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Facing Point Lock and Detection Testing

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1.0	13 Nov 23		Document renumbered from ESM-06-01. Updated the requirements of supplementary detection for longer turnouts and included additional information for VAE Unistar HR points machine.

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1 Introduction

1.1 Purpose

The purpose of this standard is to provide a consistent approach and guidance to the testing of point operating mechanism facing point locks and detection systems throughout the ARTC rail network Australia-wide.

1.2 Scope

This standard cover points operating mechanisms approved for use on the ARTC rail network.

This document is applicable to entire ARTC network.

1.3 Terms and Definition

For the purpose of this document, the terms and definition are as follow:

FPL	Facing Point Lock
TCS	Train Control System
DIRN	Defined Interstate Rail Network
EOL	Emergency Operations Lock
ESML	Emergency Switch Machine Lock
TMP	Technical Maintenance Plan
SS	Service Schedule

1.4 References

ESD-07-01	Points
SPS16	Point Mechanisms
SMS04	Mechanical Points and Ground Frames
SMS05-10	The Claw Lock Mechanism
ESI-06-01	Claw Lock Failure
Section 3	Points & Crossing

2 General Principles

All point operating mechanisms shall be periodically tested to ensure reliable operation of the points and that, with the point locking device engaged the closed switch is held firmly against the stockrail. In addition, the open switch shall be in the correct position and all mechanical components are within their operating tolerance – including the condition of the “slide” chairs, points switch rollers where fitted and stock rails.

The competent person undertaking the maintenance action shall confirm that the track is correct to gauge at the points, looking for signs of excessive wear or movement of the track that would affect the reliable operation of the points equipment. The gauge at the switch blades shall be in accordance with the ARTC Code of Practice Section 3 – Points and Crossings. Measurements outside these ranges shall be reported as defects.

The competent person undertaking the maintenance action shall notify the Infrastructure Manager or nominated representative of any undue movement or wear of the track at the points and request follow up rectification. This shall also be recorded into the Defect Management System or other nominated system to record the issue and request for rectification work. The priority or time to correct should also be recorded.

3 Precautions to be taken

For all type of point operating mechanisms, the following shall be applicable.

The competent person undertaking maintenance shall in the first instance utilise the ESML or EOL or Plug Connector and Key arrangements where available, to place protecting signals or indicators at stop after consultation with the Network Controller.

Where ESML or EOL or Plug Connector and key arrangements are not available, the Network Controller shall be contacted so that the signals or indicators protecting the points concerned are placed at stop and approaching trains brought to a stand before any works are undertaken, and that those protecting signals or indicators shall remain at stop for the duration of the works.

Where adjustments may be required, the signals or indicators protecting the points are to be booked out of use for traffic movements in accordance with the Network Rules before commencing adjustment (no requirement for disconnection in accordance with the Procedures).

4 Points detection test: Separate electrical detector

4.1 Detection

Where the detection contacts cannot be manipulated to be made or broken during tests, such as in the case of sealed detector contacts and for other types of detector contacts that are not visible, detection shall be verified electrically by connecting a voltmeter across the circuit wires from the detector to monitor the contacts changed over with a switch opening of 6mm.

The detection at the toe of the points shall be just made at 4mm and clearly broken at 6.00mm.

The detection at the supplementary or back drive detector/s is described in Section 7.

For combined detection of switches where mechanical FPLs are fitted, ensure that detection does not make until the FPL plunger engages the lock rod by at least 35mm.

4.2 Trailing points

With trailing points it is permissible to increase 6mm detection limit up to 8mm when conditions below are satisfied:

- This increased limit is necessary to avoid failures and delays to traffic.
- There is no signalled moved through the trailing points in the facing direction.
- There is no reversing move where part of the train would set back through the points in a facing direction.
- The condition causing the inability to obtain reliable detection at the lower limits is to receive attention to correct the problem.
- A record is kept of such arrangements in the Signal Maintenance Engineer's Office.
- Approval is granted using an Engineering Waiver.

4.3 Catchpoints

On single blade catchpoints, detection of the open switch position, usually the normal position, may be coarsely adjusted to make at about 13mm, measured from the switch stop, i.e. with the points open at least 100mm

5 Facing point lock testing – Mechanical FPL

5.1 General Procedure

Mechanical FPLs shall be tested to ensure reliable operation of the points and that with the FPL engaged the switches are held within 3.2mm of the running face of the stock rail.

The lock plunger travel at the FPL casting is to be 200mm, except in the case of double lock plungers worked by one lever, where travel is 175mm. When the lock plunger is withdrawn the clearance between the end of the lock plunger and the slotted lock rod or locking rod block is to be 20mm.

When gauge testing a 3.20mm gauge shall be used and the lock shall be maintained sufficiently tight to ensure that the movement of the F.P.L. lever cannot be completed with the gauge inserted between the point switch and the stock rail in line with the stretcher at the toe of the points. The switch shall be operated by means of the lever in the interlocking machine. When the FPL locks the points both ways, each switch shall be tested.

5.2 Adjustments

If, during testing under normal operation, the switches do not fit up hard against the stock rail with some spring then the points drive may need adjustment.

If, during testing under normal operation with a 1.6mm gauge, the facing point lock plunger is tight with the point switch blades fitting correctly against the stock rail then the points may need adjustment.

If, during gauge testing with a 3.2mm gauge it is found that the facing point lock lever can be put fully home with the gauge between the point switch and stock rail, then adjustment is necessary.

Before adjustment, ensure that there is no movement due to loose FPL casting or movement of stock rail or chairs.

Adjustment shall be immediately made as follows:

- Loosen the two bolts at the joint in the lock rod, sufficiently to allow the disengagement of the serrations. Adjust the lock rod bar accordingly and re-engage the serrations at the required new position. Tighten the bolts.
- If the required adjustment is less than provided by the serrations, or if the lock rod is of the non-serrated type, shims shall be used. These are to be inserted between the switch and the lock rod.
- If the extent of wear is such that a properly adjusted lock cannot be obtained, the worn fittings shall be replaced.

6 Facing point lock and detection testing – Combined point machine

6.1 Introduction

The tests, inspections and settings referred to in this section are applicable to combined or interlocked point operating mechanisms only. These include, and are not limited to;

- Westinghouse (Siemens) M2, M2D, M3A, M23A and M70 etc
- GEC HW series 4121, 4400 etc
- Nippon KA1200, KA1211C etc
- Hitachi T20, T21

6.2 Facing point lock

The points shall be operated both normal and reverse to see if the switches fit correctly against the stock rail and if the point lock plunger enters and withdraws from the notch in the lockslide freely and with sufficient clearance. If there is a failure in the tests then adjustments shall be made in accordance with the manufacturer's equipment manual.

The manual testing of the facing point lock shall be undertaken without inducing switch roll. If switch roll is induced, then the test is null and shall be repeated. The switch shall be moved away from the rail face before repeating.

The FPL plunger shall not enter the lockslide opening with a switch opening of 3.20mm but shall enter with a switch opening of 2.00mm.

The FPL test shall be carried out using gauges for openings of 3.20mm and 2.00mm between the stock rail running face and the switch at a position approximately, and not more than, 75mm back from the tip of the switch.

6.3 Detection

The detection at the toe of the points shall be just made at 4.00mm and clearly broken at 6.00mm.

Detection testing on combined point machines is not possible using gauges between the switch and stock rails without disconnecting the FPL. Options available include.

1. gauge at the gap between roller and detection slide inside the points machine, or
2. place gauge on connection between detector rods and detector slides, or
3. slacken the lock rod so the FPL plunger will complete its travel and gauge between the switch and stockrail, or

4. disconnect the lock rod so the FPL plunger will complete its travel and gauge between the switch and stockrail.

For sealed micro-switch contacts, at a 6.00mm switch opening the detector normal (or reverse) contacts are to be fully opened with the respective R-NI (or N-RI) contacts made, (This can be checked using the 6.00mm gauge with a voltmeter connected across the normal contacts then across the R-NI contacts, or across the reverse contacts then across the N-RI contacts, as the case may be.)

For semi sealed contacts such as those in Westinghouse point machines and detectors, where the contacts cannot be clearly seen, the contact must be electrically open at a 6.00mm switch opening, this can be checked with a voltmeter.

Detector contacts are not to be adjusted to be broken at a switch opening of 4.00mm or less. With track vibration such fine adjustment could lead to 'bobbing' detection failures and/or excessive wear and flats on rollers within detector mechanisms causing irregularities if not identified and corrected during routine maintenance.

Particular attention should be given to Westinghouse M2, M2D, M23A, M70 and M3A machines to ensure that flats have not developed on the roller in the contact drive cam follower nor on the roller on the detector slide.

The detection test shall be carried out using gauges for openings of 4.00mm and 6.00mm between the stock rail running face and the switch at a position approximately, and not more than, 75mm back from the tip of the switch.

6.4 Trailing points

With trailing points it may be permissible to increase the detection limit from 6mm up to 8mm when conditions below are satisfied:

- This increased limit is necessary to avoid failures and delays to traffic
- There is no signalled move through the trailing points in the facing direction
- There is no reversing move where part of the train would be set back through the points in a facing direction.
- The condition causing the inability to obtain reliable detection at the lower limits is to receive attention to correct the problem.
- A record is kept of such arrangements in the Signal Maintenance Engineer's Office.
- Approval is granted using an Engineering Waiver.

6.5 Catchpoints

On single blade catchpoints, detection of the open switch position, usually the normal position, may be coarsely adjusted to make at about 13mm, measured from the switch stop, i.e. with the points open at least 100mm.

7 Mid-Switch or Supplementary Detection

Where higher speed turnouts are installed, there is a requirement to ensure that all parts of the switch move in unison with the point drive so that there is a smooth transition as the wheelsets traverse the switch. If the toe is correctly closed and other sections of the flexible switch are not in the correct position the first wheelset to traverse the turnout can 'whip' the switch closed and there

is a risk that damage may occur – this could also be coupled with the rear of the wheel flange striking the inside of the switch resulting in a similar effect.

- Where this risk exists, mid-switch or supplementary detectors can be used based on manufacturer's guideline and the track geometry requirements to maintain the required minimum flangeway width (or clearance) as detailed in ARTC Track and Civil Code of Practise "Points & Crossings" – Section 3.

Mid-switch or Supplementary detectors can be arranged in a number of physical arrangements on the turnout, which affects how the detector adjustments are set up. The following is to be done for both switch positions.

One mid-switch / supplementary detector with a split shaft / 2 arms – this arrangement may have a fixed stretcher between the switches or switches that move independently. The detector should be adjusted to be just made with a flangeway width (clearance) of 47mm and clearly broken at 45mm on the open side. The measurement shall be taken between the switch and stockrail where the detector attaches to the switchrail.

Two mid-switch / supplementary detectors with a single shaft / 1 arm – this arrangement may have a fixed stretcher between the switches or switches that move independently. The detector should be adjusted to be just made with a switch opening of 6.00mm and clearly broken at 8.00mm on the closed side with the gauge shall be placed between the switch and stockrail where the detector attaches to the switchrail, and, adjusted to be just made with a flangeway width (clearance) of 47mm and clearly broken at 45mm on the open side. The measurement shall be taken between the switch and stockrail where the detector attaches to the switchrail.

8 HLM Point Locks

8.1 Introduction

The Siemens HLM point lock detector have been used in a variety of applications such as:

- to act as a facing point lock on points;
- to lock a mechanical ground frame or points lever in lieu of a releasing switch.

While the listed applications of the HLM differ considerably, there is little variation in the HLM itself and consequently set-up and maintenance procedures are similar for all applications.

8.2 Facing point lock – Switch Opening

The HLM lock slide for mechanical points has either one or two notches, the notch on a single position bar is typical 20mm wide, whilst the 2 position bar notches are typically 30mm wide with a pitch of 180mm.

8.3 Facing point lock – Set up

Ensure the lock is adjusted so that the lock enters each notch centrally with clearance on either side. This clearance should be 1.1mm to 2.1mm and ideally 1.6mm.

Test that the lock can enter with a 1.6mm gauge between the switch and stockrail and fail with a 3.2mm gauge.

If the lock fouls on the non-locking side, the switch travel is greater than 115mm and needs to be adjusted.

If the lock fouls on the locking side, the switch travel is insufficient.

9 Facing point lock testing – Claw Locks

9.1 Introduction

The tests, inspections and settings referred to in this section are applicable to Claw Lock installations that use a rail head locking system only.

The point operating mechanisms used to operate Claw Lock systems include, and are but not limited to;

- Westinghouse (Siemens) D84M S700K etc
- Vossloh MCEM91

9.2 Facing point lock

The points shall be operated both normal and reverse to see if the switches fit correctly against the stock rail and if the claw and drive rod travel smoothly from end point to end point without any jerking motion.

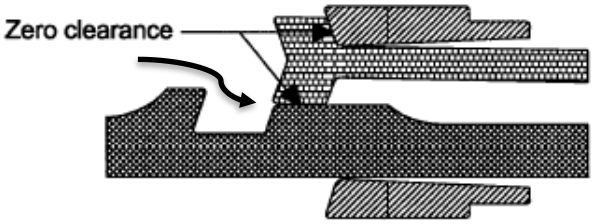
Manual testing of the locking and unlocking operation of the claw mechanism shall be undertaken to check the amount of force that the closed switch exerts on the stockrail by inspecting the switch as it closes. Claw Locks are designed to have no spring, but the switch is to be firmly against the stockrail. Where there is too much drive, the claw may bind in the housing with the risk being a failure to unlock due to binding. This shall be repeated for both sides.

The drive rod shall not complete its entire travel with a switch opening of 4.80mm but shall with a switch opening between 1.6mm and 3.2mm range.

The FPL test shall be carried out using gauges as mentioned above between the stock rail running face and the switch in line with the Claw Lock mechanism. .

9.3 Claw lock coverage

The coverage between the claw and the locking body shall be checked to ensure that the drive rod has fully completed its travel and is electrically detected in the points operating mechanism. The claw should at least align with the cutout on the drive rod as per the curved arrow in the diagram below.



Claw locked - coupling bar travel complete

9.4 Detection

The detection at the toe of the points shall be just made at 4.00mm and clearly broken at 6.00mm.

For semi sealed contacts such as those in Westinghouse point machines and detectors, where the contacts cannot be clearly seen, the contact must be electrically open at a 6.00mm switch opening, this can be checked with a voltmeter.

10 Facing point lock testing – VAE Spherolock rail head locking system

10.1 Introduction

The tests, inspections and settings referred to in this section are applicable to VAE Spherolock installations that use a rail head locking system only.

The point operating mechanisms used to operate spherolock systems include, and are not limited to;

- Westinghouse (Siemens) D84M, 84M
- Siemens S700K S700V

10.2 End caps

Where there is a possibility that the end cap may become loose, and no other locking device is fitted, it should be unwound approximately 5 threads using the Spherolock adjusting spanner (special tool) such that the end cap is not damaged. The thread & cap are to be thoroughly cleaned with a cleaning agent such as methylated spirits.

Apply Loctite 243 thread lock compound around the top edge of the end cap thread and retighten using the Spherolock adjusting spanner (special tool).

10.3 Facing point lock

The points shall be operated both normal and reverse to see if the switches fit correctly against the stock rail and if the body of the Spherolock travels smoothly from end point to end point without any jerking motion.

Manual testing of the locking and unlocking operation facing point lock shall be undertaken to check the amount of force that the closed switch exerts on the stockrail by inspecting the pressure head spring as the switch closes. Too much force (or spring) will completely compress the pressure head spring and may inhibit the locking function within the Spherolock tube. This shall be repeated for both sides.

The Spherolock body shall not complete its entire travel with a switch opening of 3.20mm but shall with a switch opening of 1.6mm

The FPL test shall be carried out using as mentioned above between the stock rail running face and the switch in line with the Spherolock mechanism.

10.4 Detection

The detection at the toe of the points shall be just made at 4.00mm and clearly broken at 6.00mm.

For semi sealed contacts such as those in Westinghouse point machines and detectors, where the contacts cannot be clearly seen, the contact must be electrically open at a 6.00mm switch opening, this can be checked with a voltmeter.

11 Facing point lock testing – VAE Unistar HR

11.1 Introduction

The tests, inspections and settings referred to in this section are applicable to installations that use a VAE Unistar HR point operating mechanism that operate with multiple individual drive and locking units.

The Drive/Lock/Detect units (DLD) are individually set up to have specific drive distances depending on their location within a turnout, and the geometry of the turnout. DLDs shall not be modified in the field to change the drive distance – they shall be returned to VAE or their agent for this to take place.

The FPL is mechanically interlocked with the detection arrangement and cannot be disengaged from the FPL to allow individual testing of the gap for both FPL and detection. This means that the FPL and detection settings are the same and the detection circuit contacts are not ‘made’ until the FPL engages – that is when the operating bar within the DLD moves towards the toe of the points as the FPL engages. In this way the detection contacts confirm the engagement of the FPL in each DLD, meaning that they operate in a less traditional manner than detection contacts in other point operating mechanisms.

The testing gauges for the Unistar HR points system are 1.25mm and 2.00mm.

All tests detailed in this section are to be undertaken by hand operation of the pump unit using the handle supplied for this purpose.

11.2 Facing point lock testing

The points shall be operated both normal and reverse to see if the switches fit correctly against the stock rail and if rodding and connection pieces travel smoothly from end point to end point without any jerking motion.

Manual testing of the locking and unlocking operation facing point lock shall be undertaken to check the amount of force that the closed switch exerts on the stockrail by inspecting the pressure head spring as the switch closes. Too much force (or spring) will completely compress the pressure head spring and may inhibit the locking function within the DLD. This shall be repeated for both sides.

For the Level 1, 2 and 3 (toe drive, 1st and 2nd backdrives) the DLD drive shall complete its entire travel with a switch opening of 2.00mm but shall not with a switch opening of 3.25mm.

The Level 4 (rear-most backdrive) moves the switch against a switchstop – not the stockrail. For this test the 2.0mm gauge is placed between the pressure head spring and the switch where the DLD drive shall complete its entire travel. The same test is repeated with a 3.25mm gauge and the DLD shall not complete its entire travel.

11.3 Detection

The detection at each DLD shall be made at 2.00mm (the operating bar will move towards the toe of the points) and not made at 3.25mm (the operating bar will not move and remain towards the heel of the points). These are the same settings as the FPL.

The detection circuit's electrical function shall be confirmed by observing either the local detector relay or input into the CBI (where no detector relays are used) to ensure correct correlation with the point's position.

12 Clamplocks

This section relates to the UK style (SPX) clamplocks that were manufactured by Smith's Industries and later SPX Industries in the UK.

Where points are driven and locked by clamp lock assemblies, the facing point lock test shall be conducted using the 1.6mm and 3.2mm obstruction gauges placed in turn between the stockrail running face and the switch in line with the lock arm.

The 2.5mm / 4.0mm obstruction gauge for the clamp lock detection test is placed between the detector blade and the detector blade lug. The detection is to be made at 2.5mm and be open with the 4.0mm gauge.

13 Vossloh rail head locking system (Clamp locks)

This section relates to the Vossloh Cogifer style clamplocks.

Where points are driven and locked by Vossloh clamp lock assemblies, the facing point lock test shall be conducted using the 2.0mm and 3.2mm obstruction gauges placed in turn between the stockrail running face and the switch in line with the lock arm.

The 6.0mm / 7.0mm obstruction gauge for the Vossloh clamp lock detection test is placed between the detector blade and the detector blade lug. The detection is to be made at 6.0mm and be open with the 7.0mm gauge.

14 Gauge for Facing Point Lock and Detection Testing

Testing of FPLs and detection shall be undertaken with a gauge designed for this specific task – which is dependent upon the type of point locking system in use. This gauge should be in accordance with the ARTC or OEM drawing. The gauge shall have a serial number and be inspected and checked with vernier calipers (or similar) every two years. If the gauge is damaged or outside of tolerances for testing it shall be replaced. Tolerance is +/- 5% of the nominated value.

14.1 Generic Gauges in use

An example of a generic magnetic gauge is shown below – 2 x 1.6mm thick flaps.

An example of general gauges that are in use of varying sizes to suit different applications.

14.2 Spherolock Point Lock Gauge - 2.0mm and 3.2mm

This is an aftermarket gauge available from Parson's Engineering, its part number is M11-138A

14.3 VAE Unistar Gauges

The VAE part numbers are as follows;

- Detection gauge plate – 1.25mm – C-904753
- Detection gauge plate – 2.00mm – C94910

Examples of the 1.25mm and 2.00mm gauges are shown below;

15 Summary of FPL and Detection Settings

The following table contains a summary of measurements to be used in the testing of FPLs and detectors in the ARTC network – this includes both facing points and swingnose crossings.

Settings for trailing points arrangements can only be altered in accordance with the requirements in Section 6.4

Points Type	FPL Pass	FPL Fail	Facing Points Detection Just Made	Facing Points Detection Clearly Open	Trailing only Points Detection Clearly Open
Mechanical	1.6mm	3.2mm	4.0mm(Elect)	6.0mm(Elect)	8.0mm (elect)
Combined Machine	2.0mm	3.2mm	4.0mm	6.0mm	8.0mm
Clawlock	1.6-3.2mm	4.8mm	4.0mm	6.0mm	8.0mm
SPX Clamplock	1.6mm	3.2mm	2.5mm	4.0mm	n/a
Vossloh Clamplock	2.0mm	3.2mm	6.0mm	7.0mm	n/a
Spherolock	1.6mm	3.2mm	4.0mm	6.0mm	8.0mm
Unistar HR	2.0mm	3.25mm	2.0mm***	3.25mm***	n/a
HLM	1.6mm	3.2mm	n/a	n/a	n/a
Mid-Switch / Supplementary Detectors	Flangeway Width Just Made	Flangeway Width Clearly Open	Closed switch Just Made	Closed Switch Clearly Open	
	47mm	45mm	6.0mm	8.0mm	

*** - Detection is the same as FPL due to the mechanical interlocking between them.