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Points

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Amendment Record

Amendment Version #	Date Reviewed	Clause	Description of Amendment
1.0	Feb 25	8, 17	Reviewed and Updated section – Points Not in Service. Aligned the document with ETS-03-00 – Points and Crossings. Document renumbered as per EGP-01-02.

Table of Contents

1 Introduction

1.1 Purpose

This standard specifies the requirements for points, catch points, derailers and crowders used in the signalling systems.

1.2 Scope

This standard covers the various types of points, catch points, derailer and crowders arrangements and systems that are installed and permitted on the ARTC network. It specifically identifies the requirements for those arrangements.

1.3 Standard Owner

The Manager Engineering Services is the Document Owner. Queries should be directed to standards@artc.com.au in the first instance.

1.4 Responsibilities

The Signal Designer, and Project Engineer are responsible for the implementation of this standard in new or altered signalling designs.

The Signal Design Manager, Signalling Manager, Signal Engineer, and Project Manager are responsible for managing and implementation of this standard.

1.5 Reference Documents

- ESD-05-01 Common Signal Design Principles S1 – Signalling Locking and Train Dynamics
- SDS 04 – Overlaps
- ESC-21-01 Inspection and Testing of Signalling - Roles, Responsibilities and Authorities
- ESC-21-02 Inspection and Testing of Signalling - Plans, Programs, Documentation and Packages
- ESC-21-03 Inspection and Testing of Signalling - Inspection and Testing Principles
- ESS-06-01 – Facing Point Lock and Detection Testing
- ETS-03-00 - Section 3: Points and Crossings
- ESP-25-01 Signal Design Process
- AS 7659 – Point locking and Detection
- AS 7706 – Interface with Points
- AS 7724 Unauthorised movement protection – Operational Requirements
- AS 7717 – Signal Testing and Commissioning AS 7718 – Signal Design Process Management

1.6 Definitions

The following terms and acronyms are used within this document:

Term or acronym	Description
Baulk	Similar to a buffer stop, a baulk is a fixed obstruction device placed across the rails and anchored to the track to stop vehicles should they begin to roll away. A baulk may consist of sleepers secured to the rail track using bolts, brackets and other suitable restraining fixings.
Ballast Drag	A Ballast drag is positioned directly after catch points and derailers in the direction of the intended derailment. The ballast is used to impede the motion of the vehicle in a controlled manner and also provide some protection to the sleepers.
Catch Points	A set of points usually comprising a single switch or run-off lead, the normal position of which provides an open trap to a movement in the facing direction resulting in an enforced derailment, thus preventing fouling other train movements, which may be taking place in the vicinity. When the catch points are reversed, they enable authorised facing and trailing moves to take place.
Crowder	A Crowder is mounted on the rail opposite a derailer and assists it to derail by guiding or 'crowding' the wheels of the rolling stock off the rail. A Crowder is attached to the derailer with a short insulated connecting rod so they both can operate in unison.
Derailer	A device consisting of a hinged ramp placed across the rail at specified locations within an interlocking. When seated over the rail head, it will deflect a low-speed movement off the rails resulting in an enforced derailment. Like catch points, a derailer is used to derail any train or vehicle to prevent it fouling other train movements, which may be taking place in the vicinity. When swung away from the rail head, the derailer enables authorised facing and trailing movements to take place.
Sagging back	Term used to describe a train rolling back as it releases its brakes when starting from stop on an uphill incline.
Scotch Block	A portable, hinged obstruction manually placed across one rail behind the wheel of a stabled wagon to prevent it rolling away and leaving the siding.
Self-restored points	Power operated points which are automatically returned by the interlocking to the normal position to provide protection after a train movement has been completed via the points reverse. Normalisation occurs after the route has been released and the track section has been clear for a predetermined time.

2 Catch Points & Derailers: Provision and Positioning

2.1 Protection of Running Lines

Signalling Principles require that movements on running lines be protected from train movements on adjacent lines or wagons stabled on adjacent lines.

Unauthorised train or wagon movements are protected against by overlaps or the setting of overlap points away from signalled train movements (flank protection). Where this is not possible because of track configuration constraints, then catch points or derailers should be used to restrict the unauthorised movement of a conflicting train.

Suitable derailing equipment (catch points or derailers) are in use in areas where a runaway wagon could enter the running line. Derailers shall not be used in new arrangements to protect the mainline track. Please refer to ETS-03-00 for more information.

Traffic operations to be protected against include, but not limited to:

- Stored wagons
- Stabled trains
- Trains sagging back on a grade (loop), and
- Shunting

2.2 When Catch Points are required

Catch points shall be considered in the following circumstances

- At converging and diverging connections into sidings or other non-signalled areas unless other independent switches will serve the same purpose. Refer to figure 1.

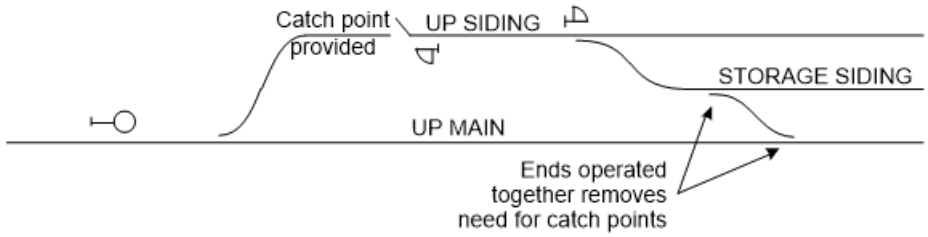


Figure 1

- Catch points can be used on lines where no overlap can be provided due to constraints governing the positioning of signals or track work. This includes lines where operating headways require signalled moves up to a home signal protecting a converging movement in the overlap, provided the simultaneous movements can be suitably protected from collision by a catch point judiciously located beyond the home signal. Refer to figure 2.

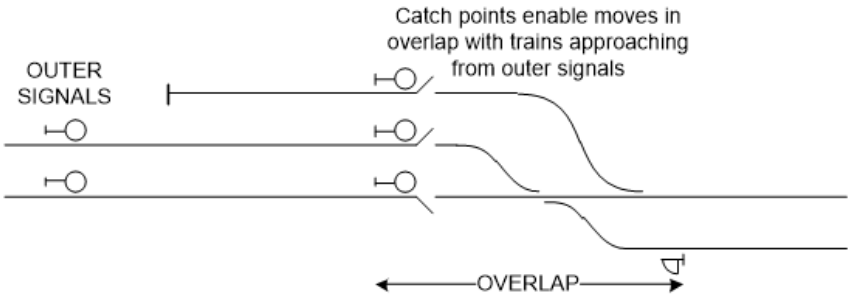


Figure 2

- On lines where shared overlap arrangements would impair the operating requirements. Refer to figures 3.
- On lines where the gradient is such that a train rolling back could foul a signalled movement. Refer to figure 3.

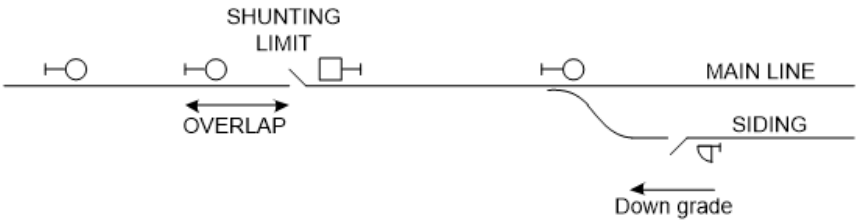


Figure 3

- At crossing loops to enable through running on the main line if the Up and/or Down loop is being shunted. Refer to figure 4.

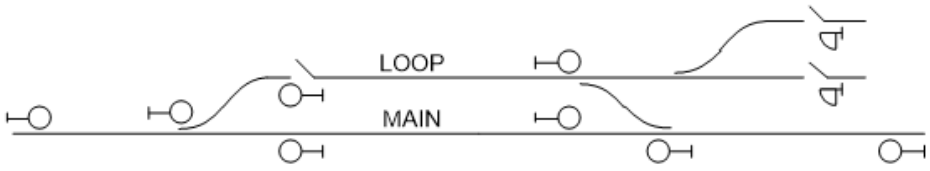


Figure 4

- At crossing loops to ease the route holding requirements.
- To prevent shunting movements from occupying certain sections of track without authority.
- On refuge loops and relief lines where wagons may be stored.

2.2.1 Catch Point Restrictions

Catch points shall not be placed on the running line or used as an option for inhibiting the operation of level crossings located within an otherwise full-length overlap.

2.3 When Derailer Devices are in use

When a derailer or derailer-crowder is in use instead of catch points, it should be assured the wagon speed is less than the device's approval speed limit and provided the calculations generated using ESI-06-05 'Runaway Speed and Ballast Drag Length Calculators' support its use. A derailer or derailer-crowder may be in use as follows:

- At converging and diverging connections into sidings or other non-signalled areas unless other independent switches will serve the same purpose. Refer to Figure 1
- On lines where the gradient is such that an uncontrolled train movement could foul a signalled movement.
- At crossing loops to enable through running on the main line if the loop is being shunted. In such cases, the device is not used to reduce the required overlap for main routes.
- To prevent shunting movements from occupying certain sections of track without authority.
- On refuge loops and relief lines where wagons may be stored.
- Derailer devices are not required at the exit end of balloon loops when:
    - the system of Yard Working is in use around the balloon loop and train speeds are low, and
    - train movements up to the exit signal at the end of the balloon loop are under the control of the loading/unloading bin operator, and
    - passenger trains are not involved, and
    - the connection to the main line is protected by a catch point or an overlap is provided in accordance with ESD-05-01. Refer to Figure 5 or Figure 6.

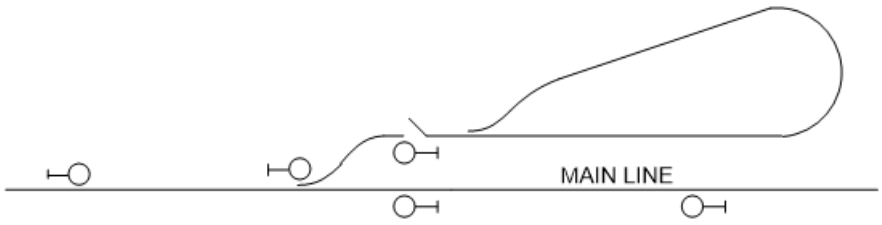


Figure 5

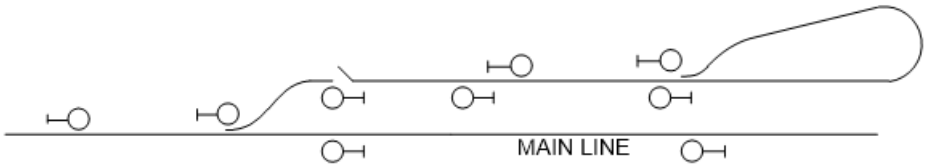


Figure 6

2.3.1 Derailer Restrictions

Derailers shall not be placed on the running line, used as an option for inhibiting the operation of level crossings located within an otherwise full length overlap or used where the speed and/or the mass of the unauthorised train movement renders the derailer ineffective – refer to Section 3.

2.4 Additional Safeguards

Catch points and derailer devices shall be positioned as far as possible away from the point where the adjacent lines are no longer parallel, and the lines start to converge/diverge.

2.5 Obstruction Devices

2.5.1 Baulk

A baulk is used primarily to contain the consequences of a runaway vehicle. A baulk is used at the dead-end of sidings. Situations where the use of a baulk may be suitable include stopping the vehicle entering public space and/or damaging significant infrastructure. A baulk should only be considered in low speed and low mass impacts. A baulk may cause derailed vehicles to concertina, baulks should not be considered within a wagon length (in any direction) of

- the running line,
- significant signalling infrastructure or
- public space.

2.5.2 Scotch Block

The portable scotch block is manually placed behind the wheel of a stationary wagon and is generally only used for securing uncontrolled stabled wagons from running away.

2.6 Design Requirements

To prevent the fouling of running lines from uncontrolled or unauthorised train or wagon movements, in all cases, calculations shall be performed using the ESI-06-05 'Runaway Speed and Ballast Drag Calculators' to determine the need for providing any derail protection. Sidings with uphill grades towards the running line may not require fitment of protection (provided the full length is uphill). However, the siding may also have downhill sections that enable runaway vehicles to gain sufficient velocity to overcome any uphill sections. The ESI-06-05 'Runaway Speed and Ballast Drag Calculators' have the capability for determining any need for providing derail protection in sections with multi-gradients.

The track engineer shall be consulted regarding the design requirements for baulks and catch points.

2.6.1 Catch Points and Derailers – Positioning Considerations

In addition to the requirements for the minimum clearance between adjacent tracks, a catch point or derailer shall be positioned to avoid the following derailment hazards whenever possible.

- Adjacent running lines.
- Other adjacent tracks.
- Embankments.
- Bridges.
- Tunnel mouths.
- Trackside structures such as signals & overhead masts, cable routes with GLT or GST etc.
- Platforms and station buildings.
- Buildings such as signal boxes and relay rooms, etc.
- Housings including location cases, traffic huts, power reticulation box, etc.
- Adjacent public roads, level crossings and other public space.

2.6.2 Derailers

A derailer or derailer–crowder is used for the purposes of derailing uncontrolled wagons and to protect running lines from shunting operations.

In all instances, a crowder (if available from the manufacturer) shall be installed with the derailer. The crowder shall be connected to the derailer so as to operate simultaneously. It is important to ensure electrical isolation from the track circuit is maintained with both the derailer and crowder fitted.

In all instances, a ballast drag shall be included with the installation of a derailer or derailer-crowder.

Derailer should be detected and indicated to train control system.

2.6.3 Catch Points as an Alternative to an Overlap

Overlaps are provided to maintain a minimum separation between trains; catch points can provide the same function.

Due to the consequence of a derailment, the use of catch points or other derailing devices for this purpose is not permitted for main routes.

2.6.4 Alternatives to Catch Points

Catch point protection is not required where:

- The required length of overlap can be provided. Subject to operational considerations, the required overlap can be achieved by extending the number of track circuits included in the overlap and/or using alternate point lie configurations.
- Delayed clearing of the warning signal aspect to control the speed of the approaching vehicle is consistent with the length of overlap available.

2.7 Compliance Indicators

The following items are indicators of compliance with this standard. They may be used by auditors or managers when reviewing performance.

a. Design Report includes calculations produced from the ESI-06-05 – 'Runaway Speed and Ballast Drag Length Calculators'.

b. Design Report includes details of selection criteria used to determine which type of derail protection is to be used.

c. Design Report includes details of selection criteria used to determine ballast drag dimensions and its location (risk review of surrounding infrastructure).

3 Emergency Crossovers Operated from Mechanical Ground Frames

This Principle addresses the requirements for operating emergency crossovers located in sections of double line track to facilitate single line operations during programmed engineering works or emergency circumstances and operated from a mechanical ground frame.

3.1 Requirement for Facing Emergency Crossovers Operated from Mechanical Ground Frames

Generally, the ground frame shall operate the facing point locks (FPL's) and points switches from three or more levers as required.

The ground frame release lever shall be the first lever and shall be fitted with either an Annett type or Fortress type lock.

The FPL lever shall be the second lever and lock the points both ways.

The crossover lever shall be the third lever (or third and fourth levers if required for 60kg crossovers).

An XL lock in NSW/QLD or a S lock in Victoria, WA and South Australia locked traffic hut shall be provided near the ground frame.

An Annett or Fortress type lock with contact box and key secured by flap and lock (XL lock in NSW/QLD or a S lock in Victoria, WA and South Australia) shall be provided in the traffic hut.

When the emergency facing crossover is not in use the ground frame shall be locked normal by the Annett type lock and the normally closed switches shall be clipped and secured with an padlock (XL lock in NSW/QLD or a S lock in Victoria, WA and South Australia).

The Annett or Fortress key shall be proved normal in the contact box. This shall enable any automatic running signals reading over the emergency crossover to clear.

3.2 Ground Frame Operation

If the emergency crossover is to be reversed, then the Annett or Fortress type key shall be removed from the contact box and the padlocks (XL lock in NSW/QLD or a S lock in Victoria, WA and South Australia) and clips removed from the points. Any automatic running signals reading over the emergency crossover shall be replaced to stop.

The Annett or Fortress type key shall be inserted in the appropriate lock fitted to the ground frame releasing lever and the lever reversed. This shall enable the FPL to be withdrawn, the crossover to be reversed, and the FPL replunged.

4 Emergency Crossovers Operated from Electric Ground Frames

This Principle addresses the requirements for protecting and operating emergency facing crossovers located in sections of double line track to facilitate single line operations during programmed engineering works or emergency circumstances and operated from electric ground frames.

The same principle may be applied to trailing crossovers.

4.1 Requirements for Facing Emergency Crossovers Operated by Electric Switch Machines and Controlled from Electric Ground Frames

Operators Panel

A simple operator's panel shall be provided to form the basis of the Electric Ground Frame and shall accommodate the following:

Controls

A push button to establish an electric release to free the crossover.

A two-position switch to operate the crossover between the Normal and Reverse positions.

Indications

A white light to indicate if the electric release is free thus enabling the release to be taken.

A white light to indicate if the crossover is detected normal.

A white light to indicate if the crossover is detected reverse.

A green light to indicate if the crossover is free from local track locking and may thus be operated.

Red lights to indicate the occupancy of the approach track circuits sections on the Up and Down lines.

Signals

The automatic running signals leading over the facing crossover shall be fitted with 'A' lights.

The automatic running signals leading over the facing crossover shall be provided with a notice board worded as shown in ## of Figure 7.

The automatic running signal in rear of the signals leading over the facing crossover shall be provided with a notice board worded as shown in # of Figure 7.

Panel Operation

If the emergency crossover is not in use, then it shall be continuously locked normal and the automatic running signals leading over the crossover shall be enabled to show proceed aspects and the ‘A’ lights shall be illuminated, and the switches shall be clipped, and padlocked (XL lock in NSW/QLD or a S lock in Victoria, WA and South Australia).

If the emergency crossover is to be reversed, then following the removal of the clips and padlocks (XL lock in NSW/QLD or a S lock in Victoria, WA and South Australia. the push button shall be operated causing the automatic signals interlocking with the crossover to be replaced and ‘A’ lights to be extinguished.

If the approach track circuits are clear on both lines and all replaced signals are proved at red, then the electric release will be free to be taken as indicated by the illumination of the white free light. Following this the crossover may be operated to the reverse position from the two-position switch.

If an approach track circuit is occupied when the signals are replaced, then the electric release will remain locked until an approaching train has been proved to be at or nearly at a stand by the expiry of a track time release. Provided that the replaced signals are proved at red the electric release will become free as indicated by the illumination of the white free light. Following this the crossover may be operated to the reverse position from the two-position switch.

Local track locking shall be applied to the emergency crossover for both the normal and reverse lays to prevent a movement of the crossover while a train is passing over it. If the crossover is track locked, then the green indication light shall be extinguished.

If the release is restored to the normal position, then its next movement to the reverse position shall be subject to the operation described above.

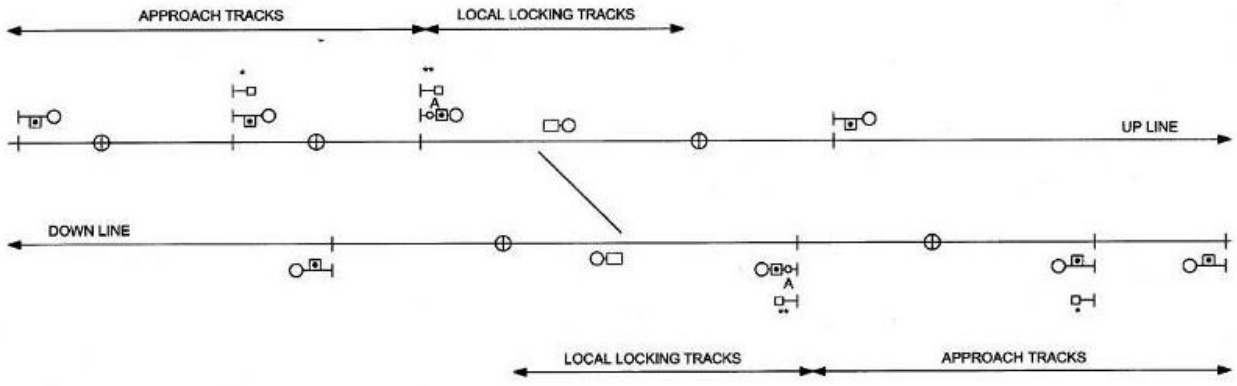


Figure 7 – Emergency Crossover Operated by An Electronic Ground frame

- drivers when passing this signal at stop in accordance with the regulations shall proceed with caution to the next signal being prepared to stop short of any obstruction.

- drivers when directed to pass this signal at stop shall proceed with caution and bring their train to a stand well clear of the crossover and shall not restart until satisfied that it is safe to do so (or that shunting is not taking place, as applicable)

5 Detection of Points

This Principle addresses the requirements for the electrical detection of mechanically, power or ground frame operated points and catch-points in colour light signal or Main Line Indicator aspects.

A facing point locking system shall be provided on facing points on running lines for all facing movements including interlocked emergency crossovers.

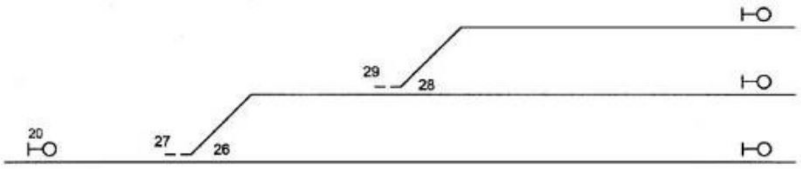
For the point detection adjustment requirements, please refer to ESS-06-01.

A point condition monitoring system can detect impending failures at an early stage, help in reducing failures and increase the availability of the signalling system for train operations. A point condition monitoring system should be considered while designing the points for the ARTC network in consultation with the signal maintenance engineer.

5.1 Detection of Mechanically Operated Points

5.1.1 Detection of Mechanical Points in the Route Section

If a set of mechanically operated facing points is situated within the route of a signal, then the correct position of the open switch, closed switch and facing point lock shall be detected before the signal is permitted to clear and continuously thereafter to maintain a clear aspect. Refer to Figure 8.

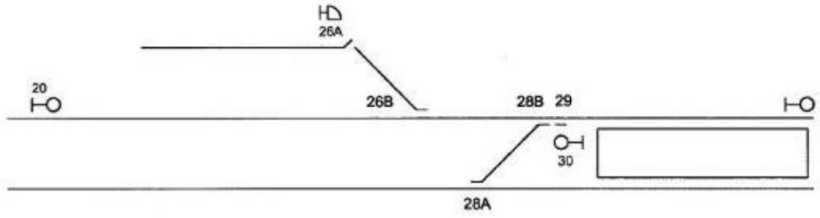


SIGNAL	DETECTS	
	POINTS	FPL'S
20	26N 26R 28N 26R 28R	27R 27R 29R 27R 29R

FPL OUT BOTH WAYS

Figure 8 Detection of Facing Points and FPL'S in Routes

If a set of mechanically operated trailing points is situated within a route, then the correct position of the open switch and closed switch will not generally be required to be detected in the signal aspect. Refer to Figure 9.

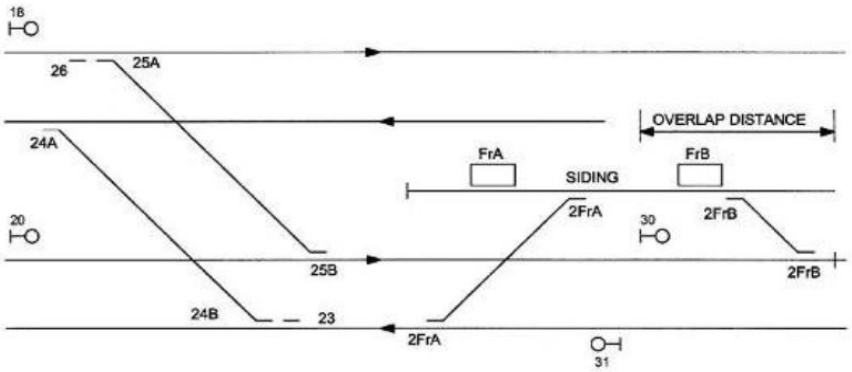


SIGNAL	DETECTS	
	POINTS	FPL'S
20	26AN	NIL
30	28BR 26AN	29R

Detection of trailing points in routes and as trapping protection

Figure 9 Detection of Mechanically Operated Points

If the end of a set of mechanically operated points is situated such that it provides trapping/flank protection to the route then it may be desirable for the correct position of the closed switch and the open switch, or the open switch in the case of single switch catch points, to be detected before the signal is permitted to clear and continuously thereafter to maintain a clear aspect. Refer to Figure 10.



SIGNAL	DETECTS		
	IN ROUTE OR OVERLAP		AS TRAPPING PROTECTION TO ROUTE OR O/L
	POINTS	FPL'S	POINTS
18	25AN	26R	
	25AR	26R	2FrAN (SIDING END), 2FrBN (SIDING END)
20			24BN, 2FrAN (SIDING END), 2FrBN (SIDING END)
30			2FrBN (SIDING END)
31	24BR	23R	2FrAN (SIDING END)
	24BN	23R	2FrAN (SIDING END)

Detection of multiple ended points in routes and as trapping protection

Figure 10 Detection of Mechanically Operated Points

5.1.2 Detection of Mechanical Points in The Route Overlap

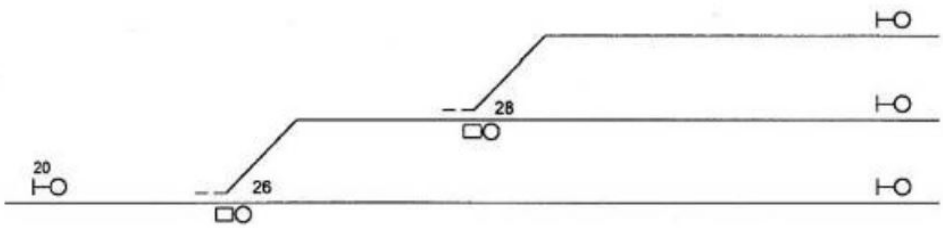
If a set of mechanically operated facing points is situated beyond the exit for the route for a signal, but within the overlap distance applicable to the signal, and is protecting an alternative overlap which is unavailable, or not permitted, then it is desirable that the correct position of the open switch and closed switch be detected before the signal is permitted to clear and continuously thereafter to maintain a clear aspect or, if it is not practical to include the points switch detection then at least the points lever shall be proved to be in the correct position and electrically lever locked, where applicable.

If a set of mechanically operated facing or trailing points is situated outside the route of a signal but offers trapping/flank protection to the route, then it may be desirable to detect the appropriate position of the points subject to operating considerations. Refer to Figure 9.

5.2 Detection of Power Operated Points

5.2.1 Detection of Power Operated Points in The Route Section

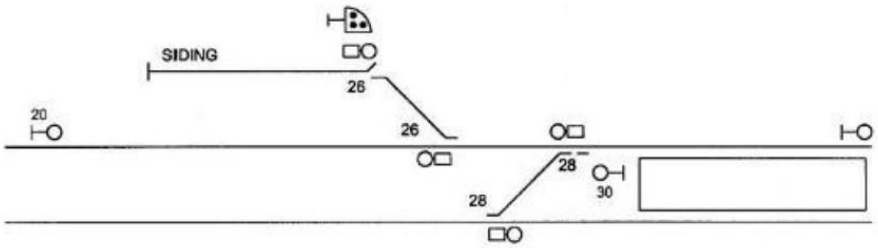
If a set of power operated facing points is situated within the route of a signal then the correct position of the open switch, closed switch and facing point lock shall be detected before the signal is permitted to clear and continuously thereafter to maintain a clear aspect. Refer to Figure 11.



SIGNAL	DETECTS POINTS
20	26N 26R 28N 26R 28R

Figure 11 Detection of Facing Points in Routes

If a set of power operated trailing points is situated within the route of a signal then the correct position of the open switch, closed switch and facing point lock, if provided, shall be detected before the signal is permitted to clear and continuously thereafter to maintain a clear aspect. Refer to Figure 12.



SIGNAL	DETECTS POINTS
20	26N 28N
30	26N 28R

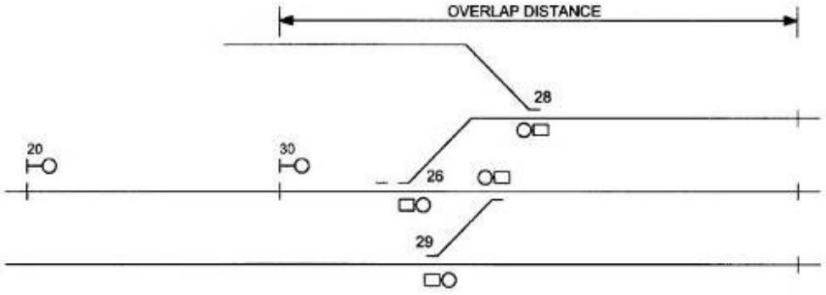
Detection of trailing points in routes and as trapping protection

Figure 12 Detection of Power Operated Points

If the end of a set of power operated points is situated such that it provides trapping/flank protection to the route then the correct position of the open switch, closed switch and facing point lock, if provided, or the open switch in the case of a single switched catch point, shall be detected before the signal is permitted to clear and continuously thereafter to maintain a clear aspect. Refer to Figure 12.

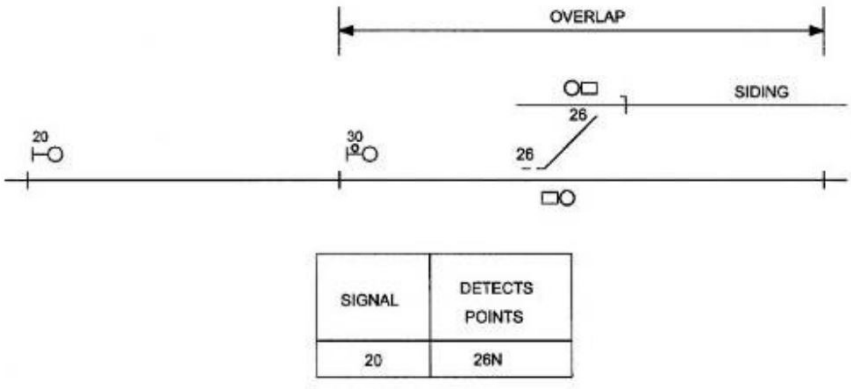
5.2.2 Detection of Power Operated Points in the Route Overlap

If a set of power operated facing points is situated beyond the exit of a route for a signal but within the overlap distance applicable to the signal and is protecting an alternative overlap which is unavailable, or not permitted, then the correct position of the open switch, closed switch and facing point lock shall be detected before the signal is permitted to clear and continuously thereafter to maintain a clear aspect. Refer to Figure 13 and Figure 14.



SIGNAL	DETECTS POINTS
20	29N W 26N 28N W 26R 26N W 28R 26R W 29R

Figure 13 Detection of Points in an Overlap



Note: No overlap is permitted into the siding detection of facing points in a fixed overlap

Figure 14 Detection of Power Operated Points

If a set of power operated trailing points is situated beyond the exit of a route for a signal but within the overlap distance applicable to the signal, the actual field position of the points switches in the line of the overlap will not require to be detected in the signal. However, if the points can be manually operated in emergencies, then operation of the emergency facility provided (e.g. ESML, EOL) shall reliably and fail-safety replace and retain at stop all signals which interlock with the trailing points; it is normal practice to include the emergency facility lock contacts in the points detection circuit.

If an end of a set of power operated points is situated such that it provides trapping/flank protection to an overlap then the correct position of the open switch, closed switch and facing point lock, if provided, or open switch in the case of a single switch catch point, shall be detected before the signal is permitted to clear over that line of overlap and shall remain detected continuously thereafter to maintain a clear aspect. Refer to Figure 12 and Figure 14.

5.2.3 Multiple Ended Points

If a set of points comprises two or more point ends, then the correct positions of the open switch, closed switch and facing point lock, if provided, at each end shall be detected as prescribed before a signal is permitted to clear and continuously thereafter to maintain a clear aspect. Normal practice shall be to include the detection of all ends of the same set of points in a common circuit.

5.3 Detection of Ground Frame Operated Points

In relation to ground frame operated facing points in the route section and point ends providing trapping/flank protection to the route section or route overlap, the correct position of the open switch, closed switch and facing point lock, if provided, or the open switch in the case of a single switched catchpoint, shall be detected before the signal is permitted to clear and continuously thereafter to maintain a clear aspect.

6 Points - Not in Service

When points are installed in an operating line but not in use, they shall be secured to prevent them from moving out of their correct position. This can be:

- Points installed but not commissioned
- Points decommissioned but not removed from the site.
- Points booked out of use for an extended period.

To ensure the safe movement of rail traffic over these turnouts or crossovers or catch-points special provisions shall be provided as detailed in this section below. These provisions are applicable to both facing and trailing movements.

6.1.1 Locking of Points not in service

For installations of new turnouts, all point rodding and fixed stretcher bars shall be installed – including the facing point locking system. Where power operated point mechanisms are used, the operating mechanism shall be mechanically secured once the facing point locking system is engaged – whether this be a facing point lock in an interlocked point machine or a rail head locking device with a non-interlocked point machine. Where mechanical point operating equipment is used, the facing point lock plunger shall be secured in accordance with ESM-00-12.

The closed switch shall be spiked and clipped with at least two separate point clips which are both locked with the appropriate safe working lock. The padlock to be used shall be of a special type not used for normal Safeworking activities - an XL lock in NSW/QLD or an Independent lock (as nominated by SME- Signal Maintenance Engineer) in Victoria or JA padlock in South Australia and Western Australia. The open blade of points not in use shall be secured by the fitting of two fixed stretcher bars or alternatively, the final points rodding and mechanism may be fitted.

Where a catchpoint is to be secured in the open position, it shall be secured with a block between the blade and stock rail which is spiked in place or clip designed to keep the blade in open position with the appropriate safety lock.

Note: Special consideration is required for spiking of points on concrete sleepers or the spiking of swing-nose points. As an example, Wooden slippers may be installed between concrete sleepers as agreed by track/civil engineer of the section. Other option such as metal spiking plates may be used if agreed and approved by the track/civil engineer.

6.1.2 Detection of Point Blades not in service

Detection of both the open and closed switches is required from the time of installation until the new signalling arrangements are commissioned into service. This detection shall be interfaced into the signalling system to prevent the clearance of the respective signals or main line indicators unless the switches are detected in the correct position. It is permitted that this interface can be implemented by using detection contacts cut into the local track circuit or axle counter system over the points in a failsafe manner. For power operated points, the point machine detector contacts shall be used. For mechanically operated points separate detectors shall be used. There shall be a stage work design for the detection and the interface, checked and independently verified in accordance with the standard signal design processes. The detail of this interface shall be defined and published in a Safe Notice/Train Notice (as applicable) at the time when the alterations take place. If points are installed within a yard where the line speed is

low, detection of the points can be omitted subject to risk assessment and outcome is accepted by the signal maintenance engineer.

Where there is no train detection system in place over the new turnout, an alternative means of indicating the state of the point detection to rail traffic crews shall be implemented following a risk assessment of the site. This can be provided by the means of mechanical point indicator or colour light indicator which proves the detection contacts in the aspect. Alarm monitoring or other communication/monitoring system may also be required to notify Network Control and/or maintenance teams of equipment condition. The arrangements implemented are to be agreed with the signal maintenance engineer.

6.1.3 Movement of Points - Not in Service

Where it is required that the points be mechanically operated to allow an unsignalled train movement over the turnout in the normally locked position, they shall be manually operated to the other position. The manual hand operation of the point motor shall be used to set the points in the other direction and to apply the facing point lock. The points are to be clipped and locked for each movement. An SL lock in NSW/QLD or a S lock in Victoria and South Australia/WA is acceptable whilst the qualified person is in attendance. This lock shall be replaced with the XL lock in NSW/QLD, independent lock (as nominated by SME) in Victoria or JA padlock in South Australia/WA respectively when the points are unattended. At completion of all train movements, the points shall be restored to the normal position and all security measures shall be reinstated and checked for their correct installation and operation.

Other locks may be approved by Signal Maintenance Engineer for the above purposes.

7 Electric Switch Machines

Requirements for the provision of crank handles, emergency switch machine locks, hand throw levers, emergency operations lock and isolating relays.

This Principle addresses the concepts and requirements for the provision of equipment which can electrically isolate an electric switch machine under various operating conditions.

7.1 Crank Handle (CH) or Hand Throw Lever (HTL)

7.1.1 Concept

A crank handle or hand throw lever is a mechanism which allows an electric switch machine to be manually operated under hand signalling arrangements or during failure conditions or for testing or maintenance purposes.

Crank handles and EOL (Emergency Operations Lock) keys (to release hand throw levers) are often configured to fit specific machines and are mechanically indexed for this purpose in NSW and QLD.

In SA, WA and Vic, the current practice is to have single crank handle box and are often common to group of points and is not indexed. Victoria mainly uses hand throw lever point machine.

Generally, a crank handle or hand throw lever requires the switch machine motor to be open circuited before the gearbox is engaged.

This is to avoid any possibility of a conflicting control being applied to the machine when it is under manual control.

The crank handle incorporates an ESML (Emergency Switch Machine Lock) key in NSW and QLD.

7.1.2 Requirements

In SA/WA/Vic, single crank handle is common to group of point machines located in same area and are generally not indexed. No ESML/EOL keys are being used in SA/VIC.

Crank handles and EOL keys shall be mechanically indexed such that they can only be inserted into the gearbox or hand throw lever lock of an identically indexed switch machine in NSW and QLD.

If a set of points has more than one end and these additional ends are operated by separate switch machines, then all the machines associated with the set of points shall be identically indexed in NSW and QLD.

Only one crank handle shall be provided for each set of points irrespective of the number of point ends. Separate EOL keys are provided for each point end.

Crank handle and EOL key indexes shall not be repeated within a specific group of points in NSW or QLD.

These groups are usually determined by the arrangement of sets of points in the track layout.

If a crank handle is inserted into a switch machine, then it shall not be possible to commence manual operation unless the motor circuit has been broken by a crank handle contact (CHC) mechanism within the machine.

If an EOL key is inserted into a hand throw lever lock, then it shall not be possible to commence manual operation unless the motor circuit has been broken by moving the selector lever from the 'motor' to the 'hand' position.

Operation of the crank handle or hand throw lever shall replace the protecting signal.

When machine is in manual operation either by crank handle or hand throw lever, detection loss should be indicated back to network controller. After completion of the manual operation, correct detection at network controller to be ensured.

Crank handles and the tag attached to the EOL key are to be inscribed with the interlocking name, type of emergency box and the points number(s) to which they apply in accordance with the following examples.

Crank Handle	1)	Single ended set of points.
		"Glenfield ESML & 43A PTS MTR"
	2)	Multiple ended set of points
		"Glenfield ESML & 42A&B PTS MTRS"
EOL Key Tag		One different tag required for each end i.e., "Strathfield EOL & 43A PTS. MTR" "Strathfield EOL & 43B PTS MTR"

7.2 Emergency Switch Machine Lock (ESML)/Emergency Operations Lock (EOL) – NSW/QLD

7.2.1 Concept

For safety reasons it is normal practice to keep the crank handle or EOL key(s) in a locked box and this way it is only available to authorised operators.

Further safeguards can be provided however by detecting the presence of the crank handle or EOL key(s) in the locked box and then ensuring that signals reading over the points are unable to clear whenever the crank handle or EOL key(s) are removed from the locked box.

The device in which the crank handle and EOL key(s) are normally held and detected is the Emergency Switch Machine Lock or an Emergency Operations Lock.

7.2.2 Requirements

If a crank handle or EOL key(s) are provided for the manual operation of an electric switch machine(s) then it shall be held in an Emergency Switch Machine Lock or an Emergency Operations Lock except when its removal has been authorised.

If a crank handle or EOL key is removed from an Emergency Switch Machine Lock or an Emergency Operations Lock, then the aspects of all the signals interlocked with the points concerned shall be replaced to and maintained at stop.

The Emergency Switch Machine Lock and Emergency Operations Lock shall be mechanically indexed such that it only accepts the crank handle or EOL key(s) for a specific and identically indexed set of points.

An Emergency Switch Machine Lock or an Emergency Operations Lock shall be given the same number as the set of points to which it applies, and the number shall be prominently displayed on the front of the Emergency Switch Machine Lock box or Emergency Operations Lock box.

7.2.3 Location

It is generally required that Emergency Switch Machine Locks and Emergency Operations Locks are mounted on the wall of a hut or the side of an equipment case containing the point control and indication circuits, and in particular the Isolating Relays and feed to the main detection relays to ensure effective single cutting of these circuit functions by the ESML or EOL contacts; alternatively the ESML or EOL should have sufficient contacts to double switch these circuits.

However further consideration shall be given to the distance between the location of the ESML or EOL and the set of points to which it applies.

This is to ensure that if an employee authorised to use a crank handle or EOL key(s) removes it from the ESML or EOL then there is sufficient time for a train which has passed the replaced signal protecting the points to arrive at the points before the employee authorised to use the crank handle arrives at the points, thus minimising the possibility of the train running through open or wrongly positioned points.

These considerations shall take into account:

- The distance between the signal or signals protecting the points and the points.
- The type or types of signal protecting the points.
- The speed of the trains approaching the signal or signals protecting the points.
- The time taken for the employee authorised to operate the points to walk between the ESML or EOL and the points.

However, bearing in mind the levels of protection required for employees crossing tracks under current safe working rules

- Other than where the points are in the centre tracks or crossovers span more than two tracks, the ESML or EOL should be located so that it is not necessary for employees to cross several tracks between the ESML or EOL and the points to which they apply.
- Where it is necessary to locate an ESML or EOL away from the hut or equipment case, then the circuit functions of the ESML or EOL contacts shall be double cut.

7.3 Isolating Relays

7.3.1 Concept

An isolating relay is used to electrically isolate the motor circuit of an electric switch machine once any signal leading over the points in the facing direction has been cleared and this condition is maintained until the signal has been restored, is free from approach locking and the track circuit(s) immediately approaching and over the points is clear.

Consequently, any spurious control conditions such as a false feed which could potentially cause a wrong side failure involving the movement of a set of points under a train will be rejected.

7.3.2 Requirements

An isolating relay shall be provided for each electric switch machine.

If a route is set in the facing direction over a set of points operated by an electric switch machine or the track circuit immediately over the points is occupied or the crank handle or EOL key is withdrawn from an Emergency Switch Machine Lock or Emergency Operations Lock, then the isolating relay shall be de-energised.

The isolating relay shall be proved to be de-energised before the aspect of a signal leading over the points in the facing direction is permitted to clear.

If the same signal is restored and is free from approach locking, then the isolating relay shall be enabled to energise.

The isolating relay shall be to BR Spec 943.

Front contacts of the isolating relay shall double cut the motor operating circuit directly.

Back contacts of the isolating relay shall double cut the detection circuit directly.

Note: Isolating relays are not required at SSI installations.

7.3.3 Location

An Isolating Relay shall be located in the hut or equipment case closest to the point machine it isolates.

8 Removal of Lockslides From Electric Switch Machines

This Principle addresses the circumstances under which it is acceptable to operate an electric switch machine without a lockslide fitted.

It does not apply to electrically driven claw lock mechanisms.

8.1 Concept

If a set of electrically operated points is signalled exclusively for trailing movements and there are no set back movements whereby part of a long train would pass over the points in a facing direction (and, having regard to the possibility of hand signalled facing movements taking place over the points and the probable frequency of single line working over the points in a facing direction), then to reduce the likelihood of detection failures arising as a result of a tight facing point lock, consideration may be given to the removal of the lockslide from the electric switch machine.

This permits coarser adjustment of the trailing detection.

8.2 Catchpoints

The normal facing point lock in an electric switch machine which operates single switch catchpoints may be difficult to keep in reliable adjustment in some poor condition track areas. Where this is a persistent problem it may be permissible to remove the normal lockslide. The unused guideways on both sides of the machine are to be plugged to prevent entry of dust and grit.

8.3 Requirements for The Removal of Lockslides

Prior to any lockslide being removed from an electric switch machine, specific approval shall be obtained, and approved designs shall be issued. Working sketches, signalling plans and track plans shall explicitly indicate which electric switch machines are subject to this procedure. These machines should be labelled for clear identification in the field.

9 Track Circuit Locking of Points

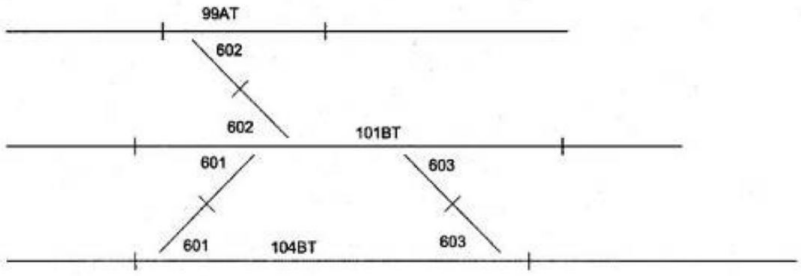
This Principle addresses the requirements for the provision of track circuit locking over power operated points and extended conditional track locking as applicable.

9.1 Purpose

Track locking is provided over points to ensure they are held in position for the passage of a train once the direct route to point locking has been normalised and the train is between the points and the signal leading over them.

9.2 Requirements - Track Circuit Locking of Points Controls

All sets of power operated points shall be locked in both the normal and reverse positions by the occupation of the track circuit or circuits immediately over the points. Refer to Figure 15.

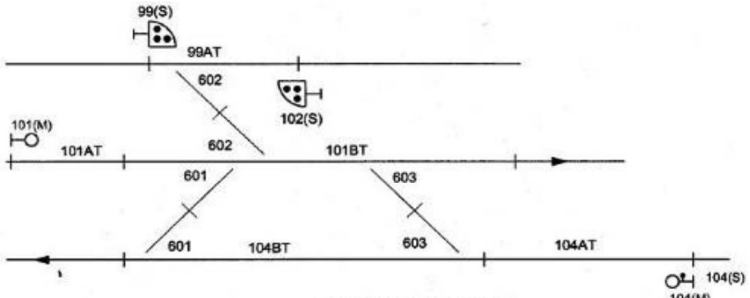


POINTS N°	LOCKED NORMAL & REVERSE BY TRACK CIRCUITS OCCUPIED
601	101BT 104BT
602	99AT 101BT
603	101BT 104BT

Figure 15

The limits of this track circuit or track circuits over the points shall extend at least as far as the clearance point.

If the track layout and train movements permit, the track locking shall be extended as far as each signal which reads over the point either in the normal or reverse position. Refer to Figure 16.



POINTS N°	ADDITIONALLY LOCKED BY TRACK CIRCUITS OCCUPIED	
	NORMAL	REVERSE
601	101AT 104AT	
602	101AT	(104AT, 104BT, W 603R)
603	101AT 104AT (99AT W 602R)	104AT

Figure 16 Track Circuit Locking of Points

If the track layout and train movement do not permit the track locking to be extended, then route holding shall be provided.

9.3 Requirement - Direct Track Circuit Control of Power Operated Point Mechanisms

In addition to the track circuit locking of the point controls described in 16.8.3 above, direct track circuit control of all power operated facing point mechanisms shall be provided.

9.3.1 Electrically Operated Points

The motor circuit of electrically operated facing points shall be directly controlled by a contact of the track circuit immediately over the points and any track circuits between the running signal or signals reading over the points via an isolating relay except in the case of points controlled from a SSI installation or where trailable point machines are installed in yards. Approach sticks relays of facing signals are also included in the isolating relays.

Track locking in the isolating relay circuit should operate through contacts of the parent track relays or through repeat relays which are close to the parent track relay.

A feature shall be included such that the occupation of the track circuits concerned does not preclude the completion of a point movement once it has commenced.

9.4 Control Tables

The requirements for the direct track locking of point operating mechanisms shall be in accordance with the Control Tables concerned.

10 Mechanical Trailable Facing Point Mechanisms

This Principle addresses the requirements for the provision of mechanical trailable facing point mechanisms, point indicators and signage.

10.1 Purpose

Mechanical trailable facing points are used where it is desired that trains proceed over the points in a facing direction without stopping with the driver viewing an indicator which gives an assurance that the points are locked in the correct position, but where it also allows the points to be trailed through in the reverse direction without the attendance of a shunter.

10.2 Mechanical Trailable Facing Point Mechanisms

Mechanisms used for this purpose shall be able to provide a mechanical indication of the closed switch being within the normal detection limits of the stock rail, and the open switch being suitably clear of the other stock rail. The switches are to be snubbed for the trailing movements to prevent continual movement of the switches between wheel sets passing over them in the trailing direction.

Mechanisms are to be able to be operated reverse by a suitable trackside lever which may be secured against misuse by a lock operated by an Operators Key, SL key or similar as appropriate to the situation.

10.3 Mechanical Point Indicators

The mechanical point indicators are a retro-reflective white bar against a black background post mounted next to the point mechanism. The indicator is double sided. A diagram of the indicator is shown in Figure 17.

When the points are set and locked for the normal direction movement the bar is inclined to 45°. The bar is horizontal when the points are unlocked.

Indication	Aspect Name	Meaning
Horizontal Bar	Stop	Stop-points are unlocked or out of position
Inclined Bar	Points normal and locked	Points are set and locked in the normal position.

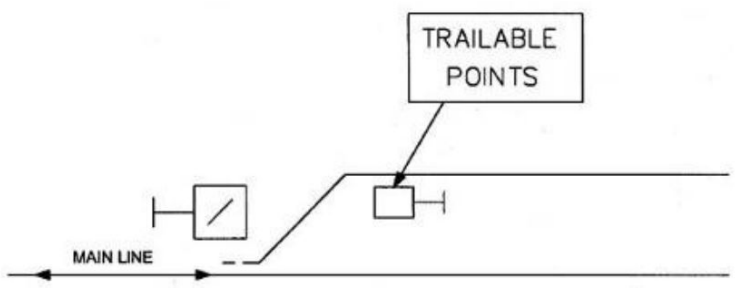


Figure 17

10.4 Signage

A notice board with black lettering on a white retro-reflective background "Trailable Points" is to be provided on the trailable road leading through the points. The points are generally only trailable while in the normal position.

10.5 Speed Restrictions

Any manufacturers' recommendation regarding speed through the points in the facing and trailing directions is to be considered. Speed while trailing is not to exceed 25km/h.

10.6 Operational Instructions

Movements over the trailable points may be made without inspection of the points providing it is a normal direction movement and the point indicator bar is inclined at 45°.

Movements through the points reverse in the facing direction may only be made after the points have been operated to the reverse position and the switches inspected to ensure they are firmly against the stock rail beforehand signalling the movement to proceed. After the movement is completed the points are to be restored to the normal position and the lever secured, if fitted with a lock. While the points are reverse, the point indicator will display a horizontal bar and movements shall not be made over the points without inspection and hand signalling.

Trailing movements through the points in the reverse position may only be made at a speed not exceeding 25km/h past a board inscribed "Trailable Points." Should the train come to a stand on the points, the train shall not set back until the points lever has been reversed and a hand signaller has inspected the points before hand signalling the train back.

After a train has completely trailed a set of trailable points, the points will automatically reset for the normal position and providing the switch is detected close against the stock rail and locked, the indicator will return to the 45° position.

The mechanical point indicator is not in itself authority for the train movement. Drivers shall ensure that the movement is authorised, and in yard areas, keep a look out for any obstruction.

11 Ground Frame Releases – NSW/QLD

This Principle addresses the requirements for the provision of ground frame releases and the methods by which releases are generally given.

11.1 Provision of Ground Frames

Ground frames are provided to operate points for infrequent movements such as for shunting, emergencies and possessions.

A ground frame may consist of levers controlling the points switches, facing point locks and signals reading over the points in the normal or reverse position. Where running signalled movements are made in the facing direction through points operated by a ground frame, a facing point lock (FPL) is provided.

Mechanical ground frames are normally held locked by a mechanical lock on one of the levers in the ground frame which acts as a releasing lever for the ground frame interlocking. In some cases, the mechanical lock is located on the facing point lock lever.

The mechanical lock on the ground frame lever is operated by a key which is only available if conflicting movements are locked out. Wards on the key (e.g. Annett or Fortress key) are matched to the wards on the corresponding mechanical lock (e.g. Annett or Fortress lock).

11.2 Ground Frames inside Interlocking Areas

11.2.1 Key from lever in the main frame

The common method of releasing ground frames within mechanical interlockings and in some electro-mechanical interlockings is by key removed from a lock on a releasing lever in the main frame in the signal box. The main frame releasing lever is locked in the releasing position when the key is removed.

Locking is provided in the main frame between the releasing lever and all points and signal levers which conflict with operation of the ground frame.

The key, obtained from the main frame releasing lever, is then taken to and inserted in the lock on the respective ground frame lever to release the ground frame.

11.2.2 Electric Releasing Switch

Where electro-mechanical, relay type or computer based interlockings are provided an electric releasing switch is generally installed near the ground frame.

The key to release the mechanical lock on the ground frame releasing lever is held locked in the electric releasing switch until the electric releasing switch lever (handle) is turned from the normal to the reverse position. The releasing switch lever (handle) is locked in the normal position until the releasing lever in the main frame at the signal box is reversed which causes the indicator in the electric releasing switch to change from a “locked” to a “free” indication. Reversing the releasing switch lever and removing the key locks the electric releasing switch reverse which, in turn, locks the signal box main frame releasing lever in the reverse position via an electric lever lock.

A reverse electric lever lock is provided on the main frame releasing lever which also has an indicator inscribed “locked” and “free”. The indicator displays a “locked” indication when the corresponding electric releasing switch is operated to the reverse position. The indicator displays a “free” indication when the ground frame and electric releasing switch are normal.

The Signaller reverses the main frame releasing lever at the request of the shunter or the traffic officer.

11.3 Ground Frames outside Interlocking Areas in Double Line Sections

In double line track sections outside interlocking areas, ground frames may be provided to operate emergency crossovers and connections to sidings.

11.3.1 Emergency Crossovers

Emergency crossovers may be released by a key from an Annett or Duplex Lock, Emergency Releasing Lock, Pilotmans Lock, or a key from an Electric Releasing Switch.

11.3.2 Sidings adjacent to Main Line

Where local regulations stipulate that portion of the train shall always remain standing on the Main Line during the time a siding is being shunted, a Guard’s Key may be used to release the ground frame.

The portion of the train standing on the Main Line maintains the signal or signals in the rear in the stop position and as a further protection, the track circuit at the points is cut through a points normal electrical detector connected to the catch points end leading out from siding.

At sidings where the whole train may be refuge, the Ground Frames are provided with an Electric Releasing Switch.

11.4 Ground Frames outside Interlocking Areas in Single Line Sections

When a siding is located in a single line staff section, a key on the Electric Staff or Ordinary Train Staff, or a Receptacle Key in conjunction with a ticket on an Ordinary Train Staff section, or a key from a Staff Drawer Lock, is utilised to unlock the ground frame, and the key is held captive in the ground frame mechanical lock until the point connections and the levers have been returned to normal.

On single line track block and single line track control sections, an Electric Releasing Switch is provided to release the ground frame, and once the release is taken the section control circuit is open circuited.

11.5 Ground Frames and Mechanical Point Indicators

When a ground frame is located in the following areas:

ordinary train staff, electric train staff, Train Order working area, yard areas where signals cannot be cleared for the train movement or where the release is by a releasing lock or loose key not directly interlocked with the signals then a mechanical point indicator is to be provided. Points fitted with mechanical point indicators shall always have a catchpoint or derail to prevent points being trailed through, unless a trailable mechanism is provided.

In staff sections, landmarks may also need to be provided.

12 Mechanical Points with Point indicators – SA

This Principle addresses the requirements for the provision of Mechanical Point machines and the methods by which releases are generally given.

12.1 Provision of Switch stand with HLM Point locks

There are mechanical point machines or Switchstands with Point indicators being used in South Australia.

Mechanical point machines in South Australia has Outlying switch lock (OSL) or HLM Point lock as a locking device.

Trackside box normally provided to show the status of the point locking and whether the point machine is available to move to other side. Trackside box are normally locked by S key.

HLM box have 3 lights (released, release available & locked) to show status of point machine.

OSL box shows the position of the indicator and lever for locking.

Release from controller is required to operate the point machine from trackside HLM box or OSL box.

13 Maximum Distances Between Mechanical Interlocking Machines and Turnouts

This principle addresses the maximum operating distances between mechanical interlocking machines and turnouts to ensure provision of safe and reliable operation of the turnout.

13.1 Operating Distances

The distance from an interlocking machine to a turnout is defined as:

- For a single turnout: - from the interlocking machine to the tip of the switches, Table 1 Single Turnout .
- For a turnout plus catch point: - from the interlocking machine to the tip of the switches of the turnout or catchpoint whichever is furthest from the machine, Table 2 Turnout plus Catchpoint.
- For a crossover: - from the interlocking machine to the tip of the switches of the end of the crossover furthest from the machine, Table 3 Crossover
- For a turnout plus derail: - from the interlocking machine to the tip of the switches of the turnout or the derail whichever is furthest from the machine, Table 2 plus 10 m.

In the tables means **Connection Not Permitted**

Table 1 Single Turnout

		Mechanical Interlocking Machine Type		
Switch	**Turnout**	**Elevated or Platform Level Machine**	**Ground Frame Type E or G**	**Single Lever Type F**
UIC 60B	Tangential 1200:24			
UIC 60B	Tangential 1200:21			
UIC 60B	Tangential 1200:18.5		Connections not permitted	
UIC 60B	Tangential 800:18.5			
UI C 60B	Tangential 800:15			
U I C 60B	Tangential 500 :1 5 (one backdrive)	95 m		
U I C 60B	Tangential 500 :12 (one backdrive)	95 m		
UIC 60B	Tangential 300:12 (one backdrive)	150 m	95 m	
UIC 60B	Tangential 300:9 (one backdrive)	150 m	95 m	
UIC 60B	Tangential 250:10.5	160 m	105 m	
UIC 60B	Tangential 250:8.25	160 m	105 m	
60 kg	1 in 15 9150 (one backdrive)	170 m	105 m	
60 kg	1 in 12 9150 (one backdrive)	170 m	105 m	
60 kg	1 in 10.5 9150 (one backdrive)	170 m	105 m	
60 kg	1 in 10.5 6100	180 m	115 m	
60 kg	1 in 9 6100	180 m	115 m	
60 kg	1 in 8.25 6100	180 m	115 m	
53 kg	13650 switch (one backdrive)	180 m	115 m	
53 kg	All others	240 m	150 m	
47 kg	All	280 m	180 m	25 m Loops, refuges, sidings, branch lines only

Table 2 Turnout plus Catchpoint

		Mechanical Interlocking Machine Type		
Switch	**Turnout**	**Elevated or Platform Level Machine**	**Ground Frame Type E or G**	**Single Lever Type F**
UIC 60B	Tangential 1200:24			
U I C 60B	Tangential 1200:21			
UIC 60 B	Tangential 12 00 :1 8.5		Connections not permitted	
UIC 60B	Tangential 800:18.5			
UI C 60B	Tangential 800 :1 5			
U I C 60B	Tangential 500 :1 5 (one backdrive)	85 m		
U I C 60B	Tangential 500 :12 (one backdrive)	85 m		
UIC 60B	Tangential 300:12 (one backdrive)	125 m	85 m	
UIC 60B	Tangential 300:9 (one backdrive)	125 m	85 m	
UIC 60B	Tangential 250:10.5	135 m	95 m	
UIC 60B	Tangential 250:8.25	135 m	95 m	
60 kg	1 in 15 9150 (one backdrive)	145 m	95 m	
60 kg	1 in 12 9150 (one backdrive)	145 m	95 m	
60 kg	1 in 10.5 9150 (one backdrive)	145 m	95 m	
60 kg	1 in 10.5 6100	160 m	100 m	
60 kg	1 in 9 6100	160 m	100 m	
60 kg	1 in 8.25 6100	160 m	100 m	
53 kg	13650 switch (one backdrive)	160 m	100 m	
53 kg	All others	215 m	130 m	
47 kg	All	255 m	150 m	

For a turnout plus derail, add 10 m to the above distances. A type F single lever may be used for a 47kg turnout plus derail to a maximum distance of 70 m.

Table 3 Crossover

		Mechanical Interlocking Machine Type		
Switch	**Turnout**	**Elevated or Platform Level Machine**	**Ground Frame Type E or G**	**Single Lever Type F**
UIC 60B	Tangential 1200:24			
UIC 60B	Tangential 1200:21			
UIC 60B	Tangential 1200:18.5		Connections not permitted	
UIC 60B	Tangential 800:18.5			
UI C 60B	Tangential 800:15			
UI C 60B	Tangential 500:15			
UI C 60B	Tangential 500:12			
U I C 60B	Tangential 300 :12 (one backdrive)	115 m		
UIC 60B	Tangential 300:9 (one backdrive)	115 m		
UIC 60B	Tangential 250:10.5	125 m	80 m ***	
UIC 60B	Tangential 250:8.25	125 m	80 m ***	
60 kg	1 in 15 9150 (one backdrive)	125 m	80 m	
60 kg	1 in 12 9150 (one backdrive)	125 m	80 m	
60 kg	1 in 10.5 9150 (one backdrive)	125 m	80 m	
60 kg	1 in 10.5 6100	140 m	85 m	
60 kg	1 in 9 6100	140 m	85 m	
60 kg	1 in 8.25 6100	140 m	90 m	
53 kg	13650 switch (one backdrive)	140 m	90 m	
53 kg	All others	190 m	110 m	
47 kg	All	240 m	125 m	

*** Claw lock mechanism shall be used on turnouts – existing mechanical equipment cannot be used. Each end of the crossover shall be operated by a separate lever.

14 Points Requiring Clipping for Unsignalled Movements

In accordance with the rules, signallers may authorise unsignalled facing movements over points.

In order to discriminate those locations which, require additional security for these movements, a sign is to be provided adjacent to the points end, for the direction that the points would become facing.

14.1 Points to be Clipped

A list of points that require to be clipped for unsignalled facing movement is displayed in the controlling Signal Box.

This list is to be maintained with any infrastructure change.

The provision of signs at these points as per this principal will apply for new works only or upon request.

14.2 Form of Sign

The sign is white lettering on a red background and states:

14.3 Identification of Points Requiring this Sign

The following criteria will identify points where this sign may be provided:

- Motor Points signalled for trailing moves only where the lock slide has been removed or a wide notch has been cut or provided with a coarse detection setting.
- Mechanically operated points without an FPL worked from the signal box, or ground frames controlling points where the rodding is greater than 100m and where no signal is provided.

Points operated from ground frames, where the channel rodding run is short and direct (less than 100m) will not require the sign.

However, any set of points where a situation exists that the points cannot be guaranteed for a movement, such as due to switch or stock rail condition, may be fitted with the sign.

The installation of signage is to be documented on the signalling plan. Refer to Figure 18.

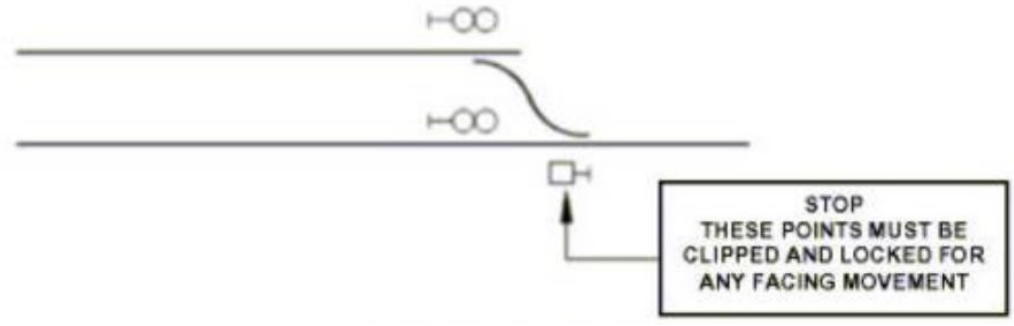


Figure 18

14.4 Points requiring Clipping when Passing Signal at Stop

The following criteria will identify points which need to be clipped when passing a signal at stop.

- Motor worked points not controlled from a Signal Box. (for example, 'Ulan' style automatic crossing loops).

The following sign is to be displayed on or adjacent to the Signal in these situations.

**BEFORE PASSING
THIS SIGNAL AT STOP,
THESE POINTS MUST BE
CLIPPED AND LOCKED**

This sign should be retroreflective white on a black background.

14.5 Motor Points not requiring special signage

Points controlled from the Signal Box where the Signaller can operate the points from one position to the other and back to confirm the correct functioning of the detector and the indicator diagram and be in a position to be able to provide advice to the driver that the points are either operating correctly or need to be clipped.

15 Application of Back-drives to Tangential Turnouts

The length and hence flexibility of the switch determines the number of thrust points or drives that are needed to ensure that:

- The switch closes up to the stock rail along its machined section and up to the chocks behind this.
- The switch opens sufficiently to provide a clear flange-way between it and the stock rail. This switch blade throat opening shall be as per ETS-03-00 (Section 3 – Points and Crossings).

The turnout manufacturer will determine the location and number of back-drives required and the turnout will be supplied with switch and (sometimes) stock rail drilled to accept the back drive components.

As a general statement 250m or tighter turnouts do not require back-drives, 300m or larger turnouts do require back-drives.

Table 4 lists the various sizes of tangential turnout and shows the number of drives generally required for each type.

Back-drives can be provided by:

- A mechanical linkage from the main drive at the tip of the switch
- A second (or second and third) power unit directly operating the back drives.

Figure 19 Mechanical back drive

Figure 20 Separate mechanism for front and back drives

Table 3 Tangential turnout and the number of drives

Turnout Type	Operating Mechanism	Back-drive required?	Preferred Back-drive Type	Alternative Back-drive Type
190m – 1 in 7.5	Spherolock or Clamp Lock – 84M or Vossloh	No		
	Switch machine	No		
250m – 1 in 8.25	Spherolock or Clamp Lock – 84M or Vossloh	No (note 1)		
	Switch machine	No (note 1)		
250m – 1 in 10.5	Spherolock or Clamp Lock – 84M or Vossloh	No (note 1)		
	Switch machine	No (note 1)		
300m – 1 in 9	Spherolock or Clamp Lock – 84M or Vossloh	Yes one	Mechanical Linkage	Mechanical Linkage
	Switch machine	Yes one	Mechanical Linkage	Mechanical Linkage
300m – 1 in 12	Spherolock or Clamp Lock – 84M or Vossloh	Yes one	Mechanical Linkage	Mechanical Linkage
	Switch machine	Yes one	Mechanical Linkage	Mechanical Linkage

500m – 1 in 12	Spherolock or Clamp Lock – 84M or Vossloh	Yes one	Mechanical Linkage	Mechanical Linkage
	Switch machine	Yes one	Mechanical Linkage	Mechanical Linkage
500m - 1 in 15	Spherolock or Clamp Lock – 84M or Vossloh	Yes one	Mechanical Linkage	Mechanical Linkage
	Switch machine	Yes one	Mechanical Linkage	Mechanical Linkage
800m – 1 in 15	Spherolock or Clamp Lock – 84M or Vossloh	Yes one	Mechanical Linkage	
	Switch machine (Note 2)	Yes one	Mechanical Linkage	
800m – 1 in 18.5	Spherolock or Clamp Lock – 84M or Vossloh	Yes one	Mechanical Linkage	
	Switch machine (Note 2)	Yes one	Mechanical Linkage	
1200m – 1 in 18.5	84M or Vossloh – Spherolock or Clamp Lock	Yes two	Multiple Drive (Note 3)	Mechanical Linkage
1200m – 1 in 24	84M or Vossloh – Spherolock or Clamp	Yes two	Multiple Drive (Note 3)	Mechanical Linkage

Notes

Back-drives may be required on some 250m curved turnouts. If required, the switches will have been machined and drilled to accept a mechanical back-drive.

While conventional switch machines will readily operate 800m turnouts under power, emergency hand operation is likely to be heavy.

For electric machines, two machines can be used, one for the main drive at the tip and one to operate both back drives. For hydraulic, a separate cylinder should be used at each drive. Note that back drive detection (on at least one drive) will be necessary. Application of facing point locks to the back-drives is optional.