

Category 2 Standard

S2550

(Formerly
SSL-S-3239)

Air operated interlocking machines; Annual maintenance method schedule

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1 Purpose

- 1.1 The purpose of this standard is to define the minimum annual maintenance requirements for hand and air operated miniature lever frames. It is not intended to define the methods of test, but where it does so the Maintainer should adhere to those tests.

2 Scope

- 2.1 The scope of this standard covers the interlocking machines used by London Underground that ensure signals cannot be cleared unless points are in correct lie and also prevents the clearing of other signals such as might lead to the collision of two trains.

3 Requirements

3.1 Safety considerations

3.1.1 Safety of the Railway

- 3.1.1.1 Interlocking machines are critical components in the safety system which directly guard against collision and derailment of trains.

3.1.2 Safety of Maintainer

Systems of work should guard against the following hazards:

3.1.2.1 *Compressed air*

The system has a nominal working pressure of 60 psi, with a maximum potential pressure on failure of the sub-station supply regulator of 125 psi.

3.1.2.2 *Electrical hazards*

Interlocking Machine contacts carry voltages of nominally 100 or 110 volts at 33.3Hz or 125Hz, or 60 volts DC. Locks and valves operate at nominally 24 volts DC.

3.1.2.3 *Hazardous Substances*

Adequate ventilation should be used when applying paint to levers. Precautions may be necessary when handling lubricants, thread locking compounds, or other substances used. COSHH Health and Safety literature shall be consulted prior to use.

3.1.2.4 *Remote operations*

Interlocking Machines are remotely controlled and are likely to operate at any time without warning. Therefore, prior to undertaking any adjustments, the Machine must be isolated from the control circuitry by removal of the compressed air supply from the Machine.

3.1.3 Safety of the Environment

- 3.1.3.1 There are not thought to be any special environmental hazards directly associated with the Interlocking Machine maintenance.



3.2 Authorisation and Planning

3.2.1 Staff Licensing

- 3.2.1.1 Maintenance staff shall be assessed to be competent to work on that asset type in accordance with the standard S1203, Competence of Personnel Working on Signal and Signal Control Systems.

3.2.2 Task Authorisation

- 3.2.2.1 Individual tasks involving disturbance to the Interlocking Machine must be sanctioned in advance and certified on completion through the issue of an Authority to Work Certificate in accordance with standards S1201, Signalling and Signalling Control – Approvals, S2529, Signalling and Control Systems safety critical processes, and S2525, Installation handbook standards.

3.2.3 Planning requirements

- 3.2.3.1 The Asset Steward shall devise a maintenance regime to ensure that the equipment is maintained in a safe and effective state. The regime shall define the frequency or other criteria for maintenance and the tasks to be carried out.
- 3.2.3.2 The Asset Steward shall employ an appropriate method of verification to monitor the effectiveness of the maintenance regime.
- 3.2.3.3 Any changes required to the maintenance regime, whether identified by the verification process, or for any other reason, shall be managed in accordance with the requirements of S1538, Assurance.
- 3.2.3.4 Any request for concessions against this standard shall be submitted in writing in accordance with S1641, Concessions to Standards.

3.3 Reporting of failures

- 3.3.1 Failure of the Air Operated Interlocking Machines to meet any of the criteria laid down in this standard that is unable to be rectified during the maintenance procedure, shall be documented for remedial work.

Failures which result in imminent danger arising either to the Maintainer or to the integrity of the signalling system shall be reported to the Line Service Centre.

The Asset Steward shall document all failures thereby creating an asset history.

3.4 Quality assurance

- 3.4.1 The Asset Steward shall maintain a register of all Air Operated Interlocking Machines. Records of annual maintenance shall be kept and made available to the Head of Signalling Engineering or his approved deputy for audit purposes when required.

3.5 Lever contacts

3.5.1 Introduction

- 3.5.1.1 On Remotely Controlled Frames and Interlocking Machines, lever contacts are divided into two groups, Safety (signalling circuits) and Non-Safety (lever operating circuits). Groups of contacts are separated by a Red Insulating Shelf running horizontally through the contact section normally between 25 and 26 slot positions.

All contacts used on Interlocking Machines are the Non-Reversible Air Break Type.



3.5.2 General Instruction

- 3.5.2.1 Information should be sought each night from the Track Access Control Centre regarding details of engineering works, Possessions, Engineering Train movements, etc.

Permission must be sought from the Duty Signal Operations Manager before turning off the air supply or carrying out any work on an Interlocking Machine.

The air supply should normally be turned off before commencing any work and restored when work is complete.

3.5.3 Lever Colour Codes

LEVER	COLOUR
Signal	RED
Point	BLACK
Release	YELLOW
King	BLUE
Control	YELLOW/RED STRIPE
Route	RED/BLACK/ RED
Slot	RED/BLACK/ RED/BLACK
Switch Lock	YELLOW/ RED STRIPE
Spare	WHITE

3.5.4 Procedure

- 1 Remove the rods and separators and place aside.
- 2 Brush off all dust from the contacts and insulations with a clean, small fitch.
- 3 Clean the top and bottom contact shaft bearing castings and lubricate the bearings with the recommended lubricant.
- 4 Thoroughly clean all contact springs and pieces with a chamois leather.
- 5 Check contact pieces for wear. Change contacts where required.

Note: Investigation is required prior to contact replacement as some contacts are modified to suite site conditions. Wear shall be considered to be a change in contact shape or surface finish attributed to abrasion between two faces.

- 6 Check the contact springs for wear and weakness in accordance with Section 3.15, Pressure gauges. Take note of springs to be changed.
- 7 Check adjustments of the contacts. See Sections 3.16, Lever frame contact adjustments and 3.17, Contact adjustments.
- 8 Lightly lubricate the contacts with recommended lubricant.
- 9 Clean the separators and rods and replace in frame.
- 10 Clean down the wiring and contact number strips on back of the contact section.
- 11 Visually check wiring in the vicinity of the contact terminations and report any potential hazards. In particular, report:
 - Insulation shrinkage.

- Liquefying or embrittled insulation.
 - Conductive deposits (such as copper chloride 'green spots').
 - Unterminated wires not protected, in accordance with S2529, Signalling and Control Systems safety critical processes.
- 12 Test the machine to ensure that the apparatus, and any circuits whose contacts have been disturbed, are working correctly.

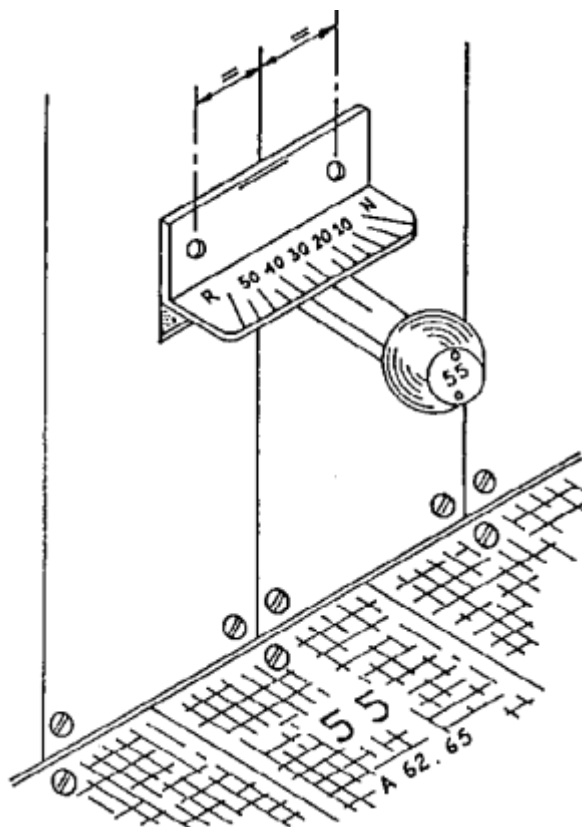


Fig 1 Protractor Label

3.6 Levers and plates

3.6.1 Procedure

- 1 Remove the protractor labels from the signal and release levers, two 6BA round head screws per plate, and leave aside. On a limited amount of sites, the lever number plates require to be removed to gain access to the 2BA lever retaining screw.
- 2 Remove the lever plates, four 2BA cheese head screws per plate, clean and place aside in order.
- 3 Clean the levers and check two 2BA Hex screw plus one 2BA Grub screw per lever. Check two 2BA Hex screws plus one 2BA screw per quadrant.
- 4 Clean and lubricate the shaft bearings using the recommended lubricant. Clean the lock bedplate immediately behind lever plates.

- 5 Replace the lever plates and lever protractor labels. Check that the lever is not fouling the plate. Check the protractor label is set at 30° with lever in mid-position, (see Fig 1).
- 6 Clean the lever number plates and finger board.
- 7 Repaint the levers as required (see Section 3.5.3 for colour codes).

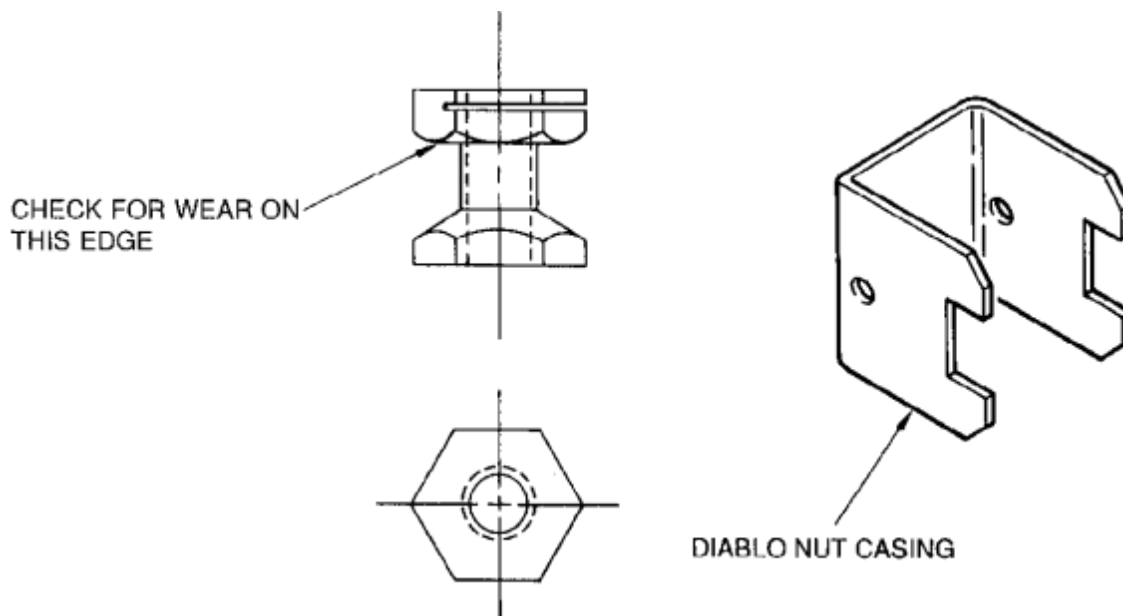


Fig 2 Diablo Nut and Case

3.7 Electric locks

Note: All electric locks on Interlocking Machines are 60V DC working, fed by a lock rectifier.

3.7.1 Procedure

- 1 Clean the lock bedplate and lock quadrants.
- 2 Clean the electric locks taking care to remove any metal dust between the core face and the armature.
- 3 Check the residual pins to ensure that a gap of 0.020" exists between the core face and armature with lock energised.
- 4 With the lock de-energised, check free movement of armature and stem and security of latch head on stem.
- 5 Remove the split pin, lock nut and casing from around the X" x 40 TPI Diablo Nut and check the nut for wear, see Fig 2. Check security of X" x 40 TPI lock nut.
- 6 Replace casing and ensure the split pin is retained.
- 7 Examine all wire to locks and lock rectifiers and report any potential hazards. In particular, report:
 - Insulation shrinkage.
 - Liquefying or embrittled insulation.

- Conductive deposits (such as copper chloride 'green spots').
- Unterminated wires not protected in accordance with S2529, Signalling and Control Systems safety critical processes.

Failures which result in imminent danger to the integrity of the signalling system shall be reported to the Line Service Centre and Duty Signal Operations Manager.

- 8 Check the pin and roller, hinge pin and cotters; lightly oil hinge pin.
- 9 Check security of the lock on frame, two 5/16" set bolts.
- 10 Check all adjustments of electric locks. See Section 3.9, Electric lock adjustments.
- 11 Check the Lever Locating Ball Catch on Signal and Release Levers. See Section 3.20, Lever position locating ball catch.

3.8 Electric lock quadrants

3.8.1 Lock Quadrants

- 3.8.1.1 Figures 4, 5 and 6, show the type of lock quadrant used on Signal, Release and Point Levers. Degrees of rake of lock face and ramp are indicated.

3.8.2 Lever/Shaft Positions

- 3.8.2.1 Fig 3 shows the relative positions of lever and shaft to lock face quadrant.

Signal lever quadrant locks at B position.

Release lever quadrant locks at D position.

Point lever quadrant locks at A and E positions.

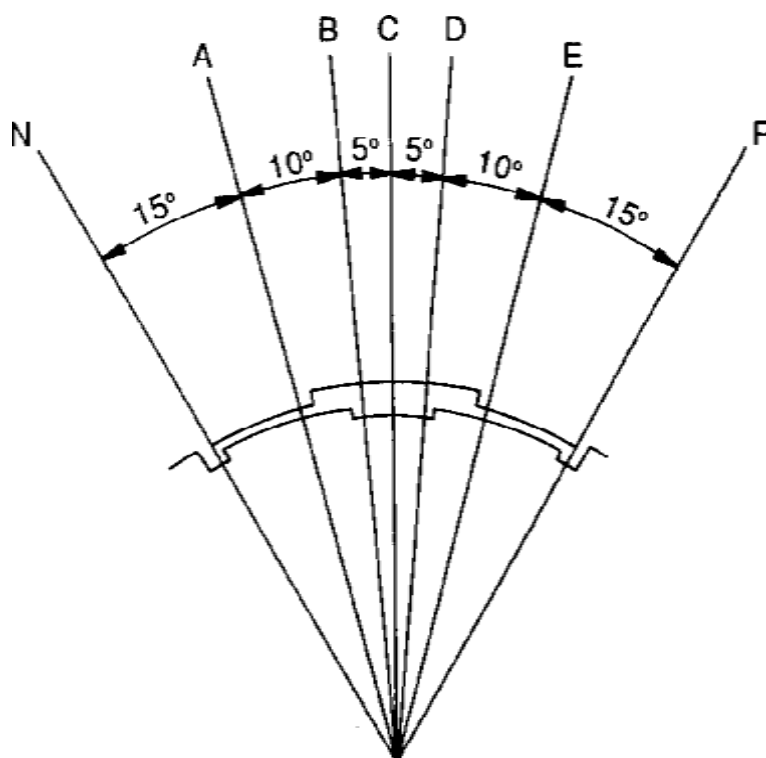


Fig 3 Position of Locking Faces of Electric Lock Quadrant (I/M s)

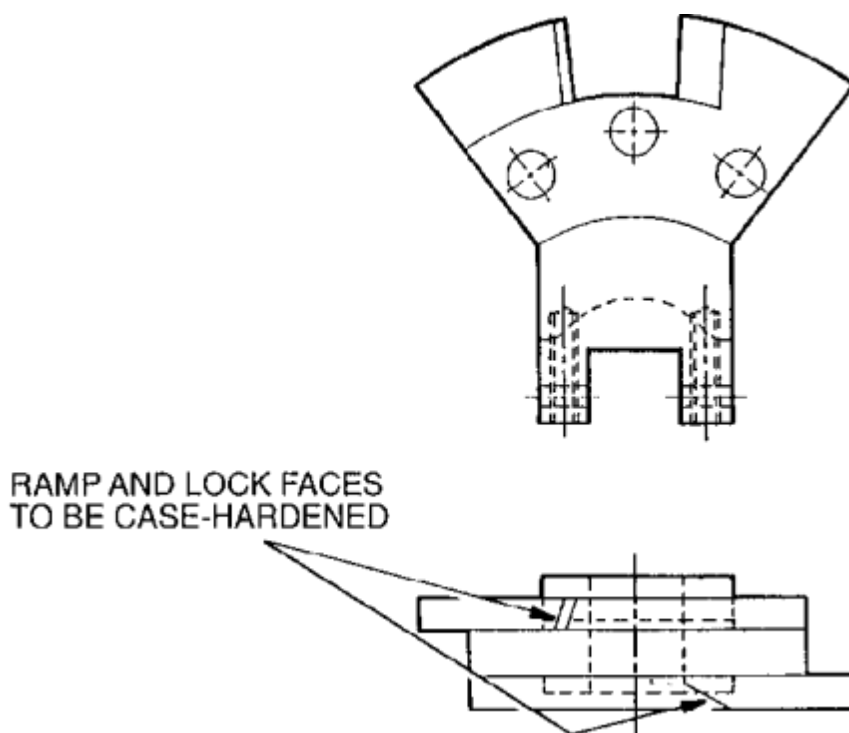


Fig 4 Locking Quadrant for Signal Lever (I/M s)

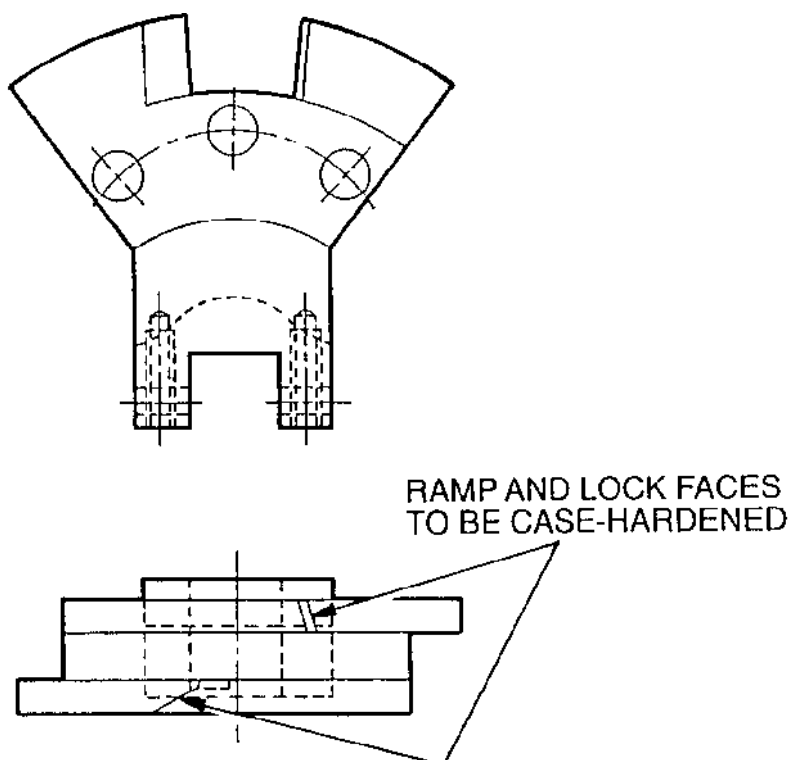


Fig 5 Locking Quadrant for Release Lever (I/M s)

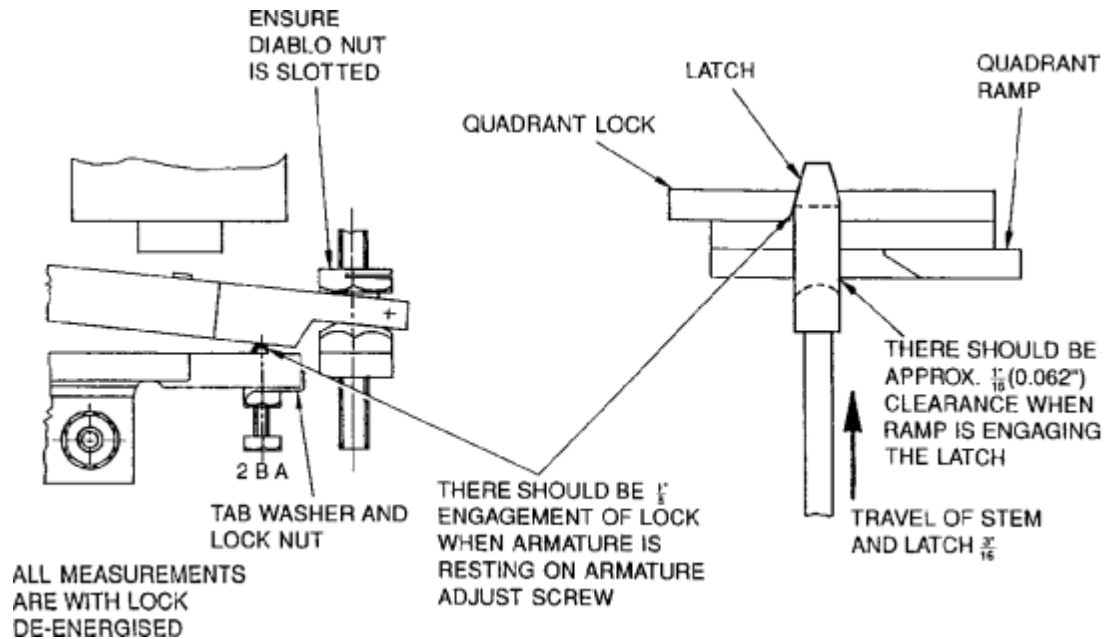


Fig 7 Electric Lock Adjustments (I/M s)

3.9 Electric lock adjustments

3.9.1 Procedure

- 1 With the lock de-energised, the latch should have $\frac{1}{8}$ " (+ $\frac{1}{64}$ " -0") engagement of locking face on quadrant.

The adjustment is obtained by a 2BA adjusting screw on the base of lock. Ensure that lock-nut and tab washer are secured.

- 2 With the Signal lever Normal, or the Release lever Reverse, and with the lock energised, check that a clearance of 0.060" (+0.002" -0") exists between the underside of the latch and top face of quadrant. See Fig 9.
- 3 With the Point lever in mid-position and the lock energised, check that there is a clearance of 0.020" (+0.002" -0") between underside of the latch and top face of the quadrant.

Adjustment in both cases is obtained by using the X" x 40 TPI Diablo Nut on the end of the stem. Ensure that lock-nut is secured after adjustment.

- 4 With the quadrant in the ramp down position, i.e. the Signal lever Reverse, the Point lever Normal or Reverse or the Release lever Normal, ensure that the lock is energised and check that there is a minimum clearance of $\frac{1}{16}$ " between the top of the 2BA adjusting screw and the underside of the armature. See Fig 7.

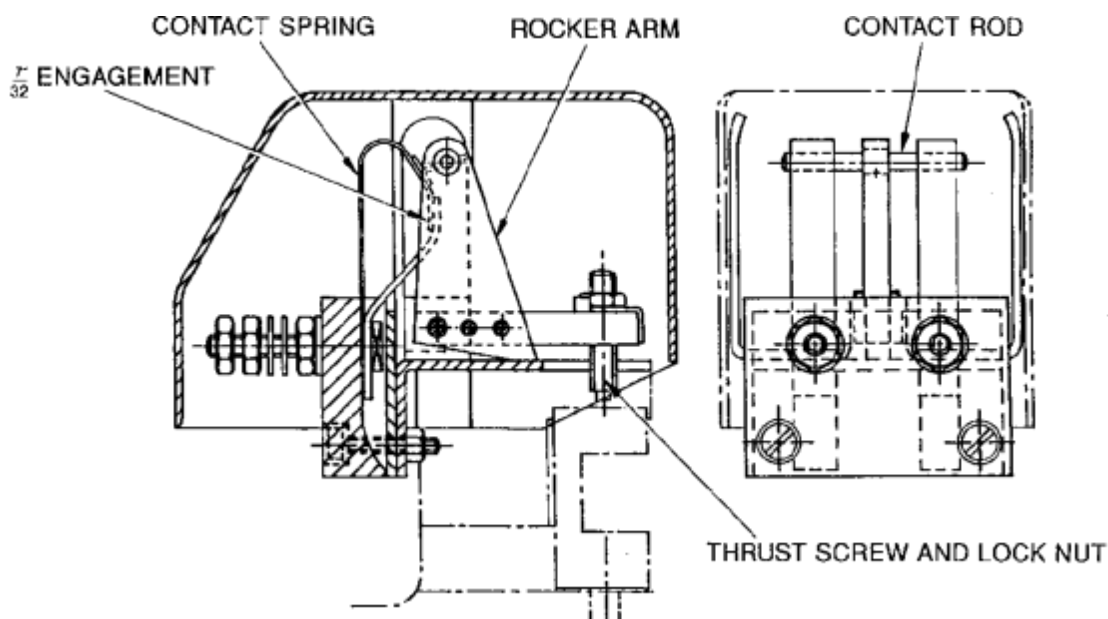


Fig 8 Lock Checking Contact for Interlocking Machines

3.10 Lock checking contact units

3.10.1 Procedure

- 1 Remove the plastic covers, clean and put aside.
- 2 Check the following:
 - the security of the unit
 - the 2BA lock-nut on the thrust screw
 - freedom of movement of the rocker arm
 - the wires on the terminals.
- 3 Check that the springs are in line and that the contact rod is striking the springs evenly.
- 4 Carefully clean the contact faces and contact rod with fine carborundum (wet and dry) paper.
- 5 Check all adjustments on the unit. See Section 3.11, Lock Checking Contact Adjustments.
- 6 Refit the plastic covers taking care that the covers are not fouling the springs on the lock quadrant.

Should contact pressure be under 60 grammes, or contact faces be badly grooved, it will be necessary to remove the unit from the Interlocking Machine in order to restore the springs for pressure and to dress the contacts.

Fig 8 shows the type and details of the Lock Checking Contact Unit used on Interlocking Machines.