



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

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1. Scope

This Specification is written to comply with Engineering Standard 1-202 in defining the requirements for the overhaul of all variants of K type Trainstops 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):

C.B.	Circuit Breaker
CPS	Critical Parameter or Setting
DCN	Design Change Notice
LU	London Underground
OEM	Original Equipment Manufacturer
p.s.i.	Pounds per Square Inch
WSL	Westinghouse Signal Limited

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 style K Trainstop which is used in the signalling system on the London Underground.

Style K 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 an item 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 item.

Any failure condition which allows a K 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 a K Trainstop is shown in Figure A.

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.

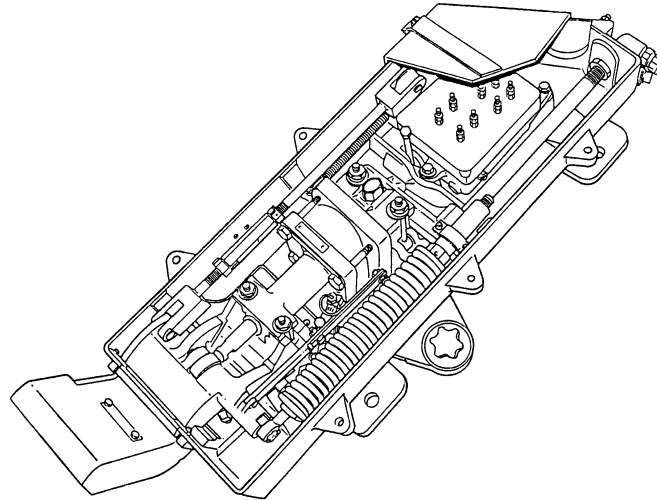


Figure A. General view of a style K Trainstop

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 Trip Cock of the train by bringing it into contact with the Trip Arm on the Trainstop. To engage the Trip Cock the Trip Arm must be in its raised, de-energised, position which is referred to as the 'ON' 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 Trip Cock.

The K Trainstop is one of three types of Trainstops that are commonly used on the Underground. It is the only type specifically designed to fit within the very tight confines of tube tunnels where there is very restricted width available between the running rail and the tunnel lining.

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 independent air valve.

A self contained Circuit Breaker box is fitted to provide detection of the status of the Trainstop. It may be exchanged on site if necessary.

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

Three versions of the K Trainstop are in circulation. They are the standard version (which predominates), a version for use with flat-bottom rail (designated as style KF) and a version for use in the peculiarly tight confines of the Central Line (designated as style KC).

The KF version differs from the standard in that the two near side fixing feet are not present. Instead studs welded to the near side to the Case are used to secure the Trainstop to the trackbed. In all other respects the workings are identical to the standard version.

The KC version has the rear outside foot removed and a hold down bracket substituted which fastens to the rib of a tunnel segment. Additionally, an angled channel insert has been let into the Case to allow the Trainstop to sit astride the rib of a tunnel segment. This modification has caused changes to be made to the internal design of the air feed to the Trainstop motor.

7. Equipment design outline

Design features built into the K 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 items.
- A site exchangeable Air Motor
- A site exchangeable Circuit Breaker Box
- An automatic oiling system for the bearings, fed by an oil pump actuated at every operation of the Trainstop
- An ability to be installed in a safe manner in close proximity to the traction rails

The unit is built using a cast iron case which has a sealed lid and sealed cable entry for the 10-core moulded cable used to attach the contacts to the fixed lineside infrastructure. The Trip Arm has a full width bearing surface and is actuated by the direct force exerted on it by the piston of the Air Motor. A single return spring attaches directly onto the Trip Arm to return it to the raised 'ON' position when the Air Motor is de-energised. A 3" diameter air motor is used to operate the Trainstop.

A self-contained Circuit Breaker Box houses the contacts which sense the position of the Trip Arm. The Circuit Breaker Box is field exchangeable and is treated as a separate item for the purpose of overhaul and is the subject of a separate Specification which details the requirements of the overhaul process.

To achieve the maximum possible integrity in detecting the presence of the Trip Arm, a separate linkage to the Trip Arm is used to operate the contacts. The Trip Arm is linked directly to an Operating Arm which couples to the C.B. Box. A separate spring on this linkage is designed to drive the C.B. Box to the 'OFF' state if the connection to the Trip Arm head becomes compromised.

A non-lubricated air motor is fitted to K Trainstops. All parts requiring lubrication are lubricated by an automatic oiling system using oil from a sump formed by the Trainstop case. The oil pump is operated at each stroke of the Trainstop and oil is supplied to the bearings through metering valves.

8. Applicability

This specification applies to the following items.

Item	Stores List No.
K Trainstop – Standard	73s163
KC Trainstop	73s161
KF Trainstop	73s175

The items above are complete, fitted with a C.B. Box.



The C.B. Box is a self contained component of the Trainstop. The overhaul of the C.B. Box is the subject of a separated Specification, Document Number MR-OS-3435, Signal equipment overhaul specification, Circuit breaker box for style J and K Trainstops.

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.

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

9. Critical functions

Critical Functions of K Trainstops 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.

Stability of gauging: 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.

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.

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. The setting of the make and break positions of both 'ON' and 'OFF' contacts is critical to ensuring that the Trip Arm is detected within its gauging window.

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 table below.



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 K Trainstops are defined and quantified below.

10.1 Trip arm gauging

With the Trainstop in the 'ON' position (Trip Arm fully raised) the top surface of the Trip Arm shall be $10\frac{1}{8}" \pm \frac{1}{16}"$ above the underside of the Trainstop fixing feet.

The width of the Trip Arm head shall be $5\frac{1}{2}" + \frac{1}{8}" - \text{nil}$.

For style K and KC only, when the Trainstop is viewed from the trip Arm end, the distance between the line joining the centres of the holes in the left hand Case feet and the left hand edge of the Trip Arm head shall be $1\frac{3}{4}" + \text{nil} - \frac{1}{16}"$.

For style KF only, when the horizontal position of the Trip Arm head shall be in accordance with drawing 6140-A1-106183.

10.2 Contact operation for 'on' and 'off' positions

Contact switching positions are defined in relation to the top surface of the Trip Arm when it is in its 'ON' position (see section 10.1).

The switching positions of 'ON' and 'OFF' contacts are as given in the Table 1 below.

Trip Arm depression from raised position	'ON' contacts state	'OFF' contacts state
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

Table 1 Contact switching positions

10.3 Contact resistance

Contact Resistance shall be measured with 0.1 Amp flowing through the contact fed from a 100V A.C. supply.

The Contact Resistance, calculated from the volt drop measured between terminal posts on the C.B. Box, shall be no greater than 0.1 Ω .

10.4 Insulation resistance

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

10.5 Operating Air Pressures

The Trainstop shall operate to the full off position (Air Motor extended to the full extent of its mechanical stroke) with an applied air pressure of 40 p.s.i.

The normal working pressure is 60 p.s.i. at which pressure the Trainstop shall operate smoothly over the whole stroke and return to the 'ON' position with no signs of sticking at the limit of the stroke.

The Trainstop shall remain in its fully 'ON' position with an applied air pressure of 16 p.s.i.

11. Equipment configuration

An Illustrated Parts List is provided as Attachment 2 to this document, comprising an itemised list and nine figures 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 applicable the workshop environment.

A regulated (0 to 60 p.s.i.) supply of compressed air is required. 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 Engineering Standard 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 (stamp-holding) 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

K Trainstops are generally left in service until they fail. A full overhaul, including repair or replacement of failed component(s) will be performed on each item returned to the workshop.

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.

Split Pins (all)	Sealing Washers (all)	Lockplates (all)
Gasket material (1-4)	Bolt Securing Washer (1-9)	Asset Label (1-19)
Locking Washers (2-53)	Packing Shims (all)	Fibre Washers (3-91)
Gasket (4-103)	Copper Washer (4-105)	Oil Seals (all)
Neoprene Gasket Block (5-157)	Oil Pump 'O' rings (5-161)	Dirt Excluder (all)
Plunger Retaining Pin (5-168)	Valve Seat Gasket (5-163)	Secondary Spring (2-59)
Headed Pin (2-45) & (2-55)	Washer Plain (2-46)	Screwed Rod & Jaw (2-48)
Screwed Rod & Jaw (2-49)	Nut (2-51) & (2-52)	Locking Washer (2-53)
Turnbuckle (2-54)		

Items listed below, and their related fixings, shall not be removed at the time of general dismantling. They may be required to be removed after they have been examined and found to be in need of replacement.

Cover Stop Plates (1-21)	Eyebolts (3-78 and 3-83)	Bearing inserts (all)
Insulating Plate (1-5)	Oil Pump Studs (5-146)	Anchor Pin (2-58)

The Circuit Breaker Assembly shall be removed as a complete unit and overhauled in accordance with the requirements of document MR-OS-3435, Signal Equipment Overhaul Specification, Circuit Breaker Box for style J and K Trainstops. No details of the overhaul of this item are included in this Specification. Items 1-28 and 1-29 are provided as part of the C.B. Box assembly

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.

All paint shall be stripped off painted components.

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 (Items 1-2a/b/c)

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 faces. No signs of cracking in these areas are acceptable.

Damage to the feet and the top edge of the Case may be repaired by welding (see section 13.1.4.1).

6 Cover Stop Plates (item 1-21) shall be present and be firmly fixed to the Case. Loose plates shall be removed and re-attached.

All oilways shall be clear of debris.

The position of the Trip Arm stop-face shall be gauged using jig J1273. This face may be refurbished if worn; see section 13.1.4.1 for details.

The welds around the channel insert on items 1-2b shall be visually examined. The weld shall not be cracked anywhere along its length. Cracked weld may be refurbished; see section 13.1.4.1 for details.

All Cases shall be suitable for use with dirt excluders around the Trip Arm. Cases which are not already suitable shall be modified in accordance with drawings AS59525 and BS46047.

Threads in the Cover holding down lugs shall be examined. Damaged threads may be refurbished; see section 13.1.4.1 for details.

13.1.3.2 Cover (Item 1-3)

The fixing straps shall be undamaged and aligned in accordance with the manufacturing drawing.

The Insulating Plate (item 1-5) shall be firmly attached to the Cover and shall be complete and undamaged.

Covers may be refurbished; see section 13.1.4.2 for details

13.1.3.3 Oil Strainer (Item 1-25)

The Oil Strainer shall be undamaged, with a complete gauze. The gauze shall not have blocked pores.

The item shall be fitted with a lifting bar in accordance with drawing AS42344

13.1.3.4 Main Spring (Item 2-40)

The plating shall be examined for cracking and peeling. No cracking or peeling of the plating is acceptable.

Springs may be refurbished ; see section 13.1.4.3 for details.

13.1.3.5 Screwed Rod and Bearing (Items 2-41 and 2-42)

The maximum acceptable diameter of the bearing is 0.628". A new bearing may be pressed into place if this criteria is not met.

13.1.3.6 Headed Pin (Item 2-45)

The surface of the Pin shall not be scored or otherwise damaged.

The minimum acceptable diameter of the Pin is 0.371".

13.1.3.7 Screwed Rod and Jaw Assembly (Item 2-48)

The Screwed Rod shall be securely attached to the Jaw. There shall be no cracking visible in the joint weld.

13.1.3.8 Screwed Rod and Jaw Assembly (Item 2-49)

The Screwed Rod shall be securely attached to the Jaw. There shall be no cracking visible in the joint weld.

13.1.3.9 Headed Pin (Item 2-55)

The surface of the Pin shall not be scored or otherwise damaged.

13.1.3.10 Secondary Spring (Item 2-59)

The plating shall be examined for cracking and peeling. No cracking or peeling of the plating is acceptable.

Springs may be refurbished ; see section 13.1.4.3 for details.

13.1.3.11 Secondary Spring Link Arm Bearing (Item 2-62)

The maximum acceptable diameter of the bearing is 0.252".

13.1.3.12 Operating Arm (Item 2-67)

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

The maximum acceptable diameter of the small bearing is 0.3785".

The minimum acceptable diameter of the small pin is 0.246".

The minimum acceptable diameter of the large pin is 0.435".

13.1.3.13 Fulcrum Pin (Item 2-73)

The bearing surface shall be smooth all over and free of blemishes.

The minimum acceptable diameter of the bearing surface is 0.746".

The maximum acceptable length of the bearing shoulder is 1.161".

13.1.3.14 Headed Pin (Item 4-117)

The surface of the Pin shall not be scored or otherwise damaged.

The minimum acceptable diameter of the Pin is 0.246".

13.1.3.15 Oil Pump Link (front half) (Item 4-119+)

The maximum acceptable diameter of the bearing hole is 0.255".



13.1.3.16 Cranked Pin (Item 4-125)

The bearing surfaces shall be smooth all over and free of blemishes.

The minimum acceptable diameter of the bearing surfaces is 0.620".

13.1.3.17 Roller and Bush (Items 4-126 and 4-127)

The outer diameter of the Roller shall not have any flat spots deeper than 0.010" below the minimum manufacturing dimension.

The maximum acceptable diameter of the bearing bore is 0.629".

13.1.3.18 Trip Arm Shaft (Items 4-128)

The Shaft shall have a polished finish and shall be free from scoring and other blemishes to ensure oiltight seals with the Oil Seals.

The minimum acceptable diameter of the bearing section is 1.3705".

All oilways shall be clear and free of foreign bodies.

13.1.3.19 Trip Arm (Item 4-129 and 4-129a)

The Trip Arm shall be examined for cracks in the casting, particularly in the area of the main shaft bearing. No cracks are acceptable.

The Trip Arm fitted to a Trainstop which has been subjected to a 'run-through' shall be discarded if the damage sustained in the 'run-through' caused the Main Shaft to be bent or the Case to be damaged sufficient to cause the Shaft or Case to be discarded.

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 bearing section of the bore shall not be scored or otherwise damaged. The maximum acceptable diameter of the bore is 1.377".

Trip Arms not to the latest design, see Parts List for details, are acceptable provided that they have been modified in accordance with drawing CS54338.

Rubbing surfaces for three dirt excluders shall be free blemishes and other damage which would cause the dirt excluder to not seal correctly. These faces may be lightly dressed to restore minor imperfections.

13.1.3.20 Trip Arm Detector Lever Bush (Item 4-137)

The maximum acceptable diameter of the bearing bush is 0.3785".

13.1.3.21 Headed Pin (Item 5-150)

The surface of the Pin shall not be scored or otherwise damaged.

The minimum acceptable diameter of the Pin is 0.309".

13.1.3.22 Headed Pin (Item 5-151)

The surface of the Pin shall not be scored or otherwise damaged.

The minimum acceptable diameter of the Pin is 0.309".

13.1.3.23 Oil Pump Operating Lever and Bush (Item 5-152 and 5-153)

The maximum acceptable diameter of the bush is 0.315".

The maximum acceptable diameter of the link pin holes is 0.318".

A new bush may be fitted as required. Excess wear in the link pin holes shall cause the Lever to be discarded.

13.1.3.24 Oil Pump Body (Item 5-154)

The pump cylinder bore shall not be scored or otherwise damaged. The maximum acceptable diameter of the bore is 0.504".

The maximum acceptable diameter of the pivot bearing holes is 0.315".

All parts of the casting shall be thoroughly clean and free of substances that would contaminate the oil system.

13.1.3.25 Oil Filter (Item 5-156)

All parts of the Oil Filter shall be thoroughly clean and free of substances that would contaminate the oil system.

The filter gauze shall be complete with no holes or blocked areas.

13.1.3.26 Oil Pump Valve Piece (Item 5-160)

The sealing faces of the item shall not be scored and shall have a polished surface. The sealing faces may be lapped and polished provided that the dimensions remain within the manufacturing tolerance.

13.1.3.27 Oil Pump Valve Seat (Item 5-162)

The sealing faces of the item shall not be scored and shall have a polished surface. The sealing faces may be lapped and polished provided that the dimensions remain within the manufacturing tolerance.

13.1.3.28 Plunger Shaft (Item 5-165)

The maximum acceptable diameter of the pin hole is 0.315".

13.1.3.29 Plunger (Item 5-167)

The surface shall be free of scratches and other blemishes.

The minimum acceptable diameter of the body is 0.4970".

Discard items not meeting the above criteria.

13.1.4 Refurbishment

13.1.4.1 Case (Items 1-2a/b/c)

Damage to the feet and the top edge of the Case may be repaired by welding.

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

Cracked weld around the channel insert on style KC Cases may be repaired by grinding out the old cracked weld for the entire length of the affected seam before rewelding the prepared joint.

Cases that have been modified to serve as KF units may not be converted back to the standard configuration by reattaching the two feet.

Damaged threads in the Lid lugs may be repaired using $\frac{3}{8}$ " BSF helicoil inserts.

13.1.4.2 Cover (Item 1-3)

Fixing Lugs may be replaced to original manufacturing dimensions as required.

13.1.4.3 Main Spring (Item 2-40) and Secondary Spring (Item 2-59)

Items with cracked or peeling plating shall be re-plated in accordance with the manufacturing drawing after completely removing the old plating.

13.1.4.4 Paint Finishes

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

All ferrous components shall be painted all over, subject to the exclusions given below, in accordance with the specification detailed in this section.

All machined surfaces, mating surfaces, bearing surfaces, screw threads and threaded holes and oilway holes shall be protected from paint application.

The Air Pipe fittings shall be painted after assembly has been completed.

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 1-10) 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.

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 to the faces of the Case and Trip Arm as indicated on drawing AS52310.

The face of the Trip Arm shall have a final coat of white gloss paint applied over the Aluminium top coat in accordance with drawing AS52310.

The inside of the Cover (item 1-3) shall have a final coat of black bitumen paint applied over the Aluminium top coat. The Insulating Plate (item 1-5) shall be left unpainted.

13.1.5 Assembly Criteria

13.1.5.1 Assembly for all variants

All mating surfaces, except those to be treated with sealing or jointing compounds, shall be lightly coated with a film of 10W grade general purpose lubricating oil before assembly.

The Main Spring (item 2-40) and the Secondary Spring (item 2-59) shall be liberally coated with Shell Alvania EP(LF)1 Grease (or other approved equivalent grease) at time of assembly.

Loctite Multi-Gasket compound, or approved equivalent, shall be used sparingly to make air-tight joints on the threaded air pipe fittings. The compound shall not be allowed to penetrate to the inside of the fittings. [CPS01]

Oil-tight joints shall be formed between the Studs (items 5-146) and the Case using Loctite Multi-Gasket compound, or approved equivalent. The Studs shall be fitted in accordance with drawing BS48542. [CPS02]

◆ The Gasket Material (item 1-4) shall be stuck to the Cover (item 1-3), in accordance with drawing AS36484.

All split pins shall be fully opened and turned back round the retained component to the extent of their length.

The Earthing Screw (item 1-10) and associated components shall be tightened down onto bare bright metal of the Case. The Case shall be cleared of paint over a 1" diameter around the fixing hole on both sides of the case. [CPS03]

The Trip Arm shall come to rest in the 'ON' position with the stop faces of the Trip Arm and the Case in contact. In this position, it shall be possible to obtain clearance between the end of the Piston Rod and the Trip Arm Operating Roller (item 4-126). [CPS04]

The Main Spring Screwed Rod (item 2-41) shall be connected to the Cranked Pin (item 4-125) in accordance with drawing AS52647.

The Trip Arm Shaft shall be fitted in accordance with drawing AS52992. [CPS05]

Golden Hermatite, or approved equivalent compound, shall be used when attaching the Main Shaft Cover (item 4-101a/b) and Gasket (item 4-103).

The sump shall be filled via the oil strainer with sufficient oil to ensure correct operation of the Oil pump prior to testing.

The length of the Oil Pump Link Assembly (item 4-118) shall be set so as to allow at least $\frac{1}{16}$ " extra stroke to be available on the Oil Pump Operating Lever (item 5-152) when the Trip Arm is driven to the limit of its stroke in the 'OFF' position. [CPS06]

The oiling system shall be assembled in accordance with drawing CS63897.

The Oil Pump shall generate an oil pressure of at least 40 p.s.i. measured at the delivery port of the pump. [CPS07]

Contact switching positions are defined in relation to the top surface of the Trip Arm when it is in its 'ON' position (see section 10.1).

The switching positions of 'ON' and 'OFF' contacts shall be set to fall within the parameters given below, reproduced from Table 1 of section 10.2 of this specification.

Trip Arm depression from raised position	'ON' contacts state	'OFF' contacts state
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

Table 1 Contact switching positions

After setting the switching positions of the contacts, the Turnbuckle (item 2-54) shall be locked in position in accordance with drawing BS56375. [CPS08]

There shall be clearance of at least $\frac{1}{16}$ " between the C.B. Box operating lever and the limit stops on the C.B. Box when the Trainstop is fully 'ON' and when the Trip Arm is driven to the full limit of its travel. [CPS09]

Screws (item 4-140) used by installation staff to attach the Can Guard shall only be tightened sufficiently to prevent them becoming detached in transit. The Lockplate (item 4-141) shall **not** be bent round the screw heads.

The tops of the terminal posts on the C.B. Box (item 1-27) shall not protrude above the top face of the case (item 1-2a/b/c). No parts of the internal mechanism shall protrude more than 0.430" above the top face of the Case. [CPS10]

13.1.5.2 Assembly for style KC variant

The component compliment varies from the standard configuration as detailed in the Illustrated Parts List (see Attachment 2). The differences occur in the Case, the Trip Arm and the Air Motor connection bracket.

All settings and tests are common to all variants (see section 13.1.5.1).