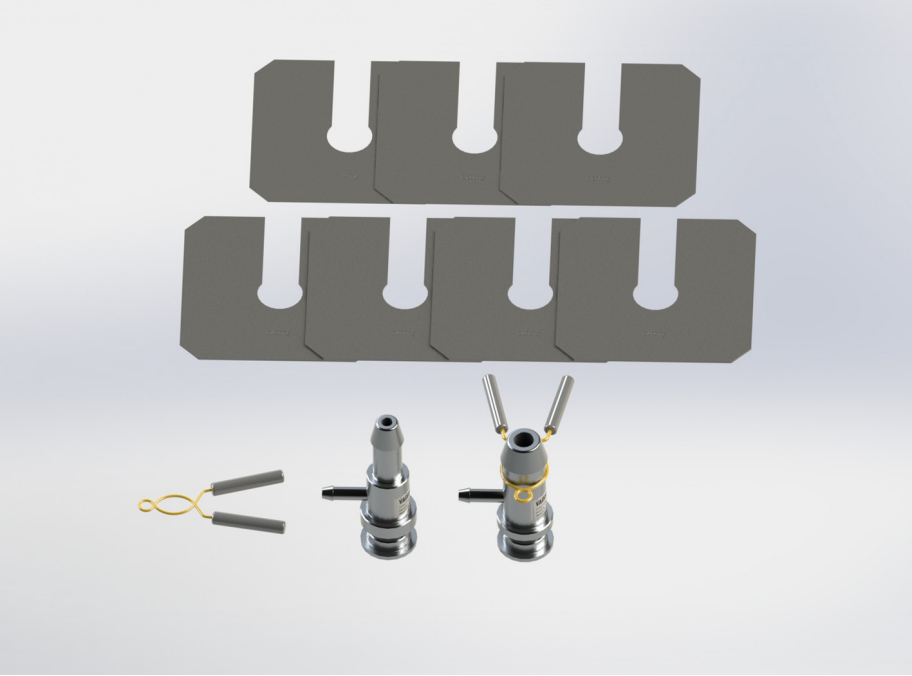
M210768EN-E

User Guide

Vaisala Filling Balance

FB13



VAISALA

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Table of Contents

1. About This Document

1.1 Version Information

This manual provides information for installing and operating Vaisala Filling Balance FB13.

Table 1 Document Versions

Document Code	Date	Description
M210768EN-E	November 2018	Updated FB13 information. New template.
M210768EN-D	January 2013	Nozzle material change. Updated figures.
M210768EN-C	March 2012	Minor editorial changes.

1.2 Related Manuals

Table 2 Related Manuals

Document Code	Name
M211667EN	*Vaisala Radiosonde RS41-SG and RS41-SGP User Guide*
M211752EN	*Vaisala Radiosonde RS41-SGM User Guide*
M211952EN	*Vaisala Radiosonde RS41-D User Guide*
M211486EN	*Ozone Sounding with Vaisala Radiosonde RS41 User Guide*

1.3 Documentation Conventions

WARNING! Warning alerts you to a serious hazard. If you do not read and follow instructions carefully at this point, there is a risk of injury or even death.

CAUTION! Caution warns you of a potential hazard. If you do not read and follow instructions carefully at this point, the product could be damaged or important data could be lost.

Note highlights important information on using the product.

Tip gives information for using the product more efficiently.

Lists tools needed to perform the task.

Indicates that you need to take some notes during the task.

2. Product Overview

2.1 Introduction to Vaisala Filling Balance FB13

Vaisala Filling Balance FB13 facilitates the use of radiosondes. It is used as ballast for obtaining the correct nozzle lift (free lift plus payload) for the radiosonde balloon. Nozzle lift refers to the weight that a balloon is capable of lifting when filled. In addition, the filling balance also acts as a gas inflation pipe.

FB13 contains two different nozzles for convenient attachment of balloons with small and large neck diameters. The balloon neck is secured on the nozzle with a spring clamp. Each nozzle has a clamp of its own and the nozzles are easily interchangeable.

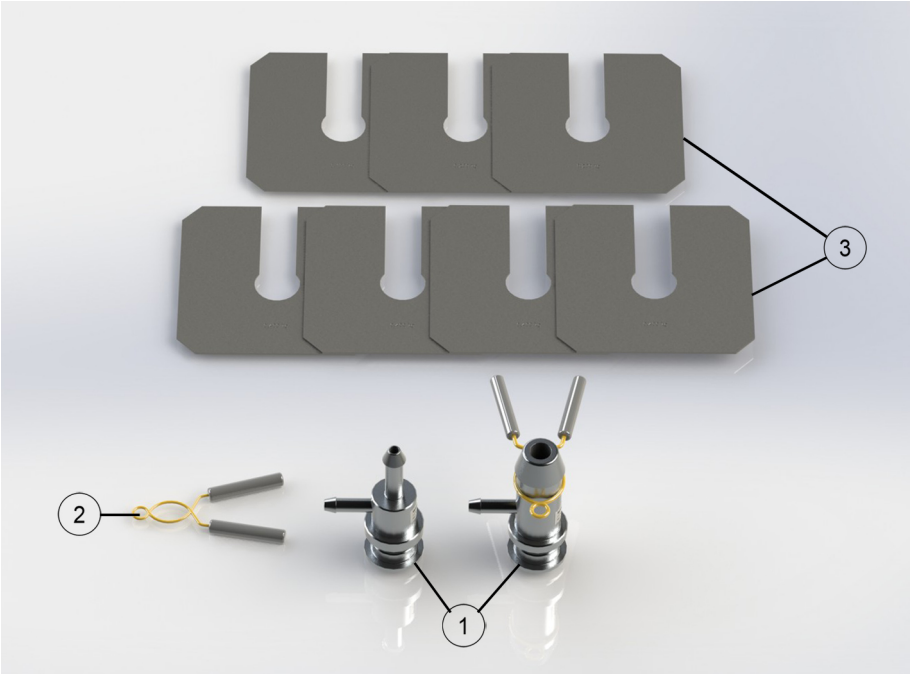


Figure 1 Filling Balance FB13

1 Nozzle
2 Spring clamp
3 Weight plates

During balloon filling, the required nozzle lift is obtained by loading the nozzle with additional weight. Nozzle lifts from 0.4 kg to 2.8 kg for the big nozzle, and from 0.3 kg to 2.7 kg for the small nozzle, can be obtained by loading weights in intervals of 0.1, 0.2 and 0.4 kg onto the nozzle. See the following table for details.

Table 3 Filling Balance FB13 Parts

Part	Weight	Quantity
Nozzle, Ø 42	0.4 kg	1
Nozzle, Ø 20	0.3 kg	1
Spring clamp		2
Additional weight	0.1 kg	1
Additional weight	0.2 kg	1
Additional weight	0.4 kg	5

The nozzles are made of aluminum, and they are grounded to remove possible static electricity formed during the balloon inflation. The weights are made of stainless steel.

The side tube of the nozzle is connected to the gas cylinder or gas piping system with a flexible plastic hose (inner diameter 1/2″). It is recommended that the gas cylinders are furnished with a pressure reducing valve. A simple screw valve can also be used.

Pressure reducing valves of conventional type with built-in back pressure valves and two pressure meters can be purchased locally. The first pressure meter indicates the pressure inside the cylinder, and is a gauge for estimating how much gas is left in the cylinder. The second is a low pressure meter that indicates the highest permissible pressure on the outflowing gas. This pressure must be adjusted according to the required speed of gas flow.

2.2 Safety

FB13 delivered to you has been tested for safety and approved as shipped from the factory. Note the safety precautions.

WARNING! Ground the product and verify outdoor installation grounding periodically. Failure to provide proper grounding can result in injury or death from electrical shock and can severely damage the equipment.

WARNING! Do not substitute parts or modify the system, or install unsuitable parts in the system. Improper modification can damage the product or lead to malfunction.

2.2.1 ESD Protection

Electrostatic Discharge (ESD) can damage electronic circuits. Vaisala products are adequately protected against ESD for their intended use. However, it is possible to damage the product by delivering electrostatic discharges when touching, removing, or inserting any objects in the equipment housing.

To avoid delivering high static voltages to the product:

- Handle ESD-sensitive components on a properly grounded and protected ESD workbench or by grounding yourself to the equipment chassis with a wrist strap and a resistive connection cord.
- If you are unable to take either precaution, touch a conductive part of the equipment chassis with your other hand before touching ESD-sensitive components.
- Hold component boards by the edges and avoid touching component contacts.

3. Operation

3.1 Selecting the Filling Balance Weight

The proper filling balance weight depends on the weight of the payload (radiosonde and possible extra equipment) and the weight and shape of the balloon. To find out the correct filling balance weight, study the following figures and tables.

The figures illustrate the estimated bursting altitudes for TA and TX balloons of different weight, material, and carrying different payloads.

The TA balloon type is suitable for most soundings, while the TX balloon type aims to reach high altitudes when the temperatures are well below –75 °C in the sounding profile.

The values presented in the following figures are typical values taken from the manufacturer's datasheet. The variation on the bursting altitude, as well as on the ascent rate, is quite high and depends on many factors, such as local conditions during the flight, the age of the balloon, and so on.

Table 4 Payload Options for RS41, Weight (g)

	RS41 with external parachute	RS41 with internal parachute (AUTOSONDE use)	RS41 with small parachute [1)]	RS41 without parachute
RS41 Radiosonde	85	85	85	85
Unwinder	25	25	25	25
Parachute	70	40	20	-
Nozzle	-	15	-	-
Total payload	180	165	130	110

1) Only with 30 g, 50 g and 100 g balloons

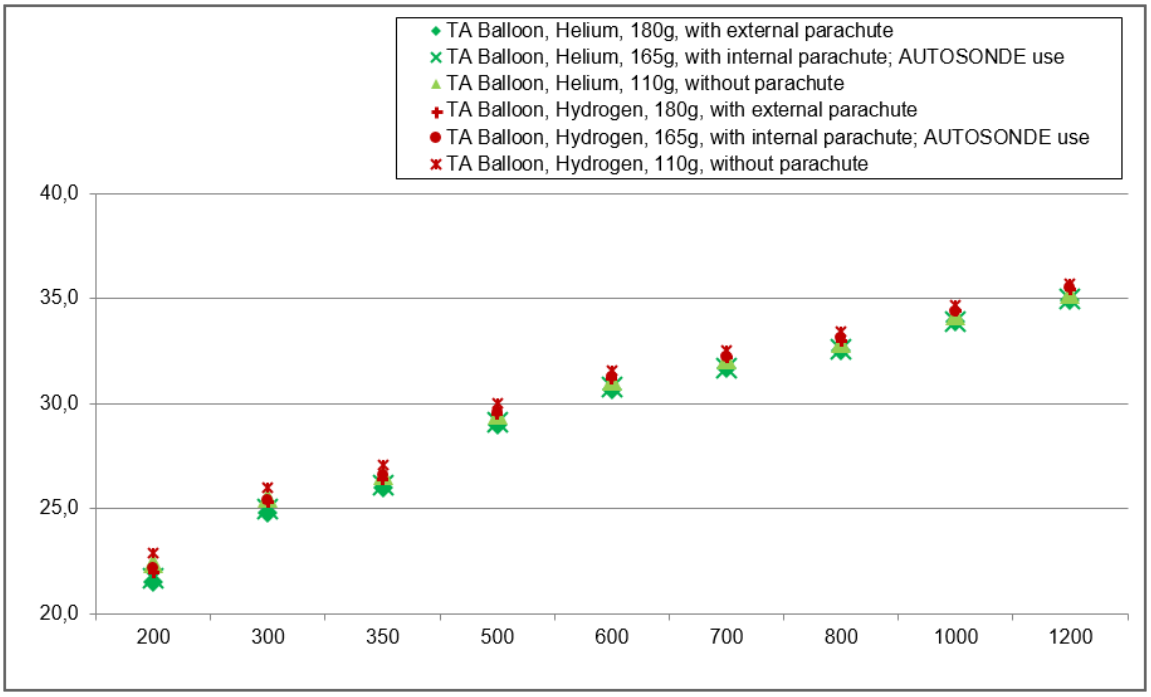


Figure 2 Bursting Altitude (km), Balloons > 200 g

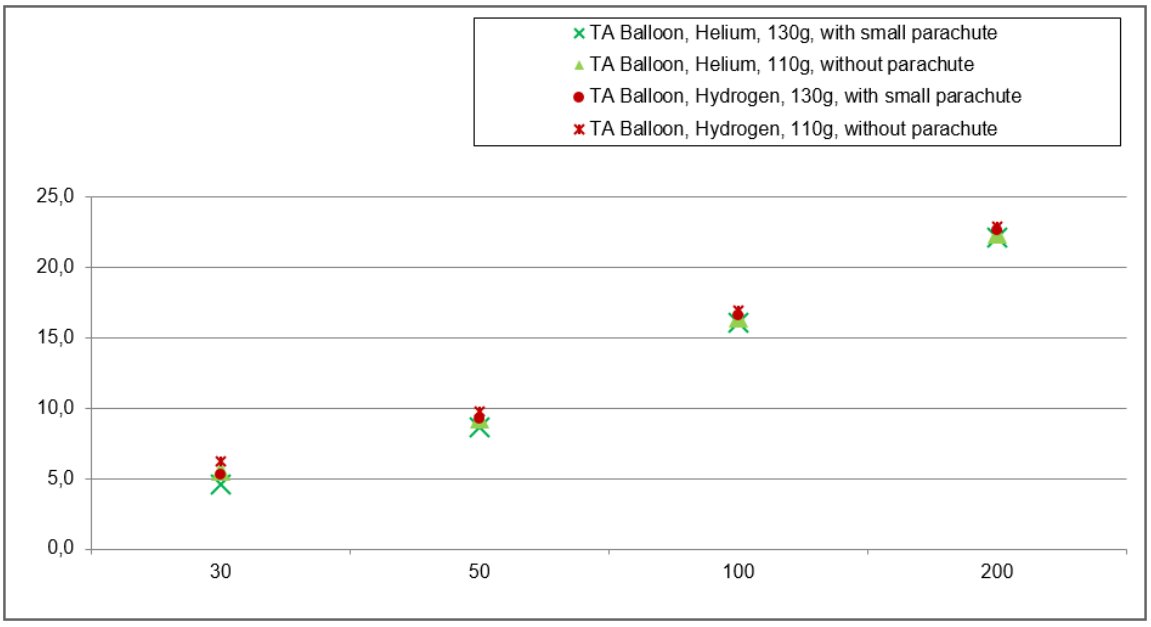


Figure 3 Bursting Altitude (km), Balloons < 200 g

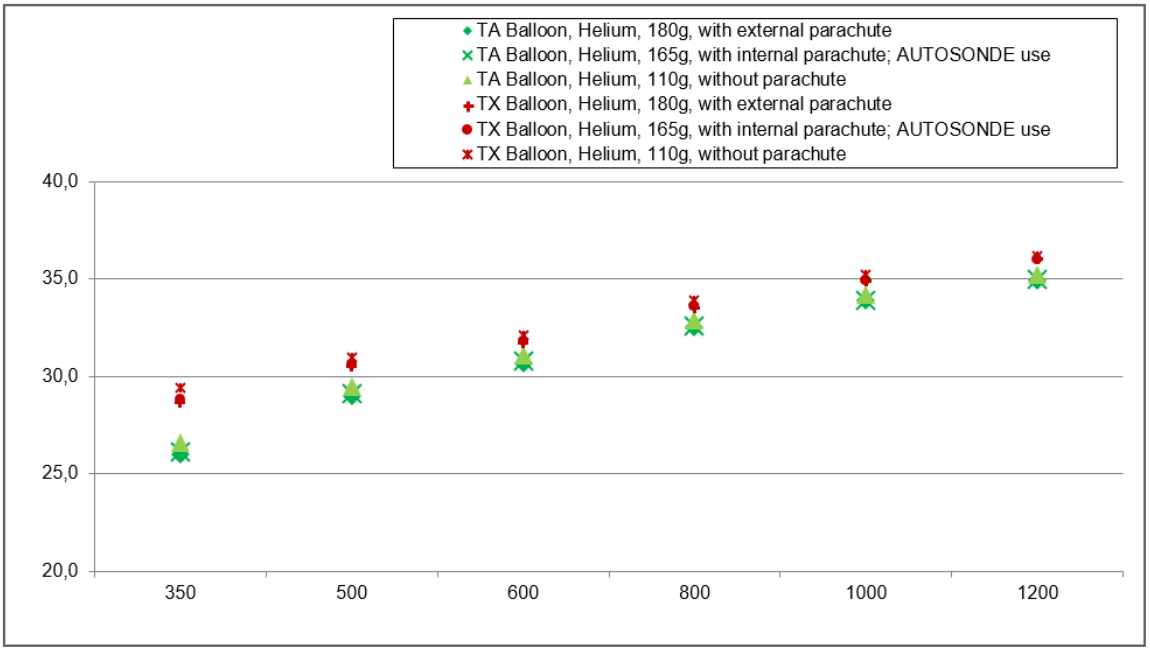


Figure 4 Bursting Altitude (km), TA and TX Balloons Compared

Determining the Nozzle Lift

To achieve the rate of ascent of 320 m/min, you must determine the required nozzle lift according to the following tables.

For example, for a Vaisala radiosonde with external parachute (180 g) lifted by a 600 g balloon, the required nozzle lift is 1015 g, and for FB13, the nozzle lift is rounded to 1000 g.

Nozzle lift is the recommended lift given by the balloon manufacturer, and it refers to the weight the balloon is capable of lifting when filled. The FB13 nozzle lift is the weight that needs to be loaded to FB13 during balloon filling (including FB13 Filling Balance and the weights).

Table 5 Balloon Filling for Payloads 165 g, 180 g and 110 g, Balloons > 200 g

	Payload								
	Vaisala radiosonde (~ 165 g), RS41 with internal parachute, AUTOSONDE use								
Balloon weight (g)	200	300	350	500	600	700	800	1000	1200
Nozzle lift (g)	625	680	705	940	990	1045	1075	1145	1205
FB13 nozzle lift (g)	600	700	700	900	1000	1100	1100	1200	1200
	Vaisala radiosonde (~ 180 g, RS41 with external parachute)								
Balloon weight (g)	200	300	350	500	600	700	800	1000	1200
Nozzle lift (g)	650	705	730	960	1015	1065	1090	1160	1225
FB13 nozzle lift (g)	700	700	700	1000	1000	1100	1100	1200	1200

	Payload								
	Vaisala radiosonde (~ 110 g, RS41 without parachute)								
Balloon weight (g)	200	300	350	500	600	700	800	1000	1200
Nozzle lift (g)	535	595	625	850	905	960	990	1060	1130
FB13 nozzle lift (g)	600	600	700	900	900	1000	1000	1100	1100

Table 6 Balloon Filling for Payloads 130 g and 110 g, Balloons < 200 g

Payload				
	Vaisala radiosonde (~ 130 g), RS41 with small parachute			
Balloon weight (g)	30	50	100	200
Nozzle lift (g)	212	305	460	570
FB13 nozzle lift (g)	300	300	500	600
	Vaisala radiosonde (~ 110 g, RS41 without parachute)			
Balloon weight (g)	30	50	100	200
Nozzle lift (g)	190	280	435	535
FB13 nozzle lift (g)	300	300	500	600

3.2 Preparing the Radiosonde Balloon

WARNING! Take extreme caution when handling the inflated balloon. Read the Safety Instructions for Balloon Operators before you start preparing the balloon.

WARNING! It is recommended that the balloon is prepared in a balloon-filling shed. The balloon-filling shed must be well ventilated so that possible gas leaks do not remain inside the shed, even in situations when there is no electricity.

3.2.1 Properties of Balloon-Lifting Gas

Radiosonde balloons can be inflated either with hydrogen or with helium. Hydrogen has a slightly greater lifting power than helium, it is much cheaper than helium, and it is usually available in most parts of the world. Hydrogen is delivered compressed in steel cylinders, or it can be generated locally by stationary or portable generators. Hydrogen is, however, a highly explosive gas when mixed with air.

WARNING! To minimize the risk of fire or explosion, take precautions strictly into account in organizing the balloon-filling shed and working procedures.

WARNING! Normally the balloon-lifting gas (hydrogen or helium) is supplied in gas bottles, but hydrogen can also be produced with a hydrogen generator. Carefully study the operation and safety instructions for the gas bottle facilities or the hydrogen generator.

More Information

- Safety Instructions for Balloon Operators (page 19)
- Regulations for Balloon-Filling Sheds (page 21)

3.2.2 Handling the Balloon

Radiosonde balloons are made either of natural rubber or of natural rubber compound with chemicals. The normal thickness of the balloon inflated for release is from 0.05 to 0.1 mm, decreasing to 0.003 mm at the bursting altitude. The diameter of the balloon is 1 ... 1.5 m on release and it expands to 5 ... 10 m before bursting.

These figures imply that even the smallest damage to the balloon during the preflight preparations will result in premature bursting of the balloon at a low altitude. To reach the maximum height, you must handle the balloon with utmost care during the preflight preparations.

When handling the balloon, use protective gloves to avoid damaging the balloon surface. Even minor grease stains can damage the balloon, causing premature balloon burst.

1. Open the balloon package carefully.

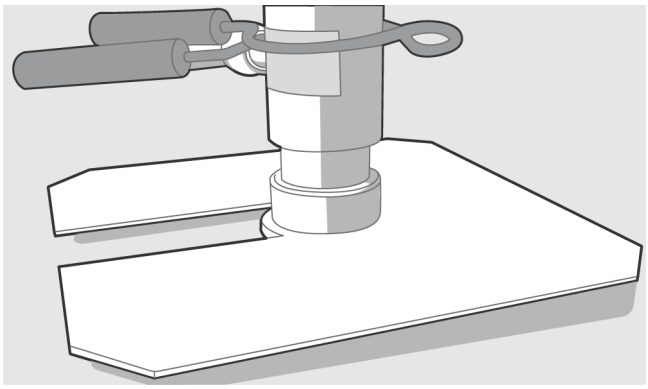
CAUTION! To avoid damaging the balloon, be extremely careful when opening the package with a knife or other sharp object.

2. Check visually that the balloon is structurally sound and has no perforations or other apparent defects in the nozzle section.

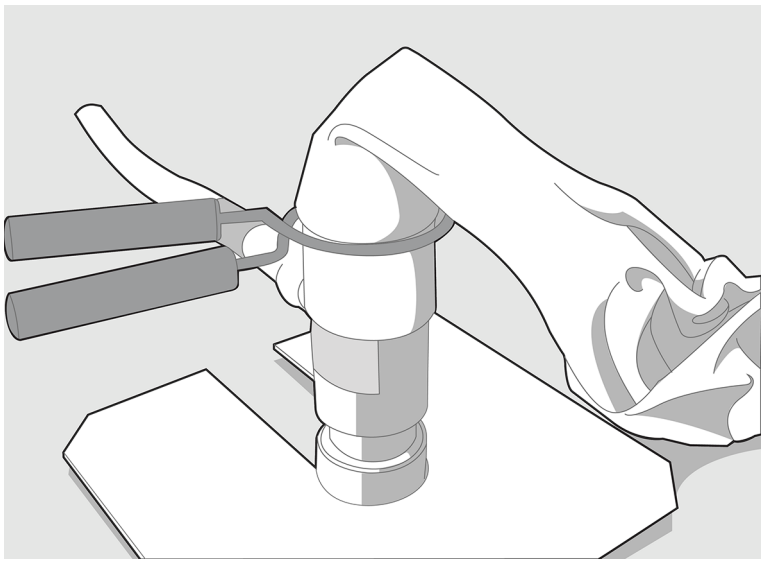
3.2.3 Filling the Balloon

These balloon-filling instructions are based on Totex balloons, but they also apply to other meteorological balloons.

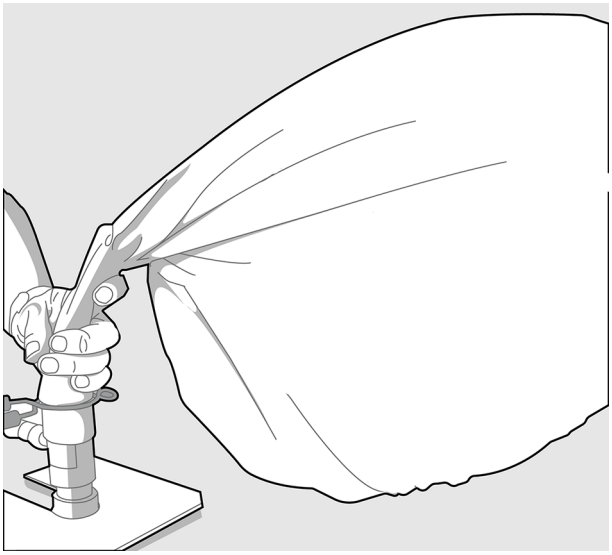
1. Connect the side tube of the filling balance to the pressure reducing valve on the gas cylinder (or hydrogen generator) with a flexible plastic hose.
2. Select the nozzle which best fits into the neck of the balloon.
3. Load the additional weights that are needed to obtain the required lift, for example, Vaisala Filling Balance FB13 weights as in the figure below.



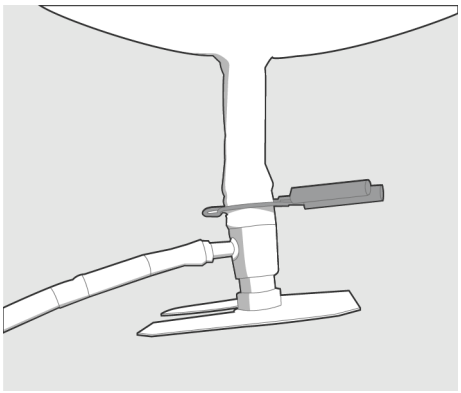
4. Secure the neck of the balloon to the balance nozzle with a clamp as shown in the figure below. Look out for sharp objects near the filling balance so that no damage is caused to the relaxed balloon.



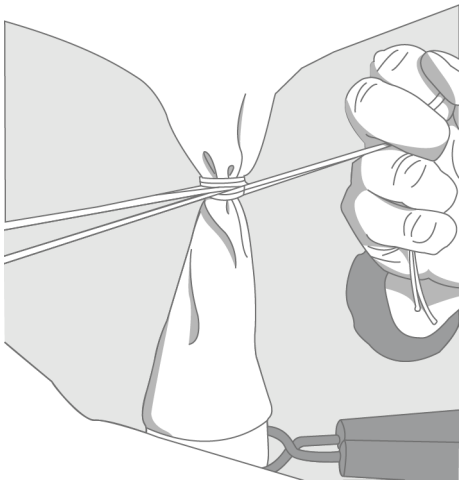
5. Turn on the gas from the pressure reducing valve. Let the gas flow slowly into the balloon. Do not leave the balloon-filling shed while inflating the balloon. Follow the balloon manufacturer's instructions when inflating the balloon.



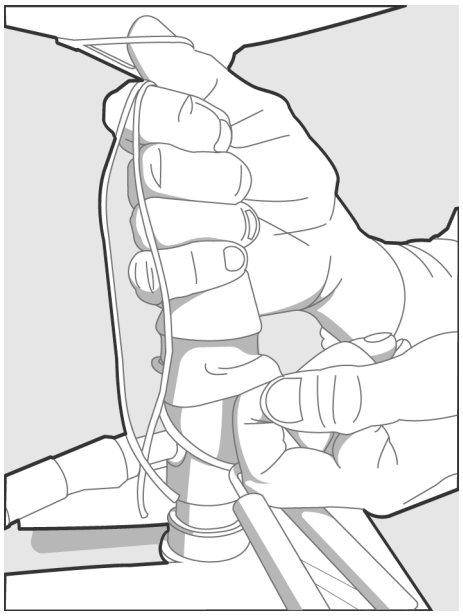
6. When the balloon is sufficiently filled, in other words, the balloon just raises the gas nozzle, close the gas valve.



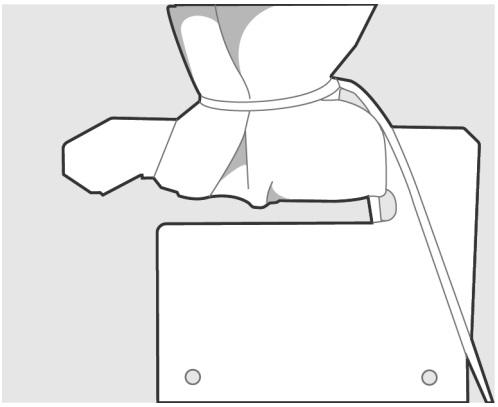
7. Before removing the balloon from the gas nozzle, tie the neck of the balloon tightly above the balance nozzle with approximately 0.5 m (2 ft) bit of string.



8. Remove the balloon from the gas nozzle.



9. Fold the neck of the balloon over and secure firmly. Cut off any extra string. The figure below shows an example of a secured balloon neck. In the figure, the balloon is attached to a balloon holder hook.



10. When the balloon is ready, make sure it does not touch anything. Hold the inflated balloon by the neck.

Appendix A. Safety Instructions for Balloon Operators

Photocopy these instructions and place the list in clear view in the balloon filling shed and in the sounding compartment.

WARNING! New operator! Carefully study the instructions for using the hydrogen generator and for the correct method of inflation.

1. No smoking or naked flame allowed.
2. If possible, avoid wearing clothing made of nylon or other synthetic fibers to prevent a build-up of static charges. Do not wear shoes with rubber soles.
3. Wear protective glasses.
4. Regularly check that the gas tube fits securely to the gas cylinder or generator nozzle and to the balloon inflation nozzle.
5. Take care to prevent a gas leak in the shed when interrupting inflation to replace a gas cylinder.
6. Never use a repaired balloon.
7. Should a leak develop in the balloon during inflation, do not let gas escape from the balloon inside the shed if possible. Instead, release the defective balloon without load. It is not advisable to deflate the balloon, even outside the shed.
8. Do not touch the balloon with bare hands except when holding it by the neck. Wear soft cotton gloves.
9. Ensure that there are no pointed objects in the shed. Nails, hooks, hinges, padlocks, etc., are dangerous as they might scratch the inflated balloon. The balloon film is only 0.05 ... 0.1 mm thick upon launch; the slightest scratch could cause the balloon to burst prematurely.
10. Keep the doors of the shed shut while inflating the balloon on a windy day. However, ensure that the shed is properly ventilated.
11. No unauthorized person shall be allowed admittance to the shed while the hydrogen generator is in operation or balloon inflation is going on.
12. Ensure that all tools and other implements not essential for balloon inflation have been removed from the shed.
13. Do not take any electrical devices (cell phone etc.) to the balloon filling shed or close to the balloon inflated with hydrogen. Safe distance when outdoors is typically 1.5 meters.

14. Always keep the radiosonde at least 50 cm below the level of the gas nozzle and the inflated balloon, and at least 1.5 meters away from the gas cylinder/hydrogen generator, connectors, and tubing. Avoid taking the radiosonde inside the balloon filling shed, if possible.
15. Follow all regulations concerning hydrogen safety.

Appendix B. Balloon-Filling Shed and Storage

B.1 Regulations for Balloon-Filling Sheds

WARNING! It is recommended that the balloon is prepared in a balloon-filling shed. The balloon-filling shed must be well ventilated so that possible gas leaks do not remain inside the shed, even in situations when there is no electricity.

- The balloon-filling shed must be spacious enough for convenient handling of all balloon types in normal use.
- The door (or doors) must be wide enough to allow free passage of inflated balloon without the risk of, for example, touching sharp corners or other objects. The door must be on the lee side of the prevailing winds.
- Good ventilation must be provided also when the doors are closed.
- If hydrogen is used as filling gas, locally applied standards for electrical equipment, installations and zone classifications in the presence of explosive gas must be followed. For instance, all electrical installations, both permanent and temporary, must be of spark-proof construction. Regular inspections must be carried out.
- The inflation nozzle (Vaisala Filling Balance FB13) must be connected to ground through a metal plate, fixed to the floor, which in turn is permanently connected to a well-grounded piping or some other construction with good earth contact.

B.2 Storing the Balloon

It is important to store the radiosonde balloons correctly if they will be used after several months of storage.

To store the balloons correctly:

- Restrict the balloon stock to the minimum. Prefer frequent deliveries, wherever possible, over purchases in large quantities with consequential long storage periods.
- To avoid the use of balloons which have been stored for a long time, use balloons always in the order of their date of manufacture.
- Store the balloons away from direct sunlight and, if possible, in dark.
- Never store balloons close to any source of heat or ozone.
- Keep all the balloons in their original packing until required for their preflight preparations.

Technical Support

Contact Vaisala technical support at helpdesk@vaisala.com. Provide at least the following supporting information:

- Product name, model, and serial number
- Name and location of the installation site
- Name and contact information of a technical person who can provide further information on the problem

For more information, see www.vaisala.com/support.

Warranty

For standard warranty terms and conditions, see www.vaisala.com/warranty.

Please observe that any such warranty may not be valid in case of damage due to normal wear and tear, exceptional operating conditions, negligent handling or installation, or unauthorized modifications. Please see the applicable supply contract or Conditions of Sale for details of the warranty for each product.

Recycling

Recycle all applicable material.

Follow the statutory regulations for disposing of the product and packaging.

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