I08 Sensor: Jib down (channel 1)
I09 Sensor: Jib down (channel 2)
I10 (spare)
I11 (spare)

Outputs REMOTE I/O Module

Q00 LED lamp: white /rail mode on
Q01 LED lamp: red / alarm/error
Q02 Output to Manitou: block trigger
Q03 LED lamp: green / turret straight
Q04 LED lamp: blue / ALO On
Q05 Valve: Pantograph move
Q06 (spare)
Q07 (spare)

Inputs slave CONTROLLER

I00 (spare)
I01 (spare)
I02 (spare)
I03 (spare)
I04 EndSwitch: rear bogie road pos. ch.1
I05 EndSwitch: front bogie rail pos. ch.1
I06 EndSwitch: rear bogie rail pos. ch.1
I07 EndSwitch: front bogie road pos. ch.1
I24 EndSwitch: rear bogie road pos. ch.2
I25 EndSwitch: front bogie rail pos. ch.2
I26 EndSwitch: rear bogie rail pos. ch.2
I27 EndSwitch: front bogie road pos. ch.2
I30 (spare)
I31 Trailer Dummy connectors
I32 Sensor: 1 meter gauge detection front
I33 Sensor: 1 meter gauge detection rear

Outputs slave CONTROLLER

Q10 Front Lower Red Lights
Q11 Rear Lower Red Lights
Q12 Front Lower White Lights
Q13 Front Lower Red Lights
Q20 Valve: Lift Front Bogie
Q21 Valve: Lower Front Bogie
Q22 Valve: Lift Rear bogie
Q23 Valve: Lower Rear Bogie
Q34 Manitou Valve: differential lock
Q35 Manitou Valve: brake
Q36 Manitou Valve: crab
Q37 Manitou Valve: 4-wheels
Q40 Valve: Oscillation cylinder (x2)
Q41 Valve: Brakes Front
Q42 Valve: Brakes Rear
Q43 Valve: Steer Left (road)
Q44 Valve: Steer Right (road)
Q45 Valve: Rail Drive (6/2 valve)
Q46 LED: green trailer control light (x2)
Q47 Buzzer: trailer system error

CHANGING RAIL GAUGES

ART 17 THM

Annex 5: Changing Rail Guages ART 17 THM version 1.1

RAIL PRODUCTS

Tools:

- Air driven torque wrench 1000Nm
- Socket wrench(Size 36)

Step 1

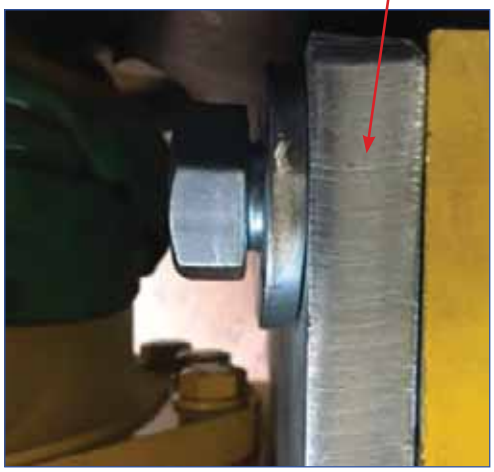
- Disassemble rail wheels.

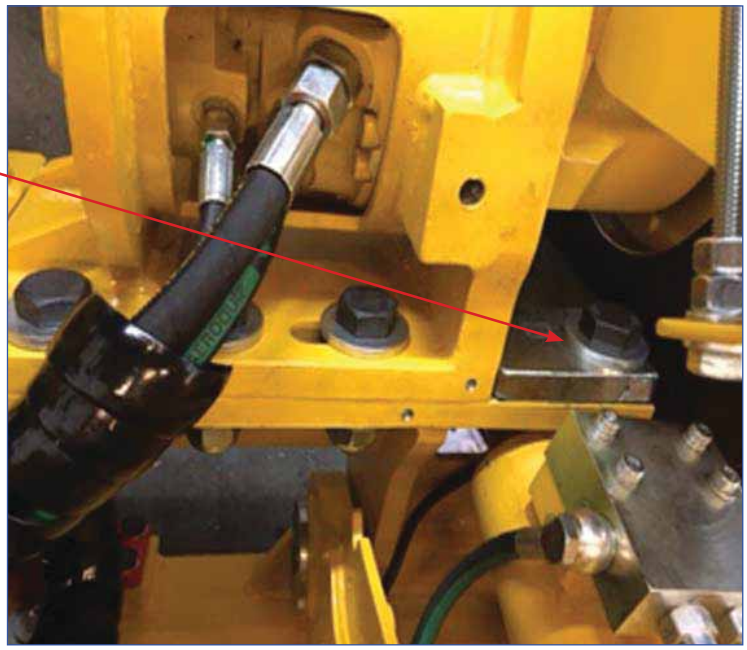
For narrow gauge (1000 mm) you'll need rail wheel 470 mm. C-Profile.

For standard gauge and above you'll need rail wheel 470 mm S-1003 profile.

Step 2

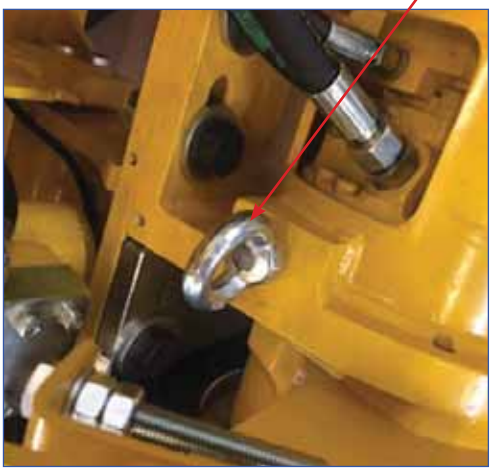
- Disassemble end plates either side (see photo) (1000 of 1435mm).





Step 3

- Assemble lifting eyes both sides (see photo).
- Connect the lifting eyes to the chains when disassembling the wheel motors.



Step 4

Disassemble the bolts of the wheel motors.

Step 5

Assembly of the right end plates (1000-1067-1435 mm.).

Retainerplate 1435 in the middle of the bogie for standard gauge.

Retainerplate 1000 at the rear end of the bogie in narrow gauge.

Photo: reconversion into standard gauge with end plate 1435 mm.

Step 6

Assembly wheel motors.

Remark:
Please begin with assembly of the center nut upper side.

Bolts on outer sides are shorter and without adapter ring.

Step 7

Assembly of the bolts and adapter ring wheel motors.

In total 6 bolts (3 up-3 down with adapter ring).

Torque moment **850 Nm** (torque) by air-driven torque wrench.

Step 8

Assembly of the correct profile rail wheels with adapter ring.

Narrow gauge rail wheel profile C- profile
Standard gauge rail wheel S- profile.

(Torque moment is **550 Nm**).

Step 8

Please measure the back to back distance.

Narrow gauge distance: 944 mm.

Standard gauge: 1360 mm.

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Operation and instruction 360 ALO slew limiter (High Performance MLD)

1. Go to DIAGNOSTIC page and press F3=ADV.

2. PIN code screen appears.
3. Enter PIN code 6252 using arrow buttons (UP/DOWN/LEFT/RIGHT) then press OK.
4. In case you enter wrong pin 3 times in a row DIAGNOSTIC page is blocked for 5 minutes.

5. CALIBRATION page appears, press F4 for 360 ALO configuration screen.

6. Using arrow keys (LEFT/RIGHT/UP/DOWN) set both angle values: starting angle and end angle then press OK.

7. Above angle values are stored in screen memory, when you switch off and on machine power values will be remembered. In case you load a new version of software to screen values will be reset to standard 0 deg and 180 deg.

Annex 7: Users comments (form)

Rail Products UK Ltd. is a company that wants to improve constantly. Therefore we need your feedback regarding this user manual. In this way we can improve future editions. Thanks for your co-operation!

Did you find the information you needed?

What did you think of the way the information is presented?

Do you have any other remarks or suggestions?

Your information:

Name:

Function:

Departure:

Plant:

Address:

Telephone number:

e-mail address:

This information is only used if there are any questions in your feedback.

Print this page, and please send it to the following address below:

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U S E R M A N U A L

INSTRUMENTED PANTOGRAPH

TYPE PA 46 / PA 52

RAIL PRODUCTS

Manufacturer	Rail Products UK
Project number	P02-031-R

MANUFACTURER:

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Document history

Version	Date	Comments
0.1	04-06-2015	Issued for internal review
0.2	08-06-2015	Added photos
0.3	15-06-2015	Added information pre-conditions
0.4	18-06-2015	Added extra information
0.5	05-02-2016	Second type Instrumented Pantograph added
1.0	08-02-2016	Added picture 'laser class'
2.0	21-02-2019	Added PA52 mark II including software description

DATE:

SIGNATURE:

Table of contents

Foreword

This user manual contains the necessary information for implementation, maintaining and proper use of the Instrumented Pantograph. The Instrumented Pantograph is installed on the ART 17 T and ART 17 TH which is basically a MANITOU, type: 160ATJ + mobile elevating work platform, extended with the equipment for rail applications.

This manual is written to inform you, as a user or mechanic, how to work safely with the Instrumented Pantograph. Users remain responsible for supervision and compliance with this manual.
Read this manual carefully before commissioning of the Instrumented Pantograph. Make sure that you have read and understood all safety warnings, -recommendations and -precautions. Also of any complementary documents.

As a Manufacturer we strongly recommend to:
- Contact the manufacturer when there are urgent questions.
- Keep the manual on a dry, safe and available place for everyone who's involved (also in the future). In the basket there is a black box provided to store documentation.
- Keep all security marks on the Instrumented Pantograph visible; replace them if needed.

This manual only applies to the "Instrumented Pantograph", not the "MANITOU mobile elevating work platform"!

For user instructions of the Manitou we refer to the Manitou Instructions Manual (see chapter 1 - Relevant Documents).

For user instructions of the ART 17 T(H) we refer to the instructions manual version 6.3 dated 24-06-2015.

Abbreviations and definitions

To create clarity of the abbreviations and definitions used in this manual, some of them are explained.

Abbreviations and definitions used in this manual:

MEWP	Mobile Elevating Work Platform
INSTRUMENTED PANTOGRAPH	Measures the distance between upper surface of the rail track and powered off (isolated) OLE equipment. IT MUST NOT be operated/extended in the live OLE environment.

1. Relevant documents

1.1. Manufacturer

Document
Hydraulic diagram Instrumented Pantograph Rev. A dated 08-06-2015
Electrical scheme Instrumented Pantograph Base E Scheme V2
User Manual ART 17 T(H) P301, version 6.3 dated 24-06-2015
User Manual Manitou 547408 EN, dated 15-05-2012

1.2. Suppliers

Document
Nokeval 301 manual
SICK DL50 manual

2. Manufacturers information

Manufacturer: Rail Products UK
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(0044) 7788 924 848 (mob.)

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Internet:www.railproducts.uk.com

3. Product information

3.1. Product description

3.1.1. General

The pantograph measures the distance between upper surface of the rail track and powered off OLE equipment. The measurement data is presented on a small LED display in the basket. The Pantograph is only used for measuring, not as power guidance. The pantograph may never be operated in live OLE environment.

Note:

Rail Products UK pantograph can only be used for the ART 17 T(H) vehicles. Use on other machines is prohibited.

DANGER!

Use of the Instrumented Pantograph under live overhead wires is **prohibited**!

The Instrumented Pantograph may only be operated under powerless isolated and earthed catenaries!

The Instrumented Pantograph may only be operated by an authorised person.

Operation Instrumented Pantograph is at own risk.

Travelling under live overhead lines is permitted only when the Instrumented Pantograph is fully down!

DANGER!

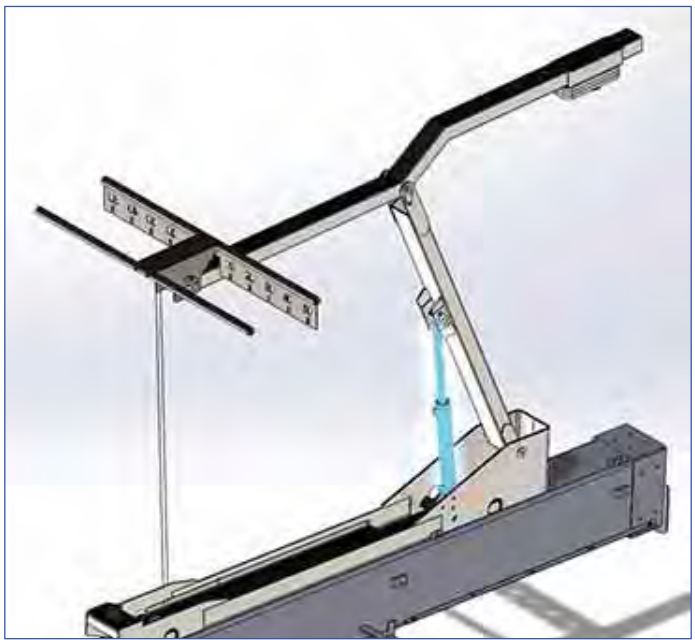
The Instrumented Pantograph may never make contact with live catenaries! RISK OF ELECTROCUTION!

3.1.2. Hydraulic system

The basic parts of the hydraulic system are:

- 6/2 valve
- D3050300ST Cylinder (highlighted in blue)

For more details about the hydraulic system of the ART 17 T(H) we refer to the hydraulic drawings, see chapter 1.

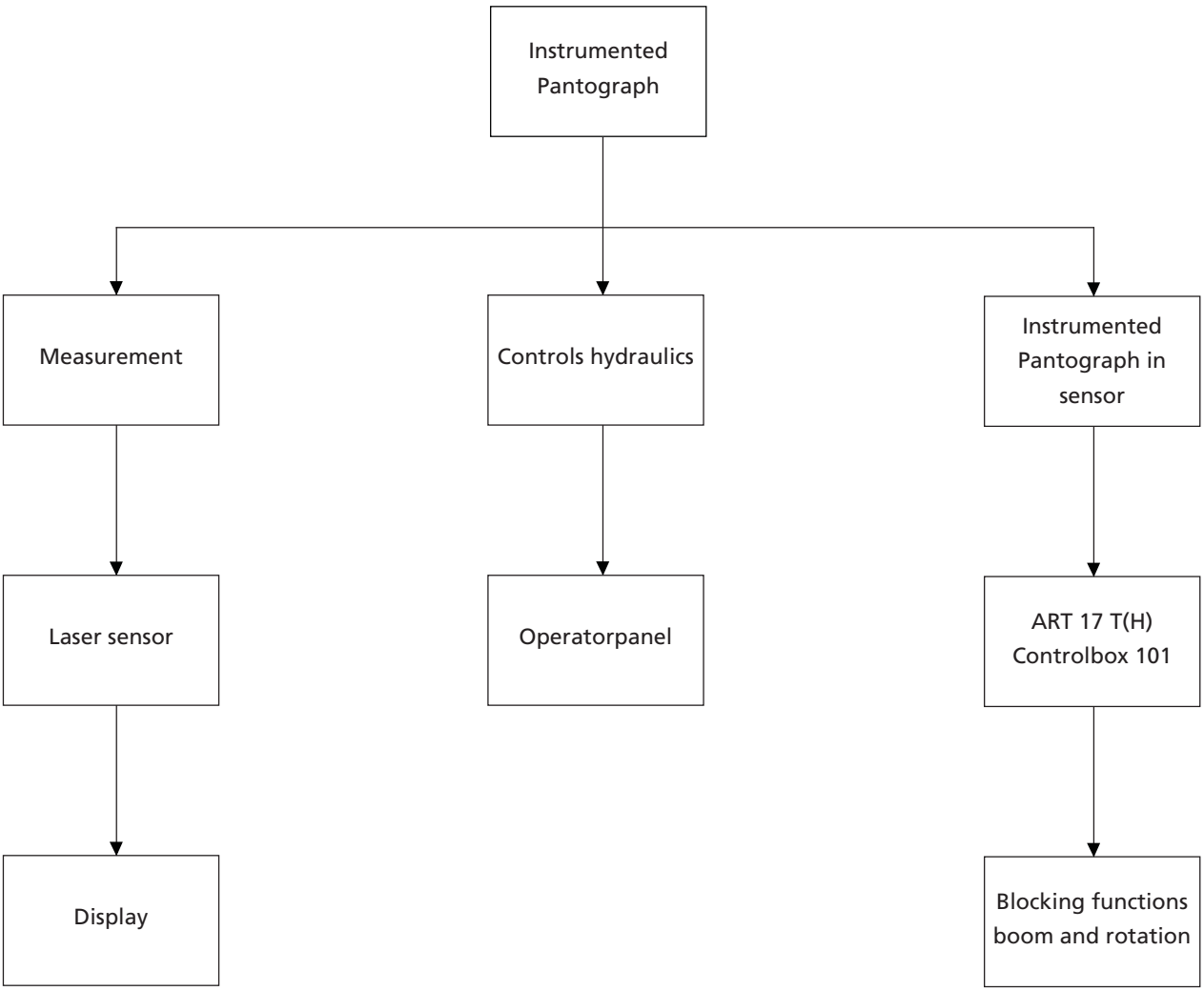


3.1.3. Electrical system

The main voltage of 12 VDC is used to power the electronic system used to control the Instrumented Pantograph. The Instrumented Pantograph is installed as an separate module, there is no data in the ART 17 T user manual or diagrams.

There are three basic electrical systems:

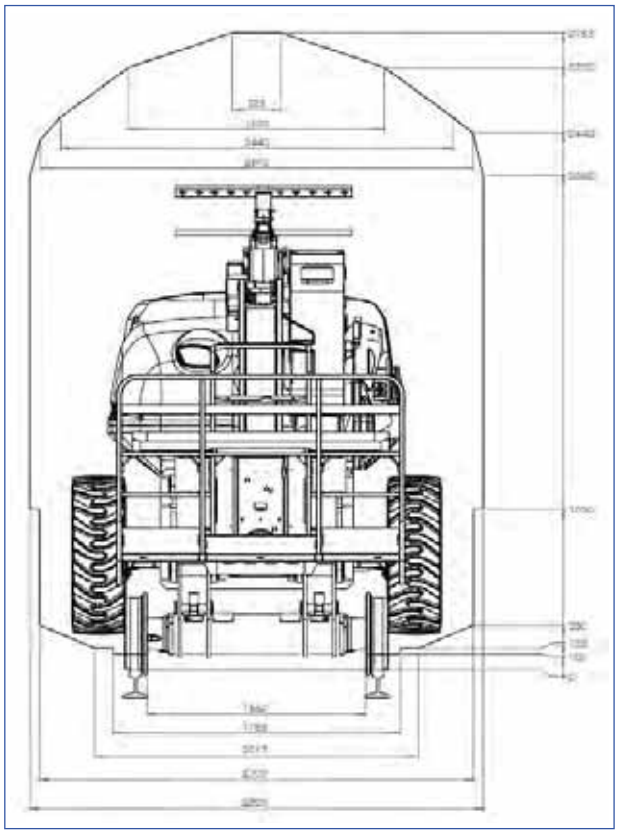
Measurement:	By laser sensor;
Controls hydraulics:	Operator panel with controls to operate the hydraulic cylinder;
Instrumented Pantograph in sensor:	Detects Instrumented Pantograph in positions, Blocks boom and rotation movement if not comply to pre-conditions. For pre-conditions see chapter 6.



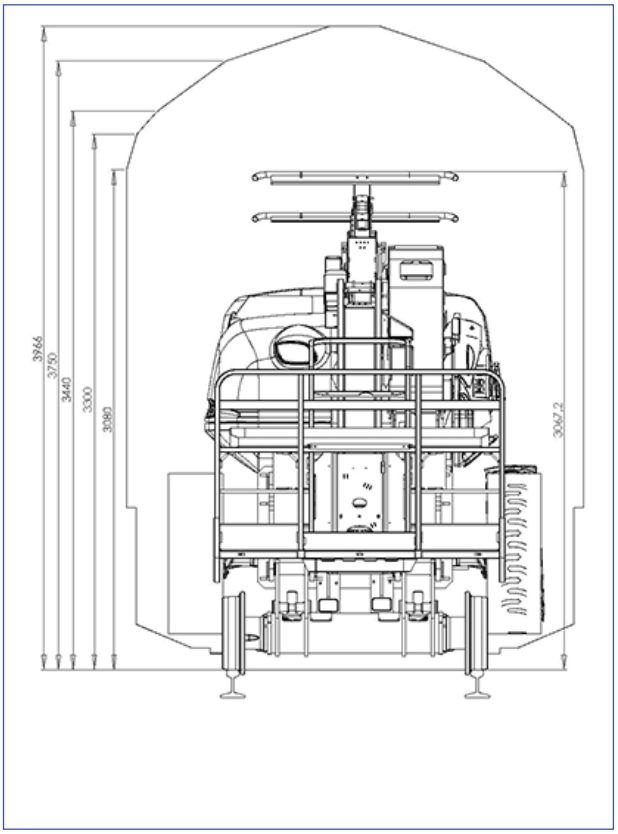
For more details about the electrical system of the Rail Lifter we refer to the electrical drawings, see chapter 1.

3.1. Specification (technical data)

3.2.1. W6a gauge



PA 46



PA 52

3.2.2. Measuring

Values for measuring vertical distance between overhead lines to rail:

Minimal distance PA 46	4200 mm
Maximal distance PA 46	4800 mm
Minimal distance PA 52	4725 mm
Maximal distance PA 52	5800 mm

3.2.3. Hydraulic system Instrumented Pantograph

Cylinder

Type	Bosch Rexroth CDL2
Max pressure	250 bar
Bore diameter	50 mm
Rod diameter	30 mm
Stroke	300 mm

Valve

Type	DFE05260001 6/2
Max pressure	200 bar
Function	OF-Function
Solenoid voltage	12V

3.2.4. Electrical system Instrumented Pantograph

Sensor

Type	Sick DL50
Operating voltage	10-30 VDC
Output	4-20 Ma
Isolation class	IP65

Display

Type	Nokeval 301
Operating voltage	10-30 VDC
Input	4-20 Ma
Isolation class	IP65

Operation buttons

Type	M22
Operating voltage	10-30 VDC
Isolation class	IP67

4. Safety

4.1. General safety

DANGER!
Use of the Instrumented Pantograph under live overhead wires is prohibited!
The Instrumented Pantograph may only be operated under powerless isolated and earthed catenaries!
The Instrumented Pantograph may only be operated by an authorised person, operation Instrumented Pantograph is at own risk.
Travelling under live overhead lines is permitted only when the Instrumented Pantograph is fully down!

DANGER!
The Instrumented Pantograph may never make contact with live catenaries! RISK OF ELECTROCUTION

DANGER!
Hazardous situations as a result of:
- possible electric arc by touching the OLE by the Instrumented Pantograph,
- Insufficient distance from high voltage parts,

must be avoided at all times, please follow instructions and supervision by operator's employee.

4.1.1. Responsibilities for owner and user

Only well **trained, certified** and **qualified** personnel are authorised to operate the machine.

Electrical safe guarding procedure necessary before use of Instrumented Pantograph isolation of the railway wire as a part of the safeguarding procedure. Don't use the machine in case of heavy rain, moisture or thunderstorm to eliminate the voltage creep from live wires due to the weather.

Trained, certified, **qualified** and **authorised** personnel must read and understand the content of this user manual and the purposed documents before they start working with the machine. Some equipment can contain complicated and potential dangerous equipment, be aware that any actions or decisions taken may not only adversely affect the initial quality of the equipment but also your own safety and that of your colleagues.

Personnel must not be allowed to perform any other proceedings than the ones described in this manual, however, in the event of an emergency, only an authorised person may perform this after consulting the Manufacturer.
If the machine is modified, without prior permission, the warranty and liability for the damage and consequences will void.

The Manufacturer cannot be held responsible for failures or (sequential) damages caused by improper actions or poor use. Personnel will always remain responsible for their actions and the consequential results.

4.1.2. Safety rules

Always follow the safety rules written by local law and/or defined by the company you are working for.
Local safety rules must always be followed. Please inform your supervisor in case these contradict to warnings given in this User Manual.

4.2. Risks for personal injury

Although the machine is designed as safe as possible, there will still be risks for personal injury. The risks mentioned below are derived from the risk assessment. Every user must be informed/be aware of these risks.

4.2.1. Electrical voltage

Where	When	Precaution	Warning sign
InstrumentedPantograph	Instrumented Pantograph making contact with live OLE	Control of Key for Console is by the Machine Controller (see 6.2.). Always lower the Instrumented Pantograph when not used, power down Instrumented Pantograph controls	
Instrumented Pantograph controls	Short circuit solenoid or operator panel when operated constantly	Always power off the machine after use	

4.2.2. Pinching

Where	When	Precaution	Warning sign
Rotating/moving parts	By working with the Instrumented Pantograph	Keep everyone away from the rotating/moving parts when using the machine	
Covers lifting cylinders	By working with the machine	Keep away from the cylinders during operation	

Pantograph should never to be used under live OLE !

5. Installation

The Instrumented Pantograph is installed by the manufacturer or a by the manufacturer's recommended company.

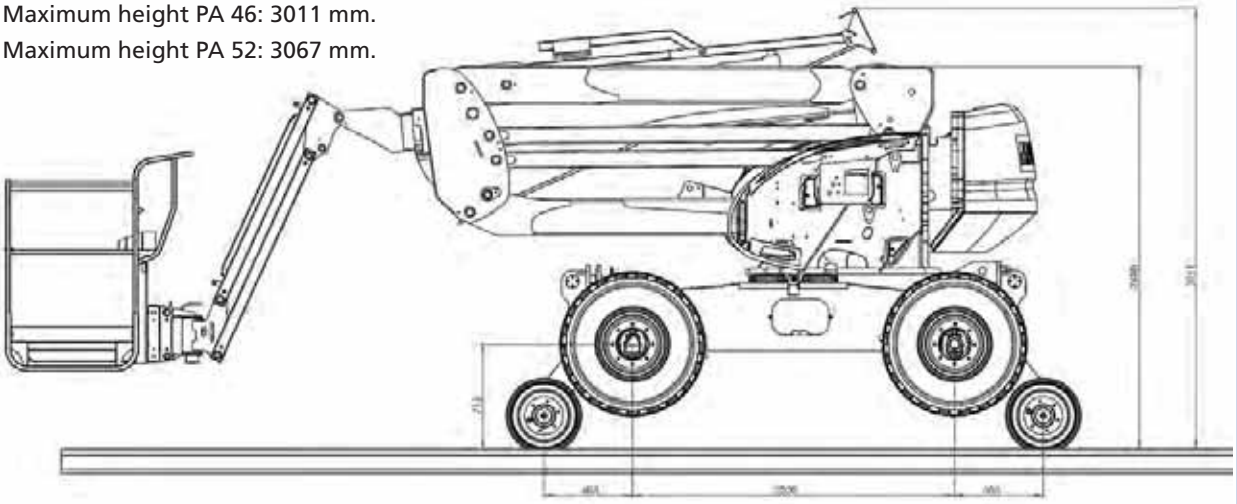
If something isn't installed correctly, please contact the manufacturer!

6. Operation

The Instrumented Pantograph
- In mode
- Out mode

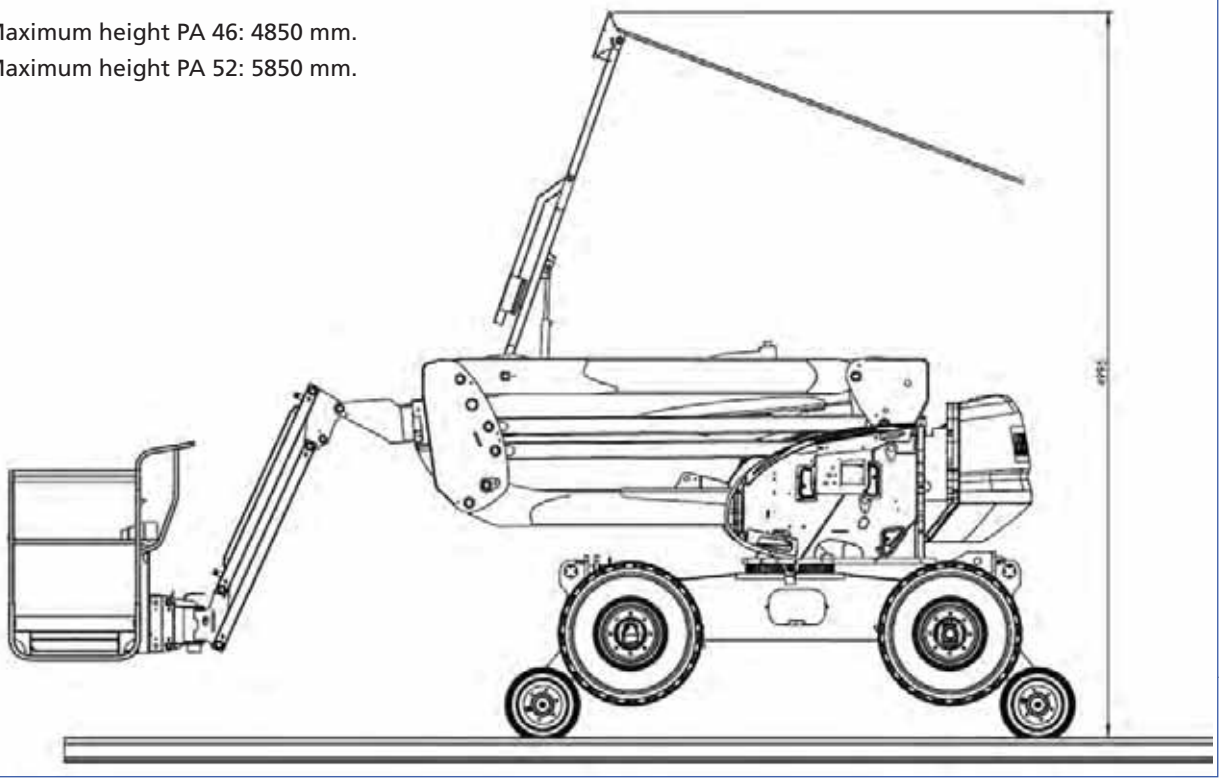
In mode
Instrumented Pantograph is fully in, hydraulic cylinder is fully down. Instrumented Pantograph and machine fits in the W6a gauge.

Maximum height PA 46: 3011 mm.
Maximum height PA 52: 3067 mm.



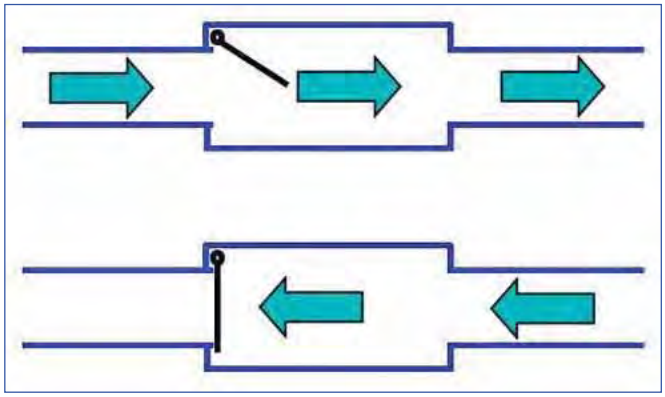
Out mode
Instrumented Pantograph is fully out, hydraulic cylinder is fully up. Instrumented Pantograph is out of travelling gauge!

Maximum height PA 46: 4850 mm.
Maximum height PA 52: 5850 mm.



6.1. Safety features

6.1.1. Hydraulic safety



A check valve (see electrical diagram) is used to stop all movements of the cylinder in case of a hydraulic hose break.

This solution prevents sudden lowering of the Instrumented Pantograph when there is no hydraulic pressure available.

6.1.2. Electric safety and pre-conditions

The controls are engineered in such a way that there are several pre-conditions to measure up to in order to operate and use the Instrumented Pantograph. This is done to prevent unintended or non-allowed movements while the Instrumented Pantograph is out.

Starting positions:
Boom Manitou down, Turret straight (0 or 180 degrees), Rail mode active, OLE not in (Lock basket). The control panel of the Instrumented Pantograph will not be active if these conditions are not reached.

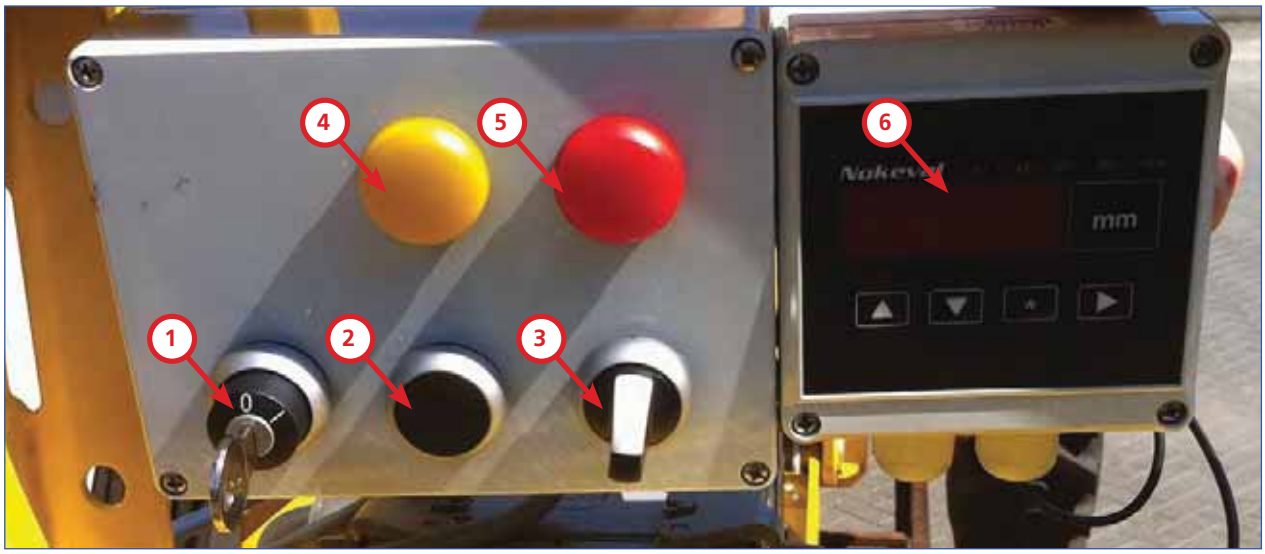
While working:
The inductive sensor installed inside the Instrumented Pantograph is used to detects if the Instrumented Pantograph is not IN. If the Instrumented Pantograph is not in, boom upwards or rotating movements will be blocked by the ART 17 T(H) safety system. Switching from rail to road or vice versa will also require the conditions Instrumented Pantograph in. If the sensor fails, the movements of the boom and rotation and the rail mode setup will not function.

Lock basket description ART 17 Rev 6.3 user manual:

Key switches.

6.2. Operation panels and buttons

6.2.1. Console in basket



Console in basket

General remark: The Manitou foot pedal must always be operated simultaneous with the Instrumented Pantograph controls. Without the foot pedal, no up or down function will work.

1) On/off
Acts as the main switch. Enables power supply to sensor and controls, users can now operate the Instrumented Pantograph. If switched off, no controls are possible. The on/off key is to be removed and to be kept by the Machine Controller, to enable the Instrumented Pantograph function.

2) Enable
Switch to enable bogie up/down control. Acts as a safety function to prohibit unintended control of the Instrumented Pantograph movement. Push the enable button (2) to operate the Instrumented Pantograph function.

3) Instrumented Pantograph up/down
Switch to operate the Instrumented Pantograph cylinder; turn to right and the Instrumented Pantograph will go up, turn to left and the Instrumented Pantograph is lowered. Switch to be operated simultaneously with “Enable” pushbutton (2).

4) Amber light
Exceeding minimal value as set in nokeval display.

5) Red light
Exceeding maximal value as set in nokeval display.

6) Display
Present measured height laser sensor + fixed value. The result is a total length between rail track surface and the Instrumented Pantograph. The fixed value is set by the manufacture. Reprogramming the display can result in incorrect measurements. For display instructions, see chapter 1 - Relevant Documents. For calibration instructions see chapter 6.6.

6.3. Operation handlings

Remark
Before operating:

- Always check: permission to use Instrumented Pantograph and check according to the procedures if OLE is switched off and earthed.
- Only **trained, certified** and **authorised** personnel should operate the Instrumented Pantograph.
- Always check the general condition of the Instrumented Pantograph; *check there are no missing parts (protective guards), damages or leakages*.
- Area is free of personnel.
- Read o this user manual and also the manufacturers manuals.

To avoid unintended operations the following operational procedures have to be followed:

1. Make sure all pre-conditions have been completed and check the block basket is not activated
2. Enable Instrumented Pantograph control key switch (see 6.2.1.)
3. Push the enable button (see 6.2.1.)
4. Press the deadman safety pedal
5. Select Instrumented Pantograph up or down with the Instrumented Pantograph switch (see 6.2.1.)
6. Release the switches if Instrumented Pantograph up position is reached
7. To drive and measure, please proceed to 6.4

The key to operate the Instrumented Pantograph (see 6.2.1) is to be removed to prevent unauthorized use (Key to be kept by the Machine Controller to enable the Instrumented Pantograph function).

6.4. Driving with Instrumented Pantograph

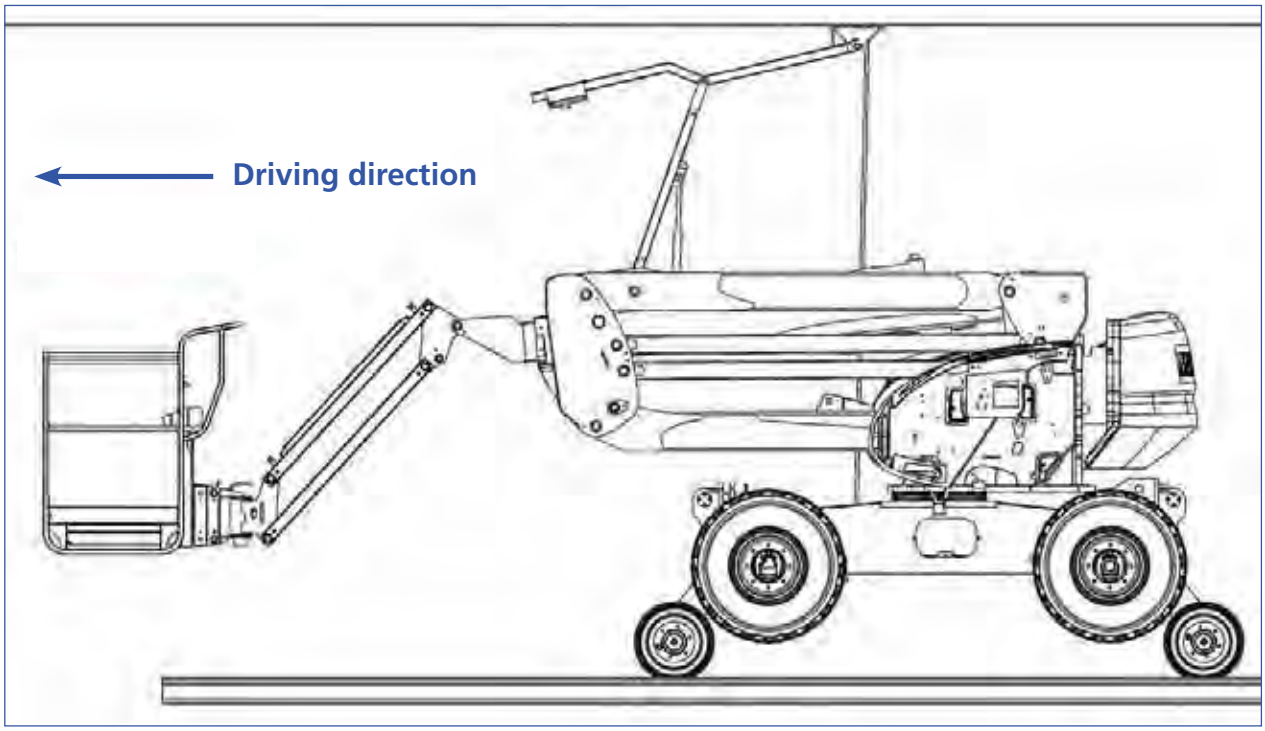
Remark

Before operating:

- Always check: permission to use pantograph and check according to the procedures if OLE is switched off and earthed.
- Don`t drive and operate the Instrumented Pantograph at the same time.
- Check for permission to drive.

To avoid unintended operations the following operational procedures have to be followed:

1. Enable rail drive mode.
2. Put the Instrumented Pantograph up, according to the previous steps in 6.3.
3. Switch drive into turtle mode to collect accurate measurements (4km/h).
4. Drive always in the forward direction to collect good measurements (see picture below).
5. Don't drive with Instrumented Pantograph fully up and with no overhead line contact.
6. Put Instrumented Pantograph down after rail drive mode, to switch back to road mode (pre-condition).



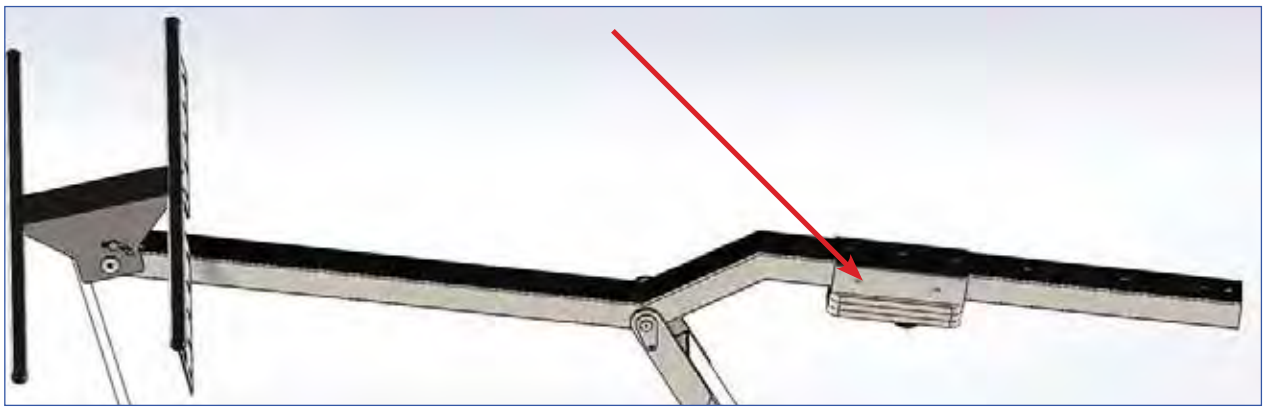
6.5. Adjusting upwards force

The upwards force of the Instrumented Pantograph head is reached by using an equivalent counterweight.

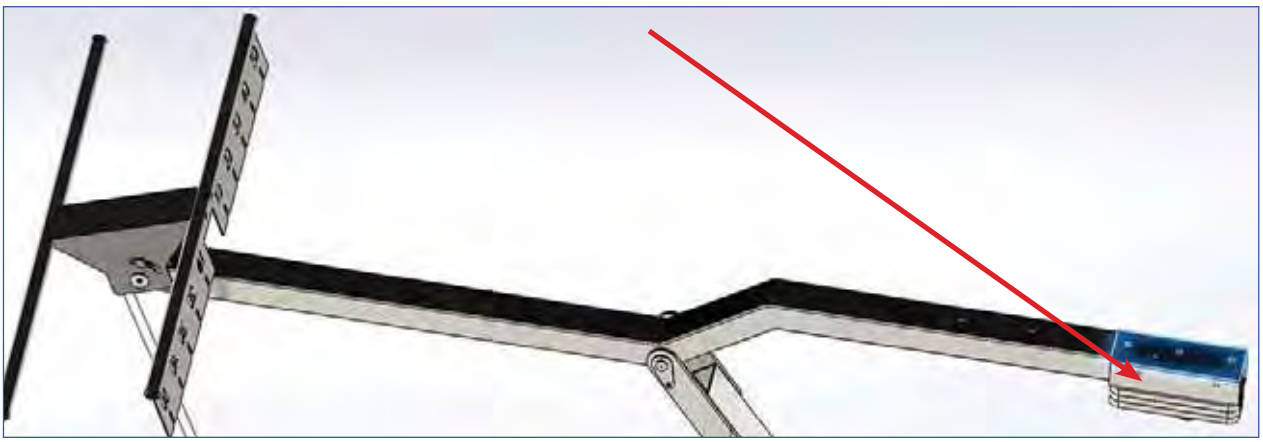
Without counterweight installed:
Standard upwards force: 4kg (8,8 lbs).

Scalable upwards pressure by using different weight setups and positions:
Weights are 2.5 kg`s. A maximum of 3 weights is permitted.

Minimal setting with additional weights:
Upwards pressure with 1 weight in this position is 7.5 kg.



Maximal setting with additional weights:
Upwards pressure with 3 weights in this position is 20 kg.



6.6. Calibration

DANGER!
Keep reflector plate clean to get accurate measurements. By dismount, please make sure the plate is horizontal levelled and recalibrate the machine.

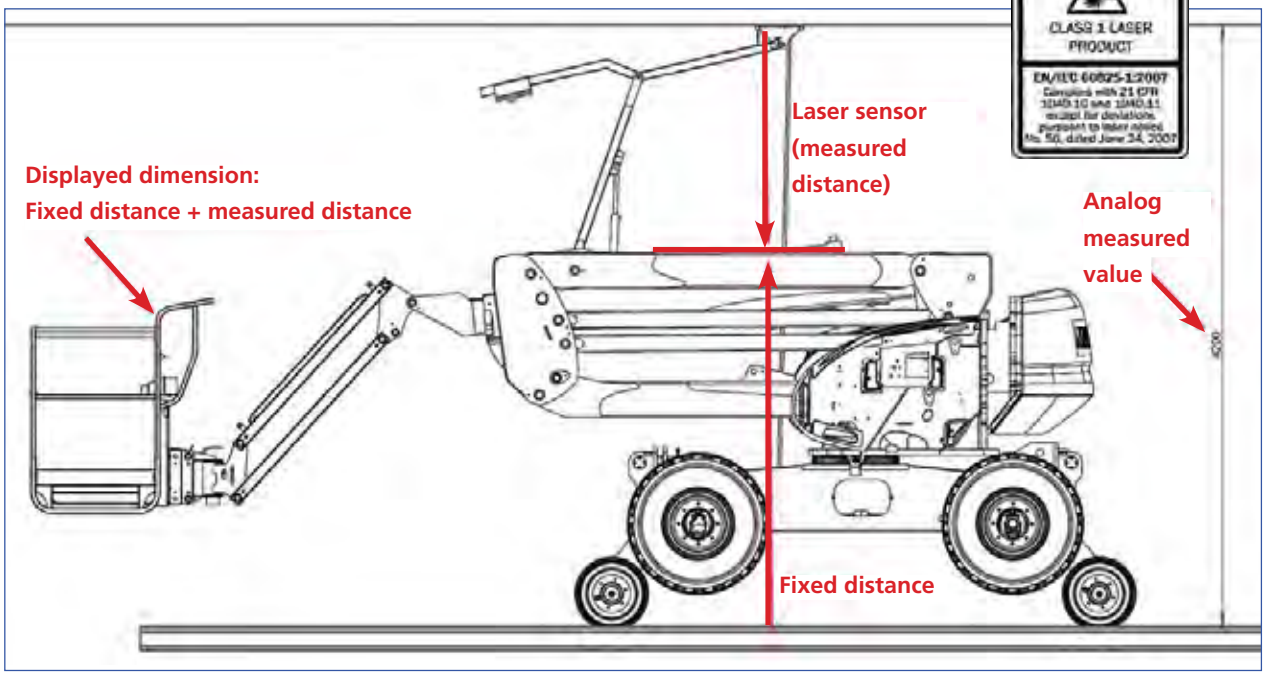
Avoid direct exposure to the laser beam. Avoid looking at the laser reflections.

Distance between overhead lines and rail tracks is measured by the following system:

1. Laser sensor.
2. Reflector plate.
3. Fixed distance.

The laser sensor uses an reference plate with special reflection material to measure the distance between Instrumented Pantograph and the ART17 T(H) machine. The fixed distance.

The formula: ***Total distance = Fixed distance + Measured distance***



Calibration steps:

1. Put ART 17 T(H) in rail position.
2. Measure distance between overhead line and topside of the rail track and write it down.
3. Mark the measured point.
4. Make sure working with the Instrumented Pantograph is authorised and approved.
5. Put the Instrumented Pantograph fully up.
6. Drive to the previous measured point.
7. Write down the distance as presented.
8. Check for any deviations between manual measurement and the Instrumented Pantograph measurement.
9. If the deviation is more than 5 mm, then proceed to setting new fixed distance on the next page.

Setting new fixed distance:

1. Make sure that the Nokeval 301 manual is read and is available onsite.
2. Press the buttons marked with red in picture below for 2 seconds.

3. Navigate with the arrows to Low setting.
4. Push the right arrow (config led will be on).
5. Re-edit the deviation for e.g. -13 mm into the fixed value.
6. Press the star button to save (config led will be off).
7. Check if measured value matches with the previous measurements.

Setting alarm settings (optional):

1. Make sure that the Nokeval 301 manual is read and is available onsite.
2. Press the buttons marked with red in picture below for 2 seconds.

3. Follow the instructions on page 8 manual Nokeval 301.
4. Check if alarm light amber is enabled : move Instrumented Pantograph to minimal position.
5. Check if alarm light red is enabled: move to Instrumented Pantograph to maximal position.

REMARKS

Laser sensor and display are calibrated when delivered. The components will not show attrition deviations in measurements, in case there do please contact manufacturer in for recalibration.

7. Maintenance

REMARKS
Only **trained, certified** and **qualified** personnel, are authorized to operate the installation.

Maintenance must only be performed by authorised and qualified personnel.
All personnel must read safety- and operating instructions in the user manuals before operating the installation or completing any routine maintenance.

Prior to Commencing Maintenance Work You Must:
- Read and fully understand the enclosed working instructions.
- Ensure that any required safety precautions have been taken.
- Adhere to safety notices contained within this manual.
- Fully understand the risks involved and be competent to perform the work.
- Use only genuine spare parts as replacement items.

Ensure that prior to the vehicle being used, after maintenance work has been completed, all safety checks and tests have been completed.
In accordance with their policy of continuous development Rail Products UK reserve the right to amend the specifications of its vehicles without prior notice.

Rail Products UK does not accept liability for:
- Vehicles that have been altered or modified without prior written approval from Rail Products UK.
- Vehicles not maintained in accordance with the conditions of operation and maintenance as specified within this manual.
- Neglect of local or national government regulations.
- Damage or injury (whether direct or consequential) resulting from ignorance or failure to comply with any of the above items.

Please contact Rail Products UK if you have any queries. It is the owner's/user's responsibility to know and comply with all applicable rules, regulations, laws, codes and any other requirements applicable to the safe use of this equipment.

7.1. Technical cleaning

The Instrumented Pantograph must be cleaned on regular basis to extend the lifetime of the machine.

REMARKS
Do not use any aggressive or abrasive cleanings.
Do not use water on or near electrical parts, electrical cables and hydraulic hoses. Please note that water on high pressure as this can potentially lead to damage.
Steelwork must be cleaned with dry cloths. By serious contamination water and soap can be used.
Control panel cabinets must be cleaned with a dry cloth or a vacuum cleaner.

7.2. Safe Working Practice

The following is for general guidance only and is not a definitive list of necessary practices necessary for undertaking the functions described. It is understood that all maintenance and repair work will be undertaken by competent and suitably qualified personnel who will apply suitable practices and judgments. Personnel should be familiar with the task before undertaking any work.

General remarks:
- Place the lifting platform with the Instrumented Pantograph in a level working area free of any items and mark off the area. If you cannot comply with these conditions (the lifting platform is on a building site), chock the wheels, mark off the area around the lifting platform and take note of any hazards associated with the surroundings.
- Switch off the lifting platform, using the battery cut-out, before embarking on any procedure (unless specifically instructed otherwise).
- As soon as the weight of a component or an assembly exceeds 20kg, the procedure indicates this and it is advisable to use appropriate handling equipment for dismantling them, provided that their characteristics (as indicated on the manufacturer's info plates or the tare plates) are suitable for the operation to be performed.
- For cleaning purposes, use appropriately approved, non-flammable solvents.
- When removing or refitting any component, scrupulously follow the procedure stated, step by step; always finish the current step before moving on to the next one.
- If you experience any resistance when removing a component, do not force it. Check that the nuts, screws, and cables have been removed and that no nearby component is interfering with the work.
- The most important factor in preserving the lifting platform's service life is to maintain a high level of cleanliness in its vital components.
- Where not stated, the refitting operations consist of performing the removal operations in reverse order.

General mechanical remarks:
- Use screws with the same characteristics as those of the original screws and of an appropriate length.
- When the procedures do not state a value for the tightening torques to be applied to the nuts and bolts, you should use the standard values appropriate for the characteristics of the particular components.

General hydraulics remarks:
- Some of the hydraulic lines are under high pressure, even when the Instrumented Pantograph is not operating. To avoid any accidents:
  - Follow the hydraulic line pressure release procedure before starting to work on one of their components.

- Some cylinders are fitted with valves used for putting the lifting platform into safe mode when the movements stop by retaining hydraulic pressure in the cylinder's chambers. This means that a cylinder once removed may still have high pressure in its chambers. It is therefore advisable to:
  - Follow the pressure release operations for the cylinder to be removed.
  - Eliminate the pressure in the chambers before starting to remove a cylinder.
- Before working on a hydraulic component, clean the immediate surroundings and provide receptacles or cloths for catching any oil likely to escape during the removal procedure and plugs or caps for sealing off the holes and to prevent foreign bodies getting into the circuit.
- The covers, hatches, seals and filters are intended to keep the hydraulic oil pure and prevent any foreign bodies from getting into the circuit. For these parts, therefore, you must periodically:
  - Check that there is no damage.
  - Maintain a correct level of cleanliness.
- Use male and female plugs for sealing off hoses and hydraulic connections.
- Cloudy oil is a sign of a significant proportion of moisture, which will cause oxidisation / corrosion of the circuit's metal parts: purge and clean the whole circuit; then refill the circuit with new oil.
- If the circuit should be contaminated by the presence of foreign bodies (metal, rubber, etc.), purge and clean the whole circuit; then refill the circuit with new oil.
- We do not recommend that you mix different types or different brands of oil in that there is no guarantee that they are of equivalent composition or viscosity.

Before lubrication and maintenance tasks Instrumented Pantograph:

- Vehicle must be on firm level ground.
- Ensure the parking brakes are applied (not manually released).
- Stop engine and remove starter key.
- Isolate the Battery.
- Allow engine to cool.
- Chock wheels.

Warning – Fluids

Handle fluids with care. Avoid skin contact with used oil. Protect hands with an effective barrier cream and/or gloves. Fluids under pressure can escape from extremely small holes. Avoid checking for leaks on pressurised systems, approach with extreme caution and NEVER use body parts such as hand or fingers to detect source. Always dispose of waste lubricants and filters in a responsible manner.

Warning-Hydraulic Connections

Ensure all hydraulic connections are tight. Relieve all pressure by moving the hydraulic control levers, venting pressurized tank and allow the system to cool before disconnecting hoses or lines. Unload hydraulic cylinders and similar systems such as brake units before working on any circuit connection where load induced or trapped pressure could be released.

Hydraulic Hoses

Ensure any replacement hydraulic hoses are of an equivalent or superior rating to original fitments and correctly routed. Refer to hydraulic circuit diagrams for specific information regarding pressures in separate parts of the hydraulic system.

Fasteners

Renewal Policy

All split cotter pins, star washers, locking tabs and spring washers removed during maintenance and repairs MUST BE RENEWED. All other fasteners removed during maintenance and repairs shall be renewed if any part of them are worn or distorted. Where fasteners are renewed, they must be renewed with parts of the same size, grade and finish.

Tightening of Threaded Fasteners

Where torque loading is specified nuts, bolts and screws must only be tightened by means of a calibrated torque wrench wherever practical to do so.
Unless otherwise specified, slotted nuts shall be over tightened if necessary to align the next slot to allow for the insertion of split cotter pins. Under no circumstances shall nuts be eased back.
When prevailing torque nuts are used, at least 1 complete threads of the bolt must protrude through the nut.

7.3. Maintenance frequency

Exam code	Frequency	Working hours
A	Daily or pre-use	10
B	Weekly	50
C	Monthly	200
D	6 monthly	1200
E	Yearly	2500
F	As required	-

7.4. Daily/Pre Use Checklist

Before use each day, or at the beginning of each shift, check the safe condition of the Instrumented Pantograph by visual inspection including, but not limited to the following:

- Operating and Safety Manuals are available and legible.
- Chassis superstructure for damage.
- Fluid leaks.
- Fluid levels.
- All instruction and warning labels are legible.
- Controls, functioning correctly & undamaged.
- Check for loose, missing or damaged parts.
- Ensure routine maintenance is up to date.

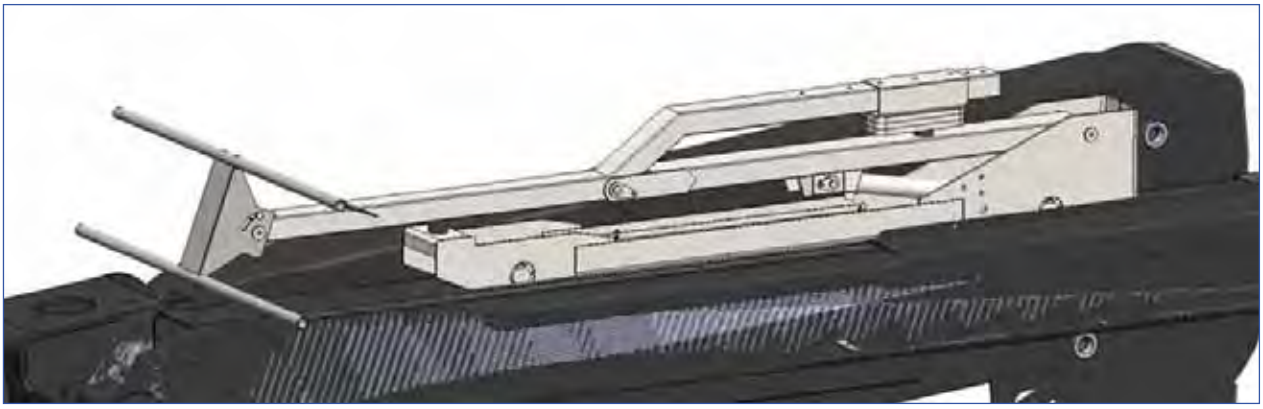
7.5. Task descriptions

For task descriptions of the ART17 base machine refer to the maintenance table in Chapter 7 of the maintenance document.

Job no.	Job title	Activity	Exam Code					
			A	B	C	D	E	F
Instrumented Pentograph								
RB01	Instrumented Pantograph	Check	X		X			
RB02	Lifting - lowering cylinder	Check		X				
RB03	Hydraulic 6/2 valve and hoses	Check		X				
RB04	Sliding bushes	Lubricate			X			
CH01	Security labels	Check	X					
ES01	Rail control panel	Test			X			
ES02	Earth connection / cables	Check	X					

7.6. Maintenance instructions: Instrumented Pantograph

7.6.1. Instrumented Pantograph – Check **Job no. RB01**



Purpose

Up or down movement mechanical, following overhead lines. Used to measure distance between overhead lines and rail track. Detect mechanical problems and damages.

Scheduled work

1. Check general condition; no visual deviations (any damage, leakage, wear, corrosion, looseness, slack, etc.).
2. Check that there is evidence of surplus grease escaping from all lubricated pins and bushes.

Put Instrumented Pantograph fully up.

3. Check for any abnormal sounds or any vibration during operation.
4. Check rubber damper for any damages or any cracks.
5. Check reflection plate.
6. Check counterweight fixation, no lose connections.
7. Check all safety labels are in place and legible.
8. Check all earth connections/cables are in place and secure.
9. Report all remarkable observations to the responsible person(s).

Arising work

1, 3, 4, 5 & 6. Renew any defective or missing components.

2. Carry out job no. RB04 Sliding Bushes – Lubricate.
7. Carry out Job no. CH01 Safety labels - Check.
8. Carry out Job no. RES02 Earth Connections/Cables – Check

7.6.2. Lifting - Lowering Cylinder – Check **Job no. RB02**

Purpose

Lifting cylinder (arrowed) to operate Instrumented Pantograph up and down.

Scheduled work

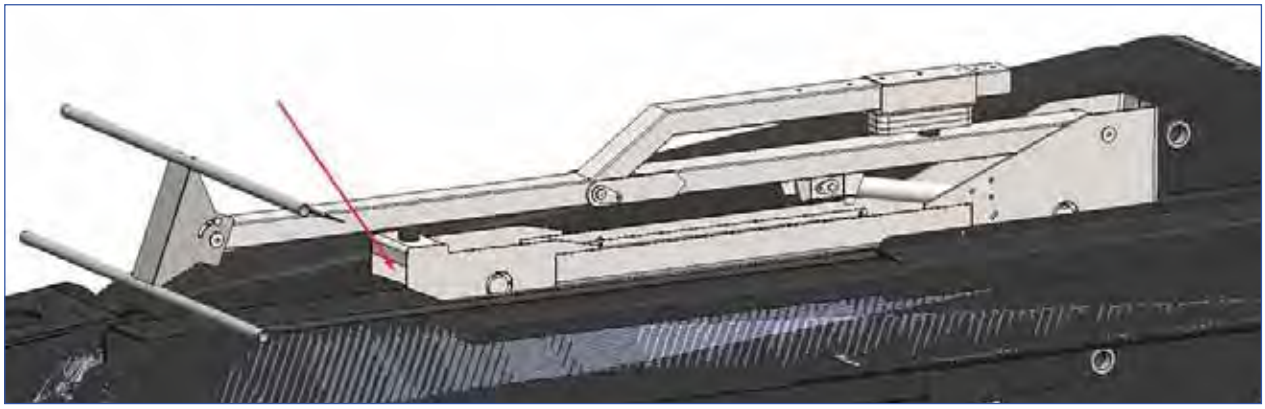
1. Check general condition; no visual deviations (any damage, any leakage, any wear, any corrosion and security etc.).
2. Check the piston rod is straight and surface is in good condition.
3. Check the check valves on all lifting cylinders for:
   - 3.1. Any mechanical damage.
   - 3.2. No leakage.
   - 3.3. Are firmly tightened on cylinder port.
4. Report all remarkable observations to the responsible person(s).
5. Check that all protective covers are back in place after completing the job.

Arising work

1, 2, 3 & 5. Renew any defective or missing components.

7.6.3. 6/2 valve – Check

Job no. RB03



Purpose

To control the Lifting cylinder to operate Instrumented Pantograph up and down.

Location

- Under rubber damper (see red arrow).

Scheduled work

1. Check moderate operating speed for Instrumented Pantograph lifting and Instrumented Pantograph lowering, without jerking.
2. Check for any indications: any oxidation or any lose wiring.
3. Check all hydraulic hoses for any leakage or any damaged rubber.

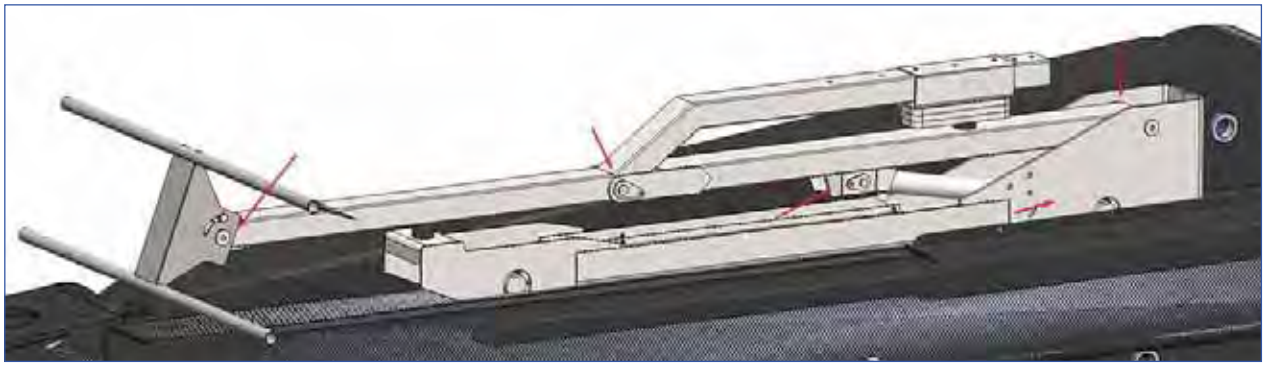
Arising work

1. Replace solenoid. Contact manufacturer.
1. Replace Valve block. Contact manufacturer.
2. Renew any defective or missing components.
3. Replace hydraulic hose with equal or higher classification.

Repeat the test after any repairs or any adjustments have been made.

7.6.4. Sliding Bushes – lubricate

Job no. RB04



Position

- Sliding bush Instrumented Pantograph frame.
- Sliding bush arm2 with arm1 connection.
- Sliding bush arm1 with base connection.
- Sliding bush cylinder with arm1 connection.

Scheduled work

1. Check general condition; no visual deviations (damage, leakage, wear, corrosion etc.).
2. Check the condition of the sliding bushes (slack on pin).
3. Check if the lock plate mounting bolts are fastened.
4. Check that there is evidence of surplus grease escaping from oscillating axle.
5. Grease all sliding bushes.
6. Report all remarkable observations to the responsible person(s).

Arising work

1, 2, 3. Renew the sliding bushes, contact the manufacturer.

7.6.5. Security Labels – Check

Job No CH01

Location

- Pinching warning on Instrumented Pantograph frame (see below).

- Electrocution warning on Instrumented Pantograph frame (see below).

- Electrocution warning near operator Instrumented Pantograph controls (see below).

- Beware Overhead line equipment and electronically warning decals near Instrumented Pantograph controls (see below).

Scheduled work

1. Check all labels are in place and are legible.

Arising work

1. Renew any missing, damaged or illegible labels.

7.6.6. Rail Control Panel – Test

Job No ES01

Location

- Instrumented Pantograph control panel in the basket (see 6.2.1).

Scheduled work

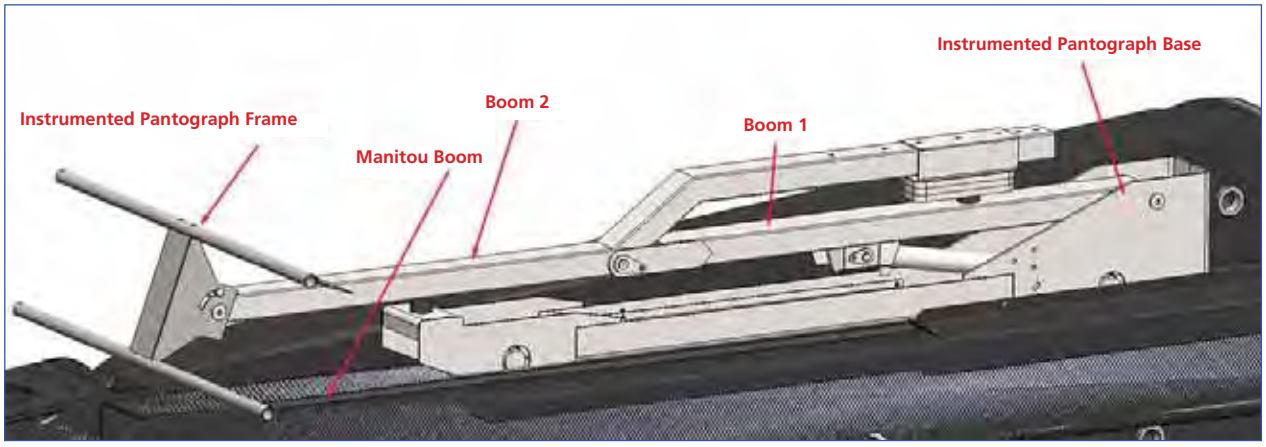
1. 1. Check the general condition of the buttons, switches and signal lamps:
   - 1.1 Fixation in the control panel.
   - 1.2 Spring return to neutral position of bogie cylinder operating switches.
   - 1.3 Test All functions.
   - 1.4 Text indication present and legible.
2. Report all remarkable observations to the responsible person(s).

Arising work

- 1.1 Secure component in control panel.
- 1.2 Replace any defective components.
- 1.3 Replace any defective components.
- 1.4 Replace missing or unreadable text plates.

7.6.7. Earth Connections / Cables – Check

Job No ES02



Location

- Wires between: Instrumented Pantograph Frame, Boom 2, Boom 1, Instrumented Pantograph Base, and Manitou Boom.
  Earth connections / cables for equipotential bounding are marked red.

Scheduled work

1. Check the general condition of the earth connections/cables (looseness, corrosion, damage).
2. Check the general condition of the earth conductors (cable mantle not cut, damaged).
3. Report all remarkable observations to the responsible person(s).

DANGER!
If any of the earth connections/cables are deemed defective then this machine **must not** travel under live OLE until the necessary repairs have been completed.

Arising work

1. Replace any defective earth connections/cables immediately.
2. Replace any damaged earth conductors.

8. Operation, data logging and error codes

8.1. Main control

Use of pantograph possible when:

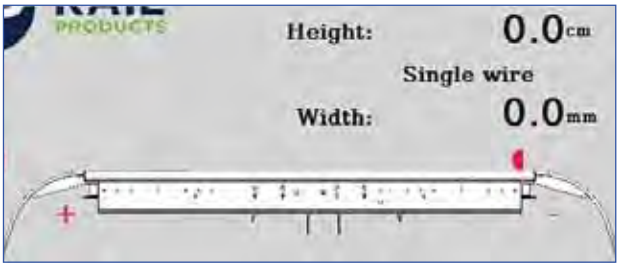
- Boom 1,2,3 down
- Machine in "rail position"
- Use of the "deadman pedal"
- "Lock basket" not active
- Key pantograph active (position 1)
- Turret straight (green LED) active

Pantograph Up
(Lock when Manitou isn't standing in correct position)

Pantograph Down

Info button (Operation Manual)

Measuring display:



Height cable wire
(Lock when Manitou isn't standing in correct position)

Position cable wire L + R
0 = centre (min: - 625 | max: + 625)

The red indicator gives an indication about the position of the cable wire

8.2. Data logging

Activate data logging:

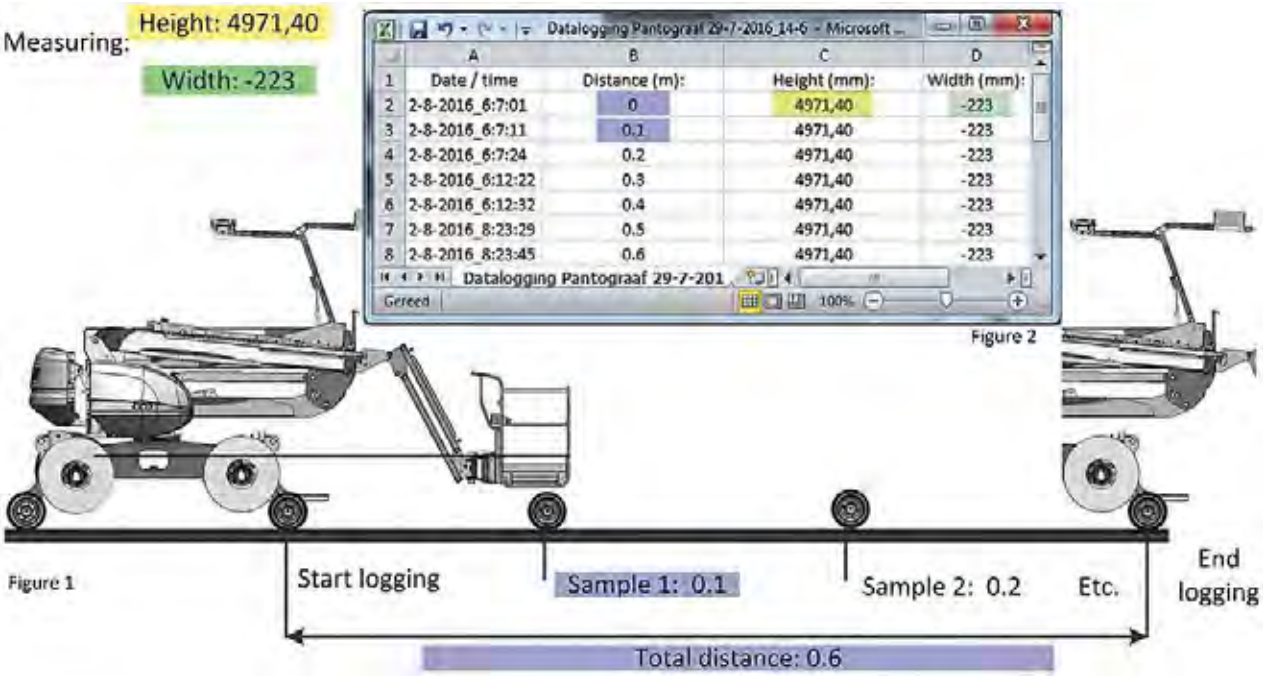
- Install the orange cable
- Press record button
- Log is active, button is flashing
- Driving in rail-mode
- End log, press record button

Distance:

Reset distance ← 

→ Total distance

(Value will be set automaticly to 0 by activation REC-function)



Sample rate:	In figure 2 the sample rate is 0,1 [m] (Difference between 2 samples)
Change value sample rate:	In menu step 1 of 7, parameter 007 (page 4)
Example:	Value sample rate = 0,1m, When you drive 0,6m in 'rail mode' then the logging creates 6 samples

Download log-data to USB

- Stop log (REC-button isn't flashing) → 

- Install USB-device
- USB-device download automatically →
- LED USB-device stop blinking, download finish

8.3. Technical information

8.3.1. Relais and fuses

Overview:

Fuses:

F1	15A	Master controller pantograph (30+)
F2	2A	Master controller pantograph (memory)
F3	5A	Master controller pantograph (15+)
F4	Spare	

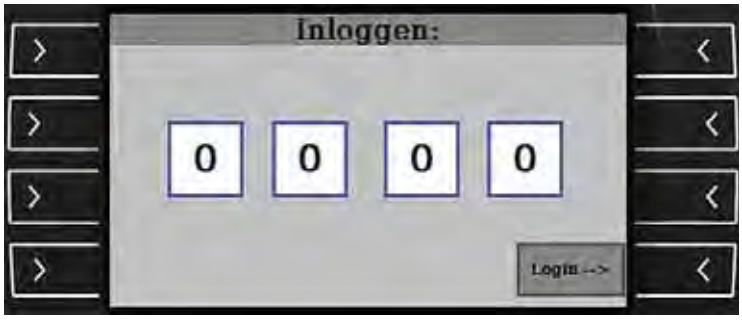
Relais:

K1	Pantograph position feedback

Location:

8.3.2. Parameters and diagnostic

Use the  button to activate the parameters and diagnostic functions.



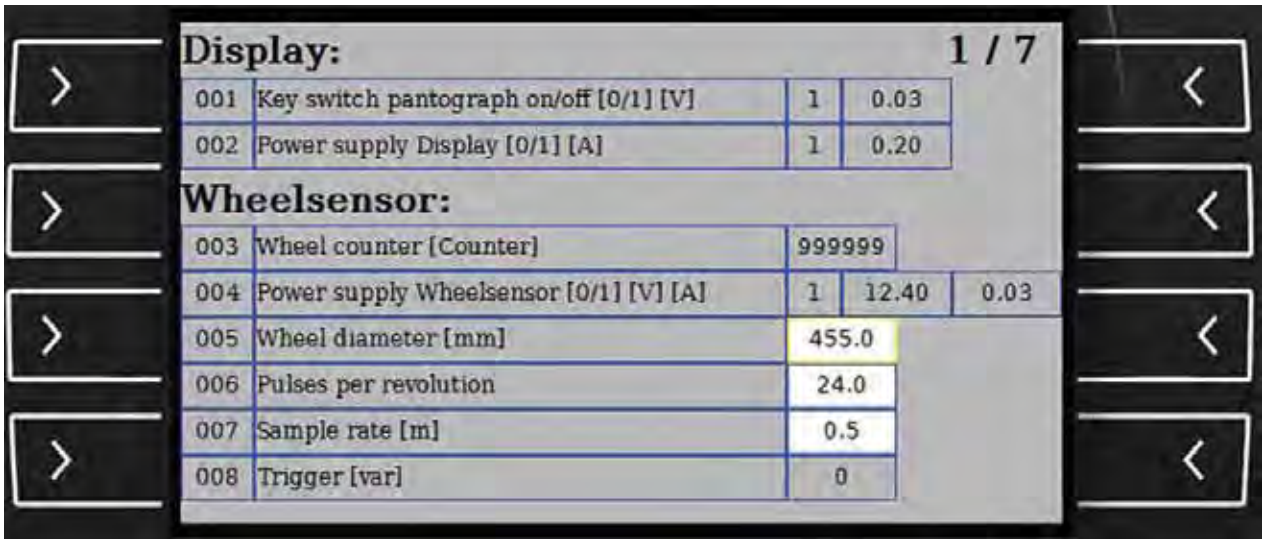
This function is protected with a password.

Code: 3760

Attention!

This menu makes it possible to make adjustments into the parameter settings of the pantograph. Adjustments can lead to inaccurate work with the pantograph an also to unsafe situations.

8.3.2.1. Step 1/7 : Wheel sensor



001 Pantograph on/off [0/1] [V] reffr. Electric drawing S1 page 5.8

0 = (0V) key switch is OFF, pantograph is disabled
1 = (12V) key switch is ON, pantograph is enabled

0.03 = Actual voltage

002 Power supply Display [0/1] [V] [mA] reffr. Electric drawing A2 page 4.15

0 = (0V) Display is OFF, pantograph is disabled
1 = (12V) Display ON, pantograph is enabled

0.20 = Actual current

003 Wheel count [0/1] [0/1] [Counter] reffr. Electric drawing B13 + B14 page 5.15 + 5.18

999999 = counting value

004 Power supply wheel sensor [0/1] [V] [mA] reffr. Electric drawing A1 page 5.12

0 = (0V) No power at the wheel sensor
1 = (12V) Power at the wheel sensor

12.40 = Actual voltage

0.03 = Actual current

005 Wheel diameter [mm]

The wheel diameter of the rail wheels, (value can be changed)
Default 455.0 mm

006 Pulses per revolution

Number of pulses in 1 revolution of the rail wheel, *(value can be chanced)*

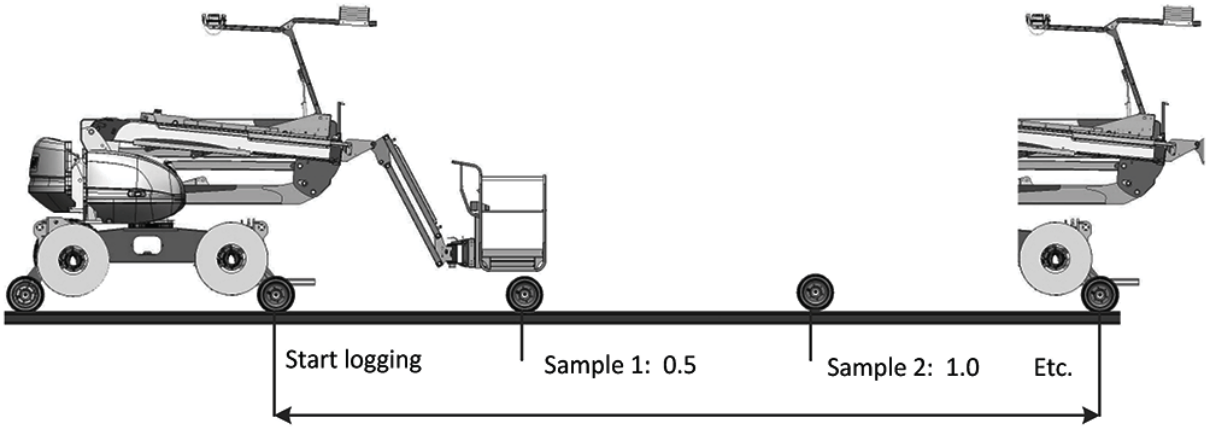
Default 24.0

007 Sample rate [m]

Example:

Value sample rate = 0,5m,

When you drive 20 m in 'rail mode' the logging creates 40 samples



003 Trigger [var]

The number of samples

8.3.2.2. Step 2/7 : Height measure system

010 Measure angle [*] [mm] reffr. Electric drawing B2 page 5.6

250,0 = Actual angle

4200.0 = Actual height cable wire

011 Power supply angle sensor [0/1] [V] [mA] reffr. Electric drawing A1 page 5.10

0 = (0V)No power at the angle sensors

1 = (12V)Power at the angle sensors

12.40 = Actual voltage

0.09 = Actual current

012 S1 (rail -> midpoint of the pantograph)

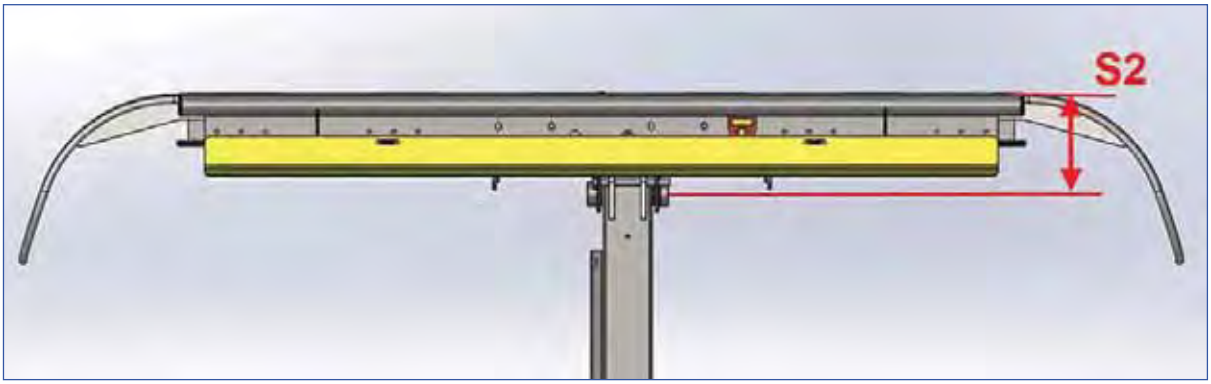
Calibrate setting (machine specific value).

S1 is for calibrating the parameter of the value for the distance between top rail and pivot point.

013 S2 (length of the pantograph head)

Calibrate setting (construction fixed value of 166).

S2 is for calibrate the parameter of the value for value for the distance between top pantograph measure head and pivot point of top.



014 S3 (Angle of the arm)

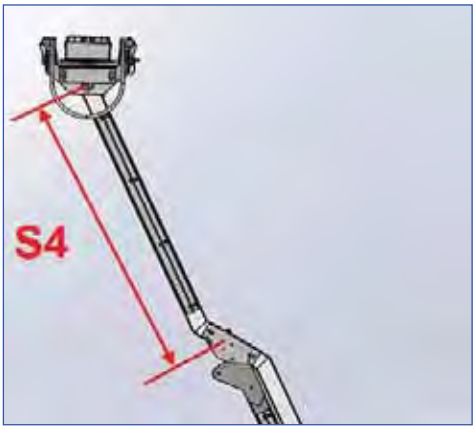
Calibrate setting (machine specific value).

S3 is for calibrate the parameter of the value for the measure angle sensor value. This value have to be the value of the parameter 010 (actual angle value) when the pantograph measure arm is in the spirit level.

015 S4 (length of the second arm)

Calibrate setting (construction fixed value of 1010).

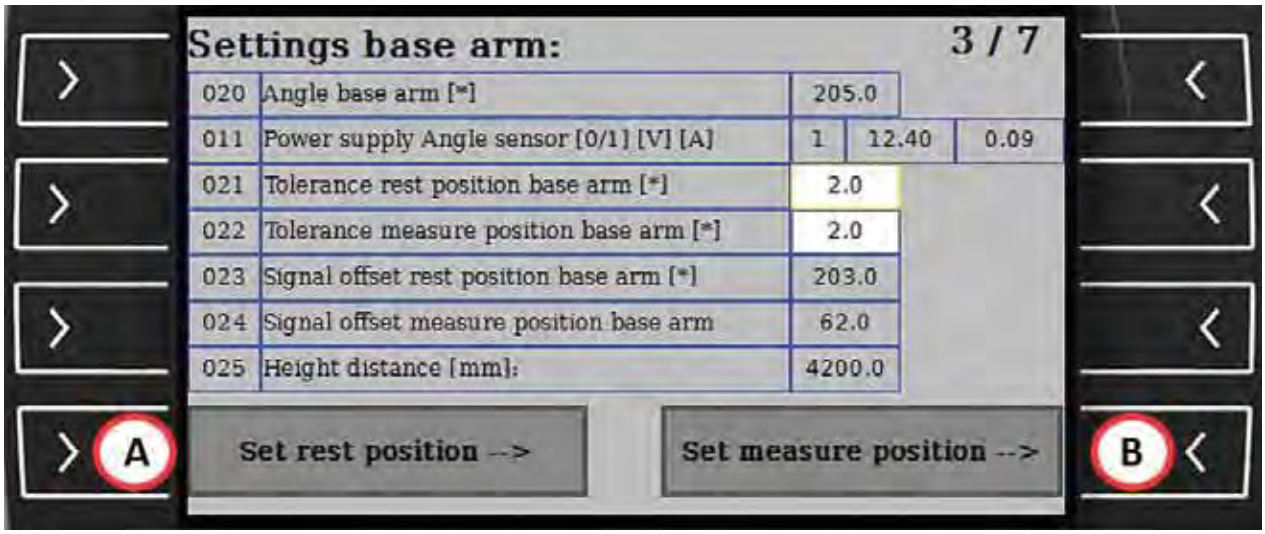
S4 is for calibrate the parameter of the value for the distance between the two pivot points of the pantoraph measure arm.



Check measure values:

If the measure value doesn't correspond modify the parameters S1, S2, S3, S4. Until the values are corresponding.

8.3.2.3. Step 3/7 : Setting angle sensors



A **Set rest position**
Button for calibration angle sensor (rest position).

Description:
- pantograph fully down,
- press the button (A).
- New value is stored.

Attention!

This setting makes it possible to make adjustments into the parameter settings of the pantograph. Adjustments can lead to unsafe situations

B **Set measure position**
Button for calibration angle sensor (measure position).

Description:
- pantograph fully up,
- press the button (B).
- New value is stored.

020 Angle base arm [*]
205.0 = Actual angle

reffr. Electric drawing B1 page 5.2
- New value is stored.

011 Power supply angle sensor [0/1] [V] [mA] reffr. Electric drawing A1 page 5.10

0= (0V)No power at the angle sensors
1= (12V)Power at the angle sensors

12.40 = Actual voltage

0.09 = Actual current

021 Tolerance rest position base arm [*]

2.0 = Tolerance of the rest position

Default 2.0

022 Tolerance measure position base arm [*]

2.0 = Tolerance of the measure position

Default 2.0

023 Signal offset rest position base arm [*]

203 = The value of the rest position (modify with button A)

Attention:
The system status of the "rest position of the base arm" detects the value of the angle sensor between 201 and 205 (tolerance parameter 021).

024 Signal offset measure position base arm

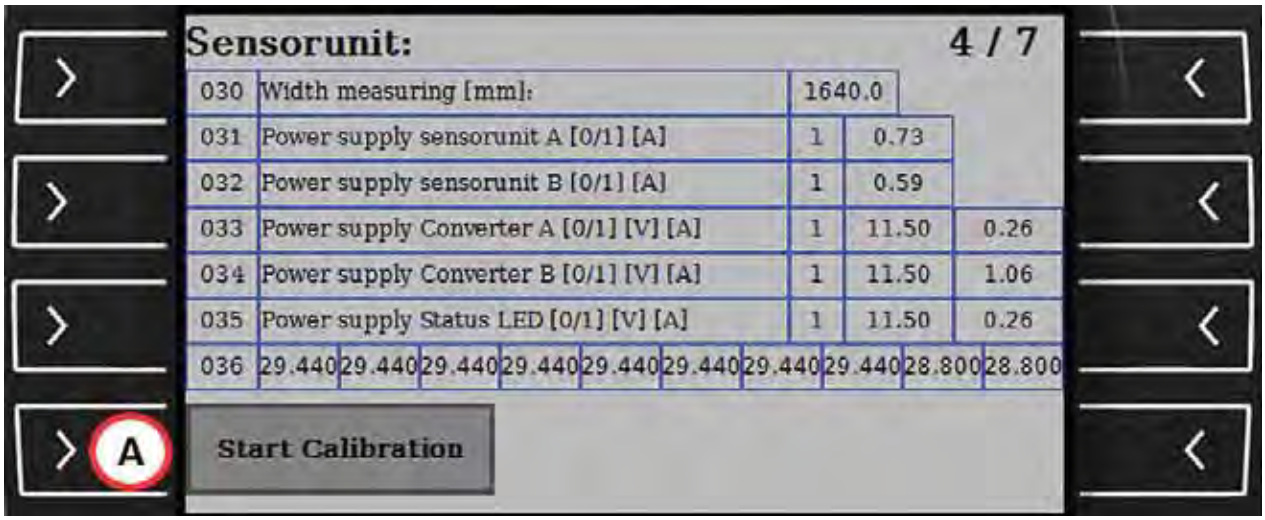
62.0 = The value of the measure position (modify with button B)

Attention:
The system status of the "measure position of the base arm" detects the value of the angle sensor between 60 and 64 (tolerance parameter 022).

025 Height distance [mm]

2400 = Actual height measure value of the cable wire

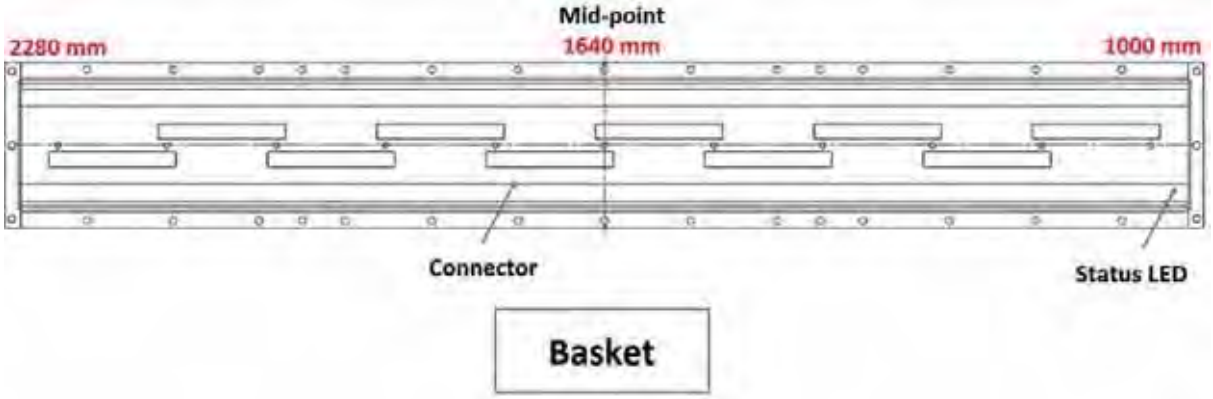
8.3.2.4. Step 4/7 : Width measure system



030 Width measuring (mm)

1640 mm = Actual position of the wire cable on the pantograph head

(See figure below for example values)



031 Power supply top part A [0/1] [V] [mA] reffr. Electric drawing A1 page 4.6

0: (0V) No power at top part A

1: (12V) Power at top part A

0.73 = Actual current

(Power supplies of pantograph head (number 031 and 032) are connected to each other.
Total current pantograph head is 0.73 + 0.59 = 1.32A)

032 Power supply top part B [0/1] [V} [mA] reffr. Electric drawing A1 page 4

0: (0V) No power at top part B
1: (12V) Power at top part B

0.59 = Actual current

(Power supplies of pantograph head (number 031 and 032) are connected to each other.
Total current pantograph head is 0.73 + 0.59 = 1.32A)

033 Power supply converter A [0/1] [V} [mA]

0: (0V) No power at converter A
1: (12V) Power at converter A

11.50 = Actual voltage

0.26 = Actual current

(Power supply of converter (number 033 and 034) are connect to each other.
Total current pantograph head is 0.26 + 1.06 = 1.32A)

034 Power supply converter B [0/1] [V} [mA]

0: (0V) No power at converter B
1: (12V) Power at converter B

11.50 = Actual voltage

01.06 = Actual current

(Power supply of converter (number 033 and 034) are connect to each other.
Total current pantograph head is 0.26 + 1.06 = 1.32A)

035 Power supply status LED[0/1] [V} [mA]

0: (0V) No power at status LED
1: (12V) Power at Status LED

11.50 = Actual voltage

0.26 = Actual current

036 Power supply sensors pantograph head

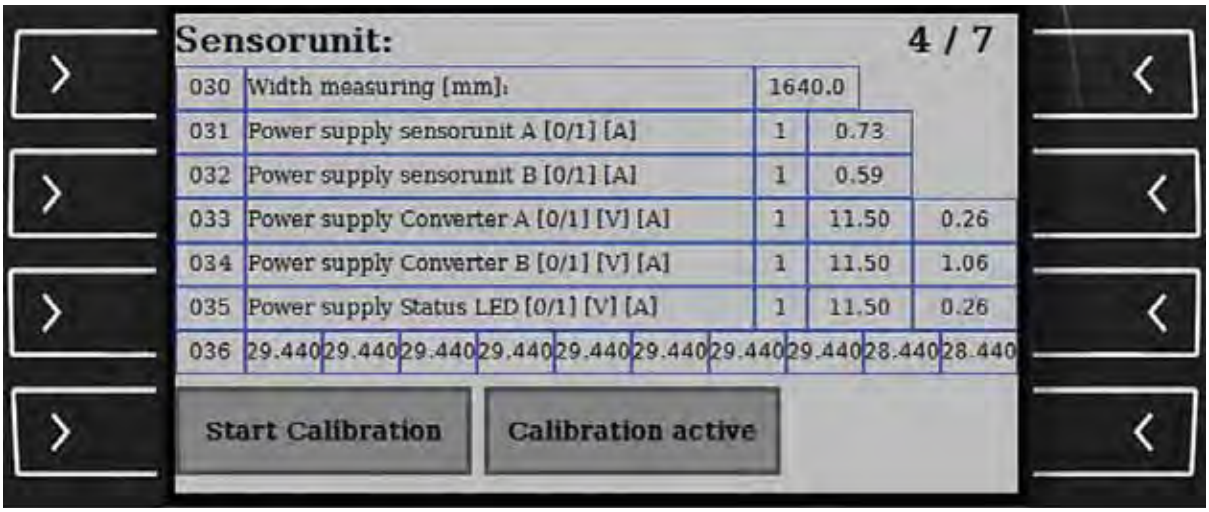
Current of each sensor [mA]

No cable	=	+/- 29 mA
Cable in sensor begin	=	4 mA
Cable in sensor end	=	20 mA

A Start calibration width measure system

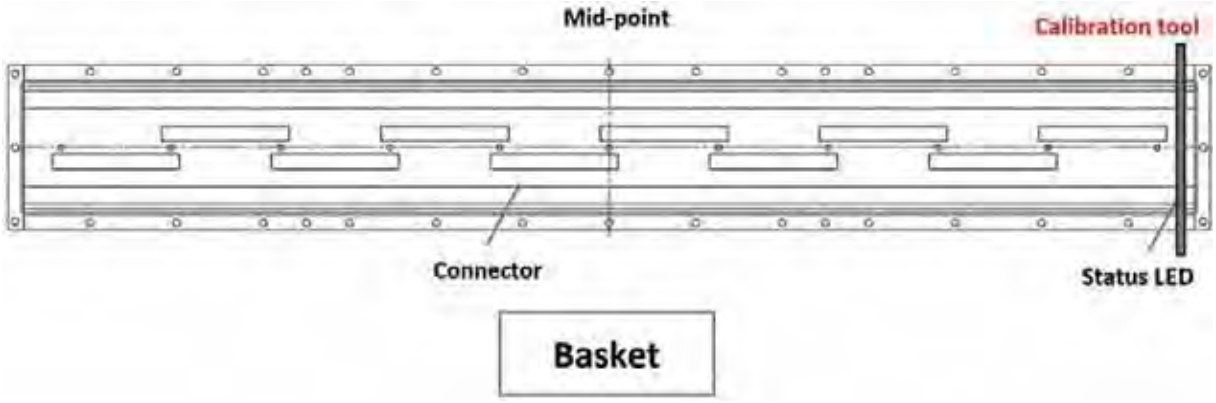
Description calibration:

1. Press start calibration (button A).
2. Now you see the indication “Calibration active”

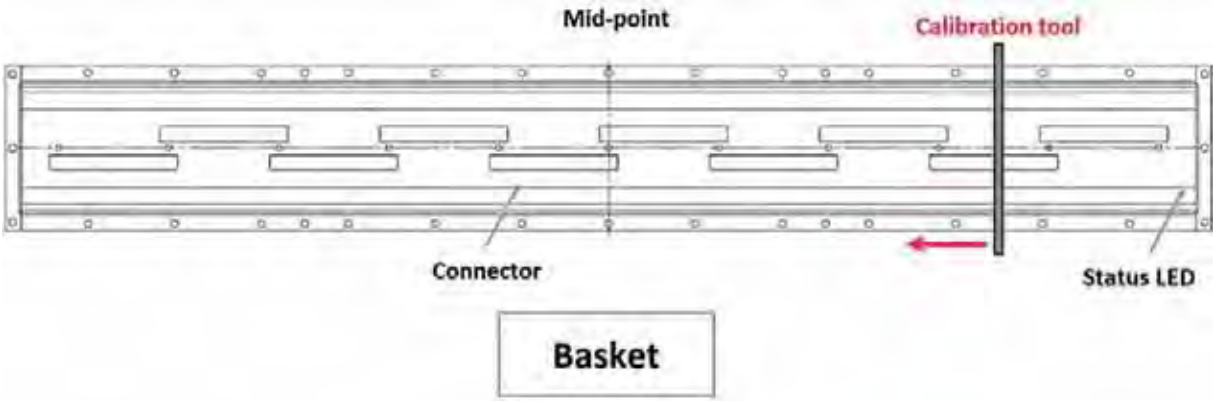


3. Place the calibration tool on the right side of the pantograph head

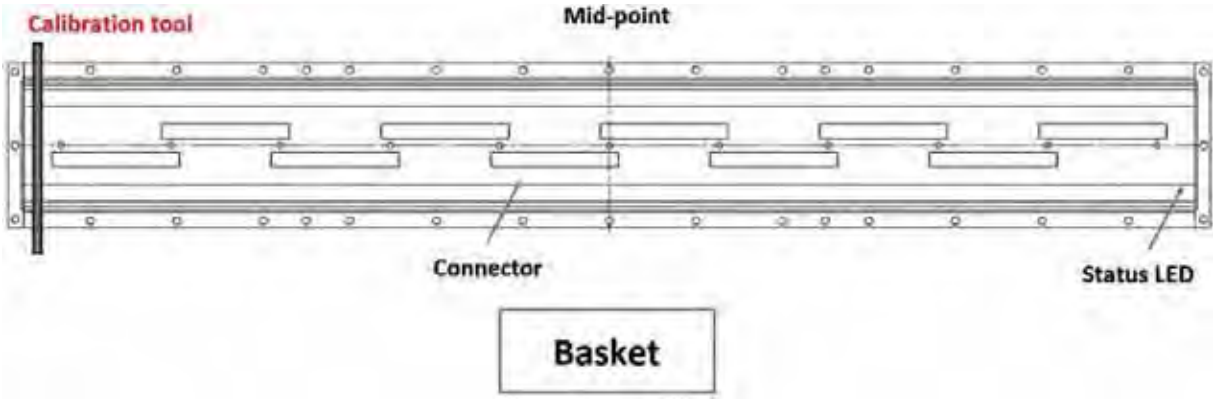
Attention! not above the sensors.

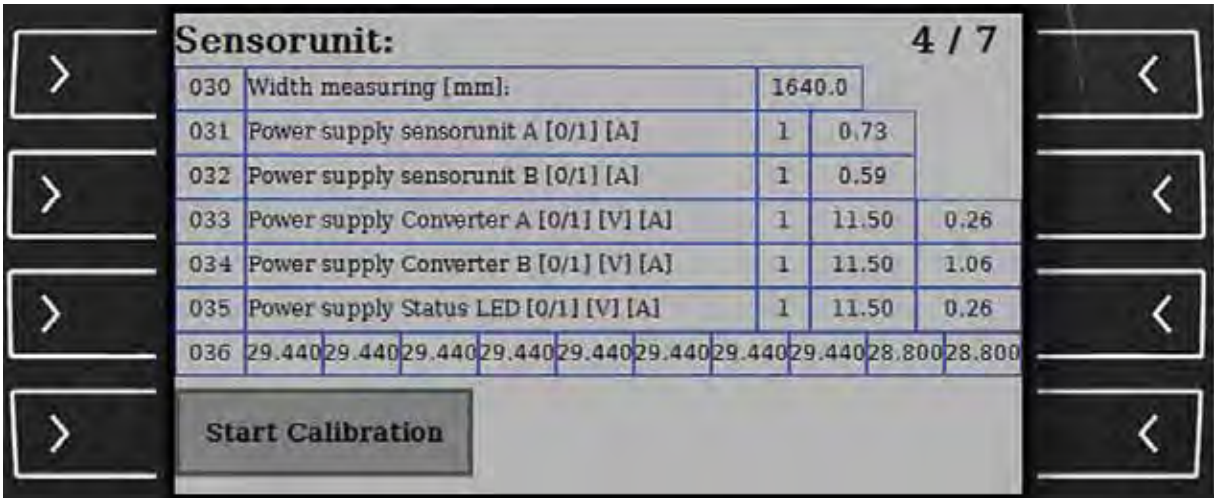


4. Move the calibration tool slowly over the sensors to the left side of the pantograph head.
   Attention! Move the calibration tool straight and flat over the sensors.

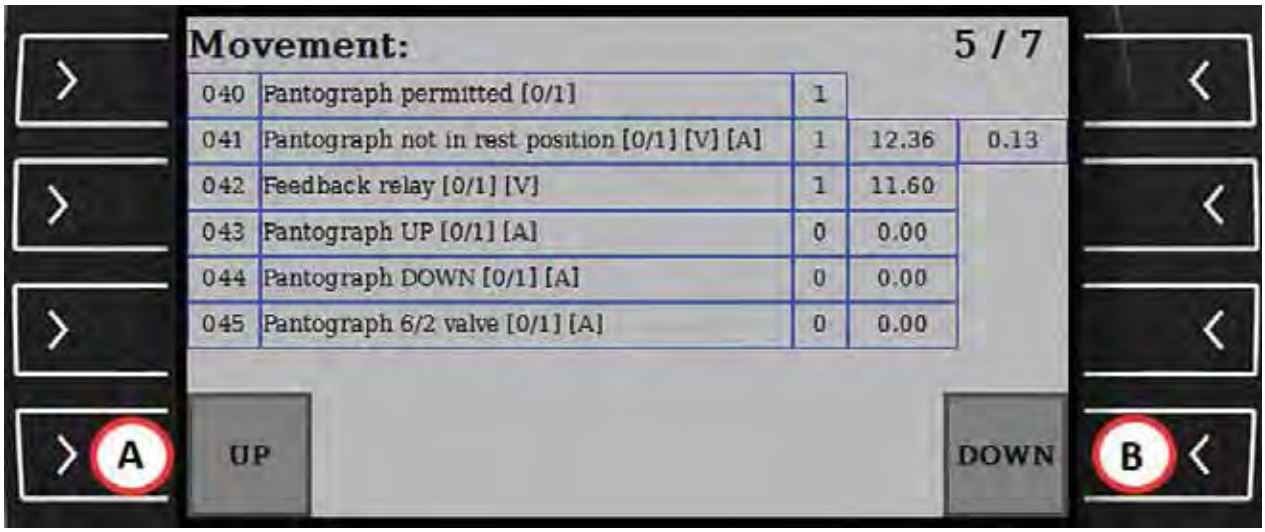


5. When the calibration tool is at the end, the calibration is finished. The "Calibration active" indication is gone.
   Attention! All the parameters of "036" are +/- 29 mA.
   Attention! When something goes wrong, restart the procedure.





8.3.2.5. Step 5/7 : Pantograph operation status



A Up

Pantograph moves upwards.

Pantograph is locked, if the machine does not satisfy the following conditions:

- Boom 1-2 and 3 down
- Turret straight (green LED ON)
- Machine in “rail position”
- Key switch pantograph ON
- “Lock basket” not active

B Down

Pantograph moves downwards. This function is always possible.

040 Pantograph permitted [0/1]p reffr. Electric drawing A1 page 5.11

1: Pantograph can move up and down

0: (0V)Pantograph can’t move up because the machine isn’t in the right position

See the follow conditions above (A UP).

The pantograph can always move down (also when 040 = 0).

041 Pantograph not in rest position [0/1] [V] [mA]

0: (0V)Pantograph is not in rest position. Following machine functions are locked:

- Rotation the turret,
- Bogies up and,
- Boom 1,2,3 are locked.

1: (12V)Pantograph is in rest position: turret basket, bogies up and boom 1,2,3 are unlocked

0.13 = Actual current

042 Feedback relais [0/1] [V] [mA] reffr. Electric drawing A1 page 5.11

0: (0V)Pantograph is not in rest position. Following machine functions are locked:

- Rotation the turret,
- Bogies up and,
- Boom 1,2,3 are locked.

1: (12V)Pantograph is in rest position: All machine functions will be active.

043 Pantograph UP [0/1] [V] [mA] reffr. Electric drawing A1 page 6.9

0: (0V) Pantograph not moving.

1: (12V) Pantograph moves upwards

044 Pantograph DOWN [0/1] [V] [mA] reffr. Electric drawing A1 page 6.10

0: (0V) Pantograph not moving.

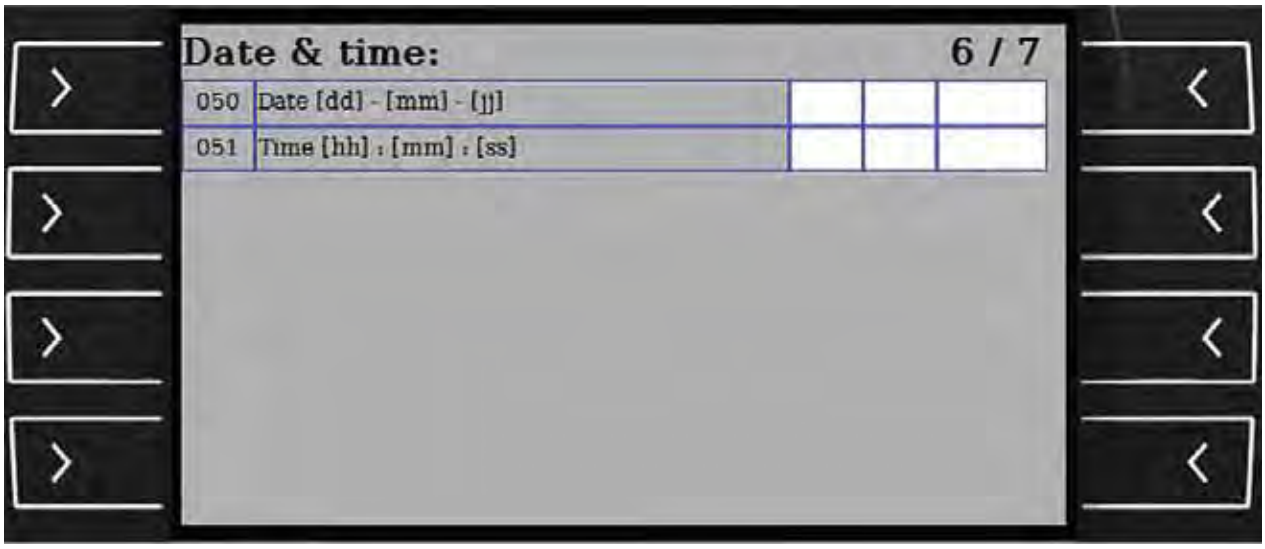
1: (12V) Pantograph moves downwards

044 Pantograph 6/2 valve [0/1] [V] [mA] reffr. Electric drawing A1 page 6.10

0: (0V) Pantograph not moving.

1: (12V) Pantograph moves upwards or downwards

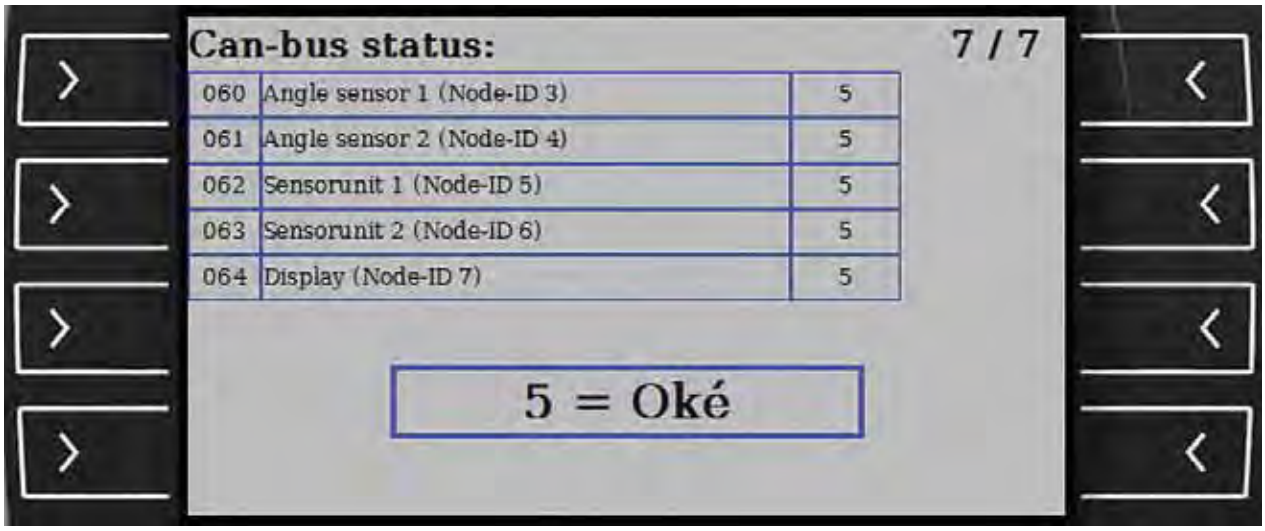
8.3.2.6. Step 6/7 : Date & Time



050 Date [dd] – [mm] – [jj]
Set the date, for data log

051 Time [h] : [m] : [s]
Set the time, for data log

8.3.2.7. Step 7/7 : CAN-bus Statuse



060 Angle sensor 1 (Node-ID 3)
OKE when value = 5

061 Angle sensor 2 (Node-ID 4)
OKE when value = 5

062 Top part 1 (Node-ID 5)
OKE when value = 5

063 Top part 2 (Node-ID 6)
OKE when value = 5

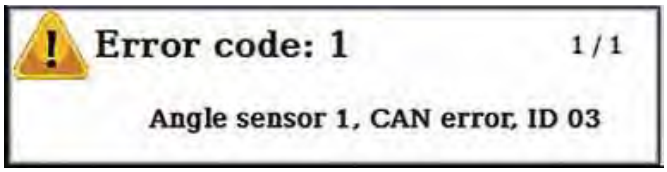
064 Display (Node-ID 7)
OKE when value = 5

8.4. Error codes

8.4.1. Error codes:

The electronic system of the pantograph has a diagnostic system . When the system detects an error, an error message appears in the home screen/main screen.
When the system detects more errors at once, the error messages appear one by one. In the example below there is one error code, if there are 3 error codes it will be (1/3).

Description:



Error code 1 = Number of error message (see paragraph 4.2 table of error messages)

1/1 = number of actual codes
(first 1 = actual displayed error code)
(second 1 = total error codes into the system)

8.4.2. Error codes list

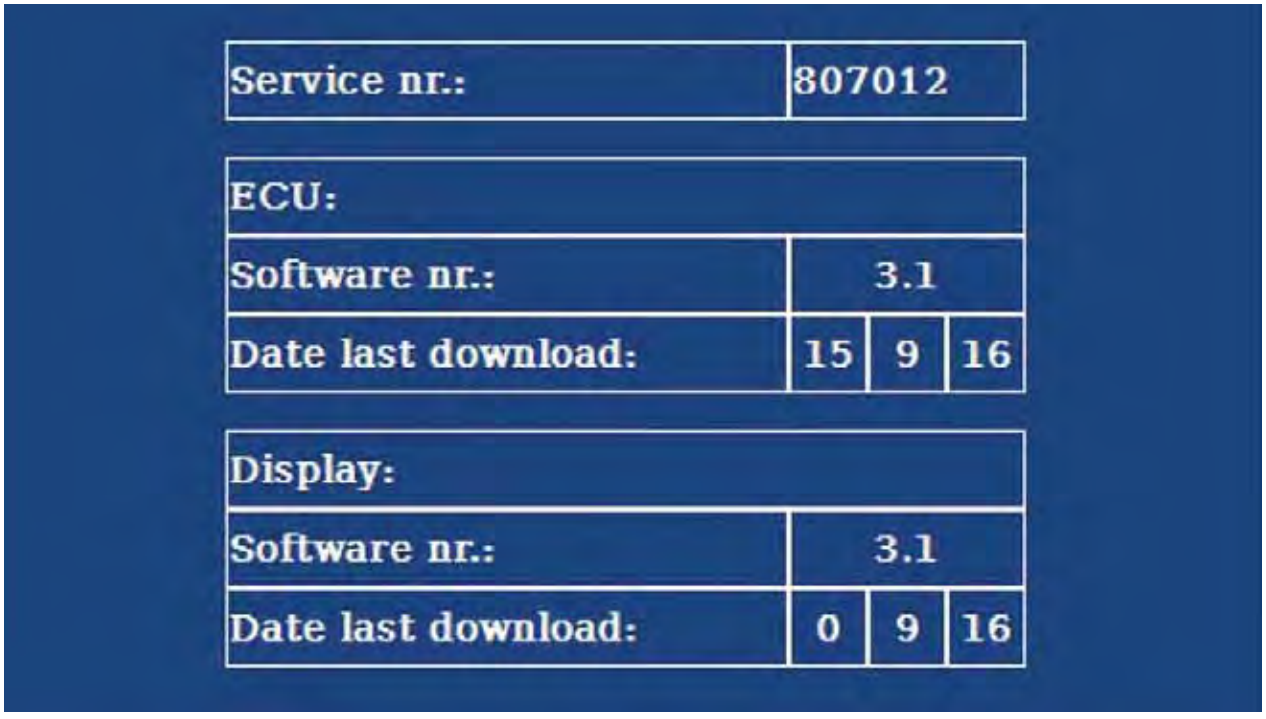
Error codes list:

Code	Discription	Explanation
1	Angle sensor 1, CAN error, ID 03	CAN-bus failler
2	Angle sensor 2, CAN error, ID 04	CAN-bus failler
3	Top-part, CAN error, ID 05 CAN-bus failler	
4	Top-part, CAN error, ID 06	CAN-bus failler
5	Display, CAN error, ID 07	CAN-bus failler
6	Master controller, temperature to high	Temperature is ingreasing 80°C
7	Top-part ID 05, temperature to high	Temperature is ingreasing 80°C
8	Top-part ID 06, temperature to high	Temperature is ingreasing 80°C
9	Angle sensor 1, power supply error	Current to lo or to high, of bolt sensors
11	Top-part, power supply error	Current to lo or to high
13	Feedback relais error	Feedback don't corresponding with the activation. Relais doens't work properly
14	Relais activation, error	Current to high
15	Hydraulic valve, 6/2 circuit error	Current to lo or to high
16	Manitou pantograph up, circuit error	Current to high
17	Manitou pantograph down, circuit error	Current to high
18	Top-part, sensor 1 error	Input sensor < 2,5mA
19	Top-part, sensor 2 error	Input sensor < 2,5mA
20	Top-part, sensor 3 error	Input sensor < 2,5mA
21	Top-part, sensor 4 error	Input sensor < 2,5mA
22	Top-part, sensor 5 error	Input sensor < 2,5mA
23	Top-part, sensor 6 error	Input sensor < 2,5mA
24	Top-part, sensor 7 error	Input sensor < 2,5mA
25	Top-part, sensor 8 error	Input sensor < 2,5mA
26	Top-part, sensor 9 error	Input sensor < 2,5mA
27	Top-part, sensor 10 error	Input sensor < 2,5mA

8.5. Software specifications

To visualise the software version press  button (A) for +/- 3 sec.

The following screen will appear:



9. Storage and transport

If the machine is stored for a prolonged period, cover the equipment and be sure the place is **dry and clean**.

10. Dismantling and elimination

After lifetime of the machine, the machine must be set secure according the safety rules.
Only a specialized company is allowed to dismantle the machine. All contaminated or harmful parts must be disposed in accordance to statutory requirements.

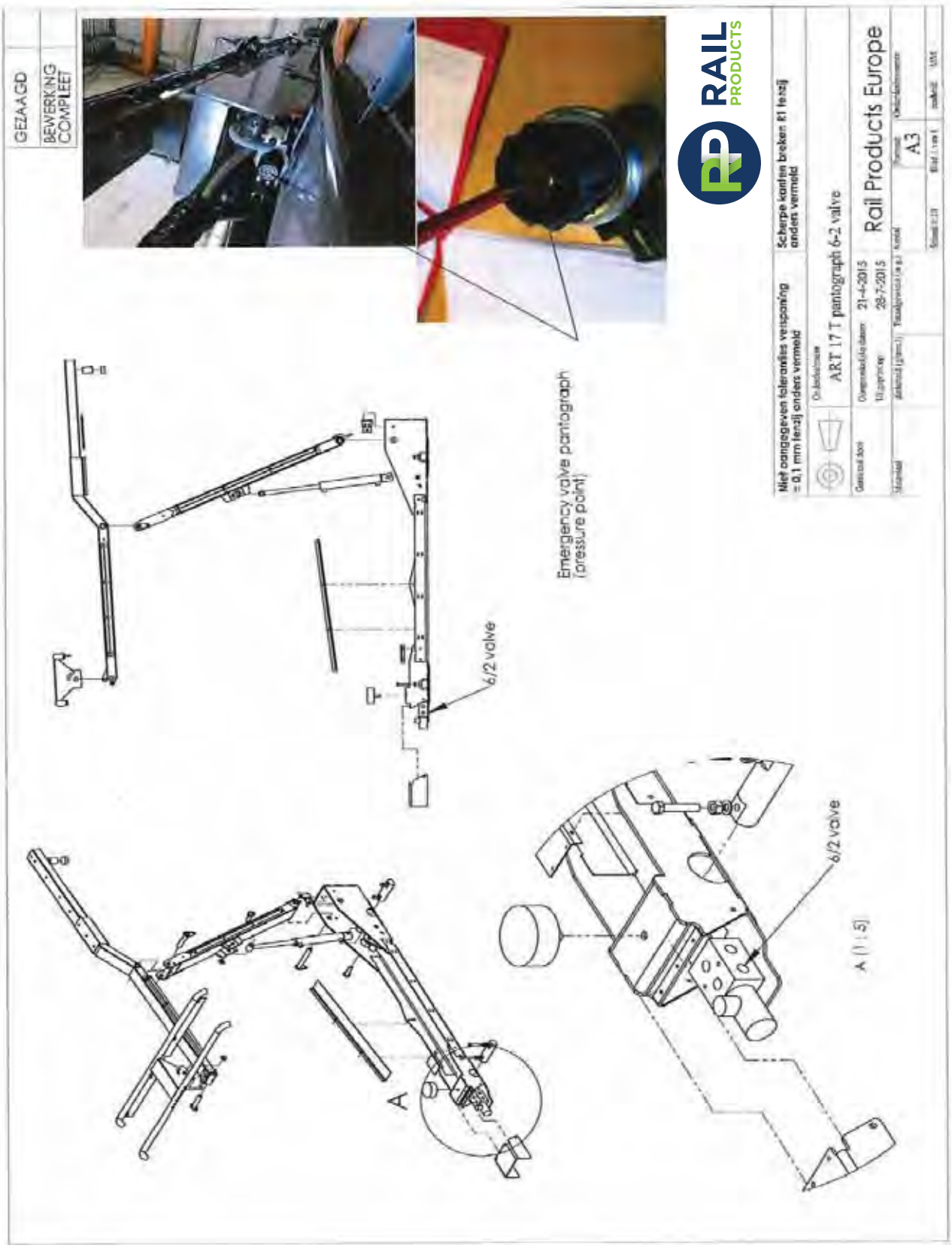
11. Instrumented Pantograph Emergency Recovery Procedure

For emergency recovery of the Instrumented Pantograph only.

STEP	Action / condition
1.	Put the MEWP into transport mode.
2.	Mount a tow bar between the towing vehicle and MEWP using the dedicated towing bar/couplings on the fixed or oscillating bogie.
3.	Using a screwdriver or other small rounded tool, manually release pressure point 6/2 valve placed below the Instrumented Pantograph (see picture in Rail Products ART17T (H) Pantograph 6-2 valve) (see details/picture 1 on page 38)
4.	Open the hydraulic circuit by pushing the 6/2 valve inwards (see details/picture 1 on page 38)
5.	Holding the pressure on the valve; the Instrumented Pantograph will now lower gradually, until the hydraulic cylinder/Instrumented Pantograph is in its lowered position. (see details/picture 1 on page 38)
	Hydraulic oil will be released out of his chamber, into hydraulic circuit.
6.	When the Instrumented Pantograph is folded down, release the pressure of the 6/2 valve by withdrawing the screwdriver/ small rounded tool.
7.	With the Instrumented Pantograph in its lowered and locked position, the MEWP can be towed at low speed.
8.	Towing the vehicle to the nearest off tracking location is a last resort.

Be aware of any hazourdous situations when lowering the Instrumented Pantograph!

ART 17 TH Instrumented Pantograph 6-2 valve



Users comments (form)

ImProvia is a company that wants to improve constantly. Therefore we need your feedback regarding this user manual. In this way we can improve future editions. Thanks for your co-operation!

Did you find the information you needed?

What did you think of the way the information is presented?

Do you have any other remarks or suggestions?

Your information:

Name:

Function:

Departure:

Plant:

Address:

Telephone number:

e-mail address:

This information is only used if there are any questions in your feedback.

Print this page, and please send it to the following address below:

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South Lanarkshire
ML8 4EN