

LONDON & NORTH EASTERN RAILWAY
(SOUTHERN AREA)

COLOUR LIGHT SIGNALLING

Including notes on signalling terms
and
methods of working ground frames

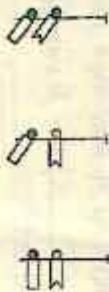
The following notes, explanations and diagrams are issued as a help to Trainmen and Signalmen and do not supersede in any way the Rules, Regulations and Appendix and other instructions issued from time to time.

COLOUR LIGHT SIGNALLING

Colour Light Signalling is a system by which signal indications are shown by high power electric lights only, instead of semaphore arms and oil lamps.

Equivalent Semaphore and Colour Light Signal Aspects.

SEMAPHORE.



COLOUR LIGHT.



Order in which Aspects are shown.



Fourth aspect (Double Yellow).

It is not always possible to provide sufficient braking distance between a signal showing Yellow and a signal showing Red, and in order to give a longer warning the signal preceding the signal showing Yellow is made to show a fourth aspect, known as Double Yellow. This Double Yellow aspect consists of one yellow light above the other.

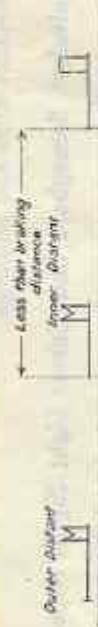
If the lamp of one of the Yellows failed the signal would show the more restrictive aspect of a Single Yellow and thus the failure of the lamp would not result in any loss of safety.

The Double Yellow has really the same meaning as an Outer Distant showing Caution, and the following example shows the equivalent semaphore signalling:—

COLOUR LIGHT SIGNALLING.



SEMAPHORE SIGNALLING.



Direction of travel →

Another important advantage is that the warning that a train will have to stop at the third colour light signal showing Red is a graduated warning. Thus it will occur at some places that a slow moving train will not require to apply the brake at the Double Yellow signal, but only at or closely approaching the Single Yellow signal. Drivers of fast moving trains or heavy unbraked trains will, however, act on the Double Yellow signal. In a few cases, where the line is exceptionally closely signalled, Drivers of ALL trains may have to act on the Double Yellow signal.

Meanings of Aspects—see Rule 43.

The meanings of colour light signal aspects are as under:—

- Red Stop.
- Yellow Proceed—prepare to stop at next signal.
- Double Yellow Proceed—pass next signal at restricted speed.
- Green Proceed.

It will be seen that in a *three aspect signal* the Green aspect indicates that the line is clear for two signal sections ahead; whereas in a *four aspect signal* the Double Yellow aspect indicates at least two sections ahead to be clear and the Green aspect that at least three sections are clear.

The following diagrams clearly indicate the difference between 3 and 4 aspect signalling:—

3-ASPECT.



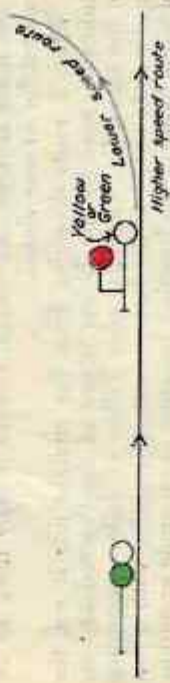
4-ASPECT.



Direction of travel →

Diverging Junction Signals.

At diverging junctions the signal in rear of the junction directing signals is usually arranged so that the Green aspect is only given for the route over which the higher speed is run, but in order to avoid an unnecessarily severe restriction for the slower speed route which would be caused by a Single Yellow aspect, the Double Yellow aspect is displayed. As the Double Yellow aspect means that the Driver must pass the next signal at restricted speed, he should have his train under control to take the junction for the diverging route. This arrangement is shown in the following diagrams:—

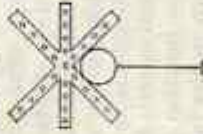


Directing Signals.

There are three methods by which diverging junction direction indication is given, namely:—

1. Separate signals placed side by side, usually stepped to indicate importance of route.
2. JUNCTION INDICATORS, which indicate direction by means of a row of white lights normally fixed above the signal and pointing to either the left or right, according to the direction of the route—See Rule 35 (c). No such indication is given when the route is set for the straight line or the Red aspect is shown.
3. ROUTE INDICATORS, which indicate the route to be travelled by displaying a letter or number.

In the case of Junction Indicators, as many as three routes to the left and three routes to the right can be displayed, which are indicated by the rows of white lights being fixed at angles of 45 degrees in the upper and lower quadrants and also at right angles to the signal post, thus:—



So many divergencies would, however, rarely have to be catered for at one signal.

When a route diverging from the straight line is set, the indication seen by the Driver is one of the Proceed aspects of the signal (i.e., Green, Double Yellow or Yellow, according to the state ahead of the line concerned) together with a row of white lights in the Junction Indicator at an angle according to the diverging route set.

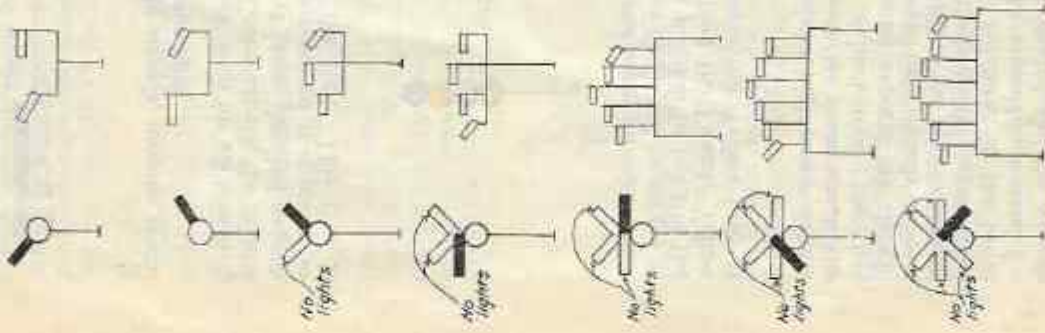
Typical examples of the use of the three types of directing signals are shown below:—

1. SEPARATE SIGNALS.

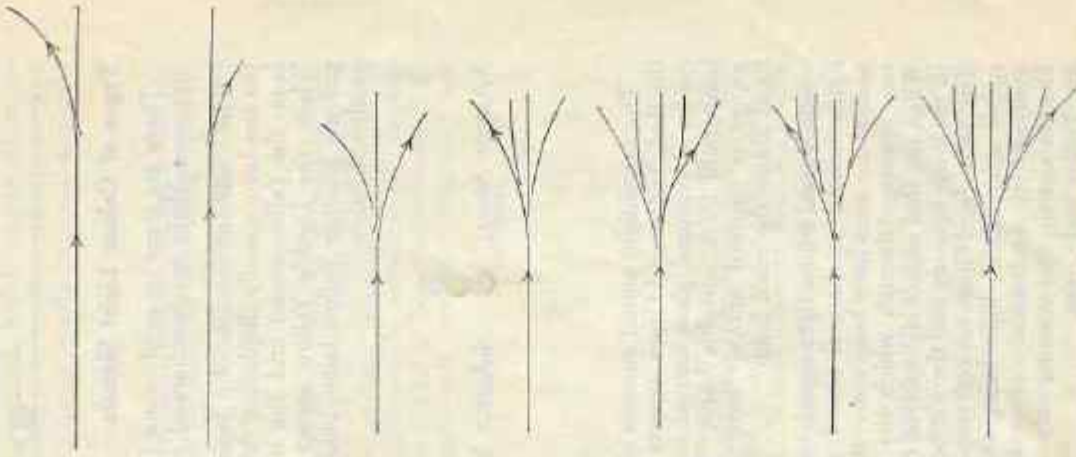


2. JUNCTION INDICATORS.

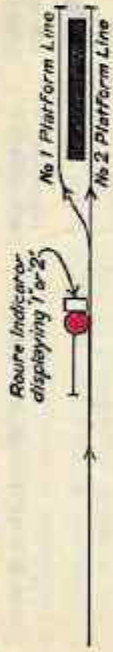
Junction indicator Semaphore equivalent



Route to which indication applies



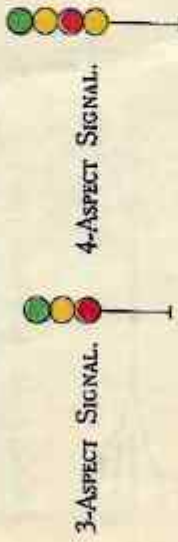
3. ROUTE INDICATOR.



Types of Colour Light Signals.

There are three types of colour light signals, namely, multi-unit, searchlight and mechanical colour light.

The multi-unit consists of a separate lamp for each aspect, the top lamp usually displaying the Green aspect, the middle lamp the Yellow aspect and the lower lamp the Red aspect. Where the Double Yellow aspect is required it is usual to provide another Yellow lamp below the Red. This type is as shown below.



3-ASPECT SIGNAL.

4-ASPECT SIGNAL.

The searchlight signal consists of one lamp through which the Red, Yellow and Green aspects are displayed by means of circles of coloured glass carried to a position in front of the lamp bulb by a movable vane. Where the Double Yellow aspect is required another lamp displaying Yellow only is fixed above the main lamp.

Mechanical colour light signals consist of high power electric lights behind mechanical signal spectacles from which the semaphore arms have been removed. A background plate has two openings through which the signal aspects are shown. When the Red aspect is displayed the red light usually appears in the lower opening and there is no light in the upper opening. The Yellow and Green aspects respectively are displayed in the upper opening, no light being then exhibited in the lower opening. If mechanical colour light signals are used for Distant signals, one opening only is provided and the aspects are Yellow and Green.

Background Plates and Hoods.

In order to provide an artificial background for colour light signals sighting plates are provided, which clearly show the light free from any surrounding interference. Hoods are also provided to prevent sunlight shining into the lamp and diminishing the strength of the light.

Height.

Colour light signals are as far as practicable fixed with the red light at 11 ft. 6 ins. above rail level, so as to bring the beam of light on a level with the Driver's eye, thus ensuring that Enginemmen get a good view of the signals.

Close-up Indications.

In order to give Enginemmen a view of a signal when the engine is standing close up to it, multi-unit signals are fitted with small side lights working in conjunction with the main lamps. With searchlight signals, segments or roundels are let into the lenses which cast a beam downwards and outwards towards the engine cab, and the following are examples:—

ROUNDEL.



SEGMENT.



Replacing to Danger.

Colour light signals are usually replaced to Danger as soon as the engine of a train passes them, this being accomplished by a track circuit joint, which is usually at the first or second rail joint ahead of the signal. Where, however, there are points ahead of the signal the replacing joint may be much nearer to the signal.

Identification.

Colour light signals are fitted with plates bearing letters and numerals for identification. Signals controlled from signal boxes bear the initial letter of the signal box concerned and the number of the controlling lever. Example: "B.20." Automatic and semi-automatic signals bear the letter "U" or "D" to denote an Up or Down line signal and the mile post passed before the signal is reached. Where there are two or more signals before the next mile post is reached, they

have in addition the letter "B," "C" or "D" after the mileage number. A typical example is:—



In the up direction, signals fixed between 21 and 20 mile posts would be plated U.21, U.21B, etc.

(See also "Automatic and Semi-Automatic Signals.")

Banner Repeating Signals.

Where, owing to local conditions, it is not possible to give a good approach view of a colour light signal, a banner repeater may be provided—see Rule 42. Banner repeaters consist of a movable black arm in a circular frame illuminated from the back. When the signal is "On" the arm is in the horizontal position and when the signal is "Off" the arm is in the upper quadrant position. Drivers should clearly understand that, when the banner repeater is "Off" the signal which it repeats may be showing any one of the Proceed aspects, namely, Yellow, Double Yellow or Green, and must be prepared to act accordingly.

Signals applying into Goods Lines, Yards or Reception Roads, etc.

Colour light signals applying into Goods lines, Yards, Reception Roads or other similar lines are fitted with small lenses to distinguish them from the Main running signals.

Subsidiary Signals (See Rules 44 to 47 inclusive).

Calling-on, Warning and Shunt Ahead signals under colour light signals take the form of a circular banner with movable red arm and the letter "C," "W" or "S." The horizontal position of the arm is the "On" indication and the upper quadrant position is the "Off" indication.

The following illustrations show the types of signal in question:—



Draw-Ahead signals under colour light signals usually take the form of disc signals.

The following diagrams illustrate the state of the section between two stop signals when the subsidiary signal under the stop signal shows "off" for a following train or engine:—

CALLING-ON SIGNAL.



WARNING SIGNAL.



SHUNT-AHEAD SIGNAL.



It is necessary in order to clear points X for a train to pass Box "A"'s starting signal at danger, whilst the section ahead may be occupied, as shown, or whilst it is clear.

DRAW-AHEAD SIGNAL.



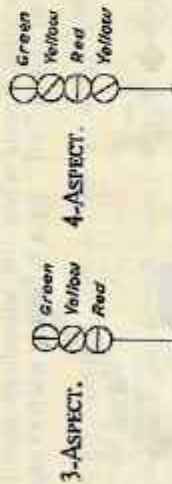
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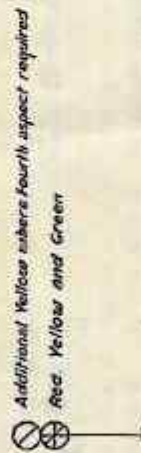
It is necessary in order to clear points X for a train to pass the Home signal at danger when the section may be clear, as shown, or it may be occupied.

Method of showing Colour Light Signals on Diagrams in Circulars.

Multi-unit type signals are shown thus :—



Searchlight signals are shown thus :—



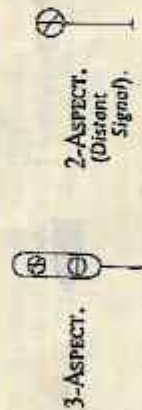
It will be seen that the lines shown in the circles indicate the aspect that can be displayed, that is to say :—

⊖ = RED.

⊙ = YELLOW.

⊕ = GREEN.

Mechanical colour light signals are shown thus :—



Repeating of Colour Light Signals in Controlling Signal Boxes.

MULTI-UNIT TYPE.

The aspect displayed by the signal is indicated by means of repeating lights in the signal cabin which actually repeat the lights of the signals.

SEARCHLIGHT TYPE AND MECHANICAL COLOUR LIGHT SIGNALS.

The "On" and "Off" position of the mechanism is repeated in the signal box, either by lights showing "Red", and "Off" or by a needle indicator.

In these cases the actual light of the signal is not repeated but double filament lamps are provided to guard against the possibility of lamp failure. Double filament lamps have two filaments, the main one being fixed in the centre of the bulb to give the best light, and the auxiliary filament being fixed as near as possible thereto. In the event of a failure of the main filament, the auxiliary filament immediately cuts in and as it is of greater power the loss of illumination due to it not being fully in the centre of the lens is in some measure compensated.

The lamps are frequently examined when any lamps where the main filament has been found to have burnt out will be replaced.

AUTOMATIC AND SEMI-AUTOMATIC SIGNALS.

Automatic signals are worked solely by the passage of trains over track circuits and are identified by rectangular plates with black band, thus :—



Semi-automatic signals are worked in the same manner, but they can also be controlled from a signal box, ground frame or level crossing. They are distinguished by rectangular plates with black band and the word "Semi" thus :—



TELEPHONES.

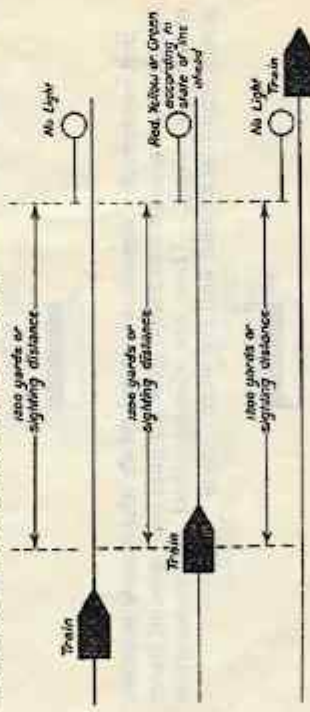
Telephones in communication with the signal box in advance are provided at all automatic and semi-automatic colour lights. As these signals are fitted with plates to denote the type of signal concerned no special sign is exhibited to indicate that a telephone is provided.

Some controlled colour light signals are provided with telephones in communication with the controlling signal box and in such cases a "D" sign is fixed to the signal post.

The telephone cupboards are usually fixed to the signal post or on the line side adjacent to the signal. The cupboards are labelled "Telephone" and are being painted in diagonal black and white stripes.

APPROACH LIGHTING OF COLOUR LIGHT SIGNALS.

It will be appreciated that where colour light signals are continuously lighted there is a heavy use of electrical energy and a strain on the lamp filaments; also where no power supply is available and the signals have to be lighted from batteries there is a considerable drainage on the batteries, rendering it necessary for constant recharging to be carried out. In order to reduce the current consumption and to give longer lamp life arrangements are made, where traffic conditions are suitable, to light the signals up only when a train is approaching and such signals are known as "approach lighted" signals. The lighting up of the signals is performed by the train itself when it enters upon a track circuit on the approach side of the signal. The signal light is extinguished after the train has passed the signal concerned. The following diagrams illustrate the arrangements:—



NOTES ON GENERAL RULES

Rule 55, Clause (g).

This clause deals with the method to be adopted when it is necessary to pass an automatic signal at Danger. As telephones are provided at all automatic signals the Enginemen,

after waiting the prescribed period (usually one minute in Suburban Areas and three minutes elsewhere) must use the telephone to communicate with the Signalman and act on the instructions received from him. The same method applies to semi-automatic signals.

It is essential that a clear understanding should be reached between the Engineman and Signalman, and in order to remove any doubt every message must be repeated by the man receiving it.

The telephones at Automatic and Semi-automatic Stop Signals are usually only equipped with apparatus to ring the Signalman and not for the Signalman to ring the person using the telephone at the signal, so that if the Signalman cannot at once give his authority to the Engineman to proceed, the Engineman must ring up the Signalman again after a few minutes have elapsed.

Automatic and semi-automatic signal telephones are also usually of the Selective type, which means that the telephones at several signals are all on one circuit to the signal box. Whilst the telephone at one signal is being used, the telephones at all the other signals on the same circuit show "Engaged" and cannot be used until the telephone being used is replaced in position in the telephone box; so it is essential that the telephone should be replaced after use. Up Line Signal telephones are nearly always on a separate circuit to Down Line Signal telephones, and in each case communicate with the box ahead.

After receiving authority to pass an automatic or semi-automatic signal at Danger, the Driver must understand that the signal may have been at Danger owing to a broken or misplaced rail or an obstruction on the line, of which the Signalman is not aware, and the Driver should be prepared to bring his train to a stand clear of any such obstruction. The signal may also have been held at danger owing to the signal ahead not going to danger after the passage of the preceding train. Drivers should also, as far as practicable, refrain from stopping their trains over catch points, and if there is a tunnel in the section, they must not unless specifically told by the Signalman that the line is clear through the tunnel, enter it until they have first ascertained that it is clear.

Although the line may be fully track circuited the need for tail lamps being carried by trains is still an important factor, as occasion may arise where it is necessary for a Driver to be authorised to pass an automatic or semi-automatic Stop Signal

and the train must be protected in the usual way, except that if no other line is affected it is not necessary for protective purposes for a Guard to go back beyond the first Automatic or Semi-automatic Stop signal in rear of the train, provided it is showing Danger. In the event of it being necessary for a second train or engine to approach from the rear to render assistance, the Guard who is protecting his train must after advising the Signalman at the box ahead by telephone of the circumstances, wait at the signal in rear to pilot the assisting train or engine to the rear of his own train.

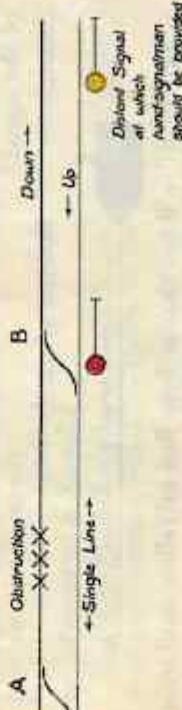
Rule 194 (c).

Although in normal circumstances during fog or falling snow a colour light Distant signal may not be fogged, arrangements must be made for a Fogman to be appointed during Single Line Working at a colour light Distant signal applicable to the obstructed line, which has to be observed by Drivers travelling over the Single Line in the wrong direction, as shown in the following diagram:—



Rule 200 (a), 2nd paragraph.

Except where an Outer Home signal is provided, a Hand-signalman should be appointed at a colour light Distant signal controlling trains approaching the Single Line to travel over that line in the right direction, as shown below:—



The necessity for the provision of this Hand-signalman is that there may be a very short overrun beyond the relative Home signal to the crossover road through which trains are crossed from the Single Line to their proper line.

at Danger, owing to a failure. There is then no positive assurance that the section ahead is clear and the possibility exists of the section being occupied by a standing or slow moving train.

Where side lights are in use, in the event of the main light of a colour light signal being out but the side light is showing an aspect other than Red, drivers must first bring their train to a stand and then proceed cautiously, being prepared to stop at the next signal if necessary. The circumstances must be reported at the next signal box or station.

Rule 81.

If a signal is held at danger owing to a failure of the signal or a failure of the controlling track circuit, a Hand-signalman must be appointed. If there is a telephone at the signal concerned the Hand-signalman must use this to obtain the Signalman's permission to authorise a Driver to pass the signal which has failed.

Rule 82.

If a Driver observes a colour light signal to be out when it should be illuminated he must treat it as a signal showing its most restrictive aspect (Red for a Stop signal, and Yellow for a Distant signal), and report the circumstances to the Signalman at the next signal box.

The Signalman must arrange for a Hand-signalman to be appointed as quickly as possible.

Rules 175 and 216.

Where Intermediate Block, Automatic or Semi-automatic Stop Signals govern the entrance to the section ahead and in consequence a setting back movement would alter the aspect of a signal or signals in the rear, Ballast trains must not be set back for even a short distance unless the Driver is in possession of a Wrong Line Order form issued by the Signalman. It is necessary to protect such trains whilst standing in the section, but where the signal in rear of the train is an Automatic or Semi-automatic Stop Signal the Guard need not go back beyond this Stop signal in rear of the train, provided it is showing Danger.

Rules 178-181.

Colour light signals must not be relied upon for the protection of a train stopped by accident, failure or obstruction.

Rule 215.

As Platelayers' trolleys cannot be relied upon to operate track circuits they must not be placed on the line until the permission of the Signalman at the box in advance on the line concerned has first been obtained. The telephone at a signal may be used for this purpose. After the Signalman's permission has been obtained the trolleys must be protected in accordance with Rule 215.

STANDARD RAILWAY SIGNALLING TERMS AND THEIR MEANINGS

The proper meanings of the following signalling terms are given for the guidance of the staff:—

Approach to a Signal.

This term (also the term "Approach side") defines position in relation to a signal where a train is approaching a signal, as shown below:—

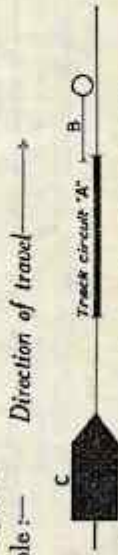


Train "B" is approaching signal "A."

Approach Control.

A control which prevents the "clear" or "caution" aspect of a signal being shown until the engine of an approaching train is within a predetermined distance on the approach side of the signal.

Example:—



Signal "B" will not change from Red to Yellow until train "C" occupies Track Circuit "A."

Approach Locking.

Electric locking which is effective whilst a train is approaching a signal showing a "proceed" aspect and which prevents

points or other signals being operated which would endanger the train.

Backlocking.

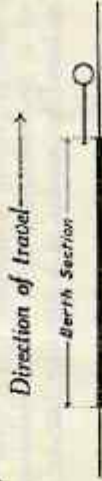
The locking of a signal lever to prevent it from being fully restored from the reverse to the normal position and consequently releasing any other levers interlocked with it until a release of this locking is given by the occupation and/or clearance of a track circuit, rail contact, etc. The lever can, however, be partially replaced to enable a Signalman to place a signal to Danger in case of emergency.

This arrangement is sometimes known as "Normal Checklocking."

Berth Section.

A section of track circuit on the approach side of a signal.

Example:—



Checklocking.

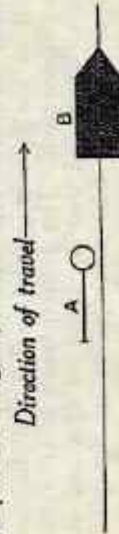
A control to prevent the full stroke of a lever in a signal box or ground frame until the apparatus controlled by the lever has completed its movement.

Dead Section.

A short non-track circuited portion of line in an otherwise fully track circuited area. They are usually found at places where one line crosses another.

In Advance of a Signal.

The definition of a position in relation to a signal where a train has passed a signal, as shown below:—



Train "B" is in advance of signal "A."

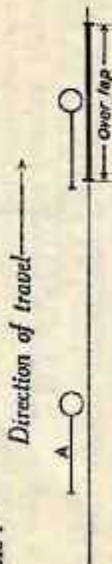
Normal Checklocking.

See Backlocking.

Overlap.

The section of line in advance of a Stop signal which must be clear before the Stop signal next in rear can show a Proceed aspect.

Example :—



Signal "A" (aspect of which is showing Red) cannot show Yellow until the overlap is clear.

Time Release.

A device used to prevent a movement of a lever until after the lapse of a predetermined time. Time Releases can be operated by hand by means of a winding handle, or automatically.

GROUND FRAMES IN AUTOMATIC AND SEMI-AUTOMATIC SIGNALLING AREAS

Electrically controlled ground frames working point connections with the running lines are usually worked by one of the three methods described below :—

1. Divided Track Circuit Control.

This method of control is adopted where there is a single trailing connection with one running line only and the running line is track circuited. The track circuit in the running line is divided at the fouling point (see "A" in diagram) with the siding connection. The ground frame lever working the points is so controlled that it cannot be operated until the track circuits on each side of the points are occupied. The operation of the point lever maintains the rear stop signal, or signals at danger.

The method of working is for the brake van, together with any other vehicles which are not required to be shunted into the siding, to be left on the approach side of the connection clear of the fouling point and for the front portion of the train to be run forward clear of the connection. The point lever is then free to be worked.

Care must be taken not to restore the point lever to normal unless the engine is standing on the running line, as if this is done it will not be possible to again operate the lever to let the engine leave the siding.

In some cases a separate lever is provided to maintain the protecting signal, or signals, at danger and in such cases care must be taken to see that the signal lever is restored to normal before the train departs on its journey.

This method does not require any control from a signal box and it does not allow a train to be shut in a siding for other trains to pass.



2. Approach Track Circuit Control.

This method is usually adopted where there is a crossover road between running lines or a connection between a running line and a siding crossing another running line, or where there is a trailing connection with one line only. Simple instances are shown below and in each case the running lines are completely track circuited :—



Levers are provided in the ground frame to place or maintain the protecting running signals at Danger so as to safeguard shunting movements requiring to pass through the point connections, and these levers are controlled by the track circuits on the approach side of these signals. This track circuit control is such that the signal levers cannot be fully replaced in the frame to free the point lever in front of an approaching

train. The track circuit control is freed from the moment that a passing train occupies releasing track circuits which commence immediately ahead of the controlling track circuits and are usually situated close to the points. The controlling track circuits and the releasing track circuits are indicated separately at the ground frame. It is, however, always possible, in case of emergency, to place the levers sufficiently far back in the frame to enable the signals to be placed at Danger.

The method of working is as follows:—

The signal control lever can be operated (a) when the protecting signal is at Danger due to the occupation of the track circuit ahead of it by the train which requires to work through the connections, or (b) when the protecting signal is at Danger due to the occupation of the track circuit ahead of it by a passing train not requiring to use the connections, or (c) when the approach track circuits are clear, or (d) when all the track circuits are clear.

All these circumstances ensure that there will be no reversing of signals in front of an approaching train.

Where a crossover or overcrossing is to be used it is, of course, necessary for the signal control levers for both running lines to be operated before the point lever or levers can be worked.

A failure of the approach control track circuits will prevent the signal control lever from being fully operated and as it may be necessary to carry out shunting movements during such failure an automatic time release is provided. This time release is set for a given period of time, usually between 1 and 2 minutes, and commences to operate when the signal control lever is placed in the checklock position, that is to say, back in the frame as far as it will go. After the expiration of the prescribed period of time the stroke of the lever can be completed. It is essential, however, that once the lever is in the checklock position it should not be moved until after the time release has operated, as if the lever is prematurely pulled back from and again placed to the checklock position it will be necessary to wait the full time period again.

One of the chief purposes of this time check on the stroke of the signal control levers is to prevent the point levers being freed until an approaching train is at a stand.

This method of control is sometimes applied to level crossings.

3. Electrical Control from Signal Box.

This method is usually adopted where there is a signal box within reasonable distance of the connections controlled from the ground frame and whether or not the line is track circuited. The ground frame levers are controlled by a release lever in the signal box and the signal box lever is interlocked with the other levers in the signal box so that it cannot be operated if any conflicting movement is signalled. A switch lever is provided in the ground frame, which is free to be moved at any time, and when operated it so locks the signal box release lever that the latter lever cannot be restored to normal until the ground frame switch lever is restored. This locking prevents the Signalman from restoring his release lever to normal before the work is completed. An indicator is provided at the ground frame to show when the Signalman has operated his release lever, provided the ground frame switch lever is reversed.

If the ground frame works connections protected by a semi-automatic signal a signal control lever is provided in the signal box, and is controlled by the approach track circuits, as set out in Method 2. The ground frame release lever in the signal box cannot be operated until this signal control lever has first been operated to place or maintain the signal at Danger.

A similar method of control is sometimes applied to level crossings.

Methods 2 and 3 usually allow of a train being shut in a siding for other trains to pass.

Detailed special instructions are exhibited at each of these ground frames and are specially drawn up to cover the working conditions at the particular places. These instructions should be carefully read and observed.

H. H. MAULDIN,

Superintendent, Eastern Section.

V. M. BARRINGTON-WARD,

Superintendent, Western Section.

Liverpool Street Station.

October, 1938.