R-Type Balloon Flight Manual

Approved by EASA under Approval Number 10057370 on 23 March 2016.

This manual forms part of EASA Type Certificate EASA.BA.028 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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Amendment Number	Description	Pages Affected	Date	Approval
B	R36 data added. R15 and R42 skirt volumes added.	1.2, 1.6, 2.8, 5.1, 5.4	August 1985	
C	'Inexperienced Pilots' limitation deleted.	2.1	September 1985	
C Amdt. 1	Anti-parachute line details added. Weights updated. Minimum equipment list updated.	1.1, 1.6, 4.9	October 1990	
C Amdt. 2	Weights added. Editorial changes.	1.1, 1.5, 4.7, 5.1, 6.1,6.3, 7.3, 7.8, 7.9	March 1991	
C Amdt. 3	Inspection statement added.	7, 7.3	March 1991	
C Amdt. 4	R-60 and R-77 details added (pages renumbered).	1.2, 1.3.2, 1.6, 2.8, 4.3, 4.6, 5.6, 5.7, 7.7.2, 8, 5.1	June 1992	
C Amdt. 5	Gondola CB778 added.	1.3.2, 5.1, 8.	May 1993	
C Amdt. 6	RN-9, R-150 and R-706 added (some pages renumbered).	1.1, 1.6, 2.8, 4.3, 4.5, 5.1, 5.2, 5.9, 5.10, 7.7.2, 8	December 1994	
C Amdt. 7	Gondola applicability added, R-706 deleted.	1.2, 1.3, 1.6, 2.8, 3.1, 4.6, 5.1, 5.10 (deleted), 8	January 1995	
C Amdt. 8	R-200 Added	1.1, 1.2, 1.3.2, 1.6, 2.8, 3.1, 4.5, 5.1, 5.9, 5.10(added), 8	December 1995	
C Amdt. 9	R-210 Added	1.1, 1.2, 1.3.2, 1.6, 2.8, 3.1, 4.5, 5.1, 5.9, 5.11(added), 8	November 1996	
C Amdt. 10	R-270 Added	1.1, 1.2, 1.3.2, 1.6, 2.8, 3.1, 4.5, 5.1, 5.12(added), 8	October 1997	
C Amdt. 11	R-450 Added	1.1, 1.2, 1.3.2, 1.6, 2.8, 3.1, 4.5, 5.1, 5.13(added), 8	July 1998	
D	Completely revised for EASA CS31HB Amendment 1 approval. R-550 added, Gondola CB6005 added (ommitted from R450 amd't in error), Burners CB6350, CB6420 and CB6541 added, Cylinders CB2585 added. Maintenance Manual now discrete document CBL/TN/FJD/2917	ALL	23 March 2016	Approved by EASA under Approval Number 10057370
D Amdt. 1	Burner CB6241 and Basket CB308-1 added	6.2.10, 6.3.6 and tables 9.3, 9.7 and A2.1. Tables 9.3 Forwards Renumbered.	October 2020	Amendment 1 to Roziere Flight Manual Issue D is approved under the authority of DOA ref. EASA. 21J.140 (C813)

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 Rozière Balloons.

Revisions to this Manual are published on the Cameron Balloons Limited website at 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.028: R-Series Rozière 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

A Rozière balloon derives its lift from a combination of a lighter than air gas, usually Helium, and heated air.

Envelopes are of sewn construction. Envelopes are made from high tenacity coated nylon fabric and polyester load-bearing tapes. The main heat source for balloon flight is a low-output burner fuelled by liquid propane (LPG). The fuel is carried in liquid form under pressure in metal cylinders. Occupants are carried in a traditional basket or carbon-fibre gondola.

A full description of the balloon and its systems is given in Section 6.

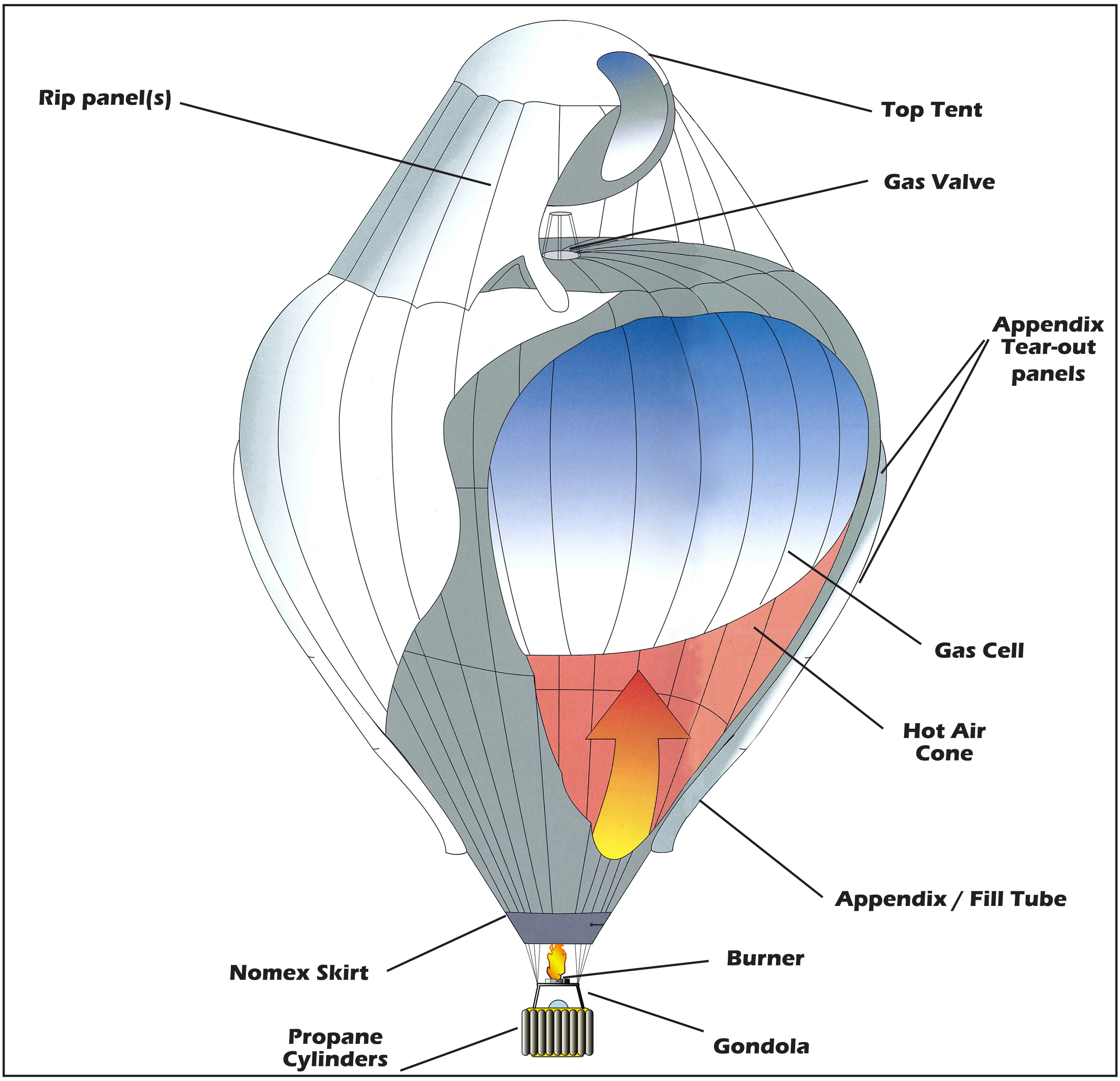

Figure 1.1 R-Type Description

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 maximum windspeed for inflation is 5 knots (2.5m/sec)and this maximum should be forecast to remain until after the intended take-off time.

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

1. Permissible Lifting Gas: Helium (He).

2. The gas cell must not be filled in excess of the limits given in Table 2.1

2.4 FUEL

1. The fuel for the burner is LPG. Propane is the preferred fuel, but some content of other hydrocarbons is permissible, provided that minimum fuel pressures are maintained through out the flight. Main and whisper burners must not be operated on a vapour fuel supply.

2.4.1 Fuel Pressures

1. The fuel pressure must never exceed the system safe working pressure of 10 bar (145 psi).

2. The minimum fuel pressure is 3 Bar (44 psi)

2.5 MASS LIMITS

1. The take-off Mass (TOM) of the balloon must never exceed the Maximum TOM (MTOM) shown in Table 2.1. 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 2.1. 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.

4. The maximum free lift for the balloon is given in Table 2.1.

2.6 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.

2.6.1 Minimum Ballast

Minimum Ballast at Take-Off: Refer to Table 2.1

2.7 CREW

Minimum crew: 1 pilot

Maximum occupants: 4

2.8 MAXIMUM RATE OF CLIMB AND DESCENT

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

2.9 MINIMUM EQUIPMENT

The following minimum equipment must be carried:

1. Protective gloves must be available to the pilot.
2. Matches or other independent means of ignition in addition to any igniters built into the burner.
3. A hand fire extinguisher.
4. A rate of climb and descent indicator (variometer)
5. An envelope temperature indicator which may either be of the continuous reading type or a type which gives a warning signal.
6. A light source capable of illuminating the filling tube (night operation only).

2.10 PERMITTED DAMAGE

The balloon must not be flown if there is any suspected damage other than small amounts of damage to fabric below the first horizontal load tape. The balloon must not be flown if there is any damage to other load carrying parts, or to any part of the fuel system, or to any gas containing fabric.

2.11 TETHERED FLIGHT

Tethered flight is not permitted.

2.12 ENVELOPE TEMPERATURE

1. The envelope temperature must not exceed 120ºC, (250ºF).

2.13 BASKETS

1. 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).

2. The must be at least one restraint, e.g. hand hold, for each basket occupant.

Table 2.1: Envelope Mass / Fill Limits

Variant	Volume (Lifting Gas)		Volume (Air)		Max. Fill (%)	MTOM		Max. permitted free lift at take-off		Minimum Ballast		Max. Occu-pants	FAI Class. AM
	ft³	m³	ft³	m³		kg	lb	kg	lb	kg	lb		
R-77	77 000	2180	15 280	432	100	**2 270**	5 004	45	99	40	88	4	8
R-90	90 000	2549	17 750	505	100	2 654	5 851	52	115	45	99	4	9
R-200	200 000	5664	40 000	1133	75	4 423	9 751	82	181	60	132	4	11
R-210	210 000	5947	42 000	1189	75	4 644	10 238	86	190	65	143	4	11
R-270	270 000	7646	54 000	1529	63	5 026	11 080	92	203	70	154	4	12
R-550	550,000	15 574	110 000	3115	60	9 726	21 442	170	375	105	231	4	14
R-550	550,000	15 574	110 000	3115	60	9 726	21 442	170	375	105	231	4	14

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.

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.

3.2.2 Emergency Landing

Emergency landings may be made by opening the rip panel(s) at heights of 10m (30 ft) 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.

The pilot should extinguish the pilot light, shut the fuel off at the cylinder in use after the last burn and empty the line if time permits.

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.

3.4.2 Gas valve fails closed

Check that the tricing line is not tight as this could prevent the valve from opening.

If the gas valve cannot be opened, a climb should be initiated, using the burner, and maintained until the balloon reaches the ceiling. At the ceiling use the burner to expand the gas inside the balloon until a significant quantity of gas has been expelled from the appendix.

This will make the balloon “heavy” and allow it to be flown using the burners.

3.4.2.1 Appendix Tear-Out Panels (R-450, R-550)

The R-450 and R-550 are fitted with Appendix Tear-Out panels

If climbing to the ceiling can not be safely achieved the appendix tear-out panels should be opened.

The two appendix tear-out panels are connected by a single line (red and yellow). Pulling the line will initially tear out the lower panel, leaving a large quantity of slack line (10m). Continuing to pull the line will release the upper panel.

The lower panel should be opened first and the effect assessed before opening the upper panel.

Once the panels are opened the balloon will continue to fly normally, but with a reduced ceiling (the panels reduce the effective volume of the envelope).

CAUTION: Opening the appendix tear-out panels near ceiling will cause a considerable quantity of gas to be expelled and a large amount of ballast may need to be dropped to arrest the subsequent descent.

3.5 GAS LOSS

3.5.1 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):

Pull the control lines to detach the lower cone (black and yellow)

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.

3.5.2 Gradual Gas Loss

If the balloon should start to gradually deflate in flight, additional heat can be added by using the whisper burners.

NOTE: The whisper burners are normally disabled by use of a cable tie, to prevent inadvertent operation, which must be broken before the valve can be used.

3.6 BURNER FAILURE

3.6.1 Burner Unit Malfunction

Transfer control to another burner unit.

Shut off the fuel supply to the defective burner unit at the cylinder valve.

Vent fuel from the defective burner unit and supply hose.

Land as soon as possible.

NOTE: If the blast valve fails in the open position, its flow can be controlled by opening and closing the cylinder valve (liquid offtake).

3.6.2 Solenoid Valve Leak

Should the solenoid valve fail to operate or leak, close the ball valves upstream and downstream to completely isolate it and revert to manual burner operation.

3.7 PILOT LIGHT FAILURE

If a pilot light is extinguished for any reason, it should be re-lit.

If a pilot light cannot be re-lit control should be transferred to another burner unit

If all pilot lights fail, the following procedure should be adopted:

1. Shut off all fuel supplies at the cylinder valve.

2. Lock one whisper burner valve fully open

3. Partially open the fuel supply to this burner at the cylinder valve, to permit a small amount of fuel to enter the burner.

4. Light the burner with a match or other igniter.

WARNING: Do not use the igniter built into the burner, as it will not ignite the fuel.

5. Fully open the fuel supply to the burner, using the cylinder liquid valve to control the flight of the balloon.

6. Partially close the cylinder liquid valve to a fractional setting, regulating the burner to maintain a pilot setting.

7. Land as soon as possible.

NOTE: Do not leave one cylinder providing the pilot setting, with main fuel taken from another, because prolonged restricted flow of liquid will cause freezing of the valves.

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

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 Gondola Rigging

The gondola should be positioned upright. The burner frame should be rigged with 4 off 4 tonne karabiners. All stores should be loaded before inflation starts. The fuel cylinders should be positioned around the gondola in their intended flight positions.

4.2.3 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.

4.2.4 Ballast / Restraint

Rig an adequate tether system from the gondola/ burner load frame to strong points or heavy vehicles. Distribute the ballast required for flight uniformly around the gondola using karabiners.

4.2.5 Trail Rope (optional)

The trail rope (drag rope) is attached to two adjacent lugs of the load frame using a Vee bridle.

4.2.6 Envelope rigging

4.2.6.1 General

The envelope must be handled with great care throughout the assembly and inflation procedure. The fabrics may be damaged by dragging over the ground, or torn by careless handling.

In particular any walking over the envelope fabric should be done in socks, and handling should be gentle and avoid putting large point loads into the fabric or the seams.

There are tape loops and plastic clips attached to the main gas cell of the envelope and to the waistcoats. These are not strong points and must not be pulled on.

There are rigging lines attached to the inside and outside of the gas cell with break ties. It is very important that these are handled carefully so that they are not pulled off the gas cell.

4.2.6.2 Safety while working inside the envelope

While a crew member is inside the balloon it is important that another crew member is outside the balloon ensuring the safety of the person inside. Working inside the balloon can be disorienting, and there is a small risk of suffocation. The person outside the balloon should have a knife and be prepared to cut the balloon open if the person inside should lose consciousness. An additional precaution would be to place another person at the crown patch hole or appendix end with a hot-air balloon inflator fan ready to blow air into the envelope if needed.

4.2.6.3 Preparation

Ensure that the surface of the ground where the envelope is to be laid out is free from any features or objects, such as sticks and stones, sharp items, and holes, as any of these may cause the balloon to be damaged when it is moved and walked on during the preparation and inflation.

The envelope should be laid on ground sheets, adequate to prevent penetration by objects on the ground. The R-550 requires a ground sheet of 55m x 35m. This is the minimum area that must be protected by ground sheets.

4.2.6.4 Assembly

The envelope is laid out normally, as though it was sideways to the gondola. Detailed assembly instructions will be supplied specific to each CN.

General Assembly Sequence:

- Assemble waistcoat together (4 sections). Position approximately 20m from the gondola,
- Attach Gas Cell to lower waistcoat (Velcro, clips and karabiners),
- Attach the cone,
- Fit the Gas Valve,
- Rig the Rip Panel(s),
- Attach the top tent,
- Attach the top tent gas cell,
- Assemble and attach upper waistcoat,
- Assemble Mouth Stiffening Rings,
- Rig Control Lines,
- Attach envelope to gondola
- Remove all transit ties.

4.3 INFLATION

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.

Expel as much air as possible from the envelope before starting to fill with gas.

4.3.1 Pre-inflation checklist

Envelope:	No unrepaired damage to envelope fabric or load tapes. Valve installed & valve line attached.
Rigging:	Basket and flying cables correctly attached. Karabiner screw gates closed. Control lines attached to load frame.
Ballast:	Is sufficient ballast positioned in the basket.
Launch restraint:	Connected to fixed point (If used)

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.

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 tube and tying tightly with a bungee cord. Attach the free end of the tube securely to the loop at the bottom of the free loadtape using the snap-hook.

Attach the remaining control lines to the load ring/frame.

4.4 TAKE-OFF

4.4.1 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 valve and tricing lines have adequate slack.
Flying Cables and basket cables	Correctly connected. Karabiner screw gates closed.
Control lines	Attached
Ballast	Correctly stowed / secured. Adequate ballast for projected flight carried.
Instruments	Switched on and set.
Pilot Restraint (if used)	Belt worn and strap connected

4.4.2 Take-Off: Envelope Partly Full

Take-off by building up lift with intermittent burning, all helpers standing well clear of the basket. The balloon will lift off, the burner can be shut off a short distance above the ground and the balloon will continue to climb in silence. Be ready to burn again at the top of the climb to prevent a descent.

4.4.3 Take-off: Envelope Full

When the balloon is completely inflated, at take-off or at any other time, the burner must not be used. Under these conditions the expansion of the lifting gas caused by heating will not increase lift, it will simply cause an overflow through the filler tube causing a loss of gas.

When the balloon is completely full, the take-off procedure should be as for a pure gas balloon by discharging ballast.

4.5 FLIGHT

CAUTION: If operation at night is envisaged a suitable light source should be included as minimum safety equipment.

4.5.1 Control in Flight

In flight the balloon may be flown in either the gas balloon or hot air balloon mode. It is in fact permissible to dismount the burners and fuel tanks, detach the base cone and fly only as a gas balloon. The full performance of the Rozière can only be obtained by using the burner.

In the hot air balloon mode, the burner is used in the same way as in a hot air balloon to maintain flight. Its function however is not mainly to heat the air in the cone, but to heat and expand the helium. This gives a great increase in lift for only a few degrees of temperature elevation.

4.5.2 Flight at Full Inflation

The burner should not be used when the balloon approaches its ceiling, as this would cause a loss of gas with no advantage in terms of lift. If the balloon is likely to approach its ceiling, then it is important to keep the burner off for some time before this so that the balloon reaches the ceiling with the helium as cool as possible to minimise this loss.

A climb above the ceiling can only be made by discharging substantial quantities of ballast, with an accompanying loss of gas. While it may sometimes be necessary to do this for reasons of weather or high obstacles, it must be remembered that it significantly shortens the possible duration of flight.

4.5.3 Gas Valve Operation

The gas valve is operated by pulling the valve line (Red/white). The valve should be opened for a short period (typical 2-5 seconds) and the effect monitored before repeated use.

The tricing line should be used after each period of valve operation.

4.5.4 Fuel Management

In flight one fuel cylinder is connected to each burner fuel supply. Two cylinders will be connected for a single or a double burner, three cylinders for a triple burner and four cylinders for a quad. These cylinders should be tested immediately before take-off and remain turned on during flight.

NOTE: Tema 3810 connectors have a latching locking ring below the main release ring. When the locking ring is ‘up’ (towards the connection), the main release ring cannot be operated to release or make the connection.

One fuel supply should be used preferentially during flight to ensure that two fuel systems are never exhausted simultaneously.

Master cylinders (if a vapour pilot light is fitted) should normally be used last. Occasionally, in very cold conditions, or where a long flight is planned the master cylinders should be used first, as the withdrawal of vapour to fuel the pilot lights reduces cylinder pressure over time. Sufficient fuel should be left in the cylinder to fuel the pilot lights- 3% of cylinder contents per hour of flight is sufficient to fuel a vapour pilot light.

The last cylinder available to each fuel supply must not be used to below 25% full. This ensures that multiple fuel supplies remain at all times and that full burner power is available in an emergency.

CAUTION: The main burners are designed to operate on liquid propane. If they are operated on propane vapour the burner will overheat and may be permanently damaged.

If it is desired to burn as much fuel as possible from a cylinder, then the last 5% of the contents should be burned with the whisper burner, where the liquid fuel can be clearly seen emerging from the whisper jet. Once liquid fuel stops emerging, discontinue the use of that cylinder as the vapour flame will not provide sufficient heat to maintain height.

Cylinder Change Procedure

1. Check function of an alternative burner or fuel supply.
2. Check safe flight path.
3. Shut off the empty cylinder at the cylinder valve.
4. Operate the burner valve to empty the fuel hose.
5. Disconnect the fuel hose from the empty cylinder and reconnect to a full cylinder.
6. Check secure connection.
7. Open the full cylinder, relight the pilot light if necessary.
8. Check function of burner.

4.5.4.1 Use Of cylinder manifolds

WARNING: Only manifolds supplied by Cameron Balloons Ltd. may be used.

The manifold must not be used to connect two or more burner fuel supplies together to reduce the number of independent fuel supplies

A manifold must not be used in such a way as to leave a bare cylinder connector (e.g. only two cylinders on a three-cylinder manifold) unless an approved hose blank is fitted.

Only one cylinder at a time should be open to each burner.

4.5.4.2 Auxiliary Fuel Cylinders

If additional cylinders with no contents gauge are fitted, they should be used first to ensure sufficient cylinders with gauges are available for the final stages of the flight.

4.6 LANDING

4.6.1 Pre-Landing Checklist

Ballast	Securely stowed / secured.
Loose Items	Securely Stowed.
Pilot Restraint (if used)	Belt worn and strap connected
Trail Rope (if used)	Attached to load frame rope for deployment.
Equipment	Instruments, cameras, etc. made safe.
Fuel	Enough fuel in cylinder(s) in use for landing and overshoot.
Liquid Fuel Supply	Check contents of cylinders in use.
Pilot Lights	Should be turned off when the pilot is satisfied that no further burner operation will be required.
rip-line (red)	Available in hand
Valve Line	Available in hand
Passengers	Briefed

4.6.2 Landing

The balloon should be stabilised at about twice the height of the trees or other obstacles.

Once clear of all property in the approach path which might be damaged the trailrope may be deployed if desired (taking account of the weight loss in the timing of the burner or use of the gas valve).

As the boundary of the field is crossed the balloon should be allowed to descend, valving if necessary, and a further burn should then be given to check the descent.

4.6.3 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.

Depending on the wind speed, pull the valve line (red/white) or rip-line (red) shortly before touch-down.

If the envelope is fitted with two rip panels, the rearmost (upwind) panel should be opened first.

The pilot then decides when the passengers may leave the basket.

4.7 DEFLATING THE ENVELOPE

The rip panel must be opened by pulling the ripline (red) (if not already opened during touch down).

If the envelope is fitted with two rip panels, both panels should be opened. The pilot holds onto the line(s) until the envelope is fully deflated.

If deflation takes place under windless conditions, the crown line (white line external to envelope) should be used to keep the envelope away from the basket. During balloon deflation the filling tube must always be kept closed.

4.8 ACTION AFTER FLIGHT

Shut off and empty any fuel hoses not already shut down and switch off instruments.

Empty the envelope of gas by folding it into a long line and expelling the gas through the open rip panels.

When the envelope is completely empty, remove the gas valve and detach the envelope from the load frame.

Fold the envelope into a long line and pack it into its bag.

5.1 INTRODUCTION

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

5.2 GAS LIFT

In normal operation the balloon will be only partly filled at launch, because the gas expands with altitude.

When the gas has expanded to completely fill the balloon, this condition is known as the "ceiling". The balloon can climb to a greater height only by losing weight.

During the flight, as fuel is used and ballast is discharged, the ceiling altitude will increase.

Where the balloon has a maximum permitted lift which is less than the lift possible with a 100% fill at sea level, this must be controlled by knowledge of the equipment and payload total weight as it is not practical to measure the percentage fill of the envelope during inflation. The amount of gas is defined by the balloon reaching equilibrium.

The Table 5.1 gives the lift of 1000 cu.ft. of helium at altitude and also shows the percentage of that volume which it would have had at sea level. (Assuming 15°C at sea level and International Standard Atmosphere).

Table 5.1: Helium (He) Lift at Altitude

Altitude (ft.)	Altitude (m)	He Lift (lb)	He Lift (kg)	% at sea level
0	0	65.9	29.9	100
5 000	1524	56.8	25.8	86.2
10 000	3048	48.7	22.1	73.9
15 000	4572	41.5	18.8	62.9
20 000	6096	35.2	16.0	53.9
25 000	7620	29.6	13.4	44.9
30 000	9144	24.7	11.7	37.5

If the take-off weight of the balloon and its payload is divided by the volume of the gas cell (in thousands of cubic feet), the result is the lift per 1000 cu.ft. required at the start of the flight.

By interpolation of Table 5.1, the ceiling altitude on the first day and the percentage fill of the balloon (sea level equivalent) can be found.

5.3 SAMPLE LIFT CALCULATION

A Cameron R-210 balloon is to take-off at sea level (ISA). A ceiling of 15,000 ft is required at the start of the flight.The balloon has a pilot and one passenger.

Equipment Weights:

Item	Weight (kg)
Gondola	200
Burner	30
Envelope	720
Cylinders	260
Occupants (2 x 77)	154
Total Equipment Weight	1364 kg

From Table 5.1

Lift of Helium per 1000 cu.ft. at 15,000 ft = 18.8 kg

Helium required to lift 1364 kg = (1364/18.8)*1000 = 72,550 cu.ft

Maximum fill (from Table 2.1) =210,000 x 0.75 =157,500

5.4 COMPONENT WEIGHTS

Component weights should be listed in Table 5.2.

Table 5.2 : Balloon Component Weight Record

Registration	
Year Of Construction	
Constructors Number	
Balloon Type	

Component	**Drawing Number**	**Serial Number**	**Weight (kg)**
Envelope			
Burner			
Basket/Gondola			
Equipment			
		Total	

Cylinder	**Drawing Number**	**No. off**	**Serial Number(s)**	**Weight (kg)**	
				Empty	**Full**
Cylinder Type 1					
Cylinder Type 2					
Cylinder Type 3					
Cylinder Type 4					
Cylinder Type 5					
Cylinder Type 6					
			Total		

Total Fuel Weight ________ kg

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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 Gas Cell

The gas cell consists of between 16 and 80 vertical gores incorporating horizontal and vertical load tapes. Gas-tightness is obtained by an internal sealing tape welded to the inside of each sewn seam.

The upper gas cell (from the crown to the equator) is manufactured from PU coated nylon fabric reinforced with heavyweight load tapes.

The lower gas cell (from the equator to the base of the cell) is manufactured from a similar but lighter weight fabric. The lightweight fabric is used to allow the lower part to nest inside the upper part in case of emergency.

At the top and bottom of the gas cell the load tapes are joined to one or more conventional crown rings.

6.2.2 Hot Air Cone

The hot air cone is made from a metallised fabric (Mylar) strengthened by a fabric gauze (scrim).

The lower part of the hot-air cone is in two sections, joined vertically and horizontally to the base of the upper part by Dutch lacing. The two sections can be torn away so that air flow is not impeded in case of emergency. Any artwork is confined to the hot-air cone.

6.2.3 Outer Skin (optional)

An outer skin, manufactured from scrimmed metallised Mylar, covers the gas cell and is attached to the hot-air cone. This second skin is separated from the skin of the gas cell above the equator by a thin layer of foam to produce an insulating effect.

6.2.4 Top Tent (optional)

A tent, manufactured from scrimmed metallised Mylar with vertical load tapes, can be fitted on top of the gas cell to provide further insulation. The tent is held in place above the gas cell by an additional internal helium filled balloon. The tent is vented to atmosphere. The tent will draw cooling air in through the vents when the sun is shining, while at night the structure will dramatically reduce the heat loss through radiation.

6.2.5 Load tapes

The main vertical load tapes pass from a load ring incorporated in the gas valve at the crown, over the upper gas cell to just below the equator where they are connected by karabiners to continuing vertical load tapes which terminate at rigging points at the base. The base of the load tapes are connected to the load cell by stainless steel cables.

Horizontal load tapes are fitted as rip-stoppers at regular intervals in order to prevent propagation of a tear to a hazardous size.

6.2.6 Deflation system

The balloon is deflated via a “chimney rip” sealed with a fabric collar. The rip-line is coloured Red 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 rip chimney. Pulling the rip-line removes cover flap before releasing the rip collar.

WARNING: Once opened the “chimney rip” cannot be resealed in flight.

6.2.7 Appendix Tear-Out Panels (larger envelopes only)

Appendix tear-out panels (2 off) are fitted in one appendix to prevent over-pressure in the even of a gas valve failure. Appendix tear-out panels are only fitted in envelopes with a volume of 210 000 cu.ft. and above.

6.2.8 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.

6.2.9 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.

NOTE: Envelopes fitted with a top tent do not have a crown line fitted.

6.2.10 Envelope Control lines

A complete listing of envelope control lines and their colour codes is given in fig 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

APPENDIX TEAR-OUT: PANELS	RED-YELLOW
LOWER CONE DETACHMENT LINES	BLACK-YELLOW

Figure 6.1 Control Line Colour Codes

6.3 BURNER

6.3.1 General

The main heat source for balloon flight is a low-output burner fuelled with liquid propane.

Burners are available in double, triple and quad configurations.

The burner valve controls are colour coded to aid recognition.

6.3.2 Main Burner

The fuel passes through a vaporising coil (burner coil) and jet system prior to combustion. Fuel flow is controlled by an on/off valve referred to as the blast valve. The blast valve control is coloured red.

6.3.3 Whisper Burner

The Whisper burner is designed for emergency use only.

The Whisper burner (‘Liquid Fire’ or ‘Cow Burner’) feeds liquid fuel directly to a multi-hole jet producing a quieter and less powerful flame. Fuel flow is controlled by a rotary valve or toggle valve which can vary the output of the burner. The whisper burner control is coloured blue.

The Whisper burner should not be operated continuously with the valve partially open as this may lead to droplets of propane being produced at the nozzle. Liquid fuel may then collect in the base of the burner and present a fire risk.

6.3.4 Pilot Light

Burner ignition is provided by a pilot light. Pilot lights may be fuelled by liquid propane taken from the main fuel supply or from a separate regulated vapour supply. The pilot light is controlled by a rotary action shut off valve. Each pilot light has its own piezo igniter (except the Shadow Single burner which shares one igniter between two pilot lights). The pilot light control obscures the igniter push button when in the closed position. The pilot light control is coloured gold.

NOTE: During initial use, some ‘bedding down’ of the pilot light and whisper burner valves may occur necessitating a simple adjustment to ensure the valves shut off correctly (Maintenance Manual Sections 4.5.1 and 4.6.1).

6.3.5 Pressure Gauge

A pressure gauge is fitted to each liquid fuel supply. The pressure gauge displays the fuel pressure at the burner.

6.3.6 Fuel Supplies

A minimum of two separate fuel supplies is always fitted. In double, triple or quad burners, each burner unit has its own independent fuel supply.

The liquid fuel hoses on triple and quad burners are marked with a coloured band at each end so that the hose couplings can be matched with their burner unit.

6.3.7 Simultaneous Multiple Burner Operation

In multiple burners, pairs of burners are linked by a crossflow valve. The crossflow valve allows the routing of single fuel supply from one blast valve to two burner coils. Maximum power will not be achieved using the crossflow as both the burners are being fed from one fuel hose.

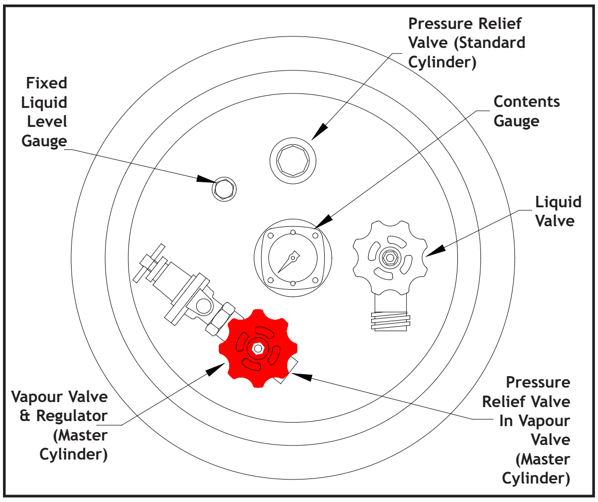
6.4 FUEL CYLINDERS

The fuel cylinders contain the liquid propane fuel under pressure. The cylinders are supplied in three configurations.

"Standard" cylinders:	Supplying liquid fuel feed only.
"Master" cylinders:	Supplying liquid fuel feed with an additional pressure regulated vapour supply for vapour pilot lights.
"Auxiliary" cylinders:	Cylinder supplying liquid and/or vapour feeds with no contents gauge

The liquid fuel is drawn from the bottom of the cylinder via an internal dip tube. The liquid supply is controlled by an external valve, either a handwheel type valve with a Rego type (screw-on) hose connector or a 'quick shutoff' lever-operated valve. The quick shutoff valve may be fitted with either a Rego type screw-on connector or a Tema push-on connector.

The regulated vapour pilot light supply (master cylinders only) is taken directly from the top of the cylinder through a handwheel type valve and an adjustable regulator. The vapour hose is connected using a quick release coupling.



Fuel Cylinder Valve Layout - Master Stainless Steel Cylinder Shown

CAUTION: The Vapour Regulator requires an internal cylinder vapour pressure of 0.5 Bar (7 p.s.i) before it operates correctly. Care must be taken at low ambient temperatures when using fuel which is predominantly butane.

6.4.1 Master and Standard Cylinders

All master and standard fuel cylinders are fitted with:

A contents gauge which indicates from approximately 33% of capacity until the cylinder is empty.

A fixed liquid level gauge (bleed valve) which indicates when the cylinder is full.

A pressure relief valve (PRV) which protects the cylinder against excessive internal pressure.

A padded cover with integral map pocket. The padded cover must be used at all times.

The cylinders are strapped vertically inside the basket. Load spreading boards must be fitted to the internal runners of woven floor baskets if cylinders with a useable volume greater than 45 litres are used.

A full description of approved cylinders is given in the Cameron Balloon Hot Air Balloon Flight Manual, Issue 10 or later EASA approved revision.

Data required for flight planning and applicability is duplicated in Section 9 of this manual.

6.4.2 Auxiliary Fuel Cylinders

Auxiliary fuel cylinders are designed to be used in addition to Master and Standard cylinders.

They are designed to be suspended from the envelope Forgecraft rings. They have volumes of approximately 200 l and are not fitted with contents gauges.

6.4.3 Mini Vapour Cylinder

The Mini Vapour Cylinder allows the main master cylinders to be pressurised with nitrogen (N_2) or carbon dioxide (CO_2) to increase burner power in cold conditions, or in cases of low gas pressure (e.g. when using butane).

A full description of approved cylinders is given in the Cameron Balloon Hot Air Balloon Flight Manual, Issue 10 or later EASA approved revision.

Data required for flight planning and applicability is duplicated in Section 9 of this manual.

6.4.4 Fuel Manifolds

Approved fuel manifolds may be used to join the outlets of several fuel cylinders to one burner fuel hose.

WARNING: Accidents have been caused by the use of non-approved fuel manifolds. In particular it is important that rigid refuelling adapters are not used to allow the combination of Rego outlet cylinders with Tema connectors or vice-versa.

6.5 BASKET/GONDOLA

6.5.1 Baskets

A full description of approved baskets is given in the Cameron Balloon Hot Air Balloon Flight Manual, Issue 10 or later EASA approved revision.

Data required for flight planning and applicability is duplicated in Section 9 of this manual.

6.5.2 Gondola

The gondola is a lightweight composite Kevlar/carbon fibre structure. It is double skinned with a layer of insulating foam between the skins. A bubble hatch is fitted on top of the gondola, adjacent to the burners and giving access to the fuel cylinders, envelope control lines etc. The hatch is a Lewmar yacht hatch with a Plexiglas dome fitted in place of the window. The watertight hatch is secured with levers.

Two keels are attached to the bottom of the gondola. In a sea landing the keels fill with water (via flooding valves) to aid stability. These keels are designed to deform and absorb shock in the case of a heavy vertical landing.

Internal fittings include full instrumentation, comprehensive communications, fuel supply and burner system controls, a bunk and storage space.

Externally a heater is fitted which circulates warm air through the gondola. The heater is fed by a propane vapour supply from dedicated cylinders.

Two retractable booms are fitted for communication / GPS antennae.

The burner system is mounted in a rectangular load frame supported by four Flexi-Rigid (Nylon) poles.

Stainless steel cables pass around the gondola and are connected to the load frame by karabiners, providing a continuous load path. The cables pass through the gondola at the base of the flexi-rigid poles to provide a cutting point to release the envelope on landing (if required).

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7.1 INTRODUCTION

This Section contains the recommended procedures for proper ground handling and servicing of the balloon.

7.2 INSPECTION PERIODS

Details of the required inspection periods are given in Cameron Balloons Rozière 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 Rozière 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.

The gondola should be stored dry with the vent closed. All electrical systems should be disabled/removed

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 Rozière 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

Date of Insertion	Doc. Ref	Description

Signed______________________ Name ______________________ Date __________________

Authority _______________________________

8.3 ADDITIONAL DATA

When the envelope detailed in the approval section is being used in conjuction 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 9.1 to 9.7 list the envelopes, baskets, burner frames, karabiners, cylinders and burners which are compatible.

Table 9.1: Envelopes

Envelope Type	Drawing Number	Applicable Burners	Applicable Baskets
R-77	CB973	B	C, D, E, F, G
R-90	CB1411	B	C, D, E, F, G
R-200	CB1153	B, C, D	E, F, G, H, J, M, O
R-210	CB1193	B, C, D	E, F, G, H, J, M, O
R-270	CB1261	B, C, D	E, F, G, H, J, M, O
R-450	CB1292	B, C, D	E, F, G, H, J, M, O
R-550	CB1720	B, C, D	E, F, G, H, J, M, O

Table 9.2: Baskets

<table>
<tr><th>Basket Cat.</th><th>Drawing Number</th><th>Basket Description*</th><th>Applicable Cylinders</th><th>Applicable Burner Frames (specific)</th><th>Applicable Burner Frames (with Assembly check)</th></tr>
<tr><td>C</td><td>CB300-2A</td><td rowspan="4">56-65 O</td><td rowspan="7">1a, 1, 2, 3</td><td rowspan="7">CB855, CB871, CB925, CB2203(Fl), CB2224(Fl), CB2231(Fl), CB2598 (Fl), CB2643, CB2665, CB2857(Fl), CB2874</td><td rowspan="7">CB2203, CB2224, CB2231, CB2598, CB2650, CB2652, CB2857, CB2995, CB8810,CB8810, CB8811, CB8820, CB8821, CB8864,CB8894, CB8902, CB8903, CB8905, Concept (CB994,CB2000), BA-152-A-002 (LBL)**</td></tr>
<tr><td>C</td><td>CB310-2A</td></tr>
<tr><td>C</td><td>CB3050-2</td></tr>
<tr><td>C</td><td>CB3115-2</td></tr>
<tr><td>C</td><td>CB3011-2A</td><td rowspan="3">56-65 OH</td></tr>
<tr><td>C</td><td>CB3023-2</td></tr>
<tr><td>C</td><td>CB3011-2B</td></tr>
<tr><td>C</td><td>CB3051</td><td>C60/70 O</td><td>1a, 1, 2, 3</td><td rowspan="9">CB855, CB871, CB925, CB2203, CB2224, CB2231, CB2598, CB2665, CB2860, CB2863, CB2874, CQ2018***, CQ2028</td><td rowspan="9">CB2643, CB2650, CB2652, CB2665, CB2857, CB2874, CB8810, CB8811, CB8820, CB8821, CB8864,CB8894, CB8902, CB8903, CB8905</td></tr>
<tr><td>D</td><td>CB300-3A</td><td rowspan="4">77-84 O</td><td rowspan="4">1a, 1, 2, 3</td></tr>
<tr><td>D</td><td>CB310-3A</td></tr>
<tr><td>D</td><td>CB3050-3</td></tr>
<tr><td>D</td><td>CB3115-3</td></tr>
<tr><td>D</td><td>CB3011-3A</td><td rowspan="3">77-84 OH</td><td rowspan="3">1a, 1, 2, 3</td></tr>
<tr><td>D</td><td>CB3023-3</td></tr>
<tr><td>D</td><td>CB3011-3B</td></tr>
<tr><td>D</td><td>CB3052</td><td>C80/90 O</td><td>1a, 1, 2, 3</td></tr>
</table>

Table 9.2: Baskets (cont'd)

Basket Cat.	Drawing Number	Basket Description*	Applicable Cylinders	Applicable Burner Frames (specific)	Applicable Burner Frames (with Assembly check)
E	CB300-4A	90-105 O	1a, 1, 2, 3	CB855, CB871, CB925, CB2203, CB2224, CB2231, CB2598, CB2665, CB2874, CQ2027	CB2203, CB2224, CB2231, CB2598,CB2650, CB2652, CB2857, CB2995, Concept (CB994,CB2000), BA-152-A-002 (LBL)**
E	CB310-4A				
E	CB3050-4				
E	CB3115-4				
E	CB3011-4A	90-105 OH	1a, 1, 2, 3		
E	CB3023-4				
E	CB3011-4B				

Basket Category	Drawing Number	Basket Description*	Applicable Cylinders	Applicable Burner Frames
G	CB303	120 - 133 O	1a, 1, 2, 3	CB855, CB871, CB925, CB2203(Fl), CB2309, CB2312
G	CB308-1	120 O	1a, 1, 2, 3	CQ2095
H	CB991	140 T	1a, 1, 2, 3	CB993, CB2264, CB2263
J	CB754	180 - 210 TT	1a, 1, 2, 3	CB750, CB2420, CB2411, CB2261, CB2371
M	CB3004	250 TT	1a, 1, 2, 3	CB2050, CB2250, CB2283, CB2303
M	CB971	250 TT D	1a, 1, 2, 3	CB970, CB2260, CB2304
O	CB3042	300 TT	1a, 1, 2, 3	CB2270, CB2258
O	CB3040	300 TT D	1a, 1, 2, 3	CB2271, CB2259
O	CB3049	300 TT S	1a, 1, 2, 3	CB2272, CB2269

Table 9.3: Gondolas

Basket Category	Drawing Number	Gondola Description*	Applicable Cylinders	Applicable Burner Frames
C	CB527	H. A. Atlantic Gondola	1a, 1, 2, 3, 4	CB855, CB871, CB925
C	CB778	H. A. Doctus Gondola	1a, 1, 2, 3, 4	CB855, CB871, CB925
J	CB6005	H.A. Atlantic Gondola (2 Man)	1a, 1, 2, 3, 4	CB6056

Table 9.4: Karabiners

Part No.	Rating	Identification Markings
CU-9825-0001	4 Tonne	STUBAI SYMOVAL4000 UIAA

Table 9.5 Fuel Cylinders

Table 9.5.1 Standard and Master Cylinders (HAB Cylinders Current)

Cylinder Category	Drawing Number	Cylinder Material	Cylinder Description
1a	CB901	ALUMINIUM	MINI WORTHINGTON
2	CB2990	ALUMINIUM	Alugas 50l
2	CB2900	DUPLEX STAINLESS STEEL	45
2	CB2901	DUPLEX STAINLESS STEEL	60
3	CB2902	DUPLEX STAINLESS STEEL	54
3	CB2903	DUPLEX STAINLESS STEEL	72

Table 9.5.2 Standard and Master Cylinders (HAB Cylinders Out of Production)

Cylinder Category	Part Numbers		Material	Designation
		Alternative		
1	DOT-4E-240	CB250	Aluminium	Worthington
2	-	CB426	St. steel	60
2	-	CB497	St. steel	40
2	-	CB599	St. steel	45
3	-	CB959	St. steel	80
3	-	CB2088	St. steel	T60
2	-	CB2380S	Titanium	60
3	-	CB2383S	Titanium	80
2	-	CB2385S	Titanium	45
3	-	CB2387S	Titanium	T60
2	-	V20-100-00/CB8420	St. steel	Colt V-20 / T&C V-20
2	830922-1	V30-100-00/CB8430	St. steel	Colt V-30 / T&C V-30
3		V40-100-00/CB8440	St. steel	Colt V-40 / T&C V-40
2	A0/V30		St. steel	Sky V-30
3	A0/V40		St. steel	Sky V-40

Table 9.5.3 Auxiliary Cylinders

Cylinder Category	Drawing Number	Cylinder Material	Cylinder Description
4	CB2585	DUPLEX STAINLESS STEEL	230

Table 9.6: Burners

Burner Category	Drawing Number	Burner Description
B	CB215	Double Rozière Burner
B	CB2060	Double Rozière Burner
B	CB6350	Double Rozière Burner (NAR/6-Can)
B	CB6420	Double Rozière Burner (NAR)
B	CB6541	Double Rozière Burner (JLE)
B	CB6421	Double Roziere Burner (Liquid Pilot Lights)

9.3 ADDITIONAL EQUIPMENT

9.3.1 Hand Fire Extinguisher

Hand fire extinguishers should conform to EN3 or an equivalent specification. The extinguisher(s) should have a minimum capacity of 2 kg when using dry powder, or when the extinguishing means is other than dry powder be at least of comparable effect and capacity.

9.3.2 Fire Blanket

A fire blanket or fire resistant cover should comply with the European Norm EN 1869 or equivalent. The size should be at least 1.2 m × 1.8 m.

NOTE: Smaller sizes are not recommended as they cannot sufficiently cover the source of developing propane fire.

9.3.3 Knife

A knife, hook knife or equivalent, capable of cutting any control line or handling rope that is accessible to the pilot-in-command or a crew member from the basket.

9.3.4 First Aid Kit

The first-aid kit should be equipped with appropriate and sufficient medication, dressings and other medical equipment to satisfy the characteristics of the operation (scope of operation, flight duration, number and demographics of passengers, etc.).

The following should be included in the first-aid kit:

(1) bandages;
(2) burns dressings;
(3) wound dressings;
(4) adhesive dressings;
(5) antiseptic wound cleaner;
(6) safety scissors; and
(7) disposable gloves.

The first aid kit should be maintained and kept up to date.

Consideration should be given to carrying an additional First Aid Kit in the retrieve vehicle.

9.3.5 Drop Line

The drop line or handling line may be used, by ground crew, to manoeuvre the balloon in light wind conditions. A minimum length of 25 m is recommended. When not in use the drop line is coiled up in a fabric bag and secured inside the basket.

9.3.6 Accurate Time Piece

A means of measuring and displaying the time in hours, minutes and seconds (e.g. wrist watch).

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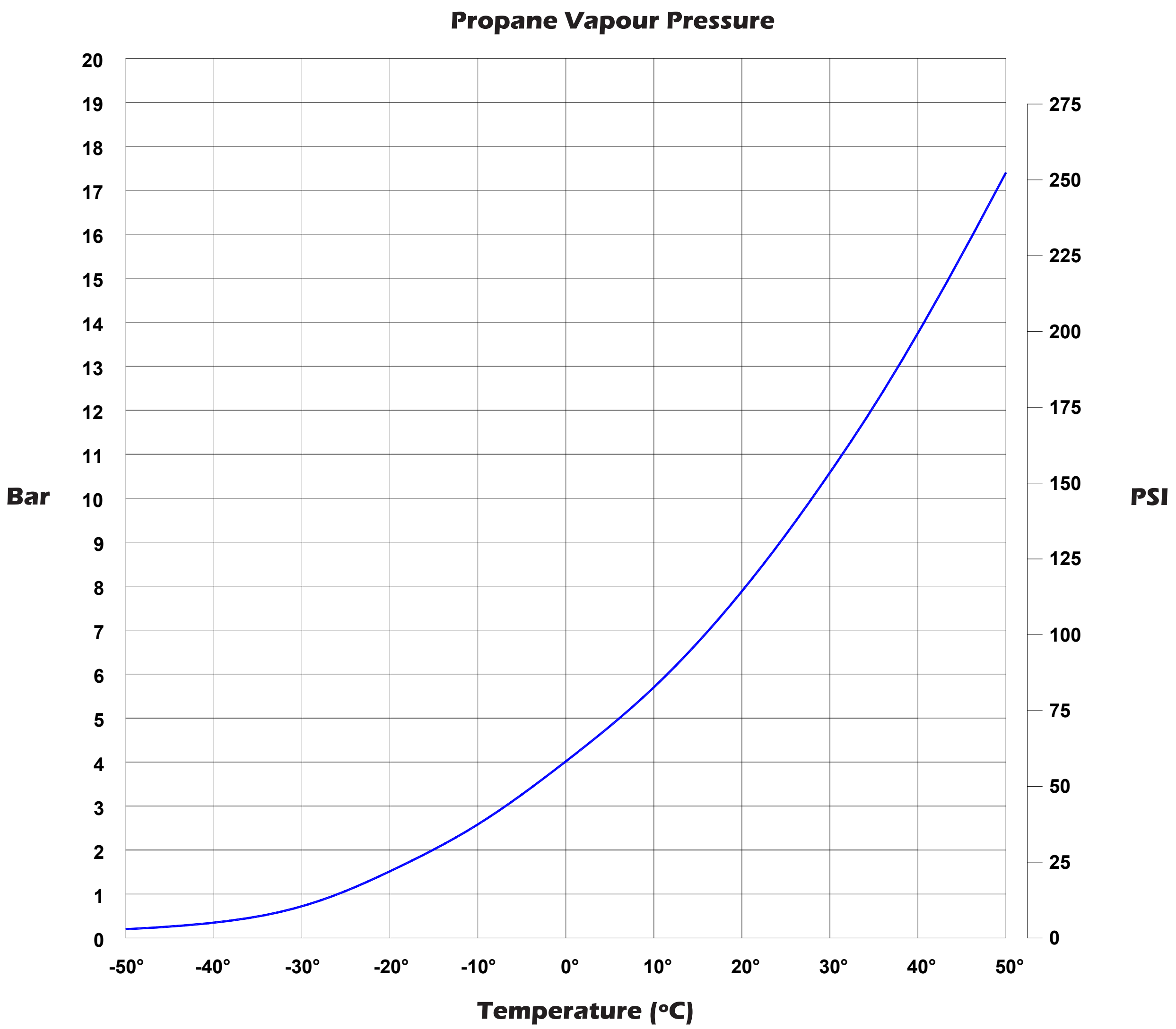
Propane is a petroleum hydrocarbon, chemical formula C_3H_8. At normal temperatures and pressures it is a vapour, but it is stored as a liquid under pressure.

Propane is in its pure state colourless and odourless, and is heavier than air (1.5 times as dense). To reduce the risk of a propane leak going undetected a sulphur compound is added to give it a noticeable smell.

The requirements for commercial propane vary from country to country. Propane may contain 'heavy ends' which are long-chain hydrocarbons (oils and greases) or water. Special care is required when using commercial cylinders for the supply of propane as these are generally used for vapour supply, allowing heavy ends and water to collect in the bottom of the cylinder. Heavy ends may contaminate the fuel system (especially the vapour side) necessitating stripping and cleaning. Water may freeze in the cylinders and obstruct the liquid fuel flow.

Commercial propane will also contain some amount of butane (C_4H_{10}). Butane is also deliberately added to propane, particularly in hot countries, in order to reduce the vapour pressure. Butane has similar properties to propane, differing mainly in its vapour pressure which is substantially lower.



A small proportion of butane in the fuel is acceptable, provided that the fuel pressure does not drop below the minimum required for flight.

The storage of the fuel under pressure is an advantage as it allows the operation of a very high output burner without a pump, but since burner power is directly related to the fuel pressure, lower burner power is obtained in winter.

Liquid propane expands rapidly with increasing temperature, making it essential to never completely fill a storage cylinder. The fixed liquid level gauge (bleed valve) is set to release liquid when the cylinder is approximately 80% full leaving sufficient vapour space to allow for normal levels of fuel expansion.

Further protection from high temperatures and overfilling is provided by a pressure relief valve in the cylinder. This valve is set to open at approximately 26 bar (375psi).

Large amounts of heat are required to change propane from a liquid to a gas. This is the reason the burner uses liquid fuel, drawn from the bottom of a cylinder via a dip tube. If vapour were drawn off at the high rates required then the cylinder would rapidly cool and lose pressure.

A vapour pilot light draws propane vapour from the top of the cylinder via a pressure regulator. Occasionally when the cylinder is on its side during inflation liquid propane will enter the regulator. The evaporation of propane inside the regulator will cause frost to form on the outside and the regulator may perform erratically or leak slightly.

NOTE: The component weights given in Tables A2.1 to A.2.4 are approximate and for guidance purposes only. For pre-flight weight calculations, the actual component weights given in Table 4 and the aircraft log book should be used.

Table A2.1: Burner Weights

Burner (Including Karabiners)	kg	lb
[1] Double (CB215 / CB2060 / CB6420 / CB6421 / CB6541)	19	42
[2] Double (6 Can) (CB6350)	35	77

Table A2.2 Standard and Master Cylinders (HAB Cylinders Current)

Cylinder Material	Cylinder Type	Volume (Litres)		Configuration	(Including Cover & Straps) Empty Weight		Full Weight	
		Total	Usable		kg	lb	kg	lb
Duplex Stainless Steel	CB2900 ‘45’	56	45	Master	21	46	44	97
				Standard	20	44	43	95
	CB2901 ‘60’	75	60	Master	23	51	53	117
				Standard	22	49	52	115
	CB2902 ‘T60’	68	54	Master	24	53	51	112
				Standard	23	51	50	110
	CB2903 ‘72’	90	72	Master	27	60	63	139
				Standard	26	57	62	137

Table A2.3 Auxiliary Cylinders

Cylinder Material	Cylinder Type	Volume (Litres)		Configuration	(Including Cover & Straps) Empty Weight		Full Weight	
		Total	Usable		kg	lb	kg	lb
Duplex Stainless Steel	CB2585	230	209	Master	51	112	163	360
				Standard	50	110	162	358

Table A2.4 Standard and Master Cylinders (HAB Cylinders Out of Production)

Cylinder Material	Cylinder Type	Volume (Litres)		Configuration	(Including Cover & Straps)			
					Empty Weight		Full Weight	
		Total	Usable		kg	lb	kg	lb
Aluminium	Worthington	47	38	Master	15	33	34	75
				Standard	14	31	33	73
Stainless Steel	CB497 ‘40’	47	38	Master	17	38	36	80
				Standard	16	36	35	78
	CB599 ‘45’	51	41	Master	20	44	41	90
				Standard	19	42	40	88
	CB2088 ‘T60’	65	52	Master	23	51	50	110
				Standard	22	49	49	108
	CB426 ‘60’	69	55	Master	22	49	51	112
				Standard	21	46	50	110
	CB959 ‘80’	88	70	Master	26	57	62	137
				Standard	25	55	61	135
Stainless Steel	V-20*	47	38	Master	17	38	36	80
				Standard	16	36	35	78
	H-30/V-30*	69	55	Master	20	44	48	106
				Standard	19	42	47	104
	V-40*	87	69	Master	25	55	60	133
				Standard	24	53	59	131
	H-55	120	96	Master	30	66	78	172
				Standard	29	64	77	170
Titanium	CB2385 ‘45’	51	41	Master	11	24	34	75
				Standard	10	22	33	73
	CB2387 ‘T60’	65	52	Master	14	31	41	90
				Standard	13	29	40	88
	CB2380 ‘60’	70	56	Master	14	31	43	95
				Standard	13	29	42	93
	CB2383 ‘80’	88	70	Master	15	33	52	115
				Standard	14	31	51	112

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^2, floor area should be allowed for each standard occupant.

When calculating the number of occupants, the area used by items of other equipment (e.g. fuel cylinders) must be subtracted from the total area.

For the purposes of these calculations the floor area taken up by single fuel cylinders can be taken as 0.1m^2 for “large” diameter cylinders (e.g. CB2901) and 0.09 m^2 small diameter cylinders (e.g. CB2900).

Example

If we consider the following example;

Envelope; R-77,

Basket; CB300-4A,

Double Burner; CB6420,

Fuel; CB2901 x 4

Limitation on occupancy by floor area;

Floor area of basket (inside) = 1.07 x 1.47 = 1.57 m^2

Floor area of equipment = [0.1x 4] = 0.4 m^2

Available floor area for occupants = 1.57 – 0.4 m^2 = 1.17 m^2

Total maximum number of occupants = 1.17 / 0.25 = 4.68 = 4 standard occupants

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