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Discipline

Engineering Standard – NSW

Category

Signalling

Title

Points

Reference Number

SDS 14 – (RIC Standard: SC 00 13 01 14 SP)

Document Control

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		Refer to Reference Number	H Olsen	M Owens	Refer to minutes of meeting 12/08/04

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About This Standard

This Principle addresses the concepts and definitions relating to certain types of points referred to throughout these Principles and with regard to the descriptions and definitions currently accepted.

Document History

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List of Amendments –

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

Table of Contents

14. Points

14.1 Principle No. 14.1 - Types Of Points Concepts And Definitions

14.1.1 Introduction

This Principle addresses the concepts and definitions relating to certain types of points referred to throughout these Principles and with regard to the descriptions and definitions currently accepted.

14.1.2 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 avoiding a potential collision between movements. When the catch points are closed they enable authorised facing and trailing moves to take place.

There are two fundamental reasons for providing catch points.

i) For the protection of main running line movements, especially passenger, from general freight or shunting movements or from unauthorised movements of loose wagons or stored rolling stock or track maintenance machines on other lines or sidings.

ii) For the protection of simultaneously authorised movements towards signals beyond which a convergence would exist within the prescribed overlap distances applicable to the signals authorising the movements in order to facilitate operating flexibility.

14.1.3 Derailer

A two position mechanical device attached to the rail. When seated over the rail head in the “tripping” position it will deflect a low speed movement off the rails resulting in an enforced derailment thus avoiding a potential collision between movements. When swung away from the railhead the derailer enables authorised facing and trailing movements to take place.

A derailer alone is only suitable for providing protection from very low speed general freight or shunting movements or from unauthorised movements of loose wagons or stored rolling stock or track maintenance machines in yards or sidings.

When combined with a “wheel crowder” its use may be extended to similar applications to catchpoints but only where the track speed on the track fitted with the derailer does not exceed 35 kph.

14.1.4 Emergency Crossover

A crossover either facing or trailing situated on a double line and where worked crossovers are long distances apart provided to facilitate single line working usually in conjunction with an extensive programme of track engineering work and subsequently left in situ to enable single line working to be initiated should the need arise.

The crossover may be mechanically or electrically operated and when not in use facing crossovers shall be clipped and XL padlocked normal.

14.2 Principle No. 14.2 - Catch Points: Provision And Positioning

14.2.1 Introduction

This Principle addresses the requirements for providing catch points to prevent collisions arising from unauthorised conflicting movements where clearances are limited or to separate different classes of trains or types of working or to replace an overlap.

14.2.2 Circumstances Under Which Catch Point Protection Shall Be Provided

Catch points shall be provided 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 no overlap can be provided due to constraints governing the positioning of signals or track work and catch points can replace an overlap. 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.
- On lines where shared overlap arrangements would impair the operating requirements. Refer to figures 3 & 4.
- On lines where the gradient is such that a train rolling back could foul a signalled movement. Refer to figure 5.
- At crossing loops to enable through running on the main line if the Up and/or Down loop is being shunted. Refer to figure 6.
- 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.

14.2.3 Consideration As To Where Catch Points Shall be Positioned

In addition to the requirements for the minimum clearance between adjacent tracks catch points shall be positioned with consideration being given to avoiding the following derailment hazards whenever possible.

- Adjacent running lines.

- Other adjacent tracks.
- Embankments.
- Bridges.
- Tunnel mouths.
- Trackside structures such as signals & overhead masts, etc.
- Platforms and station buildings.
- Buildings such as signal boxes and relay rooms, etc.
- Equipment housings such as location cases.

14.2.4 Additional Safeguards Which May Be Provided

Over and above the previous requirements, additional safeguards shall be provided as follows:-

- Double blade catch points or full lead run-offs where there is a likelihood that a single bladed catch will result in inadequate or unsafe deflection of the derailed vehicle.

  Note: This is especially important where the run off area is uneven and there is a risk of overturning a vehicle.

- Full run-off points onto a separate length of track or into a sand drag arrangement where approaching trains may be braking from the full service speed to a stand immediately in rear of the catch points. Refer to figures 7 & 8.

- If warranted in trainstop territory intermediate trainstop(s) where the speed of an approaching train can be usefully checked prior to it stopping immediately in rear of the catch points. Refer to figure 9.

14.2.5 Balloon Loop Loading/Unloading Sidings

Catchpoints are not required at the exit end of Balloon Loops where:

- 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 control of the loading/unloading bin operator, and
- passenger trains are not involved, and
- the connection to the main line is protected by catchpoints

Refer to figures 10 (a) and 10 (b).

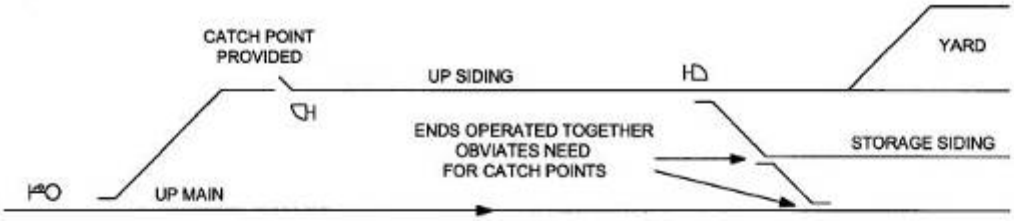


FIGURE 1

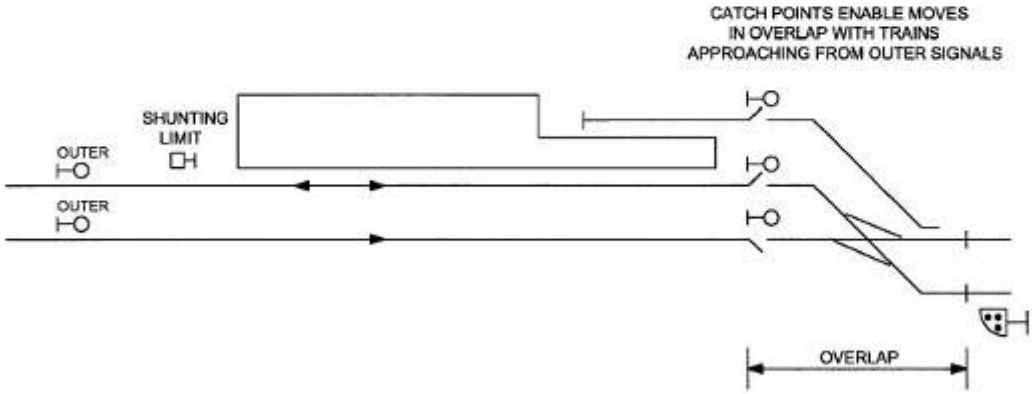


FIGURE 2

PROVISION OF CATCH POINTS

PRINCIPLE 14.2

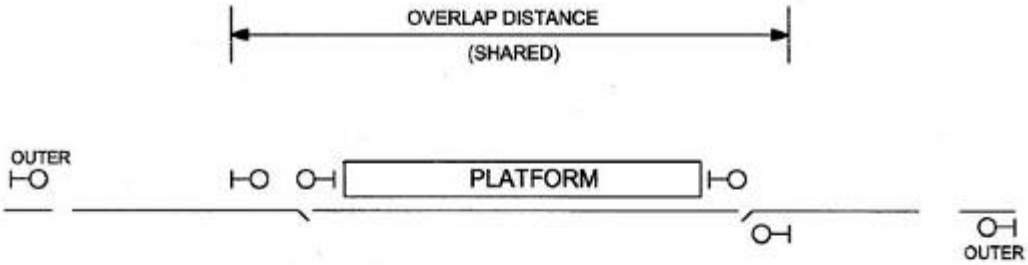
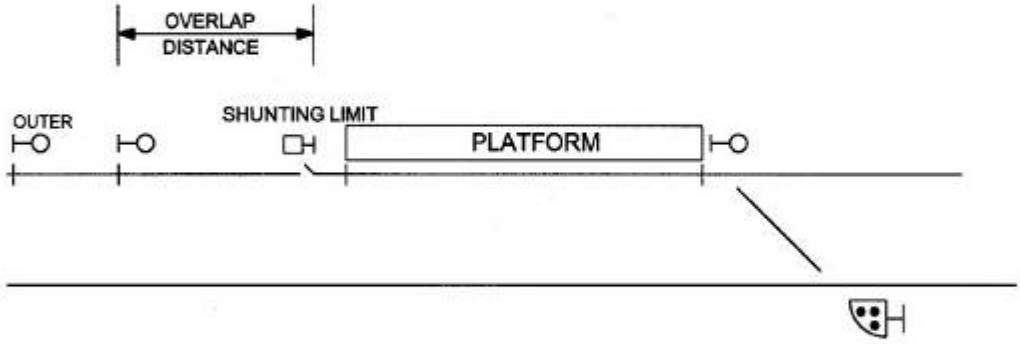


FIGURE 3



SETTING BACK FROM SHUNT INTO OCCUPIED PLATFORM AFTER TIME OR INTO CLEAR PLATFORM WITH CATCH POINTS OPEN AND SIMULTANEOUS APPROACH OF TRAIN FROM OUTER SIGNAL

FIGURE 4

PRINCIPLE 14.2

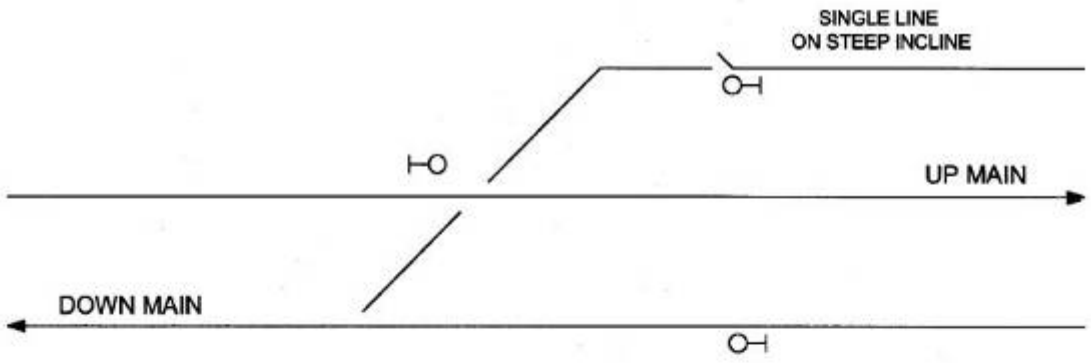


FIGURE 5

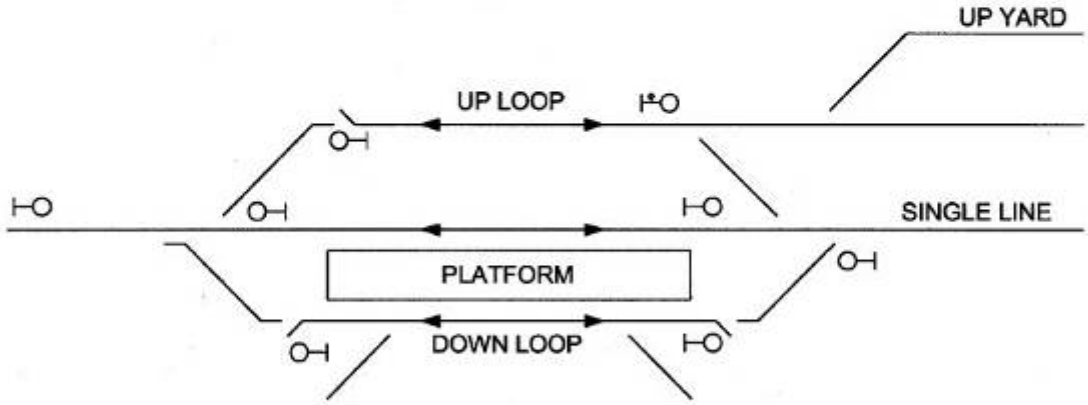


FIGURE 6

POSITIONING OF CATCH POINTS

PRINCIPLE 14.2

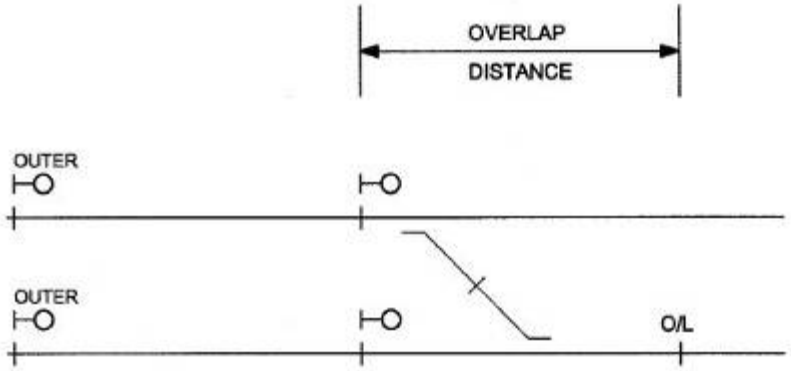


FIGURE 7

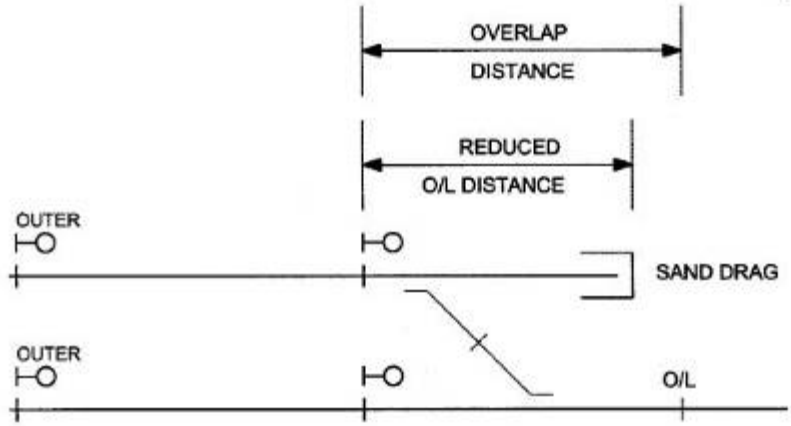


FIGURE 8

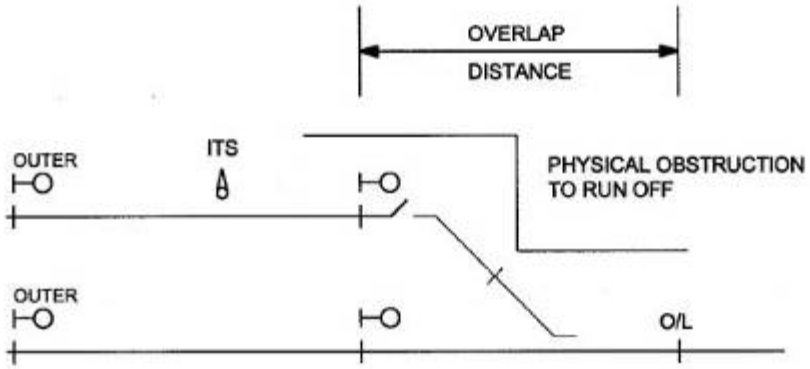


FIGURE 9

ADDITIONAL SAFEGUARDS

PRINCIPLE 14.2

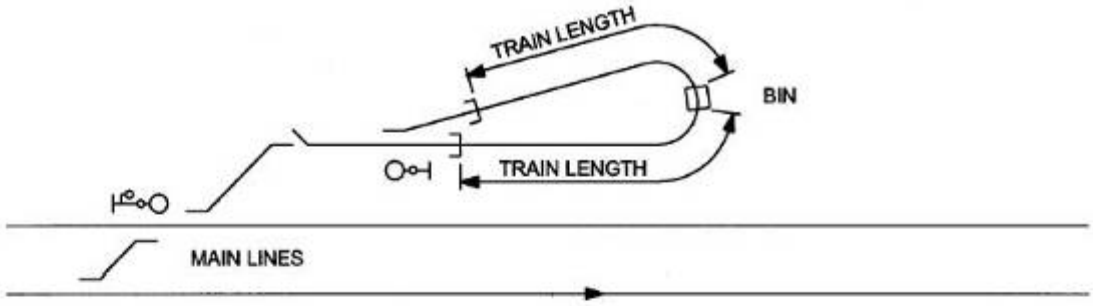


FIGURE 10(a)

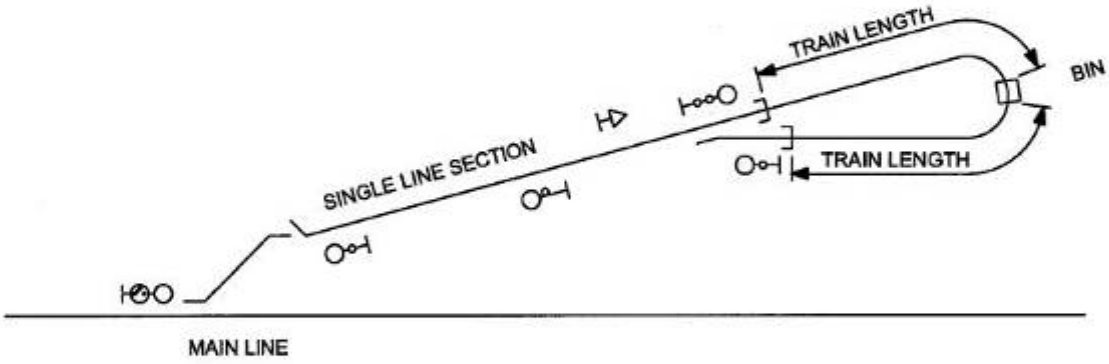


FIGURE 10(b)

PROVISION OF CATCH POINTS

PRINCIPLE 14.2

14.3 Principle No.14.3 - Emergency Crossovers Operated From Mechanical Ground Frames

14.3.1 Introduction

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.

14.3.2 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 an Annett 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 locked traffic hut shall be provided near the ground frame. A Train Working phone is also provided.

An Annett type lock with contact box and key secured by flap and XL lock 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 XL padlock.

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

14.3.3 Ground Frame Operation

If the emergency crossover is to be reversed then the Annett type key shall be removed from the contact box and the XL padlocks and clips removed from the points. Any automatic running signals reading over the emergency crossover shall be replaced to stop.

The Annett type key shall be inserted in the Annett type 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.

14.4 Principle No.14.4 - Emergency Crossovers Operated From Electric Ground Frames

14.4.1 Introduction

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.

14.4.2 Requirements For Facing Emergency Crossovers Operated By Electric Switch Machines and Controlled From Electric Ground Frames

Operators Panel

A simple operators 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 Appendix 2 to this Principle. Refer to figure 1.

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 Appendix 1 to this Principle. Refer to figure 1.

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 XL padlocked.

If the emergency crossover is to be reversed then following the removal of the clips and XL padlocks 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.

Appendix 1 to Principle 14.4

DRIVERS WHEN PASSING THIS SIGNAL AT STOP IN ACCORDANCE WITH THE REGULATIONS MUST PROCEED WITH CAUTION TO THE NEXT SIGNAL BEING PREPARED TO STOP SHORT OF ANY OBSTRUCTION.

Appendix 2 to Principle 14.4

DRIVERS WHEN DIRECTED TO PASS THIS SIGNAL AT STOP MUST PROCEED WITH CAUTION AND BRING THEIR TRAIN TO A STAND WELL CLEAR OF THE CROSSOVER AND MUST NOT RESTART UNTIL SATISFIED THAT IT IS SAFE TO DO SO (or THAT SHUNTING IS NOT TAKING PLACE, as applicable).

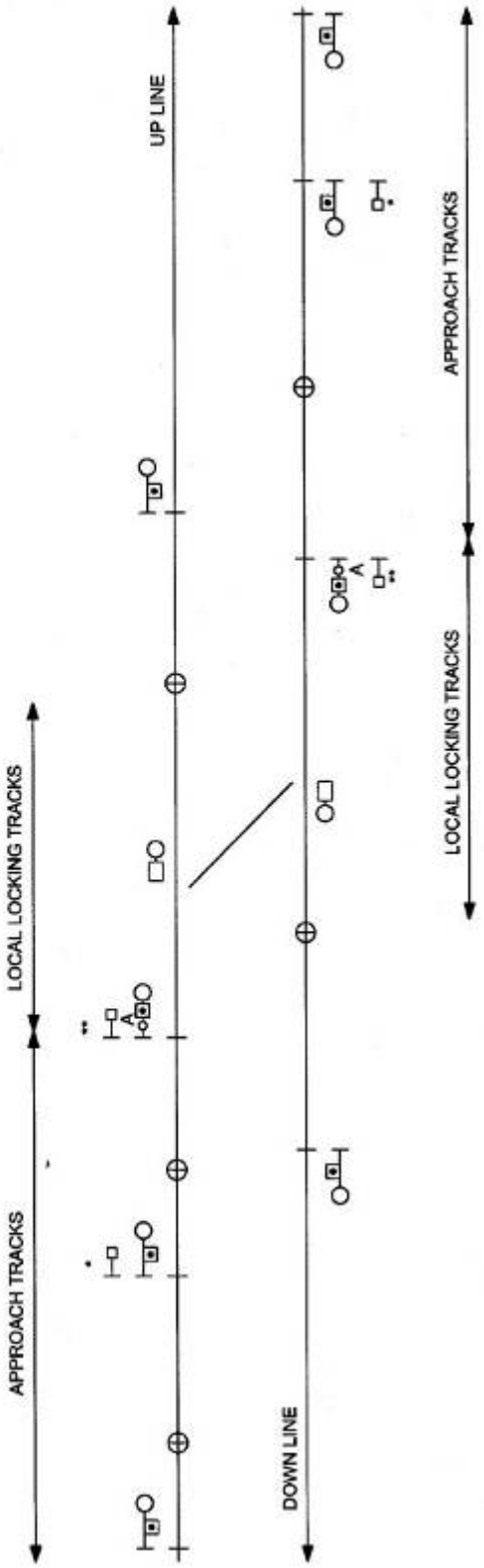


FIGURE 1

EMERGENCY CROSSOVER OPERATED BY AN ELECTRONIC GROUNDFRAME

PRINCIPLE N° 14.4

*REFER TO APPENDIX 1

**REFER TO APPENDIX 2

14.5 Principle No. 14.5 - Detection Of Points

14.5.1 Introduction

This Principle addresses the requirements for the electrical detection of mechanically, power or ground frame operated points in colour light signal aspects.

Facing point locks shall be provided on facing points on running lines for all signalled facing movements for trains conveying passengers. On electropneumatic (EP) points a plunger lock shall also be provided in these circumstances. Moreover, facing point locks are to be provided for all authorised running movements over facing points including interlocked emergency crossovers.

14.5.2 Detection of Mechanically Operated Points

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 1.

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 2.

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 3.

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 2.

14.5.3 Detection of Power Operated Points

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 (and plunger lock where used on EP points) shall be detected before the signal is permitted to clear and continuously thereafter to maintain a clear aspect. Refer to figure 4.

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 5.

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 5.

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 figures 6 & 7.

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 (eg 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.

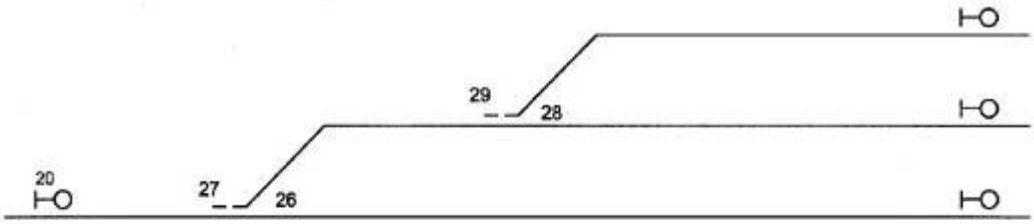
If an end of a set of power operated points is situated such that it provides trapping/flank protection to an overlap then the correct position of the open switch, closed switch and facing point lock, if provided, or open switch in the case of a single switch catch point, shall be detected before the signal is permitted to clear over that line of overlap and shall remain detected continuously thereafter to maintain a clear aspect. Refer to figures 5 & 7.

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.

14.5.4 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.

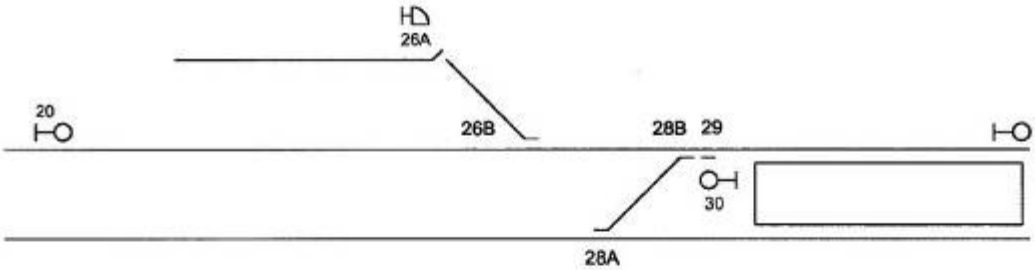


SIGNAL	DETECTS	
	POINTS	FPL'S
20	26N 26R 28N 26R 28R	27R 27R 29R 27R 29R

FPL OUT BOTH WAYS

DETECTION OF FACING POINTS AND FPL'S IN ROUTES

FIGURE 1



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

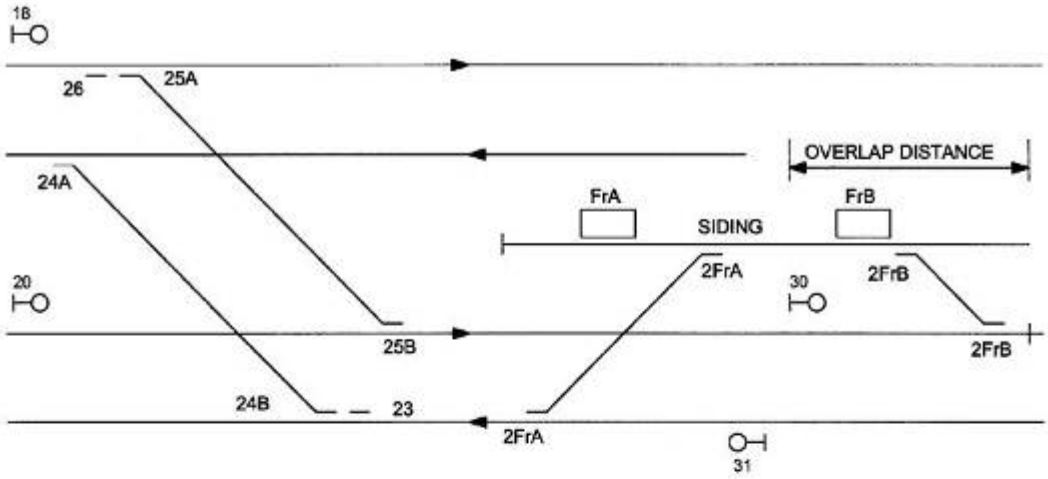
DETECTION OF TRAILING POINTS IN ROUTES

AND AS TRAPPING PROTECTION

FIGURE 2

DETECTION OF MECHANICALLY OPERATED POINTS

PRINCIPLE N° 14.5



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)

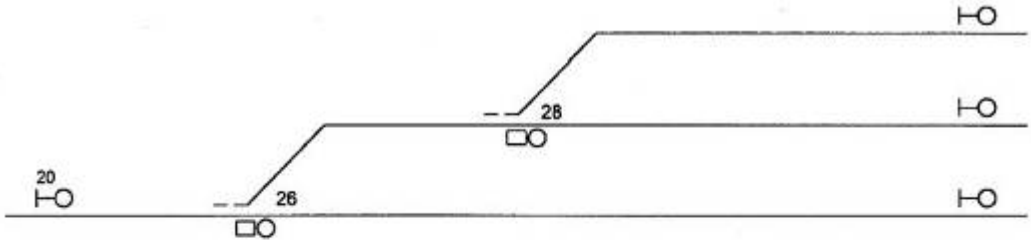
DETECTION OF MULTIPLE ENDED POINTS IN ROUTES

AND AS TRAPPING PROTECTION

FIGURE 3

DETECTION OF MECHANICALLY OPERATED POINTS

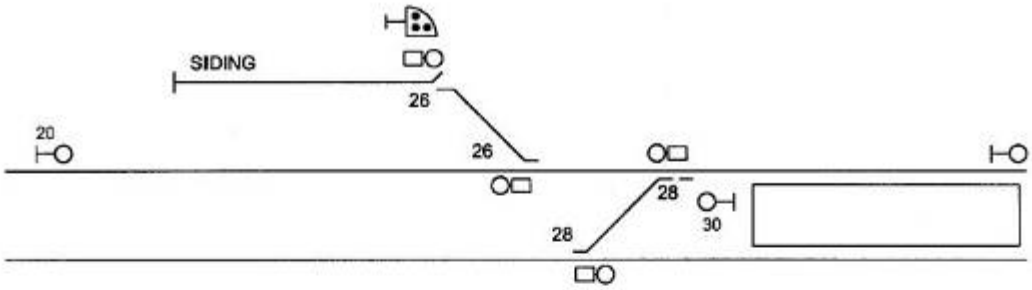
PRINCIPLE N° 14.5



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

DETECTION OF FACING POINTS IN ROUTES

FIGURE 4



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

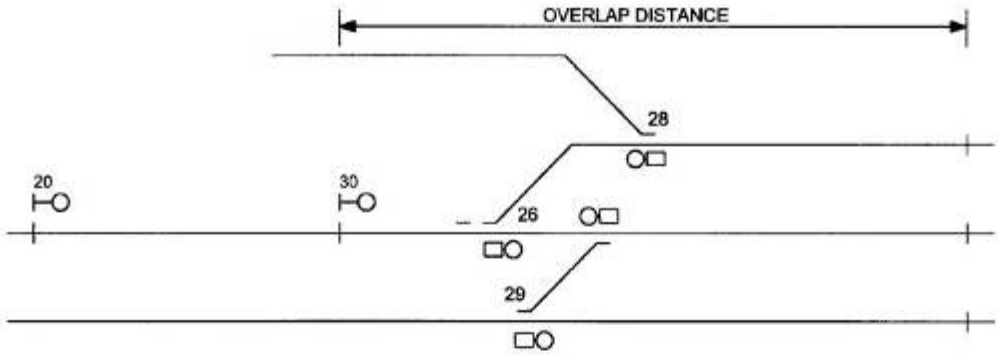
DETECTION OF TRAILING POINTS IN ROUTES

AND AS TRAPPING PROTECTION

FIGURE 5

DETECTION OF POWER OPERATED POINTS

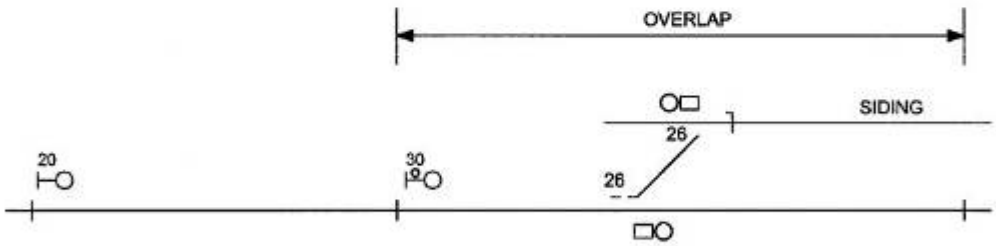
PRINCIPLE N° 14.5



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

FIGURE 6

DETECTION OF POINTS IN AN OVERLAP



SIGNAL	DETECTS POINTS
20	26N

NOTE: NO OVERLAP IS PERMITTED INTO THE SIDING

DETECTION OF FACING POINTS IN A FIXED OVERLAP

FIGURE 7

DETECTION OF POWER OPERATED POINTS

PRINCIPLE N° 14.5

14.6 Principle No. 14.6 - Electric Switch Machines

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

14.6.1 Introduction

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

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

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.

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.

Requirements

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.

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.

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.

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.

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 ie,
		"Strathfield EOL & 43A PTS. MTR" "Strathfield EOL & 43B PTS MTR"

14.6.3 Emergency Switch Machine Lock (ESML)/Emergency Operations Lock (EOL)

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.

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.

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 safeworking 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.

14.6.4 Isolating Relays

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.

Requirements

An isolating relay shall be provided for each electric switch machine. Refer to 16.8.4 for the control of isolating relays.

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.

Location

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

14.7 Principle No. 14.7 - Removal Of Lockslides From Electric Switch Machines

14.7.1 Introduction

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.

14.7.2 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.

14.7.3 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, on Nippon KA1211 electric switch machines only, 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.

14.7.4 Requirements For The Removal of Lockslides

Prior to any lockslide being removed from an electric switch machine, specific approval must be obtained and approved designs must be issued. Working sketches, signalling plans and track plans shall explicitly indicate which electric switch machines are subject to this procedure.

14.8 Principle No. 14.8 - Track Circuit Locking of Points

14.8.1 Introduction

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

14.8.2 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.

14.8.3 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 1.

The limits of this track circuit or track circuits over the points shall extend at least as far as the clearance point in accordance with Principles No. 19.1 and 19.2.

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 2.

If the track layout and train movement do not permit the track locking to be extended then route holding as described in Principle No. 12.1 shall be provided.

14.8.4 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.

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.

Pneumatically Operated Points (except claw locks)

The facing point lock of pneumatically operated facing points shall be held in position by a plunger lock device controlled by a contact of the track circuit immediately over the points and any other track circuits between the signal or signals reading over the points and the points concerned.

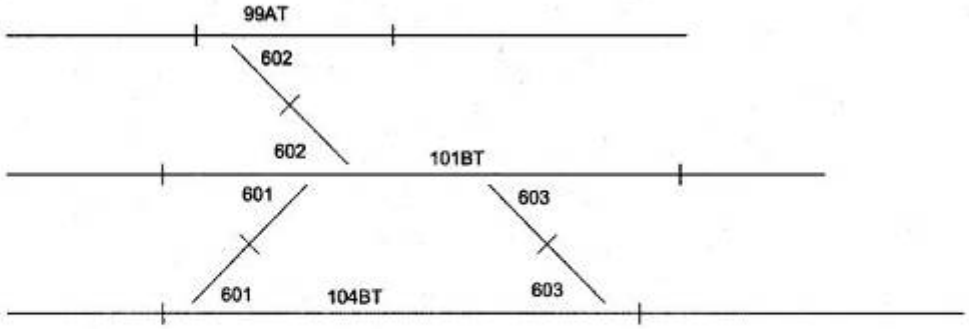
Track locking in the plunger lock circuit should operate through contacts of the parent track relays or through repeat relays which are close to the parent track relay.

Pneumatically Operated Claw Locks

Operation of the cut-off valve (LWR) shall be controlled by a contact of the track circuit immediately over the points and if facing points any other track circuits between the points concerned and the signal or signals reading over the points.

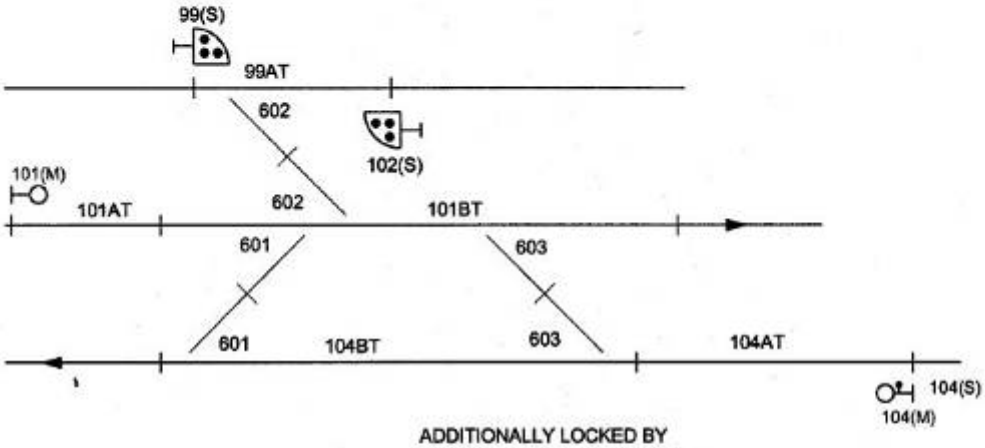
14.8.5 Control Tables

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



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

FIGURE 1



ADDITIONALLY LOCKED BY TRACK CIRCUITS OCCUPIED

POINTS N°	NORMAL	REVERSE
601	101AT 104AT	
602	101AT	(104AT, 104BT, W 603R)
603	101AT 104AT (99AT W 602R)	104AT

FIGURE 2

TRACK CIRCUIT LOCKING OF POINTS

PRINCIPLE N° 14.8

14.9 Principle No. 14.9 - Mechanical Trailable Facing Point Mechanisms

14.9.1 Introduction

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

14.9.2 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.

14.9.3 Mechanical Trailable Facing Point Mechanisms

Mechanisms used for this purpose must be able to provide a mechanical indication of the closed switch being within the normal detection limits of the stockrail, and the open switch being suitably clear of the other stockrail. 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 a Operators Key, SL key or similar as appropriate to the situation.

14.9.4 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.

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.

A diagram of the indicator is shown in Principle 19.1.4 figure 3.

14.9.5 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.

14.9.6 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.

14.9.7 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 stockrail before hand 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 must 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 must 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 automatic 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 must ensure that the movement is authorised, and in yard areas, keep a look out for any obstruction.

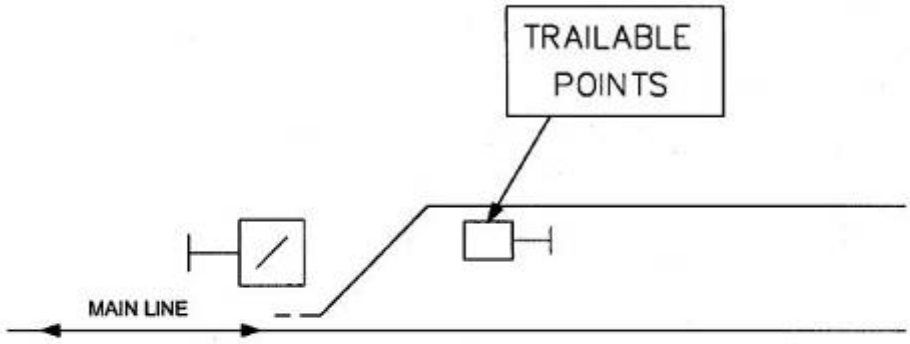


FIGURE 1

TRAILABLE FACING POINTS LAYOUT

PRINCIPLE N° 14.9

14.10 Principle No. 14.10 – Ground Frame Releases

14.10.1 Introduction

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

14.10.2 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 (eg Annett key) are matched to the wards on the corresponding mechanical lock (eg Annett lock).

14.10.3 Ground Frames inside Interlocking Areas

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.

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.

14.10.4 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.

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.

Sidings adjacent to Main Line

Where local regulations stipulate that portion of the train must 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 refuged, the Ground Frames are provided with an Electric Releasing Switch.

14.10.5 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.

14.10.6 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. Details of mechanical point indicators are given in Principle 19.2.4. Points fitted with mechanical point indicators must 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.

14.11 Principle No. 14.11 – Electro – Pneumatic (EP) Points

Requirements for the provision of emergency operations locks, (EOL) and emergency operations lock pushbuttons (EOLPB).

14.11.1 Introduction

This Principle addresses the concepts and requirements for the provision of equipment which can manually operate a set of EP points under various operating conditions.

14.11.2 Emergency Operations Lock (EOL) (Keyless Type)

Concept

An EOL switch is a rotary switch located in the EOLPB unit on the master control valve for the points.

When the switch is turned to the emergency (or manual) position, a time delay function of a minimum of 60 seconds commences. At the end of the time delay period an indicator in the EOLPB unit illuminates, advising that the normal and reverse pushbuttons are available and that points may be operated normal or reverse as required.

The cover of the EOLPB unit is arranged so that it cannot be closed with the switch in the emergency position.

The minimum time delay period is 60 seconds. However the time delay applied to any particular location must take into account:

- The distance from the points or crossover of the first warning signal protecting the points or crossover

- The speed and braking capabilities of trains using the line or lines. When the EOL switch is rotated either

- Any approaching train must be further away than the first warning signal approaching the points and be able to stop before the points

OR

- There must be sufficient time for a train which is inside the first warning signal to reach the points before the normal and reverse pushbuttons are enabled.

Optionally:

If all tracks in the approach locking to the points or crossover

are proven unoccupied, the timing function may be qualified out.

Requirement

Only one EOL switch and one set of normal and reverse pushbuttons shall be provided for each set of EP points irrespective of the number of point ends.

The master control valve fitted with the EOLPB unit shall so far as is possible be located at the facing end of any facing and trailing crossover or at the main line end of any points leading to a refuge or siding.

Indications may be provided above the pushbuttons to indicate the position to which the points have been called.

In all cases, the points must be examined, clipped and locked, before trains are permitted to pass over them.

14.11.3 Emergency Operations Lock (Keyed Type)

In the Sydney, Sydenham and North Sydney areas, the EOL unit is provided with a key and lock. Removal of this key will prevent the signals from clearing. This key is then inserted and turned in the lock in the EOLPB unit, where it performs the same function as the rotary switch in 14.11.2. Indicator lights are not provided in this unit. This method is no longer preferred.

14.12 Principle No 14.12 – Maximum Distances Between Mechanical Interlocking Machines and Turnouts

14.12.1 Introduction

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

14.12.2 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 14.12.1

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 14.12.2

For a crossover:- from the interlocking machine to the tip of the switches of the end of the crossover furthest from the machine, Table 14.12.3

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 14.12.2 plus 10 m.

In the tables means **Connection Not Permitted**

Table 14.12.1 – 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			
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 i n 15 9150 (one backdrive)	170 m	105 m	
60 kg	1 i n 12 9150 (one backdrive)	170 m	105 m	
60 kg	1 i n 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**

** Claw lock mechanism must be used on turnouts – existing mechanical equipment **cannot** be used.

Table 14.12.2 - 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			
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 i n 15 9150 (one backdrive)	145 m	95 m	
60 kg	1 i n 12 9150 (one backdrive)	145 m	95 m	
60 kg	1 i n 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	

** Claw lock mechanism must be used on turnouts – existing mechanical equipment **cannot** be used.

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 14.12.3 – 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			
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 i n 15 9150 (one backdrive)	125 m	80 m	
60 kg	1 i n 12 9150 (one backdrive)	125 m	80 m	
60 kg	1 i n 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 must be used on turnouts – existing mechanical equipment **cannot** be used.

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

14.13 Points Requiring Clipping for Unsignalled Movements

14.13.1 Introduction

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.

14.13.2

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.

14.13.3 Form of Sign

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

STOP

THESE POINTS MUST BE CLIPPED AND LOCKED FOR ANY FACING MOVEMENT

14.13.4 Indentification of Points Requiring this Sign

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

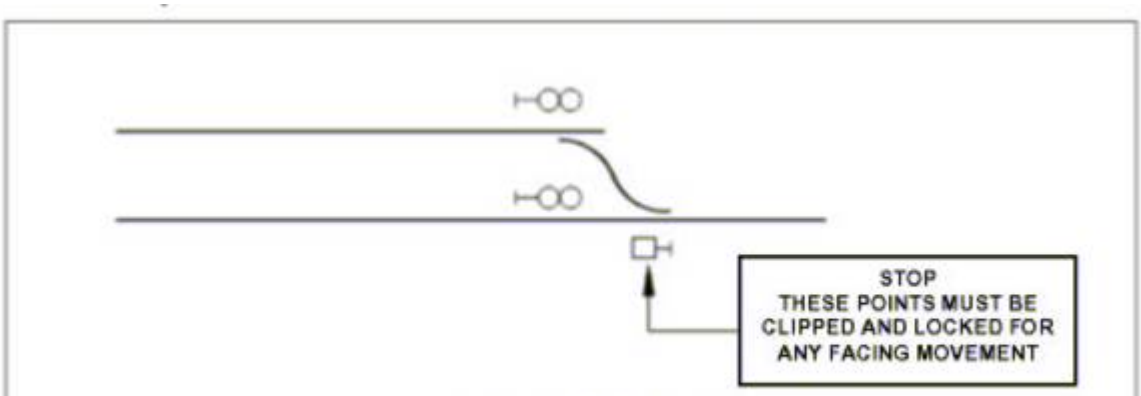
- Motor Points signalled for trailing moves only where the lock slide has been removed or a wide notch has been cut, or provided with a coarse detection setting.
- Mechanically operated points without an FPL worked from the signal box, or ground frames controlling points where the rodding is greater than 100m and where no signal is provided.
- EP trailing only points, not fitted with claw locks.

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 can not be guaranteed for a movement, such as due to switch or stock rail condition, may be fitted with the sign.

Documentation

The installation of signage is to be documented on the signalling plan. Refer to Figure 1.



Principle 14.13 Figure 1

14.13.5 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 retroflective white on a black background.

14.13.6 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.

14.14 Principle No 14.14 – 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 stockrail 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 stockrail. This flange-way must be between 50 and 65mm measured at the end of the head machining on the switch.

The turnout manufacturer will determine the location and number of back-drives required and the turnout will be supplied with switch and (sometimes) stockrail 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.

The following table 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 spring assist unit
- A second (or second and third) power unit directly operating the back drives.

Figure 1
Mechanical back drive

The spring assist unit consists of two cranks coupled by a spring link. Each crank is connected to one switch. As the operating mechanism at the tip begins to move the switches, the spring link is compressed until about mid travel. At this stage the spring link moves past centre and expands applying force to close one switch and open the other. No other linkage is required.

Figure 2
Spring Assist Unit

Figure 3
Separate Mechanisms for front and back drives
(not currently in use in NSW)

Turnout Type	Operating Mechanism	Back-drive required?	Preferred Back-drive Type	Alternative Back-drive Type
190m – 1 in 7.5	Claw lock – 84M or EP	No		
	Switch machine	No		
250m – 1 in 8.25	Claw lock – 84M or EP	No (note 1)		
	Switch machine	No (note 1)		
250m – 1 in 10.5	Claw lock – 84M or EP	No (note 1)		
	Switch machine	No (note 1)		
300m – 1 in 9	Claw lock – 84M or EP	Yes one	Spring Assist Unit	Mechanical Linkage
	Switch machine	Yes one	Spring Assist Unit ♦	Mechanical Linkage
300m – 1 in 12	Claw lock – 84M or EP	Yes one	Spring Assist Unit	Mechanical Linkage
	Switch machine	Yes one	Spring Assist Unit ♦	Mechanical Linkage
500m – 1 in 12	Claw lock – 84M or EP	Yes one	Spring Assist Unit	Mechanical Linkage
	Switch machine	Yes one	Spring Assist Unit ♦	Mechanical Linkage
500m - 1 in 15	Claw lock – 84M or EP	Yes one	Mechanical Linkage	Spring Assist Unit
	Switch machine	Yes one	Mechanical Linkage	Spring Assist Unit ♦
800m – 1 in 15	Claw lock – 84M or EP	Yes one	Mechanical Linkage	
	Switch machine (Note 2)	Yes one	Mechanical Linkage	
800m – 1 in 18.5	Claw lock – 84M or EP	Yes one	Mechanical Linkage	
	Switch machine (Note 2)	Yes one	Mechanical Linkage	
1200m – 1 in 18.5	84M – Claw lock	Yes two	Multiple Drive (Note 3)	Mechanical Linkage
1200m – 1 in 24	84M – claw lock	Yes two	Multiple Drive (Note 3)	Mechanical Linkage

Notes

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

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

3. 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 or EP, 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.

4. A single back-drive plus spring assist unit for the second back-drive can be used but only on turnouts which are not superelevated. This arrangement *will* *not operate* reliably on superelevated turnouts.

♦ **Under power, conventional switch machines will readily drive turnouts with spring assist units. However hand cranking operation, particularly with M3A machines, will be heavy until the assist unit swings over centre. This occurs slightly past half switch travel.**

