Discipline
Engineering Standard – NSW

Category
Signalling

Title
The Claw Lock Mechanism Safety and Functional Tests Routine Maintenance

Reference Number
SMS 06 – (RIC Standard: SC 07 37 00 02 EQ)

Document Control

Status	Date	Prepared	Reviewed	Endorsed	Approved
Issue 1 Revision 2	Mar 05	Standards and Systems	Standards Engineer	GM Infrastructure Strategy & Performance	Safety Committee
		Refer to Reference Number	H Olsen	M Owens	Refer to minutes of meeting 12/08/04

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Document History

Primary Source – RIC Standard SC 07 37 00 02 EQ Version 2.0

List of Amendments –

ISSUE	DATE	CLAUSE	DESCRIPTION
1.1	01/09/2004		▪ Reformatting to ARTC Standard
1.2	14/03/2005	Disclaimer	Minor editorial change

Contents

1 General 5

2 Safety and Functional Tests - Turnouts 9

2.1 Claw lock fitted with Westinghouse 84M Series Point Machines 9

2.2 Claw lock fitted pneumatic motor or with hydraulic actuators 12

3 Safety and Functional Tests - Switch Rollers 14
3.1.1 Schreck Mieves EKOS (Teksol) Type 14
3.1.2 CDP In Plate Type 15

4 Safety and Functional Tests – Swing Nose Crossings 16

4.1 Claw lock fitted with Westinghouse 84M series point machine or with pneumatic motor or with hydraulic actuators 16

5 Safety and Functional Tests – Detection – Turnouts and Swing Nose Crossings 18

5.1 Normally Closed Switch 18

5.2 Open Switch 20

5.3 Coupling Bar Detection – Pneumatic Motors and Hydraulic Actuators (Glenfield Junction Excepted) 20

5.4 Detection – Glenfield Junction 20

6 Pneumatic Motor Detection (where fitted) 22

7 Routine maintenance – Turnouts 24

7.1 Zonal Inspection .....

7.2 Trackwork .....

7.3 Switch Rollers (Where Fitted) 26
7.3.1 Schrek-Mieves EKOS (Teksol) Clamp-on type 26
7.3.2 CDP In-plate type 26

7.4 The claw lock mechanism – Applies to all types of turnouts 27

8 Routine Maintenance – Swing Nose Crossings 31

8.1 Zonal Inspection (all swing nose crossings) 31

8.2 VAE Swing nose crossings 31

8.3 PRE Swing nose crossings 33
8.3.1.1 1 in 24 Crossings (Beverly Hills) 33

8.3.1.2 1 in 12 to 15 Crossings 33

8.4 TKL Swing Nose Crossings – Glenfield 33

8.5 The Claw Lock Mechanism 34
8.5.1 All Claw Locks 34
8.5.2 VAE Claw Lock 34
8.5.3 PRE Claw Lock 36
8.5.4 ARTC/TKL Claw Lock – Glenfield Junction 37

9 Run Through of Claw Lock – Turnouts and Swing Nose Crossings 38

10 Routine Maintenance – Operating Mechanisms 40

10.1 Westinghouse 84M Series Switch Machines 40
10.1.1 Tools 40
10.1.2 External checks 40
10.1.3 Internal checks 41
10.1.4 Lubrication 43
10.1.5 Clutch Adjustment 45
10.1.5.1 Non Trailable Machines 84M and D84M 45
10.1.5.2 Trailable Machines T84M and TD84M 46

10.2 Latched Pneumatic Motor 5
10.2.1 50
10.2.2 50
10.2.3 50
10.2.4 51

10.3 HM2 Detectors 51

11 Appendix A – Lubrication Alternatives for Claw Locks, Swing Assist Units and 84M Series Switch Machines 53

12 Appendix B – Detection Gauge – Westinghouse Detectors 54

1 General

Before commencing safety and functional tests ensure that:

- All requirements of the relevant Network Rules and any additional safety instructions or requirements in force have been met.

- Claw pins are secured with retainers and bolts, retainers and split pins or "R" pins

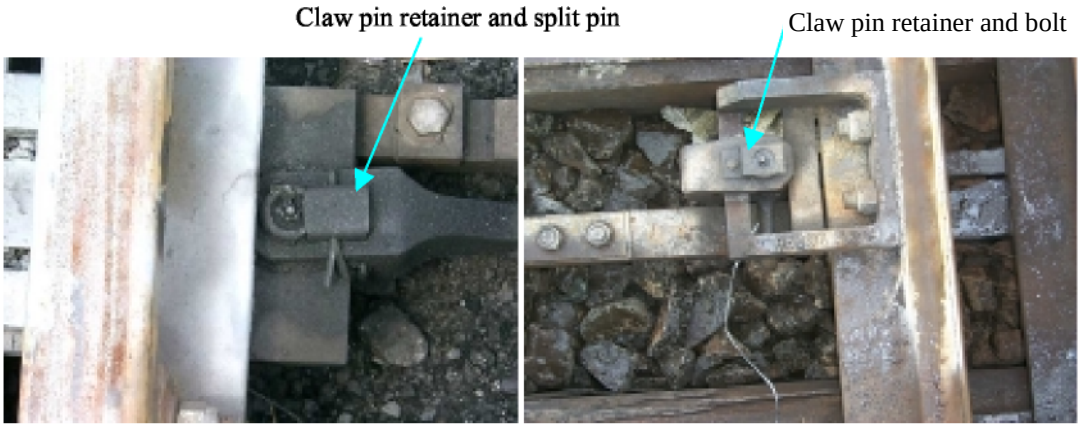


Fig 1.1 - VAE Claw Lock Mechanism Swing Nose Crossing

Fig 1.2 - Westinghouse or Steelrod Claw Lock Mechanism - Turnout

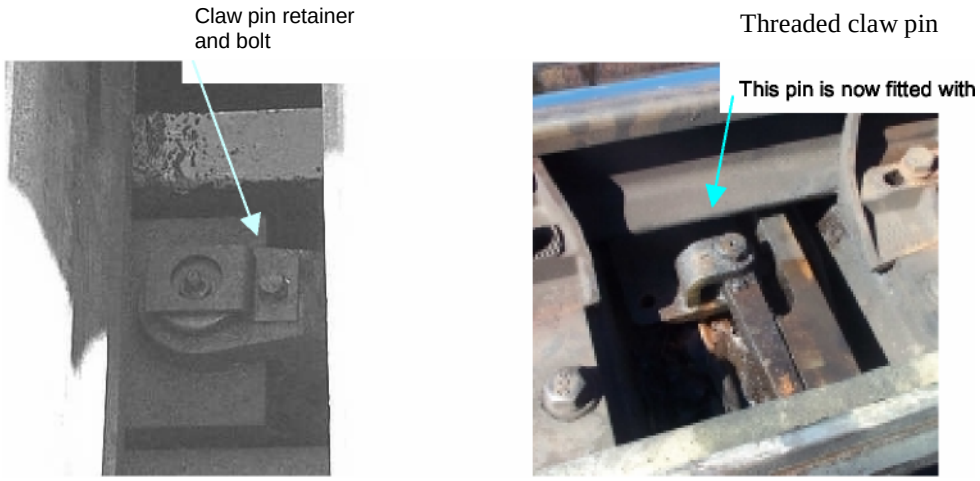


Fig 1.3 - PRE Claw Lock Mechanism 1 in 24 Swing Nose Crossing

Fig 1.4 – TKL/ARTC Claw Lock – Swing Nose Crossing Glenfield

Beverly Hills. A split pin and

Washer is also fitted under

These pins

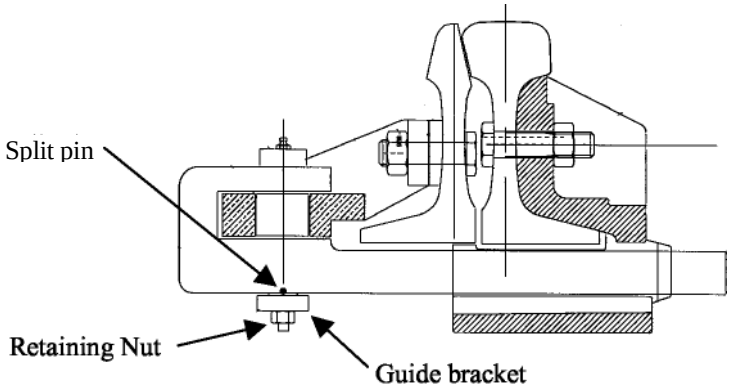
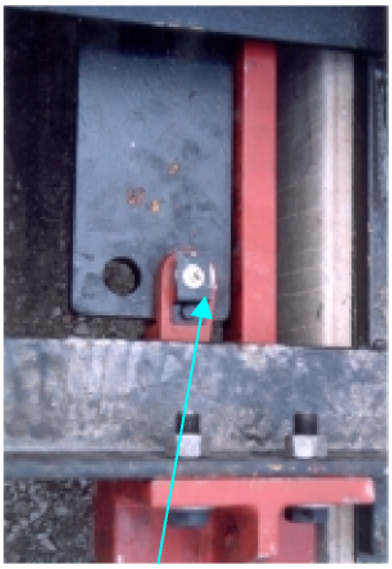


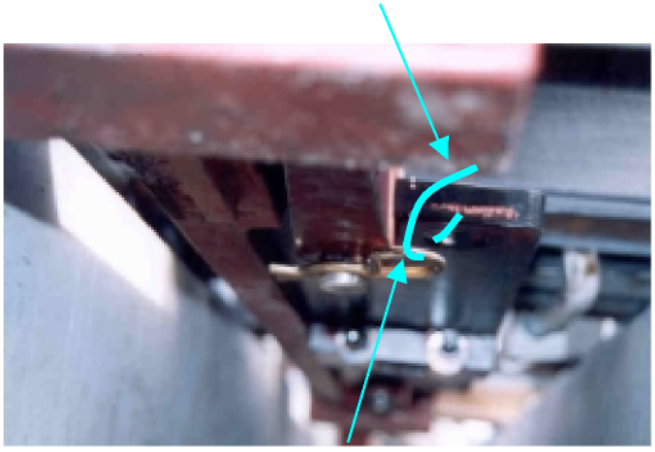
Fig 1.5 – Westinghouse Claw Lock – Full height switch on turnouts



Claw pin retainer and bolt

"R" pin is to be tied to the claw bracket with a stainless steel cable tie.

The tie is to be round the end of the claw bracket not the side



"R" pin through claw pin under claw bracket

Fig 1.6 – PRE Claw Lock fitted to 1 in 12.5 swing nose crossing

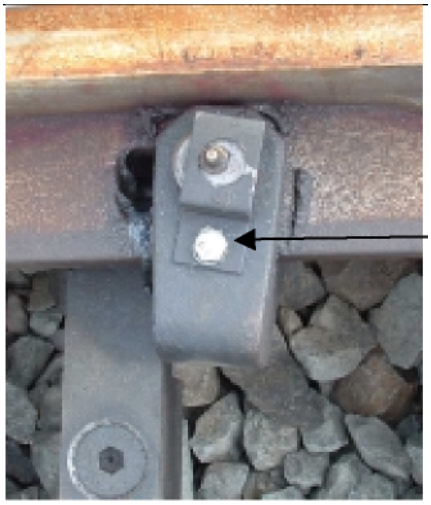


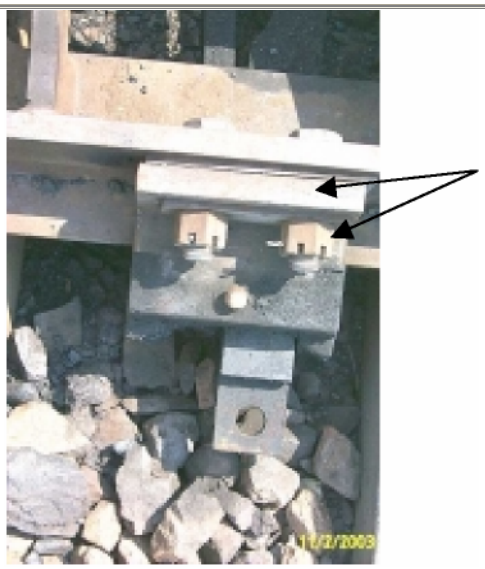
Fig 1.7 - Single Slip, claw pinned directly through switch flange. No claw bracket used.

- "R" pins, where used are secured by ties.
- The bolts securing the claw lock to the stockrail or swing nose crossing frame / wing rail / bracket are tight.
- The bolts securing the claw bracket to the switch or swing nose are tight.
- Coupling bar bolts on three piece coupling bars on turnouts are tight.
- Detection rod(s) are correctly secured at the switch or swing nose and at the detector slides. Pins (where used) are fitted with split pins.
- The connection(s) between the coupling bar and the operating mechanism is secure
- Operating mechanisms and/or detectors are securely fastened to timbers or concrete beams

It is not always necessary to use a spanner to check that a bolt and/or bracket is secure. This can be done visually by examining the joint between the bolt head and bracket or rod and between the bracket and whatever it is fastened to.

If there is an unbroken grime build up over the joint then nothing is moving and the bolt is tight.

If a crack is visible in the grime build up over the joint or if there are fresh rust stains then there is movement and bolts need tightening.



The Claw Lock mechanism Safety and Functional Tests Routine Maintenance

Breaks in dust and grime films or fresh rust stains indicate bolts are not fully tightened

Fig 1.7 – Visual detection of movement

- Examine the condition of the tip of the switch on 53 kg and 60 kg turnouts. If the tip is fractured or blunted by impact, arrange for correction at the earliest opportunity.

- On tangential turnouts examine the condition of the head of the switch between 400 and 1000 mm from the tip. Particularly on turnouts which experience predominantly trailing traffic, the head can wear away on the curved switch. This means that a new "effective tip" forms around a metre from the tip of the switch. While unimportant for trailing moves it can be potentially dangerous for facing moves since it tends to form as a blunt exposed tip.

- Check for any lip or head overflow on the switch/swing nose or stockrail/wing rail. Overflow greater than 1.5 mm is likely to affect lock and detection settings and removal must be arranged.

- Examine the tip of swing nose crossings. There should not be any evidence of impact significant enough to cause blunting of the tip

2 Safety and Functional Tests - Turnouts

2.1 Claw lock fitted with Westinghouse 84M Series Point Machines

The following procedure is to be used to test the claw lock both when being commissioned and during periodic testing visits thereafter.

84M and D84M non-trailable machines may be tested under power or by using the crank handle or hand throw lever.

While T84M and TD 84M trailable machines may be tested under power operation, this is not recommended due to the limited capacity of the trail clutches to accept prolonged slippage without compromising service life.

1. Obtain the ESML key and crank handle or EOL key.

2. Place the crank handle in the machine if 84M or T84M, or the EOL key in the machine if D84M or TD84M to release the selector lever and hand throw lever.

3. Place the selector lever into the ‘hand’ position on the (T)D84M machine.

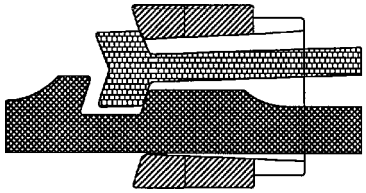
4. Using the hand throw lever or hand crank to operate the points, throw the points a couple of times to feel the effort required on the crank or hand throw lever.

5. Place a 4.8 mm gauge between switch and stockrail immediately above the claw. The gauge should extend for the full depth of the head of the switch.

   Note: If an assymetric (half height) switch is contacting the stockrail near the tip but is slightly off the stockrail (1 to 2mm) at the claw, it will be necessary to position the gauge about mid way between the claw and the tip. If the gauge is used above the claw an overly tight lock setting is likely to result from attempting to ensure lock failure at 4.8mm.

6. Close the switch against the gauge using approximately the same force on the crank or hand throw lever that was required to operate the points. Do not use excessive force in an attempt to make the hand throw lever complete its travel.

7. The claw must not swing completely out behind the claw lock and the coupling bar must not be able to complete its travel.



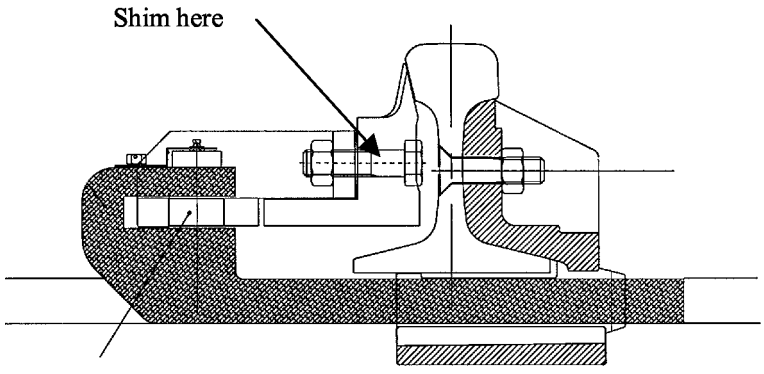
Claw not locked - coupling bar travel incomplete

This condition should apply with the 4.8 mm gauge behind the switch

Figure 2.2 – Claw not locked

8. If necessary adjust the claw lock clearance. This can only be done by adding or subtracting shims between the claw bracket and the switch or, on tangential turnouts, by rotating the eccentric bush between the claw pin and claw bracket.

> **Note:** Adjusting the throw of the points machine or adjusting the coupling bar will have no effect on the claw lock clearance. Provided these have been set up properly at installation there should never be any need for the machine throw or the coupling bar position to be touched. Variation in switch opening is relevant only to open switch detection settings. It cannot affect lock settings

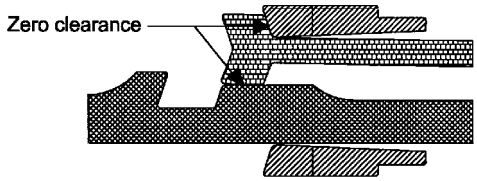


Eccentric bush – tangential turnouts only

9. Figure 2.1 – Position of shims and eccentric bush

1. Place a 3.2 mm gauge between switch and stockrail and close the switch against the gauge. The claw should swing out behind the claw lock and the coupling bar should complete its travel. Do not use excessive force on the hand throw lever. If the claw does not swing out behind the claw lock, remove one shim (thin shim if present) and retest with both 4.8 and 3.2 mm gauges,

2. Only if the coupling bar does not complete its travel with a 3.2mm gauge and there are no shims between the claw bracket and switch or if the removal of a shim means the claw will lock with the 4.8mm gauge, test again with a 1.6 mm gauge. With the 1.6mm gauge in place the coupling bar must complete its travel.



Claw locked - coupling bar travel complete

This condition should apply with the 3.2 and/or 1.6 mm gauges behind the switch

Figure 2. 3 – Claw locked

For 60 kg and 53 kg conventional layouts only;

If additional shims do not prevent the claw swinging out behind the lock box and the drive bar completing its travel with the 4.8mm gauge in place, there is excessive switch roll.

Where anti-roll brackets are fitted, shim the anti-roll bracket to reduce the clearance under the stockrail. Clearance may be reduced to zero if necessary, but the bracket must not rub hard on the stockrail.

Where anti-roll stretchers are fitted check that the stretcher is securely fastened to the switches and that there is not excessive wear in the nylon sliding blocks within the stretcher.

Details of the anti-roll brackets and anti-roll stretchers are shown in chapter 4 “Installation” (SMS 08)

3. Repeat these tests for the opposite switch.

Caution

With dual control (D84M and TD84M) it is possible for the for the dog clutch to fail to engage correctly when the selector lever is returned to the “motor” position. After using the selector lever (whether the hand throw lever is used or not), the machine should be tested under power to ensure that the dog clutch has engaged correctly.

If power operation is not possible attempt to rotate the hand throw clutch (the unit which engages with the bevel gear in the “hand” position until it is felt to engage.

2.2 Claw lock fitted pneumatic motor or with hydraulic actuators.

The following procedure is to be used to test the claw lock both when being commissioned and during periodic testing visits thereafter.

Pneumatic motor equipped points should be tested under power and hydraulic actuator equipped points with the hand pump on the power unit.

The procedure for testing is then the similar to that for 84M series electric machines

1. Place a 4.8 mm gauge between switch and stockrail immediately above the claw. The gauge should extend for the full depth of the head of the switch.

   Note: If an assymetric (half height) switch is contacting the stockrail near the tip but is slightly off the stockrail (1 to 2 mm) at the claw, it will be necessary to position the gauge about mid way between the claw and the tip. If the gauge is used above the claw an overly tight lock setting is likely to result from attempting to ensure lock failure at 4.8 mm.

2. Close the switch against the gauge.

3. The claw must not swing completely out behind the claw lock and the coupling bar must not be able to complete its travel.

4. If necessary adjust the claw lock clearance. by adding or subtracting shims between the claw bracket and the switch or, on tangential turnouts, by rotating the eccentric bush between the claw pin and claw bracket.

5. Place a 3.2 mm gauge between switch and stockrail and close the switch against the gauge. The claw should swing out behind the claw lock and the coupling bar should complete its travel. If the claw does not swing out behind the claw lock, remove one shim (thin shim if present) and retest with both 4.8 and 3.2 mm gauges,

6. Only if the coupling bar does not complete its travel with a 3.2mm gauge and there are no shims between the claw bracket and switch, test again with a 1.6 mm gauge. With the 1.6mm gauge in place the coupling bar must complete its travel.

   Note: Adjusting the throw of the points machine or adjusting the coupling bar will have no effect on the claw lock clearance. Provided these have been set up properly at installation there should never be any need for the machine throw or the coupling bar position to be touched. Variation in switch opening is relevant only to open switch detection settings. It cannot affect lock settings

   For 60 kg and 53 kg conventional layouts only;

   If the claw still swings out behind the lock box and the drive bar completes its travel with the 4.8mm gauge in place and this cannot be corrected by adding shims, then there is excessive switch roll.

Where anti-roll brackets are fitted, shim the anti-roll bracket to reduce the clearance under the stockrail. Clearance may be reduced to zero if necessary, but the bracket must not rub hard on the stockrail.

Where anti-roll stretchers are fitted check that the stretcher is securely fastened to the switches and that there is not excessive wear in the nylon sliding blocks within the stretcher.

Details of the anti-roll brackets and anti-roll stretchers are described in chapter 4 “Installation” (SMS 08).

7. Repeat these tests for the opposite switch.

3 Safety and Functional Tests - Switch Rollers

3.1.1 Schreck Mieves EKOS (Teksol) Type

Check that

- The rollers are rotating. Ie no flat spots
- That the clearances between switch and rail plates are correct.

  0.5 to 1 mm for first two to three plates near the tip of the switch increasing to 2 to 3 mm for other plates.

- That the minimum clearance between the outer roller and the closed switch on the V200 roller assembly is maintained.

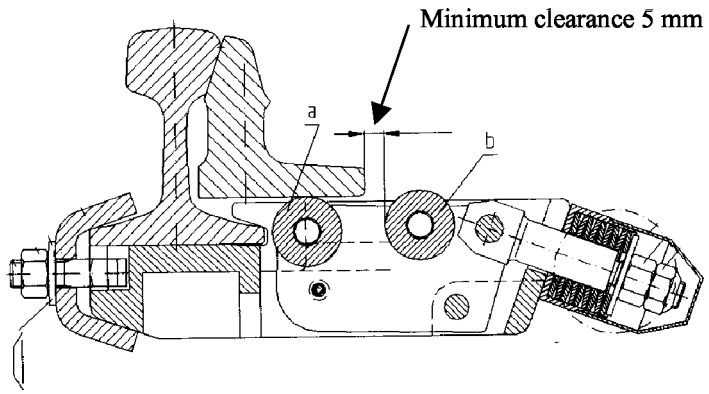


Figure 3.1 – EKOS V200 Switch Roller minimum clearance

Note: Switches may be clear of the chair plates by more than the dimensions quoted above due to variations in the level through the turnout.

If the switch is 5 mm or more clear of the plates on either side of a roller but is rubbing on plates further along the turnout, it may be necessary to vary the roller location until the deficiencies in level through the turnout have been corrected.

Do not attempt to adjust the roller higher to further lift the switch. This will result in the adjusting spring taking full wheel load when a train passes over the turnout and fracture of the roller assembly.

3.1.2 CDP In Plate Type

- Check the minimum clearance between the foot of the closed switch and the outer roller in the rocker. This should be 1 to 2 mm.

  A 1.6mm lock/detection gauge placed between the roller and foot of the switch indicates sufficient clearance provided that the switch is resting on the chair plate when closed. For each millimetre the switch is off the chair plate 1 mm must be added to the clearance between the foot of the switch and roller.

- Check the clearance between the foot of the open switch and the slide chair. This should be between 1 and 4 mm (3 mm max on chairs fitted with rollers with no shims)

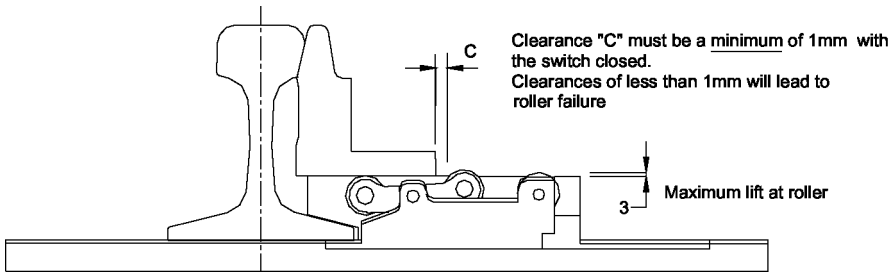


Fig 3.2 – CDP Switch Roller minimum clearance

Note: Switches may be clear of the chair plates by more than the dimensions quoted above due to variations in the level through the turnout.

If the switch is more than 3 mm clear of the plates on either side of a roller, but is rubbing on plates further along the turnout, it may be necessary to shim the roller until the deficiencies in level through the turnout have been corrected. Total shim thickness should not exceed 5 mm.

Ensure that clearances to the closed switch are maintained.

4 Safety and Functional Tests – Swing Nose Crossings

4.1 Claw lock fitted with Westinghouse 84M series point machine or with pneumatic motor or with hydraulic actuators.

The following procedure is to be used to test the claw lock both when being commissioned and during periodic testing visits thereafter.

84M and D84M machines may be tested under power or by taking the ESML or EOL key and testing with the hand crank or hand throw lever.

Pneumatic motor equipped swing nose crossings should be tested under power.

Hydraulic actuator equipped swing nose crossings may be tested under power or by using the hand pump on the power unit.

1. Place a 4.8 mm gauge between swing nose and one wing rail immediately above the claw. The gauge should extend for the full depth of the head of the switch.

   Note: If the swing nose is contacting the wing rail near the tip but is slightly off the wing rail (1 to 2 mm) at the claw, it will be necessary to position the gauge about mid way between the claw and the tip. If the gauge is used above the claw an overly tight lock setting is likely to result from attempting to ensure lock failure at 4.8 mm.

2. Close the swing nose against the gauge under power or, for 84M machines, using approximately the same force on the crank or hand throw lever that was required to operate the swing nose. Do not use excessive force in an attempt to make the hand throw lever complete its travel.

3. The claw must not swing completely out behind the claw lock and the coupling bar must not be able to complete its travel.

4. If necessary adjust the claw lock clearance. by adding or subtracting shims between the claw lock and wing rail or claw lock and mounting bracket. On VAE swing nose crossings only, coarse adjustment is also available by rotating the eccentric bush between the claw pin and claw bracket. The bush should only be used if total thickness of shims exceeds 8mm.

Shim here

Claw Lock

Swing nose crossing

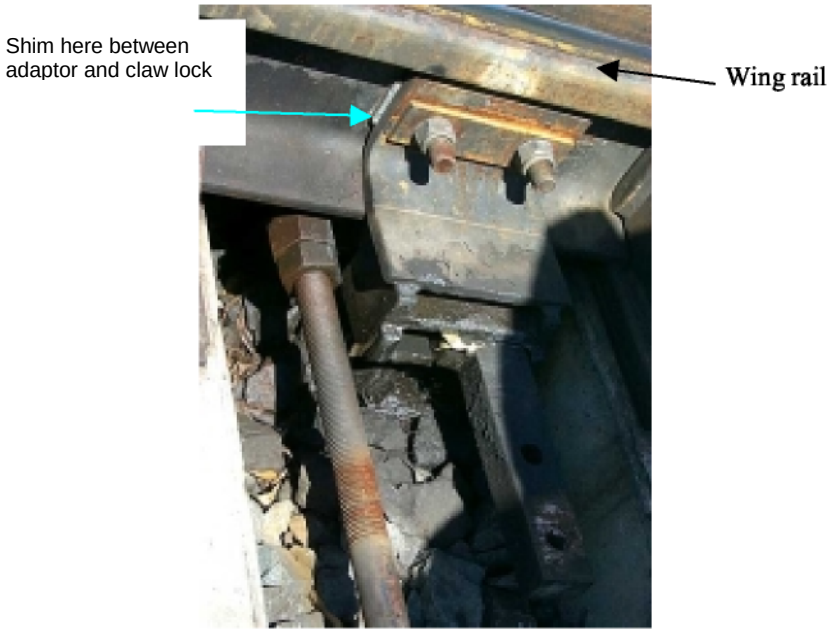


Fig 4.2 – PRE Swing Nose (Beverly Hills only)– location of shims

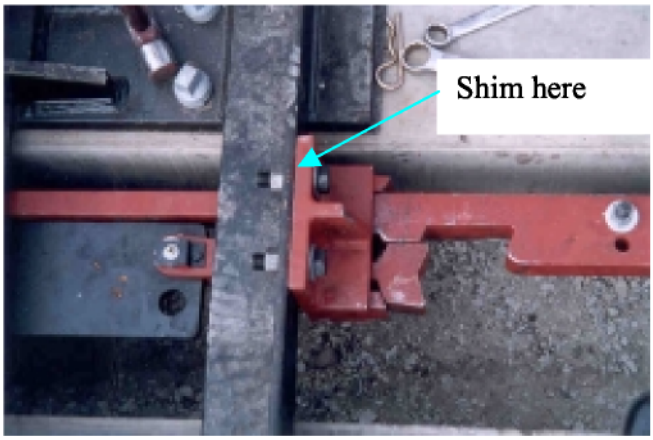


Fig 4.3 - PRE Swing Nose 1 in 12 to18.5 Type – location of shims

5. Place a 3.2 mm gauge between swing nose and wing rail and close the swing nose against the gauge. The claw should swing out behind the claw lock and the coupling bar should complete its travel. Do not use excessive force on the hand throw lever.

6. If the coupling bar does not complete its travel with a 3.2 mm gauge, test again with a 1.6 mm gauge. With the 1.6 mm gauge in place the coupling bar must complete its travel. If it does not, remove shims.

> **Note:** Adjusting the throw of the switch machine will have no effect on the claw lock clearance. Provided these have been set up properly at installation there should never be any need for the machine throw or the coupling bar position to be touched.

7. Repeat these tests between the swing nose and the opposite wing rail.

5 Safety and Functional Tests – Detection – Turnouts and Swing Nose Crossings

This procedure applies to Westinghouse 84M series switch machines and Westinghouse HM2 and HMX detectors. Detection contact assemblies are interchangeable.

A meter is required to determine whether contacts are open or closed.

5.1 Normally Closed Switch

1. Close and lock the normal switch or close and lock the swing nose normal.

2. Ensure that there are no flat spots on the detector contact rollers.

3. Check the position of the contact roller in relation to the end of the notch in the detector slide connected to the normal switch or in the swing nose normal detector slide.

4. Check the gap between the roller and the end of the notch with the 2.0 mm gauge (refer Appendix B). **This gauge must not fit.**

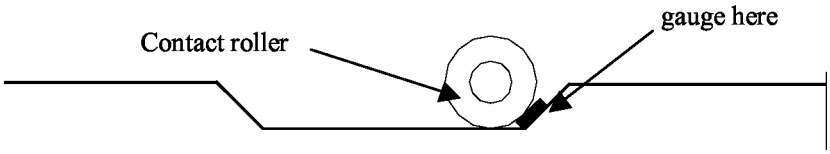
5. Check again with the 1.0 mm gauge. This should fit easily. If the gap between

   roller and end of notch is incorrect adjust the slide position.

   Note that each full turn of a nut on the detector rod is equal to 2.5 mm of slide movement. ie 1/6 of a turn or 1 flat ~ 0.5 mm

6. Repeat for the reverse switch or swing nose reverse.

   Note: A gap of 1.5 mm between the contact roller and the end of the notch in the detector slide will result in detection contacts open circuiting when the switch or swing nose has opened 4.0 to 4.5 mm.



Detector slide

5.1 – Detection gauging

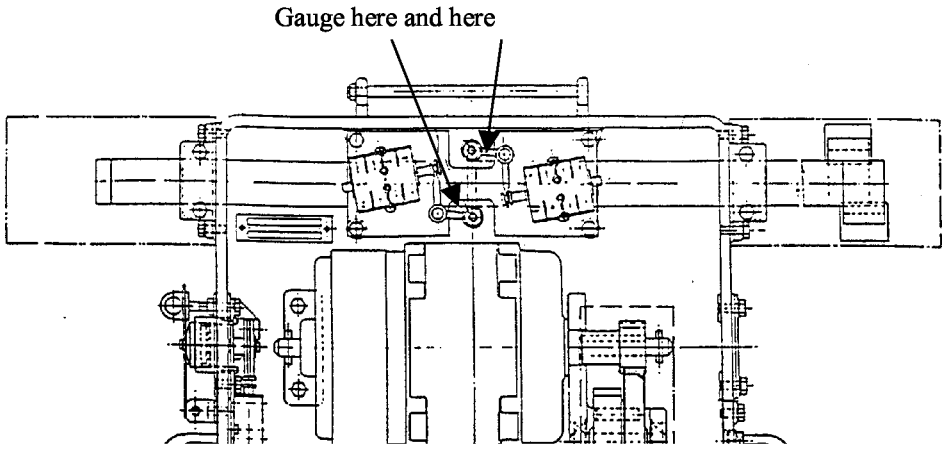


Fig 5.2 – Detection gauging

5.2 Open Switch

Open switch detection is non-adjustable. The amount of latitude available for open switch detection will depend on the switch opening. The detector is capable of accepting switch openings between approximately100 and 145 mm. (Note that ranges of 95 to 140mm and 105 to 150mm may be encountered.)

Switch Opening mm	Open switch detection available	Latitude
110	105 - 95	5 - 15
120	105 - 95	15 - 25
130	105 - 95	25 - 35
140	105 - 95	35 - 45
150	105	45

Latitude is the movement of the coupling bar before open switch detection will break

WARNING

Where pneumatic motors without motor detection contacts are used, the switch opening must not exceed 130 mm under any circumstances.

Check the switch opening where these motors are fitted.

Note also that at commissioning or after detector renewal, the open switch detection must be tested to ensure that detection open circuits at least 25mm before the locked claw is released by the coupling bar.

5.3 Coupling Bar Detection – Pneumatic Motors and Hydraulic Actuators (Glenfield Junction Excepted)

When pneumatic motors are fitted with microswitches, detection is as for "Pneumatic Motor Detection" described in clause 6

When a separate detector is fitted to the coupling bar, the detection contacts should make 4 to 5 mm before the coupling bar reaches full travel for both the normal and reverse sides.

5.4 Detection – Glenfield Junction

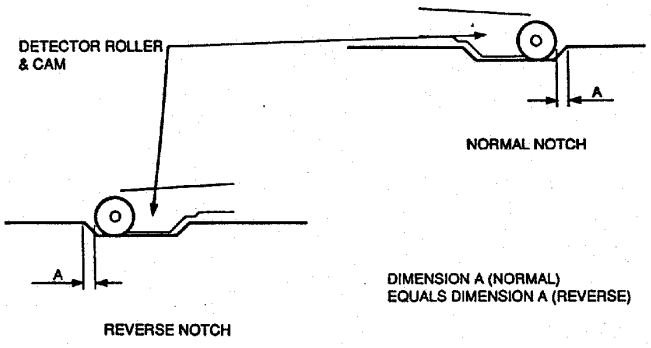
The swing nose crossings at Glenfield Junction are fitted with modified ML detectors with three slides. The bottom fixed length slide detects the swing nose and the top two adjustable slides detect the coupling bar

The bottom slide has a fixed length notch that provides for detection contacts to open circuit between 3 and 4 mm.

This slide is to be adjusted so that the gap between the detector roller and the end of the notch in the slide is the same on both the normal and reverse sides.

The top two slides are adjusted so that detection is open circuit with the coupling bar 4mm short of full travel. Detection must be made with coupling bar 2.5 mm short of full travel.

Note
The ML detectors at Glenfield are to be replaced with Westinghouse HM3 detectors. This clause will be updated when details of adjustments for these detectors are known



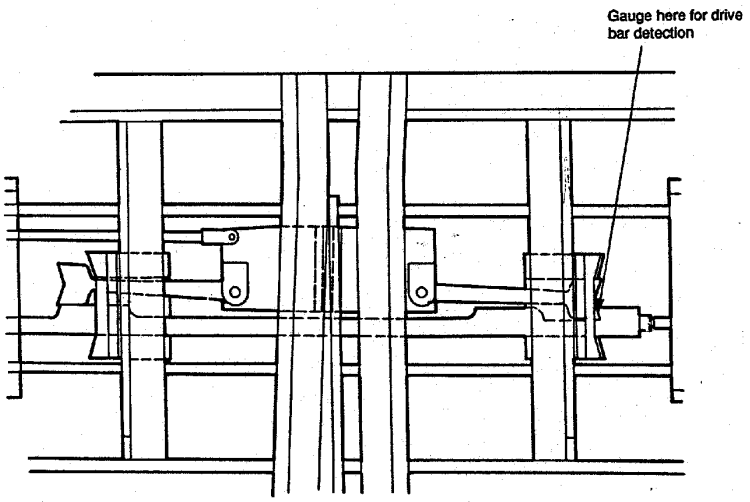


Fig 5.3 – Glenfield Junction detection testing

6 Pneumatic Motor Detection (where fitted)

A meter is required to determine whether contacts are open or closed

1. Ensure that the motor is in the fully normal position

2. Using the appropriate gauge check that the clearance between the actuator head and the microswitch plungers at the reverse end of the motor is not less than 1 mm

3. Examine the switches at the normal end of the motor. The ring in the microswitch plunger should be in line with the microswitch body.

4. Operate the motor to the fully reverse position

5. Using the appropriate gauge check that the clearance between the actuator head and the microswitch plungers at the normal end of the motor is not less than 1 mm

6. Examine the switches at the reverse end of the motor. The ring in the microswitch plunger should be in line with the microswitch body.

7. Loosen the locknuts and adjust if necessary. Apply Loctite 242 and re-tighten the locknuts or re-tighten the locknuts and apply Loctite 290 “wick-in”.

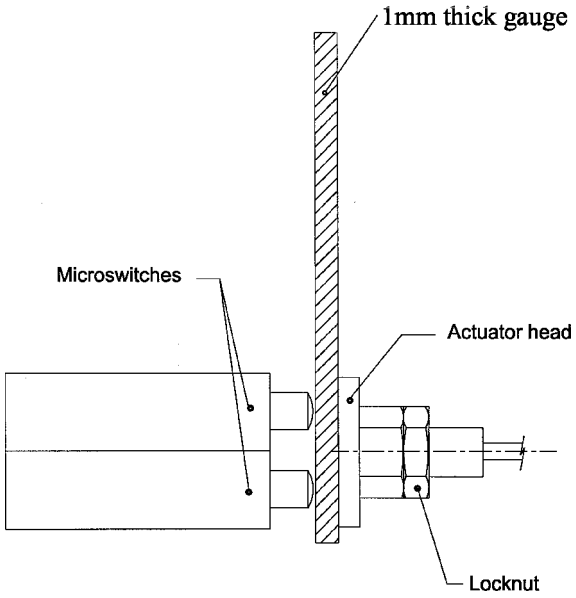


Fig 6.1 Pneumatic Motor Detection

ROUTINE MAINTENANCE

7 Routine maintenance – Turnouts

7.1 Zonal Inspection

A zonal inspection is essentially a visual and audible inspection of claw lock operation. It consists of viewing and listening to the claw lock mechanism operation to ensure: -

- That the claw is locking correctly out behind the claw lock and that the coupling bar is travelling through and securing it in place.
- That all pins are secured by retainers or split pins.
- That components are secure – there is no visual indication that the claw lock is moving or the machine is moving as the claw lock mechanism operates.
- That the coupling bar and the machine throw bar move in unison.
- That the detector rods and machine slides commence to move with the switches without any lag
- That the machine does not make any unusual sounds when operating

7.2 Trackwork

Visual examination of the general condition of the turnout. In

particular check:

Fit of switches to stockrail. Acceptable fits are:

Turnout Type	Maximum gap at tip	Recommended Maximum gap at centre of head machining	Recommended Maximum gap at end of head machining
Tangential	2 mm	8 mm	8 mm
60 kg	1 mm	6 mm	8 mm
47 and 53 kg	0 mm	4 mm	6 mm

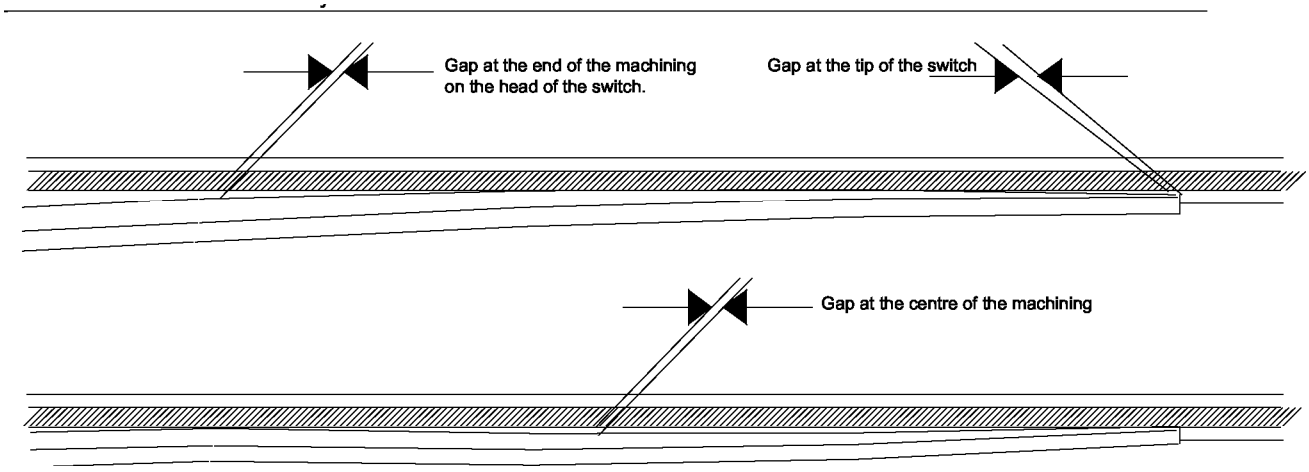


Fig 1.1 – Fit of switch to stockrail

- Bearing of switches on plates. The switch must not be more than 1.5mm clear of the A and B plates when closed.

- Variations in top surface and twist for the length of the switch and ahead of the switch which are affecting the free movement of the switch on the plates. N.B. No switch will bear evenly on all plates. If the movement of the switch is free and it is not unduly heavy to operate then the bearing, on whatever number of plates, is satisfactory. As a general rule the top surface and twist should be better than exceedent category 4 for at least 50 metres ahead of and through the turnout. (Exceedent category 4 is defined in Civil Engineering Standard C2009 "Base Operating Condition Standards of Track Geometry").

- Lateral movement of the stockrail. This should not exceed 1.5 mm unless the turnout is mounted on resilient pads such as "Cologne Eggs". With resilient mounting up to 3mm lateral movement may be possible. (Special arrangements must be made for detector mounting in this case). Lateral movement indicates loose rail brace bolts and/or loose chair or plate bolts or screwspikes

- Longitudinal movement of the switch or stockrail pair relative to one another is not more than 15 mm for tangential turnouts and 10 mm for conventional turnouts.

- One switch and/or stockrail is not more than 25 mm ahead of the other switch and/or stockrail.

- On 53 and 60 kg turnouts, security of rail brace bolts, switch chocks, screw spikes and/or plate bolts.

Report or arrange for the correction of any deficiencies found.

7.3 Switch Rollers (Where Fitted)

Caution

Rollers must not be lubricated

7.3.1 Schrek-Mieves EKOS (Teksol) Clamp-on type

Clean away any build up of oil, grease or grime from around the rollers.

Examine rollers for flat spots indicating that the roller is binding or seized. If flat spots are found, replace entire roller assembly and return the defective part to the depot for servicing or replacement.

Check that the roller assembly is securely clamped to the stockrail.

7.3.2 CDP In-plate type

Clean away any build up of oil, grease or grime from around rollers.

Examine rollers for flat spots indicating that the roller is binding or seized. If flat spots are found, replace entire roller assembly and return the defective part to the depot for servicing.

Check that the roller assembly is securely bolted to the chair plate.

7.4 The claw lock mechanism – Applies to all types of turnouts

1. Remove any build up of dirt and grease between the claw bracket and sliding bush and between the claw and coupling bar where it passes through the claw lock.

2. The Claw and or claw lock should not show wear grooves on the locking faces more than 1.5 mm deep. If wear exceeds this depth, the claw lock and/or claw should be replaced as soon as possible. Wear must not be allowed to exceed 3 mm.

3. Wear on the coupling bar adjacent to the recess in the bar. Any tapering towards the slot more than 25 mm long and 3mm deep requires replacement of the coupling bar.

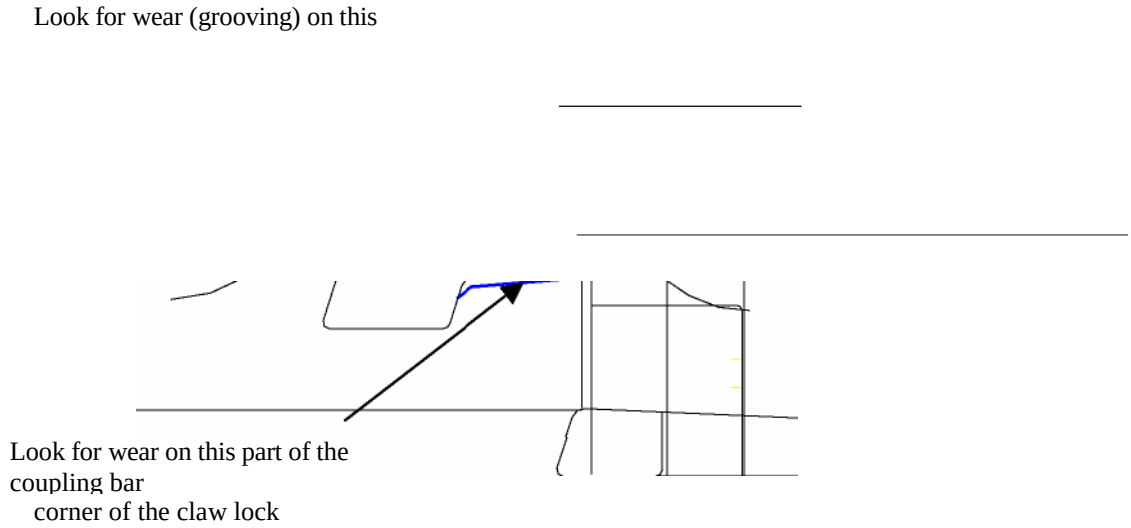


Fig 1.2 – Claw Lock wear

4. The total slack between the claw bracket and the claw, from wear in the claw pin, bush or bracket slot, should not exceed 1 mm and must not exceed 1.5 mm

> Note These components are unlikely to show significant signs of wear within the first 5 years of service unless lock settings are too tight, correct lubrication is not carried out or there are trackwork deficiencies which are causing excessive vibration.

5. Examine backdrives, where fitted, for wear in crank bearings, pins and jaws, security of bolts to plates and beams (sleepers), security of pins and locknuts at adjustable connections.

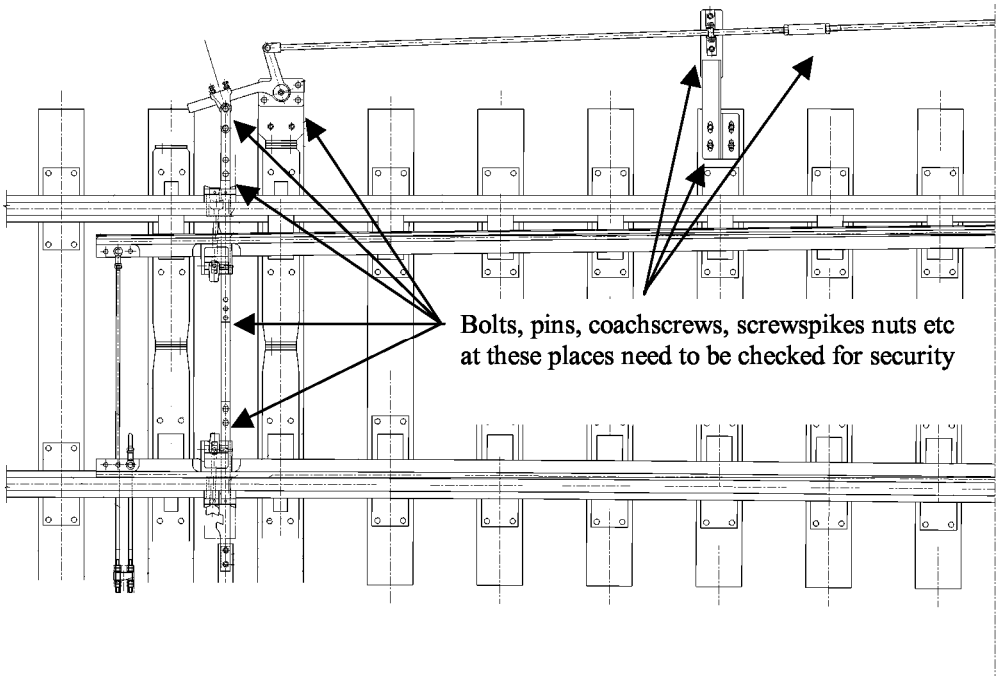


Figure 1.3 – Typical claw lock layout with backdrive

6. Ensure that claw lock covers hinge pins are secure and that covers cannot foul the claw or coupling bar. DO NOT remove covers, this will only result in faster contamination and wash off of lubricant.

7. The alignment of the coupling bar and the operating mechanism throw bar (or piston rod) should be such that when viewed from above they are either in a straight line or at least parallel to one another if offset. Misalignment indicates longitudinal movement of one or both stockrails.

   Small misalignments can be corrected by adjusting the position of one or both claw locks on the stockrail provided that this does not result in the claw pin bush being within 15mm of one end of the slot in the claw bracket.

8. Lubricate

   - the locking faces of the claw and claw lock
   - the sliding surfaces of the claw, coupling bar and claw lock
   - the sliding surfaces of the bush and claw bracket and the claw pin
   - Backdrive cranks and crank pins where required (i.e. where self-lubricating and/or plastic bushes are not used).

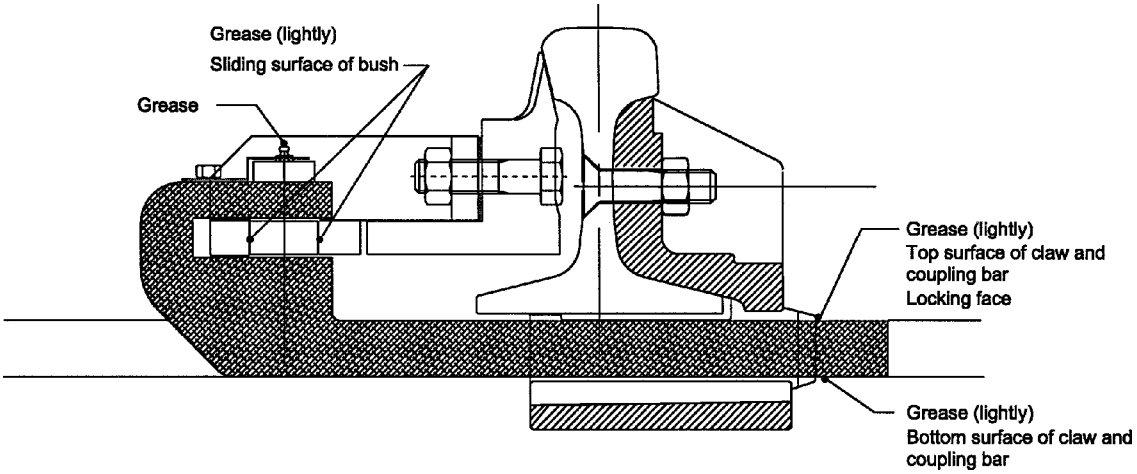
A range of lubricants suitable for claw locks, all greases for heavy duty service and with molybdenum disulphide, are listed in Appendix A.

The list is not exclusive and there are other lubricants which may be satisfactory in areas where the environment and operating conditions are not particularly harsh or where lubricating intervals are more frequent.

Dry switch plate lubricants are generally not suitable for claw locks and must not be used on claw locks on swing nose crossings.

Lubrication intervals will vary from location to location and will depend on usage (no of operations normal - reverse - normal), tonnage over the turnout and the local environment.

Generally lubrication of the claw lock, if the listed greases are used, should not be required at intervals of less than 4 weeks unless the environment is particularly harsh, and may, under benign environmental conditions and moderate usage, be extended up to 8 weeks.



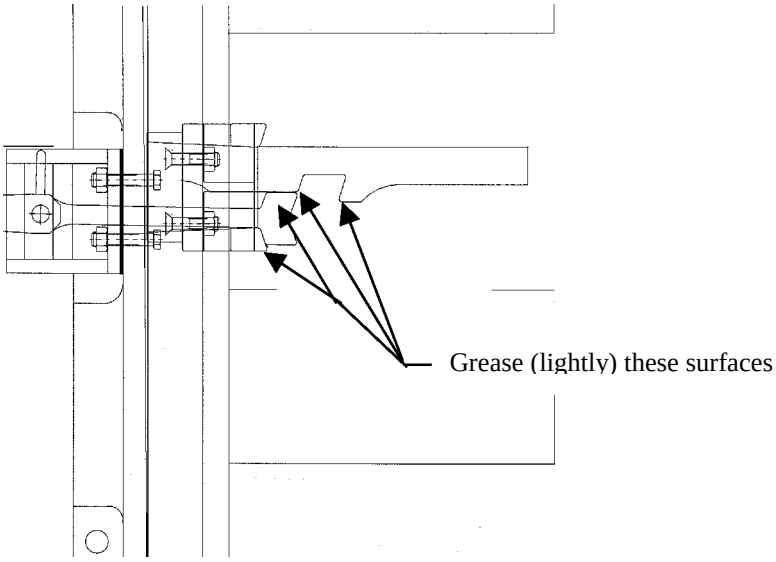


Figure 1.4 – Claw lock lubrication

8 Routine Maintenance – Swing Nose Crossings

8.1 Zonal Inspection (all swing nose crossings)

A zonal inspection is essentially a visual and audible inspection of claw lock operation. It consists of viewing and listening to the claw lock mechanism operation to ensure: -

That the claw is locking correctly out behind the claw lock and that the coupling bar is travelling through and securing it in place.

That all pins are secured by retainers and split pins or bolts and/or by split pins or tied "R" pins.

That components are secure – there is no visual indication that the claw lock is moving or the machine is moving as the claw lock mechanism operates.

For PRE 1 in 12 to 18.5 swing nose crossings, that the bracket to which the claw lock mounts is not moving on the rail plates and that the claw bracket is still secured to the swing nose.

That the coupling bar and the machine throw bar move in unison.

That the detector rod and machine slides commence to move with the swing nose without any lag.

That the machine does not make any unusual sounds when operating

8.2 VAE Swing nose crossings.

The clamp plates are part of the fastening system between the claw bracket and the swing nose and as such should be tight and not attempting to rotate. However there may be instances where the clamp plates do rotate. This can be tolerated provided that they are still firmly clamping the claw bracket to the foot of the swing nose.

If tightening does become necessary, the appropriate sized open ended spanner will need to be modified by narrowing the head until it fits between the raised edges of the clamp plates and bending the head at 45 degrees. This is then used to hold the head of the bolt while a socket is used on the nyloc nut under the claw bracket.

While the clamp plates should be clear of the underside of the wing rail, rubbing will sometimes occur. If this is only very light it is of no concern, however it can indicate a deterioration in the top surface of the track through the swing nose and means a hollow is developing under the wing rails and baseplate at the tip of swing nose. *(Note: Swing nose crossings supplied post July 2003 will have clamp plates with more clearance from the underside of the wing rail)*

To prevent a hole or dip forming under the swing nose it is essential that there is sufficient ballast left in the bays in which the claw lock and detector rod(s) are operating. Only sufficient ballast to clear the claws, claw pins, coupling bar and claw bracket should be removed. 30 – 40mm clearance from the ballast is sufficient.

Removal of ballast for most or all of the depth of the sleeper bays will lead to pumping which will cause excessive wear on the swing nose crossing and the equipment attached to it.

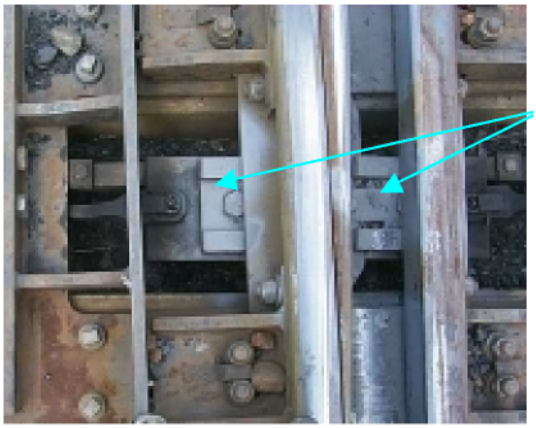


Fig 2.1 – Clamp plates - VAE swing nose

If a dry lubricant is being used on the swing nose chair plates, remove excess that may buildup on top of the clamp plates. Dry lubricant thickness on the raised surfaces on these plates must not exceed 1 mm.

Check that there are marks indicating movement between the straight rail and the turnout rail of the swing nose where they are bolted together. If there is no movement at this point, the swing nose will be extremely heavy and may become impossible to operate.

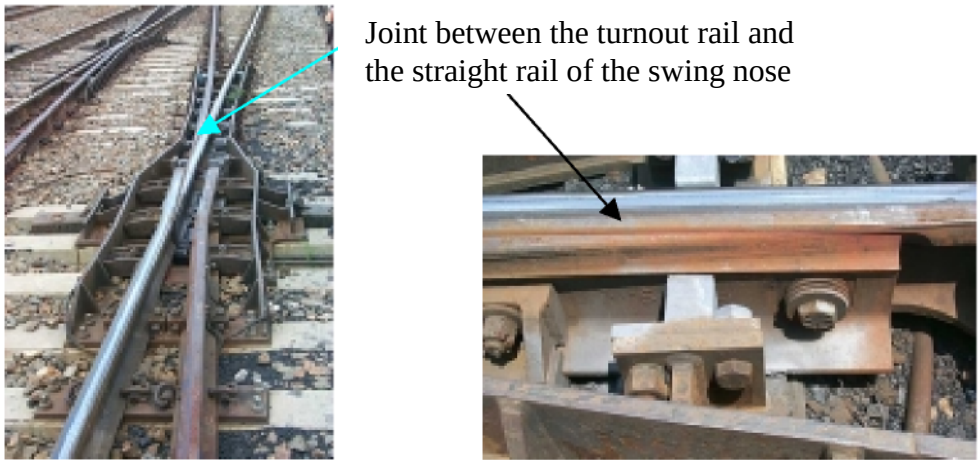


Fig 2.2 - VAE swing nose rail connection

8.3 PRE Swing nose crossings

8.3.1.1 1 in 24 Crossings (Beverly Hills)

Due to the length of these swing noses, the two rails forming the swing nose are rigidly attached with no sliding or expansion joint.

Check that the swing nose is bearing on a reasonable number of chair plates, 1/3 or more, and is bearing on or within 2 mm of the first plate. A swing nose which is lifting off the first plate will expose the tip to impact damage. This condition will result from a hump at the tip of the swing nose or a hollow in front of or behind it.

8.3.1.2 1 in 12 to 15 Crossings

These swing noses have a sliding joint in the turnout rail of the swing nose. This joint must be checked to ensure that there is a small gap remaining in the joint. A zero gap will lead to extremely heavy swing nose operation and probable failure.

Check that the swing nose is bearing on or within 2 mm of the first plate. A swing nose which is lifting off the first plate will expose the tip to impact damage. This condition will result from a hump at the tip of the swing nose or a hollow in front of or behind it.

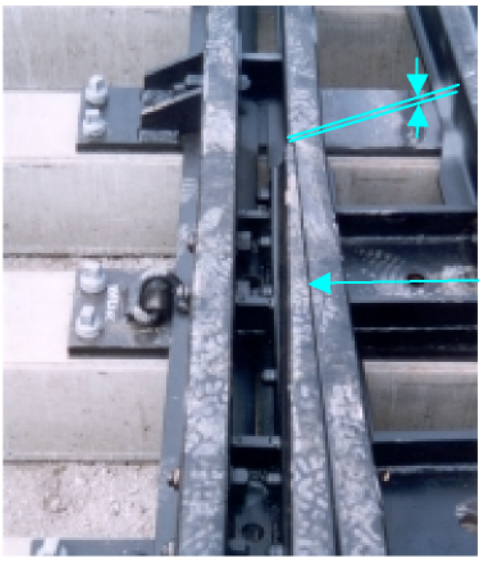


Fig 2.3 – PRE Swing Nose sliding joint

8.4 TKL Swing Nose Crossings – Glenfield

These swing noses have a sliding or expansion joint in the turnout rail of the swing nose. This joint must be checked to ensure that there is a small gap remaining in the joint with the swing nose reverse. A zero gap will lead to extremely heavy swing nose operation and may lead to failure.

Check that the swing nose is bearing on at least 1/3 of the chair plates and that the wing rails are seated correctly into the slots in the plates.

8.5 The Claw Lock Mechanism

8.5.1 All Claw Locks

The claw lock coupling bar and the drive rod from the mechanism should be in line if end connected or parallel if centre connected. Misalignment suggests that either installation is incorrect or the claw lock itself has moved on the wing rail or bracket.

Where the claw lock has slotted holes, one or both claw lock positions can be adjusted to restore alignment.

Where there are no slotted holes, the cause of the misalignment needs to be determined and corrected if it is sufficient to cause binding between claw, coupling bar and claw lock. If it has not yet reached that stage, the moving components must be restrained to prevent further misalignment.

8.5.2 VAE Claw Lock

1. Remove any build up of dirt and grease between the claw and claw bracket and between the claw and coupling bar where it passes through the claw lock on each side of the swing nose..

2. Examine for:

    - Wear on the locking faces of the claw and the claw lock. If there is grooving more than 1.5mm deep the claw and/or claw lock should be replaced.

    - Wear on the coupling bar adjacent to the recess in the bar. Any tapering towards the slot more than 25 mm long and 3mm deep requires replacement of the coupling bar.

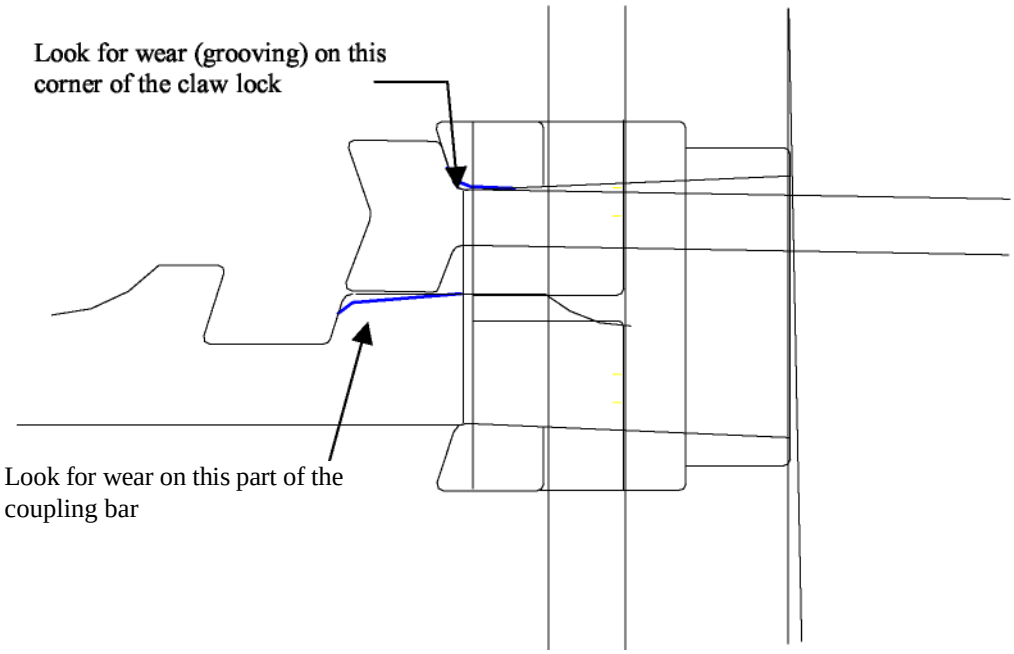


Fig 2.3 – Claw Lock wear

- Wear in the claw pin, the claw or the eccentric bush.
- Wear between the eccentric bush and the claw bracket.

  If there is more than a total of 1 mm slack between claw and claw bracket, parts should be renewed

  Note These components should not show significant signs of wear within the first 5 years of service unless lock settings are too tight, correct lubrication is not carried out or there are trackwork deficiencies which are causing excessive vibration.

3. Lubricate the claw pin and the locking and sliding faces of the claw and coupling bar. One of the greases listed in Appendix A should be used. Dry switch plate lubricants are not suitable for these claw locks.

4. Ensure that covers are secure and that they cannot foul the claw or coupling bar.

5. Check that there is no more than about 1.5mm of movement between the coupling bar and the drive rod from the switch machine. Movement indicates bush and/or pin wear and if over 1.5mm bush and pin replacement should be programmed.

6. Examine the condition of the split pin securing the claw pin retainer. The split pin must not be grooved to more than 20% of its diameter. The split pin hole in the retainer must not be worn to the extent it will allow the retainer to overlap the pin head by less than 3mm.

8.5.3 PRE Claw Lock

Fig 2.4 – PRE Claw lock – 1 in 21 swing noses Beverly Hills

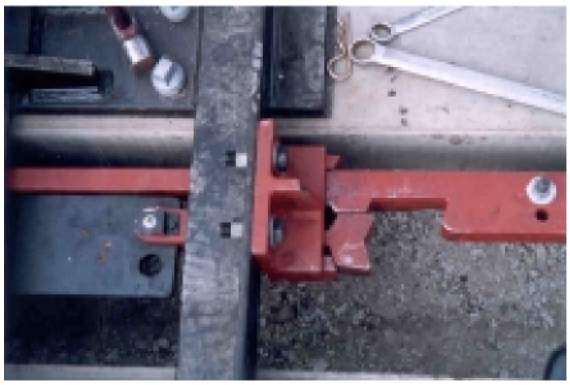


Fig 2.5 – PRE Claw lock – 1 in 12 to 18.5 swing noses

1. Remove any build up of dirt and grease between the claw and claw bracket and between the claw and coupling bar where it passes through the claw lock on each side of the swing nose.

2. Examine for:

    - Wear on the locking faces of the claw and the claw lock. . If there is grooving more than 1.5mm deep the claw and/or claw lock should be replaced.

    - Wear on the coupling bar adjacent to the recess in the bar. Any tapering towards the slot more than 25 mm long and 3mm deep requires replacement of the coupling bar.

    - Wear in the claw pin, the bushes (if fitted) in the claw or the bushes (if fitted) in the claw bracket. If there is more than 1 mm movement between the claw and bracket, parts should be renewed.

3. Lubricate the claw pin and the locking and sliding faces of the claw and coupling bar. One of the greases listed in Appendix A should be used. Dry switch plate lubricants are not suitable for these claw locks.

4. For 1 in 12 to 18.5 crossings, check that the claw bracket (or plate) is still retained in place by the keeper plates which are bolted to the swing nose. Note that the claw bracket is not attached directly to the swing nose – it can move up and down slightly and rock up and down. This is normal.

5. Ensure that covers are secure and that they cannot foul the claw or coupling bar.

6. Operate the swing nose to determine whether there is any slack in the joint between the coupling bar and the drive rod from the switch machine. There should not be any movement in this joint.

8.5.4 ARTC/TKL Claw Lock – Glenfield Junction

1. Remove any build up of dirt and dried grease between the claw and claw bracket and between the claw and coupling bar where it passes through the claw lock on each side of the swing nose.

2. Examine for:

    - Wear on the locking faces of the claw and the claw lock.

    - Wear in the claw pin, in the claw or in the claw bracket. If there is more than 1 mm movement between the claw and bracket, parts should be renewed.

3. Lubricate the claw pin and the locking and sliding faces of the claw and coupling bar. One of the greases listed in Appendix A should be used. Dry switch plate lubricants are not suitable for these claw locks.

4. Ensure that the brackets supporting the hydraulic rams are secure and that there is no evidence of fracture around welded connections.

9 Run Through of Claw Lock – Turnouts and Swing Nose Crossings.

A run through of a claw lock mechanism, except where a turnout is fitted with a trailable operating mechanism, will result in some degree of damage to at least some of the components of the claw lock mechanism even though this may not be immediately visible.

There will also always be some damage to the switches or swing nose but with light vehicles it may not be sufficient to necessitate replacement.

The extent of damage will be determined to a large extent by the weight and number of vehicles involved and the speed of the run through. While a light track maintenance vehicle may only appear to cause minimal distortion of the switch or swing nose, it will still have imposed excessive loads on some claw lock components.

Since the loads imposed by a run through are impossible to accurately calculate, the components listed below, at least, should be replaced if a run through occurs.

If a locomotive or train has run through the turnout or swing nose then components should be replaced before restoration to service. If the run through is by a light track vehicle and there is no obvious damage, replacement may be at the earliest opportunity.

Where component replacement is delayed, a weekly inspection of the claw lock installation should be implemented.

Components most likely to suffer damage are:

For a turnout

- The claw lock (box) of the closed switch.
- The claw, claw pin and claw bracket of the closed switch.
- The claw, claw pin and claw bracket of the open switch.

For a swing nose

- The claw lock (box) on the closed side of the swing nose
- The claw and claw pin on the closed side of the swing nose.
- Bolts securing claw locks and claw brackets.

Claws, claw locks and (some) claw brackets are steel castings that can develop hairline cracks if severely over stressed. These cracks will not necessarily be immediately evident.

The claw locks and components at Glenfield Junction are an exception since the claws, brackets and claw locks are made from mild steel. This material is more likely to bend or distort than crack. However, cracking adjacent to welds is still possible.

Whether or not the coupling bar suffers damage will depend on the type and strength of the operating mechanism. Damage to the coupling bar will usually be evident, such as bending, twisting or distortion at the bolted joints within the bar.

Operating mechanisms, except for hydraulic rams, will usually suffer internal damage.

Any components which have been removed after a run through must either be destroyed or, if there are no visible signs of damage, be forwarded to an accredited facility for crack testing.

10 Routine Maintenance – Operating Mechanisms

10.1 Westinghouse 84M Series Switch Machines

10.1.1 Tools

30 mm open ended spanners	2 off
Adjustable spanners 450 mm	2 off
Adjustable spanners 600 mm ***Or***	2 off
55 mm open ended spanners	2 off
Nut driver insulated 5 mm Nut	1 off
driver insulated ¼ BSW Pliers	1 off
combination 200 mm	1 off

10.1.2 External checks

Carry out the external checks
and inspections listed in the TMP (baseline or tailored) applying to the locality.

- To check that nuts and locknuts on either side of the drive lug are tight two spanners must be used, one on the nut and one on the locknut. Attempting to use a single spanner can loosen the bond between the nuts.

- Note that it is permissible for the drive lug to be able to rotate on the mechanism throw bar and on the drive rod provided that there is zero end float. Loctite 242 or similar can be used on nut and locknut threads to assist locking.

- Allowing the drop lug to rotate on the mechanism throw bar will reduce the effect of stockrail movement on throw bar/coupling bar misalignment.

- Detector rods must be firm in the lugs on the end of the detector slides but not so tight that the dished washers become ineffective. Again two spanners must be used when tightening locknuts against nuts.

- There must also be less than 1 mm of movement between detector rod and switch or swing nose. Replace bushes and/or pins where necessary.

- If the baseplate holding down bolts on concrete beams are removed for any reason, and these are stainless steel bolts, an anti-seize compound must be applied to the bolt before it is re-inserted. While not essential for galvanised or zinc plated bolts its use will still be beneficial.

- When checking emergency crank handle operation, examine the condition of the indexed bearing sleeve. If the wear is such that a differently indexed handle could be forced into the machine, the bearing sleeve must be replaced

- With dual control machines, before inserting the EOL key into the machine, lift the latch and attempt to move the selector lever. Only a few degrees of movement should be possible. If the lever can be moved more than a few degrees then the Emergency Operation Lock and slide is defective and must be replaced.

- With the selector lever in the ”motor” position, attempt to move the hand throw lever. Again the lever should not move more than a few degrees. If it does the interlocking between the two levers is defective and must be repaired or replaced.

- To check correct operation of the Emergency Operation Lock and key:-

- move the selector lever to the “hand” position

- The slide must not be able to be pushed in and the EOL key must be retained in the lock

- Move the hand throw lever to the reverse position

- Try to restore the selector lever to the “motor” position. This should not be possible.

- Move the hand throw lever back to the normal position. The slide must not be able to be pushed in and the key must be retained in the lock.

- Return the selector lever to the “motor” position

- It should now be possible to push the slide fully in and turn and remove the EOL key

10.1.3 Internal checks

Carry out the internal checks and inspections listed in the TMP (baseline or tailored) applying to the locality.

- Detector rollers should be examined to ensure that they are rotating freely and that there are no evident flat spots on the roller.

- Detector, motor control and motor cut-out switches are semi-sealed units and can only be visually examined or checked with a meter for contact resistance. Initially, a visual examination is usually sufficient to determine if a problem is developing. Internal discolouration of the case, particularly blackening, or any discolouration of the contact springs is an indication that a fault is developing and that the contact block should be changed.

- Wear in detector and motor control contact linkages will result in light contact pressures and “bobbing contacts”. These linkages need to be examined periodically

to check the degree of free play of pivots and pins and to check that the throw-over action of the motor control contacts is a "snap" action without any hesitation.

- Use the appropriate nut drivers to check that wiring and terminations within the machine are secure.

- Ensure that the detection configuration plug is secure in its socket.

- Arrange for the machine to operate normal to reverse and back and listen for any unusual noise(s) from the motor or gears. Motors cannot be field serviced and must be changed and forwarded for overhaul if any defect such as worn or dry bearings is suspected.

If the noise appears to be coming from the gears, examine the condition of the gear teeth. Signs of sharp edges at the top of gear teeth indicates heavy wear and that imminent gear replacement will be necessary. If the gears appear OK, the problem is most likely a dry or worn bearing. This will necessitate either gearbox replacement or machine replacement for overhaul.

- Check the side float in the detector slides where they pass through the mechanism case. This should not exceed 1 mm. Replace either the detector slide bearing or detector slide, whichever is worn.

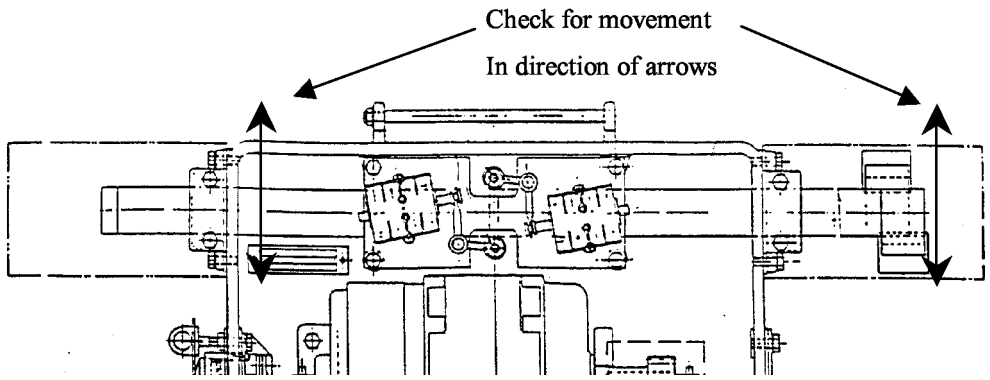


Fig 4.1 - 84M Series detector slides

If it has not already been removed, the drain plug located under the gearbox in the centre of the machine case should be removed as required to drain any accumulation of water.

10.1.4 Lubrication

The lubricants required are: -

- Petroleum Jelly or a 'Valve and O-ring lubricant' for 84M and T84M machines only.
- Grease selected from the list in Appendix A
- Mobil DTE 19 oil with 5 – 10% Molybond 2.5 additive or Shell "Tonna Oil S220"

Lubricate where shown in figure 4.2

The recommended maximum lubrication intervals are:-

- For a machine which operates less than 75 times per day:
  6 months

For a machine which operates more than 75 times per day

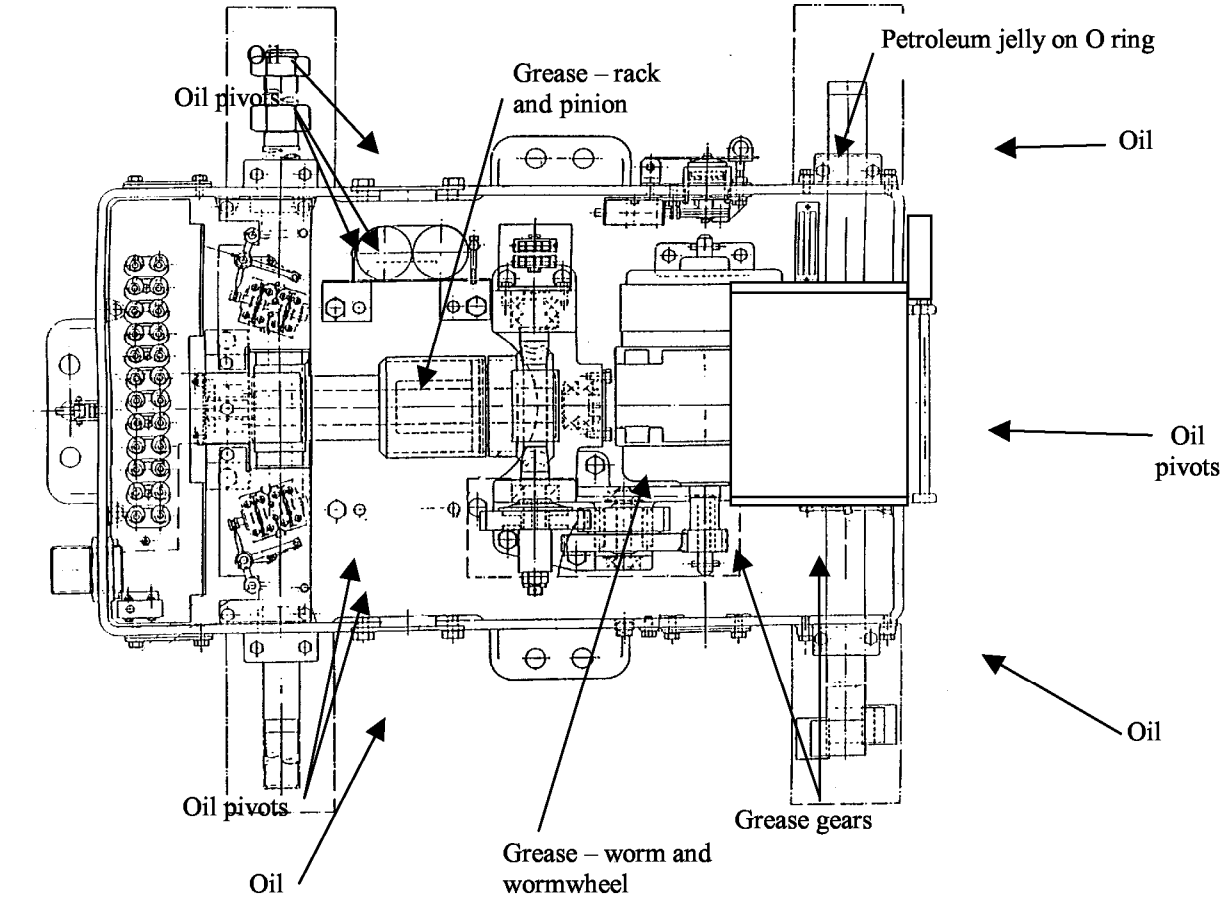
- 3 months
- For the throw bar and detector slides, additional lubrication after severe storms or prolonged periods of heavy rain.

Where machines are operating in severe environments, such as in areas with salt air or where heavy condensation is experienced, maximum lubrication intervals will need to be reduced.

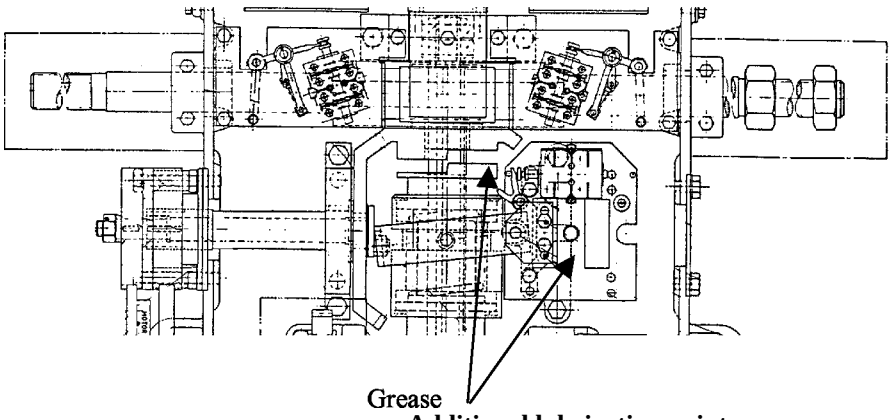
Caution

Take care not to contaminate the clutch facings with oil or grease. In particular trail clutch facings in T84M and TD84M machines must not be contaminated.

Additional lubrication is required if these mechanism are dismantled and overhauled. For details refer to chapter 3 "Overhaul" and Westinghouse Signals Australia Manual MH3408.



All Machines



Additional lubrication points on

D84M and TD84M Machines only

Figure 4.2 – Lubrication

Note that the internal appearance, motors in particular, and the location of capacitors may vary from that shown above. This has no effect on required lubrication.

10.1.5 Clutch Adjustment

Unless there have been suspected clutch slip problems, it should only be necessary to check the clutch at installation and at a minimum of yearly intervals thereafter.

10.1.5.1 Non Trailable Machines 84M and D84M

The clutch is located on the end of the extended worm shaft and may be adjusted by tightening or loosening the castellated nut. (The nut is at the opposite end of the worm shaft to the detection configuration plug and sockets)

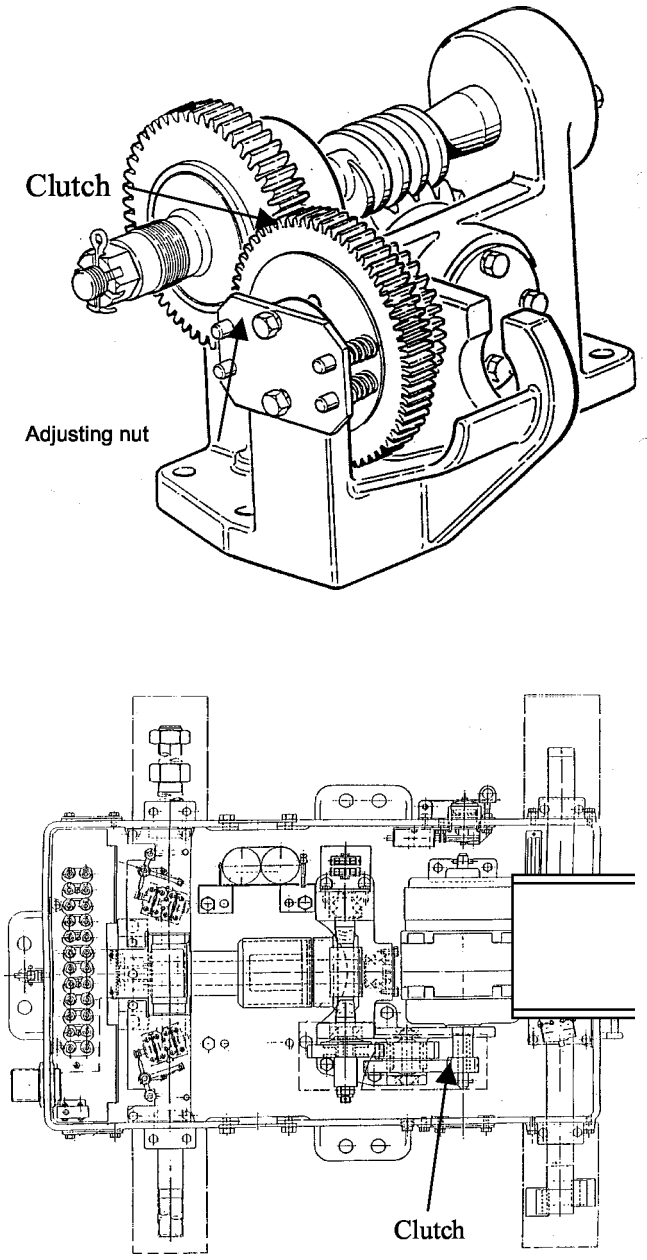


Figure 4.2 - 84M and D84M clutch

The clutch should be set for a slip load of 4.5 - 5.5 kN for Mk 1 machines and 7kn for Mk 2 machines (or Mk1 machines with Mk2 clutches fitted).

The clutch may be checked and adjusted by using the WB&S clutch setting tool, Part No 3335801201. Proceed as follows:-

Disconnect the drive bar from the points. Fit the clutch setting tool to the fully extended end of the drive bar and screw on one nut to just touch the outer collar of the tool but not compress the spring. The inner end of the tool should be bearing against the side of the mechanism case.

Check that the tool is reading zero plus or minus 0.25 kN. If not, the tool spring has been damaged and must be replaced.

Operate the machine under power and read off the load at which the clutch slips.

If the torque is too low, adjust by tightening the castellated nut. Ensure that the split pin is re-fitted.

Alternatively

A less accurate, but simpler, method of clutch adjustment, which does not require the machine to be disconnected from the points, may be used.

Use a tong type ammeter around the motor common wire to the machine.

Measure the motor operating current normal to reverse ***and*** reverse to normal.

If the motor operating current is measured at 8.5 A or more, there is either binding in the claw lock mechanism or in the turnout itself. These faults must be corrected at the earliest opportunity. *Do not* simply adjust the clutch to compensate.

Block the points and measure the clutch slip current.

- The slip current must be at least 1 A, and preferably 1.2 to 1.4 A, more than the operating current.
- The slip current must not be less than 7.5 A
- The slip current must not be more than 10.5 A

If the slip current is too low, adjust by tightening the castellated nut. Ensure that the split pin is re-fitted.

10.1.5.2 Trailable Machines T84M and TD84M

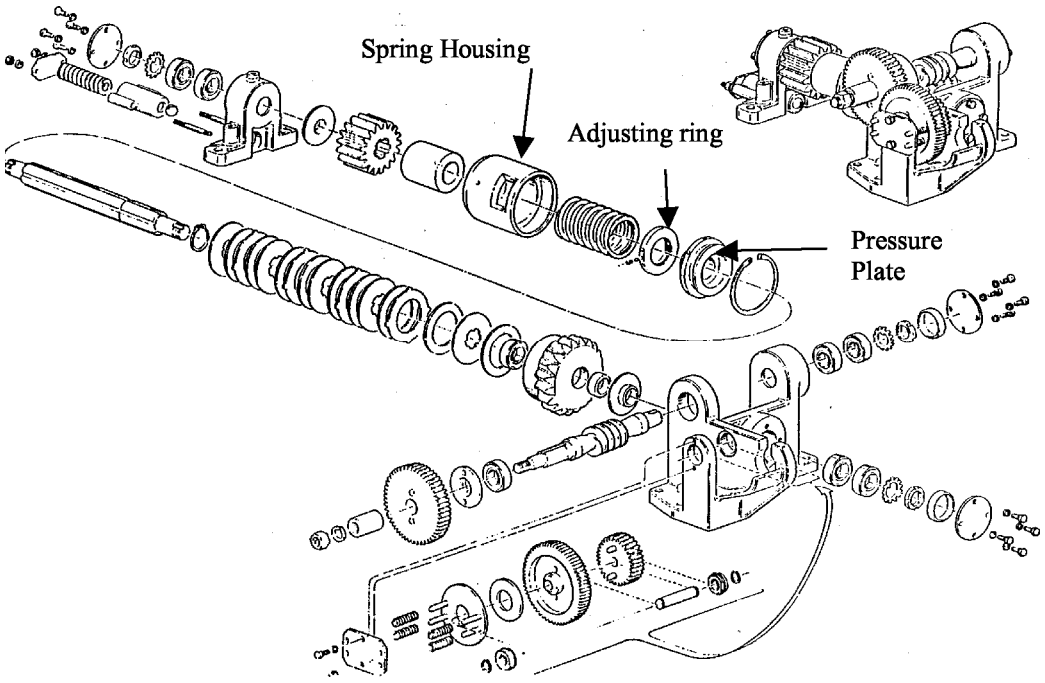
The multi-plate trail/motor clutch is contained within the worm-wheel casting and acts as both a breakaway clutch for trailing movements and a motor protection clutch.

Adjustment is carried out at the window provided in the spring housing contained on the main worm-wheel shaft.
To adjust the clutch

- Use a 6mm diameter x 150mm steel rod to rotate the pressure plate in the spring housing until the locking socket head grub screw is visible through the window.

- Loosen the socket head grub screw.

- Using one of the 6mm x 150mm bars in one of the holes in the edge of the adjustment ring and the other in a hole on the edge of the pressure plate, adjust the clutch by turning the adjustment ring while holding the pressure plate stationary.



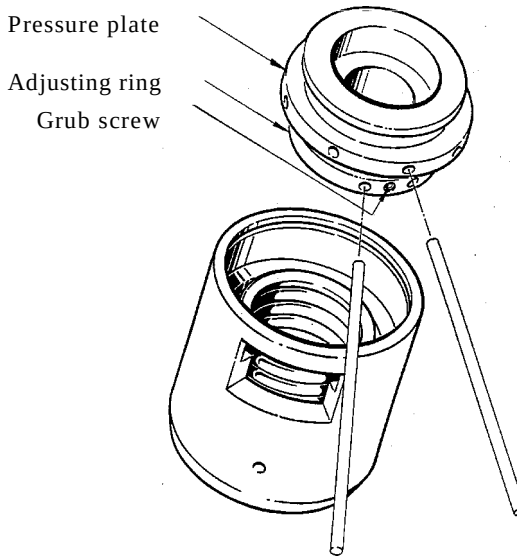


Figure 2.3.2 – T84M and TD84M Trail clutch

Viewed from the worm-wheel end, turning the adjusting ring clockwise increases the clutch slip load.

Load may be measured by using the Westinghouse clutch setting tool Part No 33358801201 in the manner described in clause 1.3.1.

When the desired setting is obtained, re-tighten the grub screw.

There are three clutch springs for T84M and TD84M machines. These are:

Clutch Spring P/N	Trail Setting	Drive Setting
4177300801	Low	1.25 to 2.0 kN
4177300701	Medium	2.2 to 3.2 kN
4177300901	High	3.5 to 4.5 kN

T84M and TD84M machines used in New South Wales are normally fitted with the high trail setting spring P/N 4177300901.

Alternatively,

A less accurate, but simpler, method of clutch adjustment, which does not require the machine to be disconnected from the points, may be used.

Use a tong type ammeter around the motor common wire to the machine.

Measure the motor operating current normal to reverse ***and*** reverse to normal.

If the motor operating current is measured at 8.5 A or more, there is either binding in the claw lock mechanism or in the turnout itself. These faults must be corrected at the earliest opportunity. *Do not* simply adjust the clutch to compensate.

Block the points and measure the clutch slip current.

- The slip current must be at least 1 A more than the operating current
- The slip current must not be less than 7 A
- The slip current must not be more than 10 A

A slip current in excess of 10 A will indicate a defect within the clutch which must be changed.

If a clutch with a high trail setting spring cannot be adjusted to exceed a 7 amp slip current, then it is defective and must be changed.

Clutch change procedure is described in chapter 4 “Overhaul”.

10.2 Latched Pneumatic Motor

10.2.1 Description

The motor is a 125 mm bore, 180 mm stroke (some early motors were 200 mm stroke) air cylinder fitted with an internal latching device at each end and, in some cases, fitted with microswitches at each end to detect piston position.

The latching devices prevent the piston from drifting from the normal or reverse position if air pressure is lost. Air pressure applied to the cylinder releases the latches before moving the piston.

The microswitches, where fitted, are operated by a push rod driven by a ramp on the piston rod and are used to detect the motor fully normal or fully reverse.

The motors are usually fitted with adjustable flow control valves on the normal and reverse ports which enable the speed of operation of the points to be varied.

10.2.2 Routine Maintenance - Mechanical

There is no periodic preventative maintenance schedule for the internal parts of the air motor. Motors are pre-lubricated at manufacture and in- service lubrication is not required.

Observe the operation of the points. If considered too slow or too fast, adjust the flow control valves on the motor ports.

Observe the operation of the latches and ensure that they are returning to the latched (fully down) position.

If there is any defect with the operation of the motor piston or latches or switch actuators, the motor must be changed and returned to the depot or workshop to be forwarded for overhaul.

10.2.3 Routine Maintenance - Electrical

1. Check that the switch driving cap and locknut on the microswitch actuator are tight.

2. Check the operation of the microswiches. This is done with the actuator in the retracted position. Depress and release each switch by hand to ensure that the switch plunger returns freely to the extended position without any grating or hesitation. The microswitches are sealed assemblies and cannot be repaired.

Caution

The signaller must be advised before this check is carried out as the detection circuits will be broken when the microswitch plungers are depressed. The check must not be carried out if there is any train within the extent of the approach locking for the points unless that train is stationary.

3. Examine the wiring and terminal block for any damage or loose connections.

If it is necessary to change microswiches this is best carried out in the depot but can be carried out on site if necessary. Proceed as follows:-

- Disconnect wiring from the terminal block
- Remove the screws securing the switch mounting plate to the terminal box
- Remove the switch driving cap from the actuator (leave the locknut in place)
- Remove the switches and mounting plate from the terminal box and switches from the mounting plate.
- Repeat these steps in reverse order to refit new switches.

10.2.4 Pneumatic Motor Overhaul

At 3 to 5 year intervals, depending on number of operations and operating environment, pneumatic motors should be removed from the track for replacement of piston seals, gland seals, latch seals and microswitch actuator seals. Motors should be returned to their manufacturer for overhaul.

10.3 HM2 Detectors

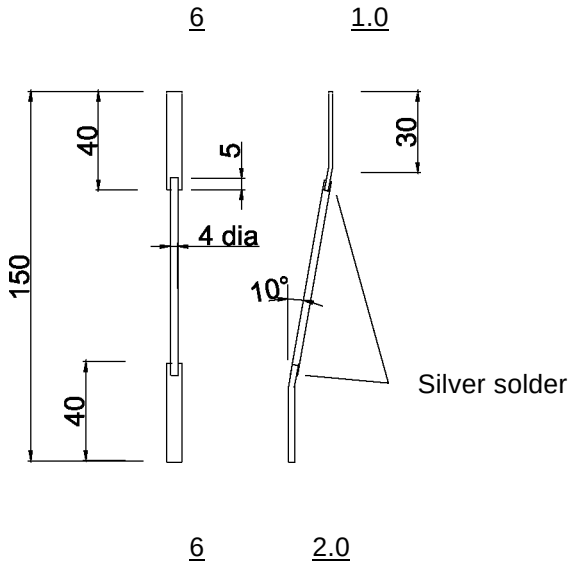
- Lightly lubricate the detector slides, where they pass through the guides in the case, with one of the greases listed in Appendix A.
- Visual examination of contact assemblies is usually sufficient to detect deterioration. Look for blackening on the inside of the plastic case or discolouration of contact springs.
- Detector rollers should rotate freely and there should be no evidence of flat spots. There should be little or no slack in the pivots and pins of the detection linkages.

11 Appendix A – Lubrication Alternatives for Claw Locks, Swing Assist Units and 84M Series Switch Machines

Manufacturer	Product	Comment	Applications
Shell	Retinax HDX2	Heavy duty EP grease, contains MoS_2, suitable for heavy duty applications with shock loading in hostile environments	Claw Lock components, spring assist units
Caltex	Molygrease Heavy	Heavy duty EP grease, contains MoS_2, high water and corrosion resistance, high load carrying capacity	Claw Lock components, spring assist units
Rocol	Tufgear 90 **	Heavy duty grease, contains MoS_2, high corrosion resistance, high load capacity	Claw Lock components, spring assist units, gears in 84M machines
Mobil	Mobilgrease Special	Heavy duty EP grease, contains MoS_2, high corrosion resistance, high resistance to water washout	Claw Lock components, spring assist units
Caltex	Texclad 2 **	Heavy duty grease, contains MoS_2 and graphite, is high adhesive, highly resistant to water wash out, resists flaking at low temperatures	Claw Lock components, spring assist units, gears in 84M machines
Shell	Malleus GL500 **	Premium EP grease, contains MoS_2, inhibits corrosion, resists drying out and 'squeeze out', reduced dirt and dust retention.	Claw Lock components, spring assist units, gears in 84M machines

Note: All of the above greases can be used on the gears within 84M series machines. However the greases marked ** are open gear greases which will resist "fling of"

12 Appendix B – Detection Gauge – Westinghouse Detectors



Material: 316 or 304 Stainless Steel

Detection Gauge for Westinghouse 84M Machines and HM2 / HM3 / HMX Detectors