

Williamsport & Susquehanna Division.

INSTRUCTION AND EXAMINATION ON SIGNALS.

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PRINCIPLES OF SIGNALLING.

It has been said by some,- and it may be the opinion of many, that our present system of signals are complicated and hard to understand. While this may seem true to a person not having occasion to look into the system, it is, nevertheless, a false conception; and if one will stop to consider the fundamental principles of our present signal system, he will find that they contain safety, simplicity, uniformity, and expediency.

There are four fundamental principles:-

First,- A signal imperfectly displayed, or the absence of a signal at a place where a signal is usually displayed, must be regarded as the most restrictive indication which can be given by that signal.

Second,- A red light, or an arm in horizontal position (other than a fish-tail arm), indicates stop, unless qualified by a more favorable color or angle of the arm.

Third,- A given aspect conveys the same information at

all places, at all times, and under all conditions; so that, an engineman, being familiar with the physical characteristics of the road and the location of the signals, is always obtaining the same information with any given signal aspect.

Fourth,- The signal must indicate where and when trains must stop, and what action is to be taken after stopping. It must indicate when, and under what conditions, train may proceed. It must also indicate when it is improperly displayed.

With this information given and properly used, an engineman can not only run safely, but can also make better time.

The first principle refers mostly to night indications, and is pretty thoroughly understood: If the active light on a stop signal is extinguished, the remaining light will be red which shows the most restrictive indication - Stop; if the active light on a distant signal is extinguished, the remaining light will be green, which shows the most restrictive indication of this signal - Caution.

The second principle is also thoroughly understood, having been used on interlocking signals for many years.

It was to cover the third principle - "a given aspect conveys the same information at all places, at all times, and under all circumstances" - that our present system was established. It is no longer necessary for an engineman to consider the geographical location of a signal before reading its indication, as, an aspect that means stop at one point is never used to indicate anything but stop at any other point; and a signal that indicates caution at one point because the next signal is at stop, does not, at another point, indicate a train in the block. Under the old system of signalling the distant signal and the one-arm home or the one-arm advance signal, when displayed at "caution", gave exactly the same aspect at night, although each signal had a different meaning, depending entirely on the signal's geographical location.

In accordance with the fourth principle,- an arm (other than a fish tail arm) in the horizontal position, or a combination of red lights, means "Stop"; if the arm has a round or a square end, or the red lights are vertical, the indication means -"Stop until authorized to proceed"; if the arm has a pointed end, or the red lights are in staggered position, the engineman is given the additional information that, after he has complied with the

"stop" indication of the horizontal arm or the red light, he may proceed carefully, expecting to find an open switch, a broken rail or the track occupied. In this way the signal indicates where and when the train must stop, and what action is to be taken after stopping.

To indicate when, and under what conditions, trains may proceed, we have three kinds of proceed signals, viz: the Caution, the Permissive, and the Clear.

Likewise, there are three classes of Caution signals:-

1. Those which indicate the track is clear to the next signal, and that that next signal is at Stop. (Automatic signals, and top and middle arms of home interlocking signals when advance signals are used)

2. Those which indicate the next signal is at Stop, but give no information as to occupancy of track between. (The ordinary Distant signal)

3. Those which indicate the next signal is at Stop, but give no information as to track occupancy, and also indicate a speed of not to exceed 15 miles per hour. (The bottom arm of the home interlocking signal, and the dwarf signal) This is the most restrictive signal under which a train may proceed.

The Permissive signal, which is an arm having a round end and a black circle on its face, displayed in diagonal position, or two green lights in horizontal position displayed in combin-

ation with one or two vertical red lights, indicates "proceed with caution", and also, by the round end and the black circle and by the two green lights, indicates that the block is not clear. Because of this second meaning, a passenger train must not proceed on a permissive signal.

There are also three indications of the Clear signal, each covering a different condition, calling for different action, and identified by a different aspect:

1. Those indicating the block is clear (The Home - or Advance, if used - Block Signal)
2. Those indicating track is clear to next signal and that signal in a proceed position. (Top and middle arms of Home interlocking signal when Advance signal is used)
3. Those indicating next signal is in a proceed position, but giving no information as to occupancy of track. (Bottom arm of home interlocking, dwarf signal, and Distant Signal in clear position).

A proceed signal at a home interlocking signal also indicates the speed at which a train may safely pass over the changeable conditions at the interlocking. The speed is designated by the location of the proceed signal with reference to other arms

or lights on the same mast. i.e., top arm or light means Authorized speed; middle arm or light, medium speed; bottom arm or light, low speed.

The speed so indicated applies only to the territory covered by the interlocking with which the signal is connected. No attempt is made to speed signal other restricted territory outside of interlocking limits.

Q U E S T I O N S A N D A N S W E R S .

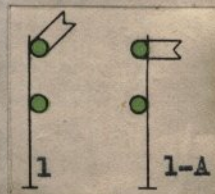
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THE DISTANT SIGNAL.

- 1. Q. What is a Distant Signal, and how is it identified?
 - A. A signal governing the approach to a switch, a home block signal, or a home interlocking signal. It is identified, by day, by a fish-tail arm on the face of which is a black stripe parallel with the end of the arm; by night, by two vertical lights, one or both of which will be green.

The One-Arm Distant Signal.

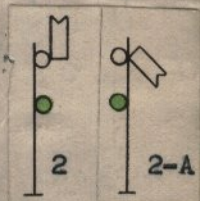
- 2. Q. What information is conveyed by this signal when displayed in the Caution position? (Figs. 1 and 1-A)
 - A. That a point is being approached where an absolute stop may be required. This point may be a facing point switch, an interlocking signal, or a block signal.



It indicates that the train must run prepared to stop at the next facing point switch, home interlocking, or block signal.

3. Q. When displayed in the Clear position? (Figs. 2 and 2-A)

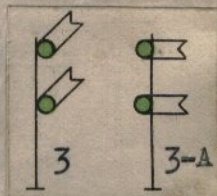
- A. That the switch (or switches) with which the signal is connected is in normal position; that the home interlocking, or the home block signal is in a proceed position.



The Two-Arm Distant Signal.

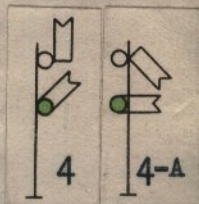
4. Q. What information is conveyed by this signal when displayed both arms at Caution? (Figs. 3 and 3-A)

- A. That a three-arm home interlocking signal is being approached and that this home signal (or the advance signal, if used) may be in Stop position, or a switch between the Distant and the Home Signals may be open.



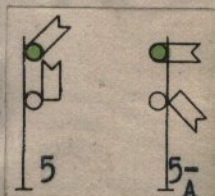
5. Q. When Top Arm is in Clear position? (Figs. 4 and 4-A)

- A. That the top arm (high speed arm) on the three-arm home interlocking signal which is being approached, is in the proceed position; that the advance signal (if used) is in a proceed position; and that all switches between the Distant and the Home signals are in normal position.



6. Q. When Bottom Arm is in Clear position? (Figs. 5 and 5-A)

- A. That the middle arm (medium speed arm) on the three-arm home interlocking signal which is being approached, is in the proceed position, and the advance signal (if used) is also in proceed position; and that all switches between the Distant and the Home signals are set normal.



NOTE- Distant Signals with fish-tail arms and vertical lights, as described above, give no information as to occupancy of the track, this information having been received at the last Block Station passed before reaching the Distant Signal.

10. Q. When in the Permissive position? (Figs. 7 and 7-A)

THE HOME BLOCK SIGNAL.

7. What is a Home Block Signal, and how is it identified?

- A. It is a fixed signal at the entrance of a block to control trains entering and using said block. It is identified by day, by square or round end arms; by night, by vertical lights.

The One-Arm Home Block Signal.

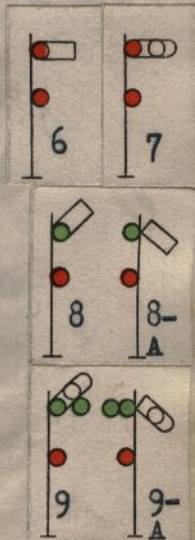
8. Q. What information is conveyed by this signal when displayed in the Stop position? (Figs. 6 and 7)

- A. That the train must stop until authorized to proceed.

9. Q. When displayed in the Caution position? (Figs. 8 and 8A)

- A. That the train may proceed expecting to find the next signal at Stop.

10. Q. When in the Permissive position? (Figs. 9 and 9-A)



A. That the block is occupied, and trains that are permitted by Rule to follow other trains into the block may proceed with caution.

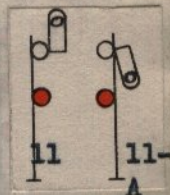
11. Q. If arm has square end and is in Clear position? (Figs. 10 and 10-A)

A. That track is clear to next signal, and that next signal is in proceed position, either Clear or Permissive.

12. Q. If arm has round end and is in Clear position? (Figs. 11 and 11-A)

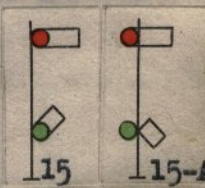
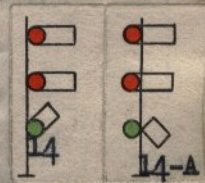
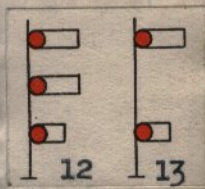
A. That the block is clear.

NOTE- The nights aspects of signals covered by questions 11 and 12 are exactly alike; but, as neither indication calls for any immediate action on the part of the engineman, confusion on his part as to the identity of the signal could not create a dangerous condition. In fact, as the conditions indicated by the two signals are similar, it is proper and desirable to have the aspects similar.



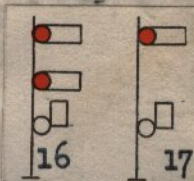
The Home Interlocking Signal.

13. Q. What is the Home Interlocking Signal, and how is it identified? (
- A. A fixed signal located at the point where trains are required to stop when the route is not clear. It has either two or three arms, and the same number of vertical lights; the arms may have either square or round ends. The two-arm interlocking signal is distinguished, at night, from the one-arm home block signal by the greater distance between the two vertical lights.
14. Q. What information is conveyed when this signal is displayed, all arms in Stop position? (Figs. 12 and 13)
- A. Train must stop until authorized to proceed.
15. Q. When bottom arm is in caution position? (Figs. 14, 14-A, 15 and 15-A)
- A. That switches are properly set and locked and train may proceed at low speed (not exceeding 15 miles per hour), prepared to find track occupied, or next signal at Stop.



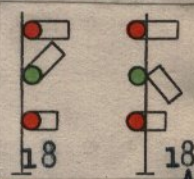
16. Q. When bottom arm is in Clear position? (Figs. 16 and 17)

A. That train may proceed at low speed (not exceeding 15 miles per hour) through the interlocking, expecting to find the next signal in proceed position.



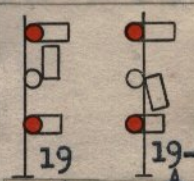
17. Q. When middle arm is in Caution position? (Figs. 18 & 18A)

A. Train may proceed at medium speed (not exceeding 30 miles per hour) providing Time-table restrictions do not require lower speed, expecting to find next signal at stop.



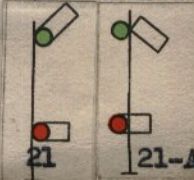
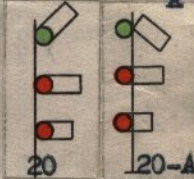
18. Q. When middle arm is in Clear position? (Figs. 19 & 19-A)

A. That train may proceed at medium speed, providing Time-table restrictions do not require lower speed, expecting to find next signal in a proceed position.

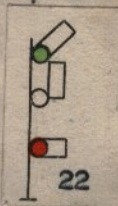


19. Q. When top arm is in Caution position? (Figs. 20, 20-A, 21 and 21-A)

A. That train may proceed at authorized speed, expecting to find next signal at stop.

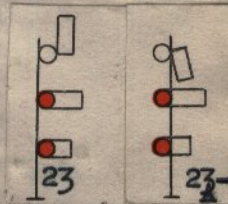


20. Q. When top arm is in Caution position, and middle arm in Clear position? (Fig. 22)



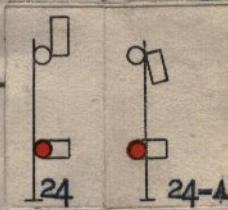
A. That train may proceed at authorized speed, expecting to find middle arm of next signal in a proceed position.

21. Q. When top arm is in Clear position?(Figs. 23, 23-A, 24, and 24-A)



A. That train may proceed at authorized speed, expecting to find next signal in a proceed position.

NOTE:- Where the Distinctive Permissive feature is applied to the Home Interlocking Signal, the indication then becomes Permissive instead of Caution, and it gives no information as to the position of the next signal. But, in cases of this kind, the next signal is far enough away to have a separate distant signal.



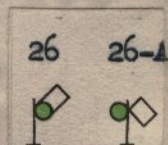
23. Q. When displayed in Clear position (Fig. 23)

A. Train may proceed at low speed, that route is not clear of current of traffic, and next signal is in proceed position.

NOTE:- Dwarf signals are used only on low speed routes or for movements made reverse to traffic through an interlocking.

The Dwarf Interlocking Signal.

22. Q. What is a Dwarf Signal, and how is it identified?
- A. A low fixed signal; identified by day, by a small arm, with square end, and a black stripe on face parallel with end of arm; by night, by one light, which may be red, green or white, according to position of arm.
23. Q. What information is conveyed by this signal, when displayed in stop position? (Fig. 25)
- A. Stop and stay until authorized to proceed.
24. Q. When displayed in Caution position? (Figs. 26 and 26-A)
- A. Train may proceed at low speed, prepared to stop, expecting to find track occupied or next signal at stop.
25. Q. When displayed in Clear position? (Fig. 27)
- A. Train may proceed at low speed, that route is set with current of traffic, and next signal is in proceed position.



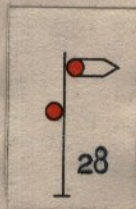
NOTE:- Dwarf signals are used only on low speed routes, or for movements made reverse to traffic through an interlocking.

AUTOMATIC SIGNALS

26. Q. What is an automatic signal?
- A. A block signal that is operated by electric, electric pneumatic, or other agency, actuated by a train in the block, or by certain conditions affecting the use of the block.
27. Q. How is an automatic signal identified?
- A. An automatic signal has either one or two arms with pointed ends; two lights in diagonal or staggered position.

The One-Arm Automatic Signal.

28. Q. What information is conveyed by this signal when displayed in the Stop position? (Fig. 28)
- A. That train must come to an absolute stop, and then proceed carefully, expecting to find an open switch, a broken rail, or the track occupied.



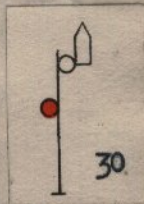


29. Q. When displayed in the Caution position? (Fig. 29)

- A. That one block is clear, and train must proceed expecting to find the next signal in Stop position.

30. Q. When displayed in the Clear position? (Fig. 30)

- A. That block is clear, and that next signal is in the proceed position. Indicating, in reality, two blocks clear.

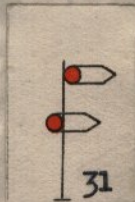


The Two-Arm Automatic Signal.

31. Q. Under what conditions would a two-arm automatic signal be used?

- A. It would be used as a distant signal to a home interlocking signal in automatic territory where the home interlocking signal has three arms; also in automatic territory where it is desired to give indication for three blocks ahead.

32. Q. What information is conveyed by this signal when both arms are in stop position? (Fig. 31)



- A. That train must come to an absolute stop, and then proceed carefully expecting to find an open switch, a broken rail, or the track occupied.
33. Q. What information is conveyed when top arm is in Caution position, bottom arm horizontal? (Fig. 32)
- A. Track is clear to next signal, train may proceed, expecting to find next signal at Stop.
34. Q. When displayed top arm at Caution, bottom arm at Clear? (Fig. 33)
- A. Track is clear to next signal, train may proceed and be prepared to pass next signal at medium speed.
35. Q. When displayed, top arm in Clear position, bottom arm horizontal? (Fig. 34)
- A. Track is clear to next signal, and next signal is in the proceed position, thus giving clear block indication for at least two blocks.

