



(Minor changes to the previous edition are indicated by ◆ placed before the relevant paragraphs)

Contents	Page		
1. Scope	1	14. Packaging and shipping of completed units	18
2. References	1	15. Prescribed methods and jigs	18
3. Abbreviations	1	16. Jigs and gauges	18
4. Definitions	2	17. Equipment identification and documentation	19
5. Introduction	2	18. Record retention	19
6. Usage of item	3	Document history	20
7. Equipment design outline	4	Document index data	21
8. Applicability	5	Attachments	
9. Critical functions	5	1. References	22
10. Performance parameters	6	2. Illustrated parts list	23
11. Equipment configuration	7	3. Critical parameters and settings	44
12. General requirements	8	4. Specification hierarchy	46
13. Overhaul definition	8		

1. Scope

This Specification is written to comply with Engineering Standard 1-202 in defining the requirements for the overhaul of all variants of the H5 Trainstop which are used extensively in the signalling system on the London Underground.

The specification hierarchy which supports these requirements is detailed in Attachment 4 to the Specification.

2. References

The text of this document cites other documents that provide information or guidance. These are listed in Attachment 1.

References to British Standards or standards in other standards systems shall be taken to include the words 'or equivalent'.

3. Abbreviations

The following abbreviations are used in this document (if from a published source this is indicated):

CPS	Critical Parameter or Setting
DCN	Design Change Notice
LU	London Underground
OEM	Original Equipment Manufacturer
p.s.i.	Pounds per Square Inch



4. Definitions

The Client – The Client is the Infracore representative responsible for administering the contract under which the overhaul work is being performed.

The Contractor – The Contractor refers to the organisation responsible for the delivery of overhauled equipment

'ON' Contact – An 'ON' Contact is a contact that is closed when the Trainstop is in the 'ON' position. A Trainstop is in the 'ON' position when the Trip Arm is in the raised position.

'OFF' Contact – An 'OFF' Contact is a contact that is closed when the Trainstop is in the 'OFF' position. A Trainstop is in the 'OFF' position when the Trip Arm is in the lowered position.

5. Introduction

This specification has been written to detail the overhaul requirements of the H5 Trainstop which is used in the signalling system on the London Underground.

H5 Trainstops are classified as items of vital signalling equipment which means that they are used to perform a safety critical function directly affecting the safe movement of trains. They have been designed to be ultra reliable pieces of equipment whose mechanical and electrical integrity will be relied on throughout its extended working life. It is a mandatory requirement that a Trainstop that has been overhauled shall have a functional performance, a safety integrity, a reliability, an expected service life in its installed condition and a shelf life equivalent to that of a new Trainstop.

Any failure condition which allows an H5 Trainstop to behave electrically as though it is in its '**ON**' (raised) position when it is not in that position is classed as a 'wrong-side' failure. Wrong-side failures are investigated exhaustively to establish the cause of the failure. Investigations into wrong-side failures will examine materials, processes and the history of overhaul operations to establish the exact cause of the event and to ensure that no other items are likely to suffer a similar failure. An occurrence of a wrong-side failure or a misoperation showing a tendency towards a wrong-side failure, even if no accident or damage is caused, can be extremely costly to investigate and could result in the need to change many units in service.

A general view of an H5 Trainstop is shown in Figure A.

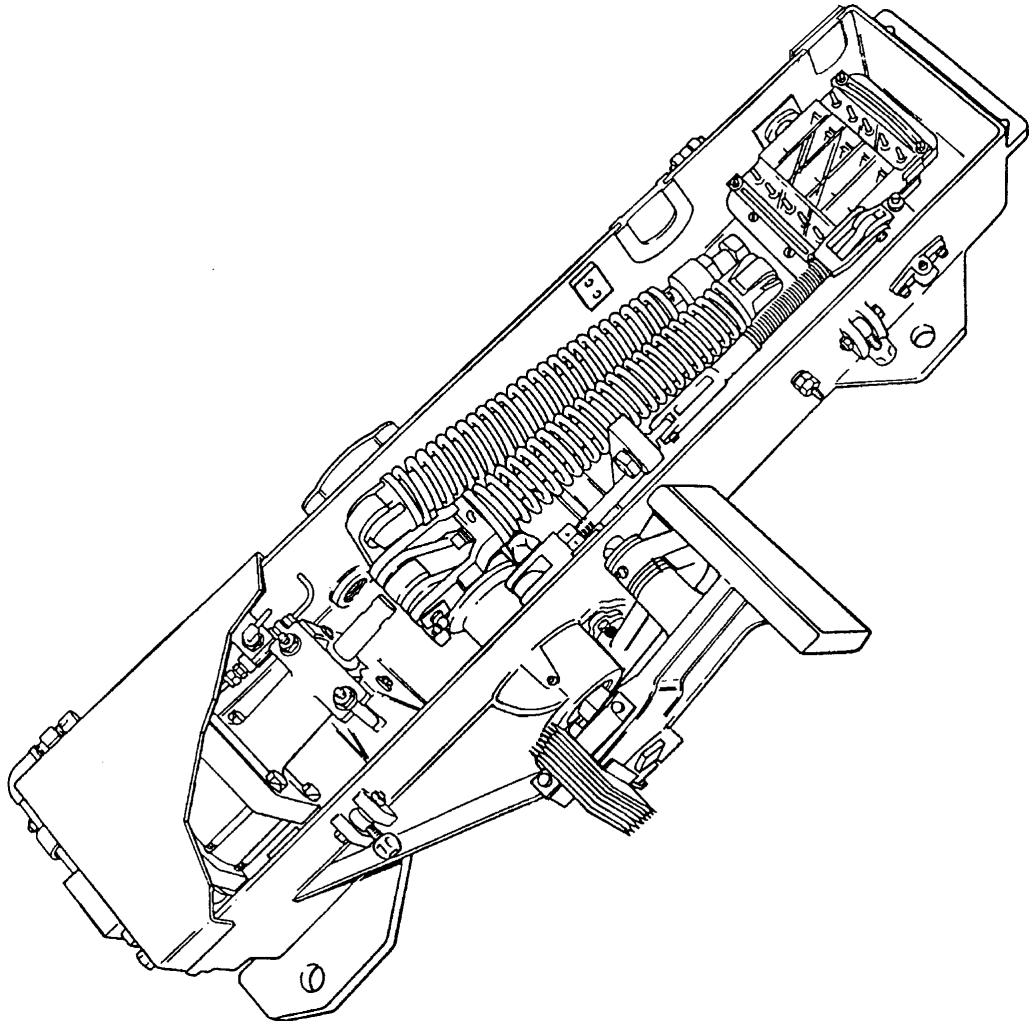


Figure A. General view of a style H5 trainstop

Items supplied for overhaul will be units which usually will have failed in service although some may be in working order. The failure mode of equipments will vary, ranging from simple causes such as wear caused by a long period in service with frequent operation, to items which have suffered severe damage. In the latter case there will be an element of salvage involved in the overhaul process. The equipment will be supplied in an 'as found' condition after being removed from its working position on the railway.

The service life of this equipment is 15 years. The shelf life is 3 years.

6. Usage of item

A Trainstop is used to apply the emergency brake to a train which proceeds past a designated stop position on the railway, e.g. a red signal aspect.

The emergency brake is applied by actuating the Tripcock of the train by bringing it into contact with the Trip Arm on the Trainstop. To engage the Tripcock the Trip Arm must be in its raised, de-energised, position.

When the signal clears and it is therefore safe to allow a train to pass the signal, the Trip Arm is lowered to a position where it will not engage with the train's Tripcock.



The position of the Trip Arm is detected by electrical contacts in the Trainstop. Both raised and lowered positions are detected by contacts which close when the Trip Arm is sensed in its requisite position. The signalling system uses the raised and lowered ('ON' and 'OFF' respectively) contact closures to detect the state of the Trainstop and control the signal system accordingly.

The Trainstop is pneumatically operated by an air motor. Air at nominally 60 p.s.i. is fed to the Trainstop by an air valve.

The H5 Trainstop is one of four types of trainstop that are commonly used on the Underground. Due to its size and configuration with the Trip Arm mounted on the side of the unit, it is only suitable for use on open or cut-and-cover track where there is sufficient clearance for it to be fitted. Over the life of the design, modifications have been carried out to equip it with a non-lubricated air motor. The main and secondary shafts have retained their original bearings which still require to be lubricated at the defined maintenance intervals with a suitable lubricant. The contacts form an integral part of the Trainstop. Silver/silver contact tips are used to provide a reliable low resistance contact arrangement.

The Air Motor is exchangeable on site to provide for easy maintenance.

Jubilee Line Extension variant: This consists of a standard H5 Trainstop fitted with a socket connection (refer drawing 6140-A1-106942). A moulded cable-harness connects terminals in the circuit breaker assembly to pins in a multi-pin socket mounted on the trainstop case. The socket is secured to the case by an adapter-plate which uses fixing-holes in the case that are normally used by the 10-core cable casting. The moulded harness-with-socket and the adapter-plate are supplied as separate components (refer drawing 6140-A1-106943). This variant is not treated separately in this specification.

7. Equipment design outline

Design features built into the H5 Trainstop include:-

- Construction that is designed to be ultra reliable in operation
- Construction designed to withstand the severe vibration and shock forces present where the units are mounted on the track bed
- Construction designed to withstand the mechanical forces imposed on it by contact with a fast moving Tripcock, and under train failure conditions by displaced parts of a train
- An ability to re-furbish the main wearing components without the need to scrap major components
- A site exchangeable Air Motor
- An ability to be installed in a safe manner in close proximity to the traction rails

The unit is built around a cast iron case which has a sealed lid and sealed cable entry for the 10-core moulded cable used to connect the contacts to the fixed lineside infrastructure. The main shaft runs in two bronze bearings and carries the Trip Arm on the outside of the case. An operating crank and two spring cranks attach to the square main shaft inside the unit. Two main compression springs are used to return the Trip Arm to the 'ON' position when the air pressure is released. A 3" diameter air motor is used to drive the operating crank to lower the Trip Arm to the 'OFF' position.

Electrical contacts are provided to sense the position of the Trip Arm. It is critically important to sense the presence of the Trip Arm in the raised position to ensure the safety of the signalling system. The Trainstop is mounted in a very vulnerable position on the track bed in close proximity to the running rail and the positive current rail. Despite the substantial construction of the trainstop a damaged shoe-beam or positive shoe has the ability to damage or break the Trip Arm.

To achieve the maximum possible integrity in detecting the presence of the Trip Arm, a separate linkage to the actual head of the Trip Arm is used to operate the contacts. The Trip Arm is linked to a secondary shaft which operates the contact cam. A separate spring on the secondary shaft is designed to drive the contacts to a safe mid-position state with all contacts open if the Trip Arm head becomes detached from its operating mechanism.



8. Applicability

This specification applies to the following item.

Item	Stores List No.
H5 Trainstop	73S9

The Illustrated Parts List and accompanying figures, Attachment 2 to this document, forms part of this specification.

Units will be supplied for overhaul without an Air Motor installed. An air motor ready to fit into a newly overhauled Trainstop will be free-issued to the Contractor.

9. Critical functions

Critical Functions of the H5 Trainstop are defined to be:-

Ultra-reliable Operation: The equipment has been designed to be a highly reliable item which will work in a hostile environment where it is mounted on the track-bed and therefore subject to high levels of vibration.

High structural integrity of Trip Arm: The Trip Arm and its associated shaft and bearings are designed to handle the significant forces imparted to the equipment when it is struck by the Tripcock of a train moving at up to 60 m.p.h.

Ability to detect the head of the Trip Arm: The mechanism to detect the position of the Trainstop Arm is linked directly to the head of the Trip Arm and is provided with a separate return spring which ensures that false detection of the Trip Arm is not possible even if it has become detached from the Trainstop.

Stability of gauging of Trip Arm position: The physical relationship of the Trip Arm in relation to the running rail is paramount in ensuring that Tripcocks engage with the Trip Arm when the Trainstop is in the 'ON' position.

High Integrity Electrical Switching Properties: Although not to a fail-safe design, the electrical contacts are designed to be ultra-safe in breaking the currents to which they are subjected. The mechanical integrity of the components of the contacts is paramount in achieving the desired performance from the equipment.

Electrical Safety. Satisfactory earthing and bonding of the Trainstop is crucial to ensure that leakage paths to the case or other extraneous metalwork in the event of faults do not give rise to electric shock hazards or to a loss of vital system integrity.

The ability of the item to meet the critical functions listed above throughout its life depends on many factors, not all of which are immediately obvious to people not familiar with all aspects of the design, overhaul and use of the equipment. To ensure that the significance of certain of the detailed requirements is understood and complied with, a number of Critical Parameters or Settings have been designated throughout the text.

Attachment 3 to this Specification lists all the Critical Parameters or Settings [CPS], a reference to the section from which the requirement originates and provides a Criticality Rating of the importance of each CPS item.

The Criticality Rating is based on the severity of the consequence if there is a deviation of the subject parameter from the value specified. Numerical values have been assigned to various levels of the Criticality Rating (CR) according to the following table.



Criticality Rating (CR)	SAFETY RELATED CRITERIA	RELIABILITY RELATED CRITERIA
10	Life critical – sole dependence Occurrence of this deviation alone may lead to an incident causing death or injury.	
8	Life critical – shared dependence Occurrence of this deviation, together with a second deviation which is potentially latent (i.e. not self announcing), may lead to an incident causing death or injury.	
7	Life critical – contributory Occurrence of this deviation increases the probability of an event which may lead to an incident causing death or injury.	Service critical – sole dependence Occurrence of this deviation alone may lead directly to an incident causing major service delays, and indirectly to the danger of a life threatening incident through enforced use of manual rules for operating the railway.
6		Service critical – shared dependence Occurrence of this deviation, together with a second deviation which is potentially latent (i.e. not self-announcing), may lead directly to an incident causing major service delays, and indirectly to the danger of a life threatening incident through enforced use of manual rules for operating the railway.
5		Service critical – contributory Occurrence of this deviation, increases the probability event which may lead to major service delays, and indirectly to the danger of a life threatening incident through enforced use of manual rules for operating the railway.
1	Not life critical	Not service critical

The criticality rating provides a scale of the importance of achieving the specified parameter and therefore of the care needed in designing the process or processes that will lead to the parameter being achieved. The design of the process or processes that will lead to the parameter being met are the responsibility of the Contractor and they shall be designed and documented in accordance with the requirements of Engineering Standard 1-202, Signalling equipment overhaul.

10. Performance parameters

Performance parameters applicable to H5 Trainstops are defined and quantified below.



10.1 Trip arm position

The height of the top edge of the Trip Arm shall be $10\frac{1}{8}" \pm \frac{1}{16}"$ above the lower edge of the feet of the Trainstop Case.

The outer edge of the Trip Arm shall be $5\frac{3}{4}" + \frac{1}{16}"$ –nil from a line joining the centres of the holes in the feet on the Trip Arm side of the Case.

10.2 Contact switching positions

Contact make and break positions are specified in relation to the top edge of the Trip Arm when it is in its fully raised position. The switching points are as defined in the table below.

Vertical depression of top of Trip Arm	State of all 'ON' contacts	State of all 'OFF' contacts
0 " to $\frac{3}{8}"$	closed	open
$\frac{1}{2}"$ to $2\frac{3}{8}"$	open	open
$2\frac{5}{8}"$ to $3\frac{3}{8}"$	open	closed

10.3 Operating air pressures

The Trainstop shall operate from an 'ON' position to the full 'OFF' position when supplied with air pressure within range 45 – 60 p.s.i..

The Trainstop shall not move away from its fully 'ON' position with an applied air pressure of 16 p.s.i..

10.4 Contact resistance

Contact Resistance shall be measured with 1 Amp flowing through the contact fed from a 100 V A.C. supply.

The Contact Resistance, calculated from the volt drop measured between terminal posts, shall be no greater than 0.05 Ω .

10.5 Insulation resistance

The Insulation Resistance between any item forming part of an electrical circuit and any other metallic part of the equipment shall be greater than 10 M Ω when measured at 1000 V DC.

11. Equipment configuration

An Illustrated Parts List comprising an itemised list and six figures is provided as Attachment 2 to this document to describe the equipment as identified in Section 8 of this specification. The Illustrated Parts List contains all relevant drawing numbers.

A convention of using the figure number followed by the item number has been adopted in this document to uniquely refer to specific components where necessary. Thus, item 1-2 is the Case.

Unless specifically noted, drawings and figures used in this Specification are for reference only.



12. General requirements

12.1 Compliance with specification

No departures from the requirements of this Specification shall be permitted (either permanently or temporarily) without compliance with the relevant change control procedures.

Neither equivalence of process nor substitution of materials shall be recognised by the Client in receiving work performed against this specification. The Client shall have the immutable expectation that equipment overhauled to this version of the specification shall be 100 % compliant with the specification herein.

12.2 Workshop environment

There are no special requirements for the workshop environment.

A regulated (0 to 60 p.s.i.) supply of compressed air is required to operate the Trainstops. Air consumption is minimal.

Calibrated test equipment shall be used to carry out all measurements specified.

12.3 Calibre of staff

Any staff involved in the overhaul process shall be competent in the tasks they carry out and the overhauling contractor shall demonstrate this in accordance with the requirements of 1-203, Competence of personnel working on signal and control systems.

12.4 Operator accountability

Process control documentation is required to be completed by identified certified operators and inspectors throughout the overhaul process. Each certified operator and inspector shall possess a uniquely numbered stamp which is traceable to the owner. Only competent operators shall be provided with a stamp. Records of the issue and withdrawal (if appropriate) of every stamp shall be kept and shall be made available to the Client on request. The retention period of these records is required to be indefinite.

13. Overhaul definition

Under certain failure modes of the compressed air supply system it may be possible for the air main to be charged at pressures of up to 10 bar. Pneumatically operated signalling equipment must withstand this pressure. It is not required in this Specification for the equipment to be tested at this pressure. However, the Contractor shall not perform any activity on the equipment which will impair its ability to withstand this pressure.

13.1 Full overhaul

A full overhaul, including repair or replacement of failed component(s) will be performed on each item returned to the workshop. Items returned to the workshop will usually not contain an air-motor. A replacement air-motor, fit for use without any work required by the workshop and already fitted with its own Asset Label, will be supplied by the Client.

No item returned after failing in service shall be overhauled until the failure report has been reviewed and accepted by the Client in accordance with a defined arrangement agreed with the Client.

Unless stated to the contrary, all processes detailed in this specification shall be performed for each overhaul.

13.1.1 Dismantle

The Trainstop shall be dismantled in a manner that shall not damage or shorten the life of any component that is required to be re-used. The life of all recyclable components is indefinite.



The items listed below shall be discarded and replaced with new items at every overhaul.

Asset Label (1-14)	Split Pins (all)	Locking Plates (all)
Lubricating Nipples (1-20, 2-55, 2-60, 4-114, 5-142)	Lead Seal (3-96) and Locking Wire	Rubber Cap (1-5)
Gasket (1-4)	Snow Bellows Assembly (2-37)	Woodruff Key (2-66)
Contact Strips (5-152 and 154)	Contact Spring Assemblies (5-151 and 153)	Air Motor Gasket (6-182)
Fulcrum Pin (3-79)	Trip Arm Retaining Bolt and Nut (2-51 and 2-52)	Blanking Plugs (1-18) Sealing Plug (1-18a) Sealing Plate (1-18b) Screws (1-18c)
Secondary Spring (3-83)	Bolt, cross drilled (3-90)	Cams (5-146)
U-cup seals (4-102a, 4-102b)		

The following items (and their associated fixings) need not be detached from their host components as part of the dismantling sequence. They should first be examined in situ to determine the need to replace or refurbish them.

Cover Stop Plate (1-16)	Oilite Bearings (all items)	Pivot Pin (2-35)
Eyebolt, Nut and Washer (1-25,26 and 27)	Screw and Nut (1-31 and 1-32)	Eyebolts (1-6, 6-174 and 6-178)

In some instances redundant holes in the case have been filled with a screw and nut. These components shall not be disturbed during the overhaul.

13.1.2 Cleaning

The following shall be implemented after the relay has been dismantled in accordance with Section 13.1.1 above.

All components shall be cleaned and degreased using a technique suitable for that component. A 'suitable technique' shall not cause short term or long term degradation to the component nor shall any solvent used leave undesirable residues on the component which will affect the performance of the component when it forms part of an overhauled unit.

13.1.3 Examination and gauging

All components shall be examined for the effects of excessive or unusual wear, general damage, damage caused by misuse or age, electrical arcing or tracking or overheating. All thread forms shall be checked for signs of over-tightening. Items exhibiting damage that will not be corrected by the specified re-furbishing processes shall be discarded.

All occurrences of excessive or unusual wear or damage shall be catalogued and reported to the Client.



The subject items of such reports and as much of the unit from which they were removed as possible, shall be saved in their as near as original condition after being discovered and shall be clearly tagged and identified and shall be made available for Client inspection if so desired.

It is critical that **only** those components specified for refurbishment should be reclaimed after failing the wear tolerances specified.

Any component which fails its examination criteria shall be discarded if there is no refurbishment process detailed for it in this Specification.

Major components and items with specific examination criteria are listed below.

All component parts set aside for use at assembly shall be to a current approved design. Modification schemes may have been commenced which may not yet have been fully implemented. Units submitted for overhaul may not be to the current build standard. Some components may therefore require to be modified or discarded.

13.1.3.1 Case (Item 1-2)

The stripped Case shall be inspected for damage, particularly for signs of cracking in the area of the bearing bores and the Trip Arm stop face.

Damage to the feet, the shoe-beam ramp bolting ledge and the top edge of the Case may be repaired by welding (see section 13.1.4.1).

All Cover Stop Plates (item 1-16) shall be present and be firmly fixed to the Case. Lose plates shall be removed and re-attached.

Both Spring Anchor Brackets (items 1-21 and 1-30) shall be securely fitted to the Case. Lose items shall be removed and re-attached.

The maximum acceptable diameter of the main bearing bores is 2.260 ".

The maximum acceptable distance between the centre-line of the main bearing bore and the front vertical face of the Trip Arm stop face is 3.0045 ". Cases failing this criteria may be refurbished (see section 13.1.4.1).

13.1.3.2 Cover (Item 1-3)

The condition of the plastic coating on the Cover shall be examined. The plastic coating shall be adhered to all parts of the base metal. Covers with blistering coating shall be stripped back to bare metal and re-coated in accordance with the manufacturing details.

The lid retaining lugs shall all be present and positioned in accordance with the manufacturing details.

13.1.3.3 Trip arm (Item 2-34)

The Trip Arm shall be examined for damage to the operating face, the attachment boss around the square hole and the proving linkage pin.

The Pivot Pin (item 2-35) shall be securely attached to the Arm and there shall be no cracking or other damage to the boss into which the Pin fits. A lose Pivot Pin may be re-fixed provided that the boss is sound and the Securing Pin hole is dimensionally correct.

The boss around the square clamping hole shall be undamaged and show no signs of cracking.

Burrs and other superficial damage to the trip head may be removed by filing. Impact damage shall not be deeper than $\frac{1}{16}$ ".



The Trip Arm shall be gauged to be within the dimensions given on drawing BS48409. Items with wear to the horizontal dimension between the square bore centre and the stop face may be refurbished (see section 13.1.4.2.).

13.1.3.4 Secondary link (Item 2-54)

The maximum acceptable diameter of all bushes is 0.6275 ". Any bush being oversize shall cause all three bushes in the component to be replaced.

13.1.3.5 Link pin (Item 2-59)

The minimum acceptable diameter of the Link Pin is 0.621".

13.1.3.6 Link arm (Item 2-61)

The maximum acceptable diameter of the bearing bore is 0.6275 ".

Items not meeting this criteria may be refurbished (see section 13.1.4.3) or if already fitted with an Oilite bush, a new bush shall be fitted.

13.1.3.7 Main spring (Item 2-69)

The plating of the Spring shall be examined for peeling. Items with peeling plating may be refurbished (see section 13.1.4.4).

13.1.3.8 Main spring fork end (Item 3-76)

The maximum acceptable diameter of the Oilite bushes in the Fork End is 0.6275 ". New bushes shall be fitted to items not meeting the criteria.

13.1.3.9 Headed pin (Item 3-81)

The minimum acceptable diameter of the Pin is 0.3085 " .

13.1.3.10 Secondary spring sleeve (Item 3-82)

The maximum acceptable diameter of the Pin holes is 0.320 ".

13.1.3.11 Secondary spring jaw (Item 3-86)

The maximum acceptable diameter of the Pin holes in the Arm is 0.3785 ". Where this criteria is not met the item shall be fitted with a new bush or refurbished (see section 13.1.4.5).

13.1.3.12 Headed pin (Item 3-87)

The minimum acceptable diameter of the Pin is 0.371".

13.1.3.13 Contact shaft operating arm (Item 3-91)

The maximum acceptable diameter of the bearing holes is 0.3785". Items not meeting this criteria shall be fitted with new bushes.

13.1.3.14 Proving arm eye rod (Item 3-93)

The maximum acceptable diameter of the bearing hole is 0.3785 ". Items not meeting this criteria may be refurbished (see section 13.1.4.6). For items already having an Oilite bush fitted, a new bush shall be fitted if required.

13.1.3.15 Proving arm screwed jaw (Item 3-95)

The maximum acceptable diameter of the bearing holes is 0.3785 ". New Oilite bushes, if required, shall be fitted as pairs. Items without bushes may be refurbished (see section 13.1.4.7).



13.1.3.16 Headed pin (Item 3-97)

The minimum acceptable diameter of the Pin is 0.371 ".

13.1.3.17 Main shaft bearing bush (Item 4-102)

The minimum acceptable diameter of the bearing is 2.244 ".

The bearing surface and grooves shall not be scored or otherwise damaged.

13.1.3.18 Main shaft (Item 4-103)

The item shall be examined for damage and wear particularly around the radiused notches where the Trip Arm and cranks are attached and where the main bearings fit.

Wear, bending or twisting of the shaft not cause the item to fall outside the manufacturing tolerances.

13.1.3.19 Operating crank (Item 4-109)

The maximum acceptable diameter of the pin hole bores is 0.6275 ".

13.1.3.20 Operating crank roller assembly (Items 4-110 and 111)

The maximum acceptable diameter of the bearing hole in the bush is 0.6275 ". A new bush shall be fitted to items not meeting this criteria.

13.1.3.21 Square headed pin (Item 4-113)

The minimum acceptable diameter of the Pin is 0.620 ".

13.1.3.22 Secondary shaft bearing bush (Items 4-117a/b)

The maximum acceptable diameter of the bearing hole is 0.7545 ".

13.1.3.23 Secondary shaft spindle (Item 4-119)

The minimum acceptable diameter of the bearing surfaces of the Spindle is 0.745 ". The surfaces shall not be scored or otherwise damaged. The Morse taper section of the Spindle shall be undamaged.

13.1.3.24 Secondary shaft arm (Item 4-121)

The maximum acceptable diameter of the pin hole in the Arm is 0.3785 ". For items already fitted with a bush, a new bush shall be fitted if the wear allowance is exceeded. Items without bushes may be refurbished (see section 13.1.4.8).

13.1.3.25 Contact shaft bearing housing (Item 5-140a)

Two patterns of this item are in circulation. Both are acceptable for re-use subject to meeting the examination criteria. The original one-piece component shall be discarded if the bearing size wears greater than the maximum acceptable diameter. The component with an Oilite bush may have the bush replaced when it wears beyond the acceptable diameter.

The maximum acceptable diameter of the bearing is 0.5025 ".

13.1.3.26 Contact operating shaft (Item 5-143)

The minimum acceptable diameter of the bearing surfaces of the shaft is 0.4955 ". The surfaces shall not be scored or otherwise damaged.

**13.1.4 Refurbishment**

The refurbishment processes detailed below are the only acceptable processes that may be applied to reclaim component parts.

Where it is deemed uneconomic to refurbish any part, the Contractor may, at his discretion, replace the worn component with a new item.

13.1.4.1 Case (Item 1-2)

The Trip Arm stop face may be restored by machining away the worn face before building it up with Stellite welding material and machining back to original manufacturing dimensions. The minimum acceptable thickness of the weld deposition remaining after machining back is 0.025".

Damage to the feet, the shoe-beam ramp bolting ledge and the top edge of the Case may be repaired by welding.

13.1.4.2 Cover (Item 1-3)

Fixing lugs may be replaced with new items to original manufacturing dimensions as required.

13.1.4.3 Trip arm (Item 2-34)

The stop face of the Trip Arm may be restored by machining away the worn face before building it up with weld and machining back to dimensions given on drawing BS48409. The minimum acceptable thickness of the weld deposition remaining after machining back is 0.025 ".

13.1.4.4 Link arm (Items 2-61)

Bushes may be fitted to Link Arms in accordance with drawing 6174-A3-102520.

13.1.4.5 Spring (Item 2-69)

Springs with peeling plating may be stripped and re-plated.

13.1.4.6 Secondary spring jaw (Item 3-86)

An Oilite Bush may be press fitted before finish machining to original manufacturing dimensions.

13.1.4.7 Proving arm eye rod (Item 3-93)

An Oilite Bush may be press fitted before finish machining to original manufacturing dimensions.

13.1.4.8 Proving arm screwed jaw (Item 3-95)

An Oilite Bush may be press fitted before finish machining to original manufacturing dimensions.

13.1.4.9 Secondary shaft arm (Item 4-121)

An Oilite Bush may be press fitted before finish machining to original manufacturing dimensions.

13.1.4.10 Protective finishes**13.1.4.10.1 Paint finishes**

All un-plated ferrous components shall be painted in accordance with the process specified below.

Painting shall be done after the item has completed any refurbishing required.

All bearing surfaces, seating faces, screw threads, threaded holes and operating faces shall be protected from paint application.



Bare metal seating to the full diameter of the fitted components shall be provided on the inside and outside of the Case to provide a good electrical connection for the Earth Screw (item 1-11) and associated parts.

Paint application shall be a base coat of Red Oxide Primer (manufacturer- Hadfields, reference 1313.006) – LU Part No. 17412/429, followed by a top coat of General Purpose Aluminium Paint to LT Specification 174-27 – LU Part No. 17450/225.

The Trip Arm side of the Case shall have a final coat of Grey High Build Car Body Paint (Ripothane, Williamson Ref. 31/PL123, LU Stores Part Number 17438/635) applied over the Aluminium coat.

The face of the Trip Arm shall have a final coat of white gloss paint applied over the Aluminium top coat.

13.1.4.10.2 Plastic coating of cover (Item 1-3)

Covers requiring a new plastic coating shall be completely stripped back to bare metal. The surface shall be shot blasted and otherwise treated to prepare it so that the plastic coating adheres to the total surface area of the item. Blisters in the coating are **not** acceptable.

The Cover shall be completely coated with a coating of black High Density Polyethylene.

13.1.5 Assembly criteria

13.1.5.1 Mechanical assembly

Cover Stop Plates (items 1-16) shall be fitted to the Case in accordance with drawing AS36517.

The Main Shaft Bearing Bushes (items 4-102) shall be orientated on the Main Shaft (item 4-103) in accordance with drawing AS45154. [CPS01]

The Trip Arm (item 2-34) shall be attached to the Main Shaft in accordance with drawing AS44514.

The outside edge of the Trip Arm shall be $5\frac{3}{4} + \frac{1}{16}$ " – nil from a line through the centre points of the Case bolting down holes on the Trip Arm side of the Case.

Spacing Washers (items 4-108a-d) shall be fitted to the Main Shaft as required to give an end-float of 0.020" - 0.030". [CPS02]

The two Main Spring Assemblies shall be assembled in accordance with drawing S3-28821.

Both Main Springs (items 3-69) and the Secondary Spring (item 3-83) shall be liberally coated with Shell Alvania EP(LF)1 Grease (or other approved equivalent grease) at time of assembly.

All bearing bushes and shaft journals shall be lubricated with a 10W grade general purpose oil at time of assembly. [CPS03]

External proving linkages shall be lubricated with Shell Alvania EP(LF)1 Grease (or other approved equivalent grease) at time of assembly. [CPS04]

A $\frac{5}{64}$ " hole shall be drilled through item 3-90 at time of assembly to take the split pin, item 3-80.

The Main Shaft Cover Plate (item 4-101) shall be sealed in position with Loctite 574. [CPS05]

Lubricating Nipples (items 4-114) shall be fitted to the Secondary Shaft Bearing Bushes (items 4-117a/b) in accordance with drawing BS28478.

Mating surfaces and threads of components associated with the Air Inlet Block shall be treated with Loctite Multi-Gasket compound or other equivalent approved compound. [CPS06]

Loctite Multi-Gasket or other equivalent approved compound shall be used to form a liquid-proof seal when fitting the Plug (item 1-19) to the Case (item 1-2).

The end of the Drain Pipe (item 6-169) shall protrude through the side of the Case by between zero and $\frac{1}{8}$ ".