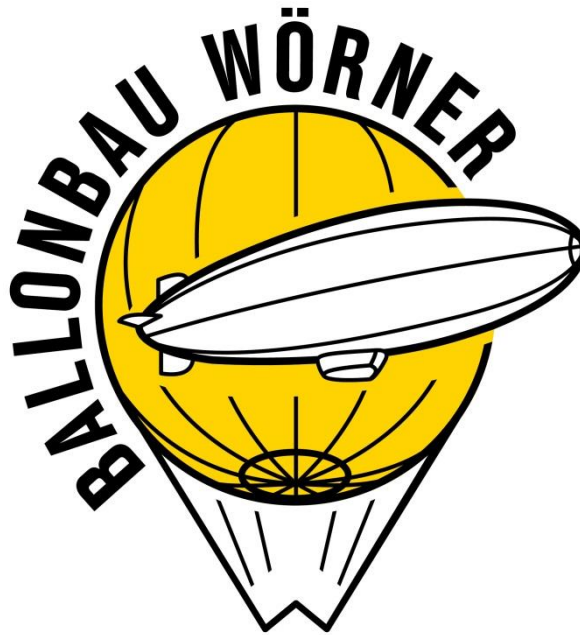


Flight Manual

for GAS BALLOONS
of Type NL-STU



DE.21G.0007
DE.CAO.0088

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Flight Manual

for operation of gas balloons of type “NL-STU”

Issue 2.0 – Revision 4

July 2026

**Nationality
and registration markings**

Type

Serial number

Year of manufacture

Manufacturer

Ballonbau Wörner GmbH
Flughafenstraße 20
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Germany

The balloon specified above is to be operated in accordance with the procedures described herein and the prescribed operating limits. The information contained in the Flight Manual must be available in the basket during flight.

This Flight Manual is approved by the competent authority.

The latest revised issue of this Flight Manual is published on the Internet page **www.ballonbau.de**.



0.0 Weighing report

	kg	Date of weighing	Performed by
Maximum mass acc. to data sheet			
Empty mass at unit testing			
Reweighing			

PRELIMINARY OBSERVATION: For reasons of legibility, male pronouns are used throughout this Flight Manual. All details referring to persons apply equally, however, to both men and women.



0.1 Revision history

Any changes to this Flight Manual, with the exception of a new weighing, must be recorded in the following table. The date of the revision is indicated at the bottom of the revised page.

All modifications made to the Flight Manual prior to approval of Issue 2.0 of this Flight Manual have been incorporated into this version.

Rev. no.	Subject / Affected sections	Affected pages	Date of Issue	EASA Approval no./ Date
1	Light weight basket with fabric wall			
	0.1 Revision history	II	25.07.2016	10059371/12.09.2016
	0.2 List of effective pages	IV	25.07.2016	10059371/12.09.2016
	Contents	V - VIII	25.07.2016	10059371/12.09.2016
	2.5 Approved envelop/basket combinations	2-4	25.07.2016	10059371/12.09.2016
	2.7.2 Basket size and number of occupants	2-5	25.07.2016	10059371/12.09.2016
	4.4.2.2 Toggle fastening to the load ring	4-3	25.07.2016	10059371/12.09.2016
	4.4.2.3 Ballast bags	4-5	25.07.2016	10059371/12.09.2016
	4.11 Landing	4-15	25.07.2016	10059371/12.09.2016
	5.3.2 Basket	5-2	25.07.2016	10059371/12.09.2016
	5.3.3 Matrix of theoretically possible loads	5-3	25.07.2016	10059371/12.09.2016
	6.4 Basket	6-2	25.07.2016	10059371/12.09.2016
	8.2 Checklists	8-2	25.07.2016	10059371/12.09.2016
2	0.1 Revision history	II	10.05.2019	10069974/22.05.2019
	0.2 List of effective pages	IV	10.05.2019	10069974/22.05.2019
	Contents	VIII	10.05.2019	10069974/22.05.2019
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	4.5 Inflating with lifting gas	4-8	10.05.2019	10069974/22.05.2019
	4.10.4 Dropping ballast	4-14	10.05.2019	10069974/22.05.2019
	8.2 Checklists	8-2	10.05.2019	10069974/22.05.2019



	Appendix	A-1	10.05.2019	10069974/22.05.2019
3	0.1 Revision history	II	30.03.2023	10081795/27.04.2023
	Front pages	---	30.03.2023	10081795/27.04.2023
4	1.0 General information	1-1	July 2026	10090521/27.07.2026
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0.2 List of effective pages

Section	Page	Date	Section	Page	Date
0	I	02.05.2016	4	4-7 appr.	10.05.2019
	II	27.04.2023		4-8 appr.	02.05.2016
	III	27.04.2023		4-9 appr.	02.05.2016
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	V	25.07.2016		4-11 appr.	02.05.2016
	VI	25.07.2016		4-12 appr.	02.05.2016
	VII	25.07.2016		4-13 appr.	02.05.2016
	VIII	10.05.2019		4-14 appr.	10.05.2019
1	1-1	27.07.2026		4-15 appr.	12.09.2016
	1-2	02.05.2016		4-16 appr.	02.05.2016
	1-3	02.05.2016		4-17 appr.	02.05.2016
	1-4	02.05.2016		4-18	02.05.2016
	1-5	10.05.2019		4-19	02.05.2016
2	2-1 appr.	02.05.2016	5	5-1	02.05.2016
	2-2 appr.	02.05.2016		5-2	27.07.2026
	2-3 appr.	10.05.2019		5-3	27.07.2026
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	2-7. appr.	27.07.2026		6-5	02.05.2016
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	4-6 appr.	02.05.2016			

NOTE: The sections or pages specially marked with the abbreviation "appr." have been approved by EASA.



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Chapter 1 – General information

1.0 General warning

The gas balloon is an aircraft. It thus brings with it all the risks and inherent dangers associated with the aircraft type and of aviation in general.

Ballooning can be dangerous!

It is the responsibility of the owner/holder/operator to ensure that the balloon is operated in an airworthy condition, is in proper working condition, and is used as intended. For this reason, maintenance work, repairs and inspections must be performed conscientiously in order to prevent personal injury to persons and damage to property.

The pilot must be licensed in accordance with the applicable aviation regulations and keep in practice.

Unauthorized modifications to the system are prohibited.

The pilot must be licensed and proficient in accordance with applicable aviation regulations. All applicable national laws and regulations must be observed.

Care is required, when handling the lifting gas. There is a danger of, among others, ignition of mixtures of gas, a danger of suffocation as well as a danger of burst of the envelope. In this regard, *Appendix 3—Handling of Gases During Operation of the NL-STU Balloon Model—* shall be applied.

Contact or collision with obstacles of any kind must be avoided.

The failure to follow these safety instructions can result in serious injury, fatal accidents and property damage.

There is a risk of fatal injury!

1.1 Introduction

This Flight Manual is intended to provide pilots and instructors with the information and assistance required to enable the safe operation of gas balloons of type “NL-STU” from Ballonbau Wörner.

The latest version of the Flight Manual can be found on the Internet page **www.ballonbau.de**. Instructions for Continued Airworthiness and any technical modifications will be published by means of Service Bulletins and/or Technical Notes and displayed on the Internet page.



In addition to the instructions contained in this Flight Manual, the pilot must also comply with the applicable national regulations. This applies to the regulations in both the country over which he is flying and the country in which the balloon is registered.

1.2 Certification basis

The certification basis are the “Preliminary Requirements for Manned Gas Balloons” (LBA file number I1-602.4/50/4/91).

The gas balloon “Wörner NL-STU” is certified by EASA with the Type Certificate No. EASA.BA.009 and by the FAA with the Type Certificate No. B03CE.



1.3 Definitions and list of abbreviations

Wind speed at ground level	The mean wind speed measured 2 meters above the ground.	
EASA	European Union Aviation Safety Agency	
Units:		
Meters - feet:	1 m = 3.28084 ft	1 ft = 0.3048 m
Cubic meters - cubic feet	1 m³ = 35.3147 ft³	1 ft³ = 0.0283 m³
Kilometers per hour - knots:	10 km/h = 5.5 kt	10 kt = 18 km/h
m/s - ft/min:	1 m/s = approx. 200 ft/min	100 ft/min = approx. 0.5 m/s
Kilograms - pounds:	1 kg = 2.204 lb	1 lb = 0.454 kg
FAA	Federal Aviation Administration	
FAI	Fédération Aéronautique Internationale	
ISA standard atmosphere	Standard air pressure: 1013.25 hPa Standard air temperature: 288,15 K (15,0 °C) Standard air density: 1.225 kg/m³	
Persons in basket	Pilot and passengers	
Service Bulletins	Maintenance notifications	
VFR	Visual flight rules; set of regulations under which a pilot operates an aircraft in weather conditions generally clear enough to allow the pilot to see where the aircraft is going.	
Maintenance manual	Refers here to the manual “Instructions for Continued Airworthiness” from Ballonbau Wörner. This maintenance manual is applicable to “NL-STU” gas balloons.	



1.4 Warning, Caution and Note

WARNING: *Failure to observe the procedures described will result in direct or serious deterioration of flight safety.*

CAUTION: *Failure to observe the procedures described will result in minor or more-or-less long-term deterioration of flight safety.*

NOTE: *Highlights a specific point that does not directly affect safety, but is important or unusual.*

1.5 General description

A manned gas balloon is a “lighter-than-air” aircraft. It consists of a gas-tight envelope with a basket suspended beneath it. The basket is attached to the envelope by means of ropes. The lifting gas is generally hydrogen or helium. The balloon rises by dropping fine sand ballast, thereby making the balloon lighter. During flight, descent of the balloon can be initiated by venting lifting gas from the envelope. The balloon can only be steered by changing altitude, as winds generally blow in different directions at different altitudes.

1.6 Description of a gas balloon

A complete description of the gas balloon and its layout can be found in Chapter 6 of this Flight Manual.

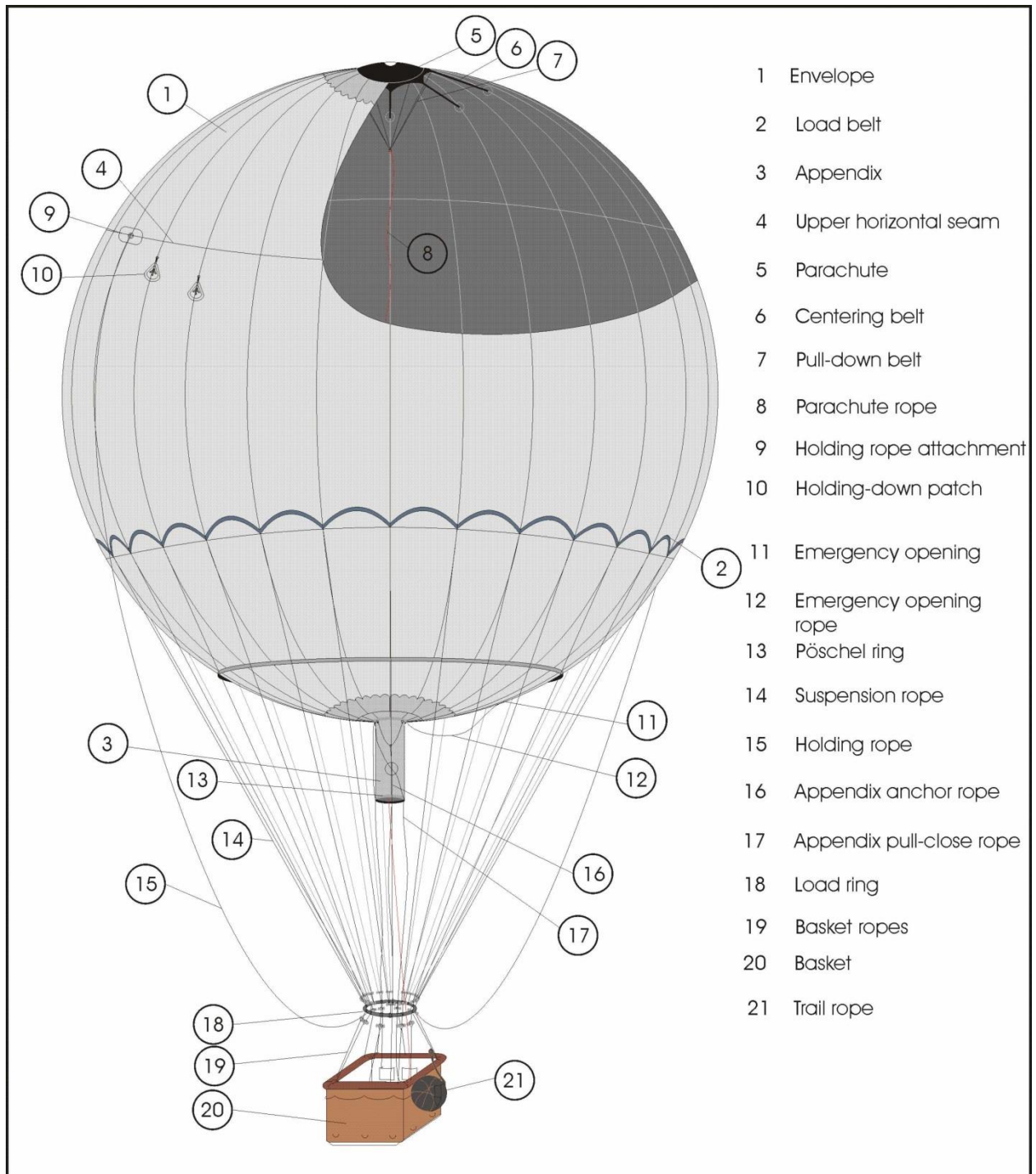


Fig. 1: Schematic representation of a gas balloon of type NL-STU

1.7 Labeling of the parts

The manufacturer, type, registration number, serial number and year of manufacture are indicated on the identification plate. The identification plate is attached in the following positions:



Fig.2:
Marking on the envelope: stainless steel plate on the clamping ring of the appendix



Fig.3:
Marking on the load ring: flexible plate



Fig.4:
Marking on the basket: brass plate in the basket.



Chapter 2 – Operating limits

2.1 Introduction

This section defines the operating limits for flying the gas balloon and for its standard equipment.

2.2 Weather conditions

Assessment of wind and weather forecasts is of the utmost importance for safe ballooning.

2.2.2 Maximum wind speed

During inflation, the average wind speed should not exceed 12 knots with gusts not exceeding a maximum of 15 knots.

For take-off, the wind speed should not exceed 15 knots.

CAUTION: *At the maximum wind speeds, inflation can only be carried out by an experienced inflation team!*

NOTE: *The maximum wind speed at ground level for a safe take-off depends on the specific conditions at the take-off site and on the ability of the pilot.*

2.2.3 Thermals and gusts

If strong thermals are forecast, the balloon should be landed as soon as the thermals arise, if possible, or the flight should be planned in such a way that the flight altitude is high above the thermals and the balloon is landed at the end of the thermals.

2.2.4 Thunderstorms and severe weather

The balloon must not be flown in thunderstorms or other severe weather conditions of any kind.

WARNING: *If meteorological conditions are thundery, there is a risk of dangerous turbulence and strong wind shear. There is a major risk of electrostatic discharge. It is also possible that the balloon might be pulled up to high altitudes with little oxygen and low temperatures.*

2.2.5 Night flights

The flight must be planned to enable landing in daylight.

CAUTION: *Landing at night is dangerous, as possible obstacles, such as overhead power lines, cannot be seen.*



2.2.6 Flights at temperatures below freezing

When the envelope is stored in the packing sack, creases are formed. At temperatures above 0 C, these creases are smoothed by the tension of the envelope. At temperatures below 0 C, the tension of the envelope may be insufficient to smooth the creases around the parachute opening. Under certain circumstances, this could result in gas leaks, because the parachute will not close properly.

Measures for reducing crease formation:

- Attach the edge protection of the parachute opening after landing
- Remove upper area of envelope from the packaging for approx. two hours before inflation, lay it out in a circle and allow to warm up to around 20 C indoors. This enables the folds to smooth out.

Measures for ensuring gas-tightness:

- Do not subject the parachute opening to loading in the kinked state in order to prevent creasing when cold.
- Stop inflation when the inflation level corresponds to a full envelope at the expected maximum flight altitude and listen out that there is no sound of gas escaping.
- If you intend to take off with the envelope not taut, perform the trial opening of the valve by pulling the line after the desired inflation level has been reached.
- If you intend to take off with the envelope taut, continue to inflate until the maximum level and leave the parachute opening subjected to the maximum possible envelope tension for as long as possible before take-off. Perform the trial opening of the valve.
- In the case of inflation at night, it may be necessary to delay take-off until the edge of the parachute opening has warmed up and turned smooth during the day. This can be detected by means of a visual inspection or possibly seen as the envelope becomes taut while the appendix is closed.

CAUTION: *If inflation and flight are to be carried out at temperatures consistently below 0°C, the ballast quantity and the anticipated flight path must be planned to enable the balloon to land with a slight gas leak.*

2.3 Condition of the balloon

WARNING: *If damage impairing airworthiness is detected during the preflight checks, take-off is not permissible!*

NOTE: *All damage resulting in loss of airworthiness of the balloon must be repaired in accordance with the maintenance manual.*



Damage resulting in loss of airworthiness:

- Tears at the parachute opening
- Damage to the parachute and its belts
- Holes or tears in the envelope that are larger or longer than 5 mm
- Detached envelope reinforcements at the north pole and at the load belt
- Damaged seams at the load belt
- Broken or deformed stainless steel rings at the load belt
- Damaged parachute line
- Damaged suspension ropes with less than 70 percent of the cross section intact
- Damaged load ring slings with less than 70 percent of the cross section intact
- Deformed load ring
- Damaged basket ropes
- Defective emergency opening line

NOTE: *The permissible limits for damage are described in Chapter 2 of the maintenance manual.*

NOTE: *A condition that may limit airworthiness is: **moisture inside the envelope.***

CAUTION: *Temperatures below 0 degrees Celsius may result in the parachute freezing to the envelope. An envelope that is moist inside may only be filled if it can be assured that:*

- *the parachute itself and an area 1 meter wide around the parachute opening are dry or*
- *have first been rubbed dry with a cloth.*

2.4 Lifting gas

Gases that may be used for filling the envelope are hydrogen, helium and coal gas (city gas). The correct handling of the lifting gas is described in Appendix 3.

NOTE: *Coal gas has a lower lifting capacity than hydrogen or helium. The pilot should be aware of the different response characteristics of the balloon in this case.*

NOTE: ***Hydrogen** is a tasteless, odorless and colorless combustible gas. Escaping hydrogen gas can displace breathable air, resulting in a risk of asphyxiation! Burning off of a hydrogen/oxygen mixture can change suddenly into a detonation with generation of pressure and heat. The particular hazards resulting from these properties must be taken into consideration in a training course dealing with the handling of hydrogen. All participants must be instructed in the hazards and safety measures applicable when working with hydrogen and relevant to the local situation.*



NOTE: *Helium is a very light, non-combustible, non-toxic, colorless and odorless gas. Inhalation of helium can lead to unconsciousness, respiratory arrest and in the worst case death. This may occur without any prior indications or symptom.*

2.5 Approved envelope/basket combinations

Envelope	280 m ³	380 m ³	510 m ³	640 m ³	840 m ³	1000 m ³
Basket I 80 x 65 cm	x					
Basket II 95 x 80 cm		x	x	x		
Basket III 110 x 95 cm		x	x	x		
Basket IV 125 x 105 cm		x	x	x	x	x
Basket V 135 x 115 cm			x	x	x	x
Basket VI 145 x 125 cm				x	x	x
Lightweight basket 125 x 105 cm		x	x	x	x	x
Fabric walled basket 125 x 105 cm		x	x	x	x	x
Race Competition Basket 120 x 98 cm	x	x	x	x	x	x

x = permissible combination

2.6 Minimum ballast

Loading may only be carried out in compliance with the prescribed minimum ballast quantity. If necessary, the number of passengers must be reduced for flights in order to ensure that the actual quantity of ballast does not fall below the specified minimum ballast quantity. The prescribed minimum ballast quantity is as follows:

Balloon size	280 m ³	380 m ³	510 m ³	640 m ³	840 m ³	1000m ³
Sand bags of 15 kg each	2	3	3	4	4	5



NOTE: The minimum ballast is reserved only for landing operations. Additional flight ballast is used for flight operations.

2.7 Number of persons in the basket

The maximum number of persons in the basket is determined first by the minimum ballast and secondly by the size of the basket. An area of min. 0.3 m² must be available for each person.

2.7.1 Minimum crew

The minimum permissible crew is 1 pilot.

2.7.2 Basket size and number of occupants

Envelope	280 m ³	380 m ³	510 m ³	640 m ³	840 m ³	1000 m ³
Basket I 80 x 65 cm	1 person					
Basket II 95 x 80 cm		2 persons	2 persons	2 persons		
Basket III 110 x 95 cm		3 persons	3 persons	3 persons		
Basket IV 125 x 105 cm		4 persons	4 persons	4 persons	4 persons	4 persons
Basket V 135 x 115 cm			5 persons	5 persons	5 persons	5 persons
Basket VI 145 x 125 cm				6 persons	6 persons	6 persons
Lightweight basket 125 x 105 cm		4 persons	4 persons	4 persons	4 persons	4 persons
Fabric walled basket 125 x 105 cm		2 persons	2 persons	2 persons	2 persons	2 persons
Race Competition Basket 120 x 98 cm	1 person	2 persons	2 persons	2 persons	2 persons	2 persons

NOTE: Two configurations are available for the Race Competition Basket. See *Appendix 4 "Using the Race Competition Basket"* for details.



2.8 Minimum equipment

For flights under visual flight rules, the following minimum equipment must be on board:

- 1 variometer
- 1 altimeter
- 1 hook knife
- 1 first aid kit (within the expiration date)

2.9 Appendix

Before take-off and during ascent, the appendix must be completely opened.

WARNING: *Take-off and ascent with the appendix closed are not permitted, as the envelope is otherwise subjected to an inadmissibly high overpressure.*

2.10 Maximum rate of climb and descent

The rate of climb must not exceed 10 m/s.

WARNING: *In the case of an inflation level of less than 50 percent and a rate of climb of more than 10 m/s, there is a risk of the parachute opening itself.*

The maximum permissible rate of descent depends on the quantity of ballast available for reestablishing equilibrium of the balloon.

NOTE: *The braking ballast required for reestablishing equilibrium of a 1000 m³ balloon is calculated using the following rule of thumb: Rate of descent in m/s squared times the drag coefficient of the balloon size.*

*Example: Balloon size 1000 m³, rate of descent 3 m/s, drag coefficient 4:
=> $3 \times 3 \times 4 = 36$ kg of braking ballast.*

Drag coefficient for all balloon sizes:

380 m ³	510 m ³	640 m ³	840 m ³	1000 m ³
2,0	2,4	2,8	3,4	4,0

2.11 Operating the parachute as a maneuvering valve

When the parachute is being used in its function as a maneuvering valve, it must not be pulled beyond the point at which the line starts to vibrate.

CAUTION: *The parachute must be opened slowly so that the vibration in the line can be clearly felt.*



WARNING: *If the parachute line is pulled beyond the vibration point, the parachute loses its function as a maneuvering valve and only functions from this point onwards as a quick deflation device!*

2.12 Further constraints

- **Area of use**

The gas balloon is flown according to VFR (visual flight rules). Flights by day and by night are only permissible in compliance with the aviation regulations applicable in the countries being flown over. These regulations also include licensing and equipment.

- In the case of **high-altitude flights** without additional oxygen, the balloon may ascend to altitudes of up to 10,000 ft (3,000 m) (ISA standard atmosphere). It is permissible to exceed this limit and ascend to an altitude of up to 12,000 ft (3,600 m) for a maximum of 30 minutes. At altitudes above 12,000 ft (3,600 m) an uninterrupted supply of oxygen to all occupants of the basket must be assured. The general operating procedures for high-altitude flights shall be followed.

- **Ignition sources**

During inflation of the balloon, the safety zones described in Appendix 3 have to be respected.

During flight, all ignition sources in the basket must be avoided.

During deflation of the balloon, all potential ignition sources within a radius of 50 m of the balloon are prohibited.

WARNING: *Non-compliance with the safety instruction or improper handling of the balloon causes an immediate and serious threat to the balloon system as well as to all personnel involved.*



Chapter 3 – Emergency procedures

3.1 Introduction

This section describes procedures for emergency situations and provides corresponding check-lists. In the case of good flight planning and well maintained balloons, emergency situations are very rare. Should an emergency situation nevertheless arise, it is essential for the pilot to act quickly and precisely. Mental preparation for conceivable emergency situations is one way of making responses automatic. For this, all steps of a flight maneuver are thought through and internalized.

NOTE: *Under certain circumstances, due to the weather or other unforeseeable conditions affecting the specific situation, the pilot may deviate from the following recommendations. In such situations, even under the influence of stress, the pilot must remain permanently aware of the fact that the safety of the people on board takes priority over avoiding damage to the balloon.*

If a balloon enters an emergency situation, the pilot must focus his concentration primarily on the balloon and its flight path. For this reason, the passengers must be given calm and thorough instruction prior to take-off in how to behave during the flight and during landing. The following applies here:

Clear instruction:	The pilot must give clear instructions. The passengers must follow these instructions in all situations.
Position in basket:	Each passenger must be assigned a specific position in the basket. He must move into this position immediately during landing and in emergency situations.
Objects:	All objects that are not required must always be stowed and secured against falling out.
Landing:	For landing, all occupants of the basket must hold on tightly to the rope handle inside the basket. The muscles in the legs must be tensed and the knees bent slightly. The landing procedure must be observed by all to prevent surprise due to the basket touching down suddenly.
Disembarking:	No-one may leave the basket until the pilot has given the instruction to do so.

In emergency situations, the procedures described here should be applied. Recovery of persons always has top priority. It may be necessary to accept damage to or loss of the balloon and other equipment.



3.2 Behavior in the event of gas fires

WARNING: *During inflation and deflation, electrostatically conductive footwear must be worn in the vicinity of hydrogen. Clothing made of synthetic materials must not be worn. Cell telephones and lighters must be removed from pockets. Clothing must not be taken off or put on within a radius of 10 m of the balloon to prevent any electrostatic charges generated from being discharged in the vicinity of the balloon.*

CAUTION: *Pure hydrogen burns with a colorless flame. For this reason, a hydrogen fire is initially difficult to detect.*

• Gas fire during inflation

The following procedure must be observed in the event of a fire during inflation of the balloon:

- | | |
|------------------------|--|
| Gas supply: | The flame must be extinguished by cutting off the gas supply immediately. If this is not possible, leave the gas fire to burn until the arrival of firefighters. |
| Persons: | Persons must be moved away from the danger zone to prevent injury from falling parts of the envelope that are on fire. |
| Secondary fire: | Secondary fires must be contained. |

NOTE: *Balloons that are filled with pure hydrogen burn with a tall, low-pressure jet of flame.*

• Gas fire during deflation

The following procedure must be observed in the event of a fire after the balloon has landed:

- | | |
|------------------------|--|
| Persons: | All persons must be moved to safety. |
| Balloon: | Leave the balloon to burn. Wait until firefighters arrive. |
| Secondary fire: | Secondary fires must be contained. |

WARNING: *The envelope and the basket must remain completely attached to one another until the envelope has been fully deflated. This is to prevent the envelope from flying away while burning in the event of a fire.*



3.3 Closed appendix during take-off and ascent

WARNING: *Take-off with the appendix closed is not allowed – **Take-off prohibited!***

If the appendix cannot be reopened during flight, and the expansion of the gas resulting from increasing temperature and altitude creates an overpressure in the envelope, the emergency opening, if present, must be opened immediately. The following procedure must be observed:

Emergency opening:	The securing mechanism of the emergency opening must be released by pulling firmly on the yellow emergency opening line. Continuing to pull on the yellow line releases the emergency opening tongue from the envelope.
Flight:	The flight may be continued as planned.

If the balloon has **no emergency opening** or if the emergency opening cannot be opened, the following procedure must be observed:

Parachute:	The parachute must be opened at brief intervals to prevent the envelope from bursting
Flight:	The flight must be continued at low altitude in order to be able to land at the next possible opportunity.

WARNING: *The appendix must never look taut!*

3.4 Overcoming obstacles at low altitude

If, during low-altitude flight, a pilot detects an obstacle very late, he must quickly decide whether it is possible to rise above the obstacle safely.

CAUTION: *The effect of dropping ballast to cause the balloon to gain altitude or pulling the parachute to lose altitude always sets in with a delay.*

If the time and/or height is insufficient to fly over an obstacle that has been detected late, a forced landing before the obstacle is the better option. This applies in particular if the balloon is already descending.



The following procedure must be observed in this case:

Parachute: Pull the parachute to initiate a faster descent of the balloon.

Passengers: Instruct.

Sand bags: Any sand bags not required for the landing must be fastened securely inside the basket on the downwind side of the basket.

3.5 Contact with overhead power lines

Irrespective of the voltage, contact with overhead power lines constitutes a danger to life and limb.

WARNING: *If a hydrogen-filled balloon envelope contacts an overhead power line, this can lead to a fire or explosion. If the suspension ropes touch the overhead power line, there is the additional risk of the basket being separated from the envelope and falling to the ground.*

If there is a risk of contact with an overhead power line, it is imperative to perform an emergency landing before the overhead power line. The basket should be brought as close to the ground as possible before contact. The following procedure must be observed in this case:

Parachute: Pull the parachute to initiate a faster descent of the balloon. Accept the possibility of a hard landing.

Emergency call: If possible, place an emergency call to have the power line switched off.

Passengers: Instruct – The power line must not be touched!

Contact with the power line: If the basket remains suspended just above the ground, there must be no contact between the basket and the ground before the power has been cut off. Passengers must not exit the basket, nor may helpers touch the basket directly or indirectly (e. g. using a pole, ladder or other item.)

WARNING: *Contact between the suspended basket and the ground constitutes a **danger to life and limb!***



3.6 Damage to the envelope in the air

The following procedure must be observed if the envelope of the balloon is damaged in the air:

NOTE: *The extent of the damage can be estimated on the basis of the response of the variometer and possibly from the sound of the escaping gas.*

• **In the case of minor damage:**

Emergency call: Depending on the situation, place an emergency call.

Drop ballast: Adjust rate of descent.

Landing: Land at the next available opportunity.

• **In the case of major damage:**

Emergency call: Depending on the situation, place an emergency call.

Drop ballast: Reduce fast rate of descent by dropping ballast/emergency ballast.

Passengers: Instruct for the eventuality of a hard landing.

Landing: Land at the next available opportunity.

3.7 Excessive pulling of the parachute

The following procedure must be observed if the parachute has inadvertently been pulled excessively during the flight:

Drop ballast: Bring the flight attitude back under control by dropping ballast.

Ballast: Check whether the remaining flight ballast available is sufficient for continued flight or whether it is necessary to land.

Landing: If there is no longer sufficient flight ballast available, the balloon must be landed as soon as possible.



3.8 Malfunction and defect of the parachute

A trial pull of the parachute must be carried out before take-off to check the functionality of the parachute. More serious defects can be detected by a slackening of the envelope tautness and possibly by the sound of the lifting gas escaping.

3.8.1 Defect of the parachute and parachute line

If the parachute can no longer be operated during flight, the balloon can be made to descend by:

- a.) waiting until the lifting gas cools naturally or
- b.) dropping several bags of ballast so that the balloon rises above its pressure ceiling. This will eventually cause the balloon to lose lifting gas and start a steady descent. The quantity of ballast to drop depends on the quantity of flight ballast available and the change in temperature of the air and the lifting gas during the descent.

The following procedure must be observed in this case:

Waiting:	Wait until the balloon begins to descend naturally and, depending on the altitude, ballast reserves and distance from the suitable landing site, carry out a moderate or forced descent.
Obstacle:	If it is necessary to avoid an obstacle on the ground, the rate of descent must be reduced in time. It must be ensured that not too much ballast is dropped, to prevent the balloon from rising back up to the pressure ceiling.
Landing:	After touch-down, the balloon must be held down on the ground by means of additional loading.
Passengers:	Passengers must not leave the basket until instructed to do so by the pilot.

3.8.2 Conspicuously low pulling force required to open the parachute

If it is possible to pull the parachute with little resistance, the parachute line may have caught on the pull-down belts. If this is detected, the following procedure must be observed:

• On the ground:

Parachute:	Pull firmly on the parachute in an attempt to free the tangled parachute line. If the problem cannot be eliminated in this way, the balloon must be deflated.
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• In the air:

Parachute: Vent carefully to initiate a descent and land at the next available opportunity. An emergency landing is not usually necessary.

3.9 Sudden loss of lifting gas

If the balloon suddenly loses lifting gas and the rate of descent increases to more than 3 m/s, the following procedure must be observed:

Appendix pull-close line:	The appendix pull-close line must be released or cut with a knife.
Appendix anchor lines:	The appendix anchor lines must be released or, if necessary, cut with a knife.
Emergency call:	Depending on the situation, place an emergency call.
Passengers:	Instruct for landing.
Drop ballast:	Drop ballast to reduce the rate of descent to less than 3 m/s and, if possible, recover equilibrium of the balloon above the ground.

3.10 Non-standard landings

3.10.1 Hard landing

A hard landing is one in which the vertical landing speed exceeds 3 m/s and/or the horizontal landing speed exceeds 20 knots. The following procedure must be observed in these cases:

• With high rate of descent:

Passengers:	Instruct for landing.
Sand bags:	All sand bags must be fastened in the basket in the direction of flight and secured.
Trail rope:	The trail rope must be cast out in time.



• With high wind speed:

Landing site:	Search for a large area that is free of obstacles for the landing.
Passengers:	Instruct for landing.
Descent:	In the final phase of the descent, approach the ground slowly.
Appendix anchor lines:	The appendix anchor lines must be pulled tight to prevent the envelope from acting as a sail after landing.
Sand bags:	Any sand bags not required for the landing must be fastened in the basket in the direction of flight and secured.
Trail rope:	The trail rope must be cast out in time.
Drop ballast:	If possible, recover equilibrium of the balloon above the ground.
Parachute:	2 m above the ground, pull firmly on the parachute to open it and keep it open until the balloon has deflated.

CAUTION: *Keep ballast ready to use, as fast winds at ground level frequently result in the formation of turbulence near the ground.*

NOTE: *After a hard landing and before the next flight, an inspection of the integrity of the balloon must be carried out in accordance with Chapter 3 of the maintenance manual.*

3.10.2 Landing in woodland

Unforeseen changes in wind direction or a lull in the wind may necessitate landing in woodland. If it is necessary to land in woodland, the landing should be initiated while there is still maneuvering ballast available. The following procedure must be observed in this case:

Trees:	If possible, look out for “soft” trees, such as firs and spruces, for the landing; “hard” trees, such as pines and deciduous trees, should be avoided if at all possible.
Descent:	Pull carefully on the parachute to descend slowly between the trees in order to reach the ground if possible.
Hanging:	If the envelope of the balloon is damaged or if the balloon is left hanging, the basket must be secured to the tree, if possible, to prevent people falling out of the basket.
Passengers:	Remain secured in the basket and wait for help.



3.10.3 Landing on water

NOTE: *Flights over large bodies of water should only be carried out with the corresponding emergency equipment on board. On larger bodies of water, it may be possible to tow the balloon to land using a boat.*

CAUTION: *The towing boat must move very slowly and smoothly.*

If a landing on water is necessary, the following procedure must be observed:

Emergency call:	Place an emergency call as early as possible.
Flight:	If possible, keep the balloon above water until help has arrived.
Occupants:	Put on life jackets. The passengers must not leave the basket until help has arrived and not until instructed to do so by the pilot.
Parachute:	While the passengers are leaving the basket, the pilot must vigorously vent the lifting gas to prevent the balloon from climbing.
Landing on water:	If it is necessary to land on water, the life jackets must not be inflated until after leaving the basket.

WARNING: *When a person leaves the basket, a strong increase in the lifting capacity of the balloon is to be expected. This must be compensated by venting lifting gas.*



Chapter 4 – Standard operating procedures

4.1 Introduction

This section describes standard operating procedures and provides corresponding checklists. The explanations with weights and balloon specifications apply to a balloon with an envelope volume of 1,000 m³. Attention is drawn to differences relating to balloon size.

WARNING: *For filling with hydrogen, only filling hoses suitable for use with hydrogen may be used. These must be inspected regularly in accordance with the guidelines of the hose manufacturer, but at least annually, for gas-tightness and sufficient electro-static conductivity of both hose and coupling.*

4.2 Weather

The operating limits for inflation and flight of the balloon were already defined in Section 2.2: During inflation, the average wind speed should not exceed 12 knots with gusts not exceeding a maximum of 15 knots; for take-off, the average wind speed should not exceed 15 knots. If strong thermals are forecast, the balloon should be landed as soon as the thermals arise, if possible, or the flight should be planned in such a way that the flight altitude is high above the thermals and the balloon is landed at the end of the thermals. The balloon must not be flown in thunderstorms or other severe weather conditions of any kind.

For this reason, the pilot must have detailed information about the weather situation – both during inflation and throughout the flight. The weather conditions must be such that a safe landing can be carried out in suitable terrain and in daylight.

4.3 Preflight checks

Parallel to layout and inflation of the balloon, preflight checks must be carried out before every take-off. The points that must be checked by the pilot for good general condition and operability are specified in the maintenance manual. For each step of the chronological sequence of checks, the corresponding control points are described below. A detailed and **legally binding** checklist for the preflight checks can be found in the maintenance manual of the balloon; the points listed here serve merely as a reminder.



Preflight checks:

Before the balloon may be put into operation, the pilot must check whether the following documents are valid:

- Entries in the log book relating to damage / repairs / clearances
- Airworthiness review certificate (ARC)
- Certificate of airworthiness, registration certificate and insurance of the balloon

4.4 Preparing for inflation

4.4.1 Take-off site

The selected take-off site should be sheltered against the wind and should be located on the windward side of the available terrain. There must be no obstacles in the take-off direction that could endanger take-off. The take-off area must be clean. There must be no sharp-edged objects lying on the ground at the take-off, such as glass and stones, that could damage the envelope. It must also be ensured that the area is free from oil, grease and fertilizer residues.

NOTE: *If a tarp is laid out beneath the balloon envelope to protect it during inflation, it must be electrostatically conductive. The electric resistance of the surface has to be less than 10^9 Ohms. Cotton fabric or damp polyamide fabric generally meet this requirement. The packing tarp of the balloon envelope must be removed. Dry surfaces at the inflation site that are not electrostatically conductive must be made damp.*

4.4.2 Preparing the balloon prior to the start of inflation

Before laying out the balloon, the inflation team must be instructed in the particular circumstances at the take-off site and in the emergency procedures. In the case of filling with hydrogen gas, it must be ensured that the footwear and clothing of all persons who could come into contact with hydrogen are made of electrostatically conductive material.

The basket is set up on the side of the take-off site facing into the wind. The side of the basket with the trail rope bag is aligned with the side facing into the wind.

Preflight checks:

The pilot must check that the basket is in a good general condition. The following must be checked: **wooden parts, basket-work, steel cables, rope handle, sand bag line, sand containers and trail rope bag**

4.4.2.1 Laying out the envelope

Lay out the envelope, starting from the basket, with the parachute pointing in the wind direction. Spread the envelope out widthwise in such a way that the differently colored marking above the appendix is situated at the center of the upper side of the envelope. Lay the two holding ropes of the envelope on the left-hand and right-hand sides. Pull out the suspension ropes to their full length and toggle-fasten them to the load ring.

4.4.2.2 Toggle-fastening the load ring

The suspension rope attached to the load belt above the differently colored marking is the first to be fastened and is fastened to the load ring at the toggle centrally above the trail rope crow's-foot (Fig. 5). Thereafter, pairs of adjacent suspension ropes are each attached to one load ring toggle leading upwards. The basket ropes are toggle-fastened to the load ring in such a way that the trail rope crow's-foot is on the windward side.



Fig. 5: Trail rope crow's-foot

NOTE: *It must be ensured that the ropes are not crossed or twisted.*

NOTE: *The assignment of the load ring may vary according to the size of the balloon envelope and that of the basket.*

NOTE: *The toggle allocation for the fabric walled basket is described in APPENDIX 2*

NOTE: *The toggle allocation for the Race Competition Basket is described in APPENDIX 4*

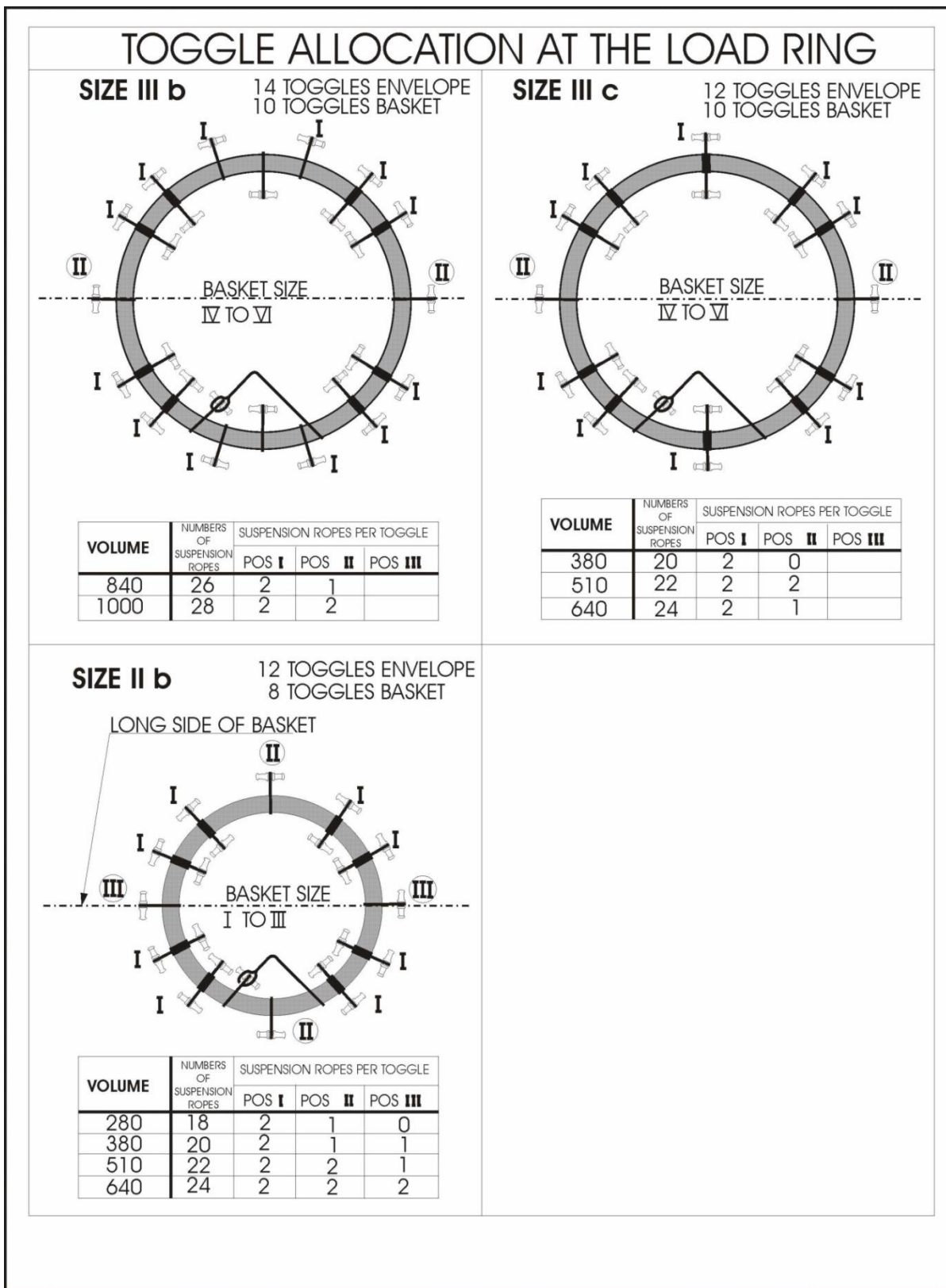


Fig. 6: Representation of the toggle assignment



Preflight checks:

The pilot must check that the load ring is in a good general condition. The following must be checked: **tubular steel ring, slings and toggles.**

4.4.2.3 Ballast bags

The basket is loaded with 30 to 40 ballast bags, each weighing 15 kg, inside the basket. A further 60 ballast bags, each weighing 15 kg, are suspended from the sand bag line on the outside of the basket and distributed evenly around all four sides of the basket. If the fabric walled basket is in use, the ballast bags have to be suspended on the load ring. Use therefore ballast straps (ref. ANNEX 2).

CAUTION: *During inflation – particularly in the case of gusty winds – it must be ensured that the balloon is weighed down with sufficient ballast to ensure that the basket remains safely on the ground.*

NOTE: *For smaller balloons, a correspondingly smaller number of ballast bags may be used. One ballast bag weighing 15 kg is required for every 10 m³ of the envelope volume.*

WARNING: If the balloon is to be anchored to a ground-level attachment point for inflation, ensure that all connections (ratchet straps, belts, etc.) are electrostatically dissipative. The electrical resistance of the connection must be less than 10⁹ Ohms.

4.4.2.4 Preparing the envelope

Check the parachute and the edge of the parachute opening for tears or damage. Then pull the parachute line out of the balloon through the parachute opening, until its lower end only extends approx. 2 m out of the stretched out appendix. Lay the parachute line in a meandering pattern, and place it approx. 2 m to one side of the parachute opening inside the envelope. This is to prevent the parachute line from getting caught in the pull-down belts during inflation.

The parachute is tied to the two oppositely arranged parachute limit tongues, each approx. 10 cm long, on the inside of the envelope. Use a cotton thread or a strip of balloon fabric with a breaking strength of 60 to 80 N (~6 to 8 kg) for tying the parachute.

CAUTION: *The parachute limit tongues must only be fastened **with a single tie!***

Preflight checks:

The pilot must check that the envelope is in a good general condition. The following must be checked: **gores, gore seams, reinforcements, deflation opening, parachute, fastening of the parachute line, load belt, suspension ropes and emergency opening, if present.**



4.4.2.5 Inflation method for envelope held down with sand bags

NOTE: *Ballonbau Wörner only recommends the inflation method described below.*

In the longitudinal axis of the balloon, approx. 2 m from the upper cross seam towards the basket, five sand bags weighing 15 kg each are attached under the inflation tarp to each of the two snap-hooks. The inflation tarp is placed over the sand bags to protect the envelope and prevent it from being damaged by sand bag hooks when the balloon is raised to the upright position. The inflation tarp is to be placed on the sand bags in such a way that the markings on the tarp indicating the directions "Parachute" and "Basket" are observed. In this way, when looking from the basket towards the parachute, the toggle for pulling up the inflation aid is located on the right-hand side.

Preflight checks:

Before use, the inflation aid must always be checked for damage as follows:

- Holding down patches and holding rope attachment on the envelope of the balloon with the adjacent areas
- Stainless steel rings and belts on the envelope of the balloon
- The stitching fastening the pipe to the belt of the inflation aid
- Stainless steel rings and belt for fastening the sand bags to the inflation aid

The envelope is then gathered across its entire width along the upper cross seam and laid down on the inflation tarp over the sand bags. The envelope must be gathered in such a way that it lies completely between the reinforced sections of envelope for the two holding rope attachments (Fig. 8). This means that one reinforced section of envelope faces down towards the inflation tarp, while the other one lies above it on top.

The four holding down patches are located on the four seams on the upper reinforced section of envelope (two seams on the left and two on the right). A steel ring is attached to the reinforced section of envelope and to each of the four holding down patches (Fig. 7). Lay the two ends of the holding belt of the inflation tarp around the gathered balloon.

The steel rings of the four holding down patches and of the reinforced section of envelope and the ring at the end of the holding belt are pushed onto the holding belt pipe in the following sequence: outer holding down patch/inner holding down patch/reinforced section of envelope/inner holding down patch/outer holding down patch/ring of the holding belt.

The loop of the 20 mm securing belt at the end of the holding belt is pulled through the hole at the end of the pipe and secured with the wooden toggle to prevent it being pulled back out. It must be possible to pull out the toggle in the direction of the parachute when the envelope is rising.



Fig. 7:
The hold-down belts



Fig. 8:
Holding down patch



Fig. 9:
The gathered envelope

NOTE:

- *It must be possible to pull the pull-up toggle of the inflation aid towards the parachute and away from the part of the envelope that is filled with gas!*
- *The holding belt must lie flat against the envelope and must not be twisted.*
- *The strain on the holding down patches should be distributed as evenly as possible.*
- *The envelope and the suspension ropes must not be twisted.*
- *The envelope must not be pinched by the sand bags when they shift towards the basket.*

The bottom end of the parachute line is attached to the extension line and secured by attaching it to five sand bags or an anchor point. It must be ensured that the sand bags cannot detach themselves from the extension line.

This means that the parachute can always be opened if necessary during inflation.

4.4.3 Attaching the inflation tube

The inflation tube made of balloon fabric for low inflation pressures up to 20 mbar is fastened to the inflation socket by means of an elastic fastener. The inflation tube for high inflation pressures up to 12 bar is fastened to the bayonet coupling of the inflation socket. The inflation tube is routed to the appendix either underneath or over the top of all the suspension ropes lying on the ground. The inflation socket is then pushed all the way into the appendix. The appendix is gathered together below the conical section of the inflation socket and firmly pulled together with an elastic Velcro fastener in order to prevent it slipping downwards and coming out. The loop of the Velcro fastener opening line is attached to the eyelet in the middle of the appendix by means of a securing tape. This securing tape with a breaking strength of 50 to 100 N is intended to prevent the Velcro fastener from opening unintentionally. The pull-down line of the inflation socket is finally pulled through the steel ring on the belt of the lower appendix ring (Poeschel ring).



NOTE: *In the case of gusty winds of 10 to 15 knots, it is advisable to route the inflation tube through the load ring.*

Preflight checks:

The pilot must check that the appendix and the ropes are in a good general condition. The following must be checked:

appendix, appendix anchor lines, appendix pull-close line, parachute line and emergency opening line, if present.

Checks after laying out the balloon and before inflation:

- Have all persons been instructed in working with hydrogen?
- Are the parachute and the parachute opening undamaged?
- Are the load belts undamaged?
- Is the parachute line secured with the extension line?
- Are the suspension ropes attached to the basket?
- Is the basket equipped with sufficient ballast?
- Has a test been performed to make sure that the pull-open line of the Velcro fastener over the inflation socket can be opened?

Preflight checks:

End of the preflight checks. The pilot must document the performance and results of the preflight checks in the log book.

4.5 Inflating with lifting gas

WARNING: *If, during or after inflation with hydrogen, it should be necessary to look inside the envelope of the balloon, it must only be illuminated using an **explosion-proof lamp** fulfilling the requirements for explosion protection (ATEX) in Zone 1 according to the currently valid standards. Entering the envelope after inflation is strictly prohibited (ZONE 0).*

RISK OF SUFFICATION, FIRE AND EXPLOSION!

NOTE: *The gas pressure is always higher than the maximum permissible pressure for the balloon. For this reason, the balloon should be inflated slowly. This protects the envelope and reduces the risk of overinflating the balloon. The inflation has to be stopped punctual.*

WARNING: *There is a risk of bursting at 225 mm Water Column (WC) overpressure; this corresponds to 22.5 hPa. Free balloons are only flown with an overpressure of 16 mm WC = 1.6 hPa. For this reason, the balloon must only be inflated until it is slightly taut.*

Allow the lifting gas to flow into the balloon slowly until there is a sufficiently large gas bubble in the envelope. The volume of the gas bubble should be approx. 300 m³ for a 1000 m³ envelope and approx. 100 m³ for a 500 m³ envelope. During inflation, the correct position of the holding belt must be monitored. Particular attention must be paid to ensuring that the belt does not roll up and that the holding down patches are loaded uniformly.

CAUTION: *If folds in the envelope are pinched, or if the envelope is twisted, this may result in damage to the envelope!*

Once the desired degree of inflation has been reached, the gas supply is shut off. The envelope is allowed to rise by opening the holding belt of the inflation aid. This is achieved by pulling the wooden toggle of the holding belt out of the loop towards the parachute. The person performing this task stands on the right-hand side of the balloon as seen from the basket and looking towards the parachute (Fig. 10). During opening, the toggle must be held in one hand while the pipe is kept as far away as possible from the rising envelope.



Fig. 10:
Raising the envelope
(The picture shows the view from the parachute towards the basket)

WARNING: *Never stand on the wrong side when opening the holding belt! (The person performing this task stands on the right-hand side of the balloon as seen from the basket and looking towards the parachute.)*

WARNING: *There must be no persons in the area of the envelope and the suspension ropes while the envelope is rising!*

CAUTION: *The pull-open line of the Velcro fastener and the pull-down line of the inflation socket must be free while the envelope is rising.*



Once the envelope has been raised to the upright position, the inflation tube, all suspension ropes and all operating lines must be checked. The two holding ropes of the envelope and the appendix anchor lines must be used to minimize swinging of the envelope during the rest of the inflation operation.

CAUTION: *If one of the two holding ropes of the envelope positioned itself over the parachute while the envelope was rising, it must be removed from this position. Take-off must not be carried out if there is a holding rope of the envelope lying over the parachute.*

The pull-down line of the inflation socket must be fastened to the load ring with a little slack. This rules out the risk of injuries to persons if the inflation socket slips out of the appendix. In the event of windy weather, it may be necessary to stabilize the appendix using the appendix anchor lines, if necessary.

CAUTION: *The holding ropes of the envelope and the appendix anchor lines must not be tied to a heavy object, as this may result in damage to the ropes and to the envelope.*

Once inflation has been completed, the Velcro fastener is removed by pulling on the pull-open line. **When doing this, the pull-down line of the inflation socket must be held tightly** and the inflation socket must be lowered slowly.

4.6 Making the ropes ready

Check whether the white marking on the parachute line is hanging at the same height as the lower appendix ring (Poeschel ring). If this is not the case, pull on the parachute and check the position of the marking again. *The balloon must be deflated if it is not possible to untangle the parachute line and pull-down belts before take-off.*

Check that the appendix closing device is functioning properly. The end of the **appendix pull-close line** is attached to the rope handle inside the basket. The remaining line is stowed in the basket bag. The appendix is closed until take-off. For this, the corresponding section of the line is tied to the rope handle with an easily released knot or wound several times around a toggle on the load ring.

The **appendix anchor lines** are wound twice around a basket rope and the ends are tied to the rope handle inside the basket. The remaining line is stowed in the basket bag. The **parachute line** is untied from the extension line and the end is tied to the rope handle inside the basket. From there it runs up to the load ring and the excess length can be wound around a toggle or stowed in an empty sand bag. The parachute line must always have about one meter of slack.



NOTE: *It must always be ensured that the end of the parachute line is firmly tied inside the basket and that it can be reached by the pilot at all times.*

WARNING: *When descending from high altitude, a parachute line that is attached to the load ring without slack may inadvertently open the parachute!*

The **emergency opening line**, if present, is attached and stowed in the same way as the parachute line.

For **trail rope attachment**, a crow's-foot with toggle and loop is provided on the load ring. At its upper end, the trail rope has a strong loop that is toggle-fastened to the crow's-foot of the load ring. During flight, the trail rope is kept coiled and stowed in the trail rope bag that is attached to the basket.

The **holding ropes** of the envelope are hooked onto two toggles on the load ring. They must not be tied on.

4.7 Flight ballast

The flight ballast must be suspended from the inside or outside wall of the basket in sand containers and bags, and/or from ballast bag holders on the load ring, and be secured against swinging and coming loose.

CAUTION: *Unsecured sand bags can cause damage, fall down or become detached in the event of a hard touch-down.*

NOTE: *Secured sand bag hooks or snap-hooks that prevent the bags from detaching themselves may be obtained from Ballonbau Wörner. All sand bags attached outside of the basket have to be connected with appropriate carabiner hooks or with special snap hooks delivered by Ballonbau Wörner.*

NOTE: *Ballast bags attached outside the basket must be secured to prevent them from falling unintentionally while taking them inboard. This can be achieved by means of a transport net or by attaching each sand bag individually with a safety rope.*

Checks after inflation

- Is the white marking of the parachute line at the same height as the lower appendix ring (Poeschel ring)?
- Does the lower part of the envelope empty quickly with the appendix closed? This would indicate major damage to the envelope or a leak in the parachute.
- Are all the ropes secured?
- Does the parachute line have sufficient slack?
- Are all the toggles on the load ring horizontal?
- Are the suspension ropes toggle-fastened in the correct position on the load ring?

4.8 Preparing for take-off



Before take-off, the balloon must be left to stand for at least 15 minutes with the appendix closed in able to detect a possible loss of gas. This is intended to ensure that the envelope is not damaged or leaking after the inflation operation.

4.8.1 Checking the weather situation

The current weather conditions and the weather forecast for the flight must be checked once again – particularly with regard to whether the weather situation forecast for the take-off time has actually materialized.

4.8.2 Checking the equipment

All technical equipment required for the flight must be switched on, adjusted and checked to ensure that it is functioning correctly before take-off.

4.8.3 Instructing the passengers

Before take-off, the passengers must be carefully instructed at/in the basket in how to behave correctly during the flight. Correct behavior during flight/landing and during the performance of emergency procedures is of particular importance.

At the very least, the instruction should cover the following points:

Clear instruction:	The passengers must follow the instructions of the pilot in all situations.
Position in basket:	Each passenger must be assigned a specific position in the basket. He must move into this position immediately during landing and in emergency situations.
Objects:	All objects that are not required must always be tidied away and secured against falling out.
Landing:	For landing, all occupants of the basket must hold on tightly to rope handle inside the basket. The muscles in the legs must be tensed and the knees bent slightly. The landing procedure must be observed to prevent surprise due to the basket touching down suddenly.
Disembarking:	No-one may leave the basket until the pilot has given the instruction to do so.

NOTE: *Instruction in the landing procedures must be repeated again before landing.*



4.8.4 Opening the appendix

The appendix must be opened completely before take-off.

4.8.5 Trial pull of the parachute

In order to test that it is functioning correctly, the parachute is opened and closed before take-off.

4.9 Take-off

Take-off with the balloon not taut is recommended in order to reach the minimum safe altitude without having to drop large quantities of ballast after lift-off.

The following points must be checked before take-off:

- Have the inflation tube and inflation socket been removed?
- Is the appendix closing device functioning properly?
- Has a trial pull of the parachute been carried out?
- Is the appendix completely open?

WARNING: *No take-off may ever be carried out for any purpose unless the appendix is completely open!*

Once all passengers have taken up their place in the basket, procedures are commenced to achieve equilibrium (neutral buoyancy) of the balloon. Once the balloon is in equilibrium, the foreseeable quantity of ballast required for the planned flight is checked. If there is insufficient ballast on board, one occupant must leave the basket and his mass must be replaced with ballast.

NOTE: *A rate of climb of about 2 m/s is recommended for take-off. For a 1000 m³ balloon, this corresponds roughly to dropping one full bag of ballast once the balloon has reached equilibrium.*

4.10 Flight

Following take-off, checks must immediately be made again to ensure that the ballast outside the basket is correctly attached and that the appendix is open as specified. If this is not the case, the emergency opening must be opened immediately using the yellow emergency opening line. If the balloon is not equipped with an emergency opening, bursting of the envelope can be prevented by repeatedly pulling the parachute.

WARNING: *The appendix must never look taut (see Section 3.3 "Emergency procedures").*



4.10.1 Checking the ropes

During flight, permanent care must be taken to ensure that the lines that are fastened to the basket or load ring, such as the parachute line, appendix pull-close line and emergency opening line, have sufficient slack, that the appendix anchor lines are not under tension, and that everything is easily accessible at all times.

4.10.2 Venting the lifting gas

If the parachute is used as a maneuvering valve (flight valve), the parachute line may only be pulled down **slowly** until the parachute becomes **leaky**. The escape of gas is indicated to the pilot by a clearly audible hissing sound. Lifting gas should be vented by briefly and repeatedly opening and closing the parachute until the balloon responds.

WARNING: *The way in which the parachute functions as a maneuvering valve differs significantly from the flap valve of a traditional gas balloon. For this reason, adequate instruction in the proper use of the parachute is required.*

Vibration in the line indicates the maximum permissible degree of opening for venting gas during maneuvering.

WARNING: *Pulling hard on the parachute line for a long time results in the need for a large quantity of braking ballast. The parachute must always be **pulled slowly** so that the vibration in the line can build up.*
This vibration in the line is the only safe indication to the pilot of the transition between the maneuvering effect of the parachute and the quick deflation effect. In the case of quick deflation, the balloon loses approx. 300 to 500 N of lifting capacity power per second, which corresponds to a weight of approx. 2 to 3 ballast bags.

4.10.3 Observing the variometer

Observe the variometer to evaluate the behavior of the balloon during ascent and descent.

4.10.4 Dropping ballast

In order to cause the balloon to ascend, fine-grained ballast must be dropped from the sand container or directly from the sand bag.

NOTE: *In addition to sand, several kilograms of water ballast can also be carried. This water is poured out if it is necessary to drop ballast over sensitive areas. The water is stored in canisters with a large opening for pouring and is secured and stowed in a similar way to sand bags.*
The water ballast has to be protected against freezing.



NOTE: *Quantity of ballast to be dropped in order to change altitude: if one percent of the mass of the balloon is dropped, the balloon rises from its equilibrium position (neutral buoyancy position) by 80 m.*

EXAMPLE: *A 1000 m³ hydrogen-filled gas balloon has a lifting capacity of around 1140 kg. If the balloon is to rise 250 m, $250 \text{ m} / 80 \text{ m} = 3.125$ times as much ballast must be dropped. This corresponds to a lifting capacity of $3.125 \times 1140 \text{ kg} / 100 = 35.6 \text{ kg}$. It is thus necessary to drop slightly more than two bags of ballast, each weighing 15 kg, to cause the balloon to rise 250 m.*

NOTE: *In order to bring on board safely the sand bags that are carried outside the basket, they must be secured against falling by means of a rope that is firmly tied inside the basket. A safety rope that performs this function may be obtained from the balloon manufacturer.*

4.11 Landing

The landing is one of the most difficult tasks during a balloon flight. It must therefore be planned, prepared and executed with foresight.

The following points must be checked before landing:

- Has the instruction to passengers on how to behave during landing been repeated?
- Have all unnecessary instruments and baggage been stowed safely in the basket bags?
- Has the bench been put away and the basket flap closed?
- Have all sand bags been fastened in the basket in the direction of flight and secured to prevent them from coming loose?
- Have all outboard fixed sand bags been secured to prevent them from commute and flipping over?
- Is the parachute line accessible at all times?
- Have the appendix anchor lines been pulled tight?
- What are the wind speed and wind direction on the ground?
- Is the landing site sufficiently large?
- Are there any obstacles that need to be taken into account in the direction of flight (e.g. overhead power lines, electric fences, etc.)?
- For the use of the fabric walled basket: Is the flap in the sidewall of the basket retracted?

Descent is initiated by pulling slightly on the parachute or using a natural drop in altitude. The rate of descent must be checked on the variometer and by looking outside. Equilibrium of the balloon is recovered above the ground by dropping ballast. The braking ballast required for recovering the equilibrium of a 1000 m³ balloon is calculated using the following rule of thumb: rate of descent in m/s squared times the drag coefficient of the balloon size.

EXAMPLE: Balloon size 1000 m³, rate of descent 3 m/s, drag coefficient 4:
 $\Rightarrow 3 \times 3 \times 4 = 36 \text{ kg}$ of braking ballast



NOTE: *Closing the appendix during the descent reduces the deflation time as a smaller volume of gas has to escape through the parachute opening during final deflation.*

WARNING: *Ballast must be kept readily accessible during the landing phase. There may be unexpected changes in wind direction at ground level. For this reason, the landing site should also have sufficient lateral clearance from overhead power lines, buildings, roads and other obstacles. Fast winds at ground level can also result in the formation of turbulence near the ground.*

4.11.1 Orienting the basket

Using a trail rope, it is possible to orient the balloon at low altitude before touch-down during landing. With the trail rope hanging out the back relative to the direction of flight, the front side of the basket is defined as the “drag side”. If landing with a trail rope, the sand ballast is always secured on the “drag side” (downwind or leading side), i.e. at the front, prior to landing. The occupants always stand behind the sand bags. If landing without a trail rope, the ballast must be positioned on whichever side of the basket is facing in the direction of flight.

NOTE: *Ballonbau Wörner recommends flying with a trail rope!
Positioning the sand bags on the “drag side” prevents them from swinging, thereby reducing the risk of injuries to legs and ankles. Further advantages of the trail rope during landing are the horizontal braking effect and stabilization resulting from friction and a reduction of the rate of descent before the balloon touches down.*

CAUTION: *Use of a trail rope entails hazards that must be weighed up by the pilot. Not all landing sites are suitable for use of the trail rope.*

4.11.2 Touch-down

Before touch-down, every occupant of the basket must adopt a stable position. Everyone must hold on tightly to the handles in the basket and tense the leg muscles. Depending on the wind speed, pull the parachute approx. 60 cm shortly before touch-down when the balloon is about **2 m above the ground**; this is to prevent the balloon from bouncing and to avoid repeated touch-down if possible. The pilot should warn passengers just before the first touch-down (and the second touch-down if applicable).

The loss of lifting capacity with the parachute completely open is approx. 400 N/s, i.e. approx. 3 ballast bags per second!

The pilot decides when the passengers may leave the basket, thereby completing the landing.

WARNING: *In contrast with the rip panel on a traditional gas balloon, the quick deflation effect of the parachute starts immediately. For this reason, in the case of higher landing speeds, the parachute should not be opened as early as the rip panel. On the other hand, the parachute line must be firmly gripped during touch-down, so as not to*



interrupt the rapid deflation of the balloon. If the pilot releases the parachute line, the parachute closes again immediately.

CAUTION: *Care must be taken to prevent multiple touch-down of the balloon, as the basket would otherwise start to swing. This could result in a situation that would be more difficult for the occupants to control!*

NOTE: *For landings with higher landing speeds, a safety harness may be used for the occupants of the basket if the basket is equipped for this.*

4.12 Deflating the envelope

CAUTION: *During deflation of the balloon, all potential ignition sources within a radius of 50 m of the balloon are prohibited.*

To deflate the balloon, the parachute must be kept completely open until the envelope comes to rest on the ground. Depending on the weather situation and landing conditions, deflation of the envelope can already be commenced during touch-down or after a certain time on the ground.

NOTE: *The parachute closes automatically when the line is released as long as there is still sufficient lifting gas in the envelope to carry it.*

NOTE: *The deflation time is shorter if the appendix is closed.*

4.13 Dismantling and packing

Once the envelope has been completely emptied, remove the envelope from the basket. It is advisable to detach the basket ropes from the load ring and to leave the suspension ropes attached to the load ring. The balloon is stretched out to its full length and the parachute is pulled slightly out of the envelope. The parachute line remains in the balloon.

CAUTION: *When stretching out the balloon, never pull directly on the parachute opening or the edge of the opening of the balloon!*

CAUTION: *The parachute line must never be stored inside the balloon for more than two days when damp. Otherwise there is a risk of mildew formation! The procedure for this situation is described in Section 2.7 of the maintenance manual.*

The envelope of the balloon is then folded longitudinally in accordance with the gores. Starting at the center of a gore, place the center of every second subsequent gore exactly on top of it. Place the packing tarp under the folded envelope in such a way that only the entire appendix protrudes over the packing tarp. Pull the upper part of the envelope with the parachute opening towards the appendix, without straining the parachute opening. Place the parachute opening on the lower part

of the envelope with a slightly oval shape in the area of the packing tarp (Fig. 12). Fit the edge protection on the parachute opening (Fig. 11). To do so, press the slit of the tube-shaped edge protection onto the edge of the envelope.

NOTE: *The edge protection prevents sharp kinking of the parachute opening during packing and transport of the envelope. This preventive measure is necessary to prevent damage to the cable that is incorporated into the edge of the envelope. It only takes a few minutes to fit and contributes considerably to extending the service life of the envelope!*

Then roll up the envelope, starting at the equator, until it is lying centrally on the packing tarp.

CAUTION: *The parachute opening must not be kinked when rolling up the envelope!*

The section of the parachute opening that has not been rolled up and the lower part of the envelope including the appendix that has not been rolled up are folded over onto the rolled up envelope. Place all the ropes around the appendix rings in a circular arrangement. If the load ring is connected to the suspension ropes, place it centrally on top of the rolled up envelope.



Fig. 11:
Fitting the edge protection



Fig. 12:
Carefully rolling up the parachute



Fig. 13:
Transport in trailer

4.14 Packing tarp

All envelopes with a polyurethane coating (manufactured since 2007) may only be packed in materials that are free of plasticizers. All tarpaulins that are coated with polyethylene, polypropylene or polyurethane are suitable for packing the envelope.

NOTE: *PVC tarpaulins contain harmful plasticizers and may not be used as packing tarps.*



Chapter 5 – Size and weights

5.1 Introduction

This section describes the size and lifting capacity of the certified balloon envelopes and their classification in various sport categories.

5.2 Sizes

In accordance with the regulations of the FAI, free balloons are divided into different classes and sub-classes, depending on their type and volume.

The following sizes of gas balloon are listed in FAI class AA:

Balloon volume	Class
250 m ³ or less	AA-1
250 m ³ to 400 m ³	AA-2
400 m ³ to 600 m ³	AA-3
600 m ³ to 900 m ³	AA-4
900 m ³ to 1200 m ³	AA-5
1200 m ³ to 1600 m ³	AA-6
1600 m ³ to 2200 m ³	AA-7

The permissible volume tolerance is +5%, i.e. a balloon with a volume of 630 m³ can still be flown as class AA-3. The sizes are based on balloons filled with coal gas. To determine the class of a balloon filled with hydrogen, the volume must be multiplied by a factor of 1.63. For balloons filled with helium, the factor is 1.509.



5.3 Standard sizes and maximum dimensions

The standard sizes for the NL-STU series in accordance with EASA Type Certificate No. EASA.BA.009 / FAA Type Certificate No. B03CE are as follows:

5.3.1 Envelope

Standard size	Number of gores	Envelope weight	Maximum take-off mass (MTOM) (H ₂) *
up to 280 m ³	18	approx. 64 kg	325 kg
up to 380 m ³	20	approx. 73 kg	441 kg
up to 510 m ³	22	approx. 85 kg	592 kg
up to 640 m ³	24	approx. 95 kg	749 kg
up to 840 m ³	26	approx. 107 kg	974 kg
up to 1000 m ³	28	approx. 114 kg	1160 kg

*acc. to data sheet EASA.BA.009

NOTE: The “maximum allowed take-off mass” (MATOM) is a theoretical value that is dependent on various factors, such as the altitude of the take-off site, outside temperature, etc. The value for the lifting capacity $H_2 = 1.16 \text{ kg/m}^3$ is used for historical reasons and was specified in the design regulations issued by the Luftfahrt-Bundesamt (German Federal Aviation Authority). Calculation of the lifting capacity is normally based on the ISA standard atmosphere with lifting capacity of $H_2 = 1.14 \text{ kg/m}^3$.

5.3.2 Baskets

Basket	Standard size	Basket weight
Basket I	80 cm x 65 cm	approx 32 kg
Basket II	95 cm x 80 cm	approx 40 kg
Basket III	110 cm x 95 cm	approx 52 kg
Basket IV	125 cm x 105 cm	approx 64 kg
Basket V	135 cm x 115 cm	approx 73 kg
Basket VI	145 cm x 125 cm	approx 88 kg
Lightweight basket	125 cm x 105 cm	approx 58 kg
Fabric walled basket	125 cm x 105 cm	approx 35 kg
Race Competition Basket	120 cm x 98 cm	approx 17 kg* approx 20 kg**

* Competition configuration (2 persons)

** Standard configuration (4 persons)



5.3.3 Matrix of theoretically possible loads

Envelope size	Max. take-off mass acc. to ISA*	Standard basket	Overall weight** incl. load ring, ropes, lines, etc.	Minimum ballast	Theoretically possible load***
280 m ³	319 kg	Basket I	102 kg	30 kg	187 kg
380 m ³	433 kg	Basket II	119 kg	45 kg	269 kg
510 m ³	581 kg	Basket III	143 kg	45 kg	393 kg
640 m ³	729 kg	Basket IV	165 kg	60 kg	504 kg
840 m ³	957 kg	Basket V	186 kg	60 kg	711 kg
1000 m ³	1140 kg	Basket VI	208 kg	75 kg	857 kg
1000 m ³	1140 kg	Lightweight basket	178 kg *****	75 kg	887 kg
1000 m ³	1140 kg	Fabric walled basket	155 kg *****	75 kg	591 kg ****
1000 m ³	1140 kg	Race competition basket	140 kg ***** (137 kg) *****	75 kg	395 kg *****

* 288 K (15 °C) air temperature / 1013.25 hPa / 1.225 kg/m³ / Take-off at mean sea level

** Mean overall weight – the overall weight may vary according to the design, e.g. due to advertising on the envelope

*** Instruments, trail rope, equipment, flight ballast and occupants must be included in the calculations

**** The theoretically possible load for the fabric walled basket exists of 2 occupants (2x77 kg), equipment (30 kg) and the minimum of ballast (75 kg). There is the possibility to storage at most 330 kg ballast in the basket. The remaining ballast has to be attached outboard

***** Trail rope and crew equipment is not included

***** The theoretically possible load for the Race Competition Basket consists of four occupants (approx. 4 × 77 kg), equipment (approx. 10 kg), and the minimum ballast (75 kg). The remaining ballast must be securely attached to the outside of the basket.



Chapter 6 – Components of the gas balloon

6.1 Introduction

A gas balloon consists of a gas-tight envelope with a basket suspended beneath it. The basket is attached to the envelope by means of ropes. The following chapter describes all functions of the individual components of the gas balloon.

6.2 Envelope

6.2.1 Material

The envelope material consists of a layer of polyamide fabric with rip-stop threads. It is coated on the inside and outside with artificial rubber or polyurethane. The inside coating is electrostatically conductive in order to distribute electrostatic charges uniformly over the entire envelope and to ensure equipotential bonding with the ground on landing. The maximum surface resistance on the inside is 10^9 Ohms. Coatings of different colors are used for the outside.

6.2.2 Openings in the envelope

The envelope of the netless gas balloon has two or three openings.

6.2.2.1 Deflation opening

The deflation opening is also used as a parachute opening. It combines the maneuvering valve and quick deflation functions. In traditional netted balloons, these tasks were shared between the flap valve and the rip panel. The deflation opening is located at the north pole of the envelope, where it is sealed with a parachute. The edge of the opening is protected against tearing by means of a bolt rope made of steel or Kevlar and is reinforced with several layers of fabric. The parachute is held in its correct position by means of centering belts. To deflate the balloon, the parachute is pulled down by the pull-down belts. The parachute is also used as a flight valve.

6.2.2.2 Emergency opening

The emergency opening is an option for this type of balloon. The emergency opening serves as a substitute for the appendix. If the balloon is equipped with an emergency opening, this opening is located above the appendix. The emergency opening is a triangular section of the envelope, the area of which roughly corresponds to the cross section of the appendix. If, for whatever reason, it should not be possible to open the appendix during flight, the emergency opening is opened by means of the emergency opening line and the expanding gas can escape during flight.



6.2.2.3 Appendix opening

The appendix, a cylindrical tube of balloon fabric, is suspended from the appendix opening. It is attached to the south pole of the envelope by means of two appendix rings. During flight, the appendix is open so that the gas may expand in case of increasing temperature or decreasing outside pressure (e.g. during ascent). The parachute line is routed out of the envelope and into the basket through the appendix. The wooden ring attached at the lower end of the appendix, the so-called lower appendix ring (Poeschel ring), keeps the appendix open during flight. When the appendix pull-close line is pulled, the lower appendix ring (Poeschel ring) is turned horizontally and at the same time tilted upwards on one side. This closes the appendix, which is of advantage for intermediate landings, gusts, and for deflation.

6.2.3 Load belt

The load belt is attached to the envelope halfway between the equator and the appendix. It consists of arch-shaped sections of belt that end in stainless steel rings. The arch-shaped sections of belt serve to introduce the load from the suspension ropes uniformly into the envelope. The suspension ropes that lead to the load ring are hooked into the stainless steel rings.

6.3 Load ring

The load ring forms the connection between the suspension ropes and the basket ropes. It consists of a welded steel pipe. Slings and toggles for attaching the suspension ropes and basket ropes are spliced onto the load ring. A crow's-foot, consisting of one rope with a loop and another rope with a toggle, is provided for the trail rope.

6.4 Basket

The wickerwork of the balloon basket is made of rattan. The floor is stiffened and reinforced with hardwood laths. The basket ropes consist of sheathed stainless steel cables. Each basket rope runs down one side wall, then horizontally through the floor of the basket before running back up the opposite side wall.

The basket size depends on the number of persons. A basket floor area of 0.3 m² per person must be calculated. Baskets for 1 to 6 persons are approved for balloons of type NL-STU, depending on the envelope size.

The bottom corners of the basket and the "drag side" are protected against wear by leather caps. The upper edge of the basket is often padded with leather. For performance flights, a lightweight 4-person basket or a 2-person fabric walled basket can be used. This two baskets are equipped with a flap in the side of the basket.



6.5 Sand bags and sand containers

The sand bags serve to carry the flight ballast in units of 15 kg. The bags are open at the top and have a rope or belt with a hook for attaching the sand bags. If the sand ballast is to be suspended outside the basket or from the load ring, the hooks must be secured to prevent them from detaching themselves. Fine-grained sand, preferably dry, is used as sand ballast.

The sand container is a bag that has room for the contents of two to three sand bags. The sand container is equipped with a scoop that the pilot can use to drop sand in small doses. The sand container hangs outside the basket on the short edge of the basket. This is generally the part of the basket in which the pilot stands.

6.6 Trail rope

The trail rope is not a compulsory part of the equipment, as the balloon does not have to be aligned with a specific orientation prior to deflation. If the trail rope is used during landing to decelerate the rate of descent prior to touch-down, it must be made of natural fibers. For a 1000 m³ balloon, a coconut fiber rope with a diameter of 30 mm and a length of 50 m is recommended.

6.7 Ropes

6.7.1 Holding ropes

The two holding ropes are attached at the upper cross seam of the envelope. During inflation, they serve to limit the lateral movement of the envelope. If the envelope has turned during the inflation operation, or if it has been incorrectly toggle-fastened, it can be turned to the correct position above the basket by means of the holding ropes. If there is no wind during deflation of the envelope, the envelope can be pulled away from above the basket by means of the holding ropes.

6.7.2 Parachute line

Since 2001, the parachute line has been colored red. The parachute line is used for opening the parachute in order to vent gas in a controlled manner and for pulling down the parachute to deflate the balloon. The transition from the valve effect to the deflation effect of the parachute is indicated by a vibration in the parachute line. It must be ensured that the parachute is not opened and closed abruptly.

6.7.3 Emergency opening line

The emergency opening is not mandatory for this type of balloon. The emergency opening line is colored yellow. One end is attached to the emergency opening tongue, while the other end runs through a deflection thimble fastened to the upper appendix ring and into the basket.



6.7.4 Appendix pull-close line

The appendix pull-close line consists of a braided artificial fiber line. It is attached to the lower appendix ring (Poeschel ring), runs in a spiral around the appendix and upwards through a guide ring to the deflection thimble on the upper appendix ring. From there it hangs down into the basket and runs back to the lower appendix ring (Poeschel ring). The appendix can be either opened or closed by pulling on one of the two sections of this line.

6.7.5 Appendix anchor line

The two appendix anchor lines are attached to the clamping ring by means of crow's-feet and ring nuts. These lines prevent the lower part of the balloon from being pushed up inside the upper part in the case of a rapid descent. These lines also prevent the lower part of the balloon from forming a sail if the basket is dragged along the ground after landing.

6.8 Electrostatic charging

All conductive parts of the balloon must be connected in a conductive manner in order to prevent accidents resulting from electrostatic charging. This results in discharge paths for the electrostatic charge. The discharge paths start at the parachute, are routed via the envelope to the appendix or via the suspension ropes, and end in the stainless steel cables of the basket. The surface resistance of the components is less than 10^9 Ohms, while the resistance of the connection between the components is less than 10^6 Ohms.

6.9 Inflation aid

The inflation aid is used to hold down the envelope at the start of the inflation operation. It consists of a tarpaulin with a belt for attaching the envelope and the sand bags. The belt encloses the folded envelope at the upper cross seam. The belt ends in a steel ring at one end and a pipe at the other. When attaching the belt to the envelope, the four rings of the holding down patches, the ring of the holding rope attachment and the end ring of the belt are pushed onto the pipe in a specific sequence. A short safety belt attached parallel to the pipe holds the rings in position by being pushed through a hole at the end of the pipe and blocked with a toggle to prevent it from being pulled back out. The tarpaulin to which the belt is stitched serves to cover the sand bags so that the envelope and the sand bags do not touch when the envelope is raised. The sand bags, whose weight serves to keep the envelope on the ground, are attached to the tarpaulin with two snap-hooks.



6.10 Instruments

6.10.1 Altimeter

Altimeters measure the static air pressure that decreases as the altitude increases. Mechanical and electronic altimeters with corresponding certification can be used, provided that they meet the specific operational requirements.

6.10.2 Variometer

Variometers measure the rate of climb and descent of the balloon. Electronic and mechanical variometers that meet the specific operational requirements are to be used.



Chapter 7 – Servicing, maintenance and inspection

7.1 Introduction

This chapter provides an overview of the balloon maintenance and servicing intervals and procedures prescribed by the manufacturer.

WARNING: *The owner/operator of the balloon is responsible for ensuring its airworthiness. Servicing and inspections/checks must be carried out in accordance with the procedures described in the balloon's maintenance manual. Repair and test methods that do not comply with the pertinent regulations result in the balloon failing to become airworthy or losing its airworthiness. It must be ensured that the servicing and inspection personnel are adequately trained, equipped and authorized.*

7.2 Inspection intervals

- Before every take-off, preflight checks must be carried out to ensure that the balloon is in a good general condition.
- Inspection after 10 flights or after a hard landing
- Annual inspection
- Inspection after 15 years or more than 1,500 hours of operation

7.3 Preventive maintenance

For balloon operation in accordance with EASA regulations: The pilot/owner may perform the preventive maintenance in accordance with Regulation (EC) No. 2042/2003 PART M, or in accordance with subsequent regulations, supplements or amendments, if he holds a valid balloon pilot license.

For balloon operation in accordance with FAA regulations: The pilot/owner may perform the preventive maintenance, as listed in 14 CFR Part 43 or subsequent regulations, supplements or amendments, if he holds a valid balloon pilot license.

Once preventive maintenance has been performed, it must be entered in the log book with specification of the following information:

- A description of the work performed
- The date of completion of the work performed
- The name of the person who performed the work
- Approval for return to service



Approval for return to service must be granted in accordance with FAA Code FAR Part 43 if the balloon is registered in the USA or in accordance with EASA PART M if the balloon is registered in the area covered by EASA.

The following examples may be considered as preventive maintenance:

- Cleaning and inspection of the envelope and its ropes
- Cleaning and inspection of the load ring and basket
- Replacement of suspension ropes

A more detailed description of the preventive maintenance measures can be found in EASA PART M Appendix VIII or, for operation in USA, in 14 CFR PART 43, Appendix A.

Most repair and maintenance work is not considered as preventive maintenance and must be carried out in accordance with FAA Code 14 CFR PART 43, section 43.3, by authorized persons, e.g. persons with a repair license, or in accordance with the EASA regulation, PART M, by recognized maintenance organizations. The pilot/owner may only perform the preventive maintenance tasks that are described in greater detail in the balloon's "Instructions for Continued Airworthiness" manual.

7.4 Transport by road

After the flight, the envelope of the balloon is to be packed using the packing tarp provided. During transport, the envelope must always be placed in such a way that the hard parts of the appendix and load ring lie on top. This prevents damage to the envelope and ropes that might be caused by constant chafing during transport.

7.5 Cleaning and upkeep

Envelope: The envelope can be cleaned with warm water and dishwashing detergent.

Basket. The wickerwork and the floor of the basket should be cleaned with a brush to remove dirt. The leather parts can be treated with dubbin wax. The use of high-pressure cleaners is **not** recommended.

Ropes: In the same way as the envelope, the ropes can be rinsed in warm water with dishwashing detergent.

NOTE: *It is important to allow all parts of the balloon to dry well after cleaning in order to prevent the formation of mildew. You are strongly advised not to use heating appliances to accelerate the drying process.*



7.6 Storage

All components of the balloon must be stored in a dry, cool and well ventilated room. It must be ensured that the balloon and all its parts are protected against exposure to direct sunlight.

WARNING: *The balloon must never be stored damp. Damp parts must be dried immediately. A cold air blower may be used for this.*

CAUTION: *If the parachute line has become wet, it can be pulled **slowly** out of the deflation opening using a 20 m extension rope and dried. Pulling the line carelessly may result in damage to the balloon!*

The basket must not be stored in heated, dry rooms, as the wickerwork would otherwise dry out too much and become brittle. The basket should be stored upright in a raised position in order to ensure that the floor of the basket also receives sufficient ventilation.

NOTE: *The practice revealed, that envelopes which were packed dry, nevertheless showed spots of mold in the area where the suspension ropes had been lying. Apparently nobody paid attention to the fact, that the ropes were still full of humidity when the envelope was packed. The residual moisture content of the ropes together with the normal contamination and the temperature, as occurring in closed storage bags and closed trailers, produce the best conditions for the development of mold.*
Therefore we recommend tearing out humid suspension ropes at the side of the folded envelope. Leave the storage bag and the trailer open and avoid temperature rise over 20°C, until the ropes have dried completely.
So you prevent the development of mold.
If spots of mold appeared, they can be cleaned and disinfected by the use of "Acticide LV 706" of "Thor" enterprises in Landwehrstraße 1, D 67346 Speyer.



Chapter 8 – Checklists

8.1 Introduction

Checklists are lists of instructions describing necessary procedures in the correct order to ensure that individual measures and checks are not forgotten. They are also intended to relieve the mental burden on the persons performing the tasks.

The legally binding checklists for the preflight checks are contained in the maintenance manual of the balloon. Recommended instructions for emergency and normal operating procedures are contained in Chapters 3 and 4 of this manual. Every pilot is called on to draft his own personal checklists on the basis of these instructions and to adapt them according to his own specific requirements.

The following is a suggested set of checklists for the instruction of passengers as well as **technical** instructions for use during operation of the gas balloon. These lists are **not complete** and provide a basic framework to which the pilot can add his own personal comments.

8.2 Checklists

Instruction of passengers:

- ☐ **Clear instruction:** The pilot must give clear instructions. The passengers must follow these instructions in all situations.
- ☐ **Position in basket:** Each passenger must be assigned a specific position in the basket. He must move into this position immediately during landing and in emergency situations.
- ☐ **Objects:** All objects that are not required must always be tidied away and secured against falling out.
- ☐ **Landing:** For landing, all occupants of the basket must hold on tightly to the rope handle inside the basket. The muscles in the legs must be tensed and the knees bent slightly. The landing procedure must be observed by all to prevent surprise due to the basket touching down suddenly.
- ☐ **Disembarking:** No-one may leave the basket until the pilot has given the instruction to do so.



Technical checks during operation of the balloon

NOTE: *The list is intended to serve as an aide-mémoire; it is a brief summary and not to be considered as complete!*

Checks after laying out the balloon and before inflation:

- ☐ Have all persons been instructed in working with the lifting gas?
- ☐ Are the parachute and the parachute opening undamaged?
- ☐ Are the load belts undamaged?
- ☐ Is the parachute line secured with the extension line?
- ☐ Are the suspension ropes attached to the basket?
- ☐ Is the basket equipped with sufficient ballast?
- ☐ Has a test been performed to make sure that the pull-open line of the Velcro fastener over the inflation socket can be opened?

Checks after inflation

- ☐ Is the white marking of the parachute line at the same height as the lower appendix ring (Poeschel ring)?
- ☐ Does the lower part of the envelope empty quickly with the appendix closed? This would indicate major damage to the envelope or a leak in the parachute.
- ☐ Are all the ropes secured?
- ☐ Does the parachute line have sufficient slack?
- ☐ Are all the toggles on the load ring horizontal?

The following points must be checked before take-off:

- ☐ Has the weather situation been checked again?
- ☐ Have the inflation tube and inflation socket been removed?
- ☐ Is the appendix closing device functioning properly?
- ☐ Has a trial pull of the parachute been carried out?
- ☐ Is the appendix completely open?
- ☐ Is the prescribed minimum quantity of ballast in the basket?
- ☐ Have the passengers been instructed in how to behave during the flight?

During the flight:

- ☐ Check the lines. Do all lines have sufficient slack?
- ☐ Is the appendix open? The appendix must never look taut!

The following points must be checked before landing:

- ☐ Has the instruction to passengers on how to behave during landing been repeated?
- ☐ Have all unnecessary instruments and baggage been stowed safely in the basket bags?
- ☐ Has the bench been put away and the basket flap closed?
- ☐ Have all sand bags been fastened in the basket in the direction of flight and secured to prevent them from coming loose?
- ☐ Have all sand bags been fastened secured against oscillation and plunging?
- ☐ Is the parachute line accessible at all times?
- ☐ Have the appendix anchor lines been pulled tight?
- ☐ What are the wind speed and wind direction on the ground?
- ☐ Is the landing site sufficiently large?
- ☐ Are there any obstacles that need to be taken into account in the direction of flight (e.g. overhead power lines, electric fences, etc.)?

Before deflating the envelope:

- ☐ Have all potential ignition sources within a radius of 50 m of the balloon been prohibited?



Chapter 9 – Combination with components from other manufacturers

9.1 Introduction

This chapter describes what components from other manufacturers may be used with gas balloons of type NL-STU.

9.2 Basket

Baskets of type TEKNO CT-01 and CT-02 from Ultramagic may be used following modification in accordance with Supplemental Type Certificate No. 10049311 and in compliance with the procedures and operating limits specified in the STC.

Annex 1 “Ultramagic TEKNO basket” must be added to this Flight Manual.



Annex

- Annex 1** Ultramagic TEKNO Basket (on request)
- Annex 2** Use of the fabric walled basket (on request)
- Annex 3** Handling of gases during operation of balloon type NL-STU
- Annex 4** Use of the „Race Competition Basket“