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INSTITUTION OF RAILWAY SIGNAL ENGINEERS
MINOR RAILWAYS SECTION

GUIDELINE ON

MECHANICALLY OPERATED POINTS

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Anyone who wishes to contribute additional items or correct / amend any of the entries or wants further information may contact the IRSE Minor Railways Section Document Co-ordinator at mrsdc@irse.org or via the IRSE Headquarters.

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1 INTRODUCTION

This document describes the layout and operation of mechanical points worked from a mechanical signal box or ground frame. It does not include the operation of points by a hand lever or pneumatic or power.

The purpose of this document is to disseminate best practice. Where possible reference's to regional variations on how to achieve the end product have not been included.

It is not intended to be a definitive document on how to design, install, test and maintain mechanically operated points.

All references to dimensions are included can be either imperial or metric as required. Where possible both the imperial and metric equivalent are stated, however this is not always possible, so the traditional dimensions will be quoted. The details in this guide are aimed at points that are to the standard British track gauge of 4'8½"or 1435mm.

The IRSE Minor Railways Section has used its best endeavours to ensure that the contents of this document are factually and technically correct and is suitable for its stated purpose but the IRSE Minor Railways Section cannot be liable for any subsequent use that the document may be put.

2 DEFINITIONS

A full description of terms used in the signalling and telecommunications Guidelines is contained in the Glossary available on the guideline section of the Minor Railways Sections of the IRSE website. The following is a list of the definitions not included in that Glossary:

Back Drive / Supplementary Drive	A second drive rod located between the first drive rod and the "heel" of the points. The purpose of which is to maintain the flange way (or free wheel clearance)
Detection	A means of proving that the switch rails are in the correct position and FPL is correctly locked
Detection Rods	The rods that connect the FPL and the ends of the switch rails to the detection equipment
Drive Rod	A rod that connects the drive mechanism to the switch rails, usually at the first stretcher bar
Facing Point Lock (FPL)	A device that is independent from the point drive and locks the points in the set position
Facing Points	A set of points which will divert trains from one track to another
FPL Stretcher Bar	The stretcher bar that the FPL acts on to lock the points
Heel of the Points	The fixed end of the switch rail
Indication Locking	Locking provided via a mechanical locking frame. The lever can only be placed in the normal or reverse positions when they have been detected electrically normal or reverse as appropriate. It is normally achieved by the use of a (NBDR) electric lock.
NBDR Lock	An electric lock that locks the point lever in four positions: • 'N' - in the normal position. • 'B' - at a point before the point lever can reach the normal position (nominally 1 ½ inches) and only effective when lever is travelling from reverse to normal. • 'D' - at a point before the point lever can reach the reverse position (nominally 1 ½ inches) and only effective when lever is travelling from normal to reverse. • 'R' – in the reverse position. The actual dimensions depend on the type of locking frame in use

Sole Plate	A metal plate that the stock rails are fixed to and maintains the correct gauge between them (also known as Stock Rail Gauge Tie) – generally the responsibility of the Permanent Way Engineer
Stock Rail	The fixed rail of the point
Stretcher Bar	A fixed length bar that joins the two switch rails together. The number of bars depends on the length of the point blades. Generally the 1st stretcher bar (which is different from the FPL stretcher bar) is the responsibility of the Signal Engineer, and the remaining bars are the responsibility of the Permanent Way Engineer
Switch Rail	The movable rail that switches the direction of the train (often called the point blade or tongue)
Toe of the Points	The movable end of the switch rail
Trailing Points	A set of points which join two converging routes. Note; some points, particularly on single line crossing loops, may be used as facing and trailing points depending on the direction of travel of the train
Under clearance	The gap between the top of the permanent way stretcher bar and the underside of the stock rail.

3 SAFETY CONSIDERATIONS

Before starting work on any point or FPL, inform the signalman and come to an understanding as to the work to be done. To ensure that the point does not move, insert a block into the open side of the switch; make sure that this is removed when the work has been completed.

Staff should wear personal protective equipment appropriate for the work being undertaken.

4 MINIMUM REQUIREMENTS

Full details of the minimum requirements for the operation of points can be found in the RSPG guides issued by the Health and Safety Executive, but in essence, if passenger trains are to be worked over points in the facing direction, they should be locked.

4.1 Typical Values

The following values should be used when testing points:

MEASUREMENT	TOLERANCE
Facing Point Lock “Pass” – Measured at Switch Tips	1.5mm
Facing Point Lock “Fail” – Measured at Switch Tips	3.5mm
Signal Detection “Pass” – Measured at 1st Chair	3.5mm
Signal Detection “Fail” – Measured at 1st Chair	5mm
Mechanical Facing Point Lock Port	50mm wide (max)
Mechanical Facing Point Lock Plunger Clearance (when withdrawn)	20mm ±6mm
Trap Point Clearance when point operated (at switch tip)	3.5mm max
Track Gauge	1435mm
Switch to Stock rail opening	102 – 120mm
1st Stretcher Bar under-clearance	6 – 9mm

5 MECHANICALLY OPERATED POINTS

Points are the means of switching trains from one track to another.

The point mechanism consists of:

- The switchable part of the track (the points).
- A means of moving the points to the required position.
- A means of holding the points in the required position

Additionally, there may also be the following:

- a means to lock the points in the required position (separate to the way in which the points are moved).
- a means to detect that the points (and lock if provided) are in the correct position.

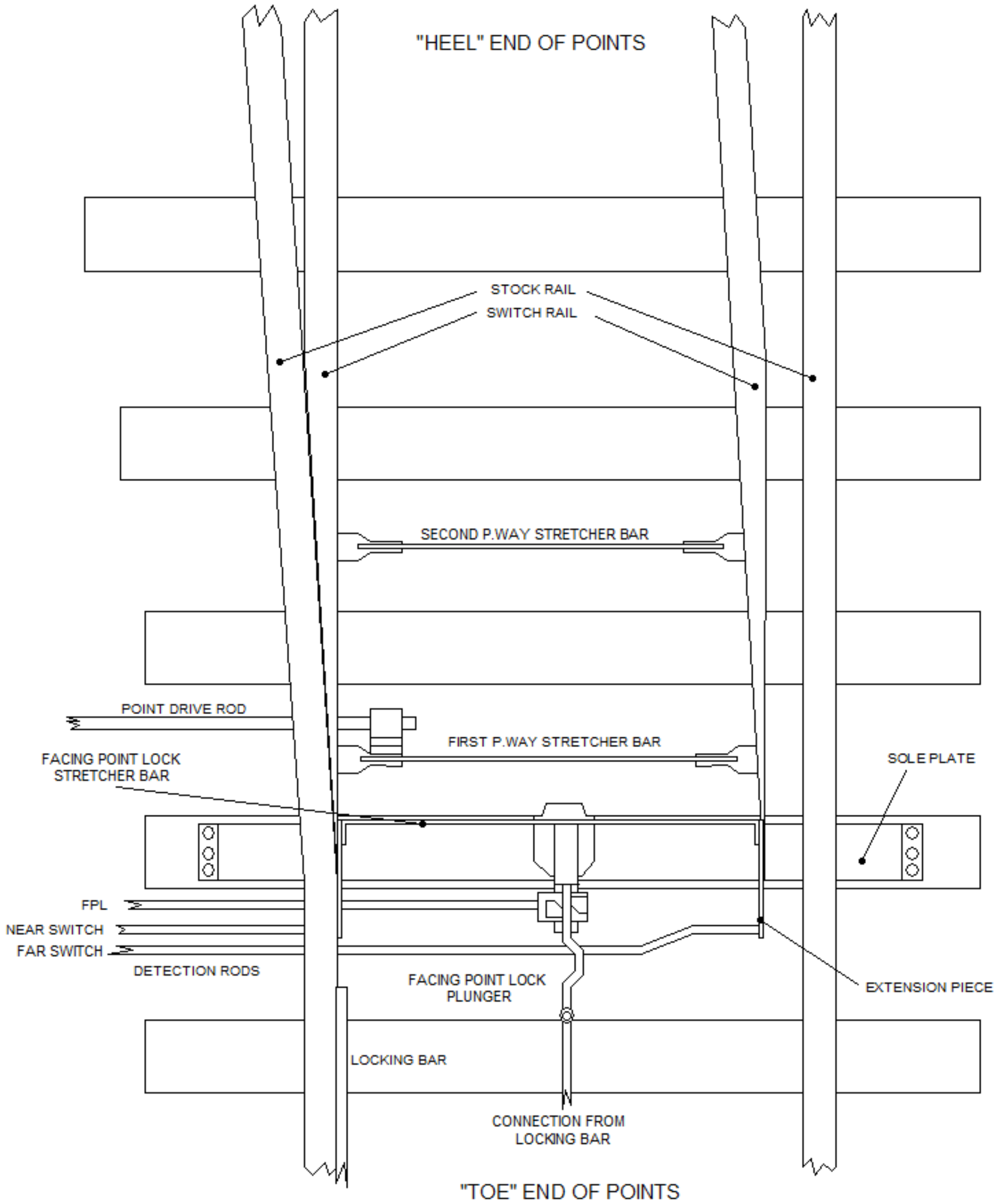
Mechanical points and FPLs are operated directly by rodding connecting the equipment to the appropriate lever in the signal box or ground frame. The point will be close to the signal box due to the force required to operate the weight of the points.

There is a requirement that all new installations of mechanical points MUST NOT be more than 350 yards from the operating lever. It is also recommended that facing points should not be more than 200 yards from the operating lever. This distance should be reduced if there would be excess effort required by the signalman to operate them, particularly where any rodding would be required to follow sharp curves in the track or require many cranks.

Dependant on the railway, the switch-able portion of the track is generally provided by the Permanent Way department, who are responsible for ensuring that it is in good condition and to the correct gauge. The opening between the switch rail and the stock rail at the toe of the points should be a nominal 4¼ inches (108mm) but may vary between certain limits according to the type of point layout.

The exact arrangement of the switch varies according to the length of the switch and the type of rails. Long switches require an increased number of stretcher bars and may have an additional drive along their length to ensure that the rails are smoothly curved without kinks. The drive, which is additional to the one at the toe of the points, is known as the back drive.

All points, regardless of their length, must have at least two Permanent Way stretcher bars; a third stretcher bar must be fitted if a facing point lock is required.



NOTE:
THIS ARRANGEMENT SHOWS A TYPICAL FACING POINT LAYOUT IN A NON TRACK CIRCUIT AREA.
THE POSITION OF THE RODDING etc WILL BE ARRANGED TO SUIT EACH SITE.

Figure 1 - Typical Facing Point Lock with Locking Bar

5.1a Point Numbering

Points are identified by the number of the lever that operates them. Two or more points may be operated from the same lever. To give them different names a letter suffix is added to the number, e.g. 12A and 12B. The letters are allocated so that the "A" end is the one nearest to the controlling signal box or ground frame.

5.1b Normal and Reverse Positions

The two positions of a set of points are known as “Normal” and “Reverse” and these correspond with the same positions of the lever or switch used to operate them.

Signalling plans and diagrams are drawn to show the lie of the points in the normal position.

Another way of describing the position of points, which may be shown on generic drawings and is often used during testing, is “Left (or Right) Hand Switch Closed” as viewed from the “four foot” in the facing direction.

5.1c Facing and Trailing Points

Points may be “Facing” or “Trailing” according to the direction of the trains over them.

- Facing points divert trains from one track to another
- Trailing points receive trains from one track or another

Many points will have trains running over them in both directions and so will act as facing or trailing accordingly.

5.1d Moving the Points

Points may be operated:

1. Manually, by the pulling or pushing of levers in a signal box or ground frame, which drives the points by rodding.
2. By machine, power being provided by an electric motor that operates the points through a gear and cam or escapement linkage
3. By a spring or other device which returns them to the normal position. This is used where the normal position acts as a “catch” to stop trains running away.
4. By a hand lever located next to the points. These are found within yards and sidings and are not usually part of the signalling system, although it is sometimes required to fit these points with detection.

It is possible for points to be operated by a combination of methods, particularly where back drives are used.

5.1e Holding the Points

In general, whatever drives the points also holds them in position. Manually operated points are connected to the operating lever by solid rodding, which should not bend or become slack. Motor operated points are driven through gears, cams and escapements, which create an effectively solid drive.

5.1f Locking the Points

Where it is essential that the points cannot be moved after they are operated, they are provided with a locking device. All points that are facing for passenger trains moves are provided with a facing point lock.

5.2 FACING POINT LOCKS

The facing point lock can be separate from the point drive or integral with it. All manually driven points have a separate facing point lock, normally worked from a separate lever in the signal box or ground frame. Some facing points will have an “Economical FPL” where the FPL and point are operated from the same lever. Here the points are moved by a sharped to hold the points locked when fully operated.

Motor operated points have the lock within the point mechanism, where a cam or escapement operated device locks the point drive when it reaches the end of its travel.

In order to prevent the movement of facing points under the wheels of a train, facing point locks (FPLs) are provided. A facing point lock stretcher bar is bolted between the tips of the point blades and passes through a slot in an FPL casting. Notches are cut in the stretcher bar, through which a plunger, operated by the appropriate lever in the signal box, is passed when the points are required to be locked. One notch is provided for each direction that the points are required to be locked. Points fitted with electrical detection require to be bolted in both positions. Figure 2 shows a standard FPL layout in a track circuit area.

Figure 2 - Standard Facing Point Lock

5.2a Facing Point Lock Gauge

The notches should be cut so that the bolt will not enter if the point blade is open by 3.5 mm ($^{1}/_{8}$ inches) or greater. The notch in the lock stretcher should be $1^{13}/_{16}$ inches wide, such that the smaller end of the FPL gauge (GO) will just fit into it. The larger end (NOT GO) of $1^{7}/_{8}$ inches (50mm) should not enter the notch. The notch should be no deeper than the shoulder of the “GO” end. When unlocked the clearance between the stretcher and the end of the bolt should be ¾ inch (20 mm) plus or minus ¼ inch (6 mm).

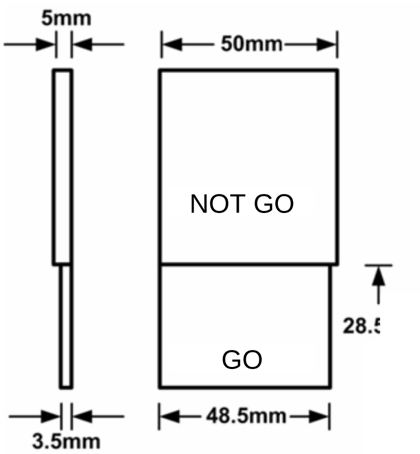


Figure 3 - Facing Point Lock G

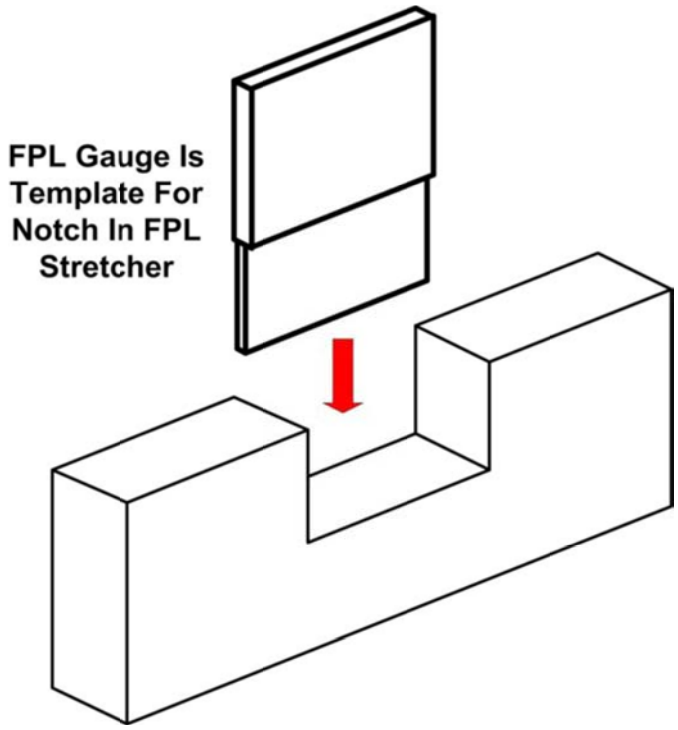


Figure 4 - Using the Gauge as a Template for cutting an FPL Notch

5.2b Locking the Facing Point Lock

The FPL must be prevented from unbolting the points as the train passes over them. This can be done in two ways, one mechanically and one electrically.

In the mechanical method, the plunger is driven by rodding through a 45 to 50 foot long lifting bar (FPL bar) fixed to the inside of the rail, ahead of the point blades. This bar is prevented from lifting, and therefore preventing the plunger from moving, by the wheels of the train passing over it.

The electric method is by using a track circuit through the points. The FPL lever in the signal box is fitted with and electric lock, which is prevented from operating when the track circuit detects a train. This will prevent the signalman from operating the lever.

5.3 DETECTION

The points shall have a means to detect that each switch is in its proper position in relation to the stock rail and that the points are bolted, before the protecting signal can be cleared. Each signalled move shall detect that the required switch is closed and that the opposite switch is open by the correct amount.

A maximum of three mechanical detector signal slides may be provided at each point end. If the number of signals reading over a single point exceeds this then electrical detection must be provided.

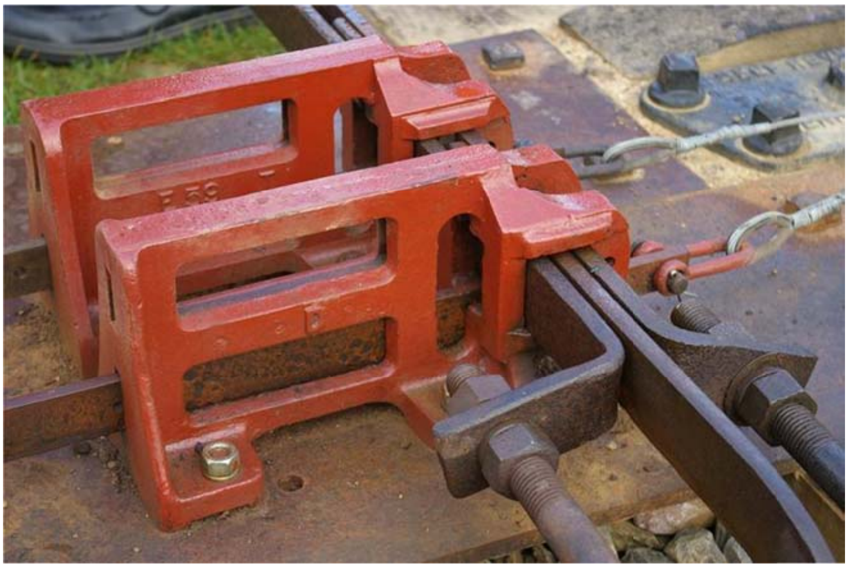


Figure 5 - Mechanical Detector

The maximum permitted distance between a signal and the furthest mechanical detector is 200 yards. Where this distance is exceeded, then electrical detection must be provided.

Figure 6 - BR Standard Electrical Detector

Electrical detection of mechanically operated points is only required where facing moves are possible. Electrical detection of power operated points is required for facing and trailing moves unless indication locking is provided when it is only required for facing moves.

5.3a Detection Requirements

Signal box manned for all movements		Main Running Signal		Shunt Signal	
		Mechanical	Colour Light or Motor Operated	Mechanical	Colour Light or Motor Operated
Facing - with FPL	Mechanical Detection	Either Mandatory	Not achievable	Optional	Not achievable
	Electric Detection		Mandatory	Optional	Optional
Facing – without FPL	Mechanical Detection	Either Mandatory	Not achievable	Either Mandatory	Not achievable
	Electric Detection		Mandatory		Mandatory
Trailing	Either Detection	Optional	Optional	Optional	Optional

Signal box not manned for all movements		Main Running Signal		Shunt Signal	
		Mechanical	Colour Light or Motor Operated	Mechanical	Colour Light or Motor Operated
Facing - with FPL	Mechanical Detection	Mandatory	Not achievable	Optional	Not achievable
	Electric Detection	Not Permitted	Mandatory	Optional	Optional
Facing – without FPL	Mechanical Detection	Mandatory	Not achievable	Either Mandatory	Not achievable
	Electric Detection	Not Permitted	Mandatory		Mandatory
Trailing	Either Detection	Optional	Optional	Optional	Optional

5.3b Adjustment

Mechanical point detector blades shall be maintained with a clearance of 3/32" (2.5mm) on each side of the signal slide.

The clearance between the notch face of the signal slide and the nearest blade should not exceed ½" for any detector not exceeding 25 yards from the signal. This is to allow for the effects of temperature changes in the wire between the signal and the detector. Where the signal to detector distance exceeds 25 yards then the clearance for the notch should increase by a rate of ¼" for every 25 yards (1 in 3600), up to a maximum of 2".

Where two or more detectors are provided in the same wire run, each notch should be cut to suit the distance to the signal.

5.4 RODDING

Point rodding can be round (tubular or solid) or channel.

5.4a Round Rodding

This is mostly of the solid type although there may be some hollow tube type still in use. Tube rodding should no longer be installed as new work or replacement. Only solid round rodding should be installed where this type is required. Round rodding is of $1^{5}/_{16}$-ins diameter and is supplied in lengths of 16 ft.

Lengths of tubular rodding are joined together by means of a screw thread plug in each end of the two pieces to be joined. One plug has a left-hand thread and the other has a right hand thread. The ends are then inserted in to a screw collar coupling which is tightened with pipe tongs or mole grips. The screwed plugs should butt up tightly to each other. This method can also be used for solid rodding where a thread is cut into the rodding. Alternatively standard gas type threads were used and the joint was prevented from moving by a tapered metal key or wedge hammered into a slot punched into each tube and a through a cast iron spigot joining both ends within the tubes.

For all new joints in tube and solid, the ends are formed into tags with two ½-in holes. The outer of the holes has a raised rim, which fits into a groove in the inner hole of the next piece of rodding. The two lengths of rodding are then bolted together using suitable sized ½-in BSW bolts. With this method, the rim around the hole and not the bolts takes the force of the rodding. This type of joint is known as Blackall's joint, having been designed by Mr A. T. Blackall, a former Signal Engineer of the Great Western Railway.

Both types of joints can be seen in figure 7.

To support the rodding, cast-iron rollers mounted in "anti-friction" cast-iron frames designed by Mr Blackall are used. To eliminate friction as far as possible, the bearing in the frame is elongated, the roller axis running or rolling on it, hence the term "anti-friction". The rollers are mounted 8 ft apart. A drawing of a roller frame can be seen in figure 8.

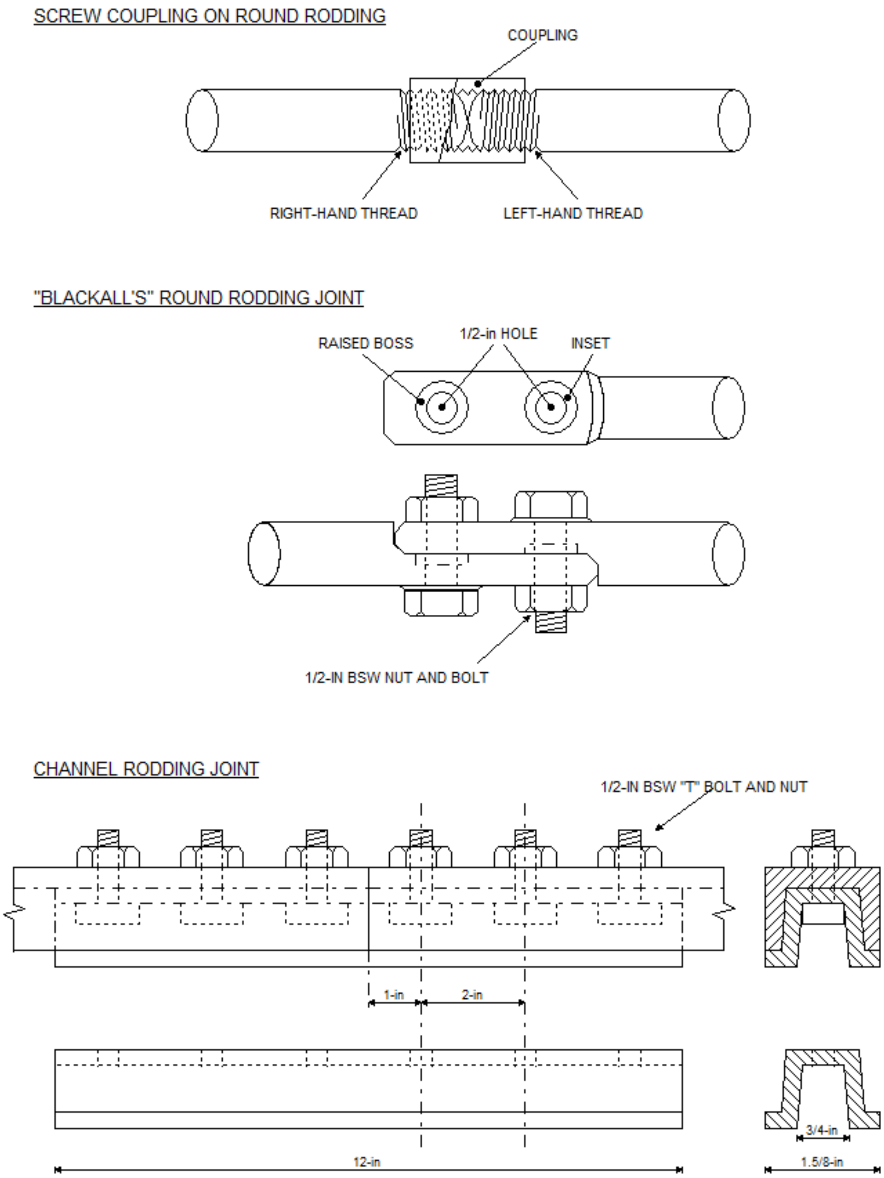


Figure 7 - Point Rodding Joints

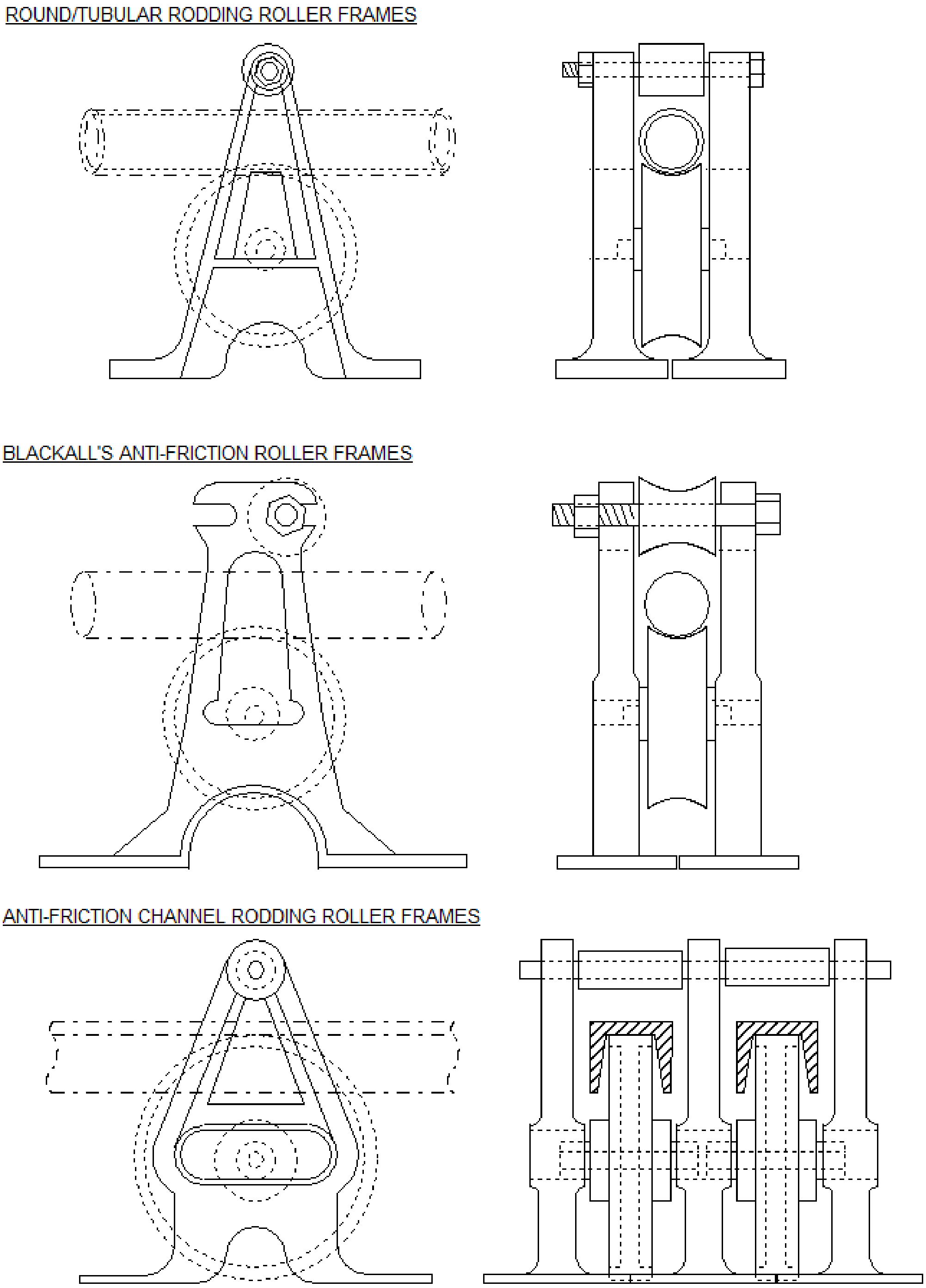


Figure 8 - Point Rodding Rollers

5.4b Channel Rodding

This is also known as channel iron as it was originally made of iron, but all modern channel rodding is now made of galvanised steel. It is $1^{5}/_{8}$-ins x $1^{7}/_{32}$-ins with the thickness of the metal being ¼-in, each length is 18 ft long.

Each end of channel rodding has three holes two inches apart, the first hole being one inch from the end of the rodding. Most modern channel does not include the middle hole at the end of each piece of rodding. Joints are made by using 12 inch long fishplates that fit inside the channel. Special “T” shape bolts, $1^{1}/_{8}$-in long with ½-in BSW thread, are fitted through the fishplates and the channel and secured with either square or hexagonal nuts.

A channel joint is shown in figure 7.

The rollers are of an “anti-friction” design in a similar manner to the round rodding, but are mounted 9 ft apart. A drawing of a channel roller guide is shown in figure 8.

5.4c Cranks

For changing direction of the rodding various types of cranks are used, fixed either vertically or horizontally as required.

Vertical, or pedestal, cranks are used under the signal box lever frame to lead the vertical rodding from the point lever to the horizontal rodding outside the signal box. A common size is 9-in or 10-in by 10-in, with the 9-in arm connected to the down rod from the lever. Other sized cranks may also be used. They should be secured to the locking room floor by means of two 6-in x ¾-in coach screws and two 8-in x ¾-in fang bolts mounted on opposite corners.

Horizontal cranks, are made for various sizes, the most common are 10-in x 10-in and 10-in x 15-in. Modern fixed cranks will be 12-in x 12-in. Adjustable cranks have one arm of fixed length, usually 10-in or 12-in and the other arm with an adjustable collar up to 17-in. When used inside the signal box, horizontal cranks should be secured in the same manner as vertical cranks. Outside, the cranks are normally bolted to a metal plate with ¾-in bolts; the plate is secured to reinforced concrete legs buried in the ground.

Accommodating cranks have fixed sides, usually 10-in x 10-in or 12-in x 12-in, but the sides are curved, capable of reaching around a higher crank base. This allows adjacent cranks and rods to be placed in close proximity. The sides are effectively a right angle.

Adjustable cranks are used where the amount of travel in a rodding run needs to be reduced or increased. This normally applies to the last crank in a run where the movement of the point has to be a fixed distance but the travel of the rodding may be different, particularly if there is wear in the rodding run.

Cranks have greasing points for maintenance.

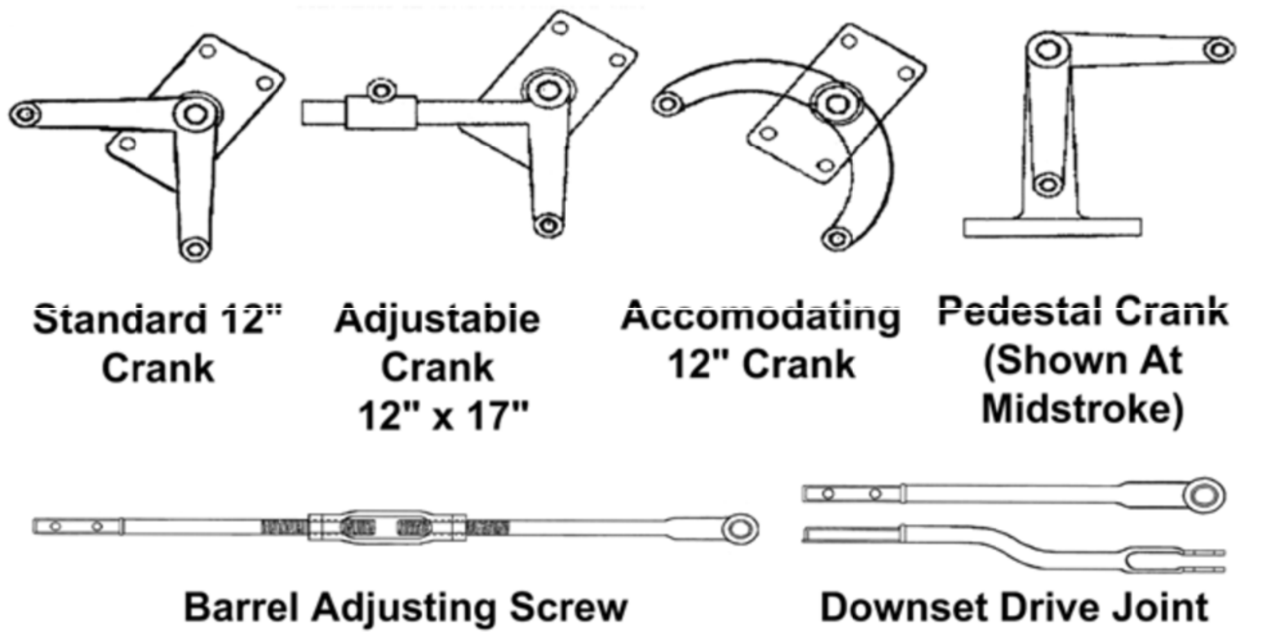


Figure 9 - Commonly used Cranks and Joints

5.4d Compensation

Point rodding, like all metal, has a fixed length depending on its temperature. A rodding run of 300 yards may expand by ¾-in for every 10° F rise in temperature. It will therefore be seen that even a short run may expand enough to make the point operation too tight in one way and too slack the other. To allow for this, some form of compensation for changes in temperature should be used.

Every rodding run has a fixed point; this is where it is connected to the lever. Assume that a continuous length of rodding is “pushed” to move the point or FPL. Should the temperature increase, the length of the rodding will increase. As one end is fixed, the end connected to the point or FPL will therefore try to move to overcome the expansion.

To overcome this, the far end of the run must also be considered as a fixed point, but the rodding must still be allowed expand and contract. This is done by dividing the run into equal lengths of “push” and “pull” so that the expansion or contraction is cancelled out.

Compensation can be carried out by the arrangement of standard cranks when a rodding run changes direction. To allow for compensation in a straight run, a special compensator crank is used.

Figure 10 - Standard Compensator

Figure 10 shows the principle of compensation in a single ended point, and how it can be achieved using standard and compensating cranks.

In cases where more than one pair of points are worked by the same rodding run, such as a crossover, separate compensation has to be applied to each connection. A simple example is shown in figure 12. It will be seen that the section of rodding between the signal box and the first point is compensated in the same manner as a single ended point. It will also be noted that the first compensator will compensate a portion of rodding beyond the first drive crank that is equivalent to the length of the first drive rod. This is known as the neutral point “N”. The remainder of the run to the far point is separately compensated by a second compensator.

When crank arms of unequal length are used, the rule that there must be an equal length of rodding in push and pull does not work; the lengths must be adjusted according to the ratio of the crank arms. In practice, cranks within the run are normally of equal arm size, eg 10-in x 10-in, only the last one connected to the final drive rod is usually a 10-in x 15-in adjusting crank.

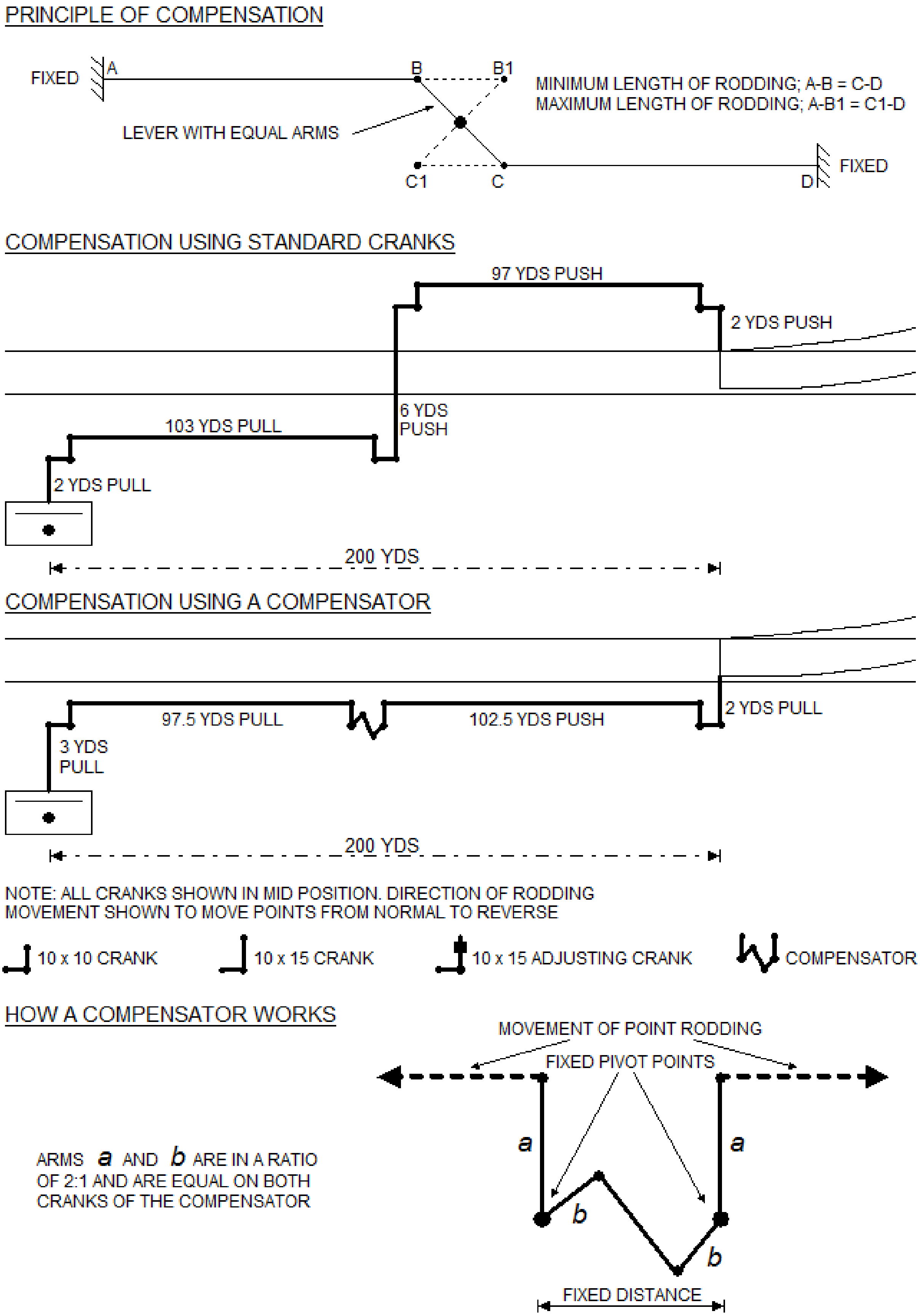


Figure 11 - Principle of Rodding Compensation

Refer to figure 10. Assuming that the travel from the lever to the last crank is $5\,^{1}/_{10}$-in and that the travel of the point is the normal 4 ¼-in; then with a 10-in x 15-in adjusting crank, the sleeve must be set at (4.25x10)/5.1 = 8.333-in, where 4.25 is the point throw, 10 is the fixed arm length and 5.1 is the travel of the rodding. It will be seen that the position of the neutral point with equal cranks would be the same length as the drive rod, i.e. 15 feet from the crank towards the signal box. With an adjusting crank, this will change to (15x10)/8.333 = 18 feet, where 15 is the length of the drive rod in feet, 10 is the length of the fixed arm and 8.333 is the setting of the adjusting sleeve.

For a crossover road, each end must be calculated separately, depending on the amount of travel of the rodding at the drive crank and the throw of the points.

The principle of compensation applies equally to facing point locks.

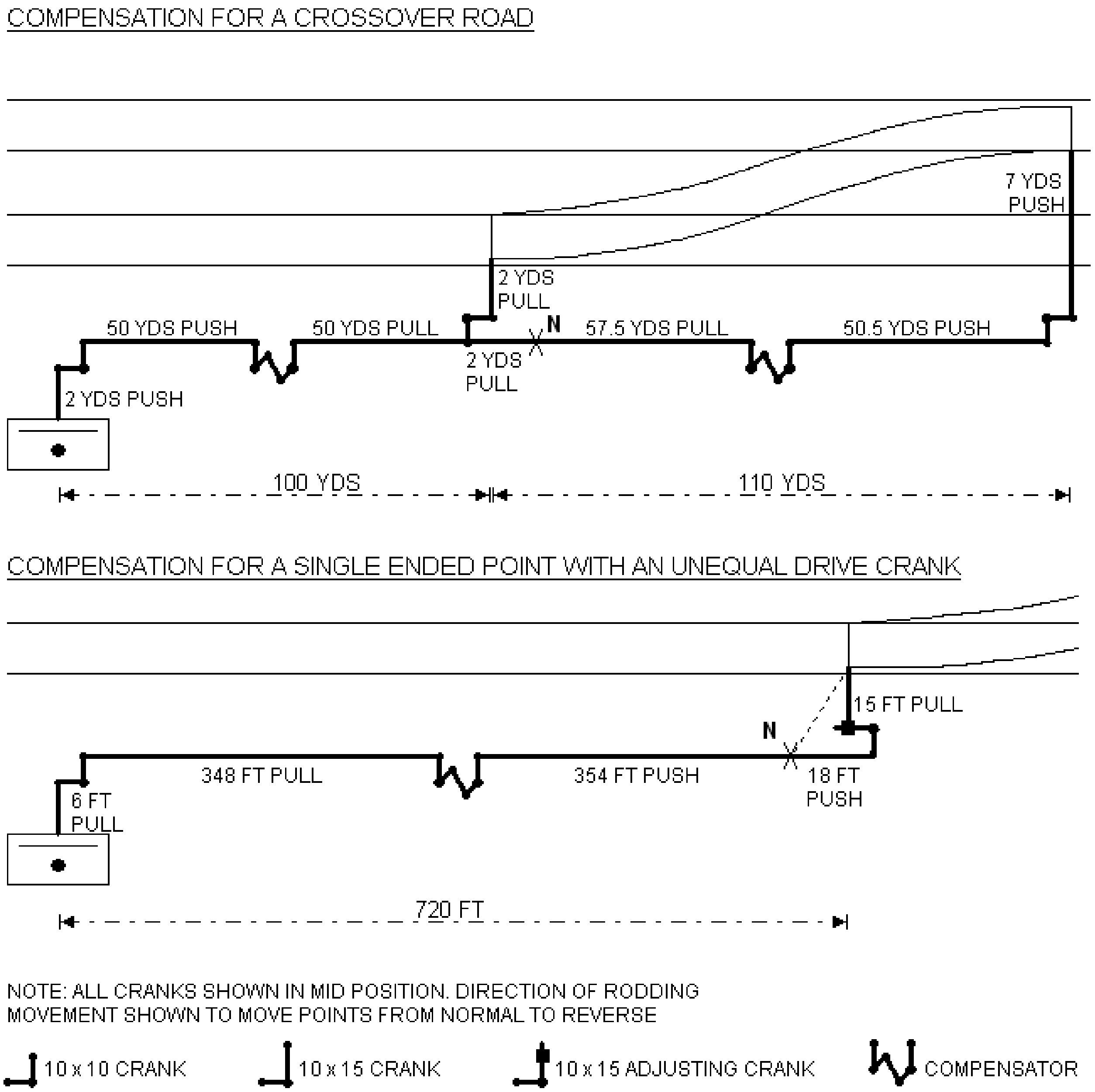


Figure 12 - Calculation of Rodding Compensation

5.4e Laying a Rodding Run

Rodding should be laid parallel and, where possible, in a straight line. In the case of channel rodding, the rollers are at 2 ¾-in from centre to centre while round rodding is at 2 ½-in centres. The rollers frames should be mounted on stools made of reinforced concrete although where access is restricted, the frames may be mounted on the sleeper ends. Stools should always be fixed as close as possible on either side of a crank or compensator ensure rigidity and to prevent the possibility of buckling.

The procedure to be used when installing a new rodding run is to lay the rodding out on the ground in its required position. The position of the roller frames should then be marked so that the joints of the rodding do not foul them and that they are no further apart than the maximum allowed.

The stool should be rigid, particularly if the rodding has to be curved to follow the lie of the track. When fixing a run on a curve, the loss of travel can be reduced in some cases by making a straight run to the compensator and another straight run from the compensator to the next crank. The angle at which the rodding leaves the compensator should be as little as possible. Stools should be buried so that to top is level with the top of the sleepers.

The run should be level with all rodding resting gently on the rollers. To test that a stool is not too high, it should be possible to lift the rodding slightly from the stool by hand.

The types of rodding should not be mixed in a run between cranks. If it is necessary to use both then the channel rodding should be taken all the way back to the signal box. Where rodding crosses a track, e.g. exit from a signal box to a “lead-off” on the far side of the track, round rodding may be used to the first set of cranks and channel rodding used for the main run.

When measuring for the length of rodding required, all cranks and compensators should be set for the mid position to ensure an equal amount of travel on each side of the crank. The length should be taken from centre to centre of the pin holes in the crank or to the centre of the rod coupling when the length terminates at an intermediate crank or at the end of the run.

Allowance should be made for the “bottle” adjusting screw in the drive rod from the adjusting crank to the point or FPL. The distance between the screw ends should be half the length of the opening in the “bottle”; this will allow equal adjustment both ways. This will apply to any situation where an adjusting screw is placed in a rodding run.

It may be necessary to make a set in the rodding where it runs under the rail or where it drops down from a run to a crank or compensator. A set may also be required where the rodding leaves the signal box to connect with the correct crank. The set should never be more than required, the maximum is 3 inches from the rod to the crank and a further 3 inches is permitted from the crank to a cross rod.

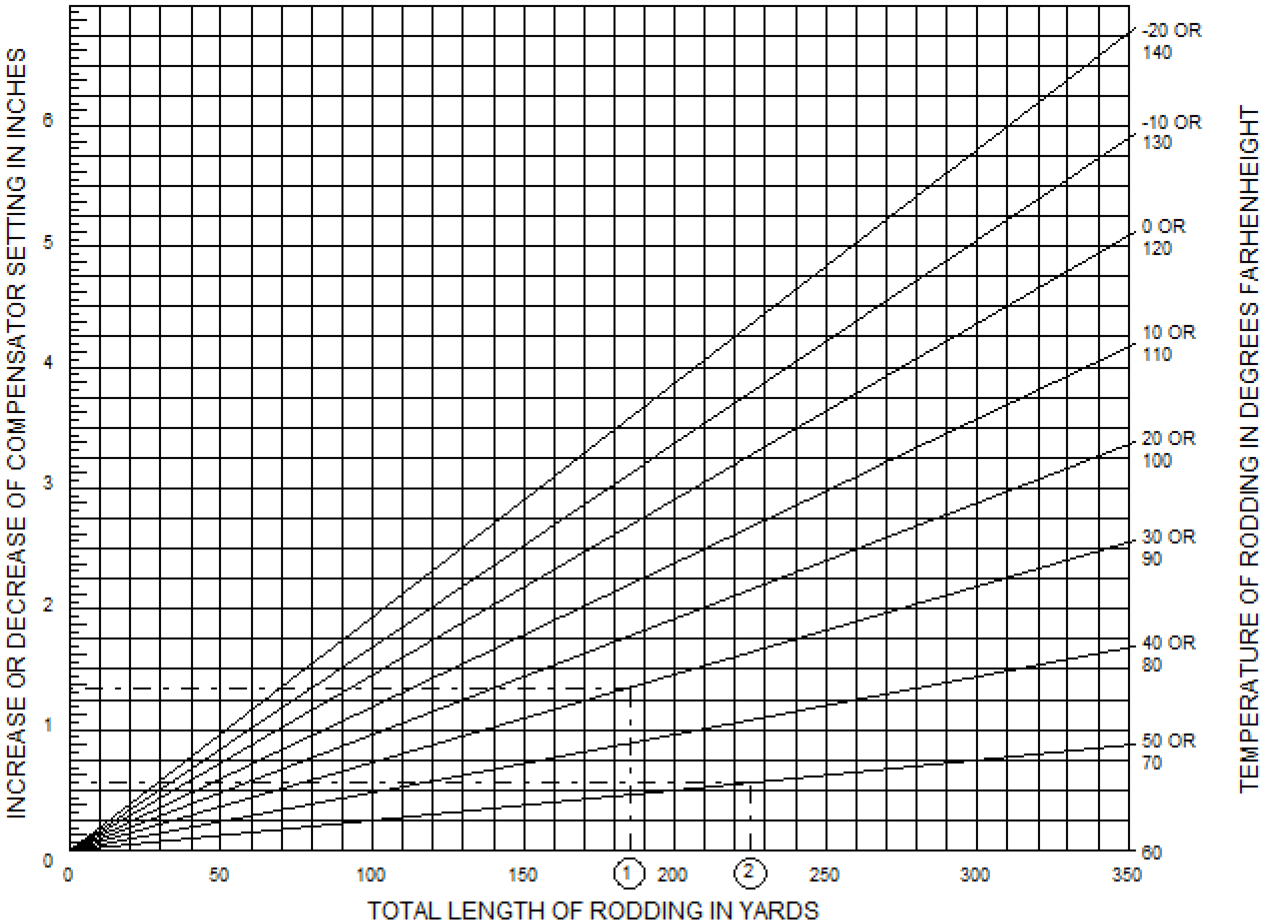
A set should be made in round solid rodding; it should never be made in hollow tube rodding and should be avoided in channel rodding. When it is required to drop from a channel rodding run to a crank or compensator, the set should be made in the solid rod “fast-end” connector. An intermediate set is permitted in channel rodding where, for example it has to go under or over an obstruction.

5.4f Setting of Compensation on Installation

It is obvious that point rodding connections cannot always be installed at the same temperature and, when fixing compensators, allowance must be made for the actual temperature.

At the standard temperature of 60^{O}F, the longer arms of the compensator should, at mid stroke, be parallel. If, at the time of installation, the temperature is lower than 60^{O}F, the arms of the compensator should be set outwards, the amount depending on the decrease in temperature. Conversely, if the temperature is above 60^{O}F then compensator arms should be set inwards by a corresponding amount.

Figure 13 shows the table of compensating for varying temperatures:



For a rodding temperature of 60^{O}F, the compensator arms should be set parallel. For temperatures below 60^{O}F, open the compensators arms by the amount shown. For temperatures above 60^{O}F, close the compensators arms by the amount shown.

For example;

1. Total length of rodding to be compensated is 185 yards. For a rodding temperature of 30^{O}F, the compensator arms should be opened by $1^{1}/_{32}$ inches.
2. Total length of rodding to be compensated is 225 yards. For a rodding temperature of 70^{O}F, the compensator arms should be closed by $^{9}/_{16}$ of an inch.

5.4g Lead-Off Bed

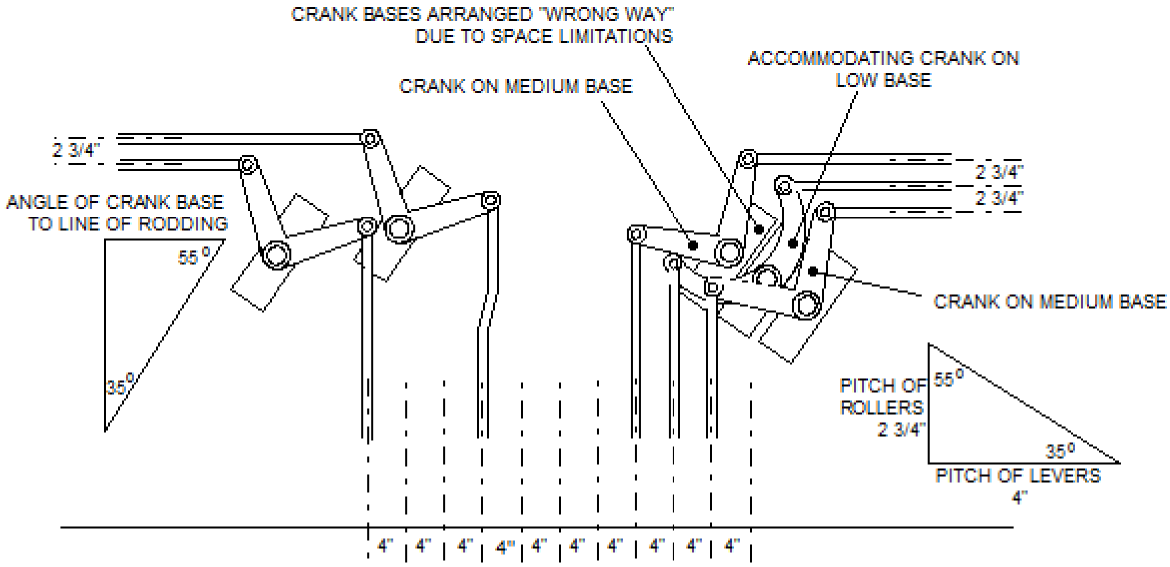
The lead-off bed is situated outside the signal box and is where the direction of the rodding from the signal box is turned through 90° to run parallel with the track. This may require a number of cranks close together. To do this, it will be necessary to mount them on bases of varying heights. Some of these may be accommodating cranks, where one of the arms on the lower cranks is curved so that it will not foul the base of a higher one.

The bases are made in three heights; low, medium and high although low and medium will be found sufficient for most purposes. The height from the bottom of the base to the centre of the crank for each is;

Low crank	3 ¼ inches
Medium crank	6 ¼ inches
High crank	9 ¼ inches

As the pitch of the rollers, and therefore the rodding, from centre to centre is 2 ¾ inches for channel and 2 ½ inches for round, the lead-off cranks must be fixed to allow for this and for the centre to centre distance of the rodding from the lever frame.

Figure 14 shows a typical lead-off bed where the levers are set at 4 inch centres. It will be seen that the cranks are fixed at an approximate angle of 35° with the front wall of the signal box.



FOR CHANNEL RODDING, CRANK BASES MUST BE SET AT 55 DEGREES SO THAT
THE MAXIMUM FORCE OF THE CRANK MOVEMENT IS ALONG THE LINE OF THE BASE

THEY SHOULD NOT BE SET AT ANY OTHER ANGLE UNLESS THERE ARE SPACE LIMITATIONS

NOTE:- FOR ROUND RODDING THE PITCH OF THE ROLLERS IS 2 1/2"
AND THE ANGLES WILL BE ADJUSTED ACCORDINGLY

Figure 13 - A Typical Lead-off Bed at 4 Inch Centres

Where the pitch of the levers is different than 4 inches then the angles will be adjusted to suit.

Some common lever pitch dimensions are;

- 4 inch – GWR Vertical Tappet; McKenzie & Holland (various); Saxby & Farmer Duplex; Westinghouse A2/A3
- 4 ¼ inch – Stevens (various)
- 4 ½ inch – Dutton; REC; Saxby & Farmer 1905 Duplex
- 4 $^{5}/_{8}$ inch – Stevens Knee
- 5 inch – LB&SC (various); McKenzie & Holland No 11 & No 16
- 5 ¼ inch – GWR Twist, Stud, Horizontal Tappet; Stevens (various)
- 5 ½ inch – LNWR Tappet, Tumbler; RSC Tappet; Tyers knee
- 6 inch – Midland Tumbler or Tappet

The run of the rods should be arranged as far as possible so that the outside rod, or the one nearest to the rail if the lead-off bed is on the opposite side of the track to the signal box, leads to the first point or FPL, the other rods following in sequence. This will avoid the need for rods to pass under a run.

The lead-off bed should be constructed from ½ inch steel plate mounted onto reinforced concrete legs buried into the ground. Except for the smallest lead-off, most will be about the same length as the frame and may require three or more legs to prevent movement. All legs should be as near as possible equal spaced along the lead-off bed, allowing for the position of the crank bases.

The cranks should be fixed by suitable size ¾ inch bolts and nuts with spring washers.

In some older locations, a timber lead-off bed may have been used. This should be 12 inch by 6 inch timber of suitable length. Bases should be fixed in the same manner as those under the lever frame by using two 6 inch x ¾ inch coach screws and two 8 inch x ¾ inch fang bolts mounted on opposite corners. Where previously used coach screws have become lose, it may be necessary to replace them with fang bolts.

Figure 14 - An Actual Lead-off Bed

5.4h Point Drive Rods

From the lead off-bed, the rodding is run as directly as possible to the point where it is connected to the fixed arm of the adjusting crank. The other arm is fitted with a sliding sleeve, which can be fixed at a varying distance from the crank centre.

Theoretically, with a nominal stroke of 8 inch at the lever and equal arm cranks in the run, a reducing crank would be required at the point to give a nominal stroke of 4 ¼ inches. A certain amount of stroke is lost due to friction etc and may become considerable when connections are worn. The adjusting crank will therefore compensate for this loss.

An adjustment screw is located in the drive rod from the crank to the points. This is used to alter the length of the drive rod so that the point blades fit tightly against the stock rails at each end of the stroke.

The point blades are tied together with at least two stretcher bars. The first of these is provided with a lug, onto which the drive rod is connected. The lug can be at the end or in the middle of the stretcher. When long point blades are used, up to five stretchers may be required. This will require an additional drive rod to ensure that the whole length of the point blade is against the stock rail. The back drive is connected to the last stretcher and can be taken from an intermediate connection off the main rodding run or from a second connection off the first stretcher.

6 MAINTENANCE REQUIREMENTS

6.1 Requirements

All moving parts of the points should be kept clean and lubricated at frequent intervals.

At periodical intervals the following should be checked;

1. Rodding Rollers – ensure the top pins are secure.
2. Rodding Stools – ensure secure in the ground.
3. Rodding – ensure that it is level and not in contact with rails. Ensure that the “T” bolts are tight.
4. Cranks and Compensators – ensure that all connections are secure, that the spindles are tight and pinned.
5. FPL – ensure that the casting is secure to the sole plate and that the plunger is not worn on the locking edge.
6. Lock Stretcher – ensure that the locking faces are not worn and that all the insulation is intact.

6.2 Maintenance Intervals

A full facing point lock test must be carried out at periodical intervals. If the plunger enters the notch, the points should be checked for the correct track gauge. Any problems with the track gauge should be reported to the Signal Engineer and the Permanent Way department.

To maintain the correct FPL gauge, a minimum amount of temporary packing may be placed between the lock stretcher and the point blade; this must be removed when the track gauge is adjusted.

An inspection and test should be made before running commences if there is a seasonal break and thereafter at regular intervals in accordance with a documented maintenance plan. The frequency of maintenance will be different for each railway concern, and the Responsible Engineer should make an assessment based on the following factors:

- Frequency and Weight of trains – if there are a lot of heavy trains then the points should be checked more frequently than a railway that runs an occasional DMU service.
- Local conditions – do the points need regular cleaning due to coal dust, sand, greasing, etc
- Number of adjustments that historically have been carried out.

6.3 Records

It is recommended that every test or adjustment is recorded on a record card or database. Generally the following items are recorded:

- Date of the test
- Who undertook the test
- Permanent Way Track Gauge
- Facing Point Lock Test Pass and Fail (both Normal and Reverse as appropriate)
- Detection Test Pass or Fail (both Normal or reverse as appropriate)
- Any Adjustments that were made
- Condition of the equipment

7 REFERENCES AND FURTHER READING

Any railway seeking to follow the guidelines in this document should ensure that it is suitable for their particular railway concern. Duty holders are reminded that they must be satisfied that they are doing all that is needed under health and safety duties to control risks. Compliance with this guideline issued by the IRSE is not mandatory as it provides advice on how an issue may be addressed. However, it is mandatory to comply with all relevant health and safety legislation.

IRSE Documents - see www.irse.org:

- British Railway Signalling Practice – Mechanical

ORR publications:

- Railway Safety Principles and Guidance Part 1 (1996)
- RSPG Part 2D - Guidance on Signalling (1996)
- The Railways and Other Guided Transport Systems (Safety) Regulations 2008 (ROGS) – A Guide to Safety Verification for Heritage Railways
- Railway Safety Publication 3 – Safe Movement of Trains
- Railway Safety Publication 4 – Safety Critical Tasks. Clarification of RPGS Regulations Requirements
- Railway Safety Publication 5 – Guidance on Minor Railways