Amendment Number	Description	Pages Affected	Date	Approval
1	List of Supplements and List of Effective Pages updated. Section 2: Completely re-issued to include 12 mm polyester load tapes. Pages 2-19 and 2-20 added. Section 4: 4.1.6 and Cylinder Torque values deleted (moved to Supplement 7.52) 4.1.7 and 4.1.8 renumbered accordingly. Section 6: Periodic testing of cylinders moved to Supplement 7.52. Cylinder rejection limits revised. Pages 6-23 and 6-24 deleted. Section 8 Page 8-2, 12mm tape description updated. Appendix 4, 12mm loadtape introduced, Typographical errors for O Types and Colt A Types corrected. Introduction of Supplement 7.51 Introduction of Supplement 7.52	i-iii, i-iv, i-v, i-vii to ix 2-1 to 2-20 4-2, 4-3, 6-1, 6-13 to 6-22, 8-2 A4-1 to A4-3	05/10/07	The technical content of this document is approved under the authority of EASA.21J.140 (C485)
2	List of Effective Pages, List of Supplements and contents updated. Section 2: Para. 2.1.3-Text updated, 2.1.4.4 moved to Supplement 7.2, 2.4.1 Repair limitations updated. Section 6: Para 6.5 (9) deleted (duplicate of 3) 6.17.2 amended to reflect Flight manual permitted damage limits. "general condition" para. deleted.	i-iii, i-iv, i-v, i-vii. 2-1,2-2, 2-4, 6-3, 6-8, 6-9	03/03/08	The technical content of this document is approved under the authority of EASA.21J.140 (C504)

Note: Any new or amended text in the revised page will be indicated by a black vertical line in the right hand margin, and the Amendment Number and the date will be shown at the bottom of the page.

The supplements ticked 'Applicable' to this balloon are inserted into this manual in Section 7.

Supplements associated with the base flight manual

Supplement Number	Description	Issue	Date	Applicable
7.2	"Kevron" Load Tapes			
7.12	Out of Production Envelope Types			
7.13	Duo Airchair MKII			
7.14	Cloudhopper Millenium			
7.15	Wheelchair Baskets			
7.16	Single Airchair			
7.19	Double, Triple and Quad Demountable Burners			
7.20	Basket Towing Plates			
7.25	Shadow Single and Shadow Mini Removeable burner			
7.26	Stealth/Shadow Electric Burner			
7.30	Envelope Laser Display System			
7.32	Out of Production Hoppers			

Supplements

Supplement Number	Description	Issue	Date	Applicable
7.51	Stealth/Shadow Burner - Valve Seal Replacement			
7.52	Periodic inspection of Fuel Cylinders			

Section	Page	Date of Issue	Section	Page	Date of Issue	Section	Page	Date of Issue
0	i-i	10 April 2006	4 (cont.)	4-7	10 April 2006	6 (cont.)	6-15	05 October 2007
	i-ii	10 April 2006		4-8	10 April 2006		6-16	05 October 2007
	i-iii	03 March 2008		4-9	10 April 2006		6-17	05 October 2007
	i-iv	03 March 2008		4-10	10 April 2006		6-18	05 October 2007
	i-v	03 March 2008		4-11	10 April 2006		6-19	05 October 2007
	i-vi	10 April 2006		4-12	10 April 2006		6-20	05 October 2007
	i-vii	05 October 2007		4-13	10 April 2006		6-21	05 October 2007
	i-viii	05 October 2007		4-14	10 April 2006		6-22	05 October 2007
	i-ix	05 October 2007		4-15	10 April 2006		6-23	Deleted
	i-x	10 April 2006		4-16	10 April 2006		6-24	Deleted
	i-xi	10 April 2006		4-17	10 April 2006			
	i-xii	10 April 2006		4-18	10 April 2006	7	7-1	10 April 2006
				4-19	10 April 2006		7-2	10 April 2006
1	1-1	10 April 2006		4-20	10 April 2006			
	1-2	10 April 2006		4-21	10 April 2006	8	8-1	10 April 2006
				4-22	10 April 2006		8-2	05 October 2007
2	2-1	03 March 2008		4-23	10 April 2006		8-3	10 April 2006
	2-2	03 March 2008		4-24	10 April 2006		8-4	10 April 2006
	2-3	05 October 2007		4-25	10 April 2006		8-5	10 April 2006
	2-4	03 March 2008		4-26	10 April 2006		8-6	10 April 2006
	2-5	05 October 2007		4-27	10 April 2006		8-7	10 April 2006
	2-6	05 October 2007		4-28	10 April 2006		8-8	10 April 2006
	2-7	05 October 2007		4-29	10 April 2006			
	2-8	05 October 2007		4-30	10 April 2006	A	A1-1	10 April 2006
	2-9	05 October 2007		4-31	10 April 2006		A1-2	10 April 2006
	2-10	05 October 2007		4-32	10 April 2006		A2-1	10 April 2006
	2-11	05 October 2007					A2-2	10 April 2006
	2-12	05 October 2007	5	5-1	10 April 2006		A2-3	10 April 2006
	2-13	05 October 2007		5-2	10 April 2006		A2-4	10 April 2006
	2-14	05 October 2007					A3-1	10 April 2006
	2-15	05 October 2007	6	6-1	05 October 2007		A3-2	10 April 2006
	2-16	05 October 2007		6-2	10 April 2006		A4-1	05 October 2007
				6-3	03 March 2008		A4-2	05 October 2007
3	3-1	10 April 2006		6-4	10 April 2006		A4-3	05 October 2007
	3-2	10 April 2006		6-5	10 April 2006		A4-4	10 April 2006
	3-3	10 April 2006		6-6	10 April 2006		A5-1	10 April 2006
	3-4	10 April 2006		6-7	10 April 2006		A5-2	10 April 2006
				6-8	03 March 2008			
4	4-1	10 April 2006		6-9	03 March 2008			
	4-2	05 October 2007		6-10	10 April 2006			
	4-3	05 October 2007		6-11	10 April 2006			
	4-4	10 April 2006		6-12	10 April 2006			
	4-5	10 April 2006		6-13	05 October 2007			
	4-6	10 April 2006		6-14	05 October 2007			

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2.1 GENERAL

The general arrangement of balloon envelopes and systems are shown in the Cameron Balloons Flight Manual Issue 10, Section 6.

2.1.1 Sewing Machines

A lock stitch must be used (chain stitching is not permitted for envelope repairs). The needle size used is 110 (18 Singer System). The stitch length should be set to give between 5 and 8 stitches per 25 mm (inch). Where a twin needle machine is used the preferred needle spacing is 8 mm (5/16"), alternatively a needle spacing of 9.5 mm (3/8") may be used.

2.1.2 Envelope Thread

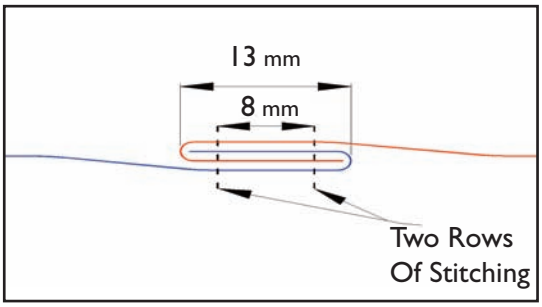
A three strand, metric 40 (210 denier) nylon or polyester thread must be used, ideally of a contrasting colour to the fabric. The envelope is manufactured using nylon thread. The scoop or skirt is manufactured using a similar thread made from Nomex.

Nylon thread is available as 'Universally Bonded', 'Usual' (S or left-twist) wound and 'Reverse' (Z or right twist) wound. These thread types are interchangeable although certain types of sewing machine may require specific threads (refer to sewing machine manual).

Note: If 'Usual' and 'Reverse' wound thread is used on twin needle sewing machines, the 'Usual' thread should be used on the outermost needle.

2.1.3 Balloon Seam

The seam used in manufacture is known as a balloon seam (French Fell seam). To produce this seam correctly, both folded-over fabric edges should be penetrated by both rows of stitching. However it is acceptable that only one row of stitching penetrates both folded-over fabric edges (similar to the seam used in Section 2.3 Sewn Patch Repairs).



▲ Balloon Seam Cross Section

The ends of stitch lines must be locked by 'back-tacking' (10 mm to 30 mm) or by overlapping the stitching by a minimum of 150 mm (e.g. when a bobbin is changed) to prevent the seam from pulling apart.

2.1.4 Limitations

2.1.4.1 Replacement Panels

Pre-cut panels or pre-sewn assemblies must be used where more than 10% of the envelope fabric panels are to be replaced at any one time.

Pre-cut panels or pre-sewn assemblies must be used for all panel replacements above the equator of the envelope.

Pre-cut and pre-sewn components must be manufactured by Cameron Balloons Ltd., or by any organisation holding a written approval from Cameron Balloons Ltd. for this purpose.

2.1.4.2 Adhesive Repairs

Adhesive repairs are less satisfactory than sewn repairs, which have the same strength as the original construction of the balloon. Repairs may be in the form of circular or oval patches over holes, or strips for straight tears. The extent to which these may be used depends on the location in the envelope.

The limitations for each type of repair (adhesive patch or strip) are given in the appropriate sub-sections of this manual.

If a panel is damaged beyond the limits laid out for adhesive repairs, a sewn patch should be used or the panel should be replaced.

2.1.4.3 Hyperlast Fabric

Other than complete panel replacement, Hyperlast fabric may only be repaired using the methods given in Sections 2.3 and 2.4.2.

2.2 PANEL REPLACEMENT

1. Unpick all the stitching around the damaged panel. If a seam is covered by a horizontal load tape, this should be unpicked to reveal the panel seam. Vertical tapes are sewn on at the same time as the vertical seams are made. Using a seam ripper, break apart every 3rd or 4th stitch and carefully pull the seam apart. Remove all traces of thread from the area unpicked. For ease of sewing, unpicking should extend at least 100 mm beyond the panel limits.

2. The replacement panel may be copied from an existing panel (within the limitations of Section 2.1.4.1). Remove an identical undamaged panel from the envelope and draw around its edge to transfer its profile onto the new fabric.

Note: Ensure the warp and weft of the fabric in the replacement panel are in the same direction as the original panel.

3. If the replacement panel is too large or too small for the aperture in the envelope, no part of the panel or envelope should be cut to make it fit. The edge which is too long should be sewn with a row of twin needle stitching. The thread tension should be set high enough to shrink the edge as required. Load tapes that are too long should also be shortened using this method.

4. The new panel should be stitched into the envelope using a balloon seam (Section 2.1.3). Start at the intersections with the horizontal seams. When stitching the vertical seams, begin and end 150 mm beyond where the seams were originally unpicked.

Note: Where seams are attached to load tapes, the seam should be sewn first. The completed seam should then be sewn to the load tape.

2.3 SEWN PATCH REPAIRS

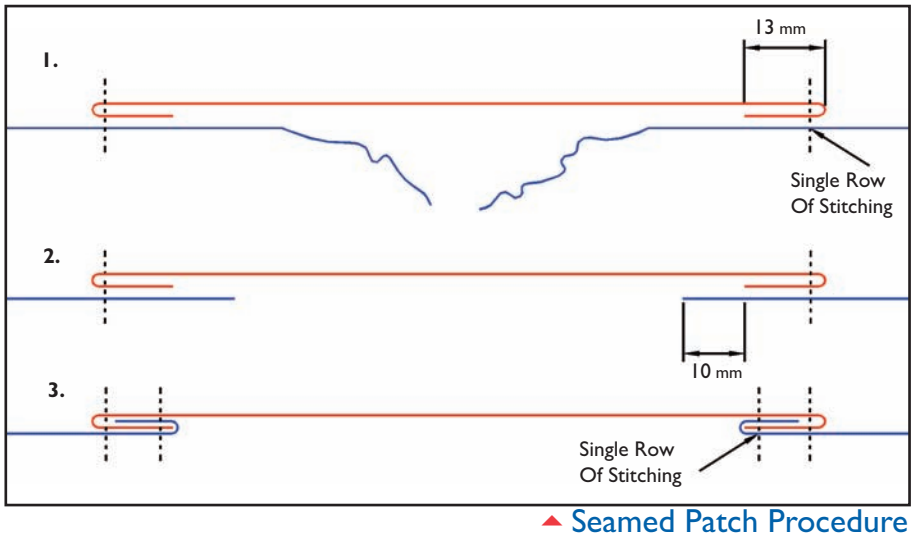
Patches may be used to make repairs to panels and should be made as follows-

2.3.1 Seamed Method

1. Cut patch to shape, fold edges over 13 mm and sew to the damaged area of the envelope.

2. Cut out the damaged area leaving 10 mm excess as shown.

3. Fold the excess under and sew as shown.



Seamed Patch Procedure

These seams are not true balloon seams because the outer row of stitches penetrates only three layers of fabric.

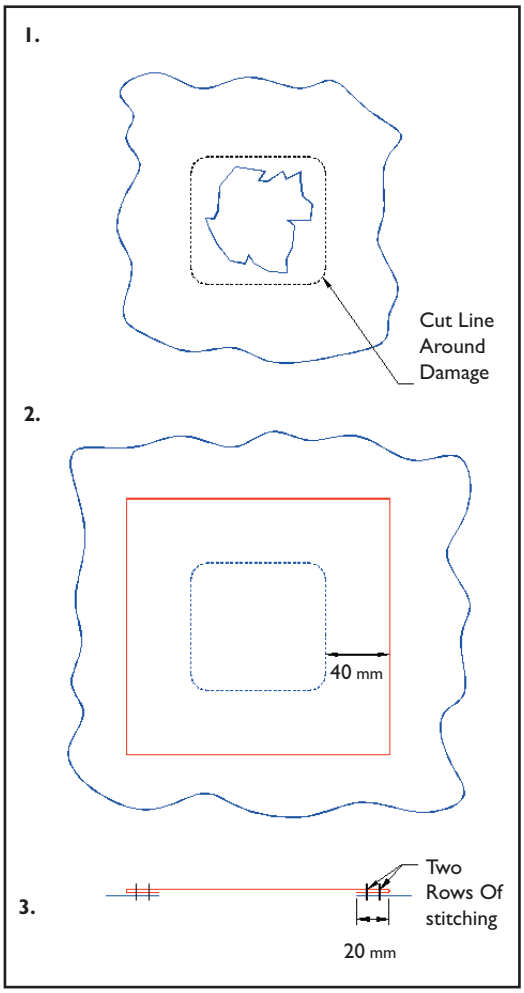
If the damage extends to within 25 mm of a seam, the seam should be unpicked and the patch continued to the panel edge. The seam at the panel edge should be re-sewn using a balloon seam.

2.3.2 Hot Cut and Overlay Method

1. Place a flat piece of wood inside the envelope, under the damaged panel. Remove the damaged area with a hot knife (this will seal the edges of the fabric). Cut a rectangular aperture with radiused corners.

2. Cut an oversize patch, adding a 40 mm seam allowance in each direction.

3. Sew the patch to the panel with a 20 mm folded hem as shown.



▲ 'Hot Cut And Overlay' Procedure

2.4 ADHESIVE PATCH REPAIRS

2.4.1 Limitations

Holes and tears in ripstop envelope fabric, less than 75 mm in any dimension, may be repaired by using an adhesive patch. There must be at least 100 mm between each patch (including existing repairs).

Holes and tears in Hyperlast fabric where the diameter of the hole is less than 25 mm diameter or the length of the tear is less than 50 mm in length may be repaired using an adhesive patch. There must be at least 100 mm between each patch (including existing repairs).

If the damaged fabric is within 25 mm of a seam or load tape the adhesive patch technique should not be used.

The number of such repairs is unlimited providing the periphery of each patch is sewn around with at least one row of stitching (Ripstop fabric) or two rows of stitching (Hyperlast).

For adhesive patches without peripheral stitching, the maximum number of repairs within these limitations is 60 in total (including existing repairs) and not more than 5 per panel.

6.5 ENVELOPE (CONTINUED)

9.	Check the joints of the vertical load tapes with the flying cables for chafing or heat damage. The Protectors must still be in place.	
10.	Check the condition of the control line pulleys and pulley attachments.	
11.	Check the condition of the flying cables.	
12.	Check the condition of the fabric panels and seams. Inspect the panels and seams for holes, tears or any other damage either by inflating the balloon or by a panel-by-panel inspection. Special shape balloons must be inflated.	

6.6 TURNING VENTS

1.	Check the stitching at the top and bottom of the vent, at the ends of the free tapes and at the ends of the pulling triangles.	
2.	Check the condition of the fabric in the turning vent- especially the portion of the fabric inside the balloon. If signs of overheating are evident, the affected areas must be grab tested.	
3.	Check that T&C envelopes with a CN number lower than 3550 and fitted with turning vents have been modified in accordance with Service Bulletin 2. (An entry will have been made in the logbook.)	

6.7 PARACHUTE DEFLATION SYSTEM

1.	Check the condition of the fabric at the edge of the parachute panel.	
2.	Check that the centralising and shroud lines are in good condition. Special attention should be given to the shroud lines near the parachute pulley.	
3.	Check the knots and the stitching of loops to both the balloon and the parachute panel.	

CN	Inspection Date	Inspectors Signature

6.8 LOCK-TOP DEFLATION SYSTEM

1.	Inspect as for a parachute deflation system (Section 6.7).	
2.	Check the stitching of the arming line guide rings and the condition of the arming line.	
3.	Check the condition of the quick release shackle and that it operates smoothly.	
4.	Check the security of the rings attached to the crown ring and the parachute crown patch.	

6.9 RDS, SMART VENT AND SKY SDS DEFLATION SYSTEMS

1.	Inspect as for a parachute deflation system (Section 6.7).	
2.	Check the centralising / shroud line pulleys (on envelope and parachute edge) for axle wear and free rotation. Check that the pulley attachments are secure.	
3.	Check the parachute shroud / centralising lines for wear or damage.	
4.	Check the parachute top strings and attachments for wear or damage. (Smart Vent and Sky SDS)	
5.	Check the parachute restraint lines and attachments for wear or damage. Check the sliding rings and the mid-gore tapes fitted with sliding rings for wear or damage (RDS).	
6.	Check the attachment of the ripline to the inside of the parachute panel.	
7.	Check that the vent line deployment bag is fitted in the basket.	

CN	Inspection Date	Inspectors Signature

6.15 BASKET

1.	Check the condition of the nylon support rods.	
2.	Check the condition of the basket wires.	
3.	Check the condition of the basket frames.	
4.	Check the condition of the basket weave.	
5.	Check the condition of the protective rawhide on the lower edge of the basket.	
6.	Check the condition of the rope handles	
7.	Check the number, condition and type of the cylinder straps	
8.	Check that the fire extinguisher maintained according to manufacturers instructions	
9.	Check the condition of the pilot restraint harness anchor (if fitted).	
10.	Check the condition of the basket floor.	

6.16 ANCILLARY EQUIPMENT (IF FITTED)

1.	**Launch restraint-** Check function and condition of latch. Check bridle and ropes for wear, fading or damage. Check karabiners for damage and correct operation.	
2.	**Pilot restraint harness-** Check function of buckle. Check webbing for wear or fading or damage.	
3.	Verify that instruments are operational (if applicable).	

CN	Inspection Date	Inspectors Signature

6.17 INSPECTION CRITERIA/TECHNIQUES

6.17.1 Documentation

Check the serial numbers of all the equipment listed in the logbook (baskets, cylinders, burners, envelopes etc.) against those to be inspected.

If any equipment is missing or additional to the original list, then note the addition or deletion of equipment in the logbook.

Check the logbook for the balloon's age and hours flown. This will provide a general idea of the condition to be expected and will indicate whether a grab test of the envelope fabric is necessary.

Examine the logbook with particular attention to maintenance, repairs, modifications and flights/hours since the previous inspection. Parts of the balloon that have been repaired or serviced should have extra attention paid to them during the inspection. During the inspection be particularly vigilant for non-approved modifications and non-approved repairs.

A list of outstanding Service Bulletins which may apply to a balloon is on the Cameron Balloons website.

If there is no mention in the logbook of the Service Bulletin having been completed, either refer to the Cameron Balloons website or contact Cameron Balloons, for details of the relevant Service Bulletin.

6.17.2 Envelopes

Envelope fabric: All fabric repairs, other than permitted damage (refer to Flight Manual Section 2), must be within the specified limitations and have been performed using approved methods (refer to Section 2). Indications for a grab test 'at inspectors discretion' include fabric porosity, fading, fungal attack or a suspicion that the logbook does not accurately reflect the hours flown.

Envelope seams: The seams adjacent to the parachute edge tape on all envelopes fitted with parachutes or lock-tops must be carefully inspected. Seams adjacent to damaged panels must be fully inspected. Damage to the stitching which is less than 50mm long is acceptable below the first horizontal tape above the Nomex (Cameron envelopes) or within 4m of the Nomex (T&C envelopes). In all other areas no damage to the seam stitching is permitted.

Load tapes: The most common damage to load tapes is wearing in the loop of the top or bottom turnback or burn damage near to the mouth of the envelope. Ensure that the stitching of turnbacks is secure and that the stitching has not been heat damaged.

On balloons fitted with Kevron load tapes the Kevron is covered in the vertical seam of the balloon, and sheathed in nylon or polyester tape at the ends. Check that the covering tape is in good condition, and the the Kevron tape is not exposed anywhere on the envelope.

Stitching of vertical load tapes to parachute edge and overlying tapes: The junctions of the vertical load tape to the parachute edge tape and the vertical load tape to the overlying tapes are sewn either with 'flag boxes' or reversed zig-zag stitching. If more than 25% of this stitching is broken then the joint must be resewn.

Crown ring: The crown ring should be free of damage or corrosion. Light surface corrosion or minor surface damage that could abrade the load tapes may be removed or smoothed over with a Scotchbrite pad. Note the size of damage / corrosion and the face of the ring on which it occurs in the log book. Excessive damage or corrosion will require replacement of the crown ring.

Control line condition: Stiffening of the outer cover is acceptable provided that the Kevlar core is not exposed. If a wire-cored lower ripline is used ensure that the red tubular tape cover is securely stitched, especially at the upper end.

Control line pulleys: Pulleys should be in good condition, free to rotate and be securely attached to the envelope. Check the pulley for axle wear by attempting to move the pulley sheave within the body of the pulley. Excessive movement indicates a worn axle.

Flying cables- stainless steel: Galvanised cables are not permitted. Cables should have no more than two broken strands, and their thimbles and ferrules should be in good condition. Check the wires for annealing- If the wire has a brown or discoloured appearance then the wires should be checked for loss of springiness. Discolouration of the wires is acceptable provided that the wires have not lost their springiness.

To test a flying wire for acceptable springiness, take hold of a 300mm section of flying wire between finger and thumb at each end of the section. Bend the wire so that the sections you are holding touch each other. Release the wire, and hold the section vertically. If the wire does not hang straight and has taken up a permanent bend in this section after the test, the wire should be replaced and scrapped.

Flying cables- Kevlar: Kevlar flying cables must be replaced if the Kevlar core is exposed or damaged, or if the flexibility of the outer cover is reduced.

Turning vents/parachute panels: The fabric that hangs inside the balloon on the parachute edge and the turning vent is especially susceptible to heat damage. This is because the fabric has hot air on both sides of it and so is exposed to much higher temperatures than the rest of the envelope fabric which is cooled on one side by the air outside the balloon.

RDS: The sliding rings may be either a stainless steel ring or a pear-shaped Maillon link. The rings must not be damaged, distorted or have rough edges, and if a Maillon link, the link screw must be tight and the rubber string retainer in place . The tapes along which the sliding rings run must be smooth, with no nicks or flaws which would prevent the smooth running of the rings. These tapes must not be worn to less than 75% of the width or thickness of an adjacent unworn tape.

Velcro rip panels: The fabric adjacent to the Velcro may become worn due to the stiff edge of the panel rubbing the fabric against the ground. Additionally the stitching of the fabric adjacent to the Velcro may become damaged by the Velcro hooks. See Section 6.19 for checking the free tape lengths.

Side vent: Check that a line stop is fitted to the opening line adjacent to the vent flap. This stop is to prevent the knot in the opening line from becoming jammed in the vent pulley.

6.17.3 Burner and Frame

Karabiners: These must be Stubai 2.5 tonne, 3tonne (steel and marked 'Stubai 2500' or 'Stubai 3000') or 4 tonne (marked 'SYM OVAL 4000 UIAA'). Refer to Flight Manual for correct applications. There must be no damage, distortion or significant corrosion. Check the hinges for free movement and lubrication. Check the screwgates are working correctly.

Burner frame: Inspect the frame carefully, paying particular attention to the condition of the welds. Check for any indications of fracture or unauthorised repairs, particularly if the frame shows signs of distortion. Check for correct gimbal (pivot) friction on the burner. Check for missing parts (especially lock nuts on burner pivots).

Heat shield: The heat shield panels should be secure.

Corner shackles: If corner shackles are fitted (older burners only) the shackles must be free of distortion or corrosion, and the shackle pin must be fitted with a lock nut.

Corner buffers: (flexible corner frames) Damaged worn or missing corner buffers are not a C of A failure, but replacement is recommended as missing buffers will increase wear and the risk of damage to other parts of the flexible corner system.

Adjustable height burners: Check function and condition of adjustable height system. Check the damper for any sign of leaking (if fitted).

Hoses: Vapour and liquid hoses. Check hose is to the correct specification (SAE 100 R1AT) with pricked outer cover. Flex and bend the hose along its entire length to check for damage e.g. bulging, cuts, abrasions, kinks, dents, cracking (visible ageing). No steel braiding should be visible and the hose must still be flexible. Check condition of end fittings (corrosion / damage)- threads undamaged, no damage to swaging.