



Pre – Course Workbook

ZKL 3000 RC User - Delegate Pre-Course Workbook

The purpose of this Workbook is to provide delegates who are due to attend a ZKL 3000 RC User course with a refresher on the fundamental requirements for using a conventional Track Circuit Operating Device (TCOD).

The pre-requisite for attending the ZKL 3000 RC User course is COSS. It is strongly recommended that you review this workbook and complete the knowledge check questionnaire prior to attending the ZKL 3000 course.

Once you have read through the material, complete the questionnaire at the end of this workbook. It is recommended that you refer to the relevant Rulebook Handbook modules in association with this.

The handbooks are referenced below:

HB6 General Duties of an IWA

HB7 General Duties of a COSS

HB8 IWA, COSS or PC Blocking a Line

If you have any questions regarding the content of this workbook, these can be raised during your course with the trainer.





Line Blockages



- The person responsible for arranging a line blockage must be an COSS or IWA competent in handbooks 6, 7, 8, 9, 10, NR/L2/CTM/021 and NR/L2/OHS/019
- Using additional protection should always be considered when planning a line blockage.
- Line blockages without additional protection should only be considered where it is not reasonably practical to arrange additional protection and only when the work does not affect the safety of the line
- Certain tasks in the Rule Book will affect the safety of trains. A Line Blockage must be taken for these tasks.
- Line blockages can be of “Between trains” or “Complete stoppage of trains” types which can be planned in advance using either Possession Planning System (PPS) or NR Green Zone Access Coordinator (GZAC)
- A COSS may create a Line blockage (“Between trains”) at site for unplanned circumstances.

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Work which requires the line(s) to be blocked, but can be carried out “between trains”, must be:

- Planned in advance;
- Done at a time which will cause the minimum interference with the passage of trains;
- Whilst pre-planning is preferred, a COSS can make a lineside request for a line blockage if there has been a change to an original plan;
- When work requires the complete stoppage of all trains, the person planning the work must agree with the appropriate Network Rail Production Department;
- The line(s) on which the protection will be required;
- The location(s) at which the protection will be provided;
- The time at which the work will start and the time by which it must be completed;
- The locations(s) where the work will be taking place.



Agreement for a Line Blockage



The COSS will confirm that their activity is permitted for this type of protection.

COSS must agree the arrangements with the Signaller as follows:

- GZAC/WON reference number (if applicable)
- Line(s) to be blocked.
- Nature of work.
- The locations between which the work will take place.
- Amount of time needed to do the work.
- The time after which permission can be given for the line blockage to start.
- Which signals will be kept at danger to protect the activity.
- The additional protection to be used.
- If the work will take place beyond points that need to be used for train movements.
- The arrangements if single line working is in place.
- The arrangements to apply at each level crossing.

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This is what the COSS needs to agree with the Signaller before permission can be granted to take a line blockage.

When a line must be blocked

If as described in handbook 6 or 7, it is necessary to block a line, as long as there are no trains or On Track Plant (OTP) involved on the line concerned, you must carry out the instructions shown in this handbook.

However, if you are to work in a possession, you must carry out the instructions shown in handbook 9.



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Means of Communication



- Adequate means of communication between you and Signaller must be available at all times while the activity is taking place.
- If the work is planned, the existing communication arrangements must be reviewed at the planning meeting to make sure enough telephones (including mobile phones) or radios will be available.
- You must make sure facilities are available that allow you to communicate with Signallers during the activity.
- If the communications fail during the test, you must not allow the work to start.
- Before the work starts, you must test the communications.

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Work Less than 200m/220yds Beyond Protecting Signal



- Normally your site of work must not be closer than 200m to the protecting signal.
- If work that will affect the safety of the line must be done within this distance,
- You must tell the Signaller and the following must apply.
 - The previous signal must be kept at danger.
 - Trains may go beyond that signal only as shown in the following diagrams.

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Hand Danger Signal to be Displayed



- The COSS must arrange for a hand danger signal to be displayed if:
 - The work affects the safety of trains approaching on the line concerned, or
 - The work is being carried out by a group at a site of work.
 - Line blockage with additional protection if the work affects the safety of trains
- The handsignal must:
 - Be placed on the ground in the “four foot” where it is clearly visible to the driver of any train approaching the site of work in the direction(s) from which trains normally approach.
 - You must do this in both directions if:
 - You are working on a single or bi-directional line
 - Single line working is in operation on the line concerned

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The COSS must arrange for a **Hand Danger signal** to be displayed if:

- The work can affect the safety of any approaching train, or
- A group is working in the protected area.

Note: If the work affects the safety of the trains additional protection is required and therefore a Hand Danger signal must be deployed.

You must make sure that the red flag or light is placed in the four foot where it will be clearly visible to the driver of an approaching train on that line.

You must do this in both directions if:

- You are working on a single or bi-directional line;
- Single line working is in operation on the line concerned.

Note: There is a Certificate of Derogation 10/202/DGN to Handbook 8. Which states that you do not need to place a hand danger signal when a COSS takes a line blockage (without additional protection) and is working in a group, if the activity is confined to patrolling or other mobile tasks such as inspecting or examining or a faulting situation where it is impractical to return to remove a red flag/light on the approach to the work group.

Also a COSS taking a Line Blockage in order to pass through a restriction would not, by the very nature of their activity, be able to recover any flag or light when seeking to give the Line Blockage back. It would not be reasonably practical to employ additional staff to remain at the each flag/light when taking a Line Blockage purely to undertake the task of removal when giving the Line Blockage back – and this would introduce risk to the individual(s) concerned.



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The COSS can then give the necessary permission for work to start, after briefing staff using Record of Arrangements and Briefing Form RT9909.

A simple method of stopping trains on the affected line and thus providing track worker protection is by the placing of a signal on the affected line to danger.

Additional protection provides a higher level of track worker safety as it requires two people to create or remove the additional protection using a track circuit operating device.

Where authorised in the sectional appendix, you can use a track circuit operating device (T-COD) as long as the signalling equipment is working normally.

The work that is to be carried out must not affect the correct operation of the track circuit concerned.

You must get the signaller's permission before a T-COD is placed on the line.

You must tell the signaller when the T-COD has been applied.

Protection is provided by the signaller using fixed signals, in the same way that a train is protected.



Line Blockage by A Single Line Staff or Token



Protection by:

- COSS being in possession of Token or Staff.
- On Absolute or Tokenless block lines with signal protection only, the Signaller will arrange for block indicators and acceptance switches to be placed in the correct position.
- If work will affect the safety of trains on an Absolute or Tokenless block line then one of the four methods of additional protection must also be used.



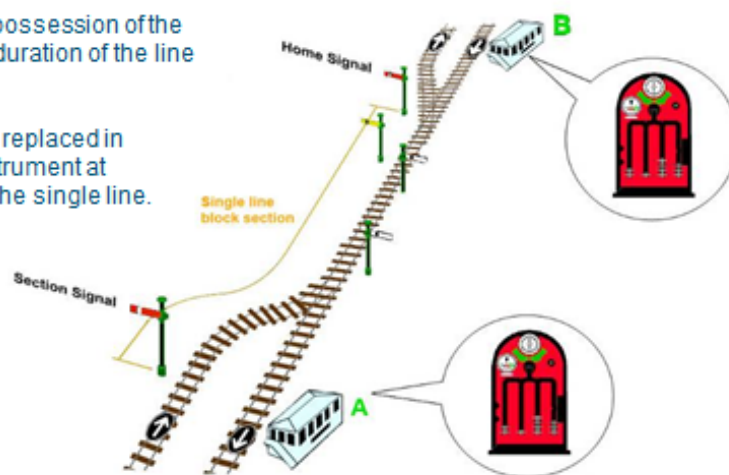


Single Line – Directional Token Working



COSS takes possession of the token for the duration of the line blockage.

Token can be replaced in the Token Instrument at either end of the single line.



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The COSS must endorse Appendix B of the Line Blockage form when either:

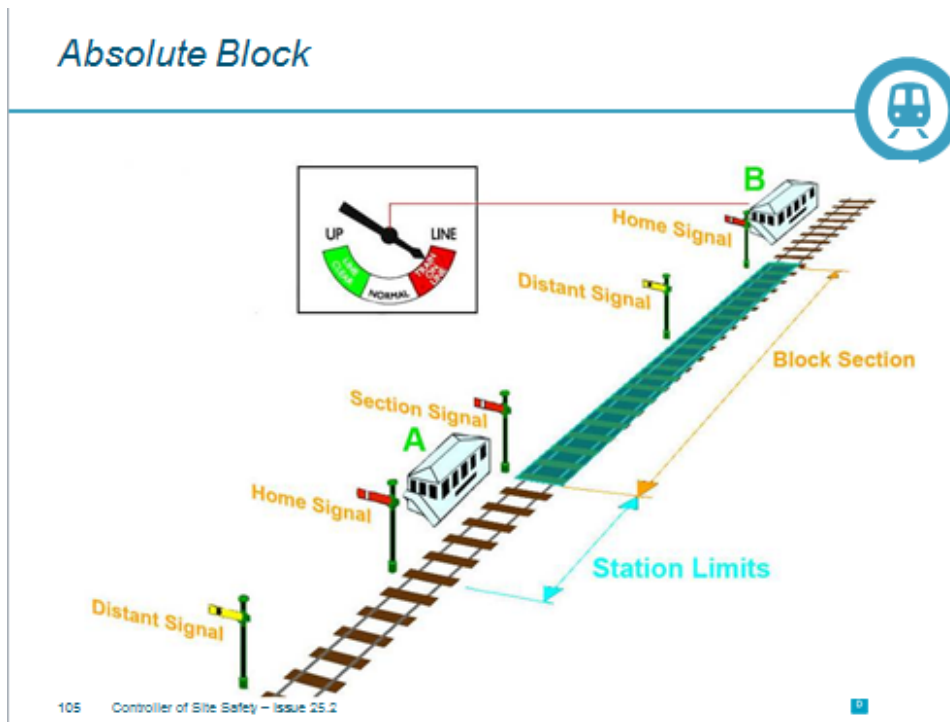
- The Token is given to the COSS **or**;
- Release is given for the COSS to obtain the Token; the signal box does **not** have to be opened specially in order for the COSS to be given the Token.

It is no longer usual for signal boxes to be left unlocked when it is closed so that a COSS can gain entry to obtain the token. Where it is necessary, local instructions exist.

The COSS must keep the Token until the work has been completed or suspended.



Absolute Block



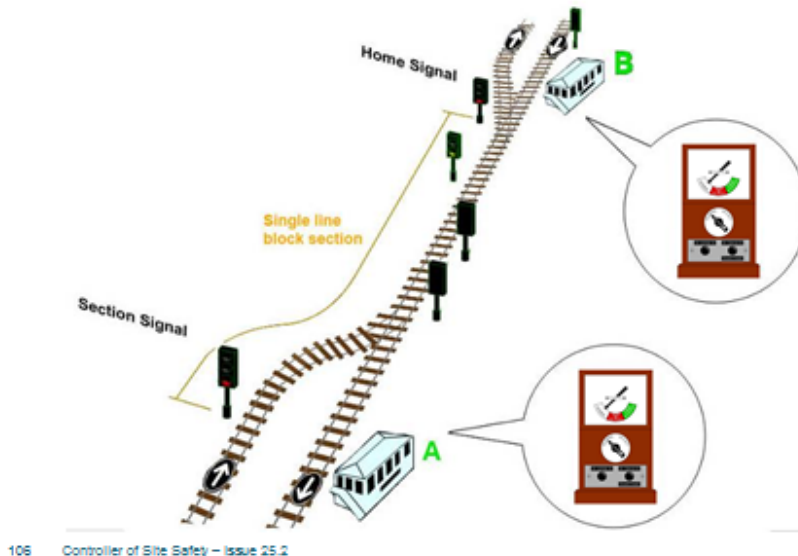
The COSS must obtain an assurance from the signaller that:

- The necessary signals have been placed and will be maintained at Danger.

When the Signaller places the absolute block indicator to Train on Line under TS1 of the rule book this does not constitute additional protection. If the task affects the safety of trains additional protection must also be placed in accordance with Handbook 8.



Tokenless Block



The COSS must obtain an assurance from the signaller that:

- The necessary signals have been placed and will be maintained at Danger

State that when the Signaller arranges for the acceptance switches at both signal boxes to be kept in the Normal position under TS1 of the rule book this does not constitute additional protection. If the task affects the safety of trains additional protection must also be placed in accordance with Handbook 8.

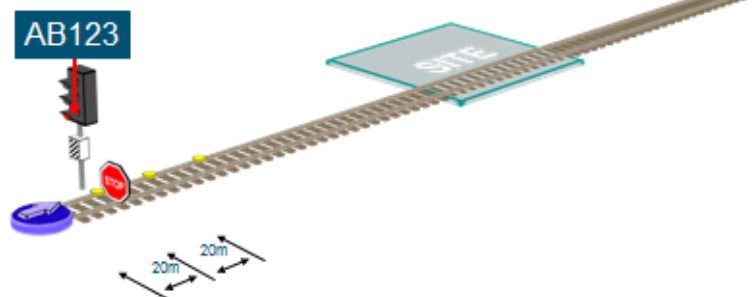
Remember, the COSS must arrange for a Red Flag or Red Light to be displayed if a line blockage with Token/Staff additional protection.



Detonator Protection – Signal



Detonators Protection placed at Signal AB123



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Protection is provided by using detonator protection.

The first detonator and PLB is placed at the signal then another detonator 20m beyond the signal then another detonator 20m beyond the second detonator.

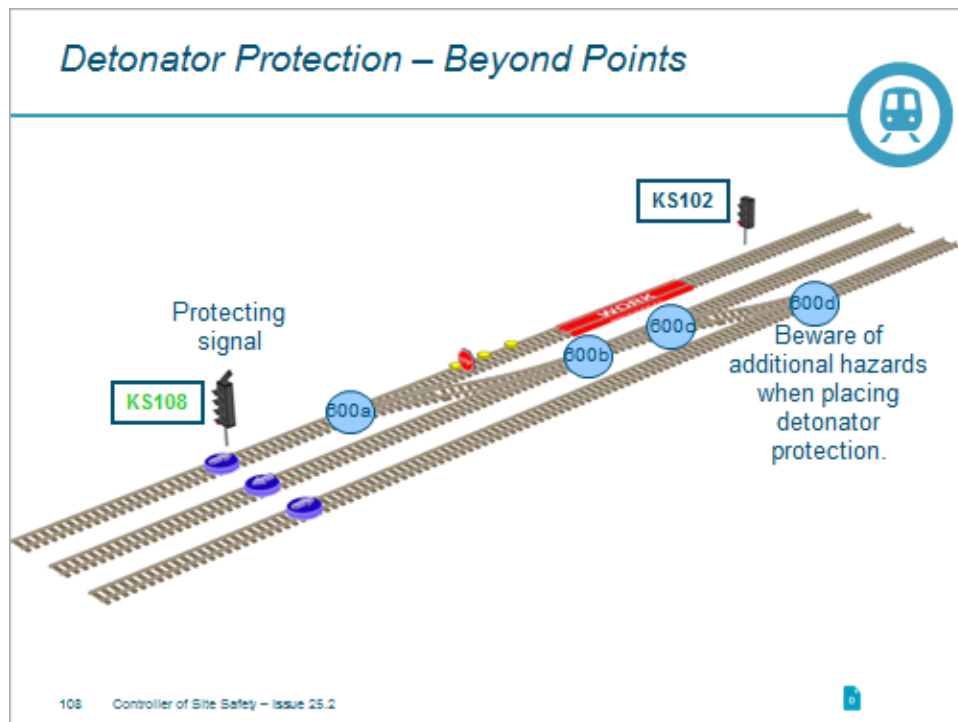
Arrange for detonator protection to be positioned at the signal(s) which will be maintained at danger to protect the work.

or

Arrange for detonator protection to be positioned clear of any points/crossover which require to be used for normal train movements.

If a competent person is sent alone to place the Detonator Protection they must be a certified IWA or IWA/COSS.

However the COSS can place the protection themselves or encompass the deployment of the protection within the Safe System of Work.



Detonator protection for a Line Blockage must comprise:

- Three detonators on the line concerned, 20 metres (approx 20yards) apart on the same rail.
- A Possession Limit Board (PLB) place next to the **first** of the three detonators in the direction from which trains would approach.

Detonators must never be placed on the approach to the protecting signal or any points/crossover which require to be used for normal train movements.

Beware of the additional hazards associated with placing detonator protection in the proximity of the crossing/points (i.e trains passing on adjacent lines etc).



Giving Up A Line Blockage



Line Blockage with Signal Protection Only

Once the line is clear and safe for the passage of trains, check you and the group are in a position of safety. (Remember to remove any hand danger signal placed in the four foot).

Contact the Signaller, quote your authority number.

The Signaller will give you a time and date when the line blockage is given up.

Record this in section 3 of the RT3181 form.

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Arranging for the Line to be Clear and Safe for Trains to Proceed

The COSS must make sure the line is clear and safe for trains to proceed before telling the Signaller that work is completed or suspended, and making arrangements to withdraw the protection.

Where the work has involved the use of a crane or other mechanical equipment which can have fouled the line(s) concerned, the COSS must make sure the crane or equipment has been moved or secured clear of the line.

Handing back with Stabled Train

When a train is stabled on a platform line, the COSS must additionally tell the signaller whether:

- Protection on the train has been removed as the work has been completed, or
- Protection has been left on the train as work will resume



Withdrawing – Signalling Disconnection.

When the line is clear and safe for trains to proceed, the COSS must:

- Ask the signaller to get the signalling technician to restore the signalling control.
- Remove any red flag / light that has been placed in the four - foot
- Once the line is safe for the passage of trains, check you and the group are in a position of safety contact the signaller, quoting your authority number, the signaller will arrange for the signalling reconnections.
- When the signaller informs you the signalling reconnections have been made they will give you a time and date when the line blockage is given up.
- Record this on the NR3180 form.

Withdrawing – T-COD

When the line is clear and safe for trains to proceed.

The COSS must then:

- Remove the T-COD from the line
- Move to a position of safety
- Inform the signaller that the T-COD has been removed

The Signaller must then:

- Check the track circuit concerned is showing clear. If the track circuit fails to clear, it must be treated as occupied until it is established that the line is clear
- The Signaller will give you a time and date when the line blockage is given up.
- Record this in section 3 of the RT3180 form.

Withdrawing - Token on a Single Line

When the line is clear and safe for trains to proceed, the COSS must **either**:

- Return the Token to the signal box at either end of the section, **or**
- Restore the Token at an instrument which is **NOT** at a signal box, in which case the COSS must first reach a clear understanding with the signaller that this is what is being done

In either case, the signaller and COSS must endorse Appendix B of the Line Blockage form.

Withdrawing - Tokenless Block Lines - Restoring Protecting Signal or Signals

Once the Line blockage is given up it is the Signaller's responsibility to restore any protecting signal or signals held a danger for the length of the Line Blockage. However if the signal has been maintained at Danger by use of a SPRS the signaller will need you to arrange for a competent person to operate the SPRS to restore the signal to automatic working.

Resumed suspension of work

When the work is to be resumed after having been suspended, the COSS must carry out the same procedure as previously.

The Signaller must issue the COSS with a **new** Authority Number on **each occasion** the work is resumed.



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The Line Blockage form provides for ten consecutive blockages of the same line(s) using the same line blockage.

The COSS must use a new form if:

- The line(s) which requires to be blocked or the protection arrangements are changed,
- There are more than ten consecutive blockages of the same line(s)



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Completed Documentation

The COSS/IWA shall return all completed and implemented **Safe Work Pack** in full to the Planner, highlighting the SSOW implemented and any errors found or changes that were required.

On completion of the work the COSS/IWA will return the implemented **Safe Work Pack** to the Planner who prepared the original pack.

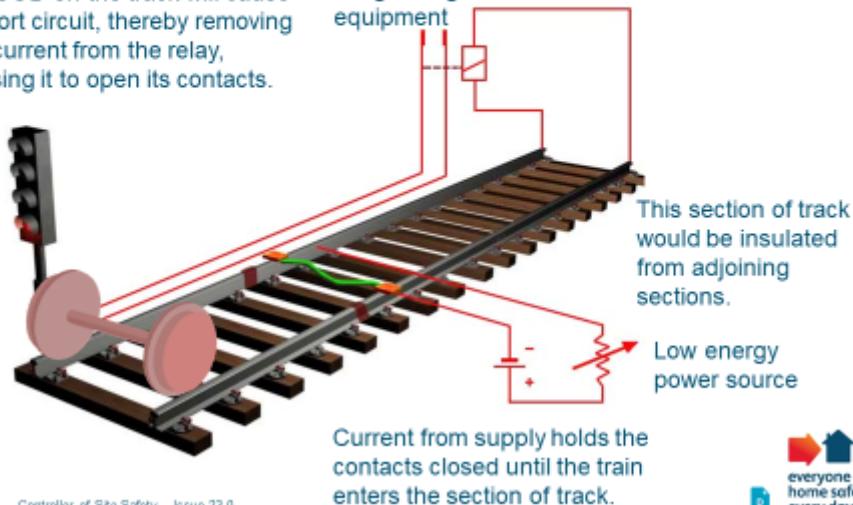


TCOD



A T-COD on the track will cause a short circuit, thereby removing the current from the relay, causing it to open its contacts.

To signalling equipment



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This diagram shows how the T-COD works by short-circuiting the Track Circuit it imitates the action of a train's wheels.

This causes the track circuit to show “occupied” on the signalling panel.



What to do before using a T-COD



- Check that the area you are working in is approved for T-COD use by checking the Sectional Appendix.
- Check that it is suitable for use on the type of rail to which it is to be fixed. There are different types of T-COD for flat bottom rail and bull head rail. The T-CODs are colour coded – Yellow for Flat bottom and Orange for Bull head.
- Examine the T-COD before each application to make sure there are no signs of damage or wear that can cause it to not work properly.
- When handling the T-COD, the COSS must always hold the device correctly as per the manufacturer's instructions.
- COSS must keep the special locking device with them at all times whilst the T-COD is in use.

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The COSS must either:

- Be competent to use a Track Circuit Operating Device (TCOD)
- Have a person with this competence working directly to his/her instructions (another COSS or IWA)

A TCOD must ONLY be used if all of the following apply:

- Its use at a particular location is permitted in local instructions (Sectional Appendix)
- The signalling equipment is working normally at the time the T-COD is to be placed on the line
- The work which requires to be carried out will not affect the correct operation of the track circuit concerned
- The COSS is able to make certain that adequate safe arrangements can be made for the removal of the TCOD when the work is completed or suspended

Additional Safety Note:

The COSS may need to remove ballast from beneath the rail before fitting the TCOD. The COSS shall make certain there are no sharps (needles) or any other hazard and would be advisable to wear gloves as appropriate.

Only one TCOD must be used in a signal section at a time.



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Where a T-COD Cannot Be Used



- WHERE CHECK RAILS EXIST – a T-COD must not be used.
- POINTS AND CROSSINGS – a T-COD cannot be used close to points and crossings unless the Signaller has taken into consideration the effect of the device on all the equipment controlled by the track circuit.
- AUTOMATIC LEVEL CROSSINGS – a T-COD will not be permitted between the 'strike-in' and 'strike-out' points of any type of Automatic Level Crossing.
- CCTV AND MANUAL LEVEL CROSSINGS – a T-COD cannot be used between the signal protecting the crossing and the crossing itself.

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A T-COD must only be used if...



- Its use at a location is permitted in the Sectional Appendix.
- The signalling equipment is working normally at the times the T-COD is to be placed on the line.
- There is a signal on the approach which can be placed to danger either by the Signaller or by the Signal Post Replacement Switch.
- The work to be carried out will not affect the correct operation of the Track Circuit concerned.
- You are able to confirm adequate safe arrangements for the use of the T-COD when work is completed or suspended.
- Only one T-COD must be used in a signal section at a time.

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Arrangement When Using T-COD



- The COSS must set up a Safe System of Work when placing/removing the T-COD from the four-foot.
- The COSS must confirm that the T-COD is placed a sufficient distance from the site of work on the approach to the work-site.
- A red flag or red light must be placed on the approach to the site of work.
- The COSS must confirm that signal overlaps are taken into account when placing the T-COD relevant to the site of work.

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The signaller will then give permission to the COSS to place the T-COD on the line.

When the T-COD has been placed on the line, the COSS must immediately:

- Move to a position of safety
- Advise the signaller that the T-COD has been placed on the line

The signaller must then:

- Check the track circuit concerned is showing occupied, the signaller will then give the COSS the name of the track circuit showing occupied the COSS must record this on the Line Blockage form RT3180 in Appendix B
- Give the Authority Number to the COSS

Note: Where more than one T-COD is required to give protection, this procedure must be applied on each occasion a T-COD is used. The signaller will NOT give the Authority Number until ALL T-CODs have been placed on the line.

Remind delegates:-

The COSS must arrange for a **Hand Danger signal** to be displayed if a line blockage with a T-COD is being applied.

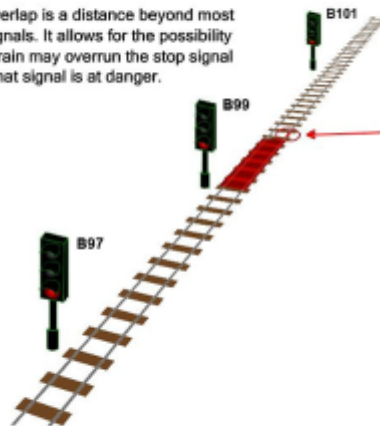
The special key supplied with the T-COD must be retained by the COSS who applies the T-COD, throughout the duration of the line blockage.



T-COD – Overlap Consideration



The Overlap is a distance beyond most stop signals. It allows for the possibility that a train may overrun the stop signal when that signal is at danger.



IF PLACED BEYOND SIGNAL B99 WITHIN THE OVERLAP AREA, THE T-COD WILL OCCUPY THE TRACK CIRCUIT TO HOLD SIGNAL B97 AT DANGER

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The TCOD must be placed on the correct track circuit; this should be discussed with the signaller at the time the line blockage details are being agreed.

Note: This can be a problem when working in the vicinity of an Insulated Block Joint (IBJ) as there is a different track circuit either side of the joint, therefore you must take the overlap into account to ensure that the correct track circuit is activated when the TCOD is deployed.



Arrangements When Using a T-COD



- The COSS contacts the Signaller and requests a Line Blockage.
- The COSS and Signaller agree: (as they did for other Line Blockage).
- The signal to protect the work must first be placed to danger either by the Signaller or by use of signal post replacement switch.
- Obtain the Signaller's permission to place the T-COD on the line concerned.
- Obtain the Signaller's assurance that the track circuit concerned is showing 'occupied'.
- Complete the form RT3181 and obtain the Authority Number from the controlling Signaller, COSS to record track circuit number/name in appendix B of the RT3181 form.
- Place a red light/flag in the 4 foot on the approach to the site of work (if affecting the safety of trains or the work is being done by a group).

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Note: When using a T-COD, you only need to use a hand danger signal if work affects the safety of the line, or you are working as a group.



Giving up a Line Blockage (with TCOD)



Once the line is clear and safe for the passage of trains, check you and the group are in a position of safety. (Remember this includes the removal of the TCOD and hand danger signal placed in the four foot).

Contact the Signaller, quote your authority number.

The Signaller will give you a time and date when the line blockage is given up.

Record this in section 3 of the RT3181 form.

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Arranging for the Line to be Clear and Safe for Trains to Proceed

The COSS must make sure the line **is clear and safe** for trains to proceed **before** telling the Signaller that work is completed or suspended, and making arrangements to withdraw the protection.

Where the work has involved the use of a crane or other mechanical equipment which can have fouled the line(s) concerned, the COSS must make sure the crane or equipment has been moved or secured clear of the line.

Withdrawing – TCOD

When the line is clear and safe for trains to proceed.

The COSS must then:

- Remove the TCOD from the line
- Move to a position of safety
- Inform the signaller that the TCOD has been removed

The Signaller must then:

- Check the track circuit concerned is showing clear. If the track circuit fails to clear, it must be treated as occupied until it is established that the line is clear
- The Signaller will give you a time and date when the line blockage is given up.
- Record this in section 3 of the RT3180 form.



Resumed suspension of work

When the work is to be resumed after having been suspended, the COSS must carry out the same procedure as previously.

The Signaller must issue the COSS with a **new** Authority Number on **each occasion** the work is resumed.

The Line Blockage form provides for ten consecutive blockages of the same line(s) using the same line blockage.

The COSS must use a new form if:

- The line(s) which requires to be blocked or the protection arrangements are changed,
- There are more than ten consecutive blockages of the same line(s)

Completed Documentation

The COSS/IWA shall return all completed and implemented Safe Work Packs in full to the Planner, highlighting the SSOW implemented and any errors found or changes that were required.

On completion of the work the COSS/IWA will return the implemented Safe Work Pack to the Planner who prepared the original pack.

This completes the revision part of the work book. The knowledge check is next. To enable you to get the best out of this knowledge check and understand where you may have knowledge gaps, complete the knowledge check without referring to the information above or the reference material. Once you have completed as much as possible, review any areas you were unsure of. This will support your learning in preparation to attend the course.



ZKL 300 RC Pre-Course Workbook Knowledge Check

- 1 Which of the following activities would be considered as affecting the safety of the line in accordance with HB6/7 section 3?
 - a) Using a ladder, unless secured so that it cannot fall towards the line
 - b) Felling or trimming trees
 - c) Patrol, inspecting or examining
 - d) Using plant within 2 metres of the line
 - e) Carrying heavy or awkward equipment or materials across the track
 - f) Conducting surveying

- 2 Which of the following must you agree with the signaller before taking a line blockage with the signaller?
 - a) The protection limits (signals/points)
 - b) Method of additional protection (e.g. TCOD)
 - c) Nature of work
 - d) Duration of the line blockage
 - e) When the line blockage is to be given up
 - f) Line(s) to be blocked
 - g) All of the above

- 3 The work can affect the normal operation of the track circuit if a TCOD is to be used as an additional method of protection. True or False?

- 4 Put the following statements into the correct order:
 - a) The protecting signal is maintained to danger (by the signaller or keyed using SPRS)
 - b) The signaller gives the COSS an Authority Number and COSS records the line blockage details on a Line Blockage Form (NR3180)
 - c) COSS agrees the arrangements for the line blockage with the signaller
 - d) The COSS receives an assurance from the signaller that the relevant track circuit is occupied
 - e) The signaller gives the COSS permission to install the TCOD

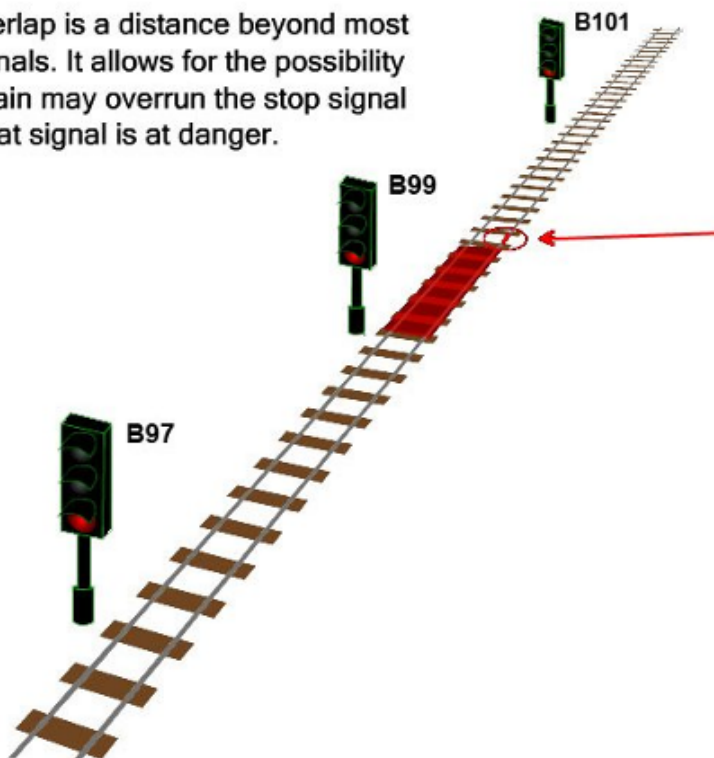
- 5 The signalling equipment must be working normally to enable a TCOD to be used as additional protection. True or False?



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- 6 This question is about when a hand danger signal must be placed in the four foot on the approach to the site of work in a line blockage. Which of the following statements apply?
- a) You must always do this
 - b) If the work affects the safety of the line
 - c) If the work is being carried out by a group
 - d) There is an exemption for this requirement if the work group is in a moving worksite
- 7 Look at the illustration below. If the TCOD was placed at the location indicated by the red arrow, which would be the protecting signal (i.e which track circuit will be affected by the TCOD)?
- a) B101
 - b) B99
 - c) B97

The Overlap is a distance beyond most stop signals. It allows for the possibility that a train may overrun the stop signal when that signal is at danger.





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- 8 Only one TCOD can be used in a track section. True or False?
- 9 If the work affects the safety of the line, a line blockage with additional protection must be used. True or False?
- 10 Where are the locations where a TCOD can be used published?
 - a) Hazard Directory
 - b) WON
 - c) Sectional Appendix



Knowledge Check Answers

Q1. a, b, d, e

Q2. g

Q3. False

Q4. c, a, e, d, b

Q5. True

Q6. b, c, d

Q7. b

Q8. True

Q9. True

10. c