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SIGTAN044 - Level Crossings (formerly RT/E/C/I 9044)

This temporary front sheet facilitates change to the new Network Rail Standards referencing nomenclature.

The Ref above will be formally allocated to this standard when it is next changed in the meantime the contents, date and issue number of this Network Rail Standard are UNCHANGED and with immediate effect it should be referred to as “(new ref) formerly (old ref)”.

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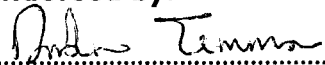


RAILTRACK LINE CODE OF PRACTICE

SIGNALLING EQUIPMENT TECHNICAL ADVICE NOTICE (SIGTAN044) LEVEL CROSSINGS

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Summary

This code of practice summarises a range of general issues relating to Level Crossings on Railtrack's Signalling Infrastructure.

Issue/Revision Record

This code of practice will be updated when necessary by the distribution of a complete document. Subsequent amendments will be marked by vertical black line in the adjacent right hand margin.

Issue	Date	Comments
1	Feb 2001	Original Issue

Implementation

This code of practice highlights issues arising from operational experience, concerning the installation and maintenance of signalling equipment. Where appropriate, it gives current best practice for mitigating risk and is for implementation from 2 June 2001. Alternative practices may be accepted where they can be demonstrated to be as good or better than the contents of this document.

Superseded document reference number	Issue	Date
Nil		

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Supply

Paper copies of this document will be available by printing from electronic copy or, where this is not possible, may be issued on request to the Document Controller.

Safety

All persons are reminded that all appropriate safety precautions must be observed when undertaking the work covered by this document.

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1. PURPOSE

This document provides a record of best practice general information relating to Level Crossings used on Railtrack Signalling Infrastructure, together with relevant technical information and where appropriate, related historical background.

2. SCOPE

This document covers Level Crossings and associated equipment in use on Railtrack Signalling Infrastructure.

3. REFERENCES

RT/E/S/10660	The Implementation of Signalling Maintenance Work Instructions
RT/E/S/10061	Signalling Maintenance Task Intervals
RT/E/S/10662	Signalling Maintenance Task Interval Change Process
RT/E/S/10047	Management of Safety related reports for Signalling and Operational Telecommunications Failures
RT/E/S/10064	General Instructions to Staff Working on S&T Equipment
RT/E/S/11231	Signalling Maintenance Testing

RT/E/WI/00013	Signalling Maintenance Work Instruction Level Crossings
LC11	Level Crossing Equipment, Flashing Road Traffic Light Signal
LC12	Level Crossing Equipment, Automatic Half Barrier Crossing, Another Train Coming Sign
LC15	Level Crossing Equipment, Lights, Barrow Crossing Type
LD11	Level Crossing Tests, Automatic Half Barrier Crossing
LD15	Level Crossing Tests, Automatic Open Crossing Remotely Monitored
LD20	Level Crossing Tests, Automatic Open Crossing Locally Monitored
LD25	Level Crossing Tests, Automatic Barrier Crossing Locally Monitored
LD31	Level Crossing Tests, Manually Controlled Barriers
LD32	Level Crossing Tests, On Call Barriers
LE11	Level Crossing Equipment, Signal Box Control Unit, Manually Controlled Barriers
LF11	Level Crossing Equipment, Barrier Machine, Automatic Half Barrier Crossing, B.R. Mk I and Mk II
LF21	Level Crossing Equipment, Barrier Machine, B.R. Spec 843
LF31	Level Crossing Equipment, Barrier Machine, G.W.E. Electro Mechanical

LF32	Level Crossing Equipment, Barrier Machine, G.W.E. Electro - Hydraulic
LF34	Level Crossing Equipment, Barrier Machine, G.W.E. Rural Barrier
LF41	Level Crossing Equipment, Barrier Machine, W.B. & S.Co. Style C
LF51	Level Crossing Equipment, Barrier Machine, Mechanical (Ex. N.E. Region)
LG11	Level Crossing Equipment, Closed Circuit Television, Marconi, Pye, Redifusion
LJ11	Level Crossing Equipment, Boom Gates
LK11	Level Crossing Equipment, Miniature Warning Lights
LM11	Level Crossing Equipment, Gates

4. TESTING

The last operation of all maintenance services is to test by operation from the signal box and to observe that the apparatus functions correctly.

5. PERSONAL SAFETY

All appropriate safety precautions must be observed when undertaking the work covered by this document.

This document does not address general personal safety measures. Local instructions including a COSHH assessment may be in operation and these will highlight those measures which must be taken to control any Health and Safety concerns.

6. LEVEL CROSSINGS, GENERAL

6.1 General Safety Arrangements

The safety of pedestrians, the road and the rail user depends on the correct operation of the crossing equipment.

Many crossing installations are protected by a combination of signs, flashing road traffic light signals and audible warning devices (usually Yodalarms but may be bells). Telephones or signs displaying telephone numbers are also fitted at automatic and open crossings as appropriate. Electrically operated signs, such as the Another Train Coming (A.T.C.) sign or the Standing Man pedestrian signal may also be fitted at some level crossings. The crossing may be protected by gates or barriers.

Most barrier type installations are fitted with boom lamps. Gates may be fitted with either boom type lamps, oil lamps or oil lamps cases fitted with electric lamps.

Telephones, where provided, must be operable. External signs that detail telephone numbers must be in good condition, current and legible. Instruction signs in the telephone cabinet, both Traffolite and illuminated (back lit) must be in good condition and legible. Signs that detail the line closure times must be kept up to date.

Arrangements must be made to replace missing, damaged or faulty telephones and / or signs as soon as practicable.

The safe operation of user worked crossing equipment, whether protected by gates or rural barrier, is reliant on the user fully understanding the method of operation. If the instructions are misunderstood, the crossing may be left open with the obvious danger to the unwary pedestrian or road user. It is therefore extremely important that, irrespective of the type of crossing, any operating instructions or warning signs are easily seen and are legible. If the instruction plates or signs have been removed, damaged, defaced or have faded, arrangements must be made to replace them as soon as is practicable. If they are obscured by foliage or structures the appropriate remedial action must be taken.

Where trains run during the hours of darkness the crossing may be illuminated to ensure safe operation. If the road approaching the crossing is illuminated the crossing should be illuminated to at least the same level. Additional illumination may be provided at AOCL and ABCL level crossings to enable the driver of an approaching train to see from the service braking distance that the crossing is not obstructed. The crossing illumination lamps should be orientated towards the centre of the crossing. It is emphasised that when adjusting the lamps to obtain optimum illumination of the level crossing that the lamps are not set so that they would shine into the face of the driver of an approaching train.

6.2 Roadside Foliage and Visibility Distances

Roadside foliage must be kept under control to ensure adequate visibility of the crossing, road traffic light signals and associated signs. This is especially important during the summer months when trees and bushes are in full leaf. Where the visibility of the road traffic light signals and / or warning signs are obstructed your manager must be informed so that suitable remedial action can be arranged.

The optimum distance from which the level crossing road traffic light signals should be visible to the approaching road user will vary according to the designated road speed. On roads where the national speed limit applies the typical road speed of the traffic may be relatively high for the locality and type of road. The table below can be used to determine whether the desired visibility distance corresponds with the speed of the road traffic.

6.3 Recommended Minimum Visibility Distances

85%ile Speed of Road Vehicles		Minimum Visibility Distance
kms/hour	miles/hour	metres
50	30	70
65	40	90
80	50	150
95	60	220
115	70	300

%ile = typical speed of a specified proportion of the vehicles (expressed as a percentage) along the road traversed by the level crossing. e.g. 85% of vehicles usually travel at 50 kms/h (30 m/h).

7. ROAD TRAFFIC LIGHT SIGNALS

7.1 General Description

To ensure that a driver approaching a level crossing has sufficient advance warning to permit safe control of the vehicle it is extremely important that each road traffic light signal assembly is correctly aligned and not obscured. See Roadside Foliage and Visibility Distances.

To ensure correct alignment, the lamp unit is mounted on a swivel device fitted to the lamp backboard. Each lamp unit must be orientated so that the lamp door hinge is on the left hand side in the nine o'clock position when viewed from the front.

The primary traffic lights (Near Side) should be aligned with a point 1.5 metres above the centre of the road 100 metres on the approach side of the STOP line. The alignment point for the duplicate primary traffic lights (Off Side) should be 50 metres on the approach side of the STOP line.

The Railway Inspectorate may alter the alignment at inspection, recording the final positions on the relevant drawings, these should be checked to see whether deviation has been made from the above.

Early type traffic lights were fitted with 36 watt lamp and can be identified by the high visibility white border on the periphery of the lamp backboard. The latest type are fitted with 50 watt Quartz Halogen (QH) lamp and can be identified by the high visibility red and white border on the periphery of the lamp backboard. The two types must not be mixed at the same crossing.

Many old installations will have been converted to use the 50 watt QH lamps to comply with the improved performance for road traffic light signals specified by BS505. On early conversions the high visibility red and white border was clamped on to the existing backboard.

The modified assemblies were fitted with a GEC identification label on the underside of the lamp bowl unit. The red lamp unit will be labelled LL5101 and the amber lamp unit LL5102.

Four conversion kits were produced. Kits one and two were for the red light units and amber light units respectively comprising the hinged front fitted with the lens, hood clips and a new hinge pin. A third kit comprising the reflector assembly complete with bi-pin lamp holder, (lamp excluded) and all fixings. The fourth kit comprised the clamp-on type red and white border for the lamp backboard.

If a replacement lens is required, old or new type, the complete front assembly must be fitted (kits one or two). The old and new type lamp/reflector assemblies must not be mixed at the same crossing.

7.2 Faulty Lamp Holders

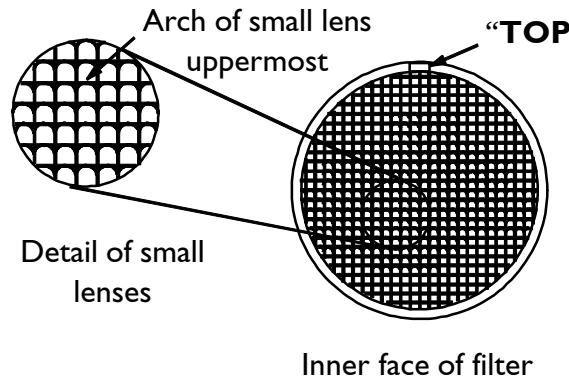
Early QH lamp holders were found to have faulty spring contacts. The lamps fell out of their holders due to vibration from passing traffic. A programme of rectification was instigated.

A faulty lamp holder can be replaced by gripping the black plastic end piece of the holder and pushing it towards the reflector. Rotate the holder approximately $\frac{1}{8}$ of a turn and withdraw it from the reflector. Fit the new holder by reversing the above procedure.

7.3 Lens Orientation

It is important that the plastic lens (Red or Amber) is installed correctly to ensure that the beam is concentrated downwards.

The plastic lens comprises a large number of small lenses arranged in rows on the rear face of the lens. The lens must be installed with the arch of the small lenses upper most. Some lenses may have the word **TOP** embossed on the inner or outer face near the edge of the lens to indicate the correct orientation. See figure 1.

**Figure 1**

The lens fitted to the QH type lamp assembly will have **TOP** moulded on a small raised block on the rim at the rear of the lens.

7.4 Lens Cleanliness

The lens of a road traffic light signal unit must be clean and in good condition to ensure optimum light output. The cleanliness of the lenses will vary according to the location of the level crossing, the typical traffic flow and the prevailing conditions. For example, the road traffic light signal at a level crossing situated on a busy main road regularly used by large commercial vehicles will be subject to excessive spray and road dirt especially during adverse weather conditions and the winter months. Whilst in areas of light traffic, usually travelling at low speeds, the contamination will be relatively minimal. Consequently, at some installations where excessive contamination is a problem the scheduled frequency of lens cleaning may have to be revised to suit the known local conditions.

Abrasive pads / cleaners must not be used to clean the lens otherwise the resulting scratches and dirt contamination will reduce the light output.

7.5 Lamp Hoods

The lamp unit hood must be in good condition and fitted correctly to ensure that the lens is not obscured and to prevent reflections and phantom aspects that may confuse the approaching road user.

8. AUDIBLE WARNING DEVICES

8.1 General Description

An audible warning device, where provided, is usually mounted at the top of the post of the nearside road traffic light signal assembly on each side of the crossing and is usually orientated to warn pedestrians on or approaching the crossing. The audible warning device may be a bell or Yodalarm. Yodalarms are fitted with time switches to reduce the volume emitted during the night. Usually 23:30 hours to 07:00 hours.

The current standard time switches are of either Sangamo or Schlumberger manufacture and may be operated by a quartz mechanism or clockwork. The clockwork mechanism provides a standby capability to cater for interruptions to the main power supply to the crossing equipment. Quartz mechanisms incorporate a Ni-Cad battery for a similar purpose. The life expectancy of the battery is approximately ten years. However, it is recommended that the time switch is replaced at five year intervals.

If a clock consistently loses time, potential failure of the battery may be the cause. The battery, which is incorporated in the printed circuit, cannot be replaced on site. Arrangements must be made to replace the time switch as soon as practicable.

8.2 Day Omit Device

The Sangamo or Schlumberger time switches may also incorporate a Day Omit option which is **not** required when they are used at level crossings. It is extremely important that this option is disabled. There are two methods by which this may be achieved.

The Day Omit option is controlled by seven arrows, one for each day. It is therefore extremely important that this option is disabled for each day of the week. Otherwise the volume of the Yodalarm will be muted during the daytime on those days not disabled.

Method 1

The position of the arrows on the Day Omit dial may be observed by carefully turning the Day Omit dial so that each arrow is just visible in turn at the edge of the main dial. The arrows on the face of the Day Omit dial must be set to point towards the centre of the dial. See figure 2. Take care not to rotate the timer dial.

To adjust the direction of an arrow use a small screw driver and turn the arrow in an anti-clockwise direction until it points towards the centre of the Day Omit dial.

Check that the time setting is correct.

Method 2

Remove the central screw holding the timer dial and carefully lift it off. See figure 2.

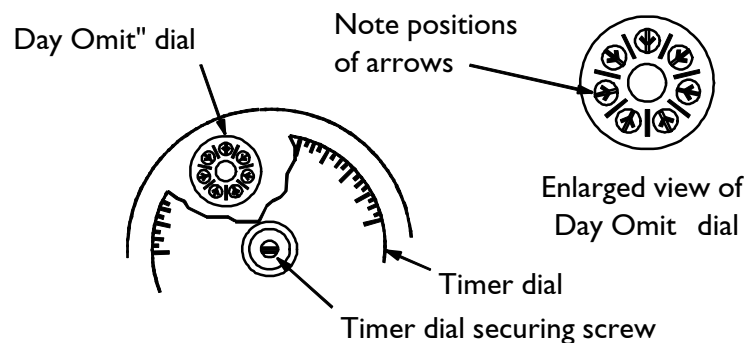


Figure 2

Caution: Do not turn the knurled knob because the ON and OFF timing tappets will be loosened and their relative time settings may be lost.

The arrows on the face of the Day Omit dial must be set to point towards the centre of the dial.

To adjust the direction of an arrow use a small flat ended screw driver and turn the arrow in an **anti-clockwise** direction until it points towards the centre of the Day Omit dial.

When all the arrows of the Day Omit device are set correctly, carefully replace the timer dial and secure with the centre screw.

Check that the time setting is correct.

8.3 Volume Control Adjustment

The times when the volume of the audible warning is to be reduced will be stipulated in the Level Crossing Order or on the crossing layout drawing where an Order does not exist. The timer ON and OFF tappets must be set to correspond with these times.

The standard time clocks are supplied with pairs of ON and OFF tappets. The second tappet acting as a back-up for each type. The ON tappets switch the audible warning to the higher volume (Day setting) and the OFF tappets to the reduced volume (Night setting). i.e. ON days and OFF nights.

The first tappet of each type (ON or OFF) should be set to the time specified in the Order or layout drawing. The second (back-up) tappet of the pair should be set to follow approximately one hour later.

The volume of the audible warning for both day and night operation is usually agreed at the time of the crossing inspection by a representative of Her Majesty's Railway Inspectorate (HMRI). Consequently the resistor values should not be altered without reference to the Infrastructure Controller.

8.4 Clock Setting

Note: Remember that timer clocks must be reset during the spring and autumn to correspond with the British Standard Time and Greenwich Mean Time adjustment made at the beginning and end of the summer months. Preferably the adjustment should be carried out on the night of the time change so that the crossing continues to comply with the Level Crossing Order. Where this may not be practicable, due to the number of crossings to be attended, every effort should be made to complete the time change within one week (either side) of the national time adjustment.

9. ANOTHER TRAIN COMING (A.T.C.) SIGN (NEON TYPE)

9.1 General Description

The neon type sign has been superseded, consequently, it may not be possible to obtain replacement components, especially the word form tubes. Replacement with a suitable alternative warning device may be the only recourse. This may be either a miniature A.T.C. sign or a metal sign as appropriate to the type of crossing and must comply with the site plan.

9.2 Testing Earth Continuity

Disconnect the 240 volt supply to the sign at the location. A test instrument with a typical range of 10 ohms will be required when testing the continuity of the earth bonding between the sign earth bolt and the earth bus bar also between the earth terminal on the mains switch and the earth bus bar. The test result should be less than 1 ohm.

9.3 Alignment of Sign

The sign should face squarely to a point on the centre line of the carriageway 9.1 m (30 feet) on the approach side of the STOP line. This is to ensure that a driver, whose view of the barrier is obscured, does not anticipate the opening of the road and is tempted to overtake the vehicle in front.

Note: The above warning distance may be revised to suit specific site requirements. This will be directed by local arrangement and recorded on the site plan.

9.4 Defect Rectification

Disconnect 240 volt supply to sign before proceeding.

Case Transformer) Complete sign to be replaced and arrangements made for repair.
Mercury Tilt Switch)

Glass) Front to be changed and arrangements made for repair.
Gasket)

Word Form Tubes Remove front, cut soft nickel security wires, unclip tube and withdraw internal leads through access holes. Remove helical springs from metal tube ends. It is essential that the internal wires do not fall back behind the background plate. This can be prevented by temporarily securing the wires in place.

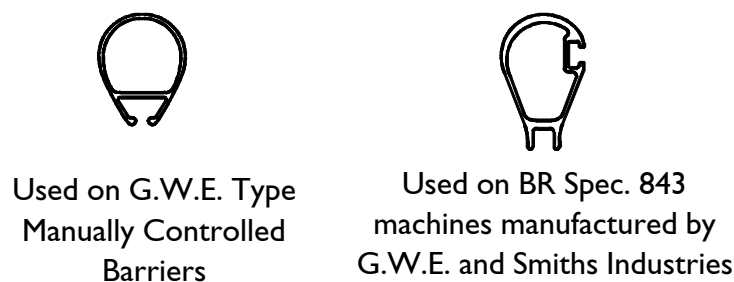
Mesh Sun Screen To be changed on site.

10. BOOMS

10.1 General Description

Booms may be constructed of wood, aluminium or glass reinforced plastic (GRP) e.g. Western Region type barrier. The method of construction will also vary. Timber booms may be laminated or jointed lengths of solid timber. Other types, such as boom gates, are constructed of marine ply to form a box section approximately 300 mm x 200 mm. The addition of vertical timbers creates the gate like assembly.

Some barrier machines are similar in design but are fitted with booms of different cross section. When replacing a damaged boom it is essential for the continued correct operation of the barrier equipment that the replacement boom is the correct length and that the boom cross section is correct for the machine. See figure 3 also Barrier Out of Balance (Tip) Force.



Cross section of typical metal booms

Figure 3

10.2 Boom Balance Weight (Ground Clearance)

With the exception of the concrete column Penguin type Automatic Half Barrier Crossing machine and the older drive - up / drive - down barriers, the balance weights are fitted to the boom carrier(s) on the exterior of the machine. Consequently, where the boom side arm / balance weights overhang the surrounding ground there is a risk of the barrier(s) being prevented from lowering due to ground heave.

Ground heave will occur during the winter months when the earth becomes frozen. If the ground heave is sufficient the barrier will be held in the raised position, a potentially dangerous situation. Other items, such as cloth or paper may become sufficiently hardened when frozen to the ground to effect the correct operation of the machine.

The clearance above the concrete base is determined by the design of the machine. i.e. The dimensional difference between the centre of the pivot to the base (length X) and the centre of the pivot to the end of the boom side arm / balance weights (length Y). The total ground clearance is this dimension plus the height of the base above ground level, where applicable.

For the BR Spec. 843 machine, the specified minimum height of the base above ground level is 80 mm. See figure 4.

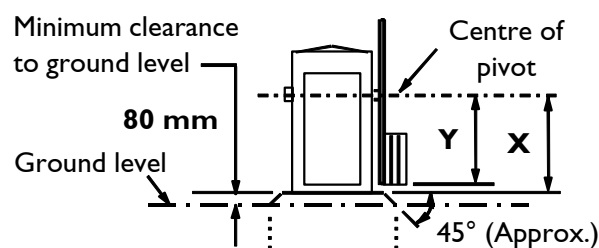


Figure 4

The difference between X (900 mm) and Y (865 mm) + the 80 mm provides approximately 115 mm clearance beneath the boom side arm / balance weights when the boom is fully raised. In early 1995 the 900 mm dimension was increased to 930 mm, consequently the total ground clearance was increased to approximately 145 mm.

10.3 Obstructions

The ground in the immediate vicinity of any type of barrier machine must be kept clear of potential obstructions, otherwise a Wrong Side Failure may occur.

Debris, such as cans, bottles and stones, if allowed to accumulate around the machine, will reduce the ground clearance beneath the boom carrier / counter weight assembly. The boom may become jammed in the raised position. The mechanism of the drive-up/drive-down type of barrier machine may be damaged if there is sufficient resistance to the operation of the barriers. See also Fire Risks.

10.4 Fire Risks

Some machines are fitted with cages to enclose the power pack and / or the counter balance weight assembly. The cage should prevent large items of debris from interfering with the operation of the machine. However, smaller items will accumulate within the cage and may interfere with the correct operation of the machine. Cages should be regularly inspected and any accumulated debris removed.

Flammable rubbish, cloth, paper, leaves and twigs may accumulate around a barrier machine irrespective of whether it is fitted with a protective cage.

This debris may be set on fire, accidentally or deliberately, and could result in severe damage to internal and external wiring, cables or components.

It is essential that any rubbish, especially flammable, is removed from the immediate vicinity of the barrier machine to prevent the risk of fire and its associated risk to safety, damage to equipment and disruption to traffic.

10.5 Boom (Critical Dimensions)

When fully lowered, the top of the boom should not be less than 900 mm above the road surface at the centre of the carriageway. The clearance between the bottom edge of the lowered boom and the road surface should not exceed 1000 mm.

(At level crossings protected by Western Region type barriers the under boom clearance should not exceed 1120 mm. This will usually be specified in the Crossing Order.)

When fully raised the barrier should be inclined towards the carriageway at angle of between 5° to 10° from the vertical. The inclination is often stated as 80° to 85° from the horizontal.

At automatic crossings protected by half barriers, the barriers, when lowered, should extend to between 150 mm and 450 mm from the centre of the carriageway. On carriageways between 5 m and 5.7 m wide, the barriers should extend to within 800 mm of the centre line so as to leave a clear exit of at least 3 m in width.

10.6 Boom (Lamp)

The boom lamps should be aligned to show in each direction along the carriageway. Correct alignment will ensure that the lowered barrier is indicated to the approaching road user to allow safe control of the vehicle. This is especially important during the hours of darkness, adverse weather conditions or at skew crossings where the barrier may not be easily seen due to the angle of approach.

The rubber housing of the boom lamp can become age hardened or perished due to environmental conditions. The ingress of water will cause the formation of condensation on the lenses and corrosion of the end cap of the lamp and the lamp holder. The boom lamp circuitry may become earthed. The lamp output will be reduced and may result in intermittent or complete lamp failure.

Correctly fitted lamp hoods reduce the effects of strong sunlight on the rubber housing and the visibility of the illuminated lamp.

Boom gates and level crossing gates may be fitted with boom lamps and / or oil lamps. At some installations the oil lamp case may have been converted to accept an electric lamp. The need for correct alignment and maintenance is equally essential irrespective of the type of lamp fitted.

10.7 Boom (Lock Down Feature)

The early electro / hydraulic barrier machines manufactured by Godwin Warren Engineering (G.W.E.) and the later models manufactured to Spec. 843 by G.W.E. (Mk I) and Smiths Industries (Mk II) are fitted with an anti-vandal lock valve. The function of the valve is often referred to as the lock down feature .

The valve is retained in the selected position by a cam that is locked with a pin and a wire seal. See figure 5.

The machines are delivered from the manufacturer with the cam set in the MANUAL position.

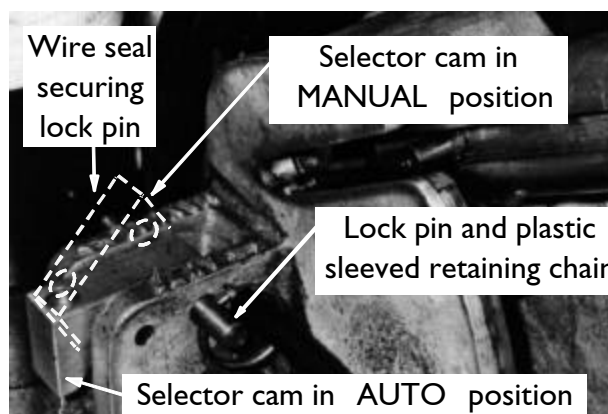


Figure 5

When set in the MANUAL position, it prevents the barrier being raised by hand. Selecting the AUTO position will allow the barrier to be raised by hand to the fully raised position. When released, the barrier will fall to the horizontal position. It is important that when the cam is set in the required mode the pin and wire seal are refitted.

The lock down feature **MUST** be operative at the following:-

- Manually Controlled Barriers (MCB)
- Remotely Controlled Manned Level Crossing (RC)
- C.C.T.V. Level Crossing (MCB-CCTV)
- Staff Operated Barrier (SOB)
- Traincrew Operated Crossing (TMO)

To check that the feature is operating correctly proceed as follows:-

Arrange for the barrier to be lowered.

Ensure that MANUAL mode is selected.

Attempt to lift the barrier by hand.

Resistance should be felt when the barrier has been raised approximately 5°. If the hand pressure is excessive the pressure relief valve will operate preventing damage to the hydraulic system.

The lock down feature must **NOT** be operative at the following:-

- Automatic Half Barrier Crossings (AHBC)
- Automatic Barrier Crossings Locally Monitored (ABCL)
- On Call Barrier (OCB)

To check that the feature is operating correctly proceed as follows:-

Arrange for the barrier to be lowered.

Attempt to lift the barrier by hand.

You should be able to lift the barrier to the fully raised position.

When lifting the barrier, the movement should be free from any intermittent resistance. However, the effort required will steadily increase as the barrier is lifted to the fully raised position.