

# GAS BALLOON FLIGHT MANUAL

Approved by EASA under Approval Number EASA.10070452 on 10 July 2019.

This manual forms part of EASA Type Certificates EASA.BA.523. Following initial certification as shown above, any subsequent revisions to this manual shall either be directly approved by EASA or be approved under the authority of Cameron Balloons Limited, DOA No. EASA 21J.140.

Any revisions/supplements made by other Approved Organisations must be separately approved.

**This Manual is specific to the following balloon:**

Model \_\_\_\_\_ Constructor's Number \_\_\_\_\_

Registration \_\_\_\_\_ Year Of Construction \_\_\_\_\_

Applicable MTOM \_\_\_\_\_ kg

This balloon is to be operated in compliance with the information and limitations contained herein.

Signed \_\_\_\_\_ Name \_\_\_\_\_ Date \_\_\_\_\_

Authority \_\_\_\_\_

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**Record Of MTOM Amendments**

Applicable MTOM	Date Of Change	Signature

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<b>Amendment Number</b>	<b>Description</b>	<b>Pages Affected</b>	<b>Date</b>	<b>Approval</b>
1	<p>Record of Amendments updated, List of Effective Pages Updated, Contents updated.</p> <p>Definitions corrected (ballast was fuel). Section 1-5 and 1-6 added. Basket description added.</p> <p>Clothing materials expanded, references to Maillon Rapide Links added. Gas Valve assembly amplified. Image of GB1000 Gas Valve added. Rip Panel assembly amplified.</p> <p>Control in Flight (Section 4.5) amplified. Checklists amplified.</p> <p>Description on servo valve added (Section 6). Control Line colour codes formatted. Trail Rope description added.</p> <p>New basket and table 9 added.</p>	<p>i-iii, i-v, i-vii to i-x, 1-1 to 1-4, 4-1 to 4-12, 6-1 to 6-3, 6-5, 9-1</p>	19/10/20	<p>The technical content of this document is approved under the authority of EASA.21J.140 (C629)</p>

**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.

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## 1.1 INTRODUCTION

This balloon flight manual has been prepared to provide pilots and instructors with information for the safe operation of all Cameron manned free gas balloons.

Revisions to this Manual are published on the Cameron Balloons Limited website at [www.cameronballoons.co.uk](http://www.cameronballoons.co.uk). Mandatory revisions to this manual will be introduced by Service Bulletin.

Email notification of revisions can be received by subscribing to the Technical Update Service on this website.

## 1.2 CERTIFICATION BASIS

The types of balloon for which this manual is applicable have been approved by EASA, under the following Type Certificate:

EASA.BA.521: GB-Series Gas Balloons

## 1.3 DEFINITIONS

Checklists are given in **blue text**, while important information is given in **bold text**.

The following definitions apply to warnings, cautions and notes used in this flight manual.

**WARNING:** Means the non-observation of the corresponding procedure leads to an immediate or important degradation of flight safety.

**CAUTION:** Means the non-observation of the corresponding procedure leads to a minor long-term degradation of flight safety.

**NOTE:** Draws attention to any special item not directly related to safety, but which is important or unusual.

The Maximum Take-off Mass (MTOM) is the maximum permissible total weight of the balloon and all its equipment at take-off, including ballast, instruments, passengers and crew.

Throughout this manual, the terms 'mass' and 'weight' are interchangeable and have an identical meaning.

## **1.4 DESCRIPTION**

The Cameron GB-Series balloon is a natural shaped netless gas balloon. It is designed to avoid the mixing of the lifting gas with air at any time, giving it improved safety when filled with Hydrogen. The balloon is completely sealed when flown and the valve is opened automatically when the balloon becomes pressurised.

Occupants are carried in a basket of traditional wickerwork construction.

The envelope is connected to the basket via a load ring with the approved karabiners or Maillon Rapide Links.

The general arrangement of a typical Cameron Gas Balloon and Cameron Gas Basket are illustrated below, however, a full description of the balloon and its systems is provided in Section 6.

## **1.5 USE OF EQUIPMENT**

Baskets and other equipment not listed in Issue 1 of GB Flight Manual maybe used provided the appropriate approved Cameron Balloons Flight Manual supplement is used.

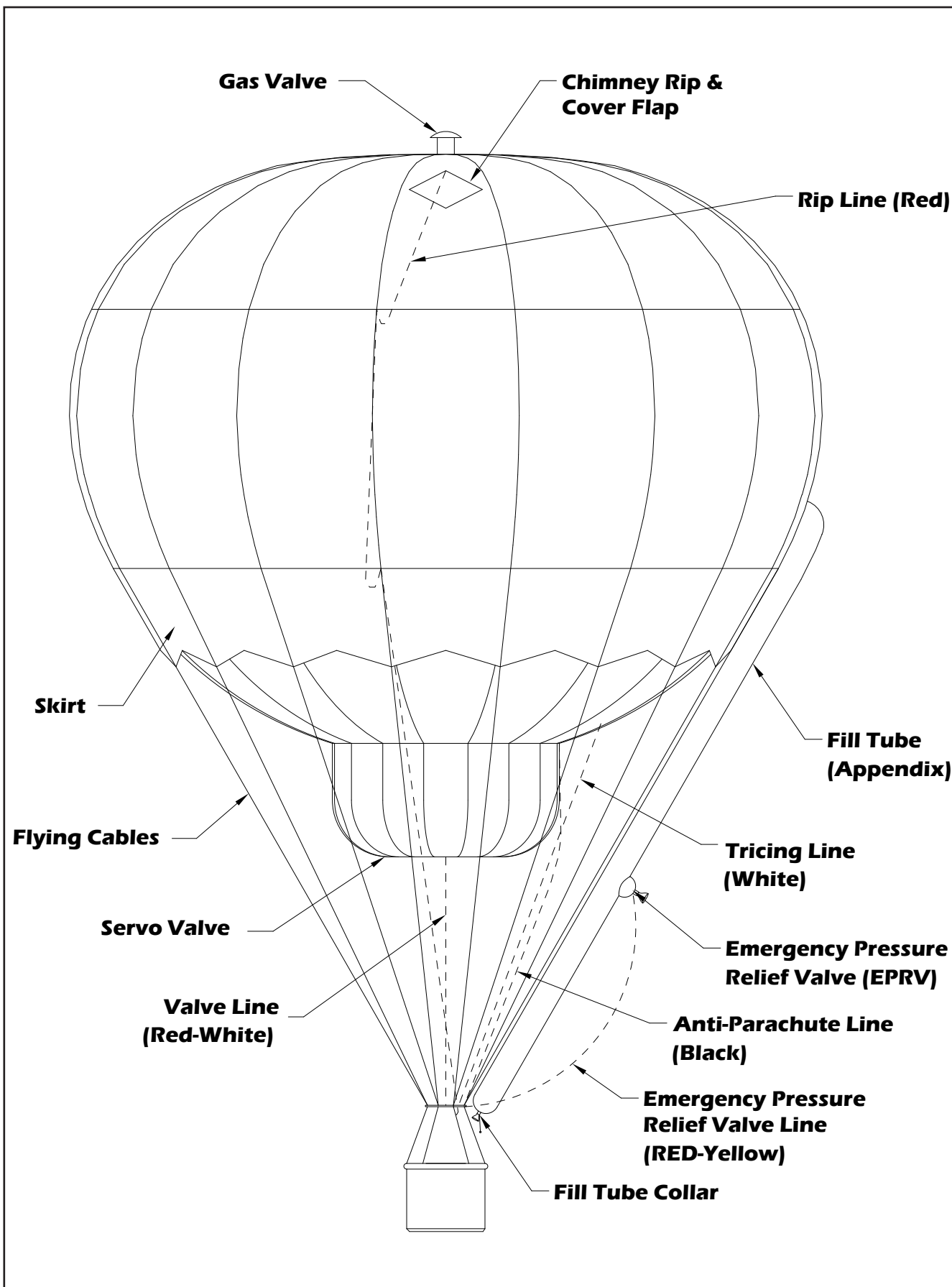
The weights of the envelope, basket and ballast must be recorded in the Component Weight Record of this manual (Section 5) and the appropriate Section of the aircraft logbook.

These weights are listed in the log book of the balloon the items were originally supplied with, or determined by weighing.

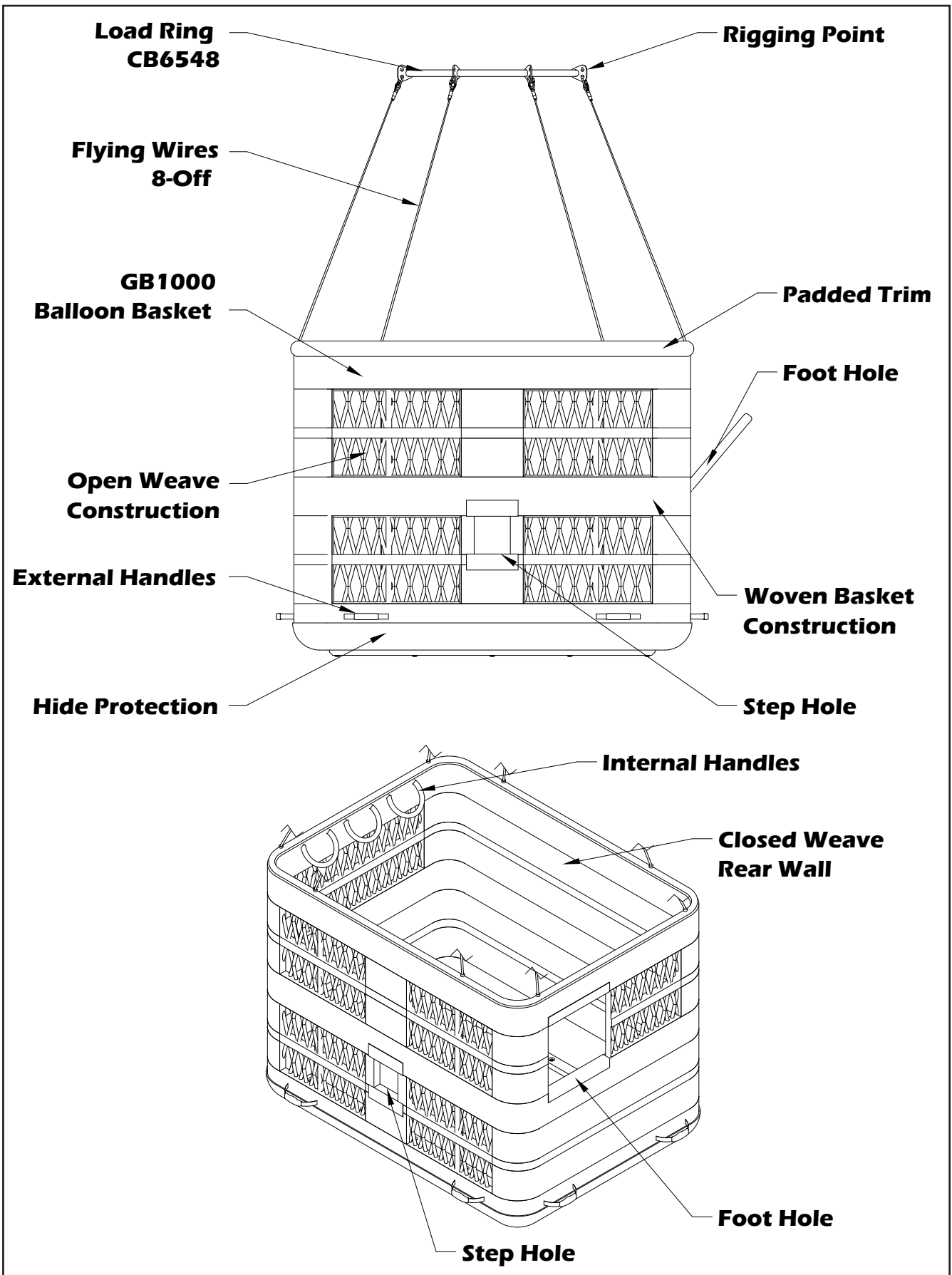
The limitations and procedures given in Sections 2 to 5 of this Flight Manual and supplements apply to all Cameron Gas Balloon Basket types. The Inspection Schedule given in Section 6 of the Cameron Balloons GB Maintenance Manual Issue 1 applies to all Cameron GB Envelope and Basket types.

## **1.6 APPLICABILITY**

This is the recommended Flight Manual for all serially produced Gas Balloons for which Cameron Balloons Limited is the Type Certificate Holder.



▲ Typical Gas Balloon Arrangement



▲ Typical Cameron Gas Balloon Basket

## 2.1 INTRODUCTION

Section 2 details the operating limitations for the balloon and its standard equipment.

The limitations included in this Section and in Section 8 have been approved by EASA.

**WARNING:** The balloon must not be flown into contact with powerlines.

## 2.2 WEATHER

1. The balloons must not be flown if the surface wind at the time and place of take-off is greater than 15 knots (7.7m/sec).
2. The balloon must not be flown if there is extensive thermal activity, any cumulonimbus (thunderstorm) activity in the vicinity of the flight path, or any turbulence which is giving rise to gusts of 10 knots (5.1m.sec) above mean wind speed.

## 2.3 LIFTING GAS

Permissible Lifting Gas: Hydrogen (H<sup>2</sup>), Helium (He).

## 2.4 MASS LIMITS

1. The Take-off Mass (TOM) of the balloon must never exceed the Maximum TOM (MTOM) shown in Section 2 Table 1. The applicability of the MTOM, either Standard or Reduced is given on page i-i.
2. If it is desired, for operational or insurance reasons, to alter the MTOM of the balloon, either the Standard or Reduced MTOM, appropriate to the balloon model, may be selected. These permitted MTOM values are shown in Section 2 Table 1. The MTOM in use must be entered as an amendment on page i.i and used for loading calculations.
3. The Minimum Mass is the empty mass plus the weight of the pilot and minimum ballast at landing.

## 2.5 BALLAST

Only dry sand or water may be used as ballast. All ballast must be carried in approved ballast bags and in such a way as to minimise its chance of accidentally coming loose.

### 2.5.1 Minimum Ballast

1. Minimum Ballast at Take-Off: 85kg
2. Minimum Ballast at Landing: 65kg

### 2.6 CREW

1. Minimum crew: 1 Pilot
2. Maximum occupants: 6 (Including the Pilot)

### 2.7 MAXIMUM RATE OF CLIMB AND DESCENT

The maximum rate of climb and descent shall not exceed 1000ft/min.(5m/sec).

### 2.8 MINIMUM EQUIPMENT

For flights under Visual Flight Rules the following minimum equipment must be carried:

1. An Altimeter
2. A rate of climb and descent indicator (Variometer)
3. A time piece
4. A knife
5. A light source capable of illuminating the filling tube (night operation only).

### 2.9 PERMITTED DAMAGE

1. There must be no unrepaired holes or tears anywhere in the envelope fabric.
2. No damage is permitted to load tapes, the basket wires or any part of the load bearing system.

### 2.10 TETHERED FLIGHT

Tethered flight is not permitted.

### 2.11 BASKETS

1. Each compartment must not contain more than six persons.
2. Reasonable space must be provided for each occupant, with regard to both comfort during the flight and to safety during the landing (Refer to Appendix I).
3. There must be at least one restraint, e.g. hand hold, for each basket occupant.

**TABLE 1: Envelope Mass Limits**

Variant	Volume		Standard MTOM		Reduced MTOM		FAI Class. AA
	ft <sup>3</sup>	m <sup>3</sup>	kg	lb	kg	lb	
GB1000	36722	1040	1060	2336	999		5



### 3.1 INTRODUCTION

Section 3 provides checklists and amplified procedures for coping with emergencies that may occur. This Section is approved by EASA.

### 3.2 AVOIDANCE OF DANGEROUS OBSTACLES AT LOW LEVEL

The pilot must decide whether to climb or to make an emergency landing.

#### 3.2.1 Emergency Climb

To initiate an emergency climb the contents of a complete sandbag may be emptied. As the ceiling is reached in a rapid climb, the envelope pressure should be monitored visually by observing the state of inflation of the appendix. Should the filling tube inflate fully to its lower end, the Emergency Pressure Relief Valve (EPRV) should be opened manually using the Red-Yellow Control Line.

**CAUTION:** Consideration should be given to the effects of the subsequent rapid climb and the availability of sufficient ballast to make a safe landing on the next attempt.

**NOTE:** The presence of the EPRV (Red-Yellow) means there should be no need to open the seal at the base of the Fill Tube after inflation. Doing so may endanger the balloon if Hydrogen is used, due to the proximity of expelled gas to potential sources of ignition in the basket.

#### 3.2.2 Emergency Landing

Emergency landings may be made by opening the Rip Panel at heights of 10m (30ft) or less.

### 3.3 PREPARATION FOR A HARD LANDING

All passengers should be briefed to stand sideways to the direction of travel with their knees bent. They should hold firmly on to the basket's internal handles keeping all limbs, hair and clothing inside the basket.

If a landing with a lot of vertical speed is anticipated then the pilot should drop as much ballast as possible during the descent (if this can be done so without endangering people on the ground) in order to slow the descent as much as possible.

### 3.4 GAS VALVE MALFUNCTION

#### 3.4.1 Gas Valve Fails Open

Should the Gas Valve fail in the open position then the envelope will progressively lose gas causing the balloon to descend. The descent rate should be controlled by dropping ballast.

Operation of the Tricing Line (White) may allow the Gas Valve to re-seal. Check also that the Valve Line is not trapped or held tight at its lower end and that there is plenty of slack Valve Line.

**NOTE:** If water enters the envelope it may collect in the Servo Diaphragm, causing the valve to open. Should this occur then the Tricing Line should be used to pull the Servo Diaphragm up into the balloon allowing the water to escape from the drain valves fitted in the upper part of the Servo Diaphragm.

### 3.4.2 Gas Valve Fails Closed

If the Gas Valve fails closed when the balloon is at or near its ceiling the Servo Diaphragm will become fully inflated and the gas level will be at or near the bottom of the Filling Tube (Filling Tube fully inflated). Check that the Tricing Line (White) is not tight as this could prevent the valve from opening automatically.

If the problem with the valve cannot be resolved immediately the Emergency Pressure Relief Valve should be opened (Red-Yellow Control Line).

Continue flying the balloon until a descent starts naturally. The descent rate may be kept under control by dropping small amounts of ballast, but be careful not to drop so much ballast that the balloon starts climbing again. Once the balloon is close to the ground (height <10m, 30ft) then the Rip Panel may be opened to finally bring the balloon to the ground.

**NOTE:** If the failure occurs in the afternoon or evening, the contraction of the gas will cause a slow descent. In the morning, gas expansion due to solar heating will make the balloon climb to its ceiling. In this situation, the balloon may be forced into a descent by discharging sufficient ballast to cause a rapid climb into its ceiling. When the balloon reaches its ceiling it will overshoot, discharging sufficient gas through the Emergency Pressure Relief Valve to cause the balloon to descend. This may be enough to overcome solar expansion.

### 3.5 CATASTROPHIC GAS LOSS

If the balloon should start to completely deflate in flight (e.g. from a major tear in the fabric or an accidental opening of the Rip Panel) then the Anti-Parachute Line (Black) should be cut or released as soon as possible. This will allow the bottom of the balloon to invert into the upper part forming a parachute.

Discharge all available ballast, and consider dropping other items also (trail rope, baggage etc) if that can be done without endangering people on the ground.

Brief the passengers for a hard landing.

## 4.1 INTRODUCTION

Section 4 provides checklists and amplified procedures for the conduct of normal operation. Normal procedures associated with optional systems can be found in Section 8. The procedures included in this Section and in Section 8 have been approved by EASA.

## 4.2 PREPARATION AND RIGGING

**WARNING:** When using Hydrogen (H<sub>2</sub>) the pilot, passengers and inflation crew must wear suitable clothing. Clothing must NOT be made of synthetic materials. Conductive shoes must be worn.

### 4.2.1 Site Selection

The site should be chosen so that the downwind path that the balloon will take is clear of powerlines or obstructions. The clear area should be large enough that the balloon cannot be damaged should it move during inflation.

The area for laying out the balloon should ideally be a smooth grass surface. Surfaces covered with rocks, sticks or other objects likely to cause fabric damage should be avoided.

### 4.2.2 Basket Rigging

**NOTE:** References to approved Karabiners and Maillon Rapide Links in the following sections can be referred to in Section 9, Table 8 and Table 9.

**NOTE:** Maillon Rapide Links may be used where weight is critical.

#### 4.2.2.1 Ballast

Place the basket upright on the windward side of the take-off site. Load the basket with sufficient sandbags, equipment or other heavy objects (approximately 1200kg) to ensure that it remains on the ground during inflation. The Load Frame may additionally be attached to a fixed point by a launch restraint (quick release) if desired.

The required flight ballast can be hung on the inside or outside of the basket. Flight ballast may also be hung from the Load Frame if desired. In all cases the flight ballast must be secured against swinging and detaching unintentionally.

#### 4.2.2.2 GB Series Titanium Load Ring (CB6548) / Cameron Gas Basket

Connect the basket to the Load Ring using the karabiners or Maillon Rapide Links. The eight basket wires each attach to the lower eight holes of the Load Ring lugs.

#### **4.2.2.3 Cameron Hot Air Balloon Load Frame / Cameron Basket**

Connect the basket to the Load Frame using karabiners. Refer to Cameron Balloons Hot Air Balloon Flight Manual Issue 10 for further detail.

#### **4.2.2.4 Ballonbau Wörner Load Ring / Basket**

Connect the Load Ring to the Basket Ropes. Refer to Ballonbau Wörner GmbH, Flight and Instruction Manual, NL/STU Section 4.2.

#### **4.2.2.5 Trail-rope (Optional)**

The Trail-Rope (if used) is attached to two adjacent lugs of the Load Ring/Frame using a Vee bridle. When using a Ballonbau Wörner Load Ring refer to Flight and Instruction Manual, NL/STU Section 4.2.

#### **4.2.3 Envelope Rigging**

Ensure that the balloon is laid out with the filling tube on the right hand side of the envelope when viewed from the basket and that the Rip Panel is on the upper portion of the envelope.

Connect the envelope to the Load Frame. Check that the free load tapes are not twisted or tangled. The sixteen free load tapes are connected to the Load Frame as follows:

##### **4.2.3.1 GB Series Titanium Load Ring (CB6548)**

The free load tapes are attached in pairs to the eight karabiners or Maillon Rapide Links, each of which are attached to the upper holes of the eight lugs on the Load Ring.

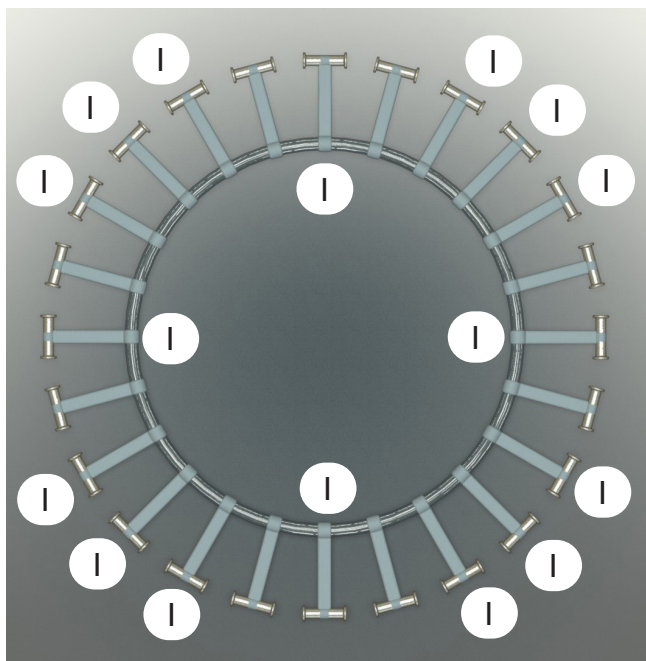
##### **4.2.3.2 Hot Air Balloon Load Frame**

The free load tapes are attached in groups of four to four karabiners, each of which are attached to the upper holes of the four corner lugs on the Load Frame.

##### **4.2.3.3 Ballonbau Wörner Load Ring / Basket**

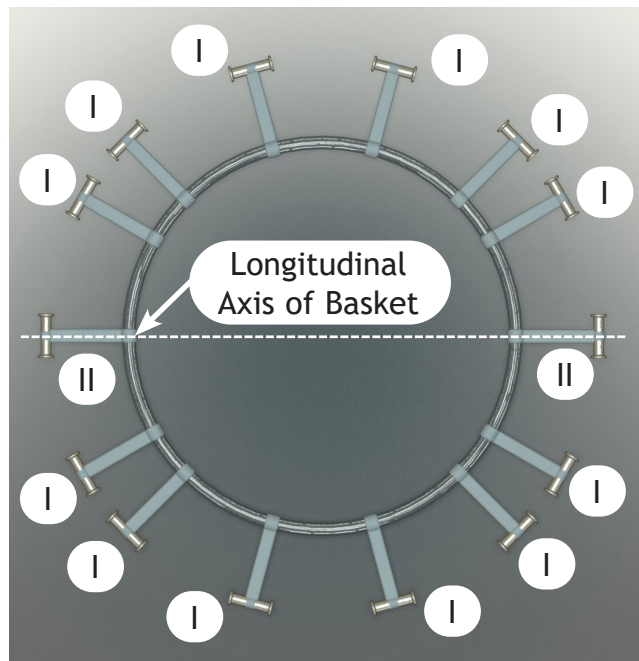
The free tapes are distributed around the Load Ring toggles as show in Figs 4.1 and 4.2.

**NOTE:** Once the free load tapes have been connected, ensure the Rip Line, Valve Line and Tricing Line are secured to the Load Ring or Load Frame via basket karabiners. Ensure the the Control Lines are free from entanglement and obstruction.



▲ FIG 4.1: Size III

Volume	X	POS I	POS II
1040	16	1	-



▲ FIG 4.2: SIZE IIIb

Volume	X	POS I	POS II
1040	16	1	2

#### 4.2.4 Install the Gas Valve

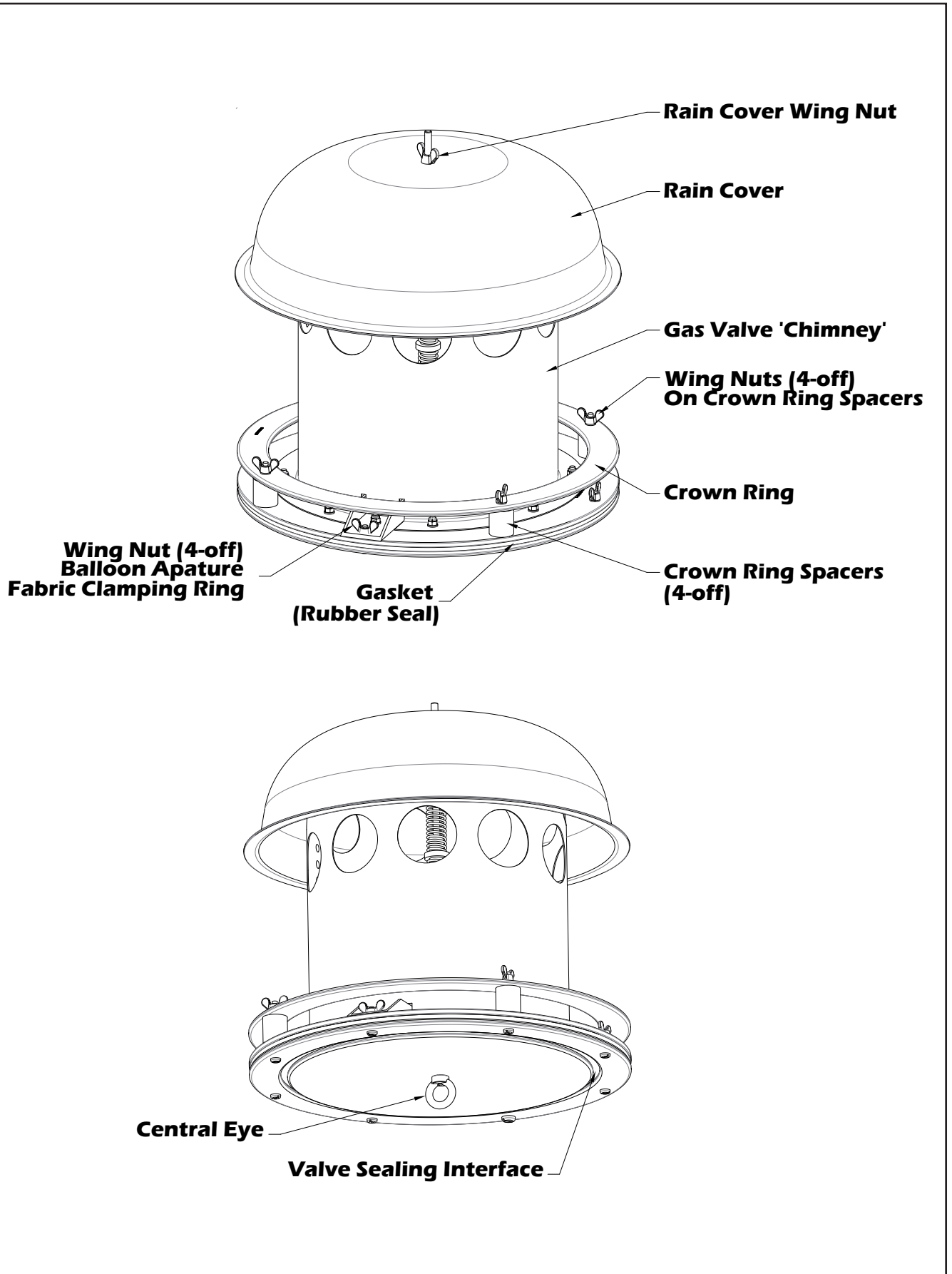
**NOTE:** The Gas Valve is assembled on top of the balloon, hence, it is important to arrange the balloon aperture for easy access and to avoid fabric damage during installation. Ensure the Crown Ring, Load Tapes and internal Valve Line are slack and central to the balloon aperture. Figure 4.3 below illustrates a typical Gas Valve for reference.

Remove the Gas Valve from its packing and remove the Rain Cover from the Gas Valve “Chimney”.

The Clamping Ring detaches from the Gas Valve by removing the Wing Nuts, Washers and Spacers. Fit the Clamping Ring and Rubber Seal to the balloon aperture from the inside. Make note of the orientation markings on the Gas Valve, Clamp Ring, Crown Ring and the envelope.

**NOTE:** At this stage, the seal between the Valve Disc and its seating may be lightly greased with a silicone grease to improve its gas-tightness.

Offset the Crown Ring and Load tapes to one side of the balloon aperture and access the Valve Line (Red-White). Fit the Valve Line to the eye on the underside of the Valve Disc. This is done by passing the Valve Line loop (1m long) through the eye and then looping it over the top of the entire valve. Once the slack has been pulled out of the Valve Line a lark’s head knot will be formed onto the eye.



▲ FIG 4.3: GB1000 Gas Valve

**NOTE:** Ensure the Valve Line has not crossed over the Crown Ring or Load Tapes.

Place the valve in position on top of the Clamping Ring noting orientation and ensuring the Valve Line is clear from obstruction inside the balloon aperture. Fit the Washers and Wing Nuts to the short screws and tighten gently down. Place the Aluminium Spacers over the long screws then pass the Crown Ring over the Valve Chimney and locate on top of the Spacers.

**NOTE:** Ensure the slack Load Taps from the balloon are evenly distributed between the 4 Aluminium Spacers and correspond to the correct quadrant on the Gas Valve.

Fit the Washers and Wing Nuts to the long screws and tighten down. Complete the Valve Assembly by fitting the Rain Cover on top of the Chimney and tighten the central Wing Nut.

#### 4.2.5 Rip Panel

The envelope has a Chimney Rip fitted. The rip is sealed from the outside. Refer to Figure 4.4 for installation guidance.

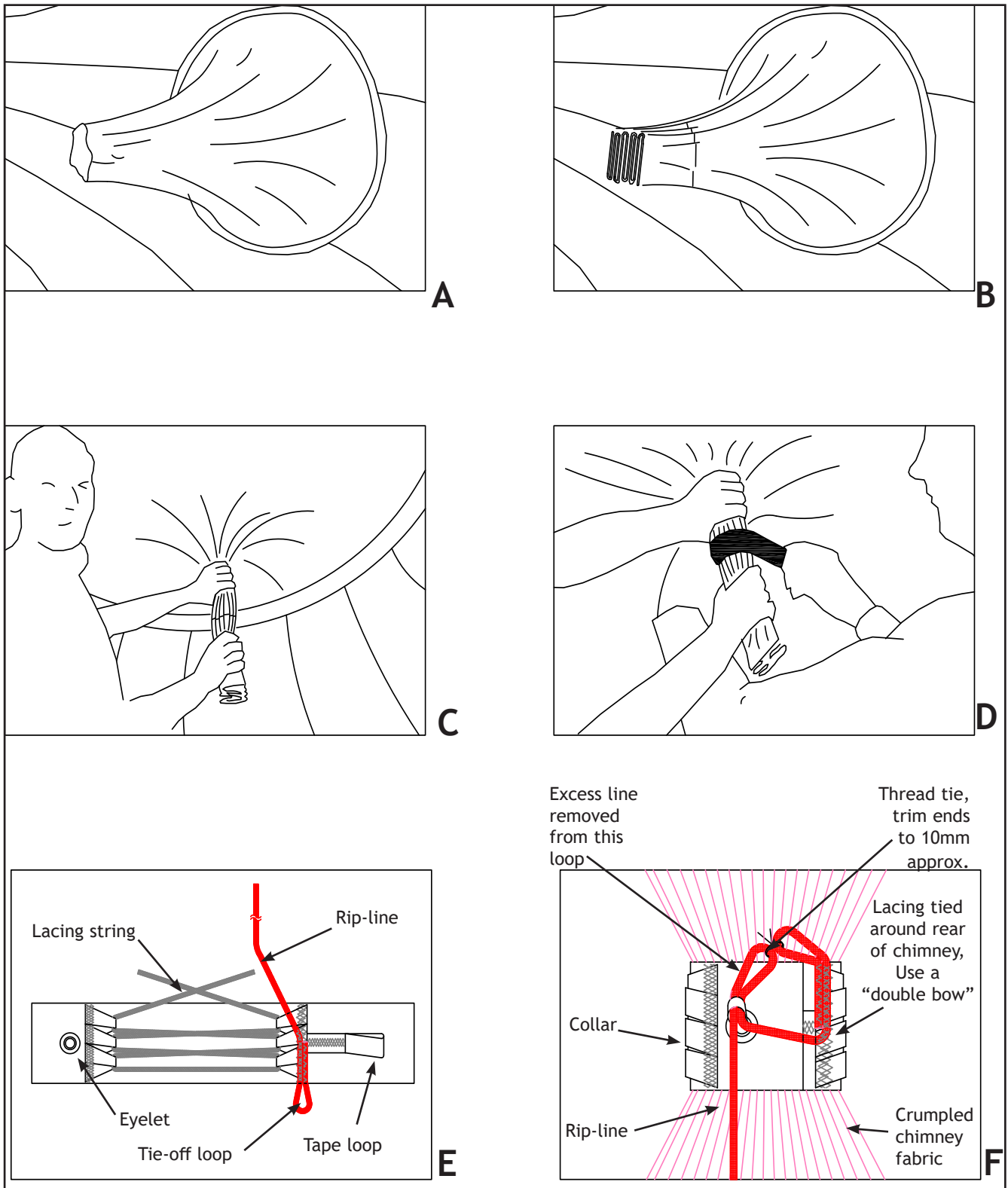
Pull the Chimney Rip out of the balloon so that it is pointing away from the balloon perpendicular to the envelope skin (A).

Gather the fabric together in a concertina fashion to form a long thin bundle, note that there is a line on the outside of the Chimney Rip; this line should form the centreline of the bundled section (B & C).

The Rip Collar (CB1651) is permanently attached to the end of the Rip Line (Red). Wrap the collar around the Chimney (D) so that the end with the tape loop lies under the eyelet. Push the tape loop through the eyelet, and then take a loop of the Rip Cord (Red) and insert through the tape loop. Secure the loop of Rip Cord to the Tie-off loop with a single thickness of break-thread (F). Take out any slack in the Rip Cord, and trim the free ends of the break-thread to a length of around 10 mm.

**NOTE:** Break-thread to be of natural, or conductive, fibre with break strength of approx. 5kg, i.e. Part No. CB1653-0001.

Tighten the Lacing Strings to compress the fabric bundle to create a gas-tight seal. Tie the lacing string securely with a double-bow.



▲ Figure 4.4: Rip Panel Installation

A Velcro Cover (fitted in-line with the Rip Line) is fitted over the Chimney Rip Panel. Make sure the Rip Panel and Rip Collar are fitted within Velcro Cover.



**NOTE:** The external Rip Line is attached to the top of the Velcro Cover. The top of the Velcro Cover must be fitted to the top of the Rip Panel Velcro on the balloon.

Tie off the upper corner of the Rip Panel Cover to the Tie Loop on the balloon using a single thickness of Breaking Thread. The Rip Line passes over the Cover and down the outside of the balloon towards the basket. Attachment loops are fitted at two locations on the Rip Line. The attachment loops are then fitted to Velcro ties on the balloon envelope, one at horizontal tape below the Chimney Rip Panel and the second on the envelope's skirt.

Attach the bottom of the Rip Line to one of the basket karabiners on the Load Frame.

**4.2.6 Emergency Pressure Relief Valve (EPRV)**

The EPRV is closed using the same method as the Chimney Rip Section 4.2.5 but no cover is fitted. Attach the bottom of the EPRV line (Red-Yellow) to one of the basket karabiners on the Load Frame.

**4.3 INFLATION**

**Pre-Inflation Checklist**

- Envelope:** No unrepaired damage to Envelope Fabric or Load Tapes.
- Gas Valve:** Gas Valve installed & Valve Line attached.
- Basket:** In good state of repair, check for wire damage.
- Rigging:** Basket cables and envelope load tapes correctly attached. Karabiner screwgates closed. Control Lines attached.
- Ballast:** Is there sufficient ballast. Is ballast positioned evenly and securely around the basket.
- Trail-rope (if used):** Hung securely to the basket. Karabiner made accessible for quick connect to Load Frame.
- Launch Restraint (if used):** Connected to fixed point. Checked for damage.
- Instruments:** Fitted and in good order.

### 4.3.1 Inflation Preparation

Expel as much air as possible from the envelope before starting to fill with gas. This is especially important when filling with Hydrogen.

Expel any air from the filling hoses with lifting gas. Connect the diffuser to the lower end of the filling tube using bungee cord, and tie the diffuser to the side of the basket.

### 4.3.2 Gas Inflation

Control the flow of gas from the supply to the maximum which does not cause undue flapping or other signs of distress to the filler tubes or balloon fabric

Restrain the balloon during inflation using the Crown Lines so as to reduce the tendency to spinnaker while partly full. Allow the balloon to rise and take on a steady state above the basket.

Continue filling the balloon until the gas cell is full or nearly full for low-level flight, or until the balloon is in equilibrium at a calculated weight for high-level flights. Turn off the gas, remove the diffuser and seal the filling tube at load frame level by twisting the filler tube and tying tightly with a bungee cord. Attach the free end of the filler tube securely to the loop at the bottom of the free load tape using the fitted snap-hook.

Attach the remaining Control Lines to the Load Frame.

## 4.4 TAKE-OFF

### Pre-Take-Off Checklist

Envelope:	Is the lower part of the envelope becoming flaccid (this could indicate evening cooling or a leak of lifting gas), no unrepaired damage.
Filling Tube:	Attached.
Gas Valve:	Check Function. Ensure that the Gas Valve and Tricing Lines have adequate slack.
Rigging:	Balloon load tapes and basket cables connected correctly and free of damage. Karabiner screw gates closed.
Control Lines:	All Control Lines attached and free from obstruction.
Ballast:	Adequate ballast for projected flight carried. Correctly arranged and secured.
Instruments:	Switched on and Set.
Passenger Briefing:	Reference Section A2.3 Passenger Briefing, Ensure the correct clothing and footwear is worn.
Pilot Restraint (if used):	Worn and strap connected.

## 4.5 CONTROL IN FLIGHT

### 4.5.1. Flight Control System

The control of a the GB1000 Gas Balloon is by use of the Gas Valve and discharge of ballast. To reduce the risk of over pressurising, an automatic 'Servo' system is fitted which operates the Gas Valve. The Gas Valve may also be manually operated by the pilot at any time. Despite the ability of the automatic system, special considerations arise from the automatic pressure control system.

### 4.5.2 Pressure Control System

The GB1000 Gas Balloon is designed to keep the internal gas completely separated from air. Gas expands greatly with increases in altitude and also with increases in temperature. To prevent dangerous internal pressures, a Pressure Relief System is provided to replace the function of the conventional open appendix. The 'Servo' system is a specially shaped fabric structure at the base of the envelope which pulls the Gas Valve Line when the envelope becomes full. Although the automatic system is reliable, it must be monitored by the pilot.

### 4.5.3 Flight at Full Inflation

When the balloon is fully inflated, which will occur at 'ceiling', the pilot must inspect the operation of the servo and monitor the internal pressure. The Filler Tube also acts as an envelope pressure gauge. Normally it will never inflate fully to the bottom because the servo will have released some gas, however if the gas valve malfunctions and gas is not released the pressure will build and EPRV MUST be released to release gas pressure.

**CAUTION:** If flying at night, a suitable light must be carried so that the servo and filler tube can be monitored.

### 4.5.4 Flight at Low Inflation

When the balloon is in a low state of inflation, either late in the flight or after a long descent, the servo and the base of the fabric of the balloon may be compressed against the valve line. In this case it is possible that unintentional pulling of the valve line may occur, resulting in a loss of gas. To prevent this, the Tricing Line MUST be pulled which pulls the Valve Line upward inside the envelope and returning the Gas Valve to a closed position. Frequent use of the Tricing Line is encouraged at low inflation, especially after Gas Valve operation, during prolonged descents, or at any part of the flight where it is thought necessary.

## 4.6 LANDING

### Pre-Landing Checklist

Landing Approach:	Approach path clear of power lines and obstructions.
Ballast:	Securely stowed / secured.
Loose Items:	Flight instruments etc. are securely stowed.
Trail-rope (if used):	Correctly attached to Load Frame and Armed.
Pilot Restraint: (if used)	Belt worn and strap connected.
Passenger Briefing:	Landing Briefing completed.
Valve Line (Red-White):	Available in hand.
Rip Line (Red):	Available to hand.

#### 4.6.1 Approach to Landing

For landing, a field must be chosen in the line of flight, containing a sufficiently large clear area in which to land the balloon with no high obstacles in the approach or over-shoot. A larger landing area will be needed in stronger winds.

Deploy the Trail-rope (if used) if the approach is clear of power lines, boundary fences and trees.

#### 4.6.2 Touch-down

Make sure everybody is in a good landing position prior to touch-down, and also that every passenger holds on tight to the handles in the basket.

Allow the Trail-rope (if used) to make contact with the ground and determine its effectiveness over a short period of time. Depending on the wind speed, pull the Valve Line (Red-White) or Rip Line (Red) shortly before touch-down.

If only the Valve Line is used continue to vent gas until the basket is sufficiently grounded and stationary. The pilot then decides when the passengers may leave the basket, and when landing is thus finished.

**CAUTION:** Once the landing has been achieved, spectators must be kept away from the balloon. All persons within a radius of 20m must be immediately warned that smoking is absolutely forbidden.

### 4.7 DEFLATING THE ENVELOPE

The Chimney Rip Panel must be opened by pulling the Rip Line (Red) (if not already opened during touch down). The Rip Panel will completely detach from the balloon and thus should be stowed away by the pilot.

If deflation takes place under windless conditions, the Crown Line (White - external to envelope) should be used to keep the envelope away from the basket.

**NOTE:** During deflation the filling tube must always be kept shut.

#### 4.7.1 Avoiding Electrostatic Discharge

In the vicinity of explosive gas mixtures (hydrogen + air) everybody must wear conductive shoes, and the clothing people wear must not be made of synthetic material. Clothes may only be taken off at a distance of 10m from the balloon, so that any existing electrostatic charge cannot discharge in the vicinity of the balloon.

### 4.8 ACTION AFTER FLIGHT

When the envelope is completely deflated and empty, remove the Gas Valve and detach the envelope from the Load Frame.

Fold the envelope into a long sausage and pack it into its bag like a traditional Hot Air Balloon.

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**5.1 INTRODUCTION**

This Section gives the equipment weights to calculate the weight range within which the balloon may safely be operated.

**5.2 EQUIPMENT WEIGHTS**

<b>Registration</b>	
<b>Year Of Construction</b>	
<b>Constructors Number</b>	
<b>Balloon Type</b>	

<b>Component</b>	<b>Drawing Number</b>	<b>Serial Number</b>	<b>Weight (kg)</b>
<b>Envelope</b>			
<b>Load Ring</b>			
<b>Basket</b>			
<b>Total</b>			

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## 6.1 INTRODUCTION

Section 6 provides a description of the standard component parts and assemblies that make up the balloon system.

Optional equipment is described in Section 8.

## 6.2 ENVELOPE

### 6.2.1 Description

The Cameron GB1000 balloon is a natural shaped netless gas balloon. It is designed to avoid the mixing of the lifting gas with air at any time, giving it improved safety when filled with Hydrogen and improved performance irrespective of the gas used. To prevent dangerous internal pressures, a pressure relief system is provided to replace the function of the conventional open appendix. The “Servo” system is a specially shaped fabric structure at the base of the envelope which pulls the gas valve line when the envelope becomes full.

### 6.2.2 Envelope Construction

The envelope is made of Nylon fabric. The inner surface is coated with a layer of conductive polyurethane to provide gas holding and antistatic properties.

The outer surface of the fabric is coated with a thin layer of pigmented polyurethane to improve the weather resistance of the fabric.

The fabric panels are joined together by sewing, and a polyurethane sealing tape is bonded to the inner surface of the seam.

The primary flight loads are carried by polyester vertical load tapes sewn to the surface of the envelope.

These tapes are joined via a turn back to an aluminium crown ring at the top of the balloon, and run continuously down to the load frame. Horizontal tapes are fitted to provide additional reinforcement.

### 6.2.3 Skirt

Where the vertical load tapes leave the envelope a skirt is fitted. This acts both to distribute any vertical load remaining in the fabric gores into the vertical load tapes and to shed any rainwater falling from the envelope outside the basket area.

### 6.2.4 Deflation System

The balloon is deflated via a “Chimney Rip” sealed with a fabric collar. The Rip Line (Red) is at the basket end and runs down the outside of the envelope. The Chimney Rip is a fabric tube sewn into the outside of the envelope which is bunched together and held

closed by a fabric collar attached to the Rip Line. When the Rip Line is pulled it releases the collar from around the fabric tube allowing it to open and the gas to escape.

For additional security a fabric “Cover Flap” secured with Velcro is fitted over the Chimney Rip. Pulling the Rip Line removes Cover Flap before releasing the Rip Collar.

**WARNING:** Once opened the Chimney Rip cannot be resealed in flight.

### **6.2.5 Filling Tube**

A Filling Tube is fitted to the envelope near its equator. It is used to fill the balloon with the lifting gas, and once inflation is complete it is sealed with a bungee cord. The position of the bottom of the gas column within the Filling Tube can be used as an indication of the gas pressure inside the envelope.

### **6.2.6 Anti-Parachute Line**

An Anti-Parachute Line is fitted to the tape loop at the bottom of the envelope. The Anti-Parachute Line is used to stop the bottom of the balloon inverting during a landing in strong winds.

### **6.2.7 Crown Line**

A Crown Line is fitted to the Crown Ring. During inflation it may be used to restrain the balloon.

If a landing is made in calm conditions the Crown Line may be used to pull the envelope away from the basket during deflation.

### **6.2.8 Emergency Pressure Relief Valve (EPRV)**

Should the envelope become over pressurised in flight an EPRV is fitted in the Filling Tube. Pulling the EPRV line opens the valve and allows the lifting gas to escape. The valve is positioned above the basket to ensure there is no risk of static discharge igniting the gas where hydrogen is used.

### **6.2.9 Envelope Control Lines**

A complete listing of Envelope Control Lines and their colour codes is given in Figure 6.1. This list can be laminated and used in the basket as a quick reference guide.

# CONTROL LINE COLOUR CODES

## NORMAL OPERATION

PRIMARY RIP-LINE:	RED
VALVE LINE:	RED-WHITE
TRICING LINE:	WHITE

## EMERGENCY OPERATION

EMERGENCY PRESSURE RELIEF VALVE (EPRV):	RED-YELLOW
ANTI-PARACHUTE LINE:	BLACK

▲ Figure 6.1 Control Line Colour Codes

### 6.3 LOAD RING

The Load Ring is a light-weight titanium tubular ring with eight karabiner lugs.

Alternatively where hot air balloon baskets are used, standard hot air balloon load frames can be fitted with the burner system removed.

Where baskets manufactured by Ballonbau Wörner are fitted, the appropriate Wörner load ring should be used. Refer to Ballonbau Wörner GmbH, Flight and Instruction Manual, NL/STU Section 4.2

### 6.4 BASKET

Baskets are of traditional wickerwork construction. The basket floors are either woven or solid plywood. The structural load is taken by stainless steel wires forming a continuous sling from the Load Frame and underneath the basket floor.

The baskets are strengthened by aluminium 'U'-tubes, stainless steel or titanium frame.

The top of the basket is padded with foam, which is then trimmed with leather or suede.

The bottom edge is covered with rawhide which protects the basket from damage during landings and transit. Openings are woven into the basket for step holes and/or foot holes.

Side or end wall cushions and cushion floors may be added inside the basket to increase the levels of passenger comfort.

#### 6.4.1 Pilot Restraint Harness

The Pilot Restraint Harness prevents the pilot being thrown from the basket during a heavy or fast landing. The harness fastens around the pilot's waist, and is attached securely either to or close to the basket floor. A quick release buckle is fitted to allow the pilot to leave the basket in an emergency.

#### 6.4.2 Quick Release

The Quick Release is designed to restrain the balloon during preparation for take-off, but must not be used for tethered flight. A locking pin is fitted to prevent accidental release.

Use of the quick release is recommended to ensure that the balloon does not drag during inflation or leave the ground prematurely.

**NOTE:** Care should be taken to protect all webbing and rope items from the effects of sunlight. Ultraviolet radiation causes degradation of the rope or webbing, considerably reducing its strength. This applies especially to the launch restraint and equipment for tethered flight. Regular checks should be made to the launch restraint and equipment for tethered flight for wear and loss of strength.

### 6.4.3 Trail Rope

The Trail Rope is used to reduce impact loads during landing. The Trail Rope is of heavy construction so by contact with the ground during landing, increases balloon lift thus reducing the vertical speed.

## 6.5 FLIGHT INSTRUMENTS

Flight instruments used in ballooning are an altimeter (for altitude measurement), a variometer (to display climb and descent rate) and a time piece (to record flight times, sunset times etc.).

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## 7.1 INTRODUCTION

This Section contains the recommended procedures for proper ground handling and servicing of the balloon. The procedures detailed in Paragraphs 7.4 and 7.5 have been approved by EASA.

## 7.2 INSPECTION PERIODS

Details of the required inspection periods are given in Cameron Balloons Gas Balloon Maintenance Manual.

## 7.3 MODIFICATIONS OR REPAIRS

It is essential that the responsible airworthiness authority is contacted prior to any modifications being made to the balloon to ensure that the airworthiness of the balloon is not compromised.

For repair procedures, reference should be made to Cameron Balloons Gas Balloon Maintenance Manual.

## 7.4 TRANSPORTATION

The following sections apply to road transportation. If the balloon is to be transported by rail, sea or air, extra protection may be required when shipping by these methods.

### 7.4.1 Envelope

When the balloon is to be transported, the envelope must be carried in its storage bag, and should be protected from weather.

### 7.4.2 Baskets

**WARNING:** Great care must be taken when transporting solid floor baskets to ensure that damage is not caused to the wires on the underside of the basket floor.

Baskets should be protected from the elements during transportation by use of a suitable cover.

When using ratchet straps to secure baskets to trailers, care must be taken not to over tighten these straps as permanent distortion to the basket can occur (especially when the basket is new or wet).

When unloading baskets from trailers, great care must be taken not to drop the basket onto the ground without cushioning the impact as damage to the structure can occur.

## 7.5 STORAGE

The balloon should be stored in a clean dry place.

The envelope should not be stored damp or wet for more than a few days, as residual moisture can result in fabric deterioration due to mould or mildew. A wet envelope should be gently dried by keeping it cold inflated with a fan, rolling the envelope over if necessary.

The basket should not be stored wet or with a covering of mud, as this will trap moisture next to the hide and wicker, leading to deterioration of the basket. The basket should be cleaned using fresh water and allowed to dry. If the basket is secured to a trailer using ratchet straps during storage, the straps should be loosened to prevent any permanent distortion.

Salt contamination of any part of the balloon and its equipment must be avoided. If any of the balloon's components become contaminated with sea water they should be washed with plenty of fresh water. Salt will cause corrosion in metal components (including stainless steel), accelerate decay in wickerwork, and adversely affect the envelope fabric and tapes.

For full cleaning instructions, reference should be made to Cameron Balloons Maintenance Manual Issue 10.



**8.1 INTRODUCTION**

This Section contains the appropriate supplements and additional approved data necessary to safely and efficiently operate the balloon when equipped with various optional systems and equipment not included in the main manual.

The balloon shall be operated in accordance with the applicable supplement and/or additional approved data when appropriate, but the content of the base Flight Manual will also apply.

Where a conflict arises between the information given in a Supplement and/or additional approved data and the information given in the base Flight Manual, the information given in a supplement takes precedence.

A complete list of Supplements is available on the Cameron Balloons Limited website.

**NOTE:** Supplements are updated independently of the base flight manual. It is not necessary to update supplements issued with a specific balloon unless notified by Service Bulletin.

**8.2 LIST OF SUPPLEMENTS INSERTED**

<b>Date of Insertion</b>	<b>Doc. Ref</b>	<b>Description</b>

Signed \_\_\_\_\_ Name \_\_\_\_\_ Date \_\_\_\_\_

Authority \_\_\_\_\_

**8.3 ADDITIONAL DATA**

When the envelope detailed in the approval section is being used in conjunction with

.....  
(insert details of basket/load ring)

the following approved data must be used.

.....  
(insert document title, section and paragraph reference)

Signed \_\_\_\_\_ Name \_\_\_\_\_ Date \_\_\_\_\_

Authority \_\_\_\_\_

## 9.1 INTRODUCTION

This Section lists the major components which may be combined with each envelope to make a complete balloon.

## 9.2 EQUIPMENT LIST

Tables 5, 6 and 7 list the envelopes, baskets, and load rings which are compatible.

Table 5 : Envelopes

Envelope Type	Drawing Number	Applicable Baskets
GB1000	CB1633	C,D,E,F,G

Table 6 : Baskets and Load Ring / Frames (Cameron)

Basket Cat.	Drawing Number	Basket Description*	Applicable Load Ring / Frame
C	CB3011-2A	56-65 OH	CB855, CB871, CB925, CB2203(FI), CB2224(FI), CB2231(FI), CB2598, CB2665, CB2874
D	CB3011-3A	77-84 OH	CB855, CB871, CB925, CB2203, CB2224, CB2231, CB2598, CB2665, CB2874
E	CB3011-4A	90-105 OH	
F	CB3513	GB1000	CB6548
F	CB3583	GB1000	CB6548
G	CB303	120 - 133 O	CB2309, CB2312

Table 7 : Baskets and Load Ring (Ballonbau Wörner GmbH)

Basket Cat.	Basket Size	Measurement [cm]	Applicable Load Ring / Frame
D	IV	125 x 105 x 110	III, IIIb
D	Lightweight Basket	125 x 105 x 110	III, IIIb
F	V	135 x 115 x 110	III, IIIb
F	VI	145 x 125 x 110	III, IIIb

Table 8 : Karabiners

Part No.	Rating	Identification Markings
CU-9820-0003	2.5 Tonne	STUBAI SYMOVAL2500 UIAA
CU-9820-0001	3 Tonne	STUBAI SYMOVAL3000 UIAA
CU-9825-0001	4 Tonne	STUBAI SYMOVAL4000 UIAA

Table 9 : Maillon Rapide Links (For Record Attempts)

Part No.	Rating	Identification Markings
CE-4103-0005	2.25 Tonne	MAILLON RAPIDE WLL 450KG N5
CE-4103-0007	3.25 Tonne	MAILLON RAPIDE WLL 650KG N6

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## INTRODUCTION

In addition to the Limitations in Section 2 and Section 5, the following factors should be considered when determining how many occupants a particular basket can carry for a particular flight. The guidance below assumes that a standard occupant is an adult of 77kg mass.

The Pilot should also take into account the relative masses and sizes of the passengers when loading partitioned baskets to evenly distribute the payload.

### Maximum Occupancy

For all baskets, a minimum 0.25m<sup>2</sup> floor area should be allowed for each standard occupant.

When calculating the number of occupants, the area used by items of other equipment must be subtracted from the total area.

### Example

If we consider the following example;

Basket: CB303

Equipment Area: 0.25m<sup>2</sup>

Limitation on occupancy by floor area;

Floor area of basket (to frame tube centre-lines) = 1.1x1.78 = 1.96m<sup>2</sup>

Floor area of equipment = 0.25

Available floor area for occupants = 1.96 - 0.25 m<sup>2</sup> = 1.71m<sup>2</sup>

Total maximum number of occupants = 1.71 / 0.25 = 6.84 = 6 standard occupants

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## A2.1 INTRODUCTION

This appendix provides guidance on handling and crew and passenger briefing. It describes practices that have been shown to be safe and effective in practice but is not compulsory.

## A2.2 CREW BRIEFINGS

### A2.2.1. General

Strong gloves (leather), footwear and clothing of natural fibre should be worn.

The crew members should be briefed before the inflation procedure is started.

**CAUTION:** The most important instruction for all crew members is to let go immediately if they are lifted off the ground.

### A2.2.2 Crown Crew Briefing

The object is to prevent the envelope from swaying excessively, and to prevent it rising until sufficiently buoyant. Apply only moderate tension, then apply maximum force until the balloon is upright. Do not try to fight the wind, but keep the envelope downwind wherever possible.

1. Hold the very end of the line; do not attempt to feed it out through the hands,
2. Do not loop or tie the crown line around your body, your arm or any object,
3. Refuse all offers of help pulling on the crown line from onlookers,
4. Hold the line slack during cold inflation,
5. Continue to pull the line until the balloon is upright during inflation,
6. On the Pilot's instruction walk up to the basket and clip the end of the line to a karabiner on the load frame.

### **A2.3 PASSENGER BRIEFINGS**

Passengers may be briefed either before inflation begins, or once they are in the basket after inflation. Passengers should be shown how to safely get into the basket before inflation starts highlighting the step holes and internal handles.

The passenger's landing position may be rehearsed before take-off to ensure that they are taking up the correct position. It is important that the passenger's knees are only slightly bent, and that they are not squatting or sitting on their heels.

#### **Passenger Briefing: Open Baskets**

1. Do not hold onto the Control Lines.
2. Hold on to rope handles or burner support rods.
3. Before landing, stow all loose items, cameras etc.
4. On landing stand sideways to the direction of travel, at the front edge of the basket (where practicable). Knees should be together and slightly bent. Hands must remain inside the basket. Hold on to rope handles. Watch the progress of the landing and brace for the touchdown. After touchdown the basket may fall on its side and drag along the ground.
5. After landing do not leave the basket without the Pilot's permission.