



## Slew Limiter Operation and Maintenance

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All information, illustrations and specifications in this Maintenance Programme are based on the latest information available at the time of publication. The right is reserved to make changes at any time without notice.

Equipment operators and installers shall be responsible for ensuring that a safe working environment and safe systems of work are in place and in certain circumstances advice and permission from the controlling authority must be sought before any operation, installation or surveying work is carried out.

Prepared by:	Authorised by:

## 1 Issue and Revision Record

This document will be updated when necessary by the re-issue of the complete document.

Issue/ Revision	Description	Date	Revised Page No.	Revised By.
1	New Document	6/09/12		CTC
2	Revisions added to meet the requirement of NR Remit for ALO Working	12/09/12	Various	CTC
3	Revision following changes to operator selector switch	8/10/12	Various	CTC

## **2 Introduction**

This manual has been produced to cover the safe use and maintenance of the Slew limiter system.

It is provided as a supplement to the original manufacturers/converters manual and should be used in conjunction with those to provide safe operation and maintenance.

It is important that all personnel are fully trained and familiar with the machine and slew limiter system and that they have read and understood the information contained in this manual before operating or maintaining this machine. Following training Drivers training records should be amended to indicate training has been carried out.

This document will be reviewed every 12 months by the Professional Head for potential to improve its effectiveness. A record of decisions made at each review will be recorded.

The vehicle log book must be updated with the date and examination type of the last maintenance carried out.

### 3 Defined Words

The following outlines the defined words used within this Maintenance Programme.

<b>Term</b>	<b>Action required</b>
<b>Adjust</b>	Correct to defined limits
<b>Change</b>	Remove the original and fit a new or overhauled part or assembly in its place.
<b>Check</b>	Determine a particular nominated condition before, during or after repair, for example completeness, security, position
<b>Clean</b>	Remove all dirt and deposits
<b>Defective</b>	Any fault or faults in a component or assembly, for example structural fractures or weld fractures, which may prevent the component or assembly from fulfilling its designed purpose
<b>Dismantle</b>	Take to pieces
<b>Examine</b>	Determine general condition before repair, for example wear, cracks, splits, leaks, scoring, erosion, breaks, distortion, looseness
<b>Gauge</b>	Determine a nominated dimension by using suitable measuring equipment, for example ruler, micrometer, callipers, feeler gauges or Go/No-Go gauge
<b>Inspect</b>	Determine general condition after repair and attention, that is, conformity to required standards
<b>Lubricate</b>	Apply lubricant
<b>Overhaul</b>	Do what is necessary to make an assembly or sub-assembly re-usable, that is dismantle, strip, clean, examine, fit new parts, repair, re-assemble, test and inspect as required
<b>Paint</b>	To impart colour to a surface
<b>Re-assemble</b>	Put together
<b>Record</b>	Put down in writing a finding from examination, test, inspection or special checks.
<b>Rectify</b>	To set right
<b>Refit</b>	Put back and re-connect
<b>Remove</b>	Disconnect and take off
<b>Renew</b>	Remove, scrap the original part and put a new part in its place
<b>Repair</b>	Restore an original part to the required condition by hand tooling, machining, build-up, welding, patching, bending, setting, heat-treating, re-securing etc
<b>Strip</b>	Remove covering, that is, paint, polish, fabric
<b>Test</b>	Prove correct operation by trial

## **4 Document Review**

The following Maintenance Programme specified on the appropriate VAB certification for each product is reviewed as follows:

1. The Maintenance Programme 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 are retained.

## **5 Slew Limiter General Arrangement**

An Electrical Slew Limiter is fitted to restrict the slew when working adjacent to open lines.

The system has a control box in the cab with a mechanical limit mounted under the boom base.

The system has been designed to monitor the slew of the front end equipment. It does not take into account the tail swing of the counterweight. This must be assessed by referencing the EAC and carrying out a site specific risk assessment.

## 5.1 Slew Limiter Control

The Slew Limiter controls are mounted in the cab on the right console. The control system comprises of limit on/off keyswitch. Left/Right Selector Switch. System active warning light and a warning light for when the slew limit is reached.



When the slew limit system is active slew speed limit valves are activated to slow the machine to 3 RPM.

## 5.2.1 Operation Left Limit

- Before on tracking the machine, the position of adjacent traffic i.e. left or right of the machine, from the forward facing cab direction should be established to ensure the correct selection of the slew limit.
- Ensure the machine is slewed to 0 degrees.
- Select the left Limit as follows,

Turn the selector keyswitch to the left on the control panel to suit the planned work on rail and to ensure the machine does not enter the prohibited area (adjacent Line) on the Right hand side.



- Remove the key and ensure the system active light is illuminated.
- An alarm will then sound until the mechanical slew limit is correctly engaged.
- The mechanical limit is pushed in until the lock pin can be located in the front hole for the left limit. Ensure the padlock is engaged and the key removed.



- If the incorrect limit is set the alarm will continue to sound.
- Whilst on rail the slew limit should not be changed.
- **If the machine is not functioning correctly it must be removed from service until repairs have been carried out.**



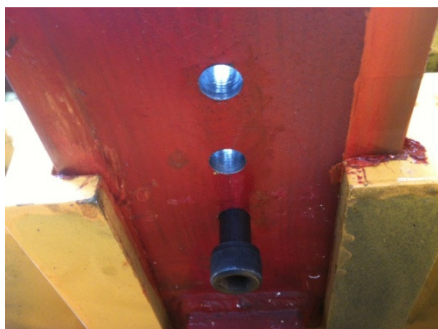
## 5.2.2 Operation Right Limit

- Before on tracking the machine, the position of adjacent traffic i.e. left or right of the machine, from the forward facing cab direction should be established to ensure the correct selection of the slew limit.
- Ensure the machine is slewed to 0 degrees.
- Select the Right Limit as follows,

Turn the selector keyswitch to the Right on the control panel to suit the planned work on rail and to ensure the machine does not enter the prohibited area (adjacent Line) on the Left hand side.



- Remove the key and ensure the system active light is illuminated.
- An alarm will then sound until the mechanical slew limit is correctly engaged.
- The mechanical limit is pulled out until the lock pin can be located in the rear hole for the right limit. Ensure the padlock is engaged and the key removed.



- If the incorrect limit is set the alarm will continue to sound.
- Whilst on rail the slew limit should not be changed.
- If the machine is not functioning correctly it must be removed from service until repairs have been carried out.

### **5.3 General**



During the course of maintenance and testing, all missing items must be replaced; defective items must be repaired or renewed; all faults rectified and equipment correctly adjusted. Replacement parts shall be identical to the original parts in fit, function and performance.



In order to carry out this Maintenance Programme, the following minimum level of facilities is required, appropriate to the jobs being undertaken:

- a) Clean, dry, covered accommodation for dealing with bearings, mechanical, hydraulic and electrical components, etc.
- b) Adequate illumination for inspection of components, bogies and underframes.
- c) Cleaning facilities which will not cause damage to the components.
- d) Handling facilities for removal and refitting of components such as rail bogies and engines.
- e) Protection from the weather of vulnerable areas of the vehicles and its components.
- f) Any specific requirements additional to those listed are identified on the applicable job description.

Maintenance action is intended to ensure the continued safe operation of the slew limiter and host vehicle. The maintenance programme has been derived from reliability and safety apportionment's and failure by the owner to follow these activities would invalidate both warranty and safety systems given for the product.

## **6 Maintenance**

This document is an addendum and should be used with the relevant document.

1. The Railway and Other Guided Transport Systems (Safety) Regulations 2006, Guidance on Regulation, Part 4 Safety Critical Work; no longer applicable.
2. The Non Destructive Testing of safety critical components (including axle testing) shall be done in accordance with GM/RT2005. Need to have a system in place for undertaking NDT, but can use 2005 as best practice.

## 6.1 Maintenance Frequencies

The machine is to be examined at frequencies no greater than the limits set out below:

Type of exam	Calendar Time
A	Pre Start
B	Monthly
C	6 Monthly
D	Yearly

## 6.2 Summary of Jobs

Schedule of work						
Job Title	Intent	Job No	A	B	C	D
<b>Pre Start 6.3</b>						
Slew Limiter	Check	6.3.1	*	*	*	*
<b>Monthly Maintenance 6.4</b>						
Proximity Sensors	Examine	6.4.1		*	*	*
Slew Speed Limiter	Check	6.4.2		*	*	*
<b>Six Monthly Maintenance 6.5</b>						
Slew Limit Test	Test	6.5.1			*	*
<b>Yearly Maintenance 6.6</b>						
Structural Integrity	Examine	6.6.1				*

### **Maintenance instructions**

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

Arising Work is that work that is done to rectify the defects found in the course of carrying out Scheduled work.

The items numbers of the two parts correspond, i.e. the work to be done to rectify a defect in item 2 of scheduled work will be found in item 2 of the arising work.

### **6.3.1 Slew Limiter-Check**

#### **Scheduled Work**

- 1 Check all Slew limiter components are securely attached.
- 2 Ensure the machine is slewed to 0 degrees.
- 3 Activate the system and ensure the system active light is illuminated.
- 4 Engage left or right slew limit and the alarm will sound
- 5 Engage the mechanical limit left or right to correspond with the limit as selected on the control panel.
- 6 The alarm should then stop.
- 7 Slew the machine and check the motion cut operates before the mechanical limit is reached and in the slew direction selected in the cab.
- 8 Repeat the test for the opposite side of the machine.

#### **Arising work**

**Remove the machine from service if any faults are found.**

- 1-8 Renew missing/Faulty components.

### **6.4.1 Proximity Sensors -Examine**

#### **Scheduled Work**

- 1 Examine the Proximity sensors for damage or loose cables.
- 2 Examine proximity sensor brackets for damage, cracks or distortion.
- 3 Check for loose or missing fasteners.

#### **Arising work**

- 1 Renew defective or damaged sensors or cables.
- 2 Repair any damaged brackets.
- 3 Renew loose or missing fasteners.

## **6.4.2 Slew Speed -Check**

### Scheduled Work

- 1 Slew the machine to 0 degrees.
- 2 Activate slew limit.
- 3 Slew right by 180 degrees and check the time taken.
- 4 It should take 10 seconds to slew 180 degrees.
- 5 Repeat the test for slew left.

### Arising work

1-5 Adjust slew speed as required. Recheck after adjustment.

## **6.5.1 Slew Limiter-Test**

### Scheduled Work

- 1 Check all Slew limiter components are securely attached.
- 2 Ensure the machine is slewed to 0 degrees.
- 3 Activate the system and ensure the system active light is illuminated.
- 4 Engage left or right slew limit and the alarm will sound
- 5 Engage the mechanical limit left or right to correspond with the electrical limit.
- 6 The alarm should then stop.
- 7 Slew the machine and check the motion cut operates before the mechanical limit is reached.
- 8 Repeat the test for the opposite side of the machine.

### Arising work

**Remove the machine from service if any faults are found.**

- 1-8 Renew missing/Faulty components.

## **6.6.1 Structural Integrity - Inspect**

### Scheduled Work

1. Inspect all brackets for damage, deformation or cracks.

### Arising work

1. Arrange for any defects to be repaired. Consult manufacturer for weld instructions.

Size	Grade					
	8.8		10.9		12.9	
	Torque		Torque		Torque	
	Nm	lbf ft	Nm	lbf ft	Nm	lbf ft
M2	<b>0.34</b>	<b>0.25</b>	0.48	0.35	0.58	0.43
M2.5	<b>0.7</b>	<b>0.5</b>	1.0	0.7	1.2	0.9
M3	<b>1.2</b>	<b>0.9</b>	1.7	1.3	2.1	1.5
M3.5	<b>1.9</b>	<b>1.4</b>	2.6	1.9	3.1	2.3
M4	<b>2.8</b>	<b>2.1</b>	3.9	2.9	4.7	3.5
M5	<b>5.5</b>	<b>4.1</b>	7.7	5.7	9.3	6.9
M6	<b>9.4</b>	<b>6.9</b>	13	10	16	12
M7	<b>16</b>	<b>12</b>	22	16	26	19
M8	<b>22</b>	<b>16</b>	32	24	38	28
M10	<b>45</b>	<b>33</b>	65	48	75	55
M12	<b>75</b>	<b>55</b>	110	81	130	96
M14	<b>120</b>	<b>90</b>	170	125	205	151
M16	<b>190</b>	<b>140</b>	270	199	320	236
M18	<b>265</b>	<b>195</b>	365	269	440	325
M20	370	275	<b>530</b>	<b>391</b>	631	465
M22	510	380	<b>720</b>	<b>531</b>	860	634
M24	650	480	<b>910</b>	<b>671</b>	1090	804
M27	950	700	<b>1300</b>	<b>959</b>	1560	1150
M30	1290	950	<b>1810</b>	<b>1335</b>	2170	1600
M33	1750	1290	<b>2450</b>	<b>1808</b>	2950	2176
M36	2250	1660	<b>3160</b>	<b>2330</b>	3790	2795
M39	2910	2150	<b>4100</b>	<b>3025</b>	4920	3628
M42	3610	2660	<b>5070</b>	<b>3740</b>	6090	4491
M45	4530	3340	<b>6360</b>	<b>4690</b>	7640	5634
M48	5430	4010	<b>7630</b>	<b>5630</b>	9150	6748
M52	7000	5170	<b>9340</b>	<b>6890</b>	11810	8709
M56	8660	6390	<b>12180</b>	<b>8990</b>	14620	10782
M60	10990	8110	<b>13460</b>	<b>9930</b>	20080	14808
M64	12980	9580	<b>18250</b>	<b>13470</b>	21900	16150

Bolts, screws and nuts **under M20** are grade **8.8**

Bolts, screws and nuts **over M20** are grade **10.9**

Cap heads are grade 12.9