# Flight Manual

# Hotair-Airship AS 105 GD

# Version GD/4 and GD/6


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**This Flight Manual is EASA approved under the Approval Number: 10029984**
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**This Flight Manual is issued for the Hotair-Airship**

**Registration:** **SN Envelope: H-** **SN Gondola: G-**

This is to confirm, that this Flight Manual for the above mentioned Hotair-Airship is a legal document. It is written in accordance with the actual build standard and this build standard complies with the Certificate of Airworthiness. This Flight Manual has to be on board at all times.

This Manual is valid for the following serial numbers: Envelope: SN 0050, SN 0056 and subsequent numbers; Gondola: SN 0025, SN 0027 and subsequent numbers. As well valid for previous serial numbers, if the Technical Note EASA.AS.002-14 is implemented.

The gondola type plate (manufactured from fire proof material) is attached to the firewall above the engine. A second plate is attached to the envelope in front of the keel opening (gondola position).

The regulations, accident prevention instructions and guidelines i.e. rules relevant for the operation of pressurised gas cylinders and liquid gas devices are to be obeyed in conjunction with the instructions of this Flight- and the Maintenance Manual.

Furthermore, relevant regulations independent from the aviation sector concerning refilling procedures of pressurised gases have to be obeyed.

The Hotair-Airship shall only be operated in accordance with the instructions and defined operational limitations of this Flight Manual and the Maintenance Manual.

Following definitions apply to warnings, cautions and notes used in this Flight Manual:

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

**CAUTION** means that the non-observation of the corresponding procedure leads to a minor or to a more or less long term degradation of flight safety.

**NOTE** draws the attention to any special item not directly related to safety but which is important or unusual.

On behalf of GEFA-FLUG GmbH

Karl Ludwig Busemeyer

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| 1 | 1.1 | Chapter 1.1<br>Page 2 and 3 | Chapter 1.1<br>Page 2 and 3 | 01.02.2013 |
| | 1.2.3 | Chapter 1<br>Page 6 | Chapter 1<br>Page 6 | |
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| | 1.7.1<br>1.7.2<br>1.7.3 | Chapter 1<br>Page 17, 18 | Chapter 1<br>Page 17, 18 | |
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| 3 | Chapter 0 | Page 1 - 6 | Page 1 - 6 | 28.04.2014 |
| 4 | Chapter 2.13 | Page 1 - 12 | Page 1 - 12 | 04.11.2014 |
| 5 | Appendix 2 | Issue 1 Rev. 4<br>04.11.14 | Issue 1 Rev. 5<br>04.06.15 | 04.06.2015 |
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## B: Abbreviations

| **Abkürzung** | |
|---|---|
| **Abbreviation** | |
| AD/LTA | Luftfahrttechnische Anweisung (LTA) |
| | Airworthiness Directive |
| AdL | Aufrechterhaltung der Lufttüchtigkeit |
| | Airworthiness Management |
| APO/PO | Genehmigter Herstellungsbetrieb |
| | Approved Production Organisation |
| ARS | Personal zur Prüfung der Lufttüchtigkeit |
| | Airworthiness Review Staff |
| ARC | Bescheinigung über die Prüfung der Lufttüchtigkeit |
| | Airworthiness Review Certificate |
| CAA | Zivile Luftfahrtbehörde von Großbritannien |
| | Civil Aviation Authority United Kingdom |
| CAME/CAMO | Handddbuch/Unternehmen zur Führung und Aufrechterhaltung der Lufttüchtigkeit |
| | Continuing Airworthiness Management Exposition/Organisation |
| CS | Freigabeberechtigtes Personal |
| | Certifying Staff |
| CofA | Lufttüchtigkeitszeugnis |
| | Certificate of Airworthiness |
| EASA | Europäische Agentur für Flugsicherheit |
| | European Aviation Safety Agency |
| DO | Entwicklungsbetrieb |
| | Design Organisation |
| LBA | Luftfahrt-Bundesamt |
| | |
| MEL | Mindestausrüstungsliste |
| | Minimum Equipment List |
| MOM/MO | Instandhaltungshandbuch/Instandhaltungsbetrieb |
| | Maintenance Organisation Manual/Maintenance Organisation |
| MTOW | Höchstabfluggewicht |
| | Maximum Take Off Weight |
| rpm | Umdrehungen pro Minute |
| | Revolution per minute |
| QM | Qualitätsmanagement |
| | Quality Management |
| SoC | Übereinstimmungsbescheinigung für Luftfahrzeuge |
| | Aircraft Statement of Conformity |
| SLL | Laufzeitbegrenzte Teile |
| | Service Life Limit |
| SSU | Seitenruder Steuerkraft Unterstützung |
| | Side Rudder Steering Power Assistant |
| TC | Kennblatt |
| | Type Certificate |

# 1 Technical Description

## 1.1 Envelope

The aerodynamic envelope is manufactured using construction methods and materials established in the Hotair-Balloon Industry. The envelope is entirely made of coated nylon fabric.

The envelope has circumferential rip-stopping loadtapes spread along the entire length of the envelope. The envelope hull forms an enclosed structure apart from a small aperture in the keel, above the pilot's seat, and the pressure relief valves. The keel opening is closed by a sliding plexiglas panel on the roof of the gondola. The pressure relief valves are closed by fabric panels so that the envelope forms a fully closed body.

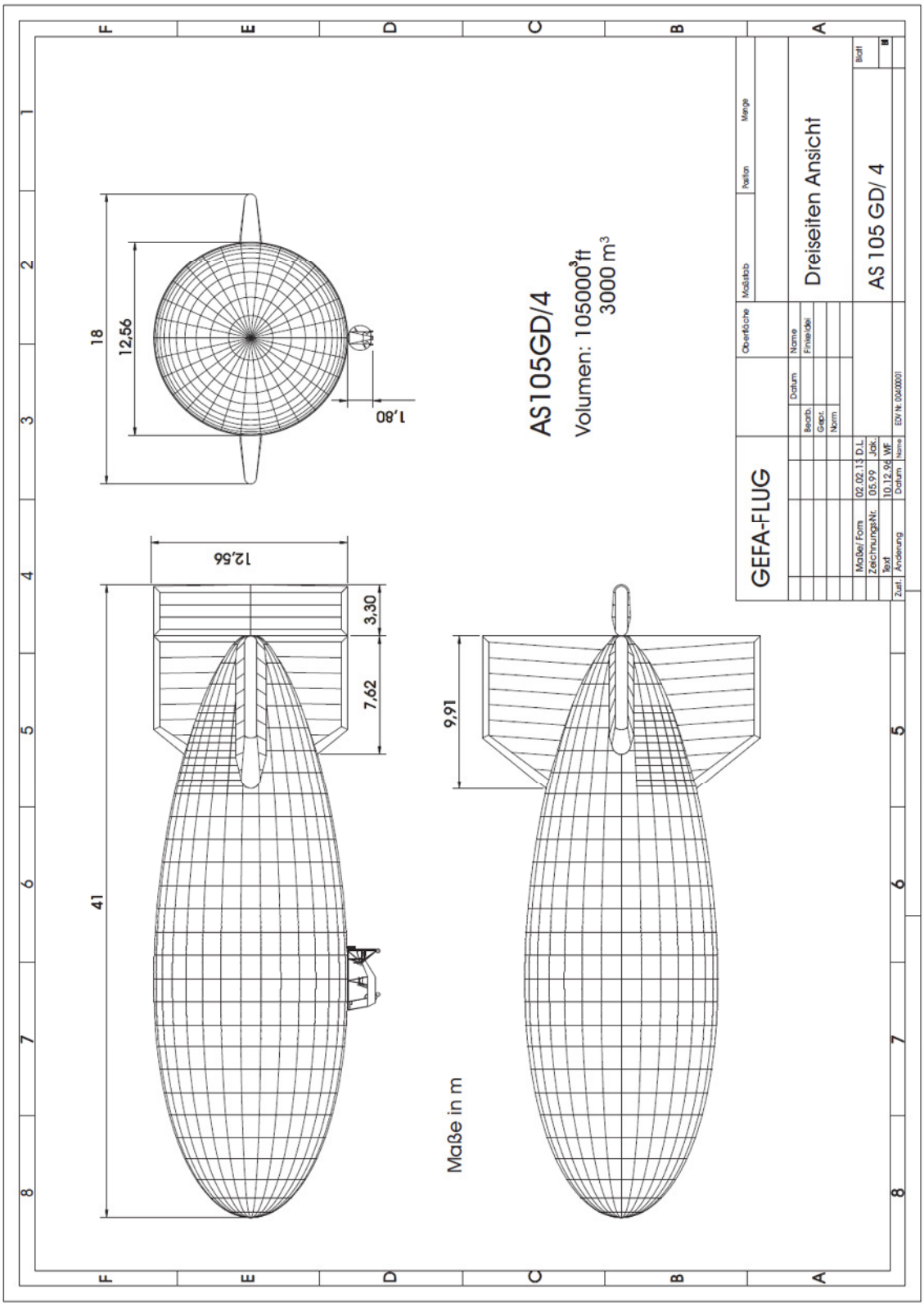
The empennage consists of two horizontal and two vertical fins which are in cruciform configuration. The empennage is inflated by the propeller slipstream via a scoop positioned directly behind the engine. The rudder is operated by control lines. The rudder deflection is 45° in both directions.

Placed in the upper part of the envelope (amidship) there is a light fabric membrane to damp the movement of air masses during climb or descent.

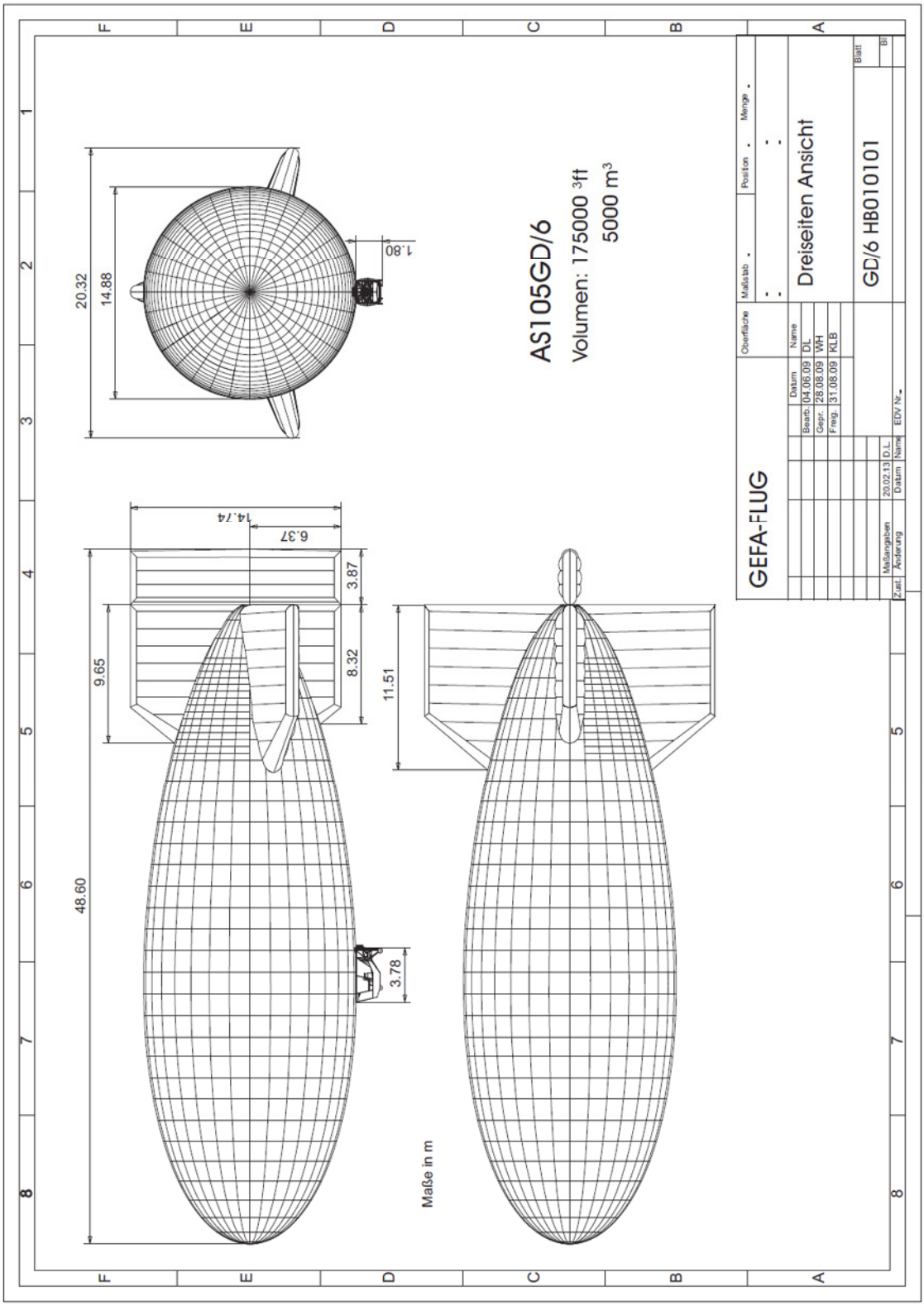
The gondola is suspended by the envelope on four hook-up points. The gondola forces are evenly transmitted into the envelope skin by two catenary curtains. A secondary suspension system (snaphooks) sewn to the envelope is connected to the upper gondola frame during assembly.

For fast deflation the envelope is fitted with a manually operated rip panel at the tail part (via a red line). The rip panel is situated between the upper vertical tail fin and the left horizontal tail fin.

**WARNING: Once opened, the rip panel can not be reclosed. Therefore it is only to be used after final landing.**



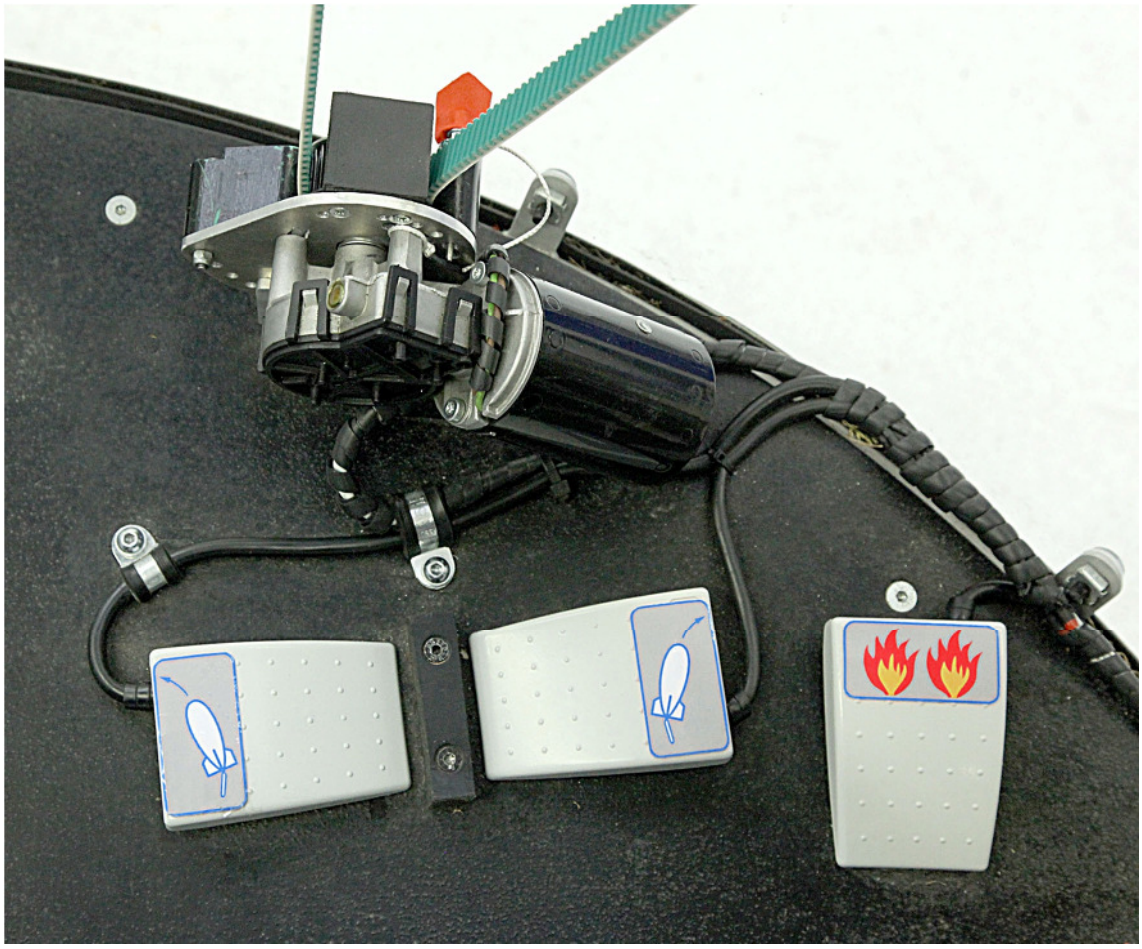

*Three angle view envelope AS 105 GD/4*




*Three angle view envelope AS 105 GD/6*

### 1.1.1 Side Rudder Steering Power Assistant (SSU)

To reduce pilot work load the airship can be fitted with an optional side rudder steering power assistant (SSU). This unit is operated by two footswitches (with placards) on the gondola floor in front of the pilot. To activate or deactivate the SSU the toggleswitch “Footswitches” (panel switchboard) has to be pushed forward or backward. In case of malfunction the SSU can be mechanically detached by pulling the red flagged safety-pin and removing the gear belt. The side rudder can then be operated as usual by pulling manually.



*SSU and operating footswitches*

| | |
|---|---|
| **SSU** | |
| Left footswitch (placard) | Steering to the left |
| Middle footswitch (placard) | Steering to the right |
| **Burner Control** | |
| Right footswitch (flamesymbols) | Operates both standard burners |

## 1.2 Gondola

### 1.2.1 Gondola Construction

The gondola consists of a tubular space frame manufactured from aerospace grade steel tubing. It has two rows of seats, set in a tandem configuration. The right front seat is reserved for the pilot.

The front of the gondola is covered by a Plexiglas windshield. The lower parts of the sides are also covered by Plexiglas panels.

**NOTE: The gondola versions GD/4 and GD/6 are not interchangeable.**

The roof of the gondola is closed above the front row of seats and has a hatch above the pilot. This hatch is closed by a sliding Plexiglas panel which seals the envelope. Through the Plexiglas sheet the inside of the envelope and the burner assembly can be seen.

The doubleburner is mounted on top of the upper frame on the front of the gondola and can be rotated to the right (in flight direction) for inflation. The burner will fold down inside the gondola for transport. The burner can be reached during flight by sliding the Plexiglas panel backwards.

Above the cockpit, below the burner, an electric pressurisation fan system is mounted. It delivers fresh air to the burner and helps to establish the envelope pressure.

The propane cylinders are fastened to the gondola frame behind the front seats with straps. Additional 20 kg propane cylinders can be placed onto the passenger floor to prolong the operating time of the airship (see Appendix 5).

The propulsion engine is mounted in the space frame behind the rear seats. The fuel tank is positioned below the rear seats, separated by a firewall.

The weight, torque and thrust loads from the gondola are transmitted into the envelope via four hook-up points on the top frame of the gondola. A secondary suspension system is formed by snaphooks as mentioned above. Landing forces are absorbed by four pneumatic tyres.

### 1.2.2 Propulsion and Pressurisation

Forward propulsion is provided by a ROTAX 582 twin cylinder, two stroke, liquid cooled engine. It drives a fixed pitch propeller via a gearbox. A tubular aluminium propeller guard protects the propeller arc from accidental contact with foreign objects or persons.

An alternator mounted to the propulsion engine produces the electricity needed to run all electric instruments and to drive the electric fan system. Together with the propeller slipstream (via the metal scoop), it supplies the necessary airflow needed to sufficiently pressurise the envelope and to provide oxygen supply for the burner.

The metal scoop has two functions: it deflects air into the envelope for pressurisation and supplies air into the tail empennage to ensure pressure and stability of the fins.

Two fabric pressure relief valves on the belly of the envelope (bow and stern) automatically regulate the internal envelope pressure.

### 1.2.3 Burner Types (GD/4 and GD/6)

#### 1.2.3.1 General configuration

There are two burner types. Both are build in a V-configuration with two burner cans. Each burner can is fitted out with a Standard Burner, a pilot light and a solenoid valve operated by a push button (burner control box) to the right of the instrument panel. Both Standard Burners can be operated individually or simultaneously. In steady flight conditions both Standard Burners can also be used parallel by a foot-switch. Propane supply is controlled by manually operated valves (between pilot´s legs). A propane pressure gauge is positioned on the burner unit in pilot´s view.

If one or more of the solenoid valves fail to work the burners can be operated manually via manual valves between pilots legs. (A functional diagram of the burner types and the propane management is laid down in Appendix 3a-3d.)

#### 1.2.3.2 Fourseat Airship Burner (GD/4)

The fourseat airship is equipped with two Standard Burners. Both are operated individually or simultaneously (see 1.2.3.1).

#### 1.2.3.3 Fourseat Airship Burner (GD/4) with “Liquid Fire”

The fourseat airship can be optionally fitted out with two extra “Liquid Fire” Burners to illuminate the airship at night. To avoid possible heat damage of the fourseat envelope the two Standard Burners and the two Liquid Fire Burners cannot be used simultaneously on the fourseat airship. A toggleswitch (burner control box) decides about heating with the Standard Burner circuit or with the Liquid Fire Burner circuit. (A functional diagram of the burner types and the propane management is laid down in Appendix 3a Liquid Fire and 3b Liquid Fire.)

#### 1.2.3.4 Sixseat Airship Burner (GD/6)

In the case of the sixseat airship both burner cans are additionally fitted out with Liquid Fire Burners as standard to provide more lift to the large envelope and to illuminate the airship at night. With push buttons all four burners can be operated individually or simultaneously.

### 1.2.3.5 AutoHeat (Burntime Sequencer)

The airship is optionally equipped with a burntime sequencer (AutoHeat) to operate both burners. This device reduces pilot load because no manual burning is necessary during long term level flight. It can be switched on and off by a single toggleswitch. In any electrical mode all solenoid burner valves can be operated as usual.

To start the AutoHeat the on board electric system must be switched on, followed by the toggleswitch “ignition both burners” to be pushed forward. To finally start the AutoHeat the toggleswitch positioned on the AutoHeat must be pushed forward.

Three LEDs on the AutoHeat display the actual operating mode: one yellow LED signals AutoHeat is in standby (NORM), two green LEDs signal AutoHeat is in operation.

AutoHeat is controlled by a three step rotary switch in accordance with the actual propane pressure (Low, Mid, High). Via a slide control marked with a flame symbol the burning time of both burners is defined.


*Burntime sequencer*

### 1.2.4 Propane System

The propane system consists of the propane cylinders, valves, vapour regulators, burners and connecting hoses.

The liquid propane is stored in cylinders containing a propane volume of 20, 30 or 40 kg each. The propane cylinders are positioned behind the front row of seats. Each cylinder has a contents gauge, valves for liquid and vapour take off, fixed liquid level gauge and a pressure relief valve set to discharge at 26 bar (375 psi/2.6 MPa). The propane cylinders are protected against accidental operation by protective hoods.

If vapour pilot lights are fitted, the propane cylinders must be equipped with separate vapour supply (Appendix 2).

Where liquid pilot lights are fitted, the propane system consists of the propane cylinders, valves, burners and connection hoses. Each cylinder has a single liquid fuel supply to the burner with a mechanically operated shut off valve (Appendix 3 a-c).

If the burner system is equipped with liquid pilot lights, standard cylinders (without vapour supply) can be used.

Additional certified propane cylinders are listed in Appendix 2.

#### 1.2.4.1 Pilot Light Ignition System

There is a pilot light built into each burner can. The pilot lights are vapour or liquid fed and are lit by two independent electronic ignition systems.

The second ignition system is independent from the main power supply and is powered by two 9 V dry batteries positioned in an enclosure underneath the burner panel.

#### 1.2.4.2 Liquid Pilot Light System

The pilot lights are fed by liquid off take from the main supply. The liquid passes through shut-off valves, attached to the burner frame, into a vaporiser under the pilot flame tube. The system is duplicated for the front and rear burner. (Sketch Appendix 3a, 3c)

#### 1.2.4.3 Vapour Pilot Light System

If the pilot lights are fed by vapour propane, cylinders must be used with a separate vapour supply. Each burner is fitted with a separate system (Sketch Appendix 3b, 3d).

## 1.3 Petrol System

The petrol tank is fitted with a filler cap, a remote filling level indicator, shut off valve with filter, drain tap and an air vent.

From the tank the petrol-oil-mixture runs through the shut off valve to the fuel pump. The pump is a membrane type and is powered by the engine. An electric fuel pump is fitted additionally which can be operated from the switch panel.

The petrol shut off valve can be operated from the pilot seat by a Bowden control cable. The engine is fitted with a choke for cold start which can be operated manually from the pilot seat. The choke lever is spring supported and jumps back to its neutral position. The petrol tank is separated from the gondola passenger compartments and the engine by a fire wall.

## 1.4 Instrumentation

The instruments and all other electrical switches necessary for operation are housed in the instrument box mounted in the front of the gondola on the right hand side from the pilot´s position.

For details see following images:

A. Instrument Box

B. Switch Panel

C. Burner Activation

D. Burner Activation during hot Inflation

## A. Instrument Box AS 105 GD/4 and GD/6


*Instrument Box (Explanation on the following page)*

The Instrument panel shows:

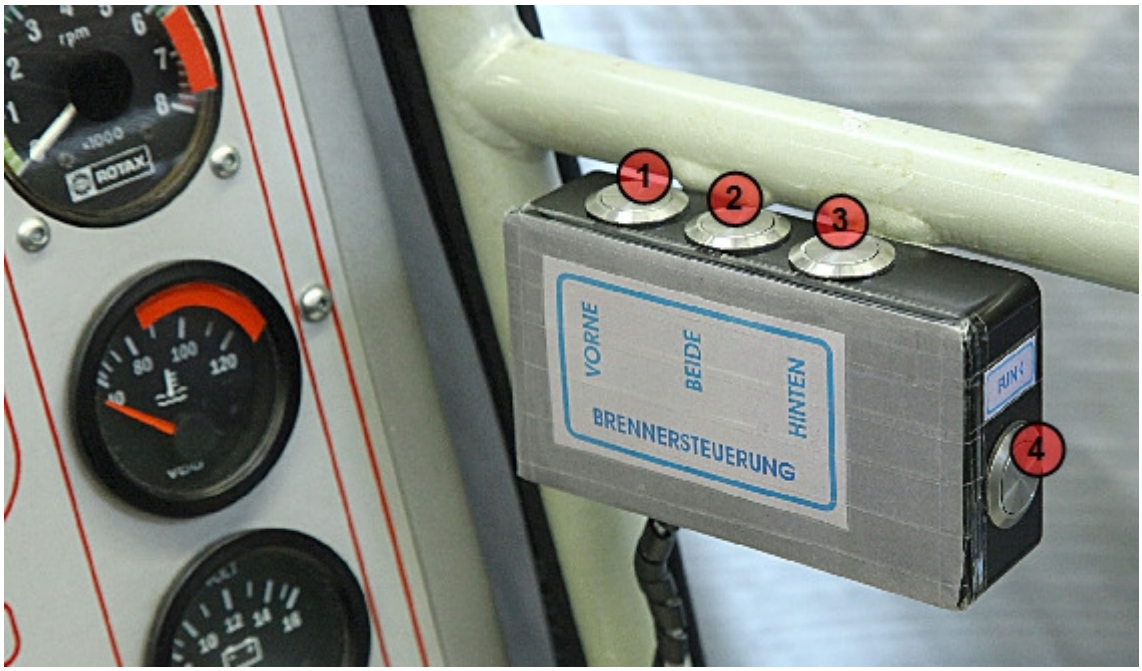
| | | |
|---|---|---|
| Engine Monitoring: | 6 | Rev. Indicator |
| | 7 | Coolant Temperature |
| | 8 | Petrol Tank Fuel Gauge |
| | 2 | Generator Warning |
| Envelope: | 5 | Envelope Pressure Gauge |
| | 1 | Envelope Temperature Gauge |
| Flight Instruments: | 1 | Altimeter |
| | 1 | Variometer |
| Avionics: | 4 | VHF Radio |
| | 3 | Intercom |
| | 9 | Transponder (optional) |
| **Further instruments (not placed in the instrument panel)** | | |
| Inclinometer | Position: Windscreen right-hand | |
| Propane Pressure Gauge | Position: Burner Unit | |
| Propane content | Indicator on propane cylinders | |

## B. Switch Panel AS 105 GD AS 105 GD/4 and GD/6


*Switch Panel*

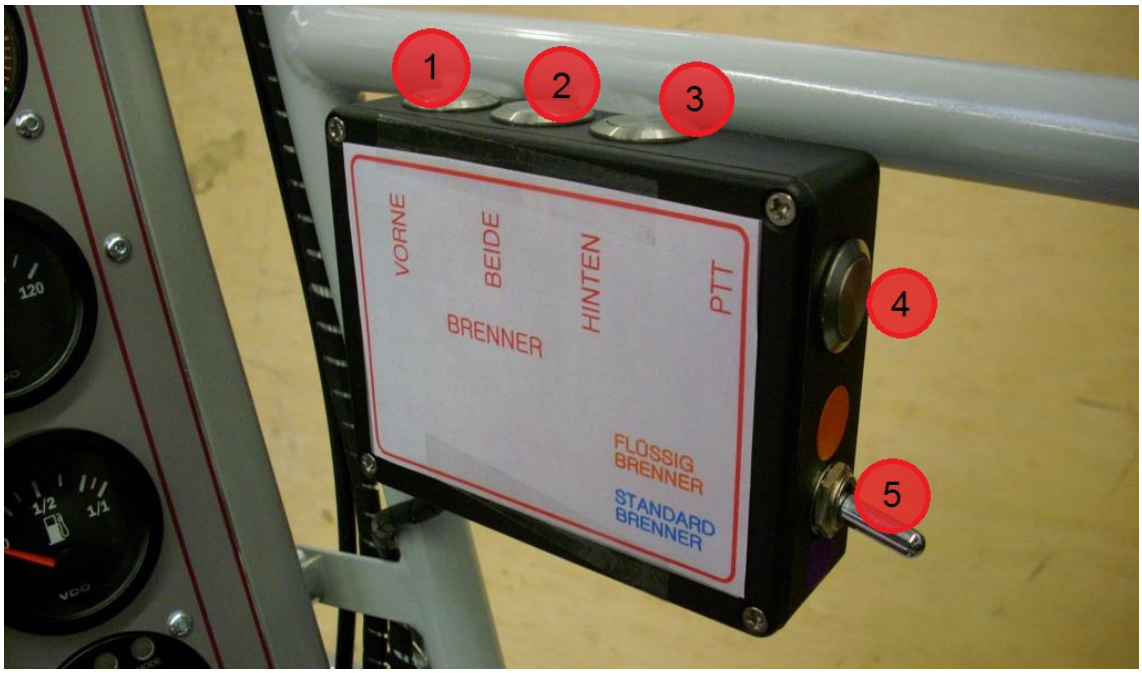
1. Starter
2. Main Switch
3. Ignition Circuit Propulsion Engine I
4. Ignition Circuit Propulsion Engine II
5. Ignition Pilot Light both burners (and AutoHeat, if fitted)
6. Ignition Pilot Light forward burner (9 Volt)
7. Ignition Pilot Light rear burner (9 Volt)
8. Electric petrol pump
9. Electric pressure fan system
10. Footswitch Double Burner (and SSU if fitted)

## C. Burner Activation AS 105 GD/4



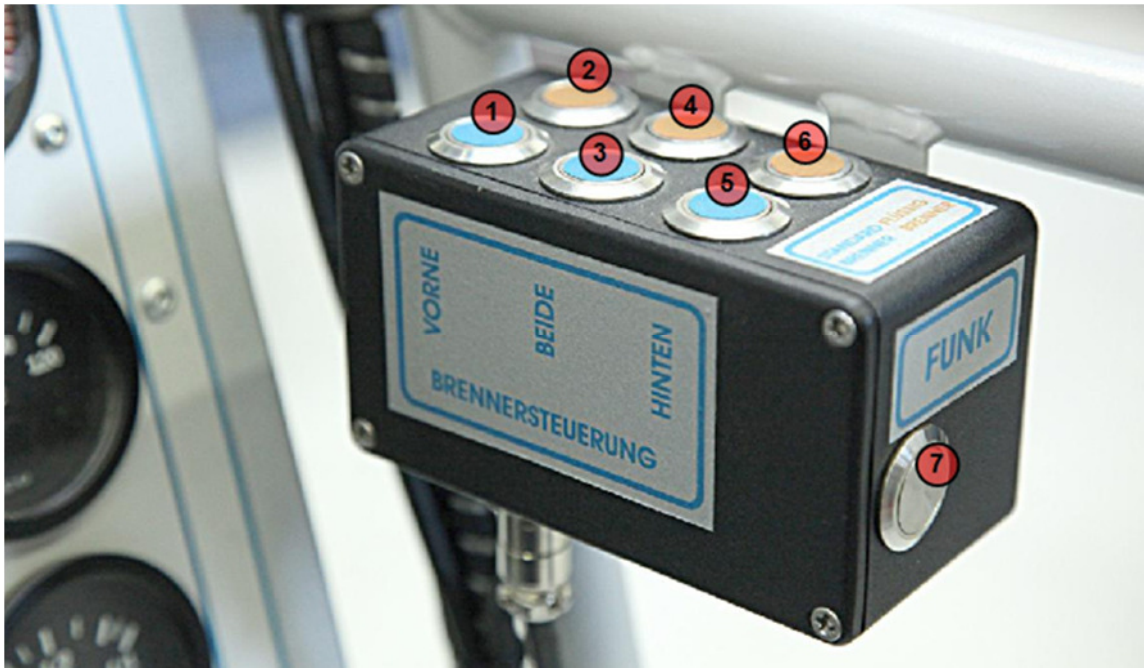

1. Front Standard Burner, 2. Both Standard Burners,
3. Rear Standard Burner, 4. Transmit Button VHF Radio

### Burner Activation AS 105 GD/4 with Liquid Fire




Function of push buttons 1. to 4., see picture above this one,
5. Toggle-Switch for selecting between Standard Burner and Liquid Fire Burner Circuit

## D. Burner Activation AS 105 G




1. Front Standard Burner
2. Front Liquid Burner
3. Both Standard Burners
4. Both Liquid Burners
5. Rear Standard Burner
6. Rear Liquid Burner
7. Transmit Button VHF Radio

## E. Burner Activation AS 105 GD/4 and GD/6 during Hot-Inflation


The above pictured assembly is positioned under the fan-panel left hand of the gondola front.

This burner control unit consists of two push buttons which help the pilot during hot inflation to operate each of the standard burners or both standard burners parallel. With one hand the pilot can tilt the burner, with the other hand he can operate the front, the rear or both burners.

## 1.5 Safety Equipment

The safety equipment consists of:

- one ABC-fire extinguisher between the front seats, a second one between the rear seats.
- A 30 m drop line in reach of the pilot
- GD/4: A first aid kit and a fire blanket are located under the front entrance
- GD/6: A first aid kit and a fire blanket are located between the front seats and between the rear seats.

## 1.6 Filling Capacities

<table>
<tr><td>Propane</td><td colspan="3">20-40 kg content stored in gas cylinders (Appendix 2)</td></tr>
<tr><td rowspan="3">Petrol</td><td>European Standard</td><td>American Standard</td><td>Canadian Standard</td></tr>
<tr><td>min. Ron 90<br>EN 228 Regular<br>EN 228 premium<br>EN 228 premium plus</td><td>ASTM D 4814</td><td>min. AKI 87<br>CAN/CGSB-3,5<br>Quality 1</td></tr>
<tr><td colspan="3">AVGAS 100LL</td></tr>
<tr><td></td><td colspan="3">GD/4: 30 litres<br>GD/6: 50 litres</td></tr>
<tr><td>Cooling System</td><td colspan="3">Aluminium Radiator anti-freeze (refer to ROTAX engine manual) Volume:<br>2 litres</td></tr>
<tr><td>Tyre Pressure</td><td colspan="3">Minimal 1.5 bar (0.15 MPa)<br>Maximal 5.0 bar (0.5 MPa)</td></tr>
</table>

### Engine Lubrication

Mixture lubrication: Super-two-stroke oil ASTM/CEC standards, API-TC classification (e.g. Castrol TTS) mixing ratio 1:50 (2 %)

## 1.7 On-Board Electrical System

### 1.7.1 External 12 Volt Power Supply

On the right hand of the front entry of the gondola (postion: metal sheet between pilots legs) is an external connection for 12 Volt power supply, which can be used to charge the starter battery or to start the engine in case of weakness of the starter battery.

### 1.7.2 Fuses AS 105 GD/4

Located in the front entry of the gondola are numbered fuses (position: metal sheet between the pilot´s legs). They are colour coded according to their individual strength. There are backup fuses for each type located separate directly next to the fuses.

| No | Designation<br>Bezeichnung | Amp |
|---|---|---|
| -- | Pull-Fuse (red marked)<br>Zugsicherung (rot markiert) | 100 |
| 1 | Master Switch<br>Batteriehauptschalter | 35 |
| 2 | Generator 1 | 20 |
| 3 | Generator 2 | 20 |
| 4 | Fan<br>Ventilator | 30 |
| 5 | Transponder<br>Antwortsendegerät | 3 |
| 6 | Burner<br>Brenner | 3 |
| 7 | Aircraft Radio<br>Flugfunkgerät | 3 |
| 8 | Fuel Pump<br>Benzinpumpe | 3 |
| 9 | Engine-Starter<br>Motorstarter | 3 |
| 10 | Combi Instrument Flytec | 3 |
| 11 | Intentionally blank<br>nicht belegt | -- |
| 12 | Intentionally blank<br>nicht belegt | -- |
| 13 | Intentionally blank<br>nicht belegt | -- |
| 14 | Engine SSU<br>Motor SSU | 35 |
| 15 | Foot Switch SSU<br>Fußschalter SSU | 3 |

### 1.7.3 Fuses AS 105 GD/6

Located in the front entry of the gondola are numbered fuses (position: metal sheet between the pilot´s legs). They are colour coded according to their individual strength. There are backup fuses for each type located separate and directly next to the fuses.

| No | Designation<br>Bezeichnung | Amp |
|---|---|---|
| -- | Pull-Fuse (red marked)<br>Zugsicherung (rot markiert) | 100 |
| 1 | Masterswitch<br>Bordnetz | 35 |
| 2 | Fan 1 | 35 |
| 3 | Fan 2 | 35 |
| 4 | Fan Relay<br>Fan Relais | 3 |
| 5 | Transponder | 3 |
| 6 | Burner Standard<br>Brenner Standard | 3 |
| 7 | Radio<br>Flugfunkgerät | 3 |
| 8 | Fuelpump<br>Benzinpumpe | 3 |
| 9 | E-Starter | 3 |
| 10 | Combi Instrument (Flytec) | 3 |
| 11 | Generator 1 | 35 |
| 12 | Generator 2 | 35 |
| 13 | Burner Liquid<br>Brenner flüssig | 3 |
| 14 | Engine SSU<br>Motor SSU | 35 |
| 15 | Foot Switch SSU<br>Fußschalter SSU | 3 |

# 2 Flight Instructions (EASA Approved)

## 2.1 Weather Conditions

The max. wind speed on the takeoff site shall not exceed 12 knots for an experienced pilot and, as a recommendation, 8 knots for an inexperienced pilot.

**NOTE: With increasing wind speed during flight a return flight to the launch field might not be possible.**

**WARNING: Flights in thermal or thundery conditions are not permitted.**

## 2.2 Pre-Inflation Checks

To ensure a smooth and fast inflation an extensive briefing of the ground crew is necessary.

First of all, the dangers of the main propeller, the petrol inflation fan and the electric pressure system, when in operation, have to be emphasised. The ground crew should be especially warned about scarves, ropes and long hair being sucked into the main propeller or into the electric fan system. Only authorised persons are permitted to approach the gondola. The gondola should be positioned facing into the wind. The burner is to be raised and secured.

The following gondola checks are carried out prior to the actual assembly:

**Propulsion engine:**

**NOTE: All instructions of the ROTAX engine manual are to be obeyed.**

- Nuts and bolts tight (engine mounts, alternator brackets, propeller and exhaust)
- Drain some petrol from tank and examine for water contamination
- Radiator cooling liquid
- Battery connections
- Exhaust system for damages and cracks
- Radiator system and hoses for leaks
- Petrol fuel lines for leaks

**NOTE: The ground crew should restrain the gondola to prevent it from moving once the engine is running**

- Apply full choke on cold engine
- Push starter button and start engine
- Once the engine is running close choke as soon as possible. Prolonged use of choke can cause engine to flood. The choke lever jumps back to its neutral position by itself

**Continuation: Propulsion engine**

- Shift the throttle lever to 3 500 to 4 000 rpm until the radiator coolant temperature raises to around 60°C, followed by a full throttle engine run for a short time (max. permitted are 6 200 rpm)
- Check ignition circuits 1 and 2; engine running at 3 000 to 3 500 rpm. Alternately ignition circuit 1 and 2 must be switched off; the engine revolution drop must not exceed max. 300 rpm
- Switch on pressurisation fan system while engine is running on idle and check engine performance
- Switch “Off” electric pressurisation fan system and engine

**Propeller**

- Check propeller serviceable
- Nuts and bolts for tight
- Check safety pins in castellated nuts
- Propeller blades and propeller guard for damages

**Petrol tank**

- Petrol level (min. 25%)
- Open fuel stop cock. Check hoses for leaks
- Fuel tank for leaks
- Ensure fuel filler cap is tightly closed
- Drainage for water contamination

**Propane cylinders**

- Propane level (min. 25 %)
- Cylinder straps for security and condition
- Propane hoses for leaks and signs of wear
- Fittings for leaks (WATCH, SMELL, and LISTEN)
- Tight fit of cylinder protective hoods

**Burner**

- Both electric ignition systems for the pilot lights
- Pilot lights for stable flame pattern
- Functional check of the burner using solenoid and manual valves
- Burntime sequencer (AutoHeat) (if fitted)
- Swivel mechanism

**Tyres**

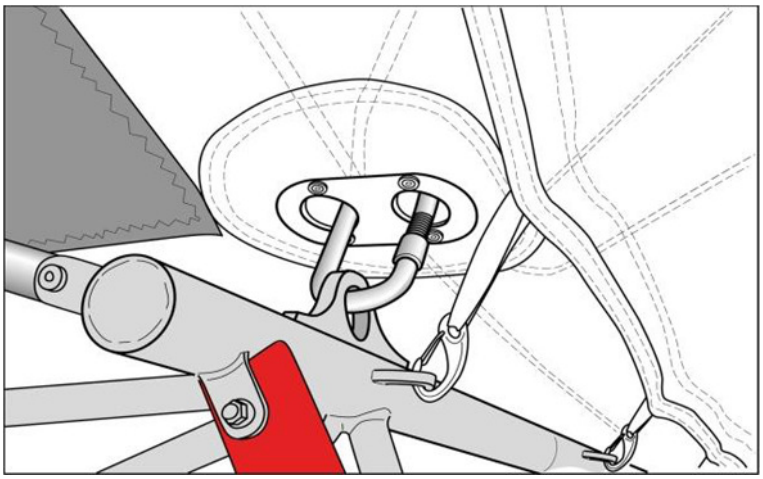
- Tyre damage and tyre pressure (1.5 bar/0.15 Mpa)

**Side Rudder Steering Power Assistant (SSU)**

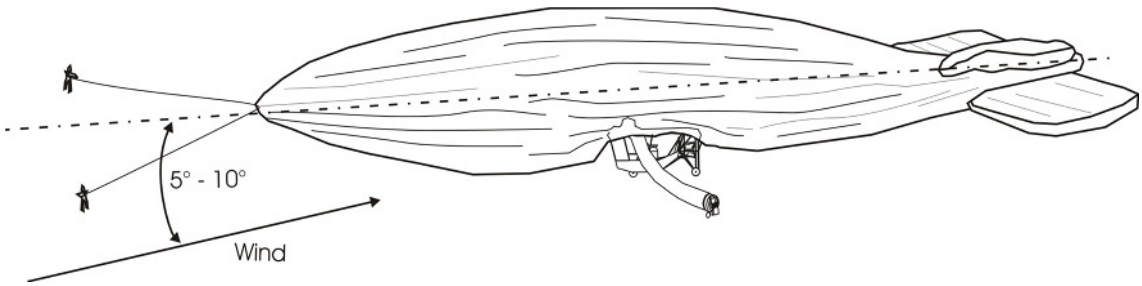
- Function Test SSU (if fitted) including uncoupling

## 2.3 Assembly

- Position car and trailer into wind
- Lay out envelope on the starboard side of the gondola. Gondola and envelope should be laid out 5° to 10° to the right of the flight direction (see sketches of inflation procedure)
- Attach envelope flying wires with the karabiners to the gondola in the following order: 1) front left, 2) front right, 3) rear left, 4) rear right



- Connect snap hooks to gondola frame
- Connect scoop including snap hook
- Spread out envelope, fins and rudder
- Close rip panel (both long sides first, short side last), close safety locks
- Connect both rudder lines to burner frame (or gear belt if SSU is fitted)
- Check all lines of the envelope for entanglement and free movement
- Check rubber cords, lines, loops of envelope overpressure valves on condition
- Close numbered velcro slots of side-fins (2 slots GD/4; 3 slots GD/6), elevators (4 slots GD/4 and GD/6), rudder (4 slots GD/4; 5 slots GD/6) and 1 slot in the stern of the envelope body




*Sketch inflation: View from above on uninflated envelope*

## 2.4 Inflation Procedure

The description assumes standard conditions:

Depending on weather conditions, crew skills (crew chief and 2-3 trained assistants), the take-off site and other factors, the inflation process may vary.

**NOTE: The launch and the landing site (size of about 80 m x 80 m) should be dry, clean and free of obstacles for a normal departure and final approach leg. Free of obstacles means, that during a normal take-off and landing procedure in a 30° take off and approach funnel obstacles of 15 m height can be overflown in secure height.**

It is required that two crew members are holding the two nose lines during the inflation process (gloves!). The distance between them should be approximately 10 m. They have to stay in visual contact with the pilot to keep the envelope under control according to pilot´s requests.

The envelope is filled with air via a fabric trunk by an external petrol fan through the closable hatch in the gondola´s roof.

All lines inside and outside the envelope are to be checked for free run during inflation, especially the catenary curtain must not be entangled and must be clearly visible. Check envelope from inside and outside for tears and any other damage. Check rudder lines outside for free run.

It is not permitted to fly with holes or tears above the envelope equator larger than 5 mm diameter

It is not permitted to fly with holes or tears below the envelope equator larger than 10 mm diameter

It is not permitted to fly with holes or tears in the fins larger than 10 mm

**NOTE: No damage may be caused by entering the envelope during the cold inflation process (if possible step in without shoes).**

Inflate the envelope with cold air to about ¾ and then start the hot inflation. The more the envelope is filled with cold air, the simpler the hot inflation process.

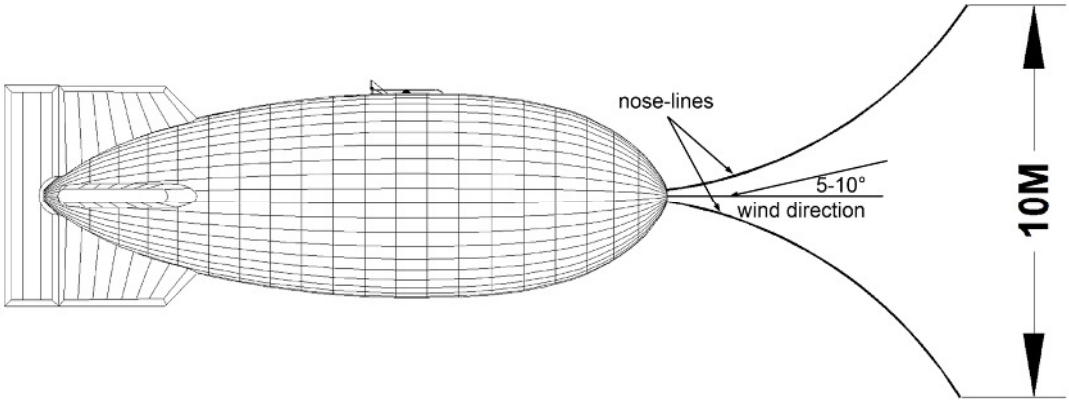
As a general rule there must always be one crew member on the left side of the gondola to avoid tipping over of the gondola due to wind gusts or other impacts.

The external fan runs on idle during this process. Swivel the burner to the right. Operate the burner and slowly swivel back to the original upright position as the envelope rises. The pilot has to aim the burner flame in such a way as to ensure that no envelope material or inner rigging is exposed to excessive heat.

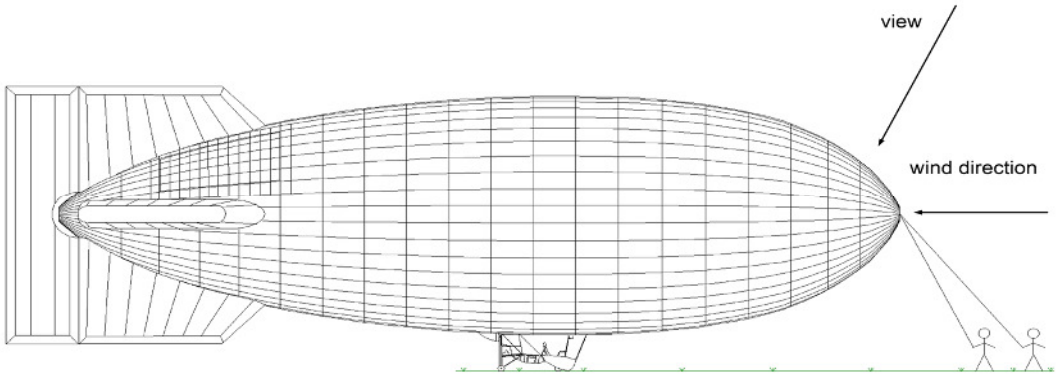
**NOTE: Whenever possible the rear burner should be used during inflation to lift the rear envelope part from the ground to help the nose-crew keeping the envelope down. The workload of the nose crew is reduced, if the nosepart is kept down to the ground by mainly using the rear burner to create lift in the rear part of the envelope.**

The crew members on the nose lines should not allow nose or tail of the envelope to rise individually. They keep the ship level with the horizon by carefully pulling the nose lines down or letting the nose lines go to avoid burn damages to the envelope. They slacken the nose lines when the envelope inevitably moves sideways (righthand in flight direction) during the hot inflation (the envelope positions itself on top of the gondola) and follow the movement of the envelope.

Once the airship is fully buoyant disconnect the inflation trunk and close the hatch above the pilot seat with the sliding Plexiglas panel. Keep the envelope into wind and in level by means of the two nose lines.




*Top view from above when cold inflated*




*Side view when hot inflated*

## 2.5 Pre-Flight Checks

The airship is up and buoyant but has not yet reached take-off temperature:

**NOTE: From now on only authorised persons are permitted in the close proximity of the airship. As a general rule everybody has to follow the pilot`s instructions.**

- Instruction of the passengers (Crew Chief) (see section 2.12)
- First use the rear seats, than the front seats from the left gondola side
- Secure loose things.
- Smoking is forbidden during flight.
- Do not open safety belts before authorisation by the pilot (after landing is finished).
- Check: Is propeller clear?
- Start propulsion engine (fins start to fill and pressurise)
- Start electric pressure fan system
- Rudder lines (or gear belt if SSU is fitted) to be hooked to the burner -frame and gondola floor
- Check side rudder to full extension to the left, neutral and right side
- Check all lines for free run
- Check correct operation of envelope pressure relief valves
- Check readability of the content gauges on the propane cylinders using the mirrors
- Check position of protective hoods
- Use the burners until lift is reached

**Final Checks**

- Check seat belts fastened
- Check front and rear secondary passenger safety belts
- Check correct operation of pilot lights (stable flame pattern)
- Check propane pressure (4 – 12.8 bar (0.4 – 1.28 MPa)
- Check engine for smooth operation on both ignition circuits up to full throttle
- Check altimeter
- Switch on variometer and temperature gauge

## 2.6 Take-Off

- The airship is to be brought precisely into wind by using the nose lines
- The airship will take off after further heating

**CAUTION: Always monitor envelope pressure, max. 15 mm $H_20$ (150 Pa)**

- Only on pilot´s instructions to the crew: release nose lines

## 2.7 Flight

The airship is controlled in its movements by three different inputs:

- The burner controls the climb and descent rate of the airship
- The engine delivers the forward thrust of the airship
- The rudder enables the airship to make changes in the yaw axis

### 2.7.1 Envelope Superpressure

The pressure in the envelope is achieved by the electric fan system and the propeller which supplies air into the envelope via the scoop to sustain the combustion and the internal pressure.

At sufficient internal pressure the envelope will maintain its shape even when flying at higher speeds.

The pressure will increase, if more air is supplied into the envelope at high engine revolutions, or if the air inside the envelope expands by using the burner. The pressure will vary between 5 – 10 mm $H_2O$ (50 – 100 Pa) during flight.

Operating with full burner power, running the engine at full throttle the envelope pressure should not increase above 15 mm $H_2O$ (150 Pa).

**Standard values envelope super pressure:**

| RPM | Envelope super pressure |
|---|---|
| Idle – 3 000 rpm | 5-6 mm $H_2O$ (50-60 Pa) |
| 3 000 rpm – 4 500 rpm | 6-9 mm $H_2O$ (60-90 Pa) |
| 4 500 rpm – full throttle (6 200 rpm) | 9-12 mm $H_2O$ (90-120 Pa) |

During fast descent rates the envelope pressure might decrease, at fast climb rates it might increase a bit more.

**NOTE: The interacting physical relations between propane pressure, use of the burners, temperature changes, rate of climb and descent, envelope pressure and engine input must be properly understood by the pilot to use the airship to its full potential.**

### 2.7.2 Aerodynamic Lift

Unlike a Hotair Balloon a Hotair Airship is influenced by aerodynamic as well as aerostatic effects. The airship is subjected to the combination and magnitude of these forces depending on flight conditions in each particular case.

At a slight positive inclination angle and full engine thrust it is possible to create approximately 5-10% of the total lift aerodynamically based on the higher flight speed. If the engine thrust is reduced the flight speed will decrease and thus the aerodynamic lift. It is necessary then to add extra heat to keep the actual flight altitude.

**WARNING: Sudden engine failure during a high speed approach to land with a positive inclination angle an unintentional landing might occur due to a loss of aerodynamic lift (a failing engine results to a reduced flight speed), if not compensated accordingly and appropriately using the burner (check the inclination angle at the inclinometer).**

### 2.7.3 Fuel Management

**A. Propane**

**Version GD/4**

Both propane cylinders are of equal value. Only one propane cylinder should be open. The second one is to be opened when the first cylinder indicates a remaining quantity of about 25 %. Maximum flight time is approx. 1 hr with a consumption of approx. 60 kg/hr.

**Version GD/6**

Both the left and the right propane cylinder have to be open. The one in the middle will be kept closed until the two others indicate a remaining quantity of about 25 %. Maximum flight time is approx. 2 hrs with a propane consumption of approx. 60 kg/hr.

**B. Petrol**

Check petrol fuel level (instrument box). Fuel consumption is approximately 15-20 l/h at 5 000 rpm.

## 2.8 Pre-Landing Checks

- Landing procedures should be initiated when 30% of content remains in the last propane cylinder
- Check petrol fuel level
- Overfly landing site to check for possible changes in wind direction (pay attention to the windsock at the landing field or close to)
- Inform ground crew via radio about the intention to land
- Switch AutoHeat “OFF” (if fitted)

## 2.9 Landing

- The landing is always made into wind
- Landing site free of obstacles
- The rate of descent during the landing approach is determined by the cooling rate of the hot air in the envelope together with loss of aerodynamic lift when flying “nose up” (ref. 2.7)
- The ground crew plays an important role in the landing phase: it is their task to catch the nose lines, to bring the airship to a complete stop, to establish a good tether
- Direct the airship into wind with the help of the nose lines

**WARNING: The engine should be switched “OFF” immediately before touchdown to avoid foreign objects being sucked into the propeller as well as ensuring that the ground crew does not get into contact with the propeller.**

## 2.10 Deflation

- Position the air ship with its nose into wind
- Shut down pilot lights and electronic ignition
- Vent liquid propane through the burner to cool it
- Close propane supply to burner and vent lines
- Shut down electric pressure fan system
- Close petrol fuel tab
- Master switch – “OFF”
- Open rip panel completely
- Pull down the airship nose (in flight direction on right hand of gondola) and hold it to the ground
- Open deflation slots in the fins
- Disconnect scoop attachment
- Disconnect rudder lines (or gear belt if SSU is fitted)
- Disconnect envelope (karabiners and snaphooks) from gondola
- Press remaining air out of the envelope and fins by packing envelope lengthwise (starting from its nose)

## 2.11 Propane Fuel Pressure

The propane operating pressure varies from 4 to 12.8 bar (0.4 – 1.28 MPa). Care should be taken with propane pressures below 4 bar (0.4 MPa) as this can cause damage to the burner system due to massive radiant heat. Also the flight characteristics are impaired due to slow response caused by the reduced burner performance.

The propane pressure and therefore the burner power differ according to the ambient temperature. Adding nitrogen to the propane, the working pressure can be increased up to 8 bar (0.8 MPa) in the cold seasons (only cylinders without vapor pilot supply should be pressurised).

For pressurisation with nitrogen an industrial pressure regulator must be used between nitrogen cylinder and propane cylinder. The maximal allowed gas cylinder working pressure with nitrogen must not exceed (8 bar / 0.8 MPa).

## 2.12 Commercial Passenger Transport

For commercial passenger transport the airship shall be fitted and certified for Commercial Passenger Operations.

The pilot has to ensure, that the passengers are briefed prior to entering the gondola. The following subjects have to be pointed out (ref. section 2.5):

- Flight- and emergency procedures
- Smoking is not permitted during the flight
- Entering or leaving the gondola only with pilot`s permission
- Entering or leaving the gondola always from the front left side
- No loose or free moving clothes (shawl, long hair, etc.) are allowed which can be sucked into the propeller

- Approaching the gondola is only allowed with permission of the pilot and only from the front left side of the gondola; never from behind (propeller is running)
- Seatbelts should only be opened on the instruction of the pilot (usually after landing
- The instructions of the pilot are authoritative

**The crew-chief must make sure before take-off that:**

- Passengers do not use by chance controls or supply hoses as means of help to board or to leave the gondola
- Passengers are seated properly, seat belts fastened
- Secondary passenger safety belts are hooked on
- The propane cylinders in the rear passenger compartment are secured with protection hoods against uncontrolled use
- Loose objects are secured

## 2.13 Dropping of parachutists

Free fall parachuting only is permitted. Static line releases are not to be used. The applicable MTOM of the airship given in 4.1 must not be exceeded. Due allowance should be made for the weights of the occupants with their parachutes. A minimum drop height (AGL) and exit should be agreed between the pilot and jumper(s) before take-off. Exit positions should be rehearsed prior to inflation/rigging to ensure no injury occurs on exit.

When parachutists are jumping from the airship, the following procedure must be used:

1. The parachutists must be briefed on suitable positions for exit at the side of the gondola frame, fuel hoses and control lines.

2. Before releasing the parachutists the pilot should establish a rate of descent appropriate to the number of parachutists jumping simultaneously as follows:

| | |
|---|---|
| 1 parachutist | 0 ft/min (0 m/sec) – level flight |
| 2 parachutists | 200 ft/min (1 m/sec) |
| 3 or more parachutists | 300 ft/min (1.5 m/sec) |

3. The engine must be stopped and the propeller stationary

4. The height of the airship above ground is greater than the agreed minimum

5. The parachutists must only exit on the agreed signal from the pilot.

# 3 Emergency Instructions (EASA Approved)

## 3.1 Flying the Hotair-Airship as a Hotair-Balloon

The airship is designed in such a manner that it is possible to fly it like a Hotair-Balloon (without engine power and without rudder), i.e. without pressurisation. The envelope will loose some of its shape and stiffness.

**NOTE: The rate of descent is determined only by reducing the envelope temperature (the envelope does not have a self-closing parachute).**

To ensure better air supply to the burner, the sliding Plexiglas panel above the pilot seat should be pushed back. Flying without running the electric pressurisation system should not exceed 20 minutes or the heating power will decrease. The rip panel should only be used after the final landing.

## 3.2 Propulsion Engine Failure

- Ignition – “ON”
- Check fuel shut off – “OPEN”
- Check petrol level
- Check throttle lever and cable
- Throttle lever on idle position
- Check choke for correct setting “OFF”
- Switch electric pressurisation fan system “OFF”
- Restart engine

**WARNING: If the propulsion engine does not start after various attempts and the starter engine starts to loose its power, refrain from further starting attempts to avoid battery collapse and a complete power loss (see section 3.7 RESTART ENGINE).**

**If engine does not restart:**

- Switch electric pressure fan system “ON”
- Fly the airship as a hot air balloon
- **Land as soon as possible!**

## 3.3 Loss of Envelope Pressure

Loss of envelope pressure can be caused by the following factors:

- Pressure relief valve stuck open or rip panel is accidentally opened
- Tear in the envelope
- Insufficient pressurising air is entering the envelope via the electric pressure system (if the fan system fails, the pilot feels a warm breezing air in his face)
- Insufficiently fastened scoop

**Action if envelope pressure has dropped down:**

- Visually check that rip panel is closed
- Visually check envelope pressure relief valves for correct function
- Visually inspect envelope internally by opening the gondola roof hatch and look for holes, particularly in the upper half of the envelope
- Keep electric pressure system running
- Visually check scoop for proper function
- Use propulsion engine at practicable level

**WARNING: If envelope pressure cannot be regained, land as soon as possible!**

## 3.4 Pilot Light Failure

- Switch AutoHeat system - “OFF” (if fitted)
- Switch electric pressure fan system - “OFF”
- Put engine back on idle
- Check propane level
- Check pilot light valves – “ON”
- Re-ignite pilot lights using one of the two electronic ignition systems

**If not successful:**

- Open main burner manual override valves a fraction
- Ignite the propane at the main burner jets with one of the two electronic ignition systems
- Leave the manual override valve slightly open and let main burner act as constant pilot light
- Switch on electric pressure fan system

**WARNING: Land as soon as possible!**

## 3.5 Burner Failure

**NOTE: The functional diagram of the burner system and the propane management are described in Appendix 3a-3d.**

- Switch AutoHeat - “Off” (if fitted)
- Check pilot lights – “ON” - and working
- Check propane shut-off valves – “OPEN”
- Check propane pressure
- Check propane level in cylinders
- Check solenoid valves serviceable

**If the burner cannot be re-lit:**

**WARNING: Prepare for a hard landing! Electric valves serviceable?**

**If one of the solenoid burner valves has failed (closed or open):**

- Switch AutoHeat –-“OFF” - (if fitted)
- Open the manual by-pass valves (both burners)
- Use main shut-off valves (between pilot`s legs) as blast valve
- Even with only one burner working the airship can still be landed safely
- Keep electric pressure system running

**Warning: Land as soon as possible!**

**AutoHeat Failure**

- Switch AutoHeat „OFF“

If it is not possible to switch the AutoHeat “OFF” pull the connector.

## 3.6 Fire On Board

### A. Locate source and type of fire

**Petrol or propane fire**

- Close petrol fuel cock and/or propane valves on gas cylinders
- Release safety lock of fire extinguisher
- Aim fire extinguisher directly at base of fire
- Fight the fire
- Try to cover source of fire with fire extinguishing blanket

**Electrical fire (wiring fire)**

- Pull main fuse
- Release safety lock of fire extinguisher
- Aim fire extinguisher directly at source of fire
- Fight the fire
- Try to cover source of fire with fire blanket

### B. Assess damage after the fire has been extinguished:

- Is an immediate standard landing possible and can be carried out with the given landing ground situation?
- Perform a normal landing
- Is an immediate landing (emergency landing or hard landing) necessary?

**WARNING: Prepare for a hard landing!**

## 3.7 Electrical Power Supply Failure

An electric power supply failure caused by the generator, starter battery, electrical shortcuts etc, might limit the performance of the airship to a major extent. Individual or all of the following components might be affected: engine starter, solenoid valves, electric fan system, instruments, radio, transponder, AutoHeat and SSU (if fitted).

### A Malfunction of the generator:

If the red warning lights (instrument panel) are **ON**: The power supply failure is caused by a malfunction of the **engine generator**.

- Open both manual valves on the burner and operate the burner by the manual gas valves between pilot´s legs
- Switch off electric fan system
- Disconnect SSU gear belt (if fitted)
- Switch off AutoHeat (if fitted)

**WARNING: Land as soon as possible**

### B Malfunction of the starter battery:

The power supply failure might be caused by a malfunction of the **starter battery**:

- If the red warning lights (instrument panel) are **OFF**: the generator still works
- Check all electrical components for proper function

**WARNING: Keep the engine running until touch down. It cannot be restarted with a collapsed power supply system. With a stopped engine the airship must be flown like a hot air balloon (see 3.1).**
**WARNING: Land as soon as possible**

## 3.8 Hard Landing

A hard landing is a landing with a higher rate of descent due to a major failure such as burner malfunction.

- Inform passengers about a possible hard landing
- Switch AutoHeat “Off” (if fitted)
- Check seat belts – they should be kept fastened tight until the airship has come to a complete stop after landing
- Close pilot lights
- Close gas valves and vent propane lines
- Leave electric pressure system running
- Keep propulsion engine running; it can be used together with the rudder to change the landing direction of the ship away from obstacles on the ground

- Shortly prior to landing: Engine “OFF”, close fuel tab and isolate the electric system with the master switch
- Pull main fuse prior to touch down
- After landing, pull rip panel completely open

## 3.9 Landing In Strong Wind

- Inform passengers about a fast and possible bumpy landing
- Check and fasten seat belts tight
- The gondola might tilt on to its side when touching down or at deflation
- Always hold on to something inside the gondola

**WARNING: Always land into wind!**

# 4 Operating Limitations & Load Charts (partly EASA approved)

## 4.1 Operating Limitations (EASA Approved)

| Parameter | Version GD/4 | Version GD/6 |
|---|---|---|
| Max. permitted envelope temperature | 127° Celsius | |
| Max.permitted rate of climb | 3.5 m/s | 3.0 m/s |
| Max. permitted rate of descent | 2.5 m/s | |
| Loss of height at max. descent until equilibrium | 100 % burner power at 6 bar propane pressure approx. 80 m | |
| max. surface wind speed in gusts | 12 kts | |
| max. air speed in zero wind | Vmax = 9.0m/s = 32.4 km/h | |
| min. / max. envelope pressure | 5 mm $H_2O$ (50 Pa) / 15 mm $H_2O$ (150 Pa) | |
| min. / max. persons | 1 pilot / 4 persons | 1 pilot / 6 persons |
| max. altitude | see load chart | |
| Propane pressure limits | 4 – 12.8 bar (0.4 – 1.28 MPa) | |
| min. / max. continuous engine rpm | 2 000 rpm / 6 200 rpm | |
| max. Take off weight (MTOW) | 900 kg | 1 488 kg |
| Gondola dry weight (depending on additionally carried equipment) | approx. 275 kg | approx. 360 kg |
| Envelope weight (depending on additionally carried artwork | approx. 220 kg | approx. 360 kg |
| min./ max. tyre pressure | 1.5 bar (0.15 MPa) / 5.0 bar (0.5 MPa) | |

## 4.2 Loading

General

The lift in kilograms is based on an envelope temperature of 120°C (max. permitted is 127°C) and ISA-conditions (International Standard Atmosphere with temperature curves:

| | |
|---|---|
| Sea level pressure: | 1 013.2 hPa |
| Sea level temperature: | 15°C |
| Sea level density: | 1.225 kg/m$^3$ |
| Vertical temperature gradient: | 0.65°C/100 m |

The maximum load depends on the planned flight altitude and the ambient temperature. It can be calculated (Appendix 4) or determined by the load charts.

## 4.3 Load Chart

The horizontal x-axis shows the ambient temperature in degree Celsius. The vertical y-axis shows the possible load A (gross lift) in kilogram at an envelope temperature of 120° C. The thick horizontal line shows the maximum permitted take-off weight not to be exceeded. Use the following instructions to determine the possible lift.

1. Fix the ambient temperature on the horizontal axis.
2. Plot a line vertically upwards until the sea level graph is reached (1).
3. For altitude correction plot a line (2) following the ISA-curve until the graph of the relevant altitude is reached.
4. Read horizontally (3) across to the y-axis to find the available gross lift at the wanted altitude.

Example: The ambient temperature of 20°C at sea level and a planned flight up to an altitude of 6 500 ft gives an available load of:

(Example GD/4) Gross lift of A = 840 kg

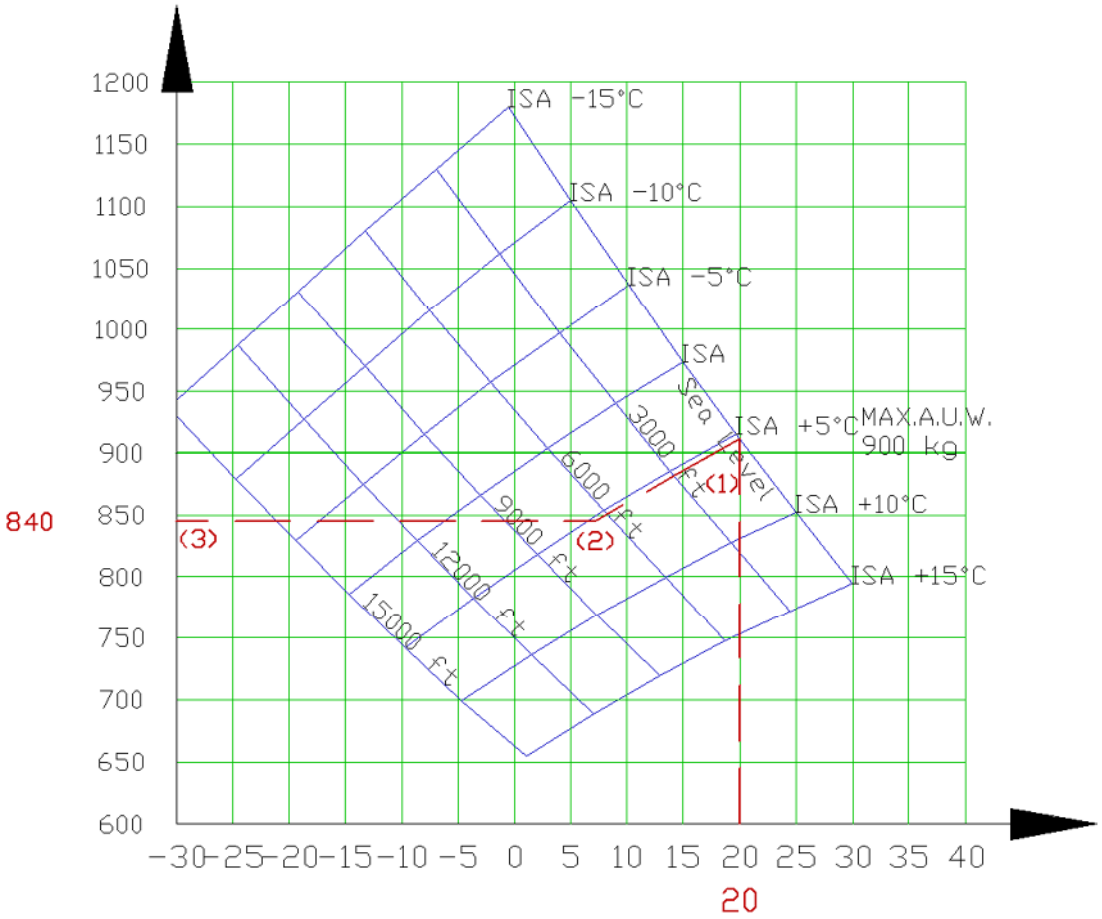
(Example GD/6) Gross lift of A = 1 420 kg

## 4.4 Load Chart

AS 105 GD/4

Envelope volume V = 3 000 $m^3$

Envelope temperature 120°C

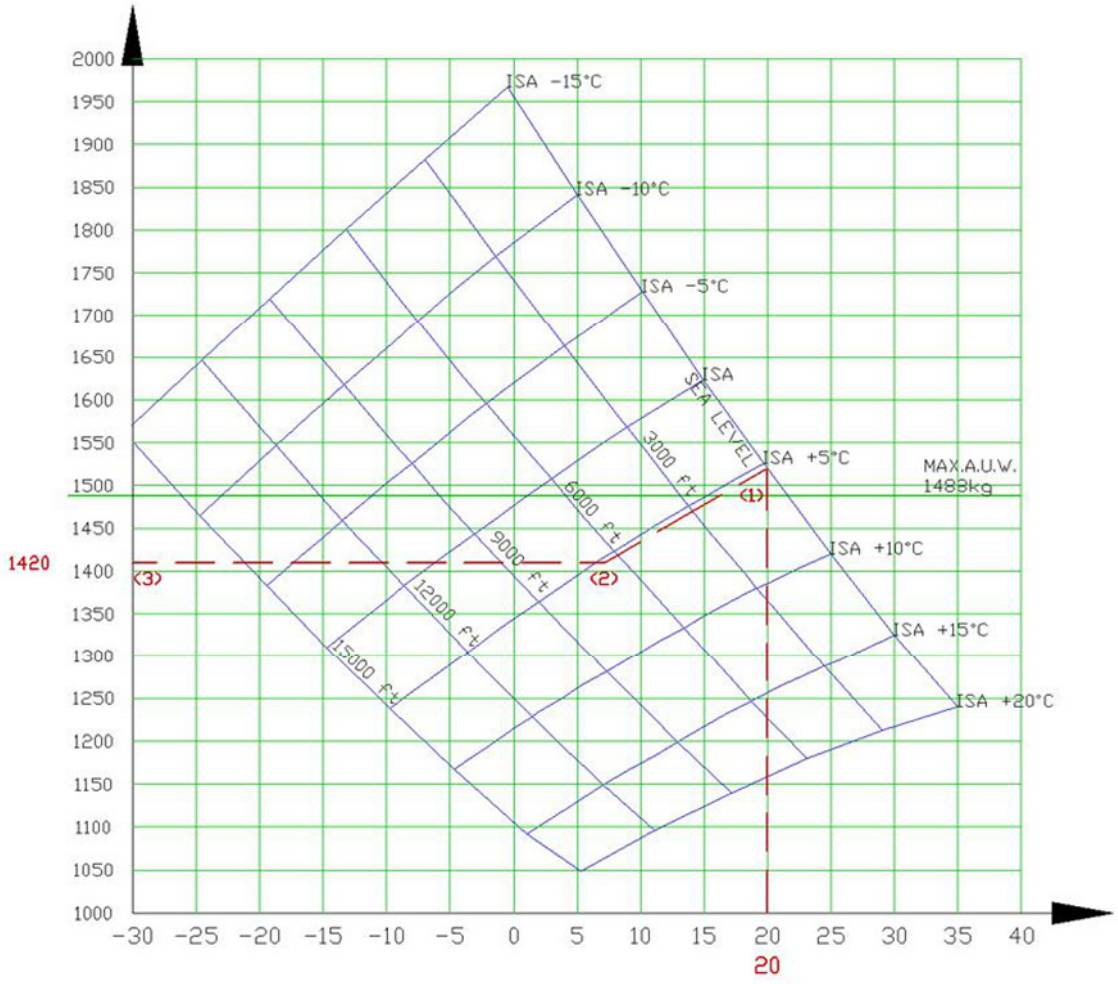



*Calculation of the maximum permitted load*

## 4.5 Load Chart AS 105 GD/6

Envelope volume V = 5 000 $m^3$

Envelope temperature 120°C




*Calculation of the maximum permitted load*

## 4.6 Airworthiness Limitations (EASA Approved)

The airship should not be operated, if it is not airworthy. If one or more of the following circumstances occur the airship is declared as being **NOT AIRWORTHY**.

- Damage to the envelope fabric (holes, tears: above the equator larger than 5 mm diameter, below the equator larger than 10 mm diameter)
- Damage to the fins or rudder (holes, tears larger than 10 mm diameter)
- Damage to the catenary system (loadtapes, cords, etc.)
- Damage or malfunction of the burner system
- Leakage to the pressurised parts of the heating system including the propane cylinders
- Leakage of the fuel system
- Damage or malfunction of the propulsion engine
- Damage to the propeller
- Damage to the electric pressure fan system
- Damage or malfunction of the flight instruments (altimeter, variometer)
- Damage or malfunction of the engine monitoring instruments (RPM counter, radiator fluid temperature gauge, petrol tank contents gauge)
- Damage or malfunction of the envelope pressure gauge
- Damage to the landing gear or too low tyre pressure

**WARNING: As a consequence the airship has to be landed as soon as possible and chapter 3 (Emergency Procedures) must be obeyed**

.

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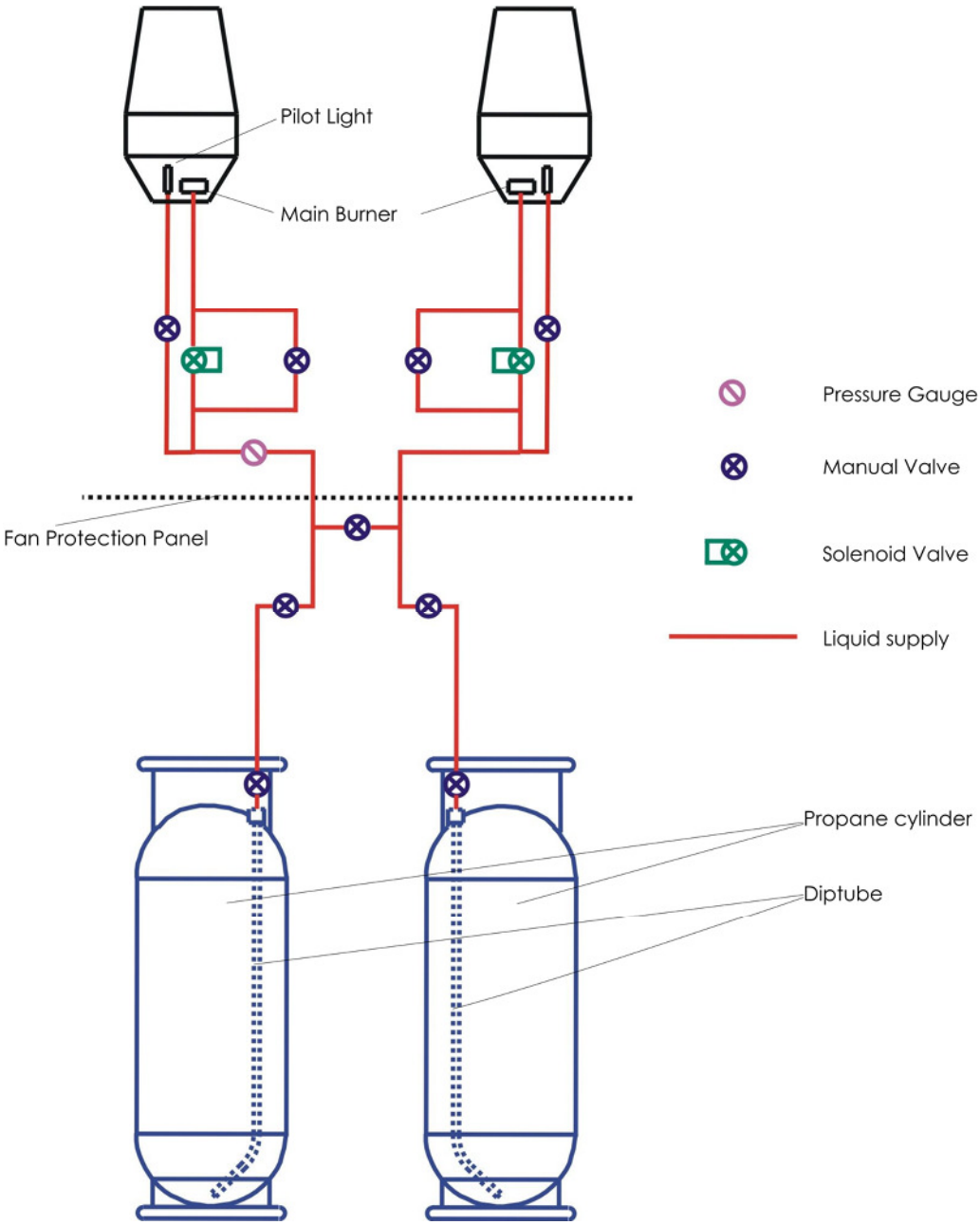
# Propane Cylinders (EASA Approved)

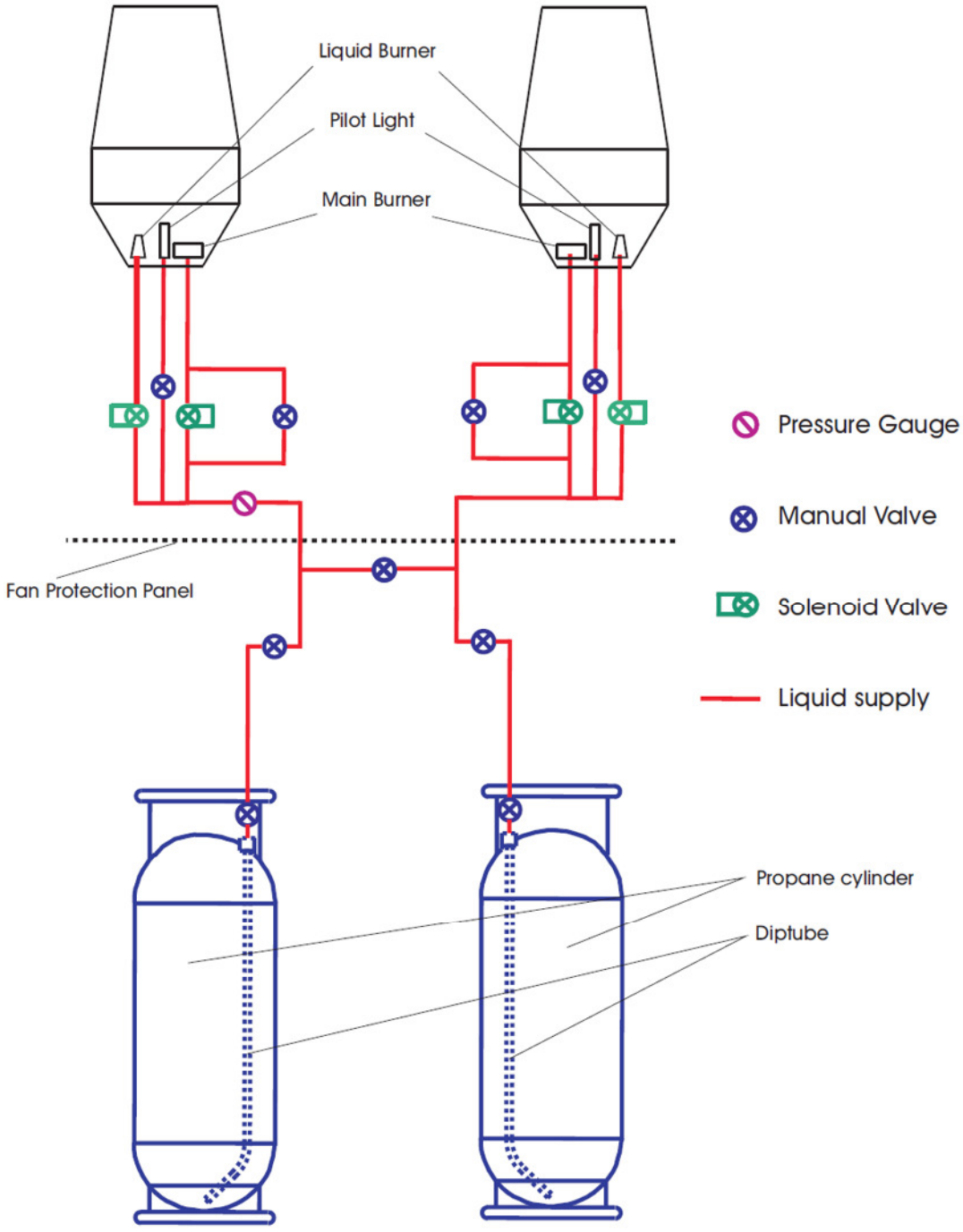
| Available for | Manufacturer | Type | Volume l | Empty Weight kg | Capacity kg | max. Weight kg | Connection Ports |
|---|---|---|---|---|---|---|---|
| GD/4 and GD/6 | Cameron | CB 426 | 69 | 21.7 kg | 27.4 | 49.1 kg | Rego or Tema |
| | | CB 599 | 51 | 20 | 21.4 | 41.4 | |
| | | CB 959 | 88 | 26 | 36,9 | 62.9 | |
| | | CB 2088 | 65 | 23 | 27.3 | 50.3 | |
| | | CB 2380 | 70 | 14 | 29.4 | 43.4 | |
| | | CB 2383 | 88 | 15 | 36.9 | 51.9 | |
| | | CB 2385 | 51 | 11 | 21.4 | 32.4 | |
| | | CB 2387 | 65 | 14 | 27.3 | 41.3 | |
| | | CB 2900 | 56 | 21 | 23.5 | 44.5 | |
| | | CB 2901 | 75 | 23 | 31.5 | 54.5 | |
| | | CB 2903 | 90.3 | 26.2 | 37.9 | 64.1 | |
| | T & C | V 30 | 69 | 21.7 | 27.4 | 49.1 | |
| | Schroeder | VA 50 | 50 | 15.5 | 21.2 | 36.1 | |
| | Schroeder | VA 70 | 70 | 18.8 | 27.8 | 46.6 | |
| | Worthington | CB 250-001 | 47 | 14 | 19 | 33 | |
| | Lindstrand | V 30 (x) | 72 | 20 | 30 | 50 | |
| | Lindstrand | V 40 (x) | 96 | 22 | 40 | 62 | |

(X) Lindstrand propane cylinders are not available with vapor pilot light supply. Airships equipped with vapor pilot lights can therefore not be operated with Lindstrand propane cylinders.

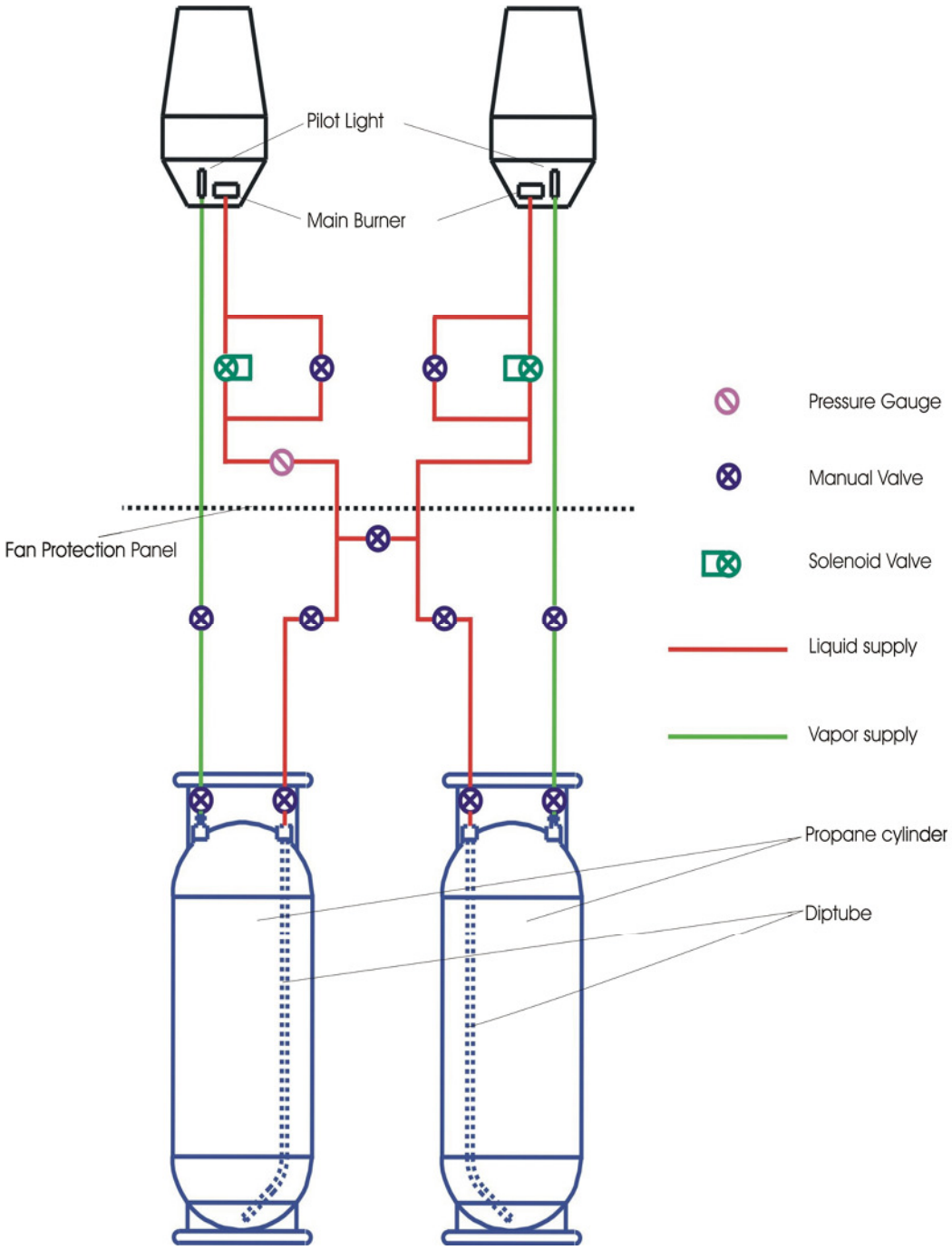
# Propane System Liquid Pilot Lights GD/4



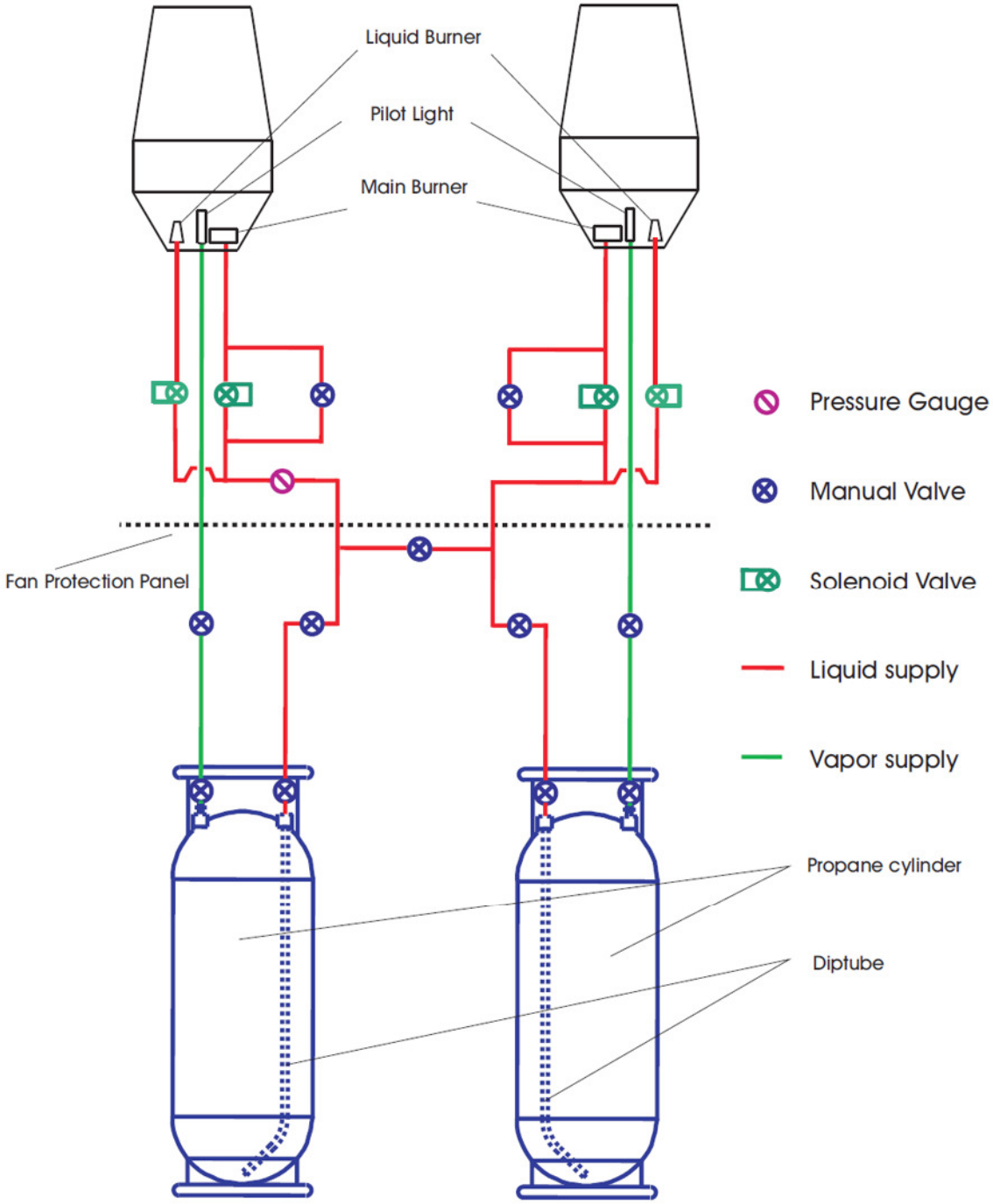
# Liquid Fire: Propane System Liquid Pilot Lights GD/4



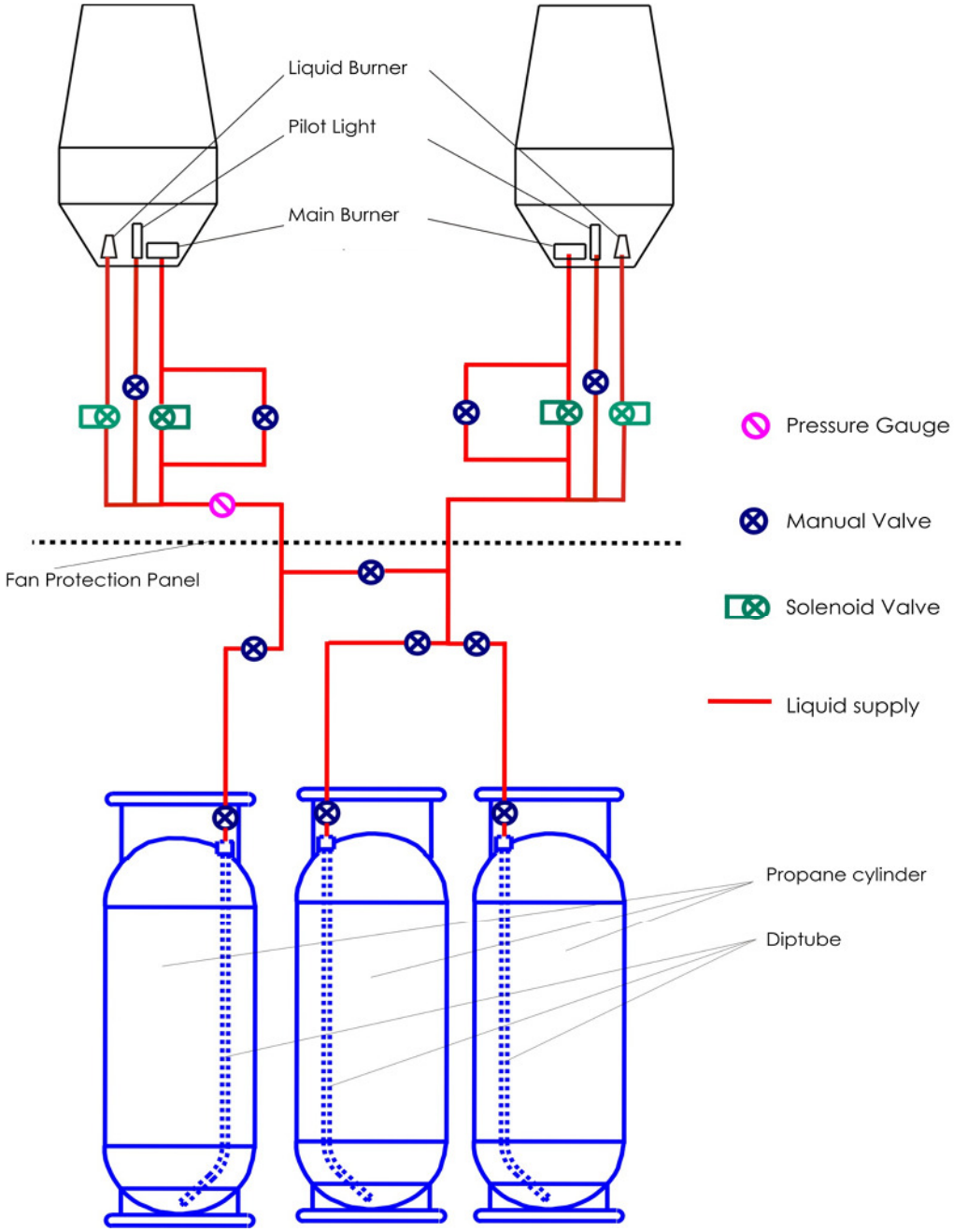
# Propane System Vapor Pilot Lights GD/4



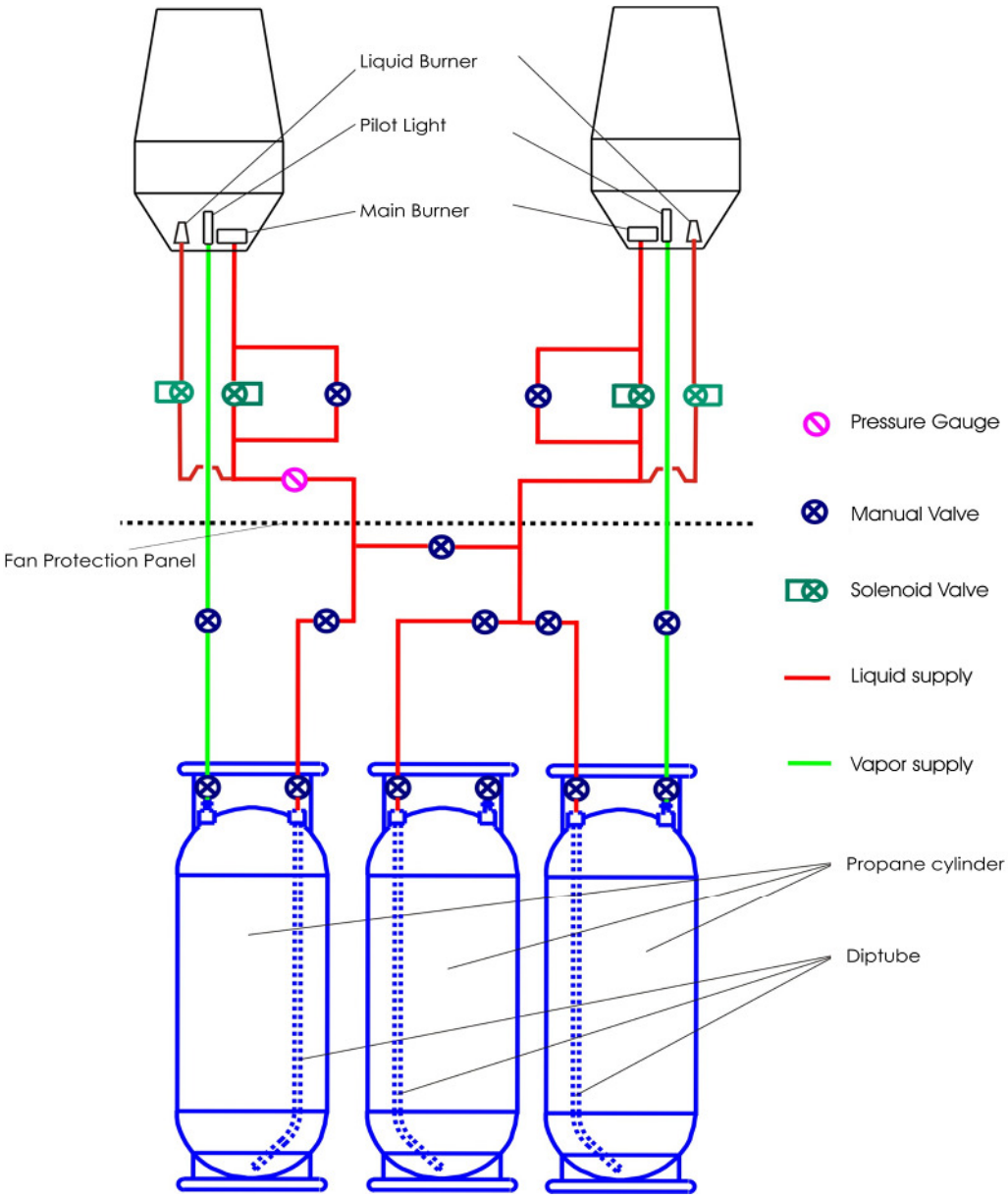
# Liquid Fire : Propane System Vapor Pilot Lights GD/4



# Propane System Liquid Pilot Lights GD/6



# Propane System Vapor Pilot Lights GD/6



# General Loading Formula

### Calculation of Maximum Loading Weight

$$A = 0.3484 \cdot V \cdot p \left(\frac{1}{t_a+273} - \frac{1}{t_i+273}\right)$$

$$p = 1013.25 \cdot \left(1 - \frac{6.5 \cdot h}{288.15}\right)^{5.255} hPa$$

A = total lift of the airship in kg
V = envelope volume in $m^3$
p = air pressure in hPa
h = planned flight altitude in km
$t_i$ = average inner envelope temperature, given with 120°C
$t_a$ = ambient temperature at flight altitude in °C

ISA standard atmosphere is assumed. The temperature gradient is assumed to

$\frac{\Delta T}{\Delta h} = 6.5° \frac{C}{1000\ \mathrm{m}}$ for an altitude up to $h = 11\ \mathrm{km}$.

### Example Calculation

| | |
|---|---|
| Envelope GD/6 | V = 5 000 $m^3$ |
| Planned flight altitude | h = 6 500 feet above sea level |
| Ambient air temperature | $t_a$ = +20°C above sea level |
| Total empty weight | $m_{ges}$ = 710 kg |

**NOTE: This example is calculated with the GD/6 (envelope volume 5 000 m³). Operating a GD/4 (envelope volume of 3 000 m³) the load is lower.**

$$p = 1013.25 \cdot \left(1 - \frac{6.5 \cdot h}{288.15}\right)^{5.255}$$

Auxiliary calculation: $1\ \mathrm{km} = 3\ 281\ \mathrm{ft} \rightarrow \quad 1.981\ km = 6\ 500\ \mathrm{ft}$

$$p = 1013.25 \cdot \left(1 - \frac{6.5 \cdot 1.981 km}{288.15}\right)^{5.255} \rightarrow p = 797\ \mathrm{hPa}$$

$$A = 0.3484 \cdot V \cdot p \left(\frac{1}{t_a+273} - \frac{1}{t_i+273}\right)$$

with $T_a = 7°C$ at planned flight altitude of $H = 6\ 500\ \mathrm{ft} = 1.981\ km$

$$A = 0.3484 \cdot 5\ 000\ \mathrm{m^3} \cdot 797\ \mathrm{hPa} \left(\frac{1}{(7+273)K} - \frac{1}{(120+273)K}\right) \quad \rightarrow \quad A = 1\ 423\ \mathrm{kg}$$

The maximum available load is:

$m_{P,max} = A - m_{godula,empty}$

$m_{P,max} = 1\,423\ \text{kg} - 710\ \text{kg} = 713\ \text{kg}$

with $m_{P,max}$ = maximum available payload

A = lift

$m_{gondula,\ empty}$ = empty weight

**Calculation of the maximum permitted number of persons on board**

| | | |
|---|---|---|
| Maximum amount of petrol | $m_{fuel}$ | 40 kg |
| Total weight of all propane cylinders including propane | $m_{propane,\ total}$ | 150 kg |
| Sum: | | 190 kg |

Hence, the free lift for persons on board is: $m_{person,total}$ = 523 kg

For the calculation the weight for persons is $m_{person}$ = 86 kg is assumed. Thus 6 persons can be transported in this case.

$$x = \frac{523\ \text{kg}}{86\ \text{kg}} = 6.08$$

x = number of persons

**NOTE: For the planned flight the maximum number of persons on board might be lower if the weight of individual persons is above 86 kg.**

# Flexible T-Connection Hose

Additional certified 20 kg propane cylinders can be used along with the standard equipment to prolong the operating time of the airship. These cylinders are placed in the passenger floor and fastened to the gondola frame. The GD/4 can be equipped with max. of 2 additional cylinders, the version GD/6 with a max. of 3 additional cylinders.

Only approved and certified components and standard connection systems (Rego or Tema) are allowed in the fabrication of the connection hose lines. T-Connection Hoses are life-limited parts which must be replaced every 10 years. The date of manufacturing should be stamped on the crimped hose sleeve close to the ball valve.

During flights with additional cylinders the following requirements have to be observed:

1. Only the main and the additional cylinder may be connected, no ring line.
2. Only one cylinder has to be opened for each burner.
3. The T-Connection Hose has to be installed at a position where there is no danger of the hose being damaged or severed in the event of a hard landing.
4. The restraint of the additional propane cylinders are the same as the restraint of the original cylinders. They are fixed with straps onto the gondola framework (O-Ring of the safety belts) and crisscrossed among themselves onto the padded top rings of the cylinders. The straps are the standard straps as used for the standard cylinders in the airship or straps which are approved in hotair-ballooning.