

Woffin

Balloon Weigh-Off Inflator

Balloon
Ascent
Technologies



User Guide

Rev. 1 – July 2019

Introduction

The *Woffin*™ is a weigh-off inflation device for latex weather balloons. It is placed in the neck of the balloon and permits inflation through a short length of latex tubing. Once the proper inflation is achieved, usually monitored by a removable weigh-off weight, the latex tubing is pinched shut and the balloon is ready to launch. The *Woffin* permits:

- Highly-accurate weigh-offs as the inflation nozzle flies with the balloon
- Quick launches, no complicated folding/taping/tying to seal the balloon's neck
- Secure balloon-to-payload attachment
- Easily accessible harness to attach a weigh-off weight or mooring line to hold the balloon while the payload is readied

Woffin Specifications

Parameter	Min	Typ.	Max	Unit
#4				
Max Diameter		46		mm
Mass (everything, PETG)		17		grams
#6				
Max Diameter		66		mm
Mass (everything, PETG)		21		grams
#8				
Max Diameter		86		mm
Mass (everything, PETG)		26		grams
#10				
Max Diameter		106		mm
Mass (everything, PETG)		29		grams

Note: the *Woffin* has been tested with payloads weighting up to 10 kg.

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1 Checklist

Pre-Flight

- 1) Open the balloon's package to just expose the neck of the balloon
- 2) Insert the *Woffin* into the neck of the balloon
- 3) Secure the *Woffin* with the Harness Zip-tie
- 4) Close up the balloon's package to protect it until inflation
- 5) Calculate and prepare the weigh-off weight

Inflation

- 6) Lay out the flight-train and securely attach it to the *Woffin*'s harness
- 7) Clip the weigh-off weight onto the *Woffin*'s harness
- 8) Connect the inflator hose to the regulator and *Woffin*
 - i. DO NOT use any tubing clamps on these connections
- 9) Verify the regulator is set for its lowest pressure
- 10) Roll out the balloon onto a protective launch sheet
- 11) Turn on the valve from the lift-gas tank to the regulator
- 12) Slowly increase the outlet pressure of the regulator
 - i. Excessive pressure will cause the hose barb to slip out, preventing the tubing from exploding, should too much pressure be applied
- 13) Continue to inflate the balloon until it becomes neutrally buoyant with the weigh-off weight attached
- 14) Remove the inflator hose and pinch the *Woffin*'s tubing closed
- 15) Install a small zip-tie to keep this tubing pinched closed during the flight

Launch

2 Rigging

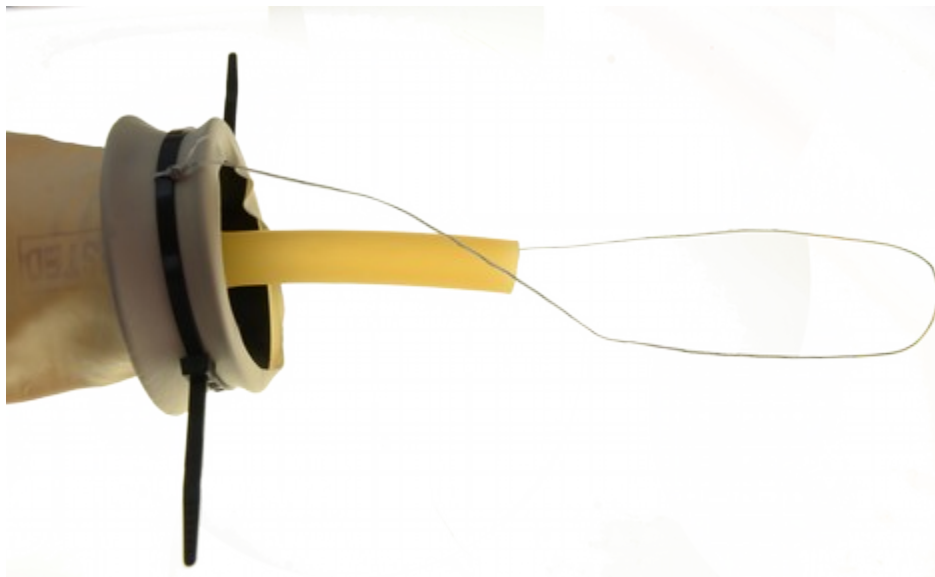
Step 1 – Insert Woffin into balloon

Carefully open the balloon's package to just expose the neck of the balloon. Then insert the *Woffin* into the neck of the balloon as shown below.



Step 2 – Attach Harness

Secure the *Woffin* with the Harness Zip-tie. Tighten the zip-tie(s) and carefully trim the excess so there are no sharp edges that might pop the balloon.

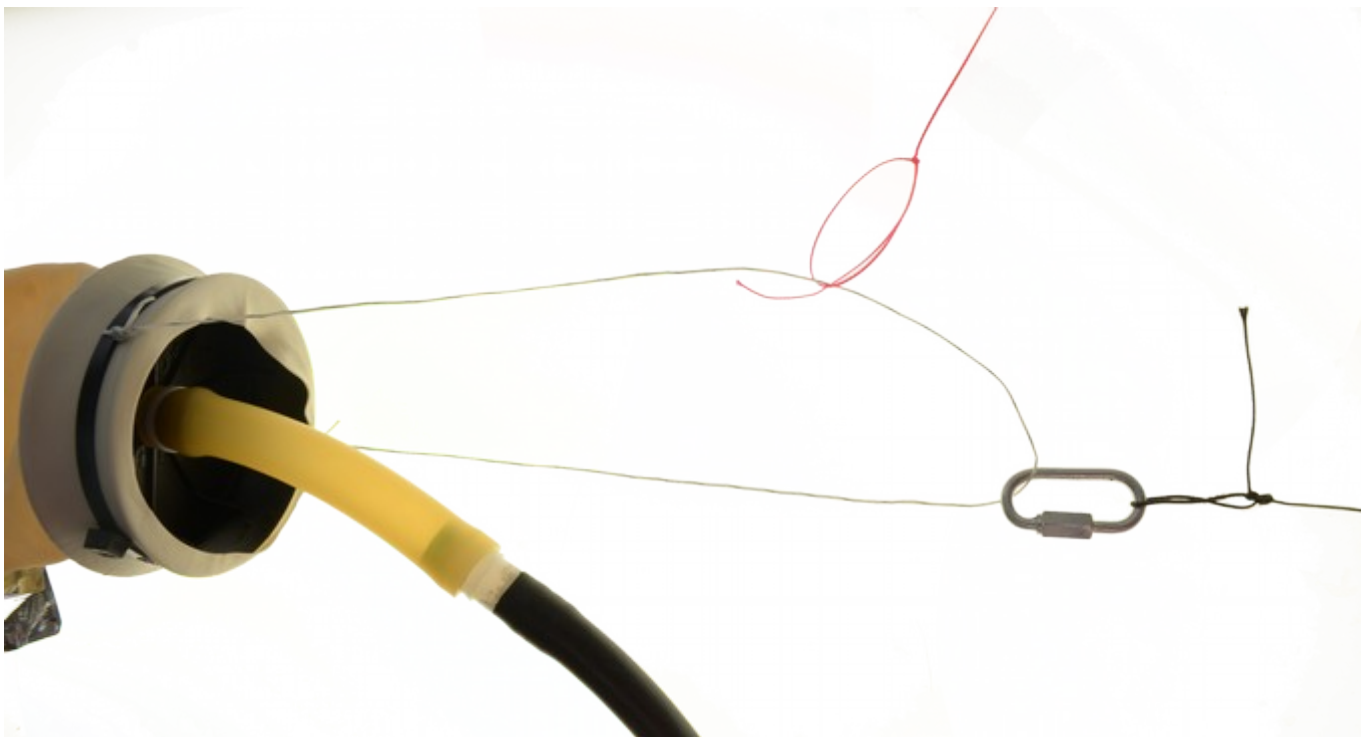


Step 3 – Inflate

Attach your flight-train (shown below with pink line) to the *Woffin*'s harness. Attach the weigh-off weight clip (shown below with black line) to the *Woffin*'s harness. Attach the inflator hose from the regulator using a 1/2 inch hose barb.

Do not use zip-ties or other hose clamps. The latex tubing is rated to a max pressure of 10 psi (0.7 bar) and can burst. However, when no zip-ties or clamps are used, the tubing will pop-off the hose barbs as the internal pressure becomes too great, preventing it from bursting.

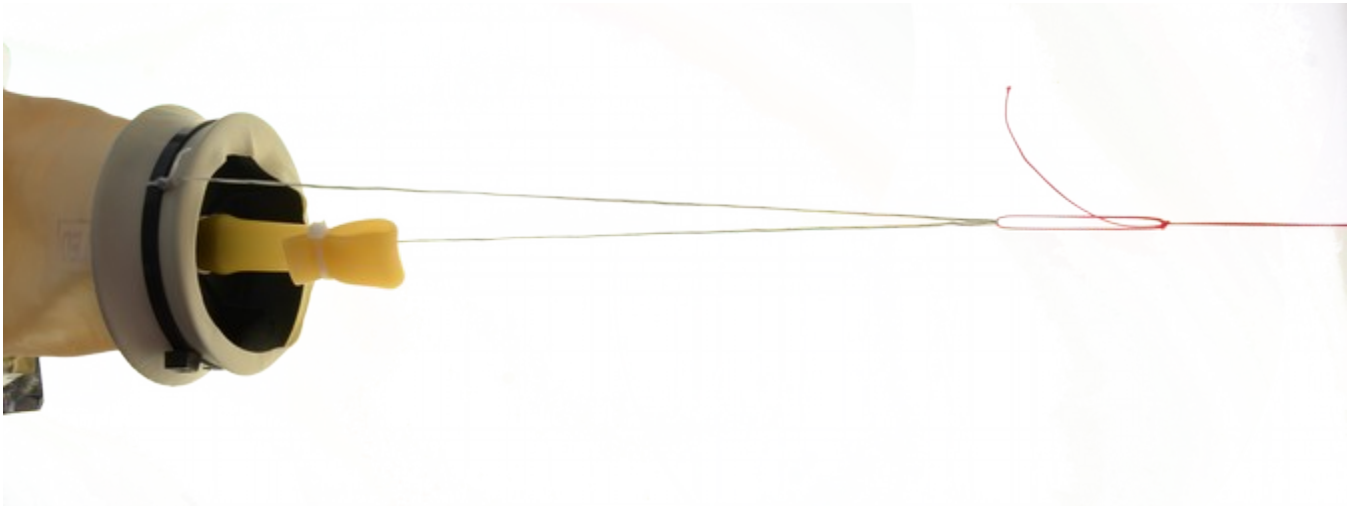
It is much quicker to add more lift-gas than vent through the *Woffin*, so it is recommend to use an iterative fill process for high-accuracy inflations. Stop the inflation before the desired lift is generated. The rapidly expanded lift gas, going from the tank into the balloon, will be colder than the ambient air temperature. As it warms up, over a couple of minutes, it will generate more lift. It is also possible with each iteration to remove the inflation hose and loosely clamp the *Woffin*'s tube closed to ensure the inflation hose's mass doesn't adversely impact the weigh-off.



Step 4 – Seal the Woffin and Launch

Remove the inflator hose and pinch the *Woffin's* tubing closed. Install a small zip-tie to keep this tubing pinched closed during the flight.

You are now ready to launch!



3 Consumables

3D Printed Part

The *Woffin* can be printed out common plastics on a 3D printer. PLA, ABS, and PETG have all been successfully tested and flown.

The design is optimized to be printed with a 0.4 mm nozzle, 0.4 mm extrusion width, and 0.2 mm layer height. It may be necessary to increase the extrusion multiplier to ensure completely sealed prints that are not porous—to avoid leaking lift-gas during the flight. Otherwise, it may be necessary to coat with a sealant after printing.

Note: for flights that separate from the balloon(s) before landing, it would be better environmentally to use 3D printed plastics that biodegrade faster (such as PLA).

Latex Tubing

The *Woffin* is designed to use approximately 10 cm of 1/2” latex tubing with a 1/16” wall thickness. It can be secured to the *Woffin*’s hose barb with a small zip-tie.

Harness

A length of approximately 60 cm line is attached to a large zip-tie that goes around the balloon neck, securing it to the *Woffin*. We suggest using the [San Diego Jam Knot](#) to attach the line to the zip-ties. This knot has proven reliable, even with slippery waxed Dacron line.

Note: two smaller zip-ties can be combined if one long enough can not be found.

Rigging Line

Below are some of the rigging line options that we have used and liked. The Green-Spot line is our preferred line due to it being widely available. The Nano cord holds knots well and comes in a wide variety of colors which helps for complicated flight-trains. The Twisted Nylon line is super stretchy and can help dampen jerks and bounces on long flight-trains during the flight.

Green-Spot Dacron Fishing Line. Some manufacturers include: [Izorline](#) or [Cortland](#)

Atwood Rope Nano Cord: <https://atwoodrope.com/collections/nano-cord>

Twisted Nylon Mason Line: Home Depot, Amazon, [Erin](#), etc.

4 Common Balloon Neck Sizes

Balloon Size	Burst Diameter (cm)	Neck Diameter (cm)	Woffin Size
<u>Hwoyee</u> Balloons (China)			
HY-100	200	3.0	#4
HY-140	200	3.1	#4
HY-200	297	3.5	#4
HY-300	430	4.3	#4
HY-350	480	4.4	#4
HY-500	580	5.1	#6
HY-600	650	5.4	#6
HY-750	690	5.4	#6
HY-800	700	5.7	#6
HY-1000	800	5.9	#6
HY-1200	910	6.0	#6
HY-1600	>1000	7.8	#8
HY-2000	>1000	7.9	#8
HY-3000	>1200	8.0	#8

<u>Totex</u> Balloons (Japan)			
KCI-150	252	3	#4
KCI-200	300	3	#4
KCI-300	378	3	#4
KCI-350	412	3	#4
KCI-500	499	3	#4
KCI-600	602	3	#4
KCI-800	700	3	#4
KCI-1000	786	3	#4
KCI-1200	863	3	#4
KCI-1500	944	3	#4
KCI-2000	1054	5	#6
KCI-3000	1300	5	#6

<u>Pawan</u> Balloons (India)			
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CPR-200			
CPR-300			#8
CPR-350			
CPR-500			
CPR-600			
CPR-750			
CPR-800			
CPR-850			
CPR-875			
CPR-1000			
CPR-1200			
CPR-1600			
CPR-2000			

5 Open Hardware License

The Balloon *Woffin* by Balloon Ascent Technologies LLC is licensed under the CERN Open Hardware License v1.2.

Woffin Git Repository: <https://bitbucket.org/Loonatec/woffin/>

Woffin Size #4 Fusion 360 Model: <https://a360.co/32jPmcM>

Woffin Size #6 Fusion 360 Model: <https://a360.co/2LMmR1y>

Woffin Size #8 Fusion 360 Model: <https://a360.co/32wUJFM>

Woffin Size #10 Fusion 360 Model: <https://a360.co/32n4032>

Balloon Ascent Technologies LLC website: <https://Loonatec.com>

CERN Open Hardware License v1.2: <https://ohwr.org/project/licenses/wikis/cern-ohl-v1.2>

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