

Technical Reference

Vaisala Guide to Sounding Preparations



VAISALA

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1. About This Document

1.1 Version Information

This manual provides general recommendations for preparing a sounding with Vaisala sounding equipment and gives information on sounding accessories.

The scope of this manual does not cover preparing an ozone sounding. For details on ozone sounding preparations, see the appropriate Vaisala User Guide.



Unless otherwise mentioned,

- RS41 refers to all Radiosonde RS41 models (RS41-SG, RS41-SGP, RS41-SGM, RS41-D).
- RS92 refers to RS92-SGP.
- RI41 refers to both RI41 and RI41-B.

Table 1 Document Versions

Document Code	Date	Description
M211367EN-F	November 2018	Added a new parachute type, Totex 280V-17, for soundings with small balloons. Updated FB13 information. New template.
M211367EN-E	April 2016	Updated information on optional sounding accessories.
M211367EN-D	March 2015	Removed information on rubber plate RS46158 and updated Totex type 5710-5 Vaisala code. Instructions for using unwinder updated.

1.2 Related Manuals

Table 2 Related Manuals

Document Code	Name
DOC231720	<i>Vaisala RS41 Unwinder Quick Guide</i>
M210329EN	<i>Ground Check Set GC25 User Guide</i>
M210488EN	<i>Vaisala DigiCORA Sounding System MW31 User Guide</i>
-	<i>Vaisala DigiCORA Sounding System MW41 On-line Help</i> , available in the sounding software web user interface
M210767EN	<i>Vaisala Balloon Launcher FB15 User Guide</i>
M210776EN	<i>Vaisala Balloon Launcher FB16A User Guide</i>
M210980EN	<i>Vaisala Balloon Launcher FB32 User Guide</i>
M211667EN	<i>Vaisala Radiosonde RS41-SG and RS41-SGP User Guide</i>

Document Code	Name
M211752EN	<i>Vaisala Radiosonde RS41-SGM User Guide</i>
M211952EN	<i>Vaisala Radiosonde RS41-D User Guide</i>
M211486EN	<i>Ozone Sounding with Vaisala Radiosonde RS41 User Guide</i>

See also the video instructions at www.vaisala.com/RS41.

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.

1.4 Trademarks

DigiCORA® is a registered trademark of Vaisala Oyj.

Windows® is either a registered trademark or trademark of Microsoft Corporation in the United States and other countries.

2. Overview of Preparing a Sounding

You must carry out the pre-launch steps as instructed and always in the same way. The workorder for a sounding is listed below.

- ▶ 1. Unpack and fill the balloon. Prepare the optional sounding accessories.
- 2. Unpack the radiosonde and the unwinder. Attach the unwinder to the balloon. See *RS41 Unwinder Quick Guide* for illustrations.
- 3. Prepare the radiosonde with the ground check device.
- 4. Attach the radiosonde to the unwinder.
- 5. Launch the radiosonde balloon.
- 6. Monitor the sounding with the sounding system. See the sounding system documentation for more information.

2.1 Safety



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



WARNING! Conduct soundings in a safe environment and in accordance with all applicable restrictions and regulations.



WARNING! Do not use the radiosonde in an area with power lines or other obstructions overhead. Make sure that you check the area for such obstructions before using the radiosonde.



WARNING! Do not use the radiosonde without consultation and cooperation with local and other applicable aviation authorities.



WARNING! Vaisala recommends the use of parachute even if it is not required by applicable restrictions.



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.



WARNING! Do not use the radiosonde for any purpose other than for soundings.

More Information

- [Safety Instructions for Balloon Operators \(page 45\)](#)

2.1.1 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. Preparing the Radiosonde Balloon

3.1 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.

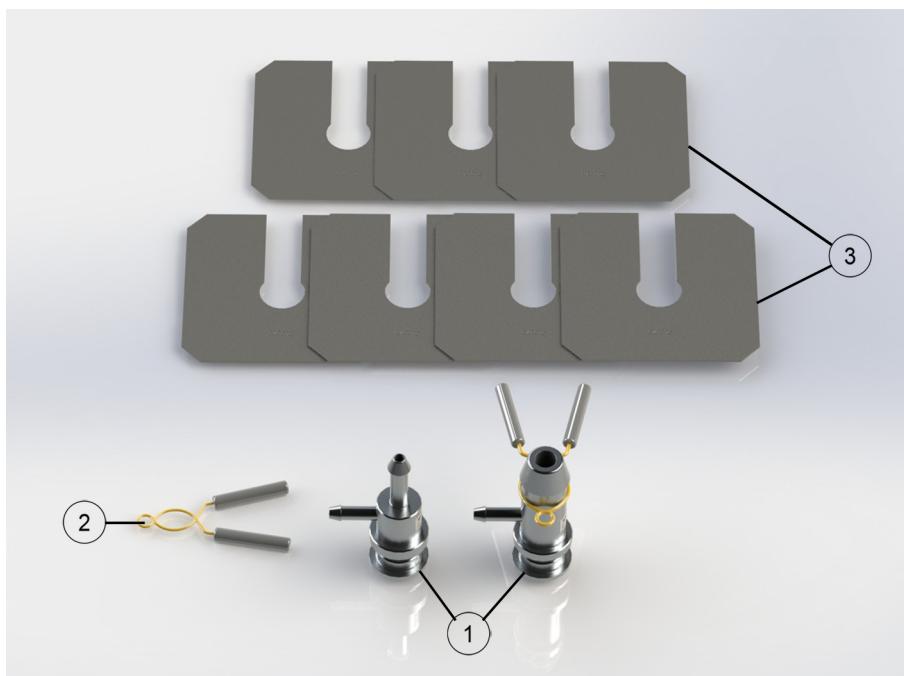


Figure 1 Filling Balance FB13

- 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.

3.1.1 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.

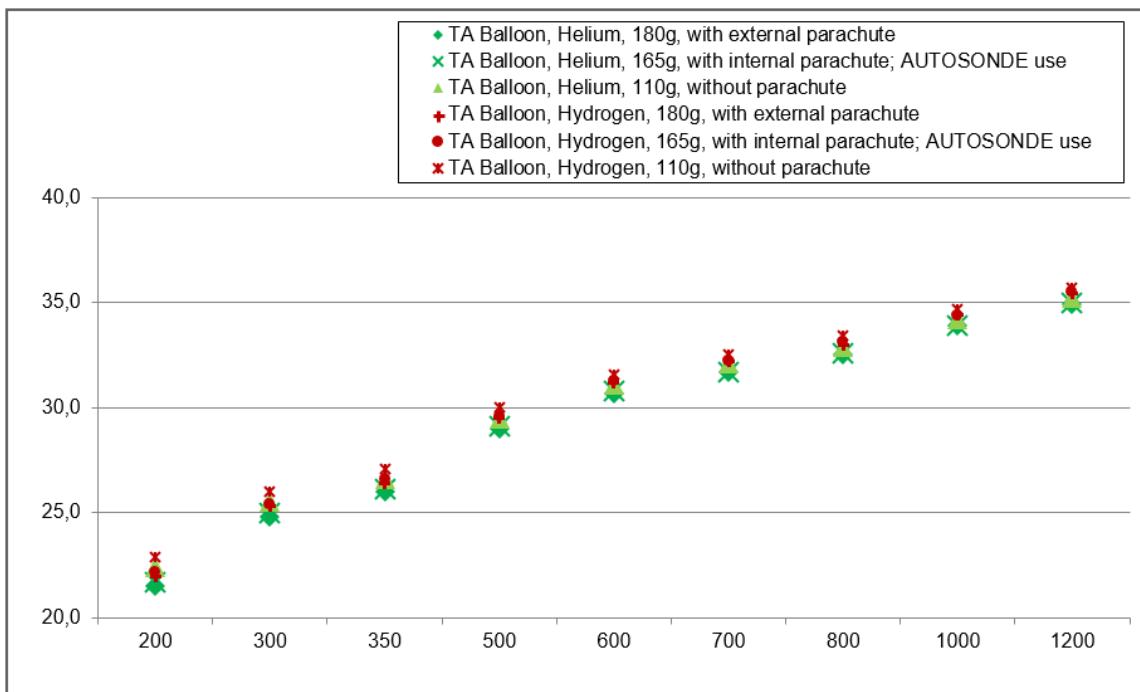


The values presented in the following figures are typical values taken from the manufacturer's datasheet. The variation on the bursting altitude, as well as on the ascent rate, is quite high and depends on many factors, such as local conditions during the flight, the age of the balloon, and so on.

Table 4 Payload Options for RS41, Weight (g)

	RS41 with external parachute	RS41 with internal parachute (AUTOSONDE use)	RS41 with small parachute¹⁾	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

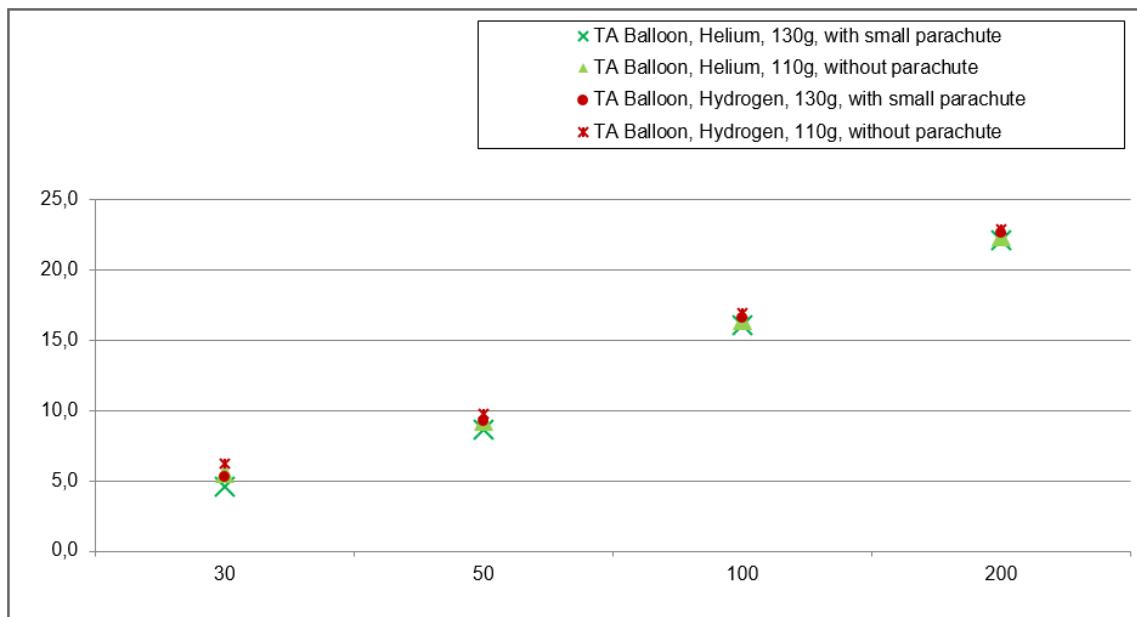


Figure 3 Bursting Altitude (km), Balloons < 200 g

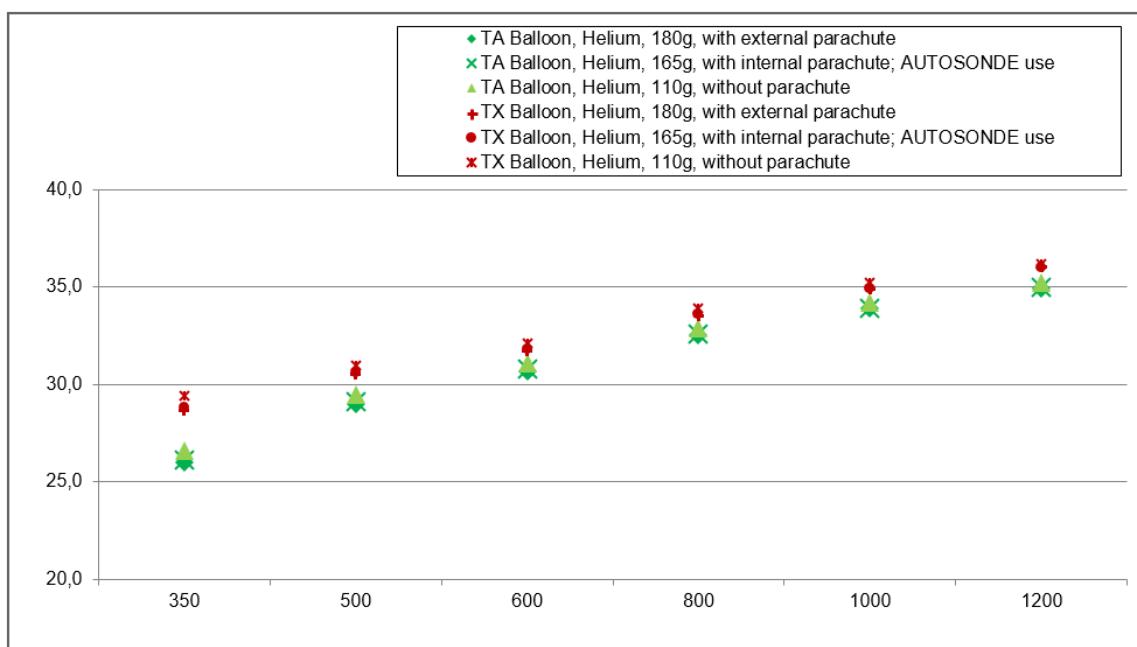


Figure 4 Bursting Altitude (km), TA and TX Balloons Compared

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.

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.

When performing a sounding with Radiosonde RS41, you can switch off the radiosonde power if there are any delays in releasing the balloon and then switch it back on before releasing the balloon. RS41 batteries have enough power for more than five hours. For more information on preparing a sounding with RS41, see the appropriate *Vaisala Radiosonde RS41 User Guide*.

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 \(page 45\)](#)
- [Regulations for Balloon-Filling Sheds \(page 47\)](#)

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.

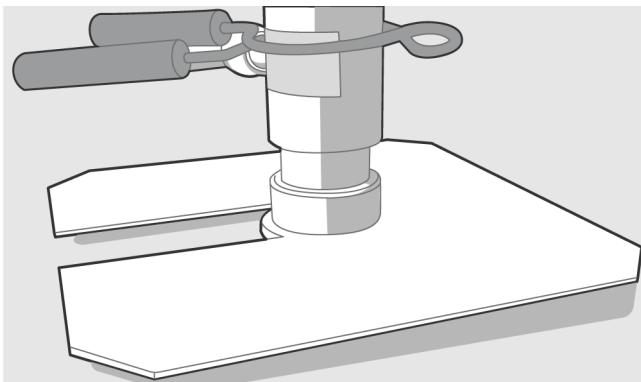
- 2. Check visually that the balloon is structurally sound and has no perforations or other apparent defects in the nozzle section.

3.2.3 Filling the Balloon

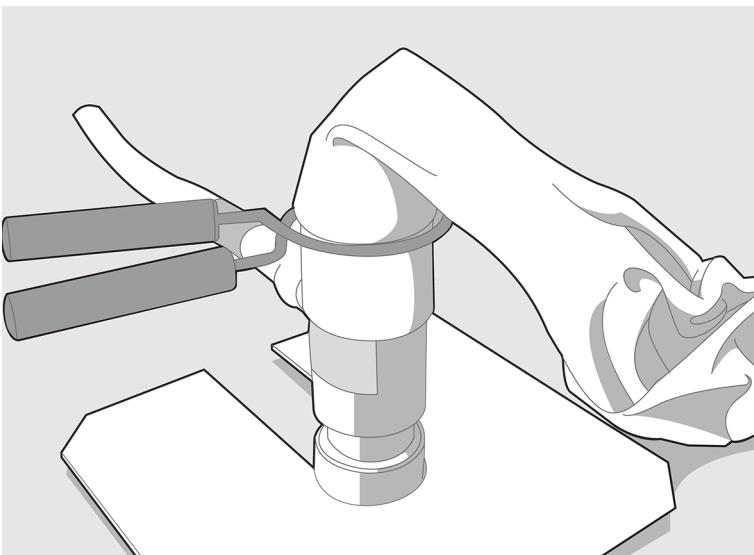
These balloon-filling instructions are based on Totex balloons, but they also apply to other meteorological balloons.

- ▶ 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.

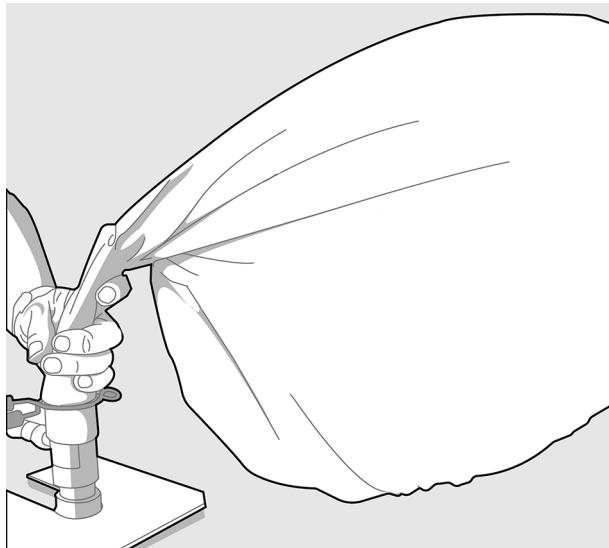
3. Load the additional weights that are needed to obtain the required lift, for example, Vaisala Filling Balance FB13 weights as in the figure below.



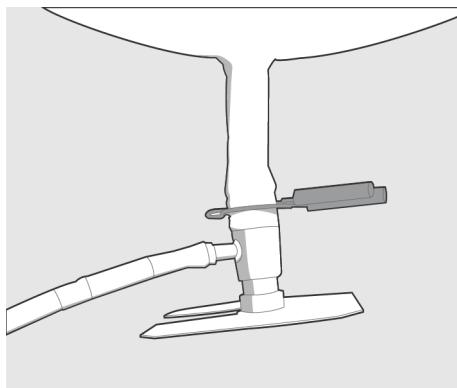
4. Secure the neck of the balloon to the balance nozzle with a clamp as shown in the figure below. Look out for sharp objects near the filling balance so that no damage is caused to the relaxed balloon.



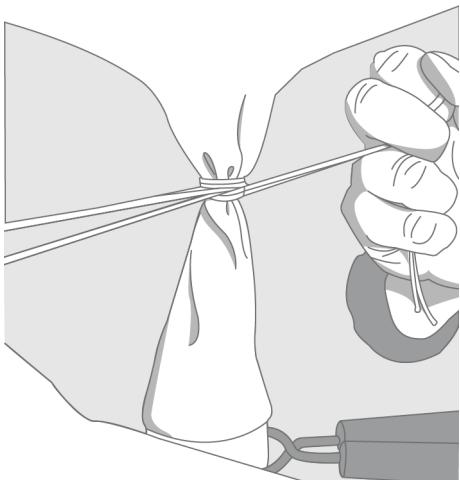
5. Turn on the gas from the pressure reducing valve. Let the gas flow slowly into the balloon. Do not leave the balloon-filling shed while inflating the balloon. Follow the balloon manufacturer's instructions when inflating the balloon.



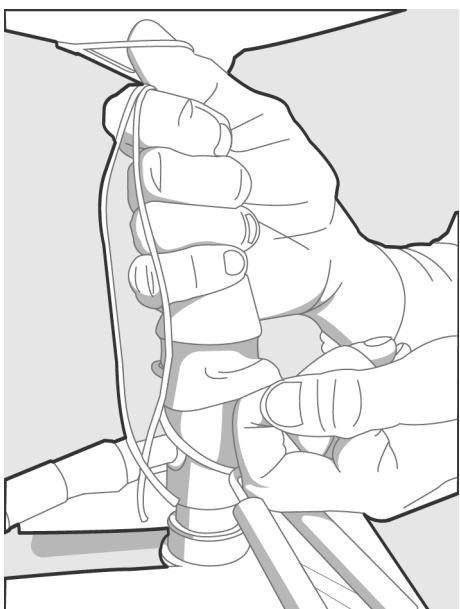
6. When the balloon is sufficiently filled, in other words, the balloon just raises the gas nozzle, close the gas valve.



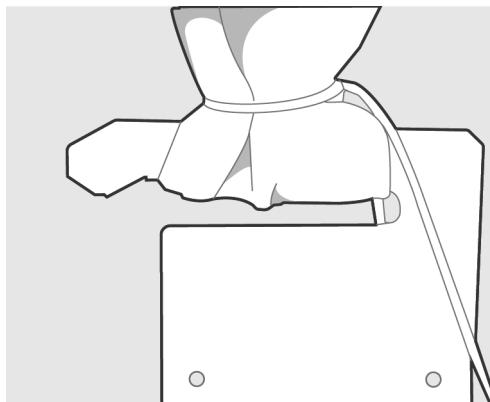
7. Before removing the balloon from the gas nozzle, tie the neck of the balloon tightly above the balance nozzle with approximately 0.5 m (2 ft) bit of string.



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.

4. Preparing the Radiosonde

4.1 Preparing Optional Sounding Accessories

The unwinder is designed to be attached directly to the folded balloon neck, but in case you cannot attach the unwinder to the balloon, the unwinder can also be used with optional sounding accessories which provide the necessary support during the sounding. The sounding accessories are needed to restrict the movement of the unwinder. Optional sounding accessories here refer to a hanger board or a parachute.

The unwinder must always be attached to a relatively firm support. The support must not let the unwinder twist freely, or otherwise the suspension string might unwind at too high a speed and the radiosonde hit the ground during the launch. However, the unwinder must be able to swing slightly during the sounding.

Similar to the balloon, the unwinder and the optional sounding accessories must be prepared before launching the radiosonde. The following figure shows the different options.

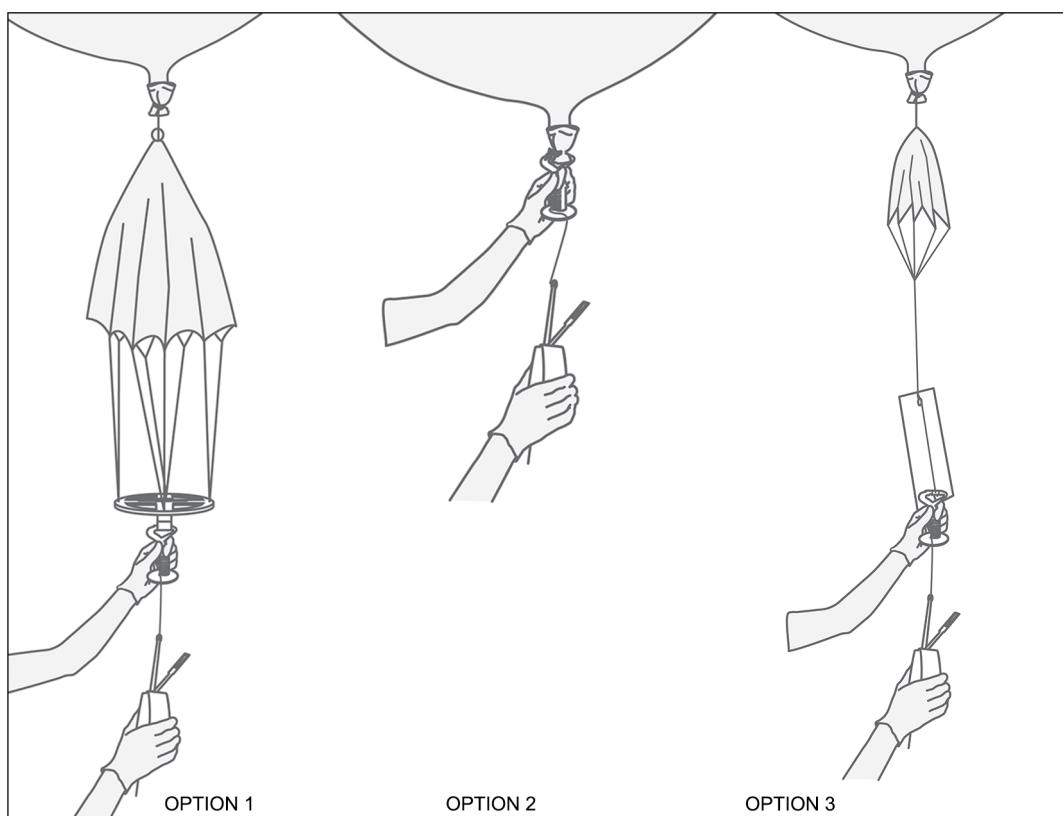


Figure 5 Radiosonde RS41 Optional Accessories



CAUTION! The strength of all the strings used during soundings must not exceed 23 kp (230 N). Knots in the strings weaken the strength to the minimum of 45 % of the original string strength. This results in a string strength of 10 kp (100 N) which is sufficient for soundings with Radiosonde RS41.

Attach all optional sounding accessories next to the balloon, otherwise they disturb the measuring environment of the radiosonde and no proper temperature and humidity measurements can be made.



Visit www.vaisala.com/RS41 to watch short videos on how to make a hanger board and how to attach the unwinder to the hanger board, and how to attach the unwinder to the parachute.

4.1.1 Preparing Totex Parachute 5710-5

The recommended parachute with big balloons (> 300 g) is Totex type 5710-5 (Vaisala code 15045). See option 1 in [Figure 5 \(page 23\)](#).

- ▶ 1. The parachute has an elastic ribbon loop below the spreader. Attach the unwinder to the loop by pushing the hook out the other side in the same fashion as with the folded balloon neck.

4.1.2 Preparing Totex Parachute 280V-17

The recommended parachute with small balloons (< 200 g) is the Totex type 280V-17 (Vaisala code 249041). See option 1 in [Figure 5 \(page 23\)](#).

- ▶ 1. The parachute has an elastic ribbon loop below the spreader. Attach the unwinder to the loop by pushing the hook out the other side in the same fashion as with the folded balloon neck.

4.1.3 Preparing a Non-Totex Parachute

- ▶ 1. If you are using a parachute that has no firm objects to prevent the unwinder from twisting, use a hanger board. The hanger board provides more stability during the sounding. See option 3 in [Figure 5 \(page 23\)](#).

4.1.3.1 Making a Hanger Board

See the steps below for instructions on how to make a hanger board out of the radiosonde cardboard package. See also the video at www.vaisala.com/RS41.



To make the hanger board, you need the following items:

- Radiosonde handling box cardboard package
- Scissors
- Some string. The string used with the hanger board must have a diameter of > 1.5 mm and the strength must be 250 ... 350 N.

-
1. Cut the radiosonde cardboard package to one whole piece that is big enough to make a hanger board.
 2. Make one hole at one end of the hanger board, four holes at the other. Make the four holes so that two holes are on top of each other.
 3. Tie a string on the unwinder hook.
 4. Thread the string through the four holes so that the unwinder is firmly attached to the other end of the hanger board.
 5. Pull the same string through the hole at the other end of the hanger board and attach the string to the parachute. The string now runs across the hanger board.

4.2 Preparing a Sounding with No Accessories

When you perform a sounding with no optional accessories, the radiosonde unwinder is attached directly to the balloon. See option 2 in [Figure 5 \(page 23\)](#).

Visit www.vaisala.com/RS41 to watch a short video on how to attach the unwinder to the balloon.



It is very important to prepare the unwinder carefully, following the given instructions. Correct handling of the unwinder ensures a successful sounding.

4.2.1 Detaching the Unwinder Stick

To start using the RS41 unwinder, you must first detach the unwinder stick from the unwinder body.

-
1. The unwinder stick (number 1 in the following figure) is attached between two plastic clips in the unwinder hook (number 2). Detach the stick from between the plastic clips and pull it out from the unwinder bottom plate (3).



If the unwinder stick is tightly attached to the bottom plate, it is a good idea to slightly twist the unwinder stick before pulling it out.

2. When you pull the unwinder stick out, make sure that the string unwinds and that it is not tangled.

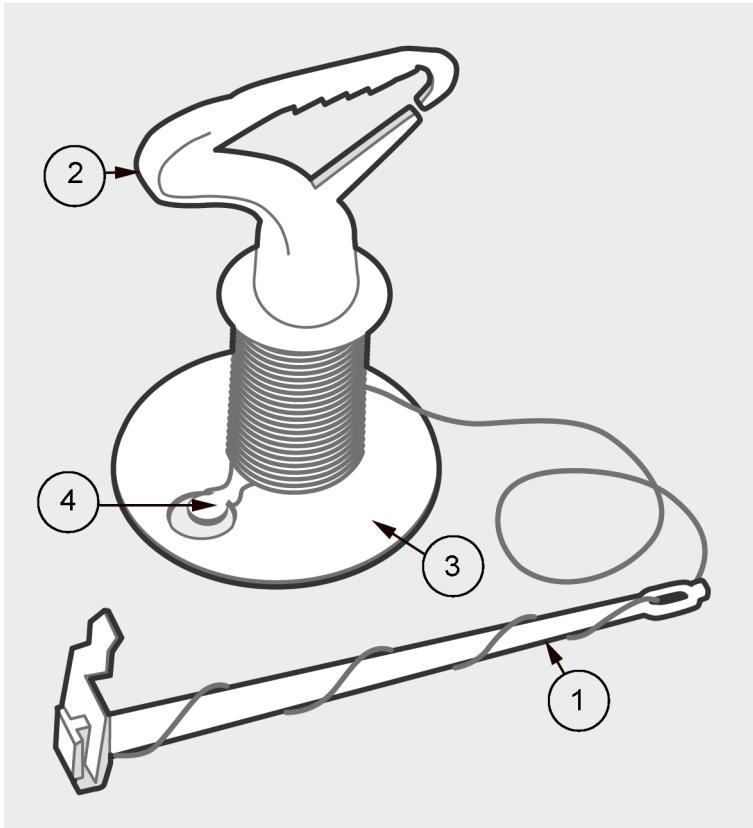


Figure 6 RS41 Unwinder Details

- 1 Unwinder stick
- 2 Unwinder hook
- 3 Unwinder bottom plate
- 4 Unwinder clip

4.2.2 Handling the Unwinder String

In the unwinder body, the unwinder string runs under a round plastic clip on the bottom plate. This keeps the string attached to the unwinder, and the radiosonde attached to the balloon.

- 1. To prevent the string from getting tangled in the clip during the sounding, make sure that the round plastic clip is level with the unwinder bottom plate.

2. If the clip is bent up, bend it gently back to level position.

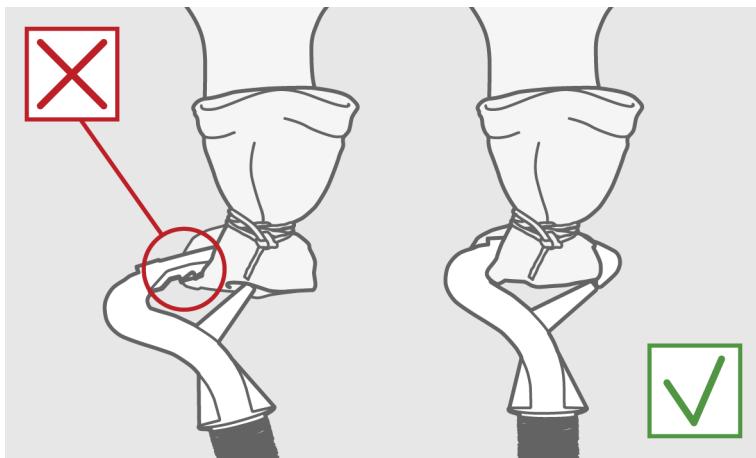


Figure 7 Unwinder Clip Is Level with the Unwinder Bottom Plate

4.2.3 Attaching the Unwinder to the Balloon

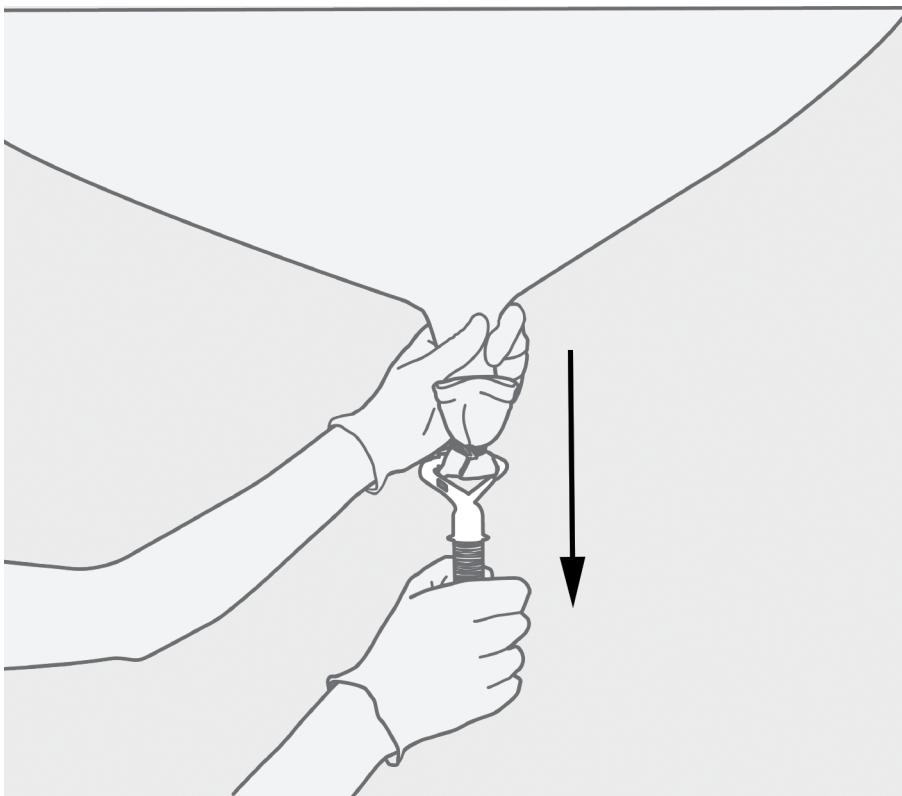
The unwinder must be attached firmly, so that it is not able to twist freely, or the suspension string might unwind at too high a speed and the radiosonde hit the ground during the launch. However, the unwinder must be able to swing slightly during the sounding. Follow the steps and figures below to attach and align the unwinder correctly when it is attached directly to the balloon.

- 1. Pass the unwinder hook through the loop created by the tied balloon neck.
- 2. Make sure that the hook comes out the other side, as shown in the following figure.



The unwinder is now firmly attached to the balloon.

3. Align the unwinder so that it points directly downwards from the balloon neck, as shown in the figure below.

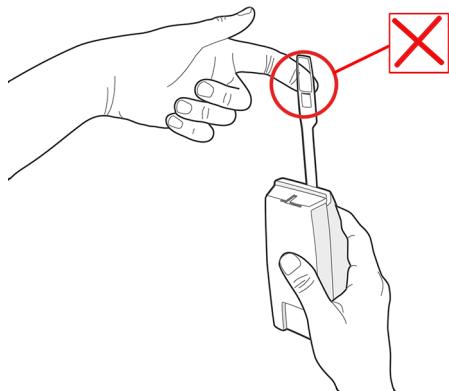


CAUTION! To ensure a successful sounding, align the unwinder so that it points downwards from the balloon neck.

4.3 Preparing the Radiosonde



CAUTION! Do not touch the radiosonde sensors. They are fragile and can be easily contaminated.



By carefully handling the radiosonde and the sensor boom you ensure that the radiosonde functions properly during the sounding.

For detailed instructions on preparing the radiosonde for the sounding by performing a ground check, see the relevant sounding system documentation.

4.3.1 Opening the RS41 Radiosonde Package

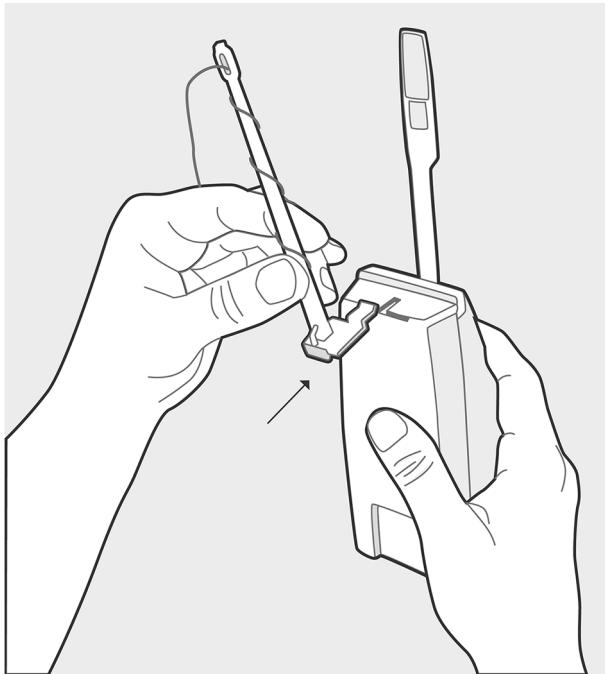
Open the radiosonde package carefully.

- ▶ 1. Open the package cover and then lift up the flap at the end of the package.
- 2. Remove the radiosonde from the package. Avoid touching or bending the radiosonde sensor boom.

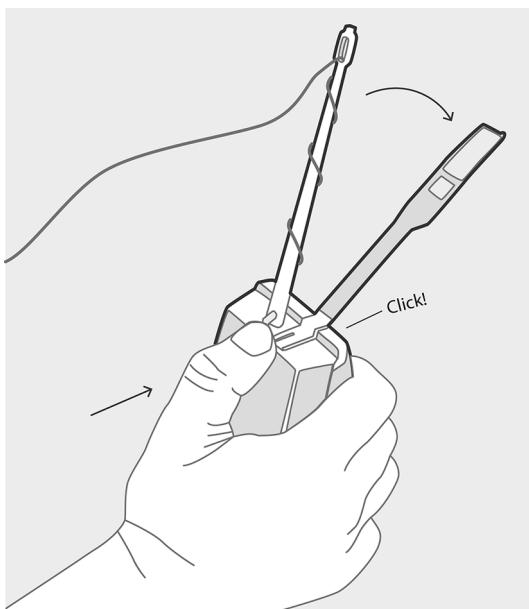
4.3.2 Preparing the RS41 Sensor Boom

Before launching the radiosonde, bend the sensor boom to the correct sounding position using the unwinder stick. This also attaches the radiosonde to the unwinder and the balloon.

- ▶ 1. Push the unwinder stick to its position at the end of the radiosonde.



- 2. As you push, the unwinder stick pushes the sensor boom to the bent position and the unwinder snap lock clicks into place.



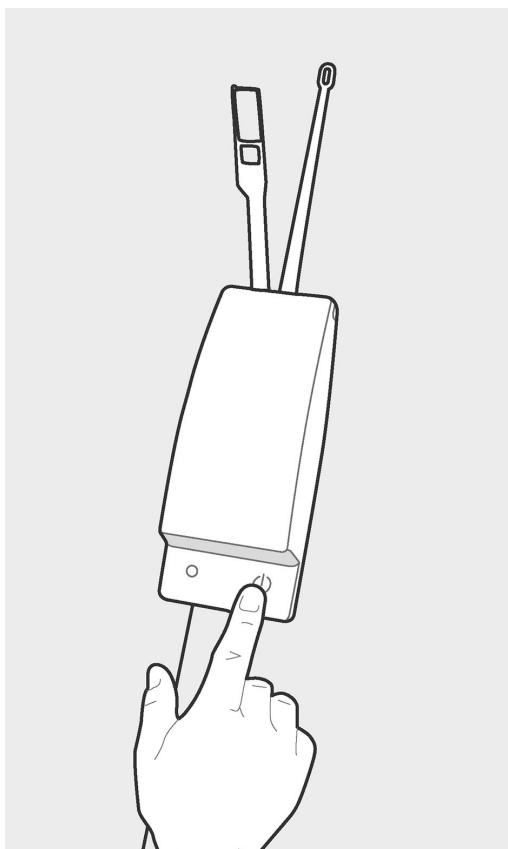
- 3. Make sure that the unwinder is firmly attached to the radiosonde.

4.3.3 Switching the RS41 Power On or Off

The radiosonde power is automatically switched on when you place the radiosonde on the ground check device for preparing the radiosonde for the sounding.

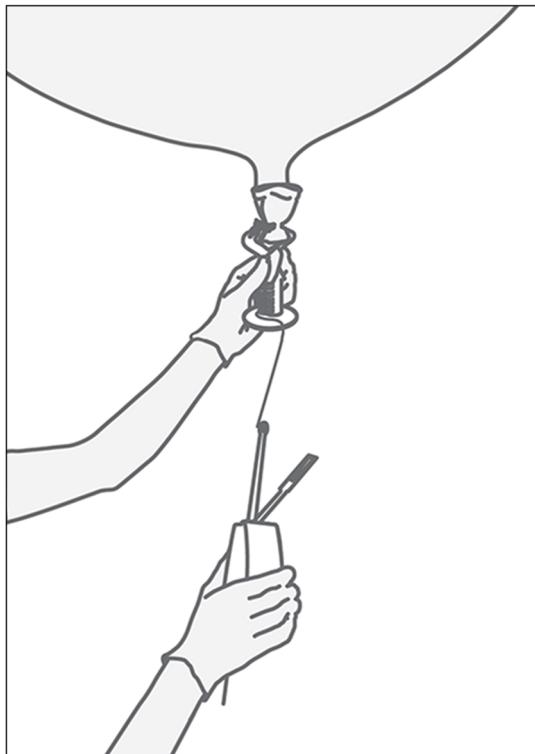
With RS41, you can use Ground Check Device RI41 for the radiosonde preparations. For information on using RI41, see the on-line help for MW41, embedded in the sounding software.

- ▶ 1. If there is any delay in starting the sounding, for example, if you must wait before releasing the radiosonde balloon, you can switch the radiosonde off by pushing the power switch. When you are ready to release the balloon, switch the radiosonde back on.



4.4 Launching the Radiosonde

- ▶ 1. Hold the balloon in one hand and the radiosonde in the other hand. First release the balloon and immediately after this let go of the radiosonde.



5. Performing a Comparison Sounding

5.1 Comparison Sounding

You can perform a comparison sounding both with Radiosonde RS41 and Radiosonde RS92.

Comparison sounding means performing a sounding with multiple radiosondes and comparing them against one another. To compare the performance of radiosondes, the radiosondes are flown together, attached to the same balloon.

In a comparison sounding, the way the radiosondes are attached affects the radiosonde measurement results. You can minimize this effect with correct sounding preparations.

To minimize the effects of the balloon or the sounding preparations on the measurement results, and to maximize radiosonde sensor ventilation, the following type of sounding construction is recommended in a twin sounding, that is, a sounding with two radiosondes.

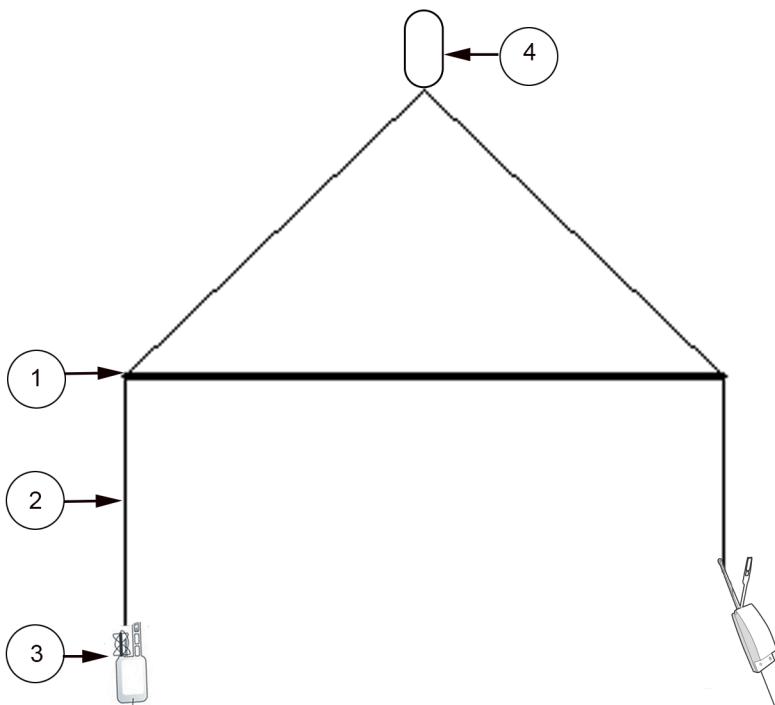


Figure 8 Twin Sounding

- 1 Wooden rod
- 2 Radiosonde unwinder string
- 3 Radiosonde
- 4 Loop made of the rod's support strings

If you fly a third radiosonde on the same rod, attach the radiosonde to the middle of the rod.

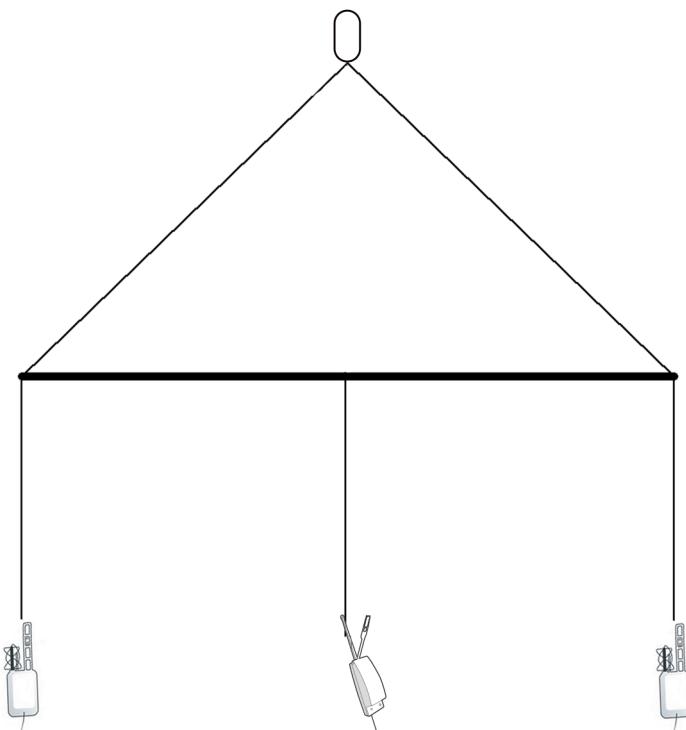


Figure 9 Comparison Sounding with Three Radiosondes



CAUTION! To bind the radiosondes on the rod for a comparison sounding, always use the unwinder string, not the rod's support string. The radiosondes must be able to rotate freely.

5.2 Preparing the Rod and Support Strings



For a comparison sounding, you need a rod that is about 310 cm long.

- ▶ 1. Make sure that the rod is not bent. If the rod is bent, let it straighten a while on a flat surface.
- 2. Locate the middle point of the rod by, for example, balancing the rod on your index finger. Mark the middle point on the rod with a pen.

3. Pass a string through the hole at the end of the rod.

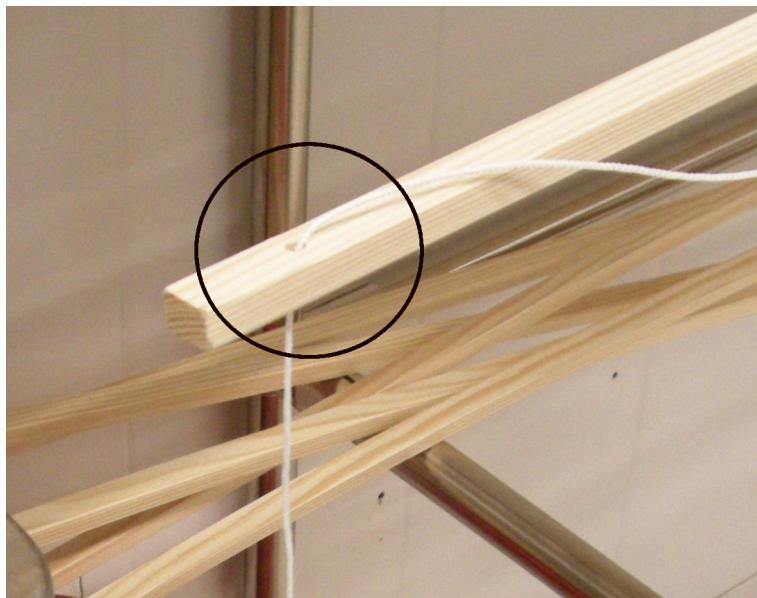


Figure 10 String Passed Through the Hole in the Rod

4. Pass the string through the hole again and tie a knot on the side of the rod.

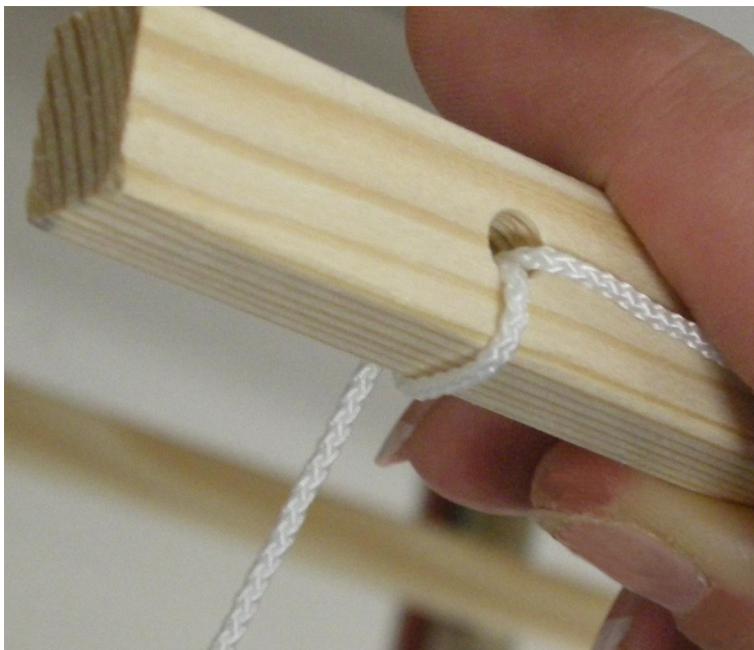


Figure 11 String Passed Through the Hole Twice

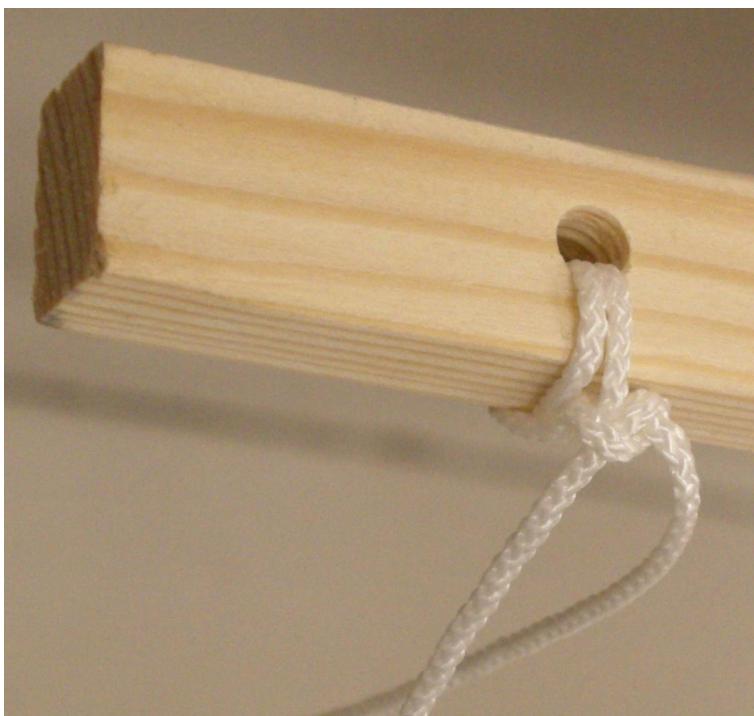


Figure 12 Knot on the Side of the Rod

5. Pull the string for about 1.5 times the length of the rod (about 4.6 m) and cut it. Repeat steps 3 and 4 for the other end of the rod. Make sure that the knot at the other end of the rod is on the same side as the first knot.

6. Pass another piece of string twice around the middle of the rod and make a knot. Make sure that this knot is on the same side of the rod as the two other knots.



Make sure that the knot is tight. It must not move during the sounding.



Figure 13 Knot in the Middle of the Rod

7. Grab hold of the strings at the ends of the rod.

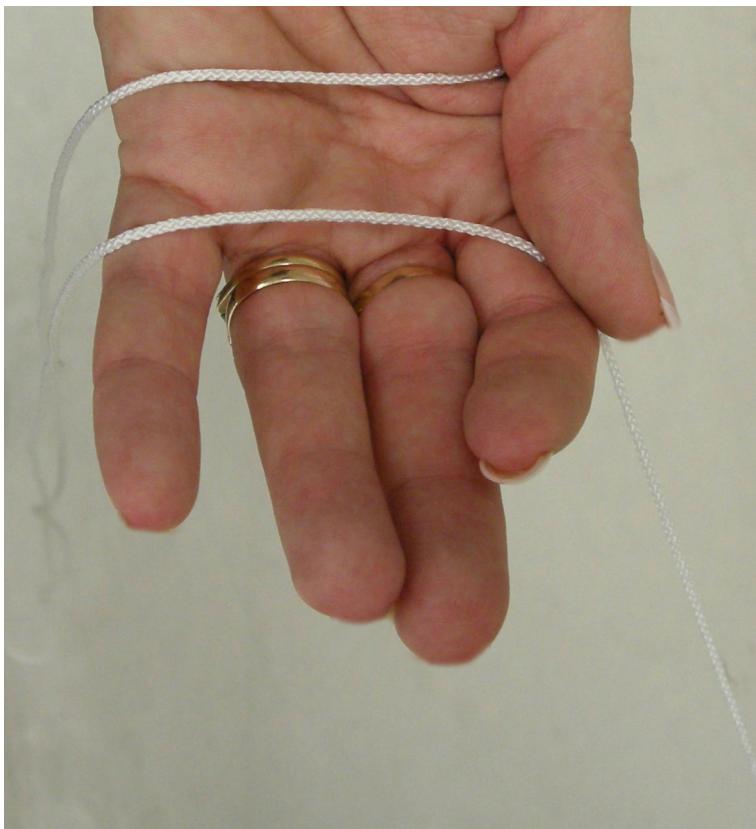


Figure 14 Holding the Strings

8. Keep holding the two strings in your hand and grab hold of the string in the middle of the rod. Lift the rod. Check that the rod is well balanced when you lift it and adjust the length of the strings, if necessary.
9. After you have checked that the length of the strings is correct and the rod is balanced when you lift it, tie all the strings together.

10. Make a second knot of the strings so that you first hold the strings attached to the ends of the rod, and then add the string in the middle of the rod and tie them all in a knot, so that they form a loop.

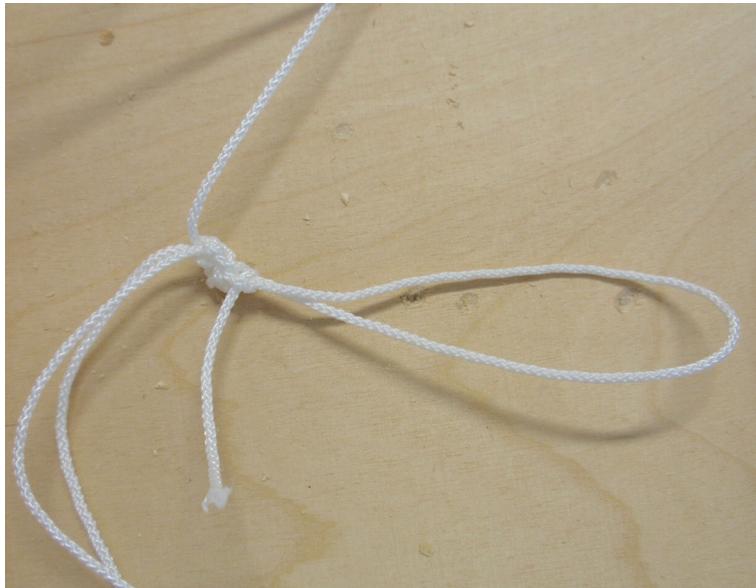


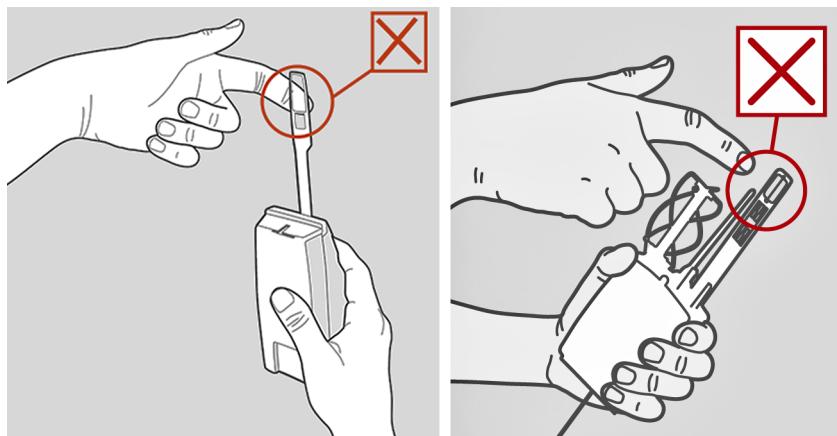
Figure 15 Loop Formed by the Strings

Next, attach the radiosondes to the rod.

5.3 Attaching the Radiosondes to the Rod



CAUTION! Do not touch the radiosonde sensors. They are fragile and can be easily contaminated.



CAUTION! Be careful not to bend the RS92 GPS antenna.



To bind the radiosondes on the rod, you need the unwinder string.



CAUTION! To bind the radiosondes on the rod for a comparison sounding, always use the unwinder string, not the rod's support string. The radiosondes must be able to rotate freely.

The maximum force the strings must endure in a sounding is 100 N (10 kp) when the total weight of the radiosondes is 1 kg or less. Ordinary knots will reduce the string strength to 40 % of the original strength of the string. With right kind of knots you can avoid the reduction of the string strength.

Attach the unwinder string to the radiosonde in the following way:

- ▶ 1. Do not remove the unwinder string from the radiosonde. Unleash roughly one meter of the unwinder string.

2. Cut the string to the length of one meter.
3. Wrap the string around the rod, so that the distance between the radiosonde and the rod is 80 cm.
4. Make a tight knot and secure the string to the rod with adhesive tape.
5. Place the rod and the radiosondes on a stand to wait for the launch. Check that all strings are untangled and that the radiosondes do not touch the ground.



Figure 16 Radiosondes Attached to a Rod, Waiting for Launch on a Stand



Figure 17 Radiosonde RS92 on a Stand

5.4 Preparing the Radiosonde Balloon for Comparison Sounding



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

- ▶ 1. Select the balloon for a comparison sounding according to the recommendations.
- 2. Prepare the balloon in the same way as in a normal sounding.

5.4.1 Recommended Balloon Type for Comparison Sounding

In a comparison sounding with multiple radiosondes, Vaisala recommends using Totex balloon TX1200 at the minimum.

Table 7 Recommended Balloon Type for Comparison Sounding

Balloon Type	Filling Gas	Total Balloon Weight
Totex TX1200 (1200 g)	Helium	2.4 kg

The balloon must be big enough to be able to lift the radiosondes to the required altitudes. A big balloon also creates a firm object, enabling better ventilation for the radiosonde sensors. The required lifting force is 1000 ... 1400 g in addition to the weight of the total sounding load.

The length of the balloon string must be at least 30 m. For a comparison sounding with multiple radiosondes up to a total weight of 1 kg, Vaisala recommends using a metallic unwinder with a 60-meter balloon string.

5.5 Preparing the Parachute for Comparison Sounding

Vaisala recommends using a parachute in a comparison sounding. For a comparison sounding, Vaisala recommends the bigger Totex parachute 160V-05, meant for heavy loads.



The parachute must be attached directly under the balloon, not close to the radiosondes.

- ▶ 1. Untangle the strings in the parachute.
- 2. Attach the parachute to the balloon.

3. Attach the unwinder to the elastic ribbon loop of the parachute with a string.
4. Attach the rod to the unwinder.

5.6 Launching the Radiosondes

In a comparison sounding, two persons are needed to launch the radiosondes. One person releases the balloon and another holds the rod. Make sure that the string is pulled straight and the balloon is released first.

Note the wind direction carefully before the launch.



CAUTION! Handle the radiosondes with care. Make sure that they do not hit the stand or the ground when you lift the rod and the radiosondes.

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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