



**LINDSTRAND TECHNOLOGIES LTD**

**HIFLYER BALLOON  
MAINTENANCE MANUAL**

**This document does not cover winch maintenance.**  
Please refer to separate Winch Operations & Maintenance Manual

### Statement of Approval

This manual forms part of the EASA Type Certificate BA.005, first approved on 4 March 2005.

Future revisions will require approval, signified by an approval number.

### Use of this Manual

This manual sets out the maintenance procedure and schedule for all LTL Captive Balloons. As each balloon may have specific features for dedicated systems, every balloon has a dedicated manual showing the serial number on the cover. Always make sure before proceeding that you have the correct manual issue.

The Maintenance Manual does not always make a distinction what work can be carried out by the operator and what can only be serviced by Factory personnel. If in doubt, always consult the manufacturer on maintenance issues.

It is the responsibility of the balloon operator to ensure that staff engaged in inspection or maintenance of the balloon are trained and competent to do any work they undertake.

Record of Amendments

No.	Date	Affected Pages	Incorporated By
2.0	12.02.09	All Pages	L Barnfield

Amendments:

This manual is kept up to date by amendments consisting of loose-leaf pages, required to add new information or amend existing information. The pages affected by an amendment and the effective date are shown above. The pages themselves are identified by a change of the issue number at the bottom of each page. The number after the point in the issue number represents the amendment level of that page, eg a page marked Issue 1.4 is at Issue 1 modified by Amendment 4. The Checklist of Pages indicates the issue level of all pages included in this Maintenance Manual. Amendments are issued to all relevant operators of the Lindstrand Technologies Ltd HiFlyer System on a free of charge basis provided that the Inclusion Check Sheet is signed and returned to Lindstrand Technologies Ltd for each issued amendment.

Change of Ownership

If the ownership of this balloon changes, it is important for the new owners to contact Lindstrand Technologies Ltd to ensure that they receive Maintenance Manual Amendments and Supplements, as appropriate.

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## **1. SYSTEM DESCRIPTION AND TECHNICAL DATA**

### **1.1 Helium Gas**

Helium is totally inert, clear, non-toxic and odourless. Its lift is about  $1 \text{ kg/m}^3$  ( $0.06 \text{ lbs/ft}^3$ ) and only hydrogen has a higher lift.

The Helium molecule is very small and electrically 'neutral' and therefore very difficult to contain. Even if there are no holes or pinpricks, Helium will still diffuse through balloon fabric as a normal phenomena. For typical HiFlyer fabric, we can assume  $1.5 \text{ l/m}^2/24 \text{ hrs}$  ( $0.03 \text{ gall/ft}^2/24 \text{ hrs}$ ). With an envelope surface area of  $1600 \text{ m}^2$  ( $17,222 \text{ ft}^2$ ), we can expect a Helium loss of  $1.5 \times 1600 = 2400 \text{ litres/day}$  ( $517 \text{ gall/day}$ ). This represents a loss of lift of  $2.4 \text{ kg/day}$ . To replenish from normal Helium storage cylinders which typically hold  $10 \text{ m}^3$  or  $10,000 \text{ litres}$  ( $2203 \text{ gall}$ ), we would need to empty a cylinder into the envelope every 4.2 days. This equates to approximately 7 cylinders per month.

It is imperative that all Helium replenishment is noted in the Technical Log Sheet LTL-TA1. The log is the most important instrument in monitoring the health of the envelope fabric.

Air will also diffuse into the envelope and slowly dilute the Helium. This rate is difficult to predict but it has the same trend as the helium diffusion. The Helium purity is measured by testing a sample of Helium from the envelope with a purity meter. Helium combines with air and the Helium purity will be the same throughout the envelope. Thus it does not matter where on the envelope the test sample is drawn from.

Decline in Helium purity will result in a loss of lift in direct proportion to the purity.

Helium is normally supplied in cylinders as a pressurised gas but sometimes as a cryogenic liquid. Both are suited for filling balloons but in the case of using liquid, make sure the necessary flow rates can be achieved. It is also important that vaporisers (heat exchangers) of sufficient capacity are in series with the flow. If the Helium enters the envelope too cold, it could cause fabric damage and the risk of overfilling, as the cold gas, once inside the envelope will expand rapidly from ambient heating.

### **1.2 The Envelope**

The layout of the balloon is shown in Fig 5.1.

In the HiFlyer balloon, the envelope contains the gas and super pressure forces. The net drapes over the balloon and transmits all the lifting forces to the winch and gondola through the load ring. Both the net and the envelope are highly stressed items; they are primary structure with no redundancy and must be inspected and maintained meticulously. If in doubt, always consult the manufacturer.

The envelope material is a polyurethane coated fabric. The coating contains titanium dioxide as a shield against ultra-violet radiation. The envelope is constructed from panels joined by welding. An internal ballonnet allows variations in Helium volume without the need for venting. Some parts of the envelope are glued due to practical restriction in welding machine access. Repair to the envelope is normally glued for the same reasons.

The balloon envelope is a super-pressure design i.e.; the Helium cell is sealed and an internal ballonnet, which is filled with air, is allowed to expand and contract to allow for variations in volume of the Helium cell. This way, the envelope is always full and spherical which minimises aerodynamic drag and creates a uniform appearance. The ballonnet (and gas cell) is under slight super-pressure. The ballonnet pressure is limited by the pressure relief valve at the bottom apex and is set to 14mm (1.57") WG. Adjacent to the pressure relief valve is a 24V electric fan which pressurises the ballonnet.

The exterior skin of the envelope is made from uniform material, but the bladder, which is lowly stressed, is made from a lighter material.

The envelope is fitted with two sealed Monsun valves for Helium inflation. These valves may also be used for purging of the Helium. A top-up hose is also provided. This runs up the side of the envelope and enters the Helium cell just above the bladder joint.

The Helium valve which is electrically operated is located at the top apex. The Helium and air control systems are shown diagrammatically in Fig 5.2.

Next to the Helium valve is an anemometer, a position light and an anti-collision light. The lights are duplicated at the bottom of the gondola.

### **1.3 The Net**

The net restrains the entire lifting force and is terminated at the top into a circular stainless steel load ring and at the bottom into eight stainless steel wire strops. The net material is polyester and the entire net is anti-u.v. treated after manufacture.

The metal parts of the net are manufactured from corrosion resistant steel and require no maintenance. Assessment of accident damage to metal parts must be carried out by Lindstrand Technologies Ltd staff.

### **1.4 The Gondola**

The gondola is a stainless steel space frame in the shape of an octagon. It is built in sections, which are joined by a bolt pattern for ease of transportation. The gondola floor is made of high grade marine plywood which is screwed on to the floor box section. The outer panels of the gondola are made from wicker in order to give the gondola its traditional look. The inside panels are made from PVC to minimise maintenance.

The upper half of the walkway is covered by a safety net to stop objects falling from the gondola. There are two doors, both opening inwards for easy loading of passengers. An instrument console is located at the operators' station. The gondola layout is shown in Fig 5.3.

### **1.5 Load Ring and attachments to Gondola and Winch**

The load ring is constructed from tubular stainless steel with eight equally spaced attachment points. It acts as a junction for all three major system components. The net transfers all the lift generated by the balloon into the upper side of the load ring. The gondola is suspended from the lower outer side of the ring and the main winch cable is attached to the lower inner side of the ring via eight steel wires which converge to a single point situated in the clear central area of the gondola.

The wires terminate onto two master links, which are looped onto a load cell shackle.

A swivel joint connects the winch cable termination to the load measuring shackle pin, which connects to the free lift readout on the control panel.

The swivel prevents balloon rotation from twisting the winch cable.

### **1.6 The Instrument Console**

The instrument console contains all control functions for the balloon and displays the following parameters: helium temperature, air temperature, Helium pressure, ballonnet pressure, wind speed, battery voltage, cable tension (load cell reading/free lift).

The Helium temperature probe is located below the Helium valve and during daylight hours it is possible for the Helium temperature to increase to 15°C (59°F) above ambient.

The Helium pressure tapping is located on the Helium valve plate. The pressure settings and limitations to which the balloon is operated are based upon the maximum static pressure.

Ballonnet pressure, tapped at the bottom of the envelope, is also displayed on a gauge. The gauge has a manually adjustable limit, which sets the pressure at which the fan trips in.

The wind speed anemometer is located at the top apex of the envelope in order to measure and record wind speeds. The information is transmitted to the console and displayed in knots or meters/ second.

Battery voltage is displayed on the voltmeter.

Winch cable tension (which translates into free lift) is measured through a load cell located between the tether cable and the swivel. This value is important in order to monitor Helium loss and available free lift, which can be the limiting factor when flying in high wind.

The following warning lights are fitted to the console:

Helium valve	-	open
doors	-	open & unlocked
envelope pressure	-	high

The following switching functions are fitted:

Helium valve	-	manual/automatic
Helium manual control	-	open/off/close
fan	-	on/off/automatic
panel lights	-	on/off
lights nav	-	on/off
lights strobe	-	on/off
security switch	-	lock/unlock

The control panel is shown in Fig 5.4.

The instrument console is subjected to the weather and like all electrics must be kept dry in order to work properly.

## 1.7 **Dimensions and Drawings**

The main dimensions of envelope are shown on Figure 5.1.

For detailed dimensions and information, consult Lindstrand Technologies for the appropriate drawing.

## 2. **PERIODIC INSPECTIONS**

*Caution: It is the responsibility of the operator to inspect and maintain the balloon as stipulated in this manual, consulting and involving the manufacturer as necessary.*

### 2.1 **Technical Log**

All monthly and annual inspections, envelope tear off coupon test results, net cord test results and all defects and rectifications are to be entered in the Technical Log.

**The Lindstrand Technologies Ltd warranty is only valid if the above inspections, maintenance and Technical Log entries are completed and if the Log is made available to Lindstrand Technologies Engineers on request.**

## 2.2 Daily Inspection / Maintenance

The results of each daily inspection shall be recorded on the daily balloon inspection form. Refer to Flight Manual (TAOM) Appendix 2, sheet A2-4 for the template form.

### 2.2.1 Structural Inspection

Structural inspection of the balloon and gondola.

#### 2.2.1.1 Balloon (use 7 x 50 binoculars)

- |                    |   |                                     |
|--------------------|---|-------------------------------------|
| Envelope           | - | No damage                           |
|                    | - | No distortion                       |
| Net & rigging      | - | Net centred on envelope             |
|                    | - | Not distorted                       |
|                    | - | No broken strands                   |
|                    | - | No frayed bridles                   |
| Helium top up tube | - | Not damaged and secured to envelope |

#### 2.2.1.2 Rigging

- |                   |   |   |
|-------------------|---|---|
| Load ring         | - | No distortion, lugs and fasteners secure  |
| Load ring rigging | - | No frayed wires or damaged ferrules, terminations and thimbles intact.                                |
| Eye bolts         | - | In place with nuts and split pins secured   |
| Load cell shackle | - | Attachments to master links and swivel secure, load cell lead connected and readout on control panel. |

#### 2.2.1.3 Gondola

- |                                    |   |                                       |
|------------------------------------|---|---------------------------------------|
| Frame & hand rails                 | - | check for cracks, distortion, damage  |
| Lugs (gondola / cable attachments) | - | check condition                       |
|                                    | - | check welds for cracks                |
| Doors                              | - | check for distortion, latch operation |
| Wicker                             | - | check condition                       |
| PVC Panels                         | - | check condition                       |
|                                    | - | no cuts                               |
|                                    | - | no loose eyelets                      |
|                                    | - | lacing intact                         |
| Safety nets                        | - | no broken strands                     |
|                                    | - | lacing intact                         |
| Floorboards                        | - | secured                               |
|                                    | - | check condition                       |
| Lights                             | - | operational                           |

- Start winch and raise gondola approx 1.5m (5 ft).
- Stop ascent
- Underfloor structure - check for cracks, distortion, damage
- Floorboard - check condition
- Bump stops - intact
- Lower gondola to platform
- Switch off winch

If the inspection reveals any cracks, distortion or damage, operations should be suspended and Lindstrand Technologies Ltd (LTL) informed of the problem. Operations shall not resume until LTL have evaluated the extent of the problem, provided a repair solution and the problem has been resolved.

### 2.2.2 Winch Inspection

See: Operations Manual Ref. LTL TAOM Appendix 2 LTL-TA3

### 2.2.3. Control Panel Checks

Battery charger - Switched off and disconnect the lead from the battery box.

#### 2.2.3.1 Battery Pack

- secured in place in the gondola
- control lead connected
- sufficiently charged

#### 2.2.3.2 Helium Valve

- Helium valve switch set to automatic
- Manual control switch in closed position
- Pressure limits correctly set (warning 38 mmWG, open 40 mm WG)

#### 2.2.3.3 Ballonet Fan

- Fan switch set to automatic
- Pressure limits correctly set (on 6 mm WG, off 8 mm WG)

#### 2.2.3.4 Circuit Breakers

- All in, no malfunctions

#### 2.2.3.5 Monitoring Instruments

- Temperature indicators, wind speed and load cell read outs all working.

#### 2.2.3.6 Connectors

- All connectors firmly in place.

### 2.2.4 Technical Log Record

The following data must be recorded in the Technical Log daily.

#### 2.2.4.1 Wind Speed

- Peak wind speed is used to establish the maximum passenger load. See Operations Manual Appendix 3.

#### 2.2.4.2 Temperature

- ambient
- Helium

#### 2.2.4.3 Pressure

- barometric
- Helium
- ballonnet

#### 2.2.4.4 Free Lift

- unladen
- elevated

#### 2.2.4.5 Helium Top Up

Free lift before and after fill.

### 2.2.5 Function Checks

#### 2.2.5.1

- |                         |   |  |
|-------------------------|---|--|
| Fan auto                | - | Ensure switch is set to automatic          |
| Fan operates            | - | Ensure flap valve closes when fan cuts out |
| Envelope fully inflated | - | visual check                               |

#### 2.2.5.2

- |                       |   |  |
|-----------------------|---|--|
| Fan                   | - | switch to 'manual',  |
| Monitor pressure      | - | confirm opens between 12 and 15 mm WG (or local site equivalent) |
| Pressure relief valve | - |  |
| Fan                   | - | switch to auto   |

#### 2.2.5.3 Anti Collision Lights

- |                 |   |                              |
|-----------------|---|------------------------------|
| Strobe 'on'     | - | confirm illuminated visually |
| Navigation 'on' | - | confirm illuminated visually |

#### 2.2.5.4 Doors

- |                                     |                   |
|-------------------------------------|-------------------|
| - open - red light on               |                   |
| - closed, latch }<br>and overlock } | warning light off |

### 2.3 Monthly Inspection / Maintenance

The results of each daily inspection shall be recorded on the daily balloon inspection form. Refer to Flight Manual (TAOM) Appendix 2, sheet A2-8 for the template form.

### 2.3.1 Access Envelope Crown

The top of the balloon when moored is 36.1m (118.4 ft) above the ground; the equator is 22.28m (73 ft). To gain access to the top of the balloon, as a minimum a cherry picker type mobile lift is required to position a man as high as possible. If necessary a man can climb over the envelope. Ensure that his clothing has no sharp objects (e.g. tools sticking out of pockets), no abrasive surfaces and he is wearing soft shoes. A safety harness with two latching lines must be worn, and at least one latching line connected to the net at all times.

### 2.3.2 Envelope Inspection

In addition to the items in 2.2 Daily Inspection, each calendar month carry out a thorough inspection as follows:

#### **2.3.2.1 Envelope washing**

The envelope, net, crown ring, and banners must be thoroughly washed to remove dirt and pollution, and prevent fungal growth, which will degrade the fabric and ropes and shorten their life.

Cleaning Solution:

The recommended solution is: Lindstrand Envelope Detergent No 1  
Dilute with 50 ml of detergent to 5 litres water.

Do NOT use detergent neat

No other detergents, cleaning agents, or chemical additives may be used without the written consent of Lindstrand Technologies Ltd

Other detergents may severely degrade the fabric and ropes

If in doubt use clean water only

#### Washing Procedure

Wash the envelope and net down from the crown, with the cleaning solution.

The solution should be 'worked in' around the net with a clean soft brush.

Rinse the solution off thoroughly with a gentle spray of clean water

Inspect the envelope fabric, net ropes, and electrical umbilical cord for abrasion, and damage.

#### **2.3.2.2 Helium Fill Tube**

Inspect for condition, security of joint to envelope and of attachment to bridle.

### 2.3.2.3 Crown Assembly

Clean all components

Wiring	-	Inspect for condition and security of connections
Anemometer	-	Inspect for damage; security and free rotation of head, confirm operation
Lightning Conductor	-	Inspect for security
Position and Anti-Collision Lights	-	inspect for damage and security, confirm operation
Helium Valve	-	inspect externally for damage and security
	-	leak test with fluid

### 2.3.2.4 Ballonet Valve and Fan

Clean valve externally, clean fan blades and duct. Inspect both components and wiring for damage and security. During control functioning tests, confirm satisfactory opening and closing of ballonet valve. Check valve seal for security and condition. Confirm satisfactory opening and closing of fan duct flap valve. See Sections 4.5 and 4.6.

### 2.3.2.5 Bridles

Inspect full length of each bridle from net to loading. Specifically check the net terminations into the 8 thimbles for security of the thimbles and condition of the bridle splices.

### 2.3.2.6 Gondola

Wash and rinse off the gondola, but use only clean water on the wicker panels if fitted. Inspect the wicker work or PVC panels for condition, and the lacquer for cracks. Touch up with varnish on the wicker where necessary.

Raise gondola 2 metres (6.5 ft); inspect underside for tubular structure and floorboard damage.

*\* Lindstrand Technologies Envelope Cleaner N° 1 is recommended.*

### 2.3.2.7 Load Cell

The balloon must be securely low moored before load cell is removed. To remove the loadcell for replacement, maintenance or recalibration to balloon must be secured to the winch frame by a certified load sling, rated at 5 tonnes

*Note: Due to the weight of the swivel and cable, the load cell is still carrying a load of approximately 0.02 tonne.*

If readout is within zero to 0.05 tonne, reset to indicate 0.02 tonne. Reconnect balloon to winch cable. If load cell readout exceeds 0.05 tonne, recalibrate. See Section 3.6.

### 2.3.2.8 Winch System

Inspect and service as specified in the winch maintenance instructions.

## 2.4 Six Monthly Inspection / Maintenance – TAOM Appendix 2 LTL-TA6

The results of each daily inspection shall be recorded on the daily balloon inspection form. Refer to Flight Manual (TAOM) Appendix 2, sheet A2-9 for the template form.

Carry out all items covered by 2.3 Monthly Inspection/Maintenance.

### 2.4.1 Envelope Fabric Test

#### CERTIFICATION MAINTENANCE REQUIREMENT

Remove two envelope test pieces, one plain and one seamed piece. Note this in the maintenance log and send the pieces to Lindstrand Technologies Ltd. See Sections 3.1 and 3.2.

### 2.4.2 Net Sample Test

#### CERTIFICATION MAINTENANCE REQUIREMENT

Remove a test piece from the net and send same to Lindstrand Technologies. Note the result in the Technical Log. See Section 3.3.

### 2.4.3 Helium Valve Operation Check

Confirm observer in position at top of balloon by radio.

Select manual control.

Lift switch to open position.

Check that red light comes on.

Immediately, move the switch to the close position. Check the red light goes out.

See Section 4.7 TAOM MM.

### 2.4.4 Gondola Maintenance

Clean the wickerwork (if fitted) with water and a brush using no detergent. Allow it to dry in the open air for 24 hours. Thereafter varnish from both sides using a good quality single pot polyurethane lacquer.

### 2.4.5 Battery Check

Carry out a capacity test on the gondola batteries. If result is less than 75%, renew batteries.

## **2.5 Annual Servicing**

An annual service is conducted on all systems after month 12. Please contact Lindstrand Technologies Ltd for further information.

## **3. SPECIFIC INSTRUCTIONS**

### **3.1 Tensile Test of Envelope Fabric and Weld Strength**

The envelope fabric will slowly degrade in tensile and tear strength due to UV radiation and the presence of certain airborne chemicals created by pollution. The degree which the fabric will degrade depends on where the balloon is operated. Consequently it is imperative to monitor fabric health by removing test panels from the envelope and performing a tensile test. These test panels are stuck on the envelope at the top of the balloon.

They consist of:

Base material tensile and porosity test panels.

12 off 105 x 21cm (41.3 x 8.3") panel from each of which a tensile test piece and a porosity test piece can be cut.

Weld tensile test panels.

12 off 105 x 21cm (41.3 x 8.3") welded panels. The panel is welded lengthwise along the centre line.

At the end of each 6 months in service, one complete base material test panel and one complete welded test panel should be cut carefully off the envelope, rolled up and sent to Lindstrand Technologies Ltd, where they are tested and the results compared to control test pieces from the same batch of material.

The normal tensile test carried out is a 2" strip test. The test value must be noted in the Technical Log.

**If the tensile strength of the envelope fabric drops below 80 kgf/50 mm, the envelope shall be withdrawn from service. (This is a Certification Maintenance Requirement)**

### **3.2 Porosity test of envelope fabric**

Provision is made to check a test panel for porosity each 6 months in service. This can be done after a shorter period, but it must be borne in mind that when all 12 test panels have been used the envelope life cannot be extended as there remains no means of monitoring condition.

### **3.3 Tensile Test of Net**

There are 12 x 2.44m (8 ft) lengths of BG5188 net cord tied to the equator area. After each 6 months in service untie one cord and return it to LTL who will carry out a tensile test and notify the customer. This tensile test must be carried out by LTL as it requires special jaws to hold the test sample or an erroneous reading may occur.

If the tensile strength of the net braid drops below 309 Kg, the net shall be withdrawn from service. (This is a Certification Maintenance Requirement)

### **3.4 Hard Landing Inspection**

A hard landing is where severe wind or mechanical circumstances caused the gondola to impact heavily on the landing platform. First inspect for obvious signs of damage such as the rubber bump stops, landing lights, door mechanism etc.

If there are signs of mechanical damage check that the gondola is true and not distorted, if so consult the manufacturer. Check welds for cracks, particularly suspension eyes. See Section 4.3.

Check the electrical system for proper functioning and run through all functions on the control panel.

### **3.5 Suspected Envelope Penetrations**

The most common envelope penetration is bullet holes. The leak from a bullet hole is not immediately detectable and it could take several days before the loss of helium gets noted. If the hole is in the helium cell, it is easily patched.

If the hole has penetrated the ballonnet, open the flap for access to the ballonnet for repair. Leave the flap open and the ballonnet fan on to circulate fresh air.

Ensure there is a second operator outside the entry to the ballonnet to monitor the repair man.

For patching, see Section 4.1.

### **3.6 Load Cell**

Wait for calm conditions

Ensure the balloon is securely low moored.

To remove the load cell for replacement, maintenance or re-calibration you can

- a) connect the balloon directly to the winch cable.
- b) secure the balloon to the winch frame by a certified load sling, rated at 5 tonnes.

Fit a 10 tonne shackle through the two master links.

Fit a 10 tonne shackle to the winch frame. Pass the sling through the shackle on the winch frame then loop it back to the top shackle, thereby doubling the strap to provide equivalent to 10 tonne (22000 lbs) capacity.

Remove the load cell shackle for calibration or replacement.

This sequence is reversed to reconnect the balloon to the winch cable via the load

If it is necessary to re-calibrate the load cell, this can be done by connecting a second load cell or weigh scale of known calibration in series with the cell under test. Then by progressively winching up to impose incremental load increases on both load cells, their readouts can be directly compared.

Alternatively the load cell can be re-calibrated by Lindstrand Technologies Ltd.

#### **4. MAINTENANCE AND REPAIR PROCEDURES**

##### **4.1 Envelope Repair Patches**

###### **Patch Application**

Patch – cut from envelope fabric of PU coated PVC

Cut patch with 50 mm margin around fault and radius corners

Mix and apply adhesive as per Process Specification PS036.

Apply patch with hand pressure working out from centre

Sealing cover – cut from self adhesives vinyl sheet

Allow 10mm overlap around patch

Peel off backing and apply over patch

##### **4.2 Net Repair**

The net carries the entire structural load and is therefore highly stressed and extreme care must be exercised not to alter any dimensions while carrying out net repairs. The net is fabricated from hollow polyester cord and the preferred repair method is as recommended by the net manufacturer. This is a very specialised technique and always consult LBL before any repair work. Always keep the net clean in order to be able to observe visual deterioration.

#### **4.3 Repair of Structural Damage to Gondola**

The gondola is manufactured from hollow section stainless steel type AISA 304. The welding method is TIG (tungsten-inert-gas) and the welding filler wire is the same as the base material i.e. AISA 316 can also be used. The welding must be carried out by the equivalent of CAA approved welders. Always consult the manufacturer before undertaking any welding, as the structure may be degraded by unapproved action. See Section 2.3.2.1

#### **4.4 Helium Purity Test**

Helium purity is directly related to gross lift. Any reduction in purity will result in a comparative loss of lift. Due to the fact that Helium does not stratify the test sample can be drawn from anywhere in the envelope. The Monson valve fill port is one of the places to test purity. The test method is based on comparative testing between a known purity of Helium (such as from a fresh helium storage bottle) and from the sample drawn from the envelope. Most Helium testers work on the same principle but always check the manufacturer's instructions. Helium purity is a good sign of envelope condition and always note the result in the Technical Log.

#### **4.5 Ballonet Fan**

The ballonet fan is a 24VDC unit operated either automatically or manually from the instrument console. The fan is in almost constant use and sucks unfiltered air and is therefore subjected to blockage and wear and tear from foreign object damage (FOD). The fan is a straight DC motor with carbon brushes and these need replacement on condition but typically every 12 months. Replacement of the fan unit is straightforward and involves low mooring the balloon and then removing the bolt pattern and electrical socket.

#### **4.6 Ballonet Pressure Relief Valve**

The ballonet pressure relief valve is purely electrical/ mechanical and is preset to open at 14mm (1.57") WG. The cracking (opening) pressure can be adjusted should it drift out of tolerance. There is a spring tension adjustment screw at the inside peak of the valve tower and clockwise operation will increase cracking pressure and vice versa. Do not increase pressure above 14mm (0.55") WG.

#### **4.7 Helium Valve**

The Helium valve is located at the very top apex of the envelope and due to its remote location it is electrically operated and controlled manually or automatically from the instrument console. The valve has a 24 VDC linear actuator of heavy duty design. If malfunction occurs first check the wiring and switch gear rather than the actuator as the most likely source of trouble. If the actuator is at fault, fit a replacement unit.

#### **4.8 Helium Top Up Hose**



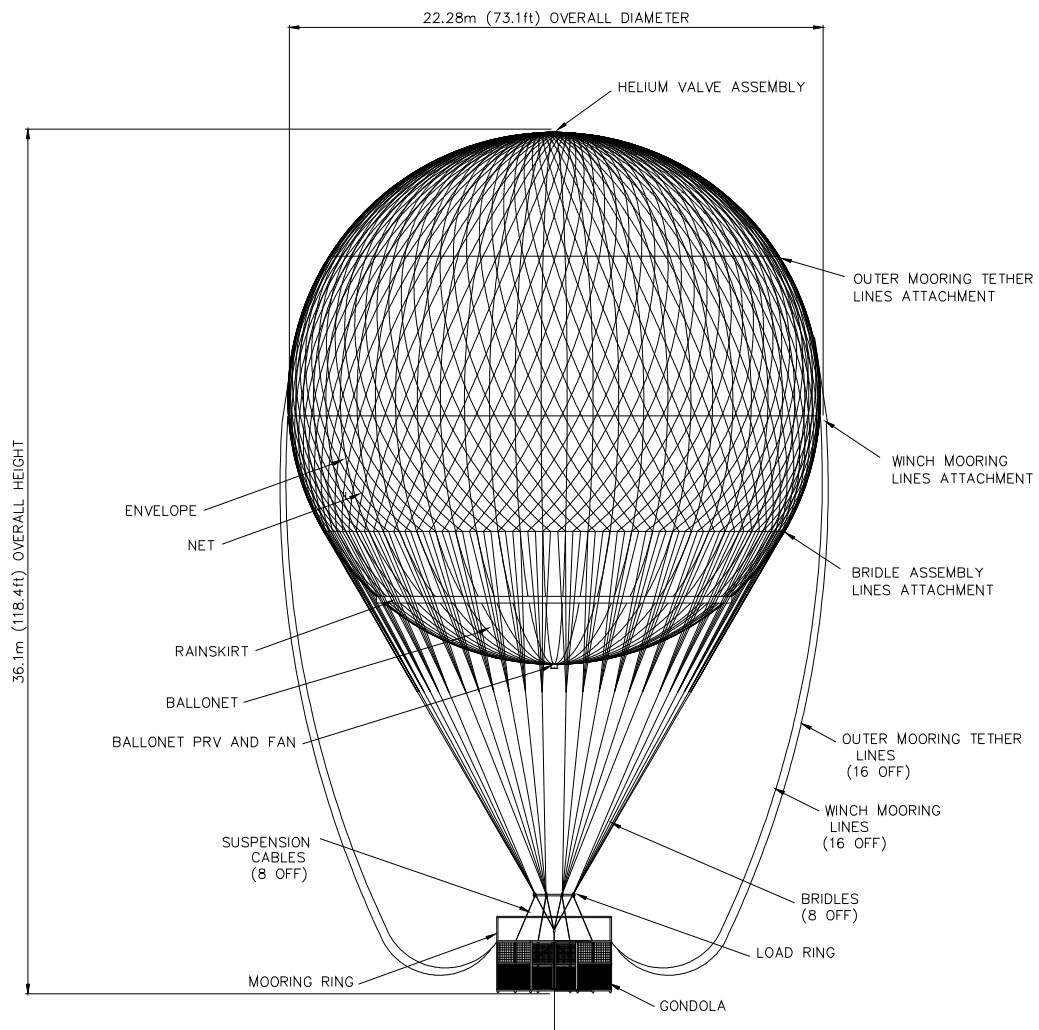
The Helium top up hose is used to top up Helium loss as this has a one-way valve fitted inside the envelope. The integrity of the fill hose is very important as any damage results in helium loss. If damaged, it should be replaced.

#### **4.9 Electrical System and Wiring Diagram**

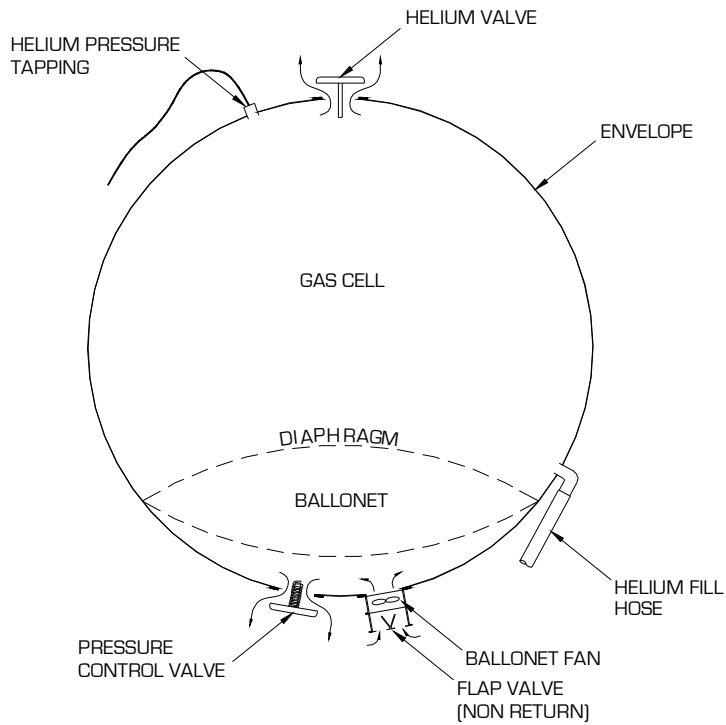
The electrical system is a typical 24 VDC negative earth system using rechargeable batteries. The batteries are charged externally and if the battery pack runs down during operations change the whole pack as there are no means of charging the battery pack during flight operations. Fault finding in the electrical system can be carried out by a qualified electrician in possession of the complete wiring diagram and this manual.

#### **4.10 Instrument Console**

The electrical components used inside the instrument console are straightforward and require no maintenance except keeping it dry and if water has entered the console dry everything and leave a few sachets of silica gel at the bottom of the instrument box. Should any component require replacing, these can be supplied from Lindstrand Technologies Ltd.

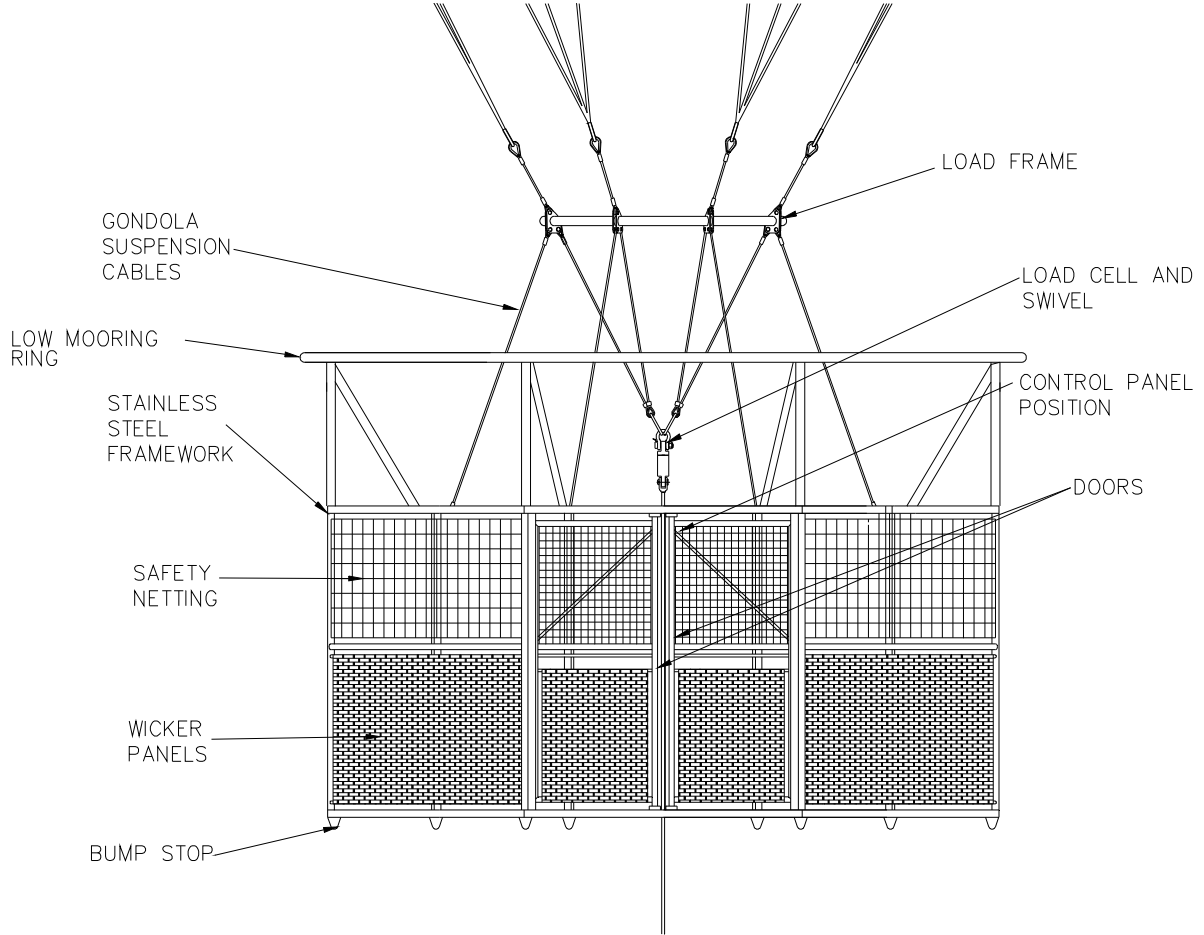


**Figure 5.1 – HiFlyer Layout**



BALLOON CONTROL SYSTEMS

**Fig. 5.2 – Balloon Control Systems**



**Figure 5.3 – Gondola Layout**

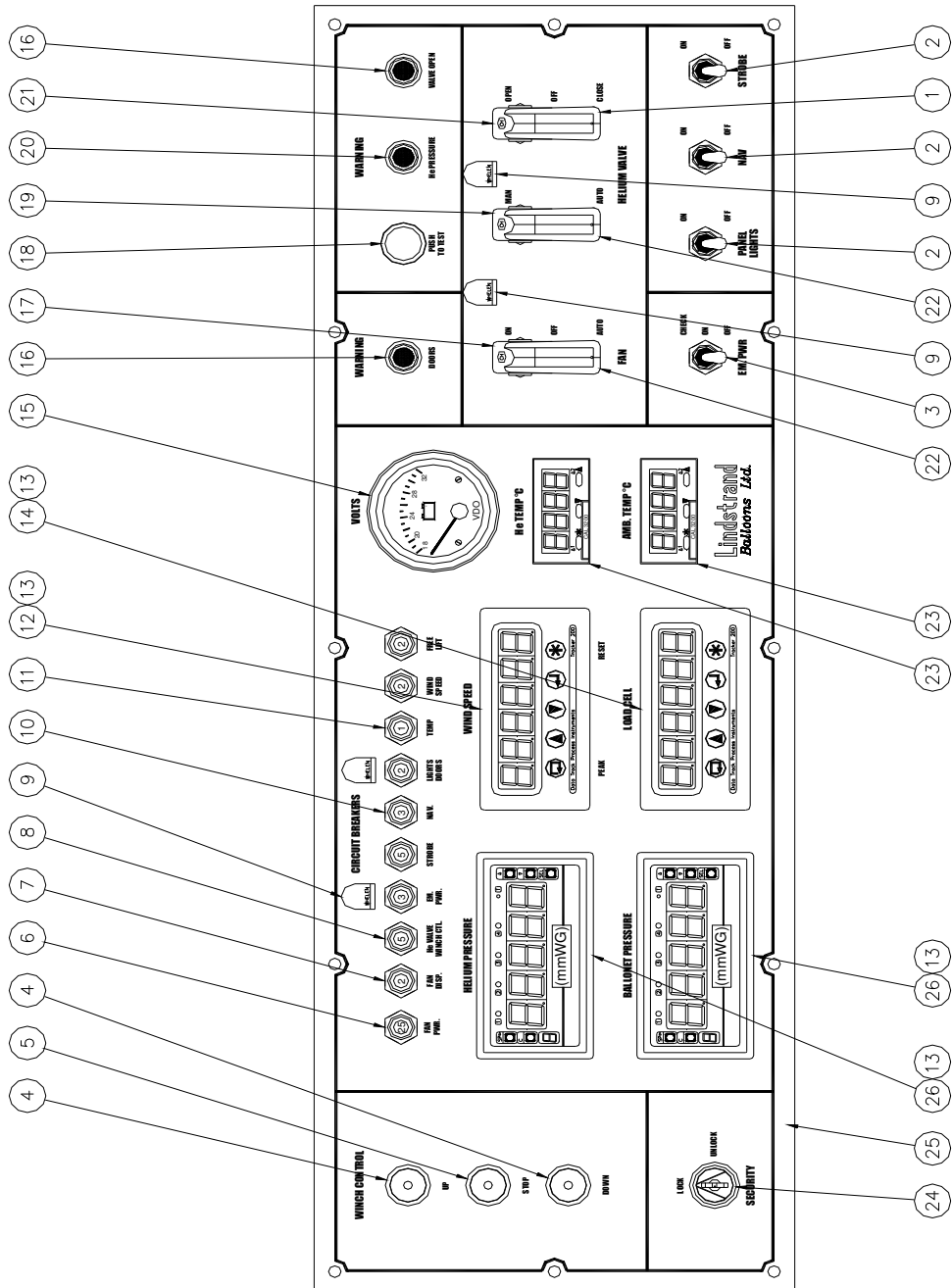


Figure 5.4 – Control Box – Instrument Panel