Safety by Engineering
Supply+

AS & Bayley Ladders

Maintenance & Repair Manual

Issue 15

March 2015

Safety by Engineering
Supply+

+ AS Fire & Safety + Bayley + Collins Youldon + Todd Research

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This manual is written expressively for the Inspection and Maintenance of ladders manufactured by AS Fire & Safety, inclusive within this are the Angus Sacol Rivet Truss Ladders and the Bayley Swaged ladders.

Additionally this Technical manual also covers the test regime for Angus Sacol Rivet truss ladders by the British Standard (BS EN1147), and where applicable the testing of Bayley Ladders to this standard.

It is important to note that due to Fire authorities obtaining older versions of the Bayley Access/Roof ladders in the field, ladders within this period need to be Tested to the Home office JCDD.

The use of this manual to carry out procedures on ladders manufactured by other companies could result in damage to them or in some circumstances cause the ladder to fail in service. For instructions on other manufacturer's ladders please consult their manual.

1 - INTRODUCTION

Ladders manufactured by Supply Plus combine light weight with strength and rigidity, and with the correct maintenance will give many years of useful service. This manual has been prepared to set out the standards of inspection, repair and testing to ensure that ladders are maintained in good working order. For normal use it is recommended that a thorough visual inspection in accordance with the BS EN 1147 Standard is carried out at least quarterly and a more detailed inspection and testing is required Annually.

In cases where the ladder has failed a visual inspection or there is reason to suspect that the ladder may have been damaged either by accident or misuse, the ladder should be subjected to the annual inspection procedure, repaired if necessary and tested before being returned to service.

Instructions are given on those repairs and replacements which maybe undertaken in workshops with the appropriate equipment. Where extensive damage has occurred or where critical components such as side members are involved, the ladder should be returned to Supply Plus for complete overhaul and repair unless the workshop has the facilities and qualified personnel to undertake major repairs. Only spare parts supplied by Supply+ should be used and the repair procedures given here should be followed exactly.

If in any doubt regarding maintenance, training or repair please contact our office or local agent. With all enquiries please quote the ladder serial number. All enquiries to:-

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2 - GENERAL CARE

2.1 - Vehicle Ladder Gantries (AS Ladders & Bayley)

Ladders spend most of their life on vehicle gantries and it is important that they do not damage the ladders. We manufacture an extensive range of gantry packages to cover most requirements, details of which are available on request. It is most important that the gantries are installed and correctly adjusted in accordance with the appropriate installation guidelines. A wrongly adjusted or third party gantry could cause substantial damage and generate the need for expensive repairs.

2.2 - Adjustment of Ladder Gantry

Please note: There are two types of Beam Gantry currently in service

1. **Slide & Tilt Gantry (Movable Beam Profile, Pivot Base, Rollers)**
2. **Traditional Gantry/Inclined Trough (Fixed Rollers & Gantry Lock)**

It is our experience that damage is caused by the incorrect adjustment of the centre and rear rollers of the traditional ladder gantry system (1).

The following procedure should be adopted when these checks are made. On replacing the ladder on the vehicle check that:

1. The centre gantry rollers are clear of the ladder and that you can see daylight between the rollers and the ladders. The more clearance the better and a minimum of 6mm is recommended **(Figure 1)**.
2. Ladders fitted with a stabiliser should have the rear rollers just touching the ladder in such a way that you can easily turn the rollers.

When sighting along the ladder there should be no twist visible.

Incorrect set-up of the Slide & Tilt Gantry (2) will also result in Damage to the Gantry system and the Equipment being housed.

Figure 1

2.3 - Handling (all AS Ladders & Bayley)

The ladder is designed to withstand normal handling and use but because of its lightweight aluminium construction it can be damaged if subject to shock loads which apply high stress in localised areas. At all times the ladder should be handled with reasonable care and should not be allowed to fall heavily when being pitched against a wall or replaced on the ladder gantry. Please refer to Fire Service Manual – Volume 4: Fire Service Training, ISBN 9780113412860.

2.4 - Periodic Inspection and Tests (all AS Ladders & Bayley)

The deflection tests are designed to show that the ladder is in good condition and that repairs have been carried out to a satisfactory standard. Testing a damaged ladder may result in further damage occurring and therefore inspection and any obvious repairs should always be carried out before subjecting the ladder to test loads.

2.5 - Repairs (all AS Ladders & Bayley)

Repairs should only be carried out by competent personnel (who have attended our 2 or 4 day course within the last three years). The passing of this course affirms that the Workshop Technician/Engineer is certified in his/her ability to competently carry out the test and inspection/Maintenance regime by themselves at a desired workshop designation outside of Supply+. Attending the recent courses within this period also affirms that the Technician/Engineer is currently up to date with all of the aspects of the ladders construction and test.

Only AS Fire & Rescue equipment shall be permitted to be used within the Inspection, Repair, Maintenance and Test phases. Also all known Test equipment used for the BS EN 1147/JCDD TEST shall be obtained from Supply Plus

Other repair procedures should not be used and on no account should welding of any type be carried out on the ladder without authority from the manufacturer.

Only high tensile alloy rivets supplied by ourselves may be used.

3 - QUARTERLY INSPECTION

To prepare for inspection the ladder should be initially viewed in the housed position to ascertain the shape of and the clearance between the ladder sections, it should then be extended one rung to ensure that both pawls on the extending sections sit squarely. This is a check for impact damage which may have lozenged the ladder.

The ladder should then be extended in the horizontal position on two supports positioned near the top and bottom ends of the main section.

If personnel do not have access to trestles and AAD pins, erect the ladder up against a structure inline with the usual operational procedures, then lay ladder down on the ground for a visual inspection. Once inspection is complete place ladder up against structure and house ladder within normal procedures.

Note: Ladders must only be extended using the rope and never by pulling the extending sections which could result in damage to the wire cable on triple extension ladders.

Visual Inspections are to include the following items:

3.1 Rivets & Bolts
3.2 Rungs & Rung Brackets
3.3 Stiles/Channels
3.4 Extending Line (where fitted)
3.5 Cable (where fitted)
3.6 AAD (automatic arrest device where fitted)
3.7 Stabiliser Bar (where fitted)
3.8 Wall Wheel Assembly (where fitted)
3.9 Roof Hook (where fitted)
3.10 Slide Wheels
3.11 Hinge Assemblies (where fitted)
3.12 Female Assemblies (where fitted)
3.13 BS EN 1147:2010 Test Labels
3.14 Stanchion Poles (AS Ladders where fitted)
3.15 Pawls (Rescue ladders only)
3.16 Rubber Feet

3.1 Rivets and Bolts (AS Ladders only)

Special care should be taken when visually inspecting a ladder to ensure rivet integrity. This should be done by feel on the blind side as well as a visual inspection on the face surfaces, paying particular attention to those in high stress areas which have additional reinforcing between the rounds. Check the tightness of all rivets and bolts

Rung brackets should be visually checked around the rivet holes to ensure that no splits or hole elongations are present.

3.2 Rungs & AS Ladder Rung Brackets (all AS Ladders & Bayley)

(i) AS Rivet Truss:
Check all rungs for looseness or excessive wear (looseness is where the rung can be turned without applying force, excessive wear can be judged by the wear on the non slip elements).

(ii) Bayley Ladders:
Inspect the swage form for any discrepancies. The shape of the swage should be concentric and held tight against the stile (no gaps). Check inside the rung for any cracks. Also hold the rung and twist back and forth, whilst doing this check to see if there is any sideways rotation at the swaged side of the rung (1) . If excessive movement is found the section/ladder should be removed from service/operation and Supply Plus are to be contacted for further inspection and if deemed necessary a replacement section/ladder is to be obtained.

3.3 Stiles & Channels (all ladders) and Slide Wheels (where fitted)

Examine stiles/channels for signs of cracking, splintering, breaks, gouges, distortion or other damage whilst checking for slide wheel damage.
If 50% or more wear is found it is highly recommended that a new stile is fitted.

3.4 Extending Line (where fitted)

It is acceptable to have an element of minor fluffing and line wear. Cuts and serious fraying of the line require replacement . Also particular attention should be observed at each end of the

Rope extending line and check for algae build up from leaving outside for long periods or grease build up from over lubrication of parts.

3.5 Cable

Check the full length of the cable for signs of wear, fraying and most Importantly kinks. If frays or kinks are found the ladder must be removed from service and returned to the workshop for the cable to be replaced.

To check the tension of the cable extend the ladder by one rung, pull the pawls on to the rung and the top section should have a spring.

3.6 AAD - Automatic Arrest Device

The AAD should be visually inspected**.** All components and fasteners must be checked for wear or damage.

This should also include the joining fasteners to the ladder rungs.

Note: If an automatic arrest device is fitted, a pin can be inserted through the hole in the casing to render the unit inoperative to enable the ladder to be re-housed. This feature must only be used for servicing purposes. The locking pin must be removed immediately after the ladder has undergone a deflection test.

If personnel do not have access to trestles and AAD pins, erect the ladder up against a structure inline with the usual operational procedures, then lay ladder down on the ground for a visual inspection. Once inspection is complete place ladder up against structure and house ladder within normal procedures.

Part No: S394: AAD DE-ACTIVATOR PIN & T/TAIL

3.7 Stabiliser Bar

Check that all the fixings are secure and that there is no denting or damage has occurred. Pay particular attention to the spindles.

These should be easily windable. Check that once you have stopped winding they don't free the wheel further.

3.8 Wall Wheel Assembly (where fitted)

Check for denting that can often occur from being drive under low tree branches.

The wheel should be free to run and run.

3.9 Roof Hook (where fitted)

Check the roof ladder hooks for any structural damage.

Ensure it opens, closes and l

AS Fire

Bayley

3.10 Slide Wheels

Check the slide wheels for cracks or damage.

3.11 Hinge Assemblies (where fitted)

Inspect for any kind of damage. Check that they open, close, lock and release correctly. On the Old style AS Hinges (figure 2), check the hinge spigot hasn't overly dented or elongated the hole that it rests in when opened.

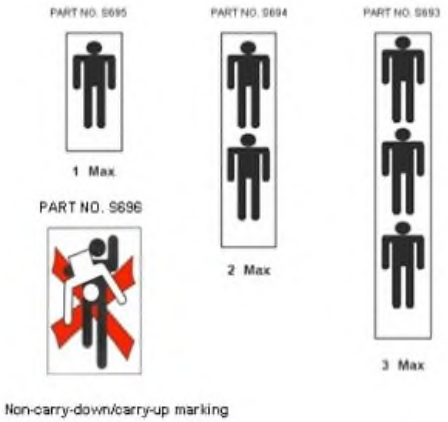
Check that the spring is still connected to its anchor.

3.12 Female Assemblies (where fitted)

Ensure that the assembly fits together and come apart easily and that the anchor pin fits freely through.

3.13 BS EN 1147:2010 Test Labels

Check that the correct labels are in tact and readable.



3.14 Stanchion Poles (AS Ladders where fitted)

Examine for signs of damage and sight along each pole to ensure they are not bent or distorted. Small dents no greater than 20mm across in either direction can be tolerated but poles with more severe damage should be replaced.

Ensure “Red Flash” markings are visible on “Compulsory Pole” ladders.

3.15 Pawls

Inspect bodies for any sign of cracks/deformation. Pay particular attention to the pawl feet and ensure they touch the rung at the same time.

Also check that the pawl fingers have some play when resting on the rung below.

3.16 Rubber Feet

Check the rubber feet and their attachments for signs of excessive wear and/or damage. Check the fixings are secure.

4 - ANNUAL INSPECTION (AS Ladders & Bayley)

To be carried out by personnel trained by Supply Plus and certified competent (within the last three years).

The annual inspection should be a more detailed and intensive version of the quarterly inspection detailed in section 3. In general the procedures are the same but after the preliminary inspection in its extended state the ladder should be dismantled into its separate sections (dependant on section type) to allow more detailed examination of each section to be made.

Important:

It is also important to note that high use ladders in service will have a greater exposure to environmental conditions. Therefore components/fasteners on all areas of the ladder which are plated will need to be inspected for oxidisation. If deemed to show excessive oxidisation then replace components straight away.
If you are unsure as to which components are mild steel/stainless then use a magnet.

Please be aware that some stainless steels are slightly magnetic (ferritic, martensitic). If you are unsure contact our office.

4.1 - Pawls (AS Ladders excluding Roof Ladders)

The pawl finger fitted to the earlier ladder has been replaced with a thicker version which in operation has the effect of giving greater clearance of the pawl foot over ladder rungs **(Figure 6)**. It is important that this clearance is checked and if necessary pawl fingers, together with their springs be replaced as a pair. A clearance of 2.5mm should be seen between the pawl foot and the adjacent rung. When the finger is resting on a rung (thereby lifting the pawl foot) the pawl finger should not be at the extent of its travel. The effectiveness of pawl finger springs should also be noted and replaced if necessary. The pawls must have a full and free action. When the ladder is in the inclined position both pawl feet must be adjusted to sit equally on the adjacent ladder rung. The folded pawl casing **(Figure 7)**, and the wire cable clip plate should be checked for splits or cracks around the area of the screw fixing. **This does not effect the later extruded profile pawl body and wire cable clip plate.**

The finger damper spring helps to ensure that the finger does not impact a rung when the ladder is housed or extended at high speed. The finger damper spring helps to ensure that the finger does not impact a rung when the ladder is housed or extended at high speed. This will hold the finger at an angle when at rest **(Figure 8).**

Figure 6

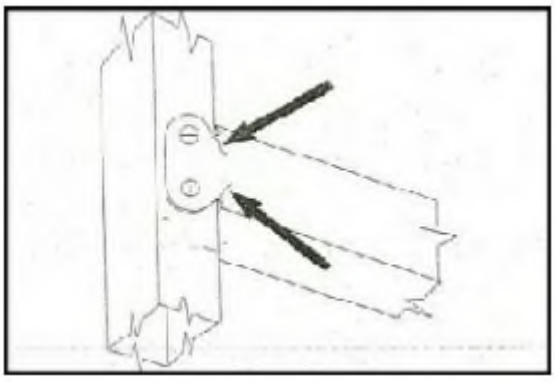


Figure 7

Figure 8

4.1.1 Pawls (Bayley Ladders)

The Construction of the Bayley Auto-pawl is different to the AS Pawl in respect to it's positioning and construction **(see Figure 9)** . However the operation/travel of the pawl over the adjoining sections is identical **(see figure 9).** Due to the Auto-pawl being housed in the side of the stile and the adjoining section uses a plastic guide **(see figure 10)** for the correct height, the clearance is always set at the correct distance.

Inspect all of the parts for wear and deformation/cracks within the Auto-pawl assembly **(see Figure 11),** pay particular attention to the pawl casting and pawl finger casting for any signs of fracture). Replace all parts in pairs (handed). Ensure you re-test the pawls operation if parts have been replaced.

Check the mechanical operation of the Auto-pawls) L/R Handed **(see Figure 9)** ensure that the pawl finger is positioned at rest as shown in figure 9. Ensure that the Main pawl casting has encapsulated the round rung. Also ensure that the Auto-pawl mechanism and encapsulation occurs simultaneously for the Handed auto-pawls. If this does not happen remove the section from service and investigate further. In some instances it is required to adjust the grub screw within the pawl casting **(see Figure 12)** to allow the pawl casting to sit concentrically onto the rung. This will be set correctly at the manufactured level, but if it is required that the component is replaced by a spare then adjust accordingly until both handed pawls are sitting concentrically. Please also note that the short bayley triple extension ladders do not use Auto-pawls but they still use Rung holding pawls that are also Aluminium casted. Also within the UK & Europe the traditional "A shaped" pawls are sometimes used. These casting components will also need to checked for stress cracks and the mechanical operation of the "A" pawls will need to be carried out. Because the "A" pawls mechanism is synchronised with a the operation of the rope, both the rope and the return pulley of this system will need to checked for wear and mechanically/operationally tested. Conducting any these teats and servicing may require further discussions with Supply Plus. Please ask for assistance.

Figure 9

Figure 10

Figure 11

Figure 12

4.2 - Stanchion Poles (AS Ladders where fitted)

Figure 13

Examine for signs of damage and sight along each pole to ensure they are not bent or distorted. Small dents no greater than 20mm across in either direction can be tolerated but poles with more severe damage should be replaced. The latest stanchion pole incorporates aluminium castings for the top hinge assembly **(Figure 13)** and for the ground spike on the other end. Earlier versions of this were remanufactured from fabricated assemblies which would allow, with force, for the pole to be incorrectly stowed 180º out of phase and thereby cause damage to the pole and ladder strings. Ensure markings are visible on “Compulsory Pole” ladders.

4.3 - Rivets (AS Ladders only)

Figure 14

It is important that only rivets purchased from Supply+ are used throughout the ladder. When an aluminium rivet is squeezed up in a gun it will work harden. It is essential that the correct grade of rivet is used so that when installed it is of comparable hardness to the aluminium extrusions of the ladder. All solid rivets supplied by our organisation carry the letter ‘S' on the head, all rivets used to manufacture new ladders carry the letter ‘A’. Any loose rivets should be re-tightened only once or replaced using the procedure in section 6.7. If a ladder is dropped, this can impose a shearing action on the ladder rivets. Special care should be taken when visually inspecting a ladder to ensure rivet integrity. This should be done by feel on the blind side as well as a visual inspection on the face surfaces, paying particular attention to those in high stress areas which have additional reinforcing between the rounds **(Figure 14)**. Solid rivets must not be replaced with pop rivets. Rung brackets should be visually checked around the rivet holes to ensure that no splits or hole elongations are present. The effect of over-tightening rivets through an incorrectly adjusted gun can split the rung bracket from the hole to the outer edge or enlarge the stile/channel/rung bracket hole. If this occurs it will dramatically reduce the overall strength of the ladder.

4.3.1 Rivet Gun Set-up & Air Pressure (Solid rivets only)

This guide example is for the Solid Rivet's S202/S20. For rivet S257 replace rivet snap tool as shown in **(Figure 17)** with larger head profile(Do not attempt to carry out repair or maintenance without official Training/Certification from Supply Plus)

Step 1: Ensure Workshop PPE and Training has been implemented for the use of Air tools.
Step 2: Inspect Air line connectors, ensure that there isn't any air leakages around the couplings.
Step 3: Ensure Air Line Pressure to Rivet Gun at the localised point is set to circa 5.5 bar (80 psi) & 5.9 bar (86 psi)
Step 4: Ensure that the Rivet gun yoke head distance is correctly set **(see figure 15)** a 4.9mm DIA metric drill is placed between the gap (this gap is critical in ensuring that the rivet guns position will allow the rivet to form/spread correctly when housed between the desired ladder substrates) Do not fire gun with drill in. Place/check with drill post firing.
Step 5: Test the Rivet Gun and rivets onto a small sample ladder section (stile/channel/tie plate) (Do not attempt to test the rivets performance and joining test onto a new/repair AS Rivet Truss ladder use a sample piece)
Step 6: Check to see if the Solid rivet has pulled the required Substrates/Materials together, visually inspect as per instructions in laid out section 4.3. If it is shown that the rivet has not fully pulled/tightened against the adjoining tie plates/stiles within the test sample, adjust the pressure in small amounts above bar/psi from Step 3. It is only permitted to re-sequence one more time to an already formed rivet.
Step 7: If the rivet has formed/pulled correctly then you will see no obvious gaps between the head of the rivet (1) and the substrate, and the formed neck (2) of the underside of the rivet is squashed uniformly **(see figure 16)**
Step 8: Once all of the above has been met and the workshop Technician/Engineer is confident that he can achieve the required criteria, then he/she can move on to the actual in-service Ladder and repair where/if required.

Note: The operation and use of the Rivet Gun will be demonstrated on the Ladder/Maintenance Training course. If in doubt post training refer to your course notes or contact Supply+.

Figure 15

Figure 16

Figure 17

4.4 - Rungs (all AS Ladders & Bayley)

AS Rivet Truss:

Check all rungs for looseness or excessive wear (looseness is where the rung can be turned without applying force, excessive wear can be judged by the wear on the non slip elements). It is recommended that only those rung assemblies which are not in high stress areas should be replaced by brigades using the procedure detailed in section 6.8.

Bayley Ladders:

Inspect the swage form **(see Figure 18)** for any discrepancies. The shape of the swage should be concentric and held tight against the stile (no gaps). Check inside the rung for any cracks. Also hold the rung and twist back and forth, whilst doing this check to see if there is any sideways rotation at the swaged side of the rung (1) **(see Figure 19).** If excessive movement is found the section/ladder should be removed from service/operation and Supply Plus are to be contacted for further inspection and if deemed necessary a replacement section/ladder is to be obtained.

Important : Due to the Bayley construction rung replacement cannot be carried out for any Bayley ladders. Under no circumstances that welding, or repairing rungs or sections shall be undertaken.

Figure 18

Figure 19

Note: Supply+ Recommend Rung replacement should only be carried out by your engineers after they have attended a 2 or 4 day training course, within the last three years. Please contact our factory or your local agent for further details.

4.5 - Stiles & Channels (all ladders) and Slide Wheels (where fitted)

Examine stiles/channels for signs of cracking, distortion or other damage. Minor dents can be tolerated but with other damage, especially cracking. Also please observe the hammering effect the ladder guide wheels are creating **(see figure 20)** onto the channels. If there is excessive hammering which deems to be detrimental to the structures strength then remove the section in question and get a second opinion. If then it is required to remove the section please contact Supply+ and we will further advise whether it is essential to replace the channel.

Note: If the hammering effect is very slight/mild we can offer Anti-wear plate's S1074 & S1075 **(see Figure 21)** for the various ladder sections. We offer as an retrofit kit supplied with rivets (S204). Please contact Supply Plus for further information.

The ladder should be returned to our factory for repair, unless your engineers have attended our 2 or 4 day training course. Ladders with damaged stiles should not be kept in service. Shape is put into a ladder to give acceptable clearances to minimise wear while the ladder is on the gantry. Different ladders require different shapes.

Figure 20

Figure 21

4.5.1 - Detailed Instructions for Ladder Slide Wheel Inspection (AS ladders)

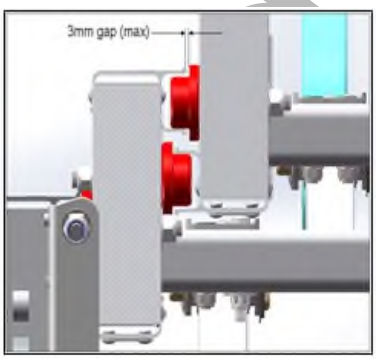


Figure 22

● The ladder should be moved against the slide wheels on the opposite side of the ladder and then checked using a 3mm gauge. The gauge should not fit in the gap Shown in **(Figure 2).** This check should be carried out on all slide wheels at the top and bottom of the ladder.
● If the gap exceeds 3mm the washers holding the slide wheel should be swapped around so he thicker washers are placed between the rung bracket & slide wheel, and the thin washer by the nut.
● The ladder should be then moved to the opposite side and the checks carried out again to all slide wheels top and bottom.
● Check stiles for deformation. These checks should be carried out with the ladder in the closed, mid-open and fully open positions to ensure that there are no issues with excessive float.
● If swapping the washers does not reduce the gap sufficiently, this would indicate either:

i. Wear of the slide wheel shoulder, requiring replacement of the slide wheel.
ii. Excessive strain has been exerted on the ladder causing the ladder to distort.
In either of these cases the ladder should be returned to workshops for investigation and analysis. Alternatively the ladder can be returned to Supply+ for the investigation and analysis to be carried out. The wheels should also be examined to ensure there is no additional “tapering” effect of the wheels. If additional “tapering” has taken place on the slide wheels, they should be replaced. Please note that during this process any dirt or oil and grease residue should be removed.

4.5.2 Annual Removal/Replacement of Ladder Guide wheels and Fasteners (AS Ladders)

We have reviewed the need for annual replacement and are satisfied that these wheels should be inspected and replacements made only when they cannot be adjusted into tolerance or are showing other signs of excessive wear of any kind. The adjustments should be made as detailed in section 4.5.1

4.5.3 Bayley Roller wheel/slide Inspection (where fitted)

The Bayley roller guide wheels and slides **(see Figure 23/24)** are also exposed to the same wear exposure as the AS ladder guide wheels. Please follow the procedure from 4.5.2

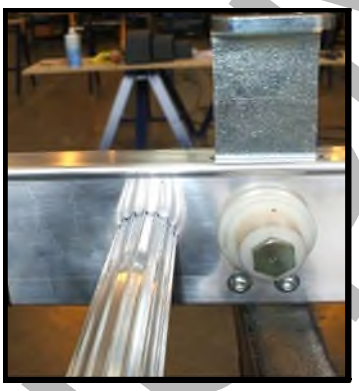


Figure 23


Figure 24

4.6 - Extending Line (where fitted)

The choice of material and size of extending line is a product of the grip factor and the comfort of operator and is not determined by line strength. The extending line used has a breaking strain of two tonnes and when in use the normal loading it is subjected to is pull load between 25kg-50kg (dependent on the exact angle of deployment and type of ladder). As a result, it is acceptable to have an element of minor fluffing and line wear **(see Figure 25).** Cuts and serious fraying of the line require replacement . Also particular attention should be observed at each end of the Rope extending line. Due to variations in the AS Fire & Bayley Ladders the fixed end (1) as shown in **Figure 25** and the stirrup retaining pins(2) are different depending on the types of ladders. However the principle is the same, the fixing ends and the retaining pins shall be inspected for wear or damage and also the retaining fasteners need to be checked (fitted correctly). Finally the stirrup housing **Figure 25** (3) also needs to be checked for stress cracks and wear and the condition of the rung and the joining rivets

4.6.1 AAD-Automatic Arrest Device (AS Ladders & Bayley where fitted)

The Automatic Arrest Device (AAD) (**see Figure 26)** which eliminates the possibility of a ladder free falling in the event of the extending line being released after the pawls have been tripped. Please see **(Appendix A)** for the **operational/functional** test of the AAD.

Important

Do not attempt to replace any of the components if it has shown that parts or the prior to this the mechanical operation has been impaired. The AAD must be returned to the Manufacturer (Supply Plus) for further inspection and test. Presently there should not be any BS EN 1147 Ladder's in service that does not have the AAD fitted as standard.

4.6.2 AAD Inspection-Workshop (AS Ladders & Bayley)

It must be stated that only inspection of the AAD **(see Figure 26)** for wear or damage shall be carried out by competent certified Technicians.

FUNCTIONAL INSPECTION (on ladder)

1. The AAD should be visually inspected **(see Figure 26).** All components and fasteners must be checked for wear or damage. Also the Joining fasteners to the ladder rungs need to be inspected.

2. The rope on both sides of the pulley wheel should be pulled at the same time towards the base of the ladder (see Appendix A). The pulley should move towards the base of the ladder and return freely under the action of its spring when the rope is released.

3. With the pulley pulled away the toothed cam should be checked for ease of movement and it should spring back to the rest position when released.

4. Even though it has shown from this preliminary inspection that the AAD is working as it should, it still doesn't mean that the individual parts are not. Therefore if you identify wear/oxidisation/damage of the AAD Parts. Then remove AAD from the ladder **(see figure 27)** as shown using the retaining pin (which holds the AAD main spring in tension) and pull the Extension line through and pulley and remove the AAD completely by loosening the 4 off bolts.

MECHANICAL INSPECTION (removal from ladder)

Only required when it is deemed necessary from Functional inspection findings (AAD on ladder)

1. Identify anomalous part by labelling of highlighting component (see example from **Figure 28**). Remove component into quarantine and fill out the relevant documents and send back to Supply Plus.
2. Contact technical sales for full replacement AAD Assembly to be sent to the workshop.
3. Adopt the reverse process when installing the AAD.
4. Carry out functional inspection and operation test laid out in Appendix A

Figure 25

Figure 26

Figure 27

Figure 28

4.7 - Cable (AS Ladders where fitted)

Special attention should be given to the cable condition to ensure there are no kinks and/or loose wire strands. The condition of the straining screw is important and attention should be given to the security of the locking nut. Correct assembly of this device is essential for safe and smooth operation of the ladder.

4.7.1 Correct Cable adjustment (AS Ladders where fitted)

1. If the cable is deemed mechanically and visually safe the next phase is to correctly set up the tension of the cable when housed on the ladder, Firstly ensure that the feed direction is as shown through the cable return pulley assembly **(Figure 29)**.
2. Once the cable pulley and cable are set-up onto the ladder extend the sections from the Heal of the ladder up to the second rungs so that the pawls are sitting in contact with the rung in each case respectively **(see Figure 30)**
3. Adjust the cable tensioned attachment bolt **(see Figure 30)** and adjust. If the cable is set up correctly the contacted pawls onto the second rungs will move away (circa 5mm) gap due to the correct tension of the cable

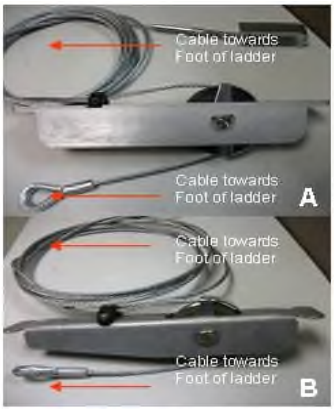


Figure 29

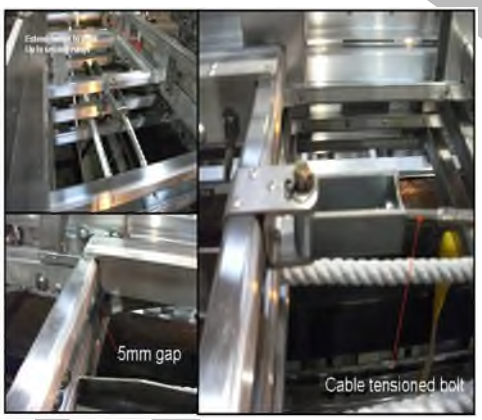


Figure 30

4.7.2 – Cable Pulley Assembly Current/Old (AS Ladders)

There are currently 4 (Four options) either in service/OEM/by request (see figure 28/29/30/31).

1. Cable pulley assembly shown in **Figure 31** is currently housed on ladders pre 2011
2. Cable pulley shown in **Figure 32** is currently housed on OEM ladders post 2011. This pulley assembly part number (S098/WN) can be bought as an retrofit kit to replace old cable assembly shown in **Figure 31.**
   The full replacement components consist of 1 x S098/WN (Cable Assembly), 2 x S012 (and Middle section reinforced Rung assembly),32 x S202 (solid rivets) & 4 x S243M(M6 x 40 csk slot screw)
3. Cable pulley assembly shown in **Figure 33** is an option where the Brigade/Technician can keep the original folded clip plate but can replace the Steel pulley sheave with the revised improved Nylatron Pulley sheave (S1060). It is also important to be aware that the Through
   Pivot pin (S082) clip plate has been recently updated to Stainless steel. We recommend that the replacement components should be 1 x S1060, 1 x Revised S082 & 1 x S1062 (Cable pulley guard wide)
4. Cable pulley assembly shown in **Figure 34** is currently housed on ladders pre 2011

Important: Irrespective of the Clip plate Supply+ strongly recommend that the Steel pulley Sheave should be replaced with the Nylatron Pulley Sheave, inclusive of the above relevant components added for fitment.

Figure 31- Folded body/Steel Pulley Sheave

Figure 32- Extruded body/Nylatron Pulley Sheave

Figure 33- Folded body/Nylatron Pulley Sheave

Figure 34- Extruded body/Steel Pulley Sheave

4.8 - Stabiliser Bar (AS Ladders where fitted)

All Stabilisers are subject to the same inspection and maintenance criteria.

For your notice there are several types of stabilisers currently in service the simple classification is:

1. Steel Stabiliser (Fixed) Currently supplied with older ladders or OEM preference only. (Housed on older TX ladders) **see Figure 35**
2. Steel Stabiliser (Removable) supplied as optional housed on TX ladders currently in-service (**see Figure 36)**
3. Alloy Stabiliser (Fixed) currently supplied as standard OEM on all TX ladders & DX if specified **(see Figure 37)**
4. Alloy stabiliser LW (identical to 3 with the exception one fixed hand wheel and spigot and one adjustable as per normal stabiliser **(see Figure 38)**

Figure 38

Check that the hand wheels **(see Figure 37)** all types can be freely rotated over the full travel of the screw threads and that the foot pads are free to rotate and swivel. The rubber foot pads should be replaced if worn. If the screw thread is damaged, a new assembly must be fitted. Friction pads, where fitted, should be adjusted to apply light friction to the spindles. A check should be made to examine the hand wheel for cracking around the spoke/rim join and to the handles to ensure that no cracks exist **(Figure 39)**. The condition of the stand off rings and their liners should be examined for damage and corrosion and replaced if necessary (**see Figure 37** (1))

Also it is required to ensure that the clamp pad inside the stabiliser tube **(see Figure 40**) is correctly set so that there is some degree of turning resistance when cranking the hand wheel. Common sense should prevail here, if you over tighten the clamp pad then turning will become harder and vice versa.

Figure 35

Figure 36

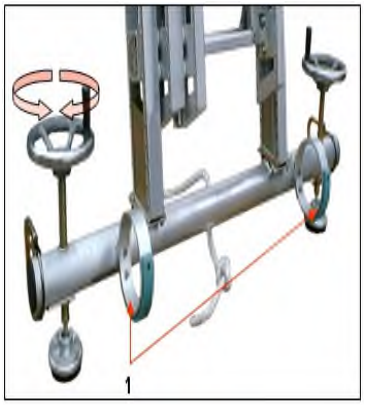


Figure 37

To tighten the spindle travel, use the available allen key access hole (as shown in **figure 35**) Use an 8mm metric allen key

Figure 39

Figure 40

4.9 - Wall Wheel Assembly (AS Ladders & Bayley)

If the covering of the wheel is worn or damaged new wheels should be fitted **(see Figure 41).** Special attention should be paid to the bonding of the tyre to the wheel hub **(see Figure 41)**. Also pre 2011 the Wall wheel axle was manufacture in steel and zinc plated. However post 2011 we have replaced the steel axle with an improved stainless-steel axle. We recommend that older ladders with the steel plated axle should be replaced with the stainless version.

Where fitted, the wall wheel heat sensor label should also be inspected see section 2.6 for details.

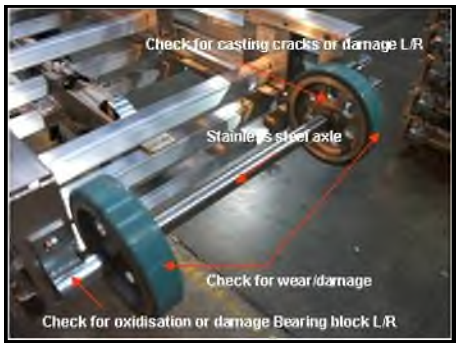


Figure 41

4.10 - Pawls and Stanchion Pole Assemblies (AS Ladders & Bayley)

These should be checked for damage and signs of wear in the Stanchion pole hinges, before dismantling the ladder as in sections 4.1 and 4.2. For Bayley Ladders refer to sections (4.5.3/4.4/3 41.1).

4.11 - Detailed Inspection (AS Ladders & Bayley) (see Section 6 Repair & Replacement)

Dismantle the ladder into its separate sections if possible using the procedure given in AS section 6.4 & Bayley Section. Each section should be examined separately by placing horizontally onto two trestles positioned approximately 300mm from each end. The trestles should be set up with perfectly horizontal bearing surfaces by checking with a spirit level. Inspection should then be carried out as detailed in AS section 4 and Bayley Section 4 covering the following details:

- Rivets
- Rungs and Rung Brackets
- Stiles/Channels
- Extending Line (where fitted)
- Heat Labels (where fitted)
- Cable (where fitted)
- AAD (automatic arrest device where fitted)
- Stabiliser Bar (where fitted)
- Wall Wheel Assembly (where fitted)
- Roof Hook (where fitted)
- Slide Wheels
- Hinge Assemblies (where fitted)
- Female Assemblies (where fitted)
- BS EN 1147:2010 Test Labels

4.12 - Repairs (AS Ladder & Bayley)

AS Rivet Truss

We recommend that any AS rungs found to have cracks in the ends should be replaced. Any replacement or tightening of the rivets or replacement of AS rung assemblies should be carried out at this stage before continuing with the next stage of inspection. It is recommended that only those rung assemblies which are not in high stress areas are replaced by workshops using the procedure dealt with in section 6.8.

Bayley Ladders inspection

Due to the Bayley construction the rungs are not replaceable individually. If the rungs are damaged or cracked then the whole section will need to be replaced. However due to the manufacturing swaging process of the rung and the stile. It is extremely rare that any cracking or damage will happen at the manufacture level.
The most common occurrences of damage or cracking is the misuse of the ladders capabilities and operation.
If it has shown that the rung and the joining stiles are in acceptable conditions then dismantling sub-assemblies shall be adhered to in Bayley section 6.4.3-6.4.6.

4.13 – Lubrication & Cleaning (AS ladders & Bayley)

Only clean on stiles and channels only. A non abrasive and dust free cloth should be used to remove excess /oil/grease/deposits from the stiles and channels. Then a cleaning agent such as Amberklene FE10 or LO30 is to be used along the stiles and channels. Wipe any excess deposits with a dust free cloth. Do not use abrasive cleaning pads. As the particulates in the pads will impregnate into the aluminium and will contaminate the alloy.

You will commonly see some white marks on the aluminium stiles and channels if the ladders are continuously left outside, this is known as water staining. If you are unsure and believe this is something other than water excess then contact Supply+ for further investigation. It is our recommendation that correct sensible storage of spare ladders or ladders in for repair are carried out. We do not recommend that you leave ladders outside for long periods of time. If this is the case then the life and condition of the parts will shorten. Storing in a dry environment is recommended.

Important:- Before procuring any cleaning solution, ensure the Brigade/Workshops is authorised to use the Solvents and is privy to the COSHH regulations. Data Sheets can be obtained if required by the solvent manufacturer.

Lubrication/Sub components and Fasteners

Remove existing grease before applying specified new grease.

Good quality, high melting point grease (ref Rocal Sapphire Aqua-Sil) should be used on the axle, stanchion assembly, pawls, nylon slide wheels, wire and return pulley. Excess lubrication only attracts dirt and should be avoided. Clean off surplus lubricant with a rag soaked in cleaning agent Amberklene FE10 or LO30. Lubrication points are illustrated in **(Figures 42 to 49)** for AS Ladders. AS TX Ladder's) which house the Nylatron pulley sheave within the Cable Assembly do not need lubricating.

Bayley Ladders

Due to the construction of the Bayley it is not required to Lubricate the components (ref Rocal Sapphire Aqua-Sil) with the exception of the Wall Wheel, **see AS Figure 46** which are housed on Bayley DX ladders.

Figure 42 Lubrication 1

Lubricate Centre of Pin for old Style Pulley only.

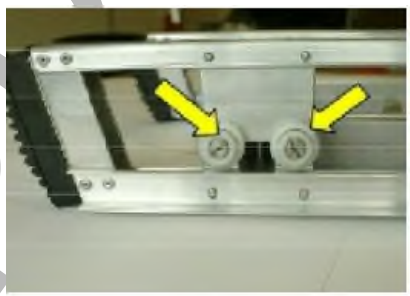


Figure 43 Lubrication 2

Lubricate Runner Wheel Lobe Points

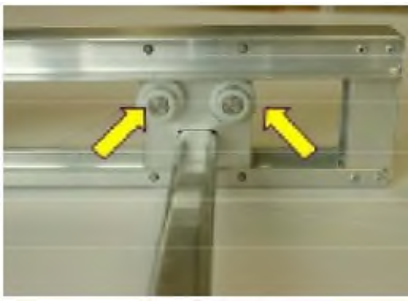


Figure 44 Lubrication 3

Lubricate Runner Wheel Lobe Points

Figure 45 Lubrication 4

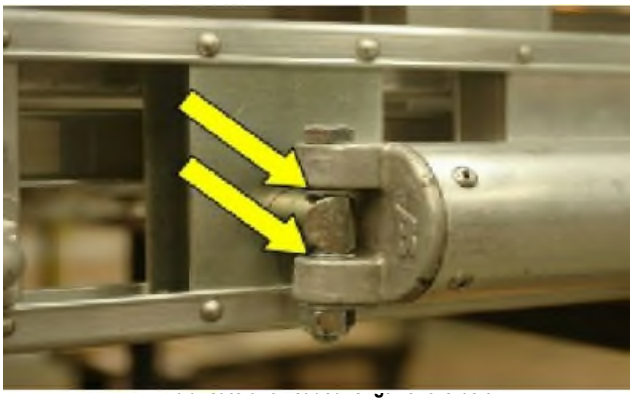
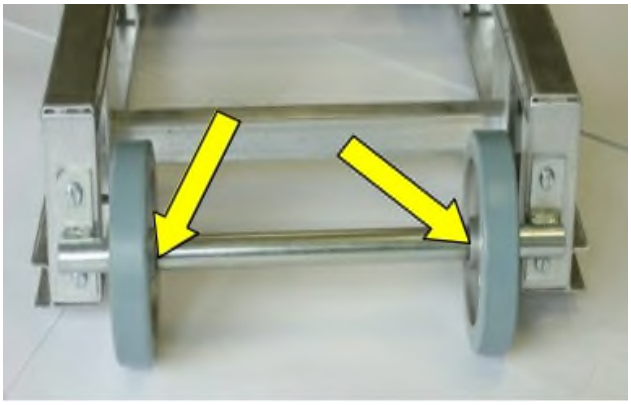
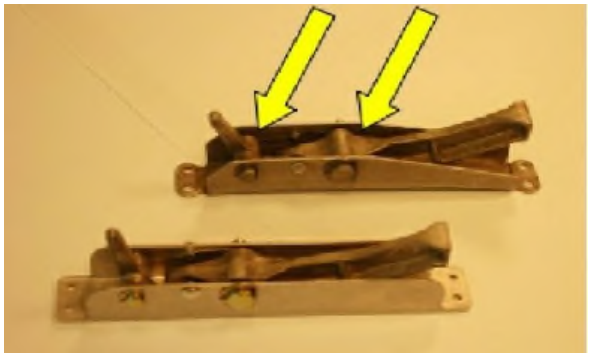


Figure 46 Lubrication 5



Lubricate narrowed ends of axle

Figure 47 Lubrication 6

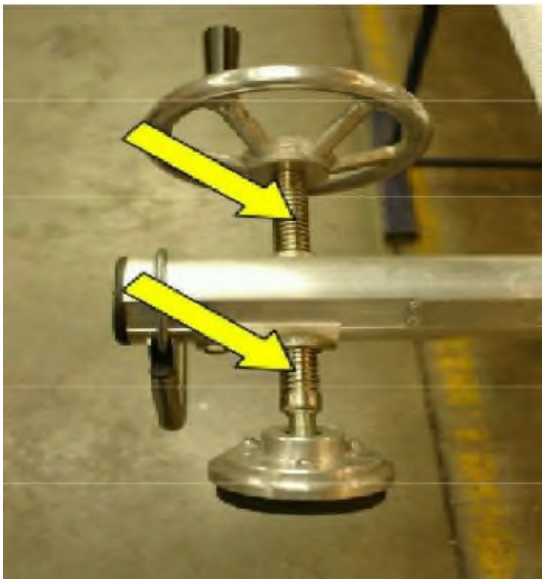


Lubricate middle point(s) of the pawl finger pin & the pawl arm pin

Figure 48 Lubrication 7

Lubricate middle of pin

Figure 49 Lubrication 8



Ensure threaded spigot bar is fully wound in/out before applying specified grease.

Apply lubricant onto threaded spigot and wind the handle until the threaded spigot has completed the turns to it's natural stop point

5 - ANNUAL TESTS (AS Ladders & Bayley)

The following tests are to be carried out annually or when considered necessary (see criteria for “necessary”) but only after the ladder has undergone the annual procedure and any necessary repairs have been made. A measuring tolerance of +/- 3mm applies to all the test measurements given in this section. Criteria examples for Ladder testing outside Annual test:

- When the ladder's have been damaged within operation, and repairs have been carried out.
- When the ladder's have been exposed to excessive heat (Fire Damage), and repairs have been carried out.
- When any Ladder components or parts have been replaced within the quarterly period's)
- When the ladder has been damaged when stowed on the fire appliance, and repairs have been carried out.

Extending	No of Persons	Use
	3	Rescue and access
	2	Rescue and access
	1	Access
Hook	1	Access
One piece	3	Rescue and access
	2	Rescue and access
	1	Access
Roof	1	Access
Sectional	3	Rescue and access
	2	Rescue and access
	1	Access
Stick	1	Access

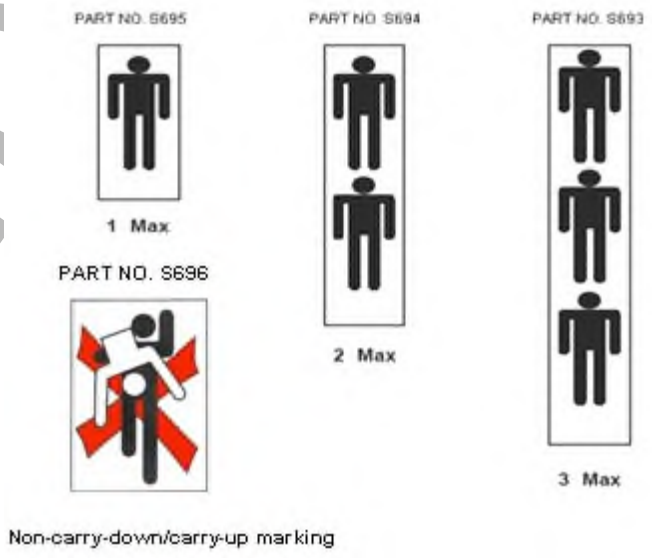
5.1 - Annual Tests (AS Ladders & Bayley)

When testing ladders it is important that they are tested to the specification/standard to which they were built. Our ladders are all now built to BS EN 1147:2010 and this is the standard to which they should be tested. Older ladders which conform to the requirements and standards of the Home Office JCDD mark should be tested using the tests laid down for that standard. Ladders may be damaged and could be a potential hazard if they are tested to the wrong standard. If you have any doubts please contact us for clarification.

5.1.1 - BS EN 1147:2010 Testing (AS Ladders & Bayley)

Unless specified to the contrary all **AS/Bayley** extension ladders that have the new EN1147 1/2/3 person – rescue serial number plate shall also have the 1/2/3 person max self-adhesive label shown in (**Figure 50).** This is to be positioned (AS Ladders) on the climbing side of the bottom section right hand stile 5th rung up from the foot. For bayley ladders the Labels shall be positioned on the outside of the bottom section right hand stile between the 5th & 6th rung up from the foot. Where is it stated for a 1 person access ladder (AS ladder) serial plate the Non-carry-down/carry up label/1max label must be placed on the climbing side of the bottom section right hand stile 5th rung up from the foot. Finally for Bayley 1 person access the relevant labels shall be positioned on the outside of the bottom section right hand stile between the 5th & 6th rung up from the foot.

Figure 50 - Test Labels



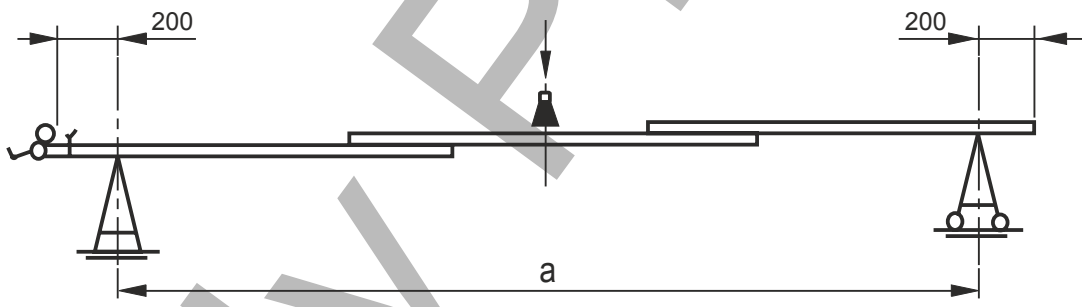
Non-carry-down/carry-up marking

Table 5.1 — Deflection Test Loads

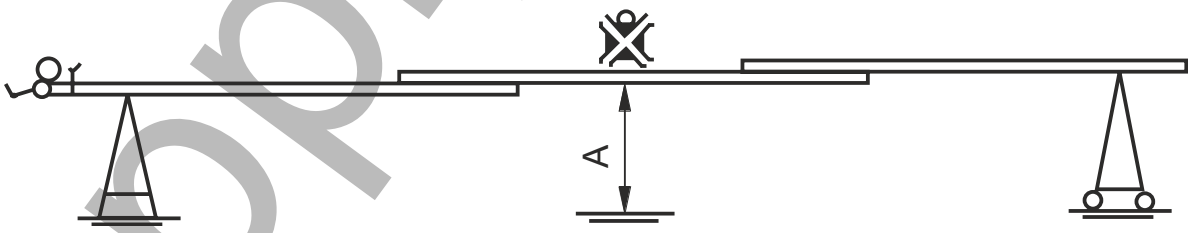
Ladder Type	Material	Pre-Load	First Load	Second Load
3 Person Ladder	Wooden	735N (75kg)	490N (50kg)	735N (75kg)
	All Other	1029N (105kg)	686N (70kg)	1029N (105kg)
2 Person Ladder	Wooden	588N (60kg)	392N (40kg)	588N (60kg)
	All Other	822N (90kg)	588N (60kg)	822N (90kg)
1 Person Ladder	All	735N (75kg)	490N (50kg)	735N (75kg)
Roof Ladder	All	822N(90kg)	588N (60kg)	822N(90kg)

5.1.2 - Deflection test for all ladders not covered by section 5.1.3

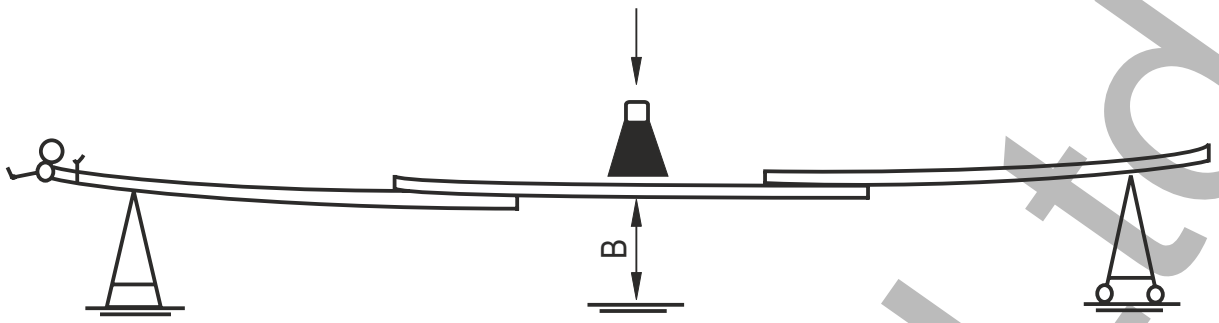
- **Figure 51 — Deflection Test − Layout**



- **Figure 52 — Test Datum Point**

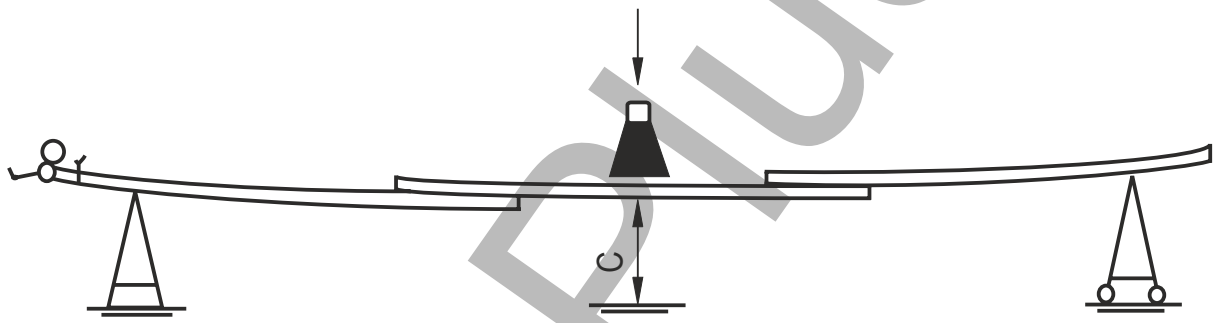


• **Figure 53 — First Deflection**



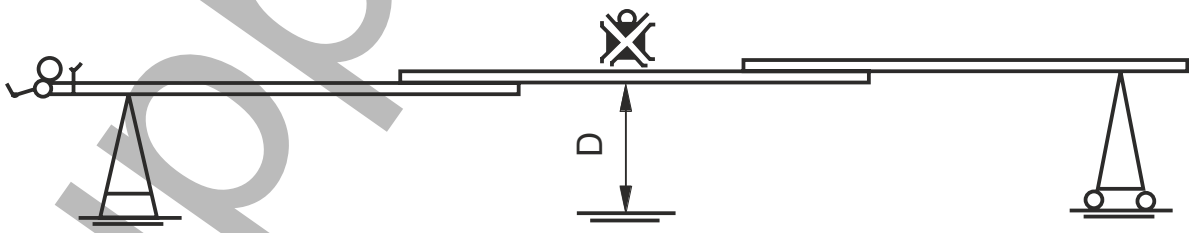
Apply the first load as specified in Table 5.1 for a minimum of 60 seconds at a point on the ladder mid-span between the trestles. Measure the distance B from the point on the ladder mid-span between the trestles to the horizontal datum **(Figure 53)**. Remove the load and measure the distance (A) from a point on the ladder mid-span between the trestles to a horizontal datum on the ground vertically below **(Figure 52).**

• **Figure 54 — Second Deflection**



Increase the load to the second load specified in Table 5.1 and apply it for a minimum of 60 seconds at a point on the ladder mid-span between the trestles. Measure the distance C from the point on the ladder mid-span between the trestles to the horizontal datum **(Figure 52)**.

• **Figure 55 — Deflection Test − Return**

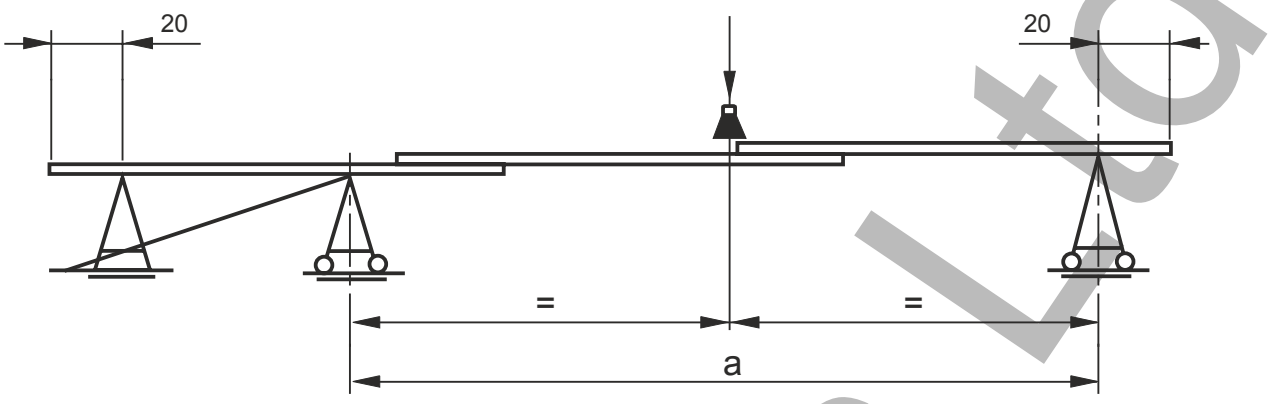


Not more than 60 seconds after removal of the load in the first deflection, measure the distance D from the point on the ladder mid-span between the trestles to the horizontal datum **(Figure 52)**.

The ladder shall not touch the ground during any point of the test.

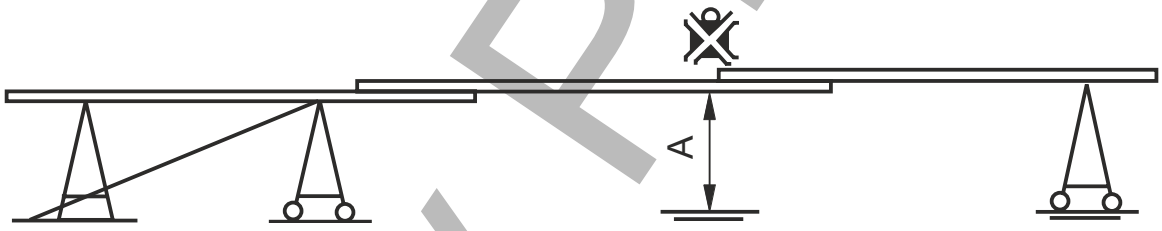
5.1.3 - Deflection test for compulsory pole ladders

- **Figure 56 — Test Layout**

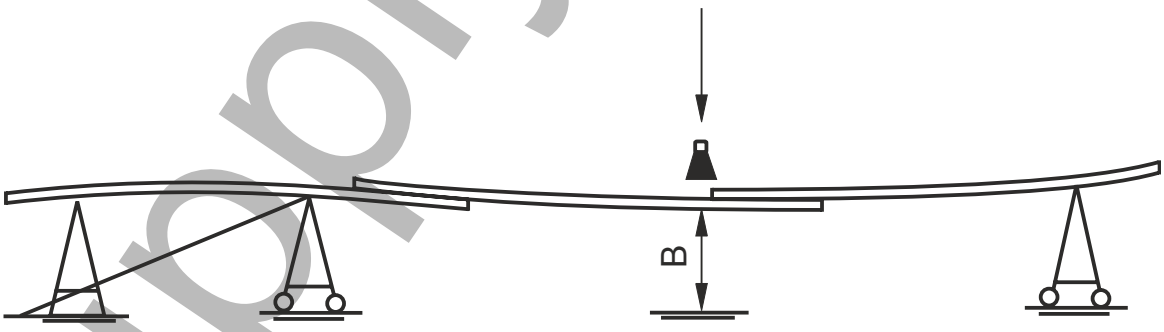


Support the ladder horizontally at its maximum working length, on trestles placed 200mm in from each end of the stile, with third trestle at the joining point of the poles to the ladder. Ensure the trestle at the bottom end of the ladder is fixed and the other two are mobile. Secure the trestles to the ladder **(Figure 56)**.

- **Figure 57 — Test Datum**



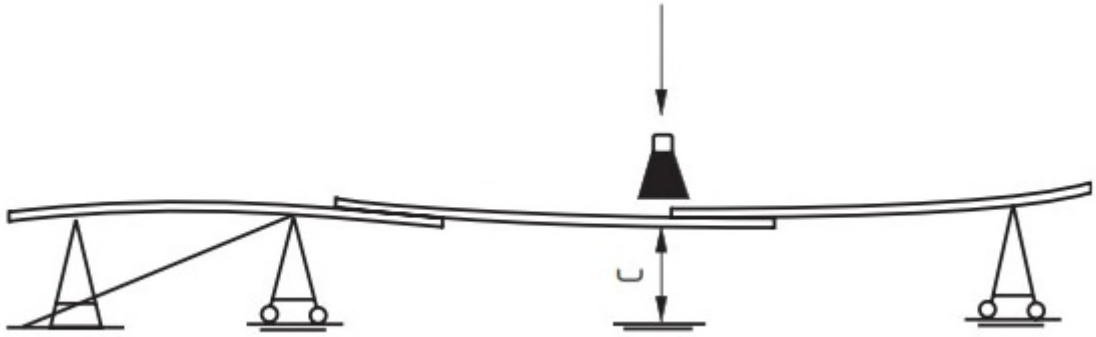
- **Figure 58 - First Deflection**



Apply the first load from Table 5.1 for a minimum of 60 seconds at a point on the ladder mid-span between the two trestles. Measure the distance B from the point on the ladder mid-span between the two mobile trestles to the horizontal datum **(Figure 58)**.

Remove the load and measure the distance A from a point on the ladder mid-span between the two mobile trestles to a horizontal datum on the ground vertically below **(Figure 57)**.

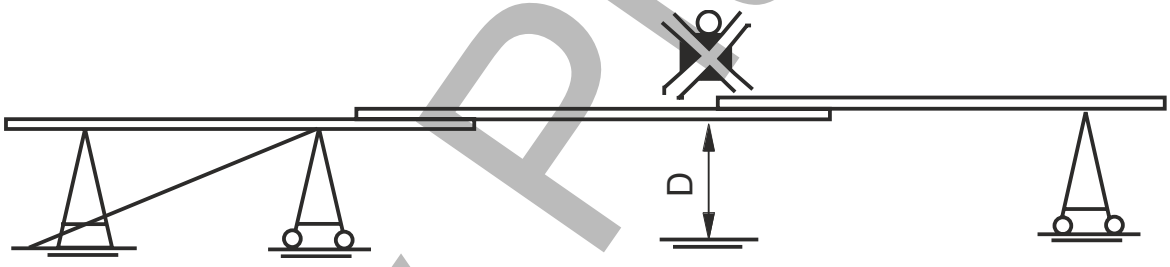
- **Figure 59 - Second Deflection**



Increase the load to the second load in Table 5.1 and apply it for a minimum of 60 seconds. Measure the distance C from the point on the ladder mid-span between the two mobile trestles to the horizontal datum **(Figure 59)**.

Remove the load and measure the distance A from a point on the ladder mid-span between the two mobile trestles to a horizontal datum on the ground vertically below **(Figure 57)**.

- **Figure 60 - Test Return**



Not more than 60 seconds after removal of the load in the first deflection test, measure the distance D from a point on the ladder mid-span between the two mobile trestles to the horizontal datum **(Figure 60)**.

The ladder shall not touch the ground during any point of the test.

The preceding test outlines the test procedures for BS EN 1147:2010. However it is highly recommended that each workshop holds its own copy of BS EN 1147:2010 available from the British Standards Institute. The contents of this manual do not set out to give a comprehensive guide to the requirements. It is the responsibility of the testing centre to ensure that they comply fully with the requirements of the standard.

Recommended roof ladder hook test (not a requirement within the specification). With the ladder resting horizontally on a test rig with the bearing point of the hook against a stop the load is to be applied away from the hook along the centre line of the ladder.

Test load: 6 x 25kg (Total = 150kg) for 60 seconds.

No permanent deformation to occur.

5.1.4 – BS EN 1147 Test Loads All ladders - below 11 meters Annex A (including Roof ladder Hook test)

Weights required:

3off 25kg (+3 extra if roof hook testing)
1off 20kg
1off 10kg
1off 5kg
Weight tolerance + or - 1%

Equipment required: 1 x fixed + 1 x wheeled trestle, horizontal even surface.

Deflection test procedure Measuring tolerance + or - 3mm.

1. Secure the trestles to the ladder 200mm in from each end. Extension ladders to be fully extended and secured in the pawled position to prevent further extension.

2. At the loading point mid way between the trestles apply the pre-load to the ladder for 60 seconds. The permitted load spread is no more than two rung spaces.

3. Remove the pre-load and measure the span between the trestles (S)

4. At mid span (S) measure from underside of the ladder to the floor (H1)

5. Apply the first load to the load point and after 60 seconds again measure from the underside of the ladder to the floor (H2).

6. The first deflection (D1) is calculated by subtracting the first load height (H2) from the initial height (H1). The first deflection (D1) must not exceed 2.5% of the span (S). (D1<0.025xS).

7. Apply the second load at the load point and after 60 seconds again measure from the underside of the ladder to the floor (H3)

8. The second deflection (D2) is calculated by subtracting the second load height (H3) from the initial height (H1). The second deflection (D2) must not exceed 1.5 times the first deflection (D1). (D2<1.5xD1)

9. Remove the loads after 60 seconds again measure from the underside of the ladder to the floor (H4). The initial height (H1) and the final height (H4) must be the same. A measuring tolerance + or - 3mm applies.

Test loads:

3 Person rescue rated (deflection)
Pre-load 3 x 25kg + 1 x 20kg + 1 x 10kg (total = 105kg)
First load 2 x 25kg + 1 x 20kg (total = 70kg)
Second load 3 x 25kg + 1 x 20kg + 1 x 10kg (total = 105kg)

Roof ladder 1 person access rated (deflection)
Pre-load 3 x 25kg = 1 x 10kg + 1 x 5kg (total = 90kg)
First load 2 x 25kg = 1 x 10kg (total = 60kg)
Second load 3 x 25kg = 1 x 10kg + 5kg (total = 90kg)

Recommended roof ladder hook test (not a requirement within the specification)
With the ladder resting horizontally on a test rig with the bearing point of the hook against a stop the load to be applied away from the hook along the centre line of the ladder.
Test load: 6 x 25kg (Total = 150kg) for 60 seconds. No Permanent deformation to occur.

5.1.5 – BS EN 1147 Test Loads All ladders - above 11 meters Annex B

Weights required:

3off 25kg (+3 extra if roof hook testing)
1off 20kg
1off 10kg

Weight tolerance + or - 1%

Equipment required: 1 x fixed + 2 x wheeled trestle, horizontal even surface.

Deflection test procedure Measuring tolerance + or - 3mm.

1. Support the ladder horizontally at its maximum working length on the trestles. Place 200mm in from each end with a third trestle at the joining point of the poles to the ladder. Ensure the trestle at the bottom end of the ladder is fixed and the other two are mobile. Secure the trestles to the ladder.

2. Apply the pre-load for a minimum of 60 seconds at the mid span point between the two mobile trestles.

3. Remove the pre load and measure the distance from the underside of the ladder to the floor, at the mid span point between the two mobile trestles (H1)

4. Apply the first load for a minimum of 60 seconds at the mid span point between the mobile trestles. After 60 seconds measure the distance from the underside of the ladder to the floor at the mid span point between the two mobile trestles (H2)

5. The first deflection is done by subtracting the first load height (H2) from the initial height (H1). This is D1.

6. Increase the load to the second load and after 60 seconds measure the distance to the floor at the mid span point between the two mobile trestles (H3)

7. The second deflection is done by subtracting the second load height (H3)from the initial height (H1). This is D2.

8. Remove all of the weights. After 60 seconds measure the distance to the ground at the mid span point between the two mobile trestles (H4).

9. The final deflection is done by multiplying D1 by 1.5. This is D3.

10. The deflection is that D2 must be less than D3 with a 3mm tolerance.

11. The distance of H4 must be within 3mm + or - of the initial height of H1.

12. The ladder should never touch the ground during this test.

Test loads:

3 Person rescue rated (deflection)
Pre-load 3 x 25kg + 1 x 20kg + 1 x 10kg (total = 105kg)
First load 2 x 25kg + 1 x 20kg (total = 70kg)
Second load 3 x 25kg + 1 x 20kg + 1 x 10kg (total = 105kg)

5.1.6 - JCDD Test Loads (included as a guide for operators still using JCDD specification ladders)

Please note that we no longer manufacture JCDD ladders unless specifically requested. Therefore all ladders manufactured currently conform to the requirements of BS EN 1147:2010.

Weights required:

11 of 10kg (+5 extra for roof hook testing)
1 of 5kg
1 of 2kg
2 of 1kg
Equipment required:2 trestles (without wheels), horizontal even surface.

Deflection Test Procedure, **Measuring tolerance + or - 3mm (1/8")**

- Place the trestles under the ladder 610mm (24") in from each end. Extension ladders to be fully extended and pawled. At the loading point midway between the trestles apply the pre-load to the ladder for 60 seconds. **Remove the pre-load.**
- At mid span between the trestles (S) measure from the underside floor (H1).
- Apply the first load at the load point and again measure from the underside of the ladder (H1).
- The first deflection (D1) is calculated by subtracting the first load height (H2) from the initial height (H1). The first deflection (D1) must not exceed the value of the ladder stated in our Maintenance & Repair Manual.
- Apply the second load at the load point and again measure from the underside of the ladder (S) to the floor (H3).
- The second deflection (D2) is calculated by subtracting the second load height (H3) from the initial height (H1).
- The second deflection (D2) must not exceed 1.5 times the first deflection (D1) (D2<1.5xD1).
- Remove the loads and again measure from the underside of the ladder (S) to the floor (H4). The initial height (H1) must be more than the final height (H4).

A measuring tolerance + or - 3mm (1/8") applies.

Test loads: Extension ladders to JCDD (deflection)
Pre-load = 3 x 10kg + 1 x 5kg + 1 x 2kg + 1 x 1kg (Total = 38kg)
First load = 7 x 10kg + 1 x 5kg + 1 x 1kg (Total = 76kg)
Second load = 11 x 10kg + 1 x 2kg + 2 x 1kg (Total = 114kg)

Roof ladder hook test

With the ladder resting horizontally on a test rig with the bearing point of the hook against a stop, the load is to be applied away from the centre line of the ladder.

Test load: 16 x 10kg (Total = 160kg). No permanent deformation to occur.

(Note the weight of the test weight cradle may reduce the number of weights required)

5.2 - Roof Ladder Annual Test for JCDD Ladder

The test to be carried out with the ladder laid flat on a bench and held in position by the roof hook bearer engaging on one end of the bench. A load of 160kg (352lbs) is to be gradually applied to the middle of the bottom rung and in a separate test to at least one other rung by means of a rope attached to a metal hook, having a bearing surface of 50mm wide and suitably lined to prevent bruising of the rung. The rope for applying the load is to be fed centrally between the stiles and over a pulley at the opposite end of the bench from the ridge hook, to the testing weights. There must be no sign of failure or permanent distortion of any part of the ladder or roof hook assembly.

5.3 - Failure of Annual Test (AS Ladders & Bayley)

If it is found that the ladder does not comply with the specifications laid down in any of these tests the ladder should be returned to Supply+ for overhaul and assessment or contact Supply+. No ladder which has failed any of these tests should be in service.

AS & Bayley Repair & Replacement Section
(all ladders where required)

This manual is written expressly for Inspection and Maintenance of ladders manufactured by AS Fire & Safety.

The use of this manual to carry out procedures on ladders manufactured by other companies could result in damage to them or in some circumstances cause the ladder to fail in service.

For instructions on other manufacturer's ladders please consult their manual.

6 - REPAIR AND REPLACEMENT (AS Ladders & Bayley) including roof ladders

ınformation for Bayley construction:- Bayley ladders are very low maintenance due to construction of the main stile & rungs. The section outlined for Bayley is predominantly replacement of sub-components (Auto-pawls, Rollers, pawls, rollers, rubber foot pads

All ladders that have been inspected and components that have been replaced must post this repair shall undertake the BSEN1147/JCDD (ladder specific tests).

Re-certification and acceptance can only be carried out by an certified ladder Technician who has attended the Ladder maintenance course at Supply+ within the last Three years.

(Due to the huge variances of components and fasteners we are not able to name part numbers for components/fasteners within this document (with the exception of common AS Rivets). However we understand that parts /fasteners will need to be replaced, if so then please send photos of parts/fasteners with a clear description, Our Technical sales will then be able to send replacement parts/fasteners if required. We will also be able to send a parts list to assist the technician)

6.1 – AS Tools required (all ladders)

The following tools and equipment are required to carry out all the repairs described in this manual.

a. Pneumatic riveting gun - the riveter should only be used with an air supply of 5.5 to 5.9 bar (80-85 psi). The tool complete with the special yoke and riveting snaps, is available from Supply+ (Part No TS034).

b. Repair table- this is fully explained in section 6.2.

c. Lazy Tongs blind riveting tool 4mm nose piece and 5mm nose piece.

d. Locating Pins.

e. Cold Chisel.

f. 3mm Pin Punch.

g. 3.5mm Twist Drill.

h. 4mm Twist Drill.

i. 5mm Twist Drill.

j. 5.16mm Twist Drill.

k. 6.35mm Twist Drill.

l. 8mm Twist Drill.

m. 10.3mm Twist Drill.

n. 340 to 450 gram Hammer.

o. 6 off 150 mm G-Clamps (for use in conjunction with item b).

p. Wick Loc lock pins /pliers.

q. 7mm Spanner.

r. 8mm Spanne

s. 10mm Spanner.

t. 2 of 13mm Spanners.

u. 2 of 17mm Spanners.

v. 10mm Socket.

w. Air Twist Drill.

x. Set of Flat Blade Screwdrivers.

y. Phillips Screwdriver

6.1.1 Bayley Tools Required (all ladders)

- Spanners 4mm-19mm
- Allen Keys hex) 2mm-8mm
- Screw Drivers Small flat to Large flat
- Steel Hammer
- Mole grips Small to Large
- Drill (Pneumatic)
- Rivet Gun (see 3.3.1 step 3 for pressure settings)
- Hacksaw

6.2 - Repair Table (AS Rivet Truss construction)

Certain ladder sections are built with a contour or set and this must be maintained when repairs involving tightening or new rivets are undertaken. Before starting repairs the ladder must be clamped to a specially contoured ladder rig. The table is set up using three steele trestles 750mm (30in.) to 900mm (36in.) high with bearing surfaces at least 750mm (30in.) long. They are positioned at 240mm (8 feet) intervals on a perfectly level floor with the bearing surfaces checked with a spirit level to ensure they are horizontal.

Two 6100mm (20ft) lengths of 127mm x 63.5mm x 8mm (5in. X 2.5in. X 5/16in.) channel section steel beam are laid flat side uppermost across the tops of the trestles and square to them. The two beams must be adjusted to suit the particular ladder sections under repair.

If the trestles have been set up correctly both beams should be straight and in the same horizontal plane. Check this by sighting along each beam for straightness and use a spirit level placed square across the two beams at several points along their length to ensure they are horizontal. Pack the trestles, if necessary, to obtain the correct position.

It is then necessary to set a convex contour in the table. This is done by placing metal packing strips 5mm thick between the beams and the middle trestle and suspending 25kg (56lbs) weights approximately 305mm (1ft) from the end of each beam. The weights bow the beams to the correct contour and ensure they rest firmly across the three trestles.

6.2.1 Bayley Repair conditions (all ladders)

The only requirement for the repair bed is a workshop which has the space and working height for the correct removal of the sections (if required). And trestles which have protective lining to prevent stile damage.

6.3 - Other Repairs (AS Rivet Truss Construction including Roof ladders)

Repairs to or replacement of pawls, cables, stabiliser bar, stanchion poles and wall wheel assemblies may also be carried
out without fully dismantling the ladder.

6.3.1 - Other Repairs (Bayley Ladders excluding Roof ladders)

For Bayley repairs to sub-components/Rollers it is required to remove DX/TX sections and placed individually per section on a suitable repair bed.

Important : Due to the Bayley construction rung/stile replacement cannot be carried out for any Bayley ladders. Under no circumstances that welding, or repairing rungs or sections shall be undertaken.

6.4 - Ladders Dismantling and reassembly (AS Rivet Truss Construction) including Roof ladders

When dismantling the ladder for repair or inspection, the following procedure should be followed. Lay the ladder in the partially extended position across two trestles. When a rope clip is fitted, disconnect the rope from the stabiliser bar, remove the eight securing bolts and detach the stabiliser bar. Where fitted withdraw the stanchion pole hinge bolts and remove the props. Where fitted disconnect the wire cable at both ends by removing the remaining bolts **(Figures 61/62).** Unscrew the four screws retaining the cable pulley, (see section 3.7 reference 31-34)and remove complete with cable. Remove the extending line retaining bolt **(Figure 63)** and withdraw the line from its pulleys.

Figure 61

Figure 62

Figure 63

Figure 64

Figure 65

Remove fixings from return pulley and pulley assembly **(Figure 64)**. Remove the screws from each stop block **(Figure 65)** and remove the blocks. Pull out the top and middle sections where fitted from the bottom section. To reassemble the ladder, reverse the above procedure. It is important after the ladder is reassembled that the cable is correctly adjusted .The ladder must be extended onto the second rung, by adjustment of the bottle screw, the feet of the pawls must be almost touching the rung so that when put under tension the feet can be made to contact the rung. Check slide wheel clearance in both stowed and extended conditions. This should not exceed 3mm with the ladder pushed to one side .If greater, adjust the spacing washers to close the gap to less than 3mm, in both open and closed positions. See section 3.5.1 for fully detailed instructions.

Note: If an automatic arrest device is fitted, a pin must be inserted through the hole in the casing to render the unit inoperative to enable the ladder to be re-housed. This feature must only be used for servicing purposes. The locking pin must be removed immediately after the ladder has undergone a deflection test (see section 3.6)

Information:

AS Fire roof ladders are based on the same construction as the AS Rivet truss extension ladders, with the exception that all AS roof ladders are not extended using the manual push operation or rope pulley system. The open close operation from folding roof ladders is achieved by two variation design hinge mechanisms (**see Figure 66/67)**

Figure 66

Figure 67

In principle the mechanical operation/closure of the above hinges are similar in operation and both if maintained /inspected correctly will work.

AS Old Hinge Design (see Figure 67)

Areas to check ladder hinge link, ensure block is in good condition, also check the pivot pins and the nylatron washers check mechanical operation of the pivot to identify any excess slack or tightness it is possible to replace these components whilst hinge assembly is housed onto the ladder

Check the outer Anchor hinge body plate for damage or wear or oxidisation. It is not possible to replace this component due to the position and joining to the inner tensioned spring (**see Figure 68 item 4)** which is not accessible whilst being housed on the ladder.

Check latch strike pin/anchor plate retaining pivot pin for damage or wear it is possible to replace these components whilst hinge assembly is housed onto the ladder

Check the tension spring is working correctly and observe within the inspection hole that the spring ends are housed within the washer tabs and the spring retaining pin which is housed through the Anchor plate. **(Figure 68 item 5)**

It is not possible to replace this spring mechanism whilst being housed onto the roof sections. The Anchor hinge body S316 L/R hand holding rivets will need to be removed **(see figure 69)**. As such due to the anchor body side **(see figure 68 item 1)** & the retaining body being **(see figure 68 item 2)** housed onto different sections, we strongly recommend the complete replacement of both housings. Once channel rivets (S255) are removed the hinge bodies can be removed and parts replaced if required. Only replace the hinge assembly if you have attended the ladder maintenance course in the past three years if so (follow instructions in section 6.6.2) for pop rivet removal.

Check hinge location hole for elongation/wear, replace as per section 4 if required. This elongation will only occur if the hinge bodies. section do not align together when being operated opening/closing

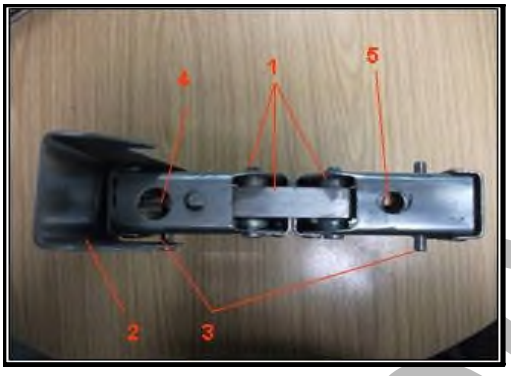


Figure 68

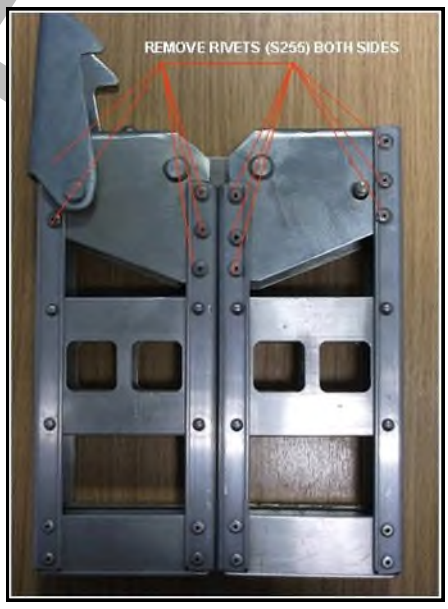


Figure 69

In principle the mechanical operation/closure of the old/new hinges are similar in operation and both if maintained inspected correctly will work. AS New Hinge Design **(see Figure 66)**

Areas to check ladder hinge plunger assembly and pin, ensure hinge bodies are in good condition. Check mechanical operation of the pivot to identify any excess slack or tightness

Hinge plunger assembly, check wear or damage and plunger operation, due to mechanism being held by compression spring the spring action should be smooth.

Check the plunger pin location hole for elongation or damage. This hole should be concentric if there is any indication of hole elongation or damage then it would suggest that the hinge assembly has been incorrectly housed, stile section damage or the ladder has been misused in operation. The hinge mechanism is tested in build for such issues before being released to workshops.

It is not possible to replace these components individually as this hinge body's) L/R /function as a pair. Our recommendation is to replace both bodies if damage has occurred on either side. This will ensure that the wear rate is distributed equally between both sides. **(ref item 2&4 figure 66)**

Check guide plunger pin half moon cut-out/lead-in for damage or wear. For normal contact between the pin and the ramp you should see a polishing effect on the surface. This is normal. If you see very deep scratches then this would indicate that the hinge assembly has been incorrectly housed, stile section damage or the ladder has been misused in operation

It is not possible to replace these components individually as this hinge body's) L/R /function as a pair. Our recommendation is to replace both bodies if damage has occurred on either side. This will ensure that the wear rate is distributed equally between both sides. **(ref item 2&4 figure 66)**

Hinge main bodies are to be checked for any excessive wear or damage as stated in **(item 1/2/3 figure 66)**. Also check that the rivets that house the bodies onto the channels have formed correctly. A small amount of twist between the roof sections should occur, however excessive twist would indicate channel damage or within the hinge body joining rivets some indication of mechanical failure (rivets have sheared, rivets not formed due to incorrect gun pressure, wrong rivets used, pre-drilled rivet holes within the hinge bodies are too big).

If you are unsure then remove the roof ladder from inspection, tag/quarantine ladder laid out in you workshop procedure and replace the damaged hinge assembly. Also if you have damage to the hinge then there may also be damage to the ladder channels, inspect and replace if required.

Only attempt to replace hinge assembly if you have attended the ladder/maintenance course within the last 3 years.

AS Roof ladder Upgrade.

It is now possible to replace the traditional hinge with the new hinge (see appendix B) for procedure to achieve this.

Only attempt to upgrade hinge assembly if you have attended the ladder/maintenance course within the last 3 years.

6.4.1 - AS Roof Sub-components and inspection

As with all ladders specified ensure that all of the relevant labels have been used and are currently housed on the ladders, see section 7 for heat sensor qty by Ladder designation

Generic inspection (whole ladder)

- Check overall condition of the ladder, particularly in respect to the hinge mechanism, unfold (where applicable) the roof ladder onto trestles and look down the length of the ladder from the base of the ladder, and check for the ladders flatness in the horizontal plane (y axis) and then check the flatness in the (x axis). If it is found that there is excessive twist in both axis or one side of the channel is higher than the other, then further inspection is required to determine the cause of the change in plane reference height. This would indicate (damage in operation, incorrect rung assembly replacement, incorrect hinge set-up, loose rivets) Replace components if required to do so.

Sub components including all fasteners

Replace components if required to do so post inspection:-

- Check stand-off pads and rubber block for fire damage or excessive wear/perishing replace if required to do so **(see Figure 71)** always replace both sides at the same time.
- Check and inspect/operation Roof hook assembly (standard/Ashford/fixed) **see Figure 71.**
- Check and inspect folding open/close operation of roof hook.
- Check and inspect roof spring locking latch mechanism and retraction/detraction operation. Ensure the operation is smooth. Inspect the retaining latch holes.
- Check for general were or oxidisation of the roof hook assembly
- Important-inspect all the weld points within the whole assembly for cracking, pitting, oxidisation.
- Check and inspect the rubber support pad were wear/perishing. (this part is heat shrunk, training is required when replacing this part)
- Inspect wall wheels and the fasteners for damage/wear/rolling performance.

Check roof assembly joining plate and fasteners/rivets (and bolts for damage. (to remove the whole hook assembly just remove 4 off bolts shown in **Figure 72)**

Additional Roof 3 Rung extension (for Fixed section only)

An additional option by brigade request is to carry an additional 3 rung roof ladder extension section which offers the increased overall ladder length.

The joining mechanism which allows this process to take place is a male and female coupling which is secured using a sword pin through the joining coupling or a ball pin. If it is shown that the joining components are loose, then a new male/female coupling can be supplied, and repairs carried out as per section (6.6 & 6.8 respectively)

Figure 71

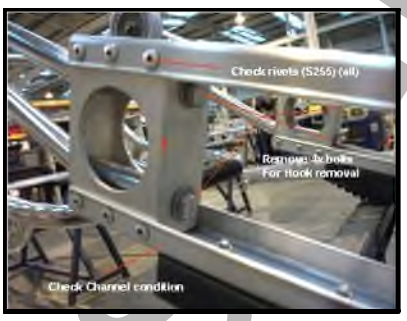


Figure 72

6.4.2 - Ladders Dismantling and reassembly (Bayley Construction) including Roof ladders

As with all ladders specified ensure that all of the relevant labels have been used and are currently housed on the ladders, see section 7 for heat sensor instructions. Important :-Due to the Bayley construction rung/stile replacement cannot be carried out for any Bayley ladders. Under no circumstances that welding, or repairing rungs or sections shall be undertaken.

DX/TX Short These ladder's) are particularly low-maintenance, however if the ladder is subjects to high use then parts will wear and it is then necessary to replace relevant components. Due to the simplicity of the DX& TX Bayley short ladders the removal of the ladder into it's individual section is fairly straightforward **(see Figure 73)** Removal of the top

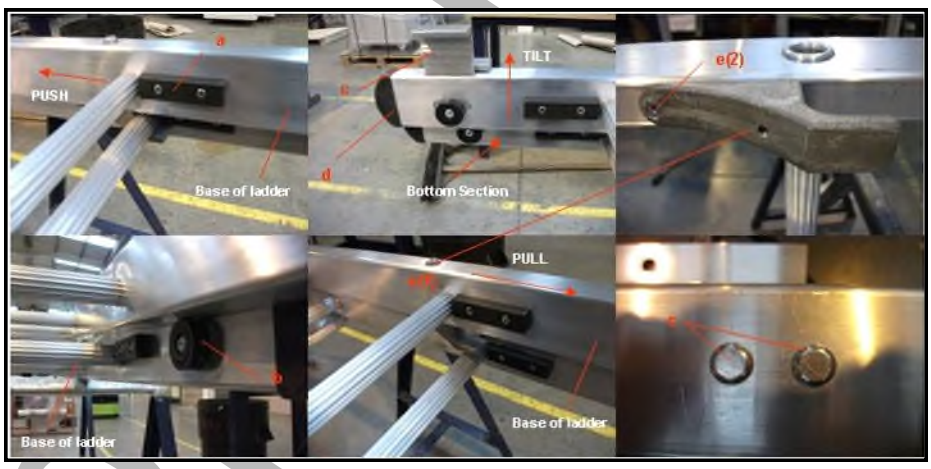


Figure 73

Removal of Bayley DX/TX Short components if required (Due to the extensive variation parts and fasteners please contact Technical sales for the correct replacement Rivets fasteners and components)

- Ladder slide block/held using pop rivets/replace slide by drilling out rivets and replacing with new rivets
- Roller wheel guide, held using cross head machine screw/replace by removing screw
- Ladder clamp, housed within an cut-out in the stile and held using 2 x blind nuts/Remove roller wheel and remove 2 x countersunk screws which are locked into 2 x Aluminium blind nuts. To remove clamps use relevant mole grips to hold blind nuts and then remove screws and replace clamp if required
- Remove rubber feet by drilling out 1x pop rivet, replace Rubber feet and replace rivet.
- Pull casting, remove bolt shown in e(1) and drill out rivet shown in e(2)/replace pawl and replace rivet and if required the bolt if shown to be damaged

Replacing identification plates (all ladder types) (if needed) requires the technician to drill out the existing rivets and replacement with new rivets **(see Figure 74)** For all other labels see section 5.1.1 for correct label based on the type of ladder.

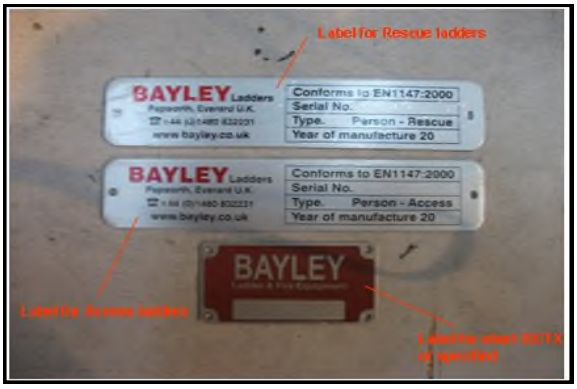


Figure 74

6.4.3 - Bayley Ladders DX 7.3m/9m/10.5m (BS EN 1147)

As with all ladders specified ensure that all of the relevant labels have been used and are currently housed on the ladders, see section 7 for heat sensor qty by ladder designation

The general pictorial's) shown below are for the removal and replacement of the 7.3m DX with Auto-pawls, the design is the same as the 9m & 10.5DX with the only difference being the length. Therefore for dismantling instruction for the 9m & 10.5m DX use the method below as shown for the 7.3mDX.

As for the 9m DX we do offer an alternative “A” pawl configuration which will be shown within this document. Before the removal of Auto-pawls the ladder must removed in to it’s individual sections.

Dismantling and Removal of ladder sections DX

- Lay down ladder on trestles as shown in **(Figure 75)**
- Remove ladder retaining strap **(see Figure 76)**
- Remove extending line from stirrup housing **(see Figure 77)**
- Lift Auto-pawls up as shown in photo and push top section forwards towards the head of the bottom section **(see Figure 78)**
- Continue to push the top section towards the head of the ladder until it reaches the Rung stop, push the stop inside the rung **(see Figure 79)**
- Once it has cleared the rung clamp plate **(see Figure 80)** then continue to remove the section until it reaches the end **(see Figure 81)**
- Place the top section on trestles next to the bottom section **(see Figure 82)**
- Carry out visual inspection of all the sub-components.
- The AAD will need to be tested (see appendix A), if found to be damaged or not functioning correctly then remove the 4 x fasteners **(see Figure 83)** and return to Supply+

Bottom section Inspection:- Inspect the stiles and rungs for excessive damage or wear, remove from service and contact Supply+ for new section, Check AAD, All fasteners,
Hold-down clamp/stops **(see Figure 84),** Rubber feet, Rollers guide **(see Figure 84)** and the extension line and the karabiner housing.

Replace relevant parts if required with the (excluding the AAD).

Top Section inspection:- Check all fasteners, ladder slide guide **(see figure 85),** stops **(see figure 86),** Stirrup **(see figure 87**), Wall wheel assembly **(see figure 88),** Rubber feet & Auto-Pawls **(see Figure 81/89),** for removal/replacement of Auto-pawl see section 6.4.5

Figure 75

Figure 76

Figure 77

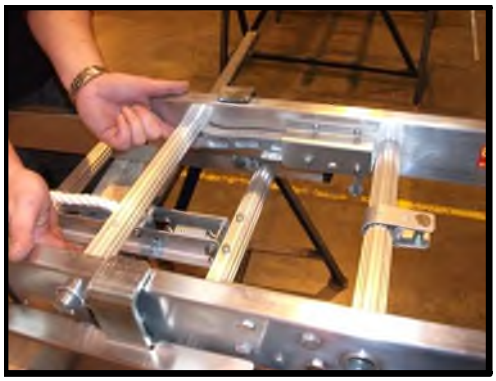


Figure 78

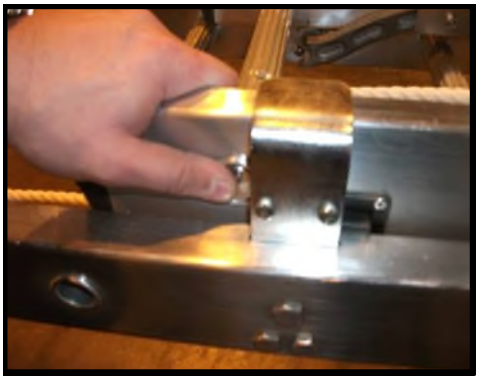


Figure 79

Figure 80

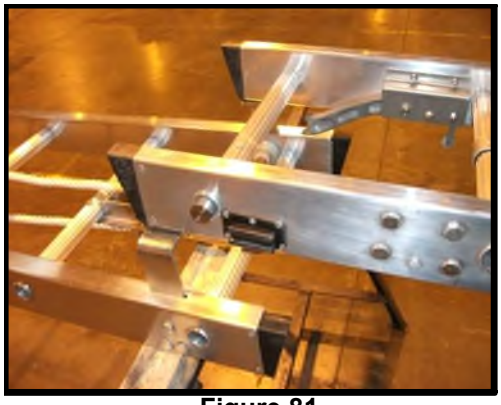


Figure 81

Figure 82

Figure 83

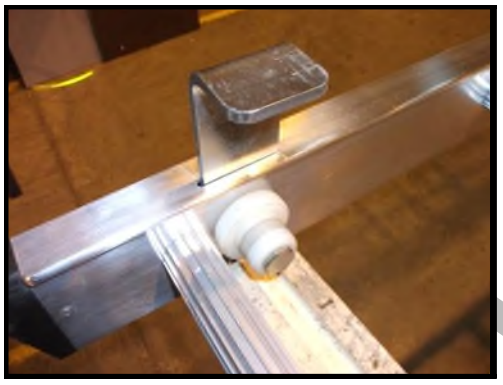


Figure 84

Figure 85

Figure 86

Figure 87

Figure 88

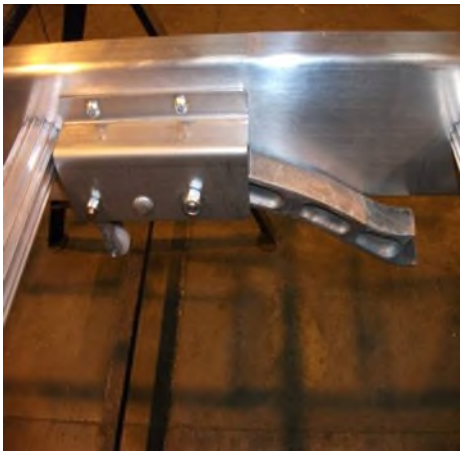


Figure 89

6.4.4 - Bayley Auto-pawl removal/replacement (only for BS EN 1147 DX ladders) Handed pairs

(Due to the huge variances of components and fasteners we are not able to name part numbers for components/fasteners within this document. However we understand that parts /fasteners will need to be replaced, if so then please send photos of parts/fasteners with a clear description, Our Technical sales will then be able to send replacement parts/fasteners if required. We will also be able to send a parts list to assist the technician)

Important: Only remove this assembly if it is absolutely required, only if you have discovered any Auto pawl mechanical/operational difficulties, or any obvious component failure. Which requires the pawl housing to be removed.

Note:- Replacement shown for RH Auto-pawl assembly

- Acquire tools as shown in **(figure 90)**
- Remove Button Head Socket screws 2x as shown in **(figure 91)**, use socket wrench to hold the blind nuts (see **figure 92**) whilst removing bolts in **figure 91**
- Next remove the nuts **(see figure 93** holding the pawl finger pivot pin (1) and the pawl arm pivot pin (2)
- Remove all retaining fasteners store in a safe place, then remove pawl cover plate housing **(figure 94)**
- Store the cover plate and ensure that the spring retaining rivet is positioned as shown (when required for refit) **see figure 95)**
- Check the condition of the Pawl arm and the pawl finger (all components & fasteners) this includes wear factors and any stress cracks on the castings (replace if required)
  see figure 96/97.
- Remove pawl finger casting and Pawl arm casting, the relevant torsion spring's) must be replaced at this point, remove spring arms from their respective holding points
  (see figure 97)
- Remove pawl finger/pawl casting pivot pin's) using mole grips held on to pivot pin) and socket wrench located onto the blind nuts **(see figure 98/99)**
- Once all parts have been removed check the condition of the relevant retaining holes **(see figure 100)** on the stile for elongation or damage.
  If elongation has been identified then remove section and all parts and contact Supply Plus.Technical sales for a complete section replacement.
- If at this stage that as shown in section 9 that the pawl retaining holes are acceptable, then replace worn/damaged components and follow the process above but in reverse

Important: for the Auto-pawl to function/operate correctly it is required that the Pawl arm torsion spring post re-housing the assembly **(see figure 101)** that the spring sits on the pivot pin Sits on the shoulder portion of the pivot pin **(see figure 102)**. Otherwise the Auto-pawl will not work) Use a small flat head screw driver to lift the spring onto the shoulder/in position whilst tightening the Pawl arm nut

- When all the components have been tightened and the pawl housing cover is secured **(figure 91)** and all the top section components have been checked, join the sections together and check the operation of the auto-pawls laid out in section 4.1.1
- Heat Sensors are to be replaced if found to be damaged (see section 7 for instructions)

Figure 90

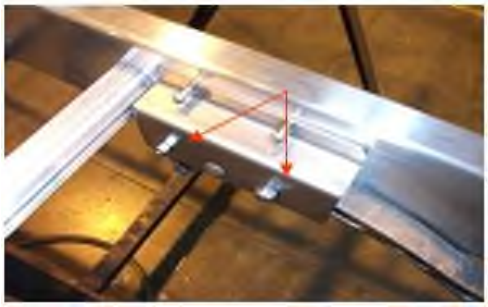


Figure 91

Figure 92

Figure 93

Figure 94

Figure 95

Figure 96

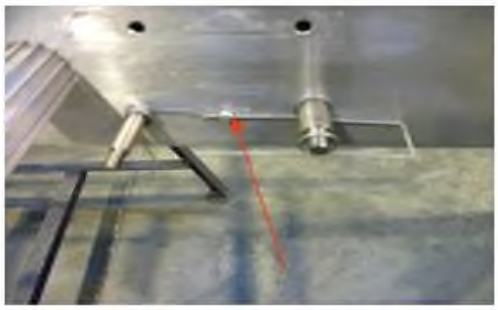


Figure 97

Figure 98

Figure 99

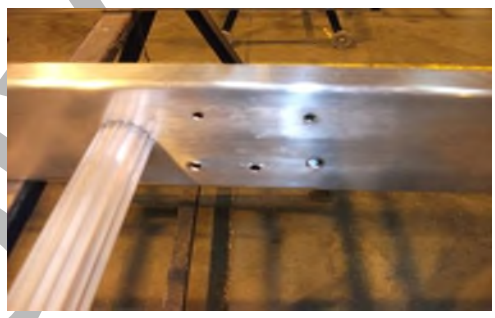


Figure 100

Figure 101

Figure 102

6.4.5- Bayley Roof ladders Repair & Replacement (all types) and Stowaway (all types)

As with all ladders specified ensure that all of the relevant labels have been used and are currently housed on the ladders, see section 7 for heat sensor qty by ladder designation

Important : Due to the Bayley construction rung/stile replacement cannot be carried out for any Bayley ladders. Under no circumstances that welding, or repairing rungs or sections shall be undertaken.

At present there are 4 (Four) Generic Roof ladder configurations out in service.

Bayley Roof Ladders configurations:-

- 2 section Folding Roof ladder with fixed
- 2 Section Folding Roof ladder with folding hook (Ashford fold hook or standard)
- Single section Roof ladder with folding hook (Ashford fold hook or standard)
- Single section Roof ladder with fixed hook

All of the above are available in various lengths and folding points dependant on brigade specification.

Replacement of the Roof Hook can be carried out at workshop level, it is not a mandatory requirement but Supply+ recommend that the hook shall re-tested BS EN 1147 as laid out in section if workshop has the roof hook test equipment and test sheet see section 5.1.4

Removal and replacement of Roof ladder sub components (roof ladder shown with Ashford hook)

- Lay Roof ladder onto trestles and where required unfold **(see figure 102/103)**
- Carry out general inspection to identify any other issues/damage/wear
- Start at the roof hook end and work along towards the foot of the ladder and inspect the Stiles and the rungs (see section Bayley 3.4)
- Check the open/close operation (**figure 102** of the roof hook and check the folding hook pin (2)(f**igure 104)** for damage and operation.
- Replace L/R hand **(see figure 104)** if shown to be damaged, to remove hook pin (2) or spring (3), use long nose pliers to remove split pin (4) and washer's) (5)
- Before replacement of components check the roof hook retaining holes for elongation or excessive oxidisation L/R hand **(see Figure 104** (6))
- Both the folded portion hook and the assembly can be totally removed (if required) from the ladder (**see figure 105** (1&2))
- Also the fixed roof hook arm with wall wheel can also be totally removed if found to be damaged (**see figure 106 (3))**
- Within the folded portion of the rook hook (**see figure 105)** the Head bar (4) and the ties (5) also can be replaced by removing the screws either end.
- Replace wall wheels **See figure 106** (1) if found to have excessive wear or cracking, remove screw and blind nut to replace wall wheel housing.
- Next move along and inspect and replace where required the pressure plate assembly(1) **(see figure 107)**, replacing the pressure plates is achieved by removing the outer
  4 x retaining screws and the retaining inside blind nuts. When replacing with new pressure plate make sure the fasteners are secured with (Loctite 243)
- Inspect retaining strap **(figure 108)** for degradation or fraying and observe rivets for damage. Drill out 2x rivets and replace strap with new rivets if required.

Carry out folding hinge open/close operation to identify any operational/mechanical difficulties with the hinge assembly

- Folding hinge assembly (Shown in folded state) **(see figure 109)** check plunger pin housing (1) for damage & oxidisation, check hinge bodies (2/3) for damage, pay particular attention to the latch pin lead in (4) and the retaining latch pin hole(5) for elongation and damage. Due to the fitment of the Hinge assembly hinge replacement must be undertaken back at the manufacturing facility at Supply Plus.
- Inspect rubber feet **(see figure 110**) if shown to worn then replace by roving the holding rivet which is housed on the side of the stile.
- Heat Sensors are to be replaced if found to be damaged (see section 7 for instructions)

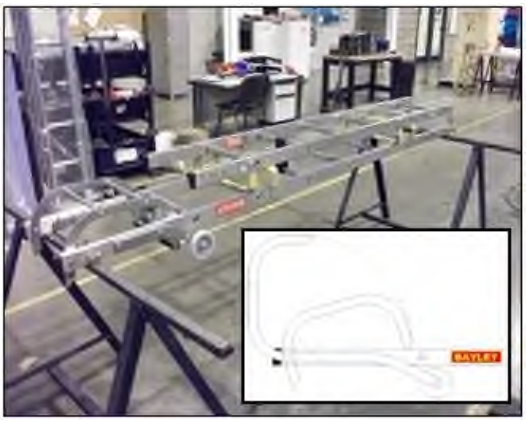


Figure 102

Figure 103

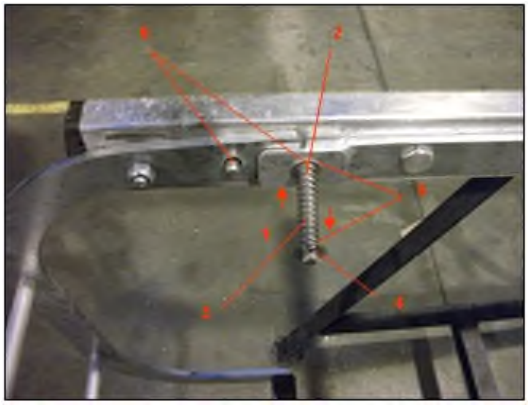


Figure 104

Figure 105

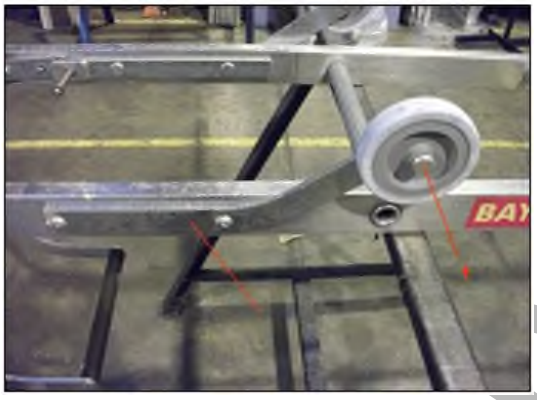


Figure 106

Figure 107

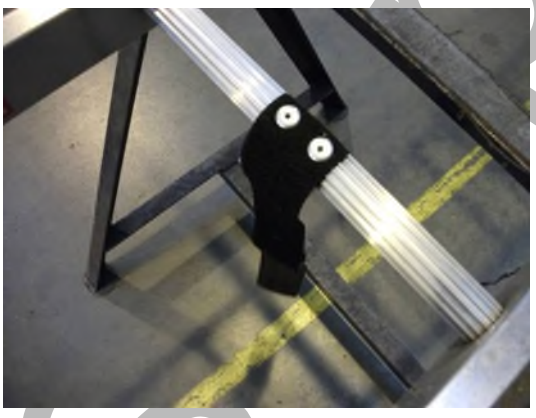


Figure 108

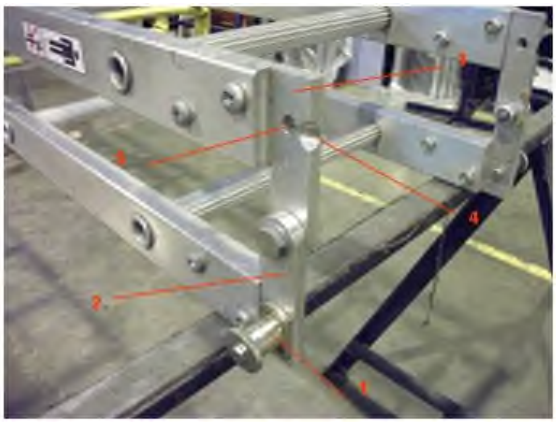


Figure 109

Figure 110

Stowaway replacement components/parts and inspection

As with all ladders specified ensure that all of the relevant labels have been used and are currently housed on the ladders, see section 7 for heat sensor qty by ladder designation

Important : Due to the Bayley construction rung/stile replacement cannot be carried out for any Bayley ladders. Under no circumstances that welding, or repairing rungs or sections shall be undertaken.

- House stowaway **(see figure 111/112/113))** onto clean level floor in folded state and inspect the whole ladder, particularly the hinge assembly, ladder retaining straps and also the shape of the stowaway in the folded state, if it is shown that there is twist in the closed state then it would either indicate stile damage or hinge damage

- Due to the fitment of the Hinge assembly it is not possible to replace this component at the Technicians brigade workshop. The whole ladder will need to be sent back to Supply+ for assessment and where necessary hinge replacement undertaken. if it has shown that the stiles are deformed or damaged in any way the whole section will need to be replaced

- Replacement of the rubber feet and strap retention replacement is the same as in the bayley roof **(see figure 108/110)**

- Unfold stowaway **(see figure 114)** and place on trestles and inspect further, pay extra attention to the hinge assembly and surrounding components for any closure/housed looseness or damage. Also check the stile sections and the condition of the rungs for damage or looseness (see section 3.4).
- Next fold the centre hinge mechanism and place the stowaway where applicable into the “A” frame configuration **(see figure 115),** instability could indicate worn feet, damaged stiles and damaged hinge assemblies.
- It is still required that the BS EN 1147 Deflection test is carried out post replacement of relevant parts.
- Heat Sensors are to be replaced if found to be damaged (see section 7/ref qty and appendix ref for positioning)

Figure 111

Figure 112

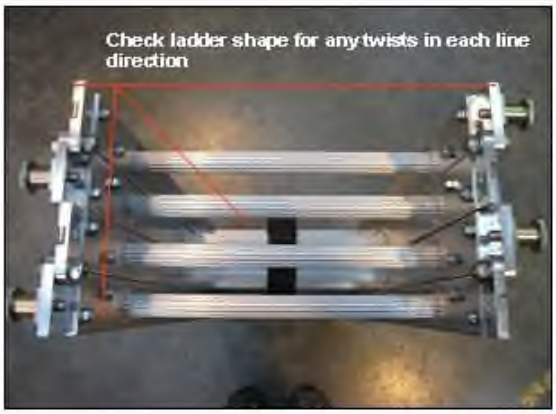


Figure 113

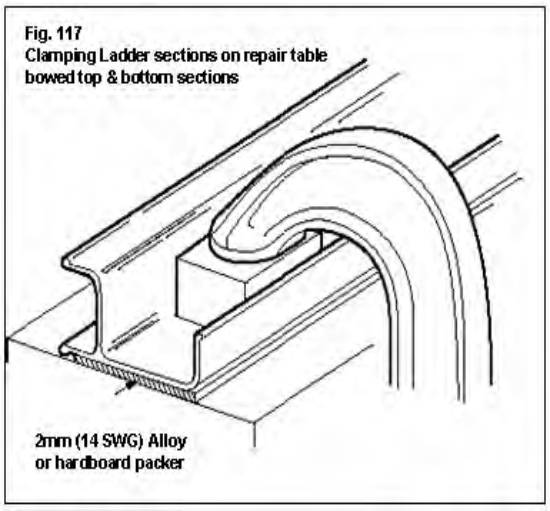
Figure 114

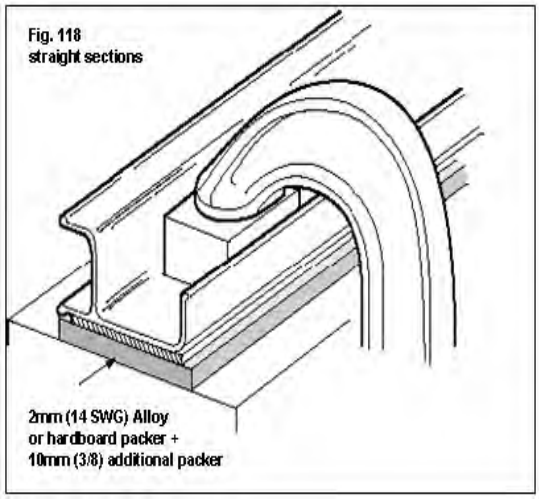
Figure 115

6.5 - Position of Ladder Sections on Repair Table (AS Ladders)

In describing the correct positioning of ladder sections on the repair table, it should be understood that with the ladder pitched the front of each section will face away from the building and the back will face towards it. Some ladder sections have a set or contour, shown diagrammatically in **(Figure 116)**, which must be maintained when rivets are being tightened or replaced.

This is done by firmly clamping each section in a specific way to the curved repair table, using 150mm (6") G clamps positioned on both sides of the section in the middle and at the ends as shown in **(Figure 117/118)**.





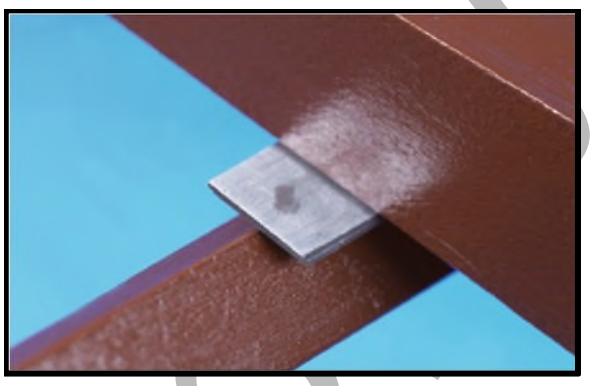
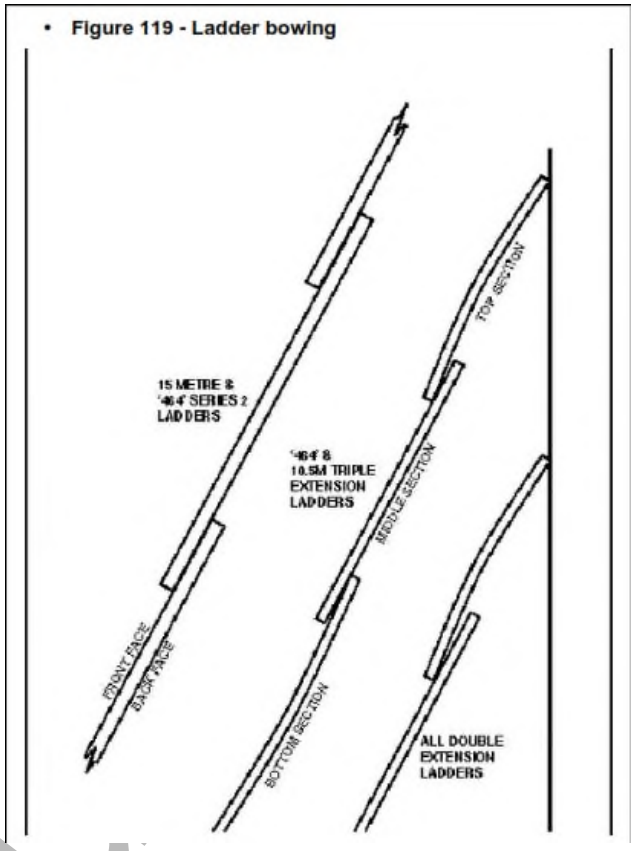


Figure 119

A 25mm x 40mm (1" x 1" x 1½") wooden block should be placed inside the stile under each clamp to prevent damage when the clamps are tightened. There is a strengthening bead along each stile and to prevent distortion when clamping, 100mm x 50mm (4" x 2") packer (preferably 2mm - 14SWG light alloy or alternatively hardboard) should be placed at each clamping point between the stiles and the table. Alternatively the repair rig may be closed together so as to allow the beads to sit over the edge of the rig and the packing placed under the beams **(Figure 119)**.The correct positioning for each section is as follows:-

- Bowed bottom sections must be clamped with uppermost, e.g., the section should be clamped with the two stile sections down and the two “U” channels uppermost. The beams should be approximately 450mm (18") apart.
- Straight sections can be clamped either way up but in addition to the normal alloy or hardboard backing under each clamp, alloy or 5mm (3/16") packing must be placed between the rig and the trestles at the points where the four clamps are positioned. No extra packing should be placed under the two middle clamps.
- Bowed top sections are clamped directly onto the table with the front uppermost and the back resting on the table. The beams should be placed approximately 200mm (8") apart.

- **Figure 119 - Ladder bowing**



6.6 - Removal of Rivets (all ladders)

The following end cap assemblies are located using S 255 pop rivets:-

- Foot of main ladder section - stabiliser attachment
- Head of top ladder section - wall wheel axle bearing blocks

All other end caps and some rope clip stirrups etc are located using pop rivets (ref. no. S 270).

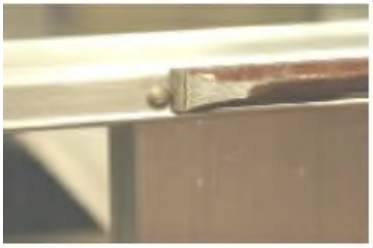
6.6.1 - Solid Rivets

There are two ways of removing a rivet from your ladder.

1) Firstly if you are just replacing a rung or a single rivet you need to take more care, so you do not damage the stiles or channels involved. This is done by carefully filing or grinding a flat surface onto the rivet/s, then using a centre punch to give you a place to start drilling. Using a 3.5mm drill bit, drill in just further than the rivet heads thickness, then using a cold chisel and hammer, lightly tap and remove the weakened rivet head. You will now be able to see the rivet’s hole in the stile or channel, letting you punch or finish drilling out the back of the rivet.

2) The second way of removing rivets is done when you are removing a complete stile or channel. This is done by using the cold chisel and hammer to forcibly remove the rivet heads on the whole stile or channel involved **(Figure 120/121)**. Next get a good set of mole grips or pliers and start at one end of the stile/channel and lift the stile/channel away from the rungs. After going down once, repeat the process, but this time you will pop off the other side of the stile/channel. Once the stile/channel is totally removed you can use the rivet back removal tool to finish clearing the rungs ready for the new stile/channel to be fitted. Great care should be taken not to elongate the holes in both methods.

- **Figure 120- rivet removal**



- **Figure 121- rivet removal**

6.6.2 - Pop Rivets

Removal of pop rivets should be carried out by carefully drilling out the head of the rivet and tapping out with the pin punch.

Use a 4.9mm dia Twist Drill for the removal of S255 rivets

Use a 4mm dia Twist Drill for the removal of S270 rivets

6.7 - Solid Rivets (AS Ladders)

6.7.1 - Tightening Loose Rivets (AS Ladders)

- **Figure 122 - tighten loose**

When several rivets require tightening, the section should be set up on the trestle table as indicated in **(Figures 120/121)**, slight pressure being applied in order to hold the Rivet in position. The riveter should be held horizontally and square to the ladder section to ensure correct location of the rivet. **(see Figure 122)** The riveter should be operated for a couple of seconds to ensure that the rivet is fully tightened. Care must be taken to set the jaw gap correctly in accordance with the tool manufacturers' recommendations. See notes in section 7 regarding the setting procedure for different rivets.

6.7.2 - New Rivets

If rivets have previously been re-tightened, they should be removed as described in section 6.6. New rivets should be placed with the domed heads on the outside of the section and tightened as indicated above.

6.7.3 - Pop Rivets

If rungs are replaced close to the foot of the bottom section of the ladder, it may be convenient to remove the stabiliser attachment end cap assemblies in order to remove the rungs and fit new ones. The stabiliser bar should be bolted on before re-riveting the end cap assemblies. The normal pop riveting procedure is used with rivets (ref no. S 255). Pop rivets (ref no.S 270) are used elsewhere on the ladder and normal pop riveting procedures should be followed.

6.7.4- Re-Bowing of Ladder Sections

If a ladder section needs to be re-bowed to give the necessary clearances between sections, the following procedure should be adopted.

1) After inspection of the ladder section it should be placed on the repair table on two blocks of timber placed under the extreme ends of the ladder section, with the direction of desired bow down against the table.

2) Clamp the ladder at the centre of the point at which adjustment is required.

3) With a sacrificial timber block approximately. 50mm sq. x 300mm long (2"sq x 12" long and of suitable thickness) gently dress the area over the rungs.

4) Repeat the above until the desired shape is achieved.

5) When this procedure is complete check that no damage has occurred to the rivets or ladder structure generally.

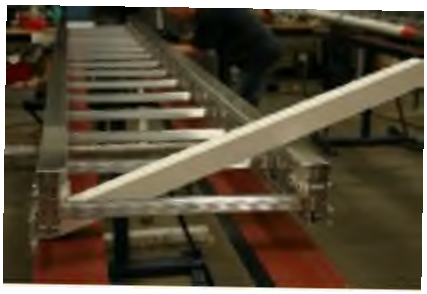
Note: The procedure must only be carried out by trained personnel and should only be used as a matter of last resort. If in any doubt return the ladder to Supply+ or contact your local agent for repair.

6.7.5 - Ladder Twist

After riveting has taken place the ladder must be checked prior to reassembly, to ensure that no twisting of the structure is evident.

This is carried out according to the following procedure:

- Figure 123 Twisting of ladder



● The ladder section is mounted on the repair table on two blocks of timber approximately 1m (3ft) long placed 150mm (6") in from the end of the ladder section.

● Feel the weight of the ladder section by lifting each corner in rotation to see if the section is equally balanced.

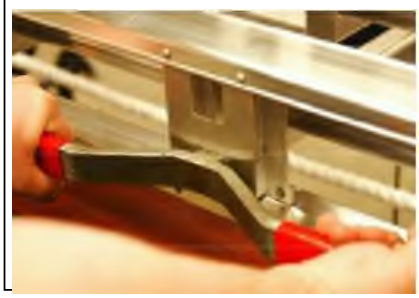
● In the event of detecting an imbalance the heavier side should have a loose fitting clamp at the opposite end of the ladder and using a length of timber as a lever the ladder is twisted against the clamp to restore the balance. Care must be taken when carrying out this procedure to ensure that no damage occurs to the stiles of the ladder **(Figure 123)**.

● Note: It is not possible to see the twist that may reside in a ladder section as this can be masked by the weight of the ladder which will assume the profile of the surface on which it lies.
● The above has been found, over many years, to give the most accurate way of checking for ladder twist.

6.8 - Removal of Rungs (AS Ladders)

In the event of rungs becoming damaged, the ladder should be carefully inspected for damage to the stiles/channels before replacement is undertaken. If it is found that the stiles/channels are cracked or badly deformed, the ladder should be returned to Supply+ for overhaul, unless your engineers have attended the 2 or 4 day training course. Rungs are removed using one of two methods.

- Figure 124 - Rung



1) Firstly, if you need to replace any of the end three rungs in the ladder you should remove all the rivets (using rivet method 1) from all the rungs up to and including the damaged one. When the rungs are removed tap the rung/s out of the end then replace with new rung/s.

2) Secondly, if you need to replace a middle rung start by removing all of the damaged rung's rivets (using rivet method 1), then the top rivets from the 2 rungs either side of the damaged rung. When all these rivets are removed, use the rung removal tool to twist the damaged rung so it sits at a 45° angle. This will allow room to insert the new rung. When the new rung is set at an angle of 45° angle, you can twist the damaged rung completely out. Finally you can twist the new rung into position and use the locating pins before riveting can begin **(Figure 124)**.

6.9 - Stanchion Poles (AS Ladders where fitted)

The stanchion poles cannot be repaired if they become bent or damaged and should therefore be replaced. To replace a stanchion pole, remove the pivot bolt and detach. The new stanchion pole should be bolted on, care being taken to ensure that it is correctly positioned with regard to the offset **(Figure 125).**

- Figure 125 - Stanchion pole

if the plastic Netlon hand-grips are damaged, they can be replaced by cutting off the old grip and fitting new ones, after first having removed the stanchion pole from the ladder. Swarfega, or a similar type of hand cleanser smeared onto the pole will facilitate the fitting of Netlon mesh type plastic hand-grips and can be washed off with water when fitting is complete. To replace grip tape, use a pointed edge to lift the end and then pull off. Clean the area and apply a new length. Heat shrink grips can be replaced wholly or in part using a soft flame propane torch or similar heat source.

To replace the ground spike, drill out the retaining pop-rivet and then drift out the unit which is a tight push fit in the tube. When re-fitting the ground spike, tap into the prop tube using a copper mallet. It is essential that when refitting the unit, it is pushed squarely into the tube and that the rivet holes are aligned. Secure the unit by means of three pop rivets (ref. no. S270). Should the stanchion pole retaining clip become damaged (on the old type of metal clips), the rivets should be removed and a new clip bolted into position. Note that the latest clip supplied is manufactured from polyurethane and will not damage the stanchion pole.

6.10 - Steel Stabiliser Bar (AS Ladders where fitted)

It is recommended that the only repairs that should be carried out to the jacks are the replacement of the rubbers on the stand-off bracket, if fitted, and friction pads and replacement of the spindle should the threads become damaged. The original style rubber strips on the stand-off brackets have been phased out and replaced by polyurethane pads. These are now replaceable and are secured by bolts to the stand-off brackets. Should the spindle thread become damaged a new assembly should be fitted. To remove the spindle, firstly unscrew the retaining socket screw and drift off the hard wheel. Remove the friction pads and adjusters if fitted. The spindle should then be unscrewed from the assembly. If the spindle is severely bent, it may be necessary to cut the spindle to facilitate removal. Since the ball joint is a press fit in the end of the spindle, the complete assembly must be replaced. The new spindle assembly should be fitted and the hand wheel replaced, by reversing the above procedure. If assembly has been damaged in any other way, it should be returned to Supply+ for overhaul and repair.

6.11 - Aluminium Stabiliser Bar (AS Ladders where fitted)

On aluminium stabiliser bars it is possible to replace the stand off rings if required. It is not considered practicable to replace the tube as special tools and jigs are required. A replacement tube assembly is available from our factory or agents. To remove or adjust the spindle damper first remove the plastic end cap from the tube .This will reveal an aluminium plate held by 2 nuts. Tightening these will increase the damping of the spindle. To remove the spindle undo (but do not remove) the nuts until the spindle is free moving.

6.12 - Pawl Assembly (AS Ladders where fitted)

In normal use the only parts of the pawl assembly which should be replaced are the pawl finger, hook and finger springs. Should other parts become damaged or worn, a complete new assembly should be fitted. To replace either hook or finger spring, firstly remove the assembly by unscrewing the four retaining screws. Remove the split pin from the appropriate pivot pin and withdraw the pin. The hook or finger can then be removed together with the spring. A new spring should then be fitted, the hook or finger repositioned and the pivot pin replaced. Before replacing the split pin (always use a new pin) check that the spring is correctly located under the spring retainer. Adjust the finger spring if necessary, by bending it carefully with a pair of snub-nosed pliers, and refit the assembly. Check that both pawl and finger clear the rungs.

6.13 - Extending Line and Cable (AS Ladders where fitted)

The extending line and wire cable should be checked for damage and replaced if necessary. To replace the extending line, disconnect it from the rope clip, remove the retaining bolt **(Figure 126)** and withdraw it through the pulley assemblies. Feed the new extending line through the pulley assemblies in the reverse manner and secure the retaining bolt. The wire cable, where fitted, together with the pulley assembly, is removed as detailed in section 6.4. To detach the cable from the pulley assembly, remove the split pin from the pivot and remove the pivot and pulley. The cable can then be pulled through the housing. Ensuring that the straining screw is in the 'open' position to allow for maximum adjustment, fitting the new cable is the reverse of the procedure above.

- **Figure 126 Extending line retaining**

6.14 - Wall Wheel Assembly (AS Ladders)

The wall wheel assembly can be removed by unscrewing the four screws holding the two bearing blocks or angle spigots. The bearing blocks, axle, or axle spigots should be replaced if worn and new wheels fitted if the tyre is worn or damaged.

6.15 - Wear on Stiles, Channel and Rung Sections (AS Ladders)

Wear to ladder components are normally caused when the ladder is housed on the gantry of a moving vehicle. An element of wear on both stile sand rungs is acceptable only under the following conditions. It is presumed that ladders are regularly maintained and will be re-inspected on a quarterly basis.

1. The centre of the ladder is to be regarded as high stress and it is only permissible for the beading on the edge of the stile to be allowed to be worn away by the rung. Wear on rungs should be no deeper than 1mm (0.040").
2. In the area of the slide wheels wear up to 50% of the material thickness of the stile is acceptable. If wear is beyond the above limits the components must be replaced

6.16 - Auto Arrest Device (AAD) Retrofit Installation Guide (Converting from JCDD to BS EN 1147)

The same AAD **(Figure 127)** is used on both double and triple extension ladders, but should only be fitted to ladders that have pawl dampers.

1. With the ladder wide section up remove the existing rope pulley from the wide section.
2. Offer up the AAD as shown above using the original left hand fixing holes and drilling new holes for the right hand. It will be necessary to file the AAD body to fit tightly between the rungs.
3. Fill the original pulley right hand fixing holes with bolts.
4. Having fitted the AAD pull the sheave away from the cam and insert a pin or screwdriver through the maintenance holes in the AAD body angles. The rope can now be fitted.
5. Remove the pin or screwdriver and the AAD and the ladder is now operational.

Note: It is important that both the cable and rope are in good condition, with the cable adjuster fitted being the closed eye type and that the cable and not spliced ends.

- **Figure 127- Auto Arrest Device (AAD)**

7 - HEAT REACTIVE LABELS (AS Ladders & Bayley where fitted)

Where heat reactive labels have changed colour (the central section goes from grey to black) they should be removed and replaced with new labels. To remove the labels simply peel off, it will then be necessary to clean the glue residue off using a spirit based cleaner. This will ensure that the area is also grease free for application of the new label. The new label is applied and smoothed using any flat object. Please contact Supply Plus for the label position instructions and the quantity used.

8 - SETTING OF THE RIVET GUN (AS Ladders)

The correct setting of the rivet gun is of vital importance as if set too wide the assembled structure will not have the correct tension. The correct setting is achieved as follows:-

- For 4mm diameter rivets used on all rungs and tie plates the gap between the snaps should be 3/16”. This is best set using the shank of a 3/16” diameter drill.
-
- 5mm rivets used for stanchion attachment brackets should be set using the shank of a ¼” diameter drill.
-
- After any adjustments ensure that the locking ring is tightened to prevent movement of the yoke of the gun.

Rivets may only be ‘tightened’ once. To achieve this, the yoke can be tightened by not more than ¼". This must never be exceeded or damage to the rung brackets may result.

Note: DO NOT shoot the rivet gun snap onto the drill diameter you require, as this will damage the snaps cups. Instead shoot the rivet gun, and then try to insert the drill diameter between the gun and the front resting on the table.

APPENDIX A - Automatic Arrest Device

Inspection & Testing

The procedures below are intended as a guide to the inspection and testing of the **AS Fire & Rescue AAD**. This device is fitted as standard on all **AS** rope operated EN1147 ladders as well as some others. A similar device is fitted to **BAYLEY** rope operated EN1147 ladders and the following applies.

With the ladder housed and the bottom (wide) section up:

INSPECTION

1. The AAD should be visually inspected.

2. The rope on both sides of the pulley wheel should be pulled at the same time towards the base of the ladder (shown in Fig1). The pulley should move towards the base of the ladder and return freely under the action of its spring when the rope is released.

Figure 1. AAD Inspection

Figure 2. AAD inspection

3. With the pulley pulled away (Shown in Fig 2) the toothed cam should be checked for ease of movement (shown Fig 3) and it should spring back to the rest position when released.

Figure 3 AAD Inspection

4. Check there is no significant sideways play in the wheel or the cam ensuring they are aligned.

TESTING

CAUTION: The AAD should be tested by releasing the rope whilst lowering the ladder sections. If unable to stand up the ladder follow the process using trestles. The method set out below should be used.

5. Pull the rope from the bottom of the ladder moving the ladder up to just past the 2nd rung so the pawls aren't footed. This will momentarily free the cam with each pull.

Figure 4. Ladder pulled out past the 2nd rung.

6. Push the upper section back from the top end down towards the stowed position. (shown Fig 5). Note that the ladder will start to show signs of resistance.

Figure 5. Pushing top section back

7. Once the ladder cannot be pushed back without any resistance check the AAD has locked. This will indicate that the AAD is working sufficiently.

Figure 6. AAD working correctly.

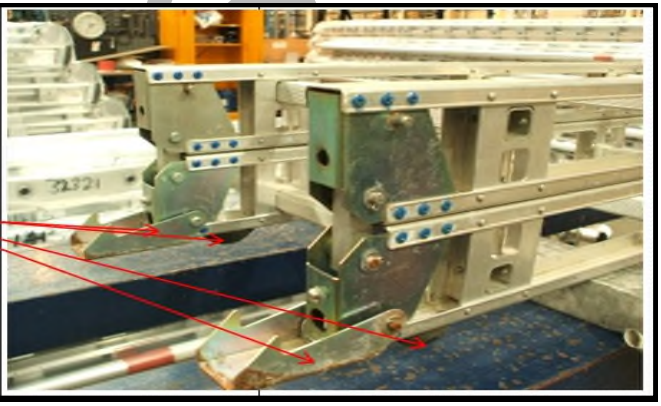
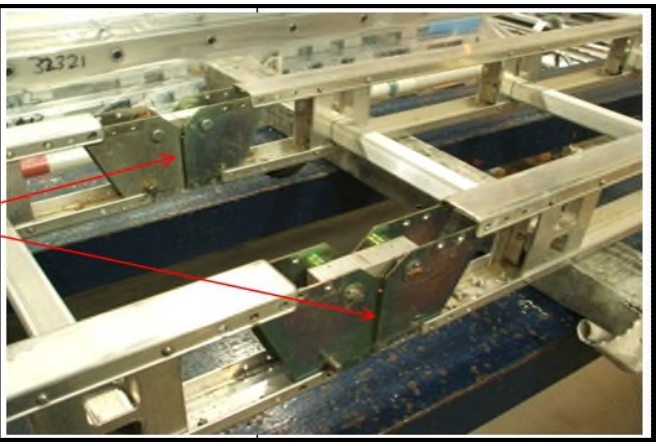
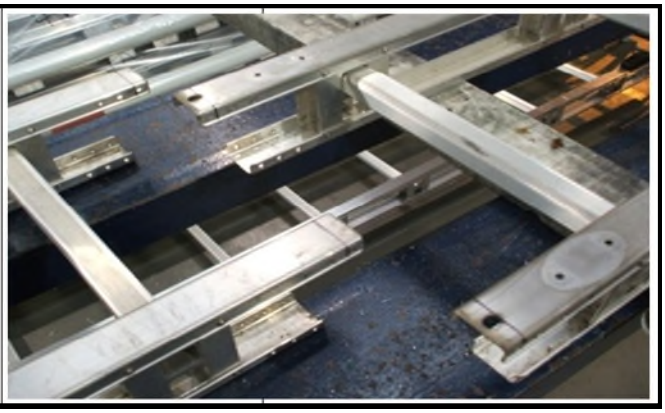
Figure 7. AAD Cam engaging with rope.

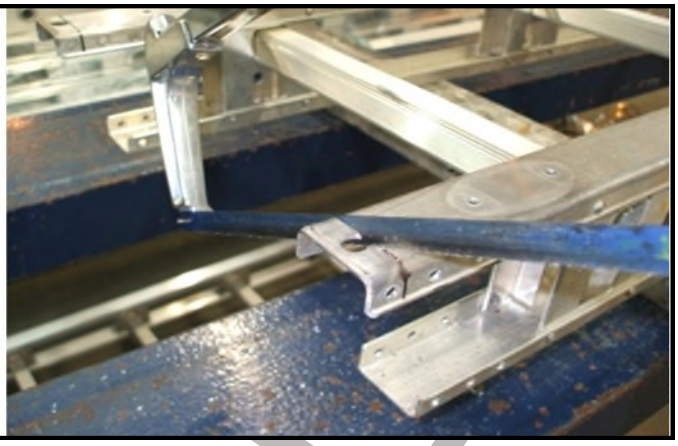
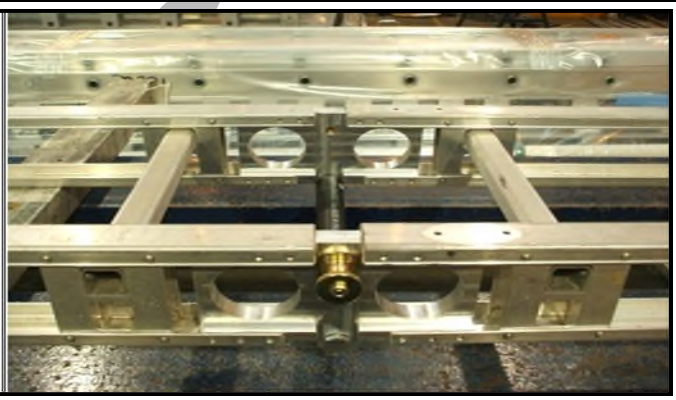
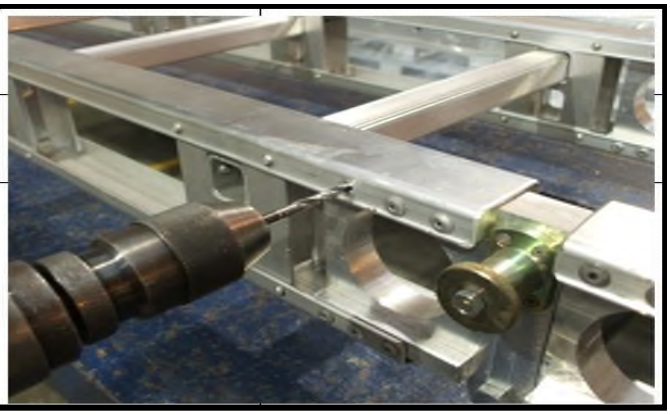
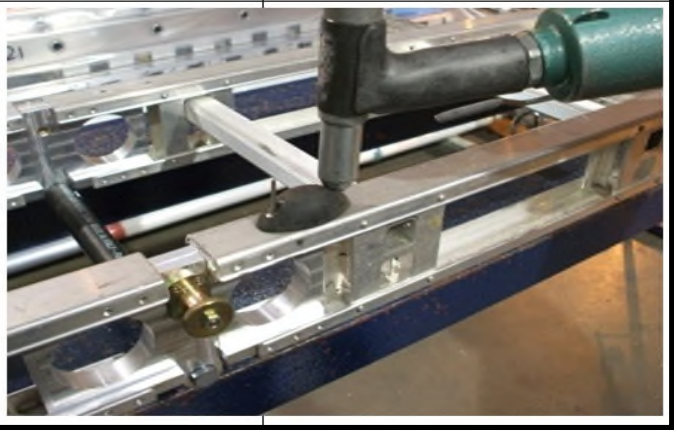
MAINTENANCE

Because of the important nature of the function carried out by this item maintenance should not be attempted and the AAD returned to our factory for repair.

If we can be of further assistance please contact us.

APPENDIX B - Roof Ladder Hinge Upgrade

No.	Part No.	OPERATION DESCRIPTION	KEY POINTS QUALITY CRITERIA	VISUALISATION / SKETCHES
1	n/a	Remove all the rivets on the fitted hinge by drilling them out with a 4.9mm Dia. Drill bit.	***Remove the rivets highlighted on the photo!***	
2	n/a	Remove the latch and the large rubbers near the hinge.	***Remove!***	
3	n/a	Pull the two sections apart and disgard the old hinge.	***Disgard!***	
4	n/a	Using a steel rule measure 105mm on the longest channel and mark (from the centre of the last rivet to the end)		

5	n/a	Carefully cut the longer channel to the length marked at op40.	***Both channels to be the same length!***	
6	n/a	Remove burrs from the cut channel with a file		
7	n/a	Slide the new hinge into the channel	***Ensure that the widened part of the Hinge ends flush with the end of the channels! Hinge Plunger to go into the section with the hook attached!***	
8	n/a	Using the holes in the channels as a template- drill through them into the new hinge with a dia. 4.9mm drill bit		
9	n/a	Rivet new hinge into place using 4.9mm tank rivets		
10	n/a	When all existing rivet holes have been riveted drill 2 further dia 4.9mm holes in position as shown on the now shortened channel to ensure this channel has 3 rivets.		
11	n/a	rivet the 2 new positions using a 4.9mm tank rivet.		
12	n/a	Rivet the large rubbers back on using 5.1mm stainless steel pop rivets.	***Please note that the original bolts cannot be used due to access restrictions!***	

13	n/a	Measure and mark a position 60mm in from the hook end of the ladder on the opposite side to the large rubber. Mark through the rubber foot and drill using a 6.35 mm (1/4") drill bit.		 
14	n/a	Fit the new rubber foot with M6 x 35mm Pan Head Bolt(S271), M6 Stainless Steel Washer(R2125M) , M6 Nyloc Nut(S210) and M8 form B washer(S252M).