

# KITES FOR CONNOISSEURS

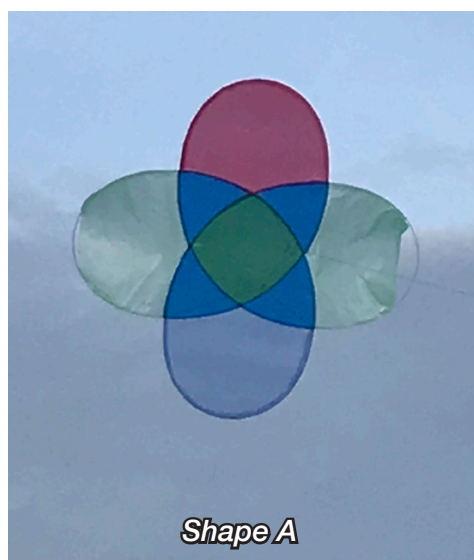
## ABOK #2287

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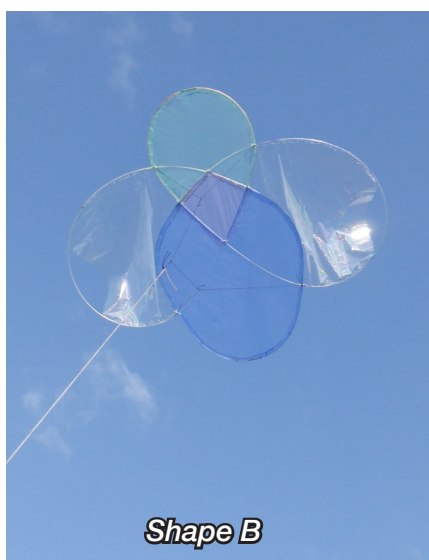
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*Kites for Connoisseurs* is a collection of plans for kites designed by Andreas Ågren. These kites often have a unique technical twist. The plans can be found at <http://windman.se/kite-plans> and they may not be used for commercial purpose without written consent.



Shape A



Shape B



Shape C - Gnat

In the **Ashley Book of Knots** the knot #2287 is a “four-bight Turk’s Head knot, in disk form” without any special name. The knot can be used as frame of a small kite. The bights lengthways then have a plain skin while the bights across have vented wings, what the Japanese call *fu-tai wing* (kanji 風袋), that create an in-sail dihedral.

This plan describes three different shapes (A, B and C) of the #2287 knot, as well as three different sizes for the shapes A and B.

- A. Regular knot.
- B. Insect.
- C. Gnat.

Since the **Abok #2287** [**Ashley Book of Knots**] is not an original *Windman-Biegolmai* invention, only various applications of an existing frame, this description is not a regular step-by-step plan but leaves much to own experiments.

**Abok #2287** is essentially a low wind kite and can fly at a quite steep angle also in low wind.

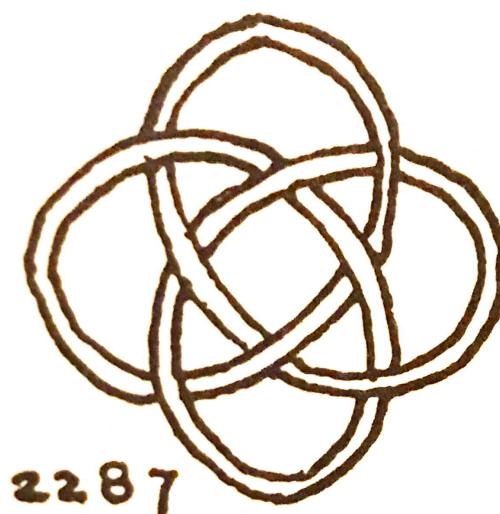


Figure #2287 at page 371 in the **Ashely Book of Knots**.

## Material.

- Fibreglass rod, 1 - 1.5 mm, 2 - 4 m long.
- Plastic, rescue film, washi paper, cellophane, ripstop or similar.
- Ferrule, 1 - 1.5 mm.
- Glue with high viscosity. The glue should become clear when cured and the dispenser should have a fine nozzle.
  - The glue *UHU twist & glue* meets the requirements and has been working fine. Both the 35 ml and the 90 ml bottles have the same size of nozzle.
  - Double sided tape is probably not an option since it would probably not last very long.

## Flat knot (disk form).

A flat knot is tied by “weaving” a strand alternatively over and under another part of the same strand.

## Three shapes.

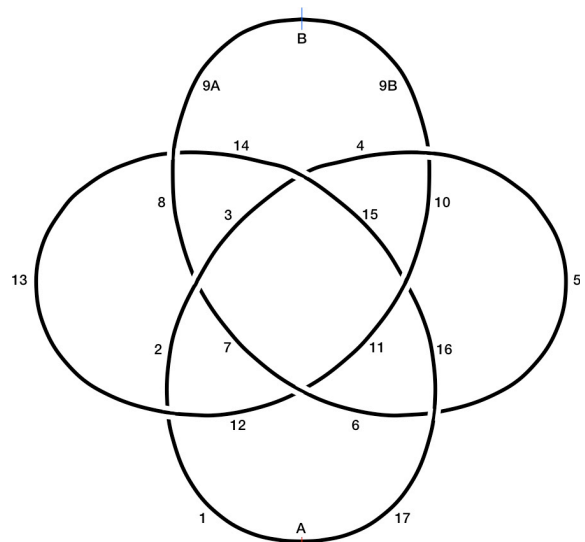
Below are three shapes described with the section length between the intersections of two strands for different sizes indicated.

Generally, each figure shows the numbered sections of the rod. The length of each section until next intersection is listed in the tables below for the different shapes and sizes. The numbering starts at point **A** which is in the rear end of the knot and where the two ends of the rods are joined. If two rods are used the joining point of these is marked with a **B**, which is in the front edge of the knot.

## Making a #2287 knot kite.

The eight general steps of making the kite:

1. Choose the shape of the kite.
2. Decide the size of the kite (i.e. total length of the fibreglass rod).
3. Mark the intersection points on the rod(s). Draw the marks all the way around the rod.
4. Tie the #2287 knot (see page 9).
5. Adjust the intersections to the marked points and secure the intersections with a knot of thin thread. A drop of super glue on the knots might help.
6. Draw the outline of the body (or the different panels of the body) on paper for later use (see page 11).
7. Cut the wing skin parts according to the included templates and glue them to the frame:
  - a. Glue first the side of the wing skin, front and rear sections, to the body frame.
  - b. Then glue the front and rear of the wing skin to the wing frame.
  - c. Make template(s) for the body part/panels.
  - d. Cut the body skin part(s) and glue them to the frame, starting from the rear edge of the body.
8. Tie the bridle.



Each number indicates a section/leg between two intersections (or between start/end and nearest intersection). The number also goes for the intersection itself at the end of the section.

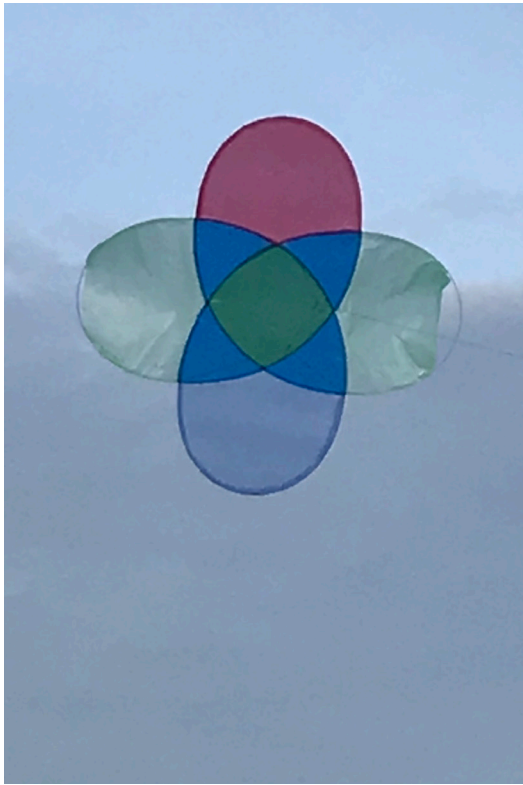
The **A** marks the joining point of a single rod and the starting point for measuring the leg lengths (numbered 1 - 17) to the marks of the intersections.

The **B** (together with the **A**) marks the joining point when two rods are used.

## Knot #2287, shape A.

As it comes.

The regular four-leaf clover shape is straight from the book at page 371.



### Small knot.

Approximately 34 x 34 cm.

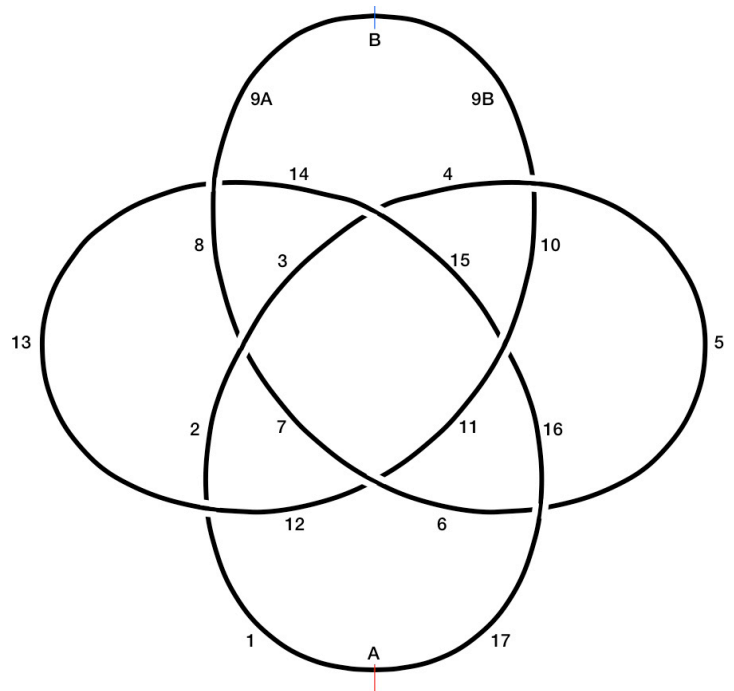
1 pcs 2 meter of 1.0 - 1.5 mm fibreglass rod.

Check that the rod is exctly 200.0 cm long!

Note! This small regular knot kite is the only one of the #2287 kites that is a bit difficult to tune to a balanced flight.

### A to A, individual leg lengths in cm.

1: 13.5  
2: 7.5  
3: 8  
4: 7.5  
5: 27  
6: 7.5  
7: 8  
8: 7.5  
9: 27  
10: 7.5  
11: 8  
12: 7.5  
13: 27  
14: 7.5  
15: 8  
16: 7.5  
17: 13.5



The A marks the joining point of a single rod and the starting point for measuring the leg lengths (numbered 1 - 17) to the marks of the intersections. An intersection shows which strand is over and which is under.

The B (together with the A) marks the joining point when two rods are used.

### A to A, aggregated leg lengths in cm.

1: 13.5  
2: 21  
3: 29  
4: 36.5  
5: 63.5  
6: 71  
7: 79  
8: 86.5  
9: 113.5  
10: 121  
11: 129  
12: 136.5  
13: 163.5  
14: 171  
15: 179  
16: 186.5  
17: 200

Middle: 100 in other colour.

9. Or, instead of continued aggregated measuring: start measuring from the other end of the rod using measurements for sections 1 - 8.

Put a mark in different colour on the middle of the stick, 100 cm, just to keep track of the middle.

**Medium size knot.**

Approximately 51 x 51 cm.

1 pcs 3 meter of 1.5 mm fibreglass rod (or 2 pcs 1.5 m).

***A to A, individual leg lengths in cm.***

1: 20.5  
2: 11  
3: 12  
4: 11  
5: 41  
6: 11  
7: 12  
8: 11  
9: 41  
10: 11  
11: 12  
12: 11  
13: 41  
14: 11  
15: 12  
16: 11  
17: 20.5

***A to A, aggregated leg lengths in cm.***

1: 20.5  
2: 31.5  
3: 43.5  
4: 54.5  
5: 95.5  
6: 106.5  
7: 118.5  
8: 129.5  
9: 170.5  
10: 181.5  
11: 193.5  
12: 204.5  
13: 245.5  
14: 256.5  
15: 268.5  
16: 179.5  
17: 300

Middle: Mark 150 in other colour.

*9. Or, instead of continued aggregated measuring: start measuring from the other end of the rod using measurements for sections 1 - 8.*

If using a single rod put a mark in different colour on the middle of the stick, 150 cm, just to keep track of the middle.

**Large knot.**

Approximately 68 x 68 cm.

2 pcs 2 meter of 1.5 mm fibreglass rod, total length 4 m.

***A to B and B to A, individual leg lengths in cm.***

1: 27  
2: 15  
3: 16  
4: 15  
5: 54  
6: 15  
7: 16  
8: 15  
9A: 27  
9B: 27  
10: 15  
11: 16  
12: 15  
13: 54  
14: 15  
15: 16  
16: 15  
17: 27

***A to B, aggregated leg lengths in cm.***

1: 27  
2: 42  
3: 58  
4: 73  
5: 127  
6: 142  
7: 158  
8: 173  
9A: 200

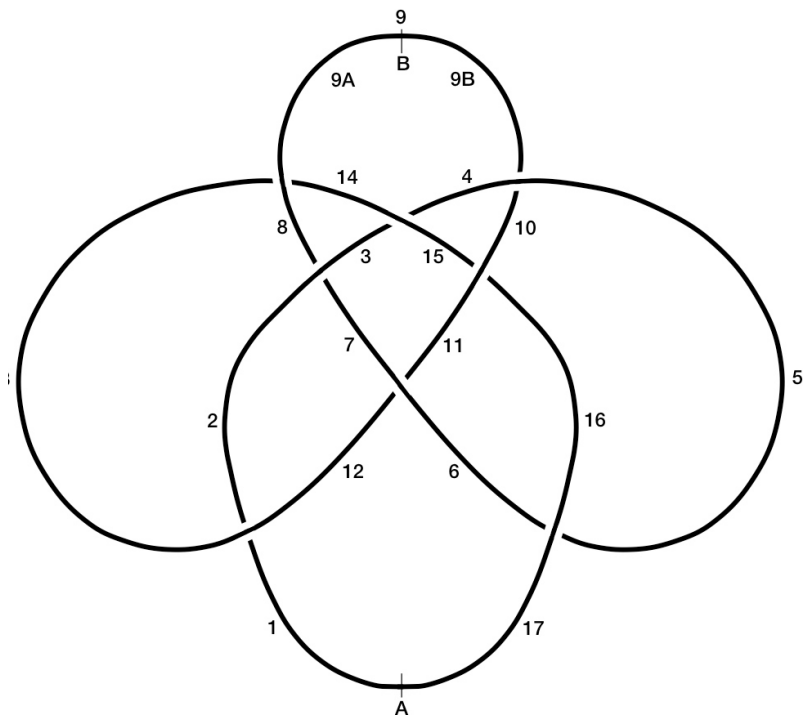
Put the two rods side by side and make the intersection marks on both rods at the same time. Also mark which ends are A and which ends are B.

Glue the B ends together in a ferrule.

## Knot #2287, shape B.

Modified to an insect shape.

Smaller head and backwards angled wings.



The A marks the joining point of a single rod and the starting point for measuring the leg lengths (numbered 1 - 17) to the marks of the intersections. An intersection shows which strand is over and which is under.

The B (together with the A) marks the joining point when two rods are used.

### Small insect.

Approximately 34 x 33 cm.

1 pcs 2 meter of 1.0 mm fibreglass rod.

#### A to A, individual leg lengths.

- 1: 11
- 2: 14
- 3: 4.5
- 4: 5.5
- 5: 33.5
- 6: 10
- 7: 6.5
- 8: 4.5
- 9: 21
- 10: 4.5
- 11: 6.5
- 12: 10
- 13: 33.5
- 14: 5.5
- 15: 4.5
- 16: 14
- 17: 11

#### A to A, aggregated leg lengths.

- 1: 11
- 2: 25
- 3: 29.5
- 4: 35
- 5: 68.5
- 6: 78.5
- 7: 85
- 8: 89.5
- 9: 110.5
- 10: 115
- 11: 121.5
- 12: 131.5
- 13: 165
- 14: 170.5
- 15: 175
- 16: 189
- 17: 200

Middle: Mark 100 in other colour.

9. Or, instead of continued aggregated measuring: start measuring from the other end of the rod using measurements for sections 1 - 8.

Put a mark in different colour on the middle of the stick, 100 cm, just to keep track of the middle.



**Medium size insect.**

Approximately 51 x 50 cm.

1 pcs 3 m rod or 2 pcs 1.5 meter of 1.5 mm fibreglass rod.

***A to A, individual leg lengths in cm.***

1: 16.5  
2: 21  
3: 6.5..  
4: 8.5..  
5: 51  
6: 15  
7: 10  
8: 6.5  
9: 30  
10: 6.5  
11: 10  
12: 15  
13: 51  
14: 8.5  
15: 6.5  
16: 21  
17: 16.5

***A to A, aggregated leg lengths in cm.***

1: 16.5  
2: 37.5  
3: 44  
4: 52.5  
5: 103.5  
6: 118.5  
7: 128.5  
8: 135  
9: 165  
10: 171.5  
11: 181.5  
12: 196.5  
13: 247.5  
14: 256  
15: 262.5  
16: 283.5  
17: 300

Middle: Mark 150 in other colour.

*9. Or, instead of continued aggregated measuring: start measuring from the other end of the rod using measurements for sections 1 - 8.*

If using a single rod put a mark in different colour on the middle of the stick, 150 cm, just to keep track of the middle.

If using two rods put the rods side by side and make the intersection marks on both rods at the same time. Also mark which ends are A and which ends are B. Glue the B ends together in a ferrule.

**Large insect.**

Approximately 68 x 66 cm.

2 pcs 2 meter of 1.5 mm fibreglass rod, total length 4 m.

***A to B and B to A, individual leg lengths in cm.***

1: 22.5  
2: 28  
3: 9  
4: 11.5  
5: 66.5  
6: 20  
7: 13  
8: 9  
9A: 20.5  
9B: 20.5  
10: 9  
11: 13  
12: 20  
13: 66.5  
14: 11.5  
15: 9  
16: 28  
17: 22.5

***A to B, aggregated leg lengths in cm.***

1: 22.5  
2: 50.5  
3: 59.5  
4: 71  
5: 137.5  
6: 157.5  
7: 170.5  
8: 179.5  
9A: 200

Put the two rods side by side and make the intersection marks on both rods at the same time. Also mark which ends are A and which ends are B.

Glue the B ends together in a ferrule.

## Abok #2287, shape C.

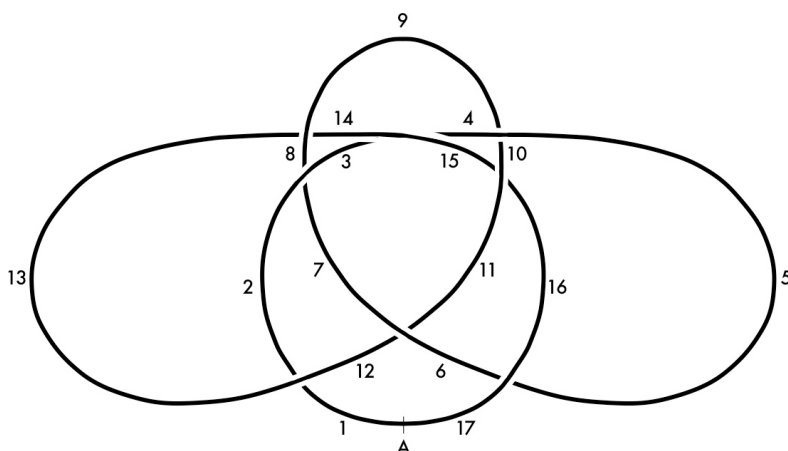
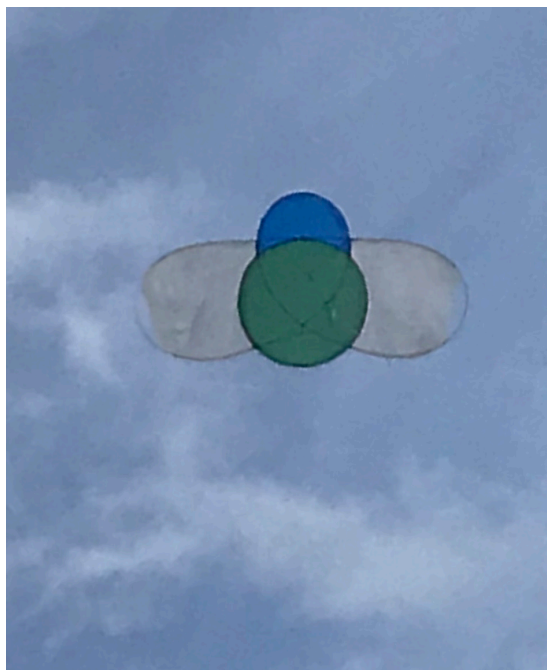
Insect - Mini Gnat.

As this is a small insect it only comes in one size.

### Gnat.

Approximately 39 x 23 cm.

1 pcs 2.0 meter of fibreglass rod, 1.0 - 1.2 mm



The A marks the joining point of the single rod and the starting point for measuring the leg lengths (numbered 1 - 17) to the marks of the intersections. An intersection shows which strand is over and which is under.

#### A to A, individual leg lengths in cm.

- 1: 6.5
- 2: 13
- 3: 6
- 4: 6
- 5: 39.5
- 6: 6.5
- 7: 11
- 8: 2
- 9: 19
- 10: 2
- 11: 11
- 12: 6.5
- 13: 39.5
- 14: 6
- 15: 6
- 16: 13
- 17: 6.5

#### A to A, aggregated leg lengths in cm.

- 1: 6.5
- 2: 19.5
- 3: 25.5
- 4: 31.5
- 5: 71
- 6: 77.5
- 7: 88.5
- 8: 90.5
- 9: 109.5
- 10: 111.5
- 11: 122.5
- 12: 129
- 13: 168.5
- 14: 174.5
- 15: 180.5
- 16: 193.5
- 17: 200

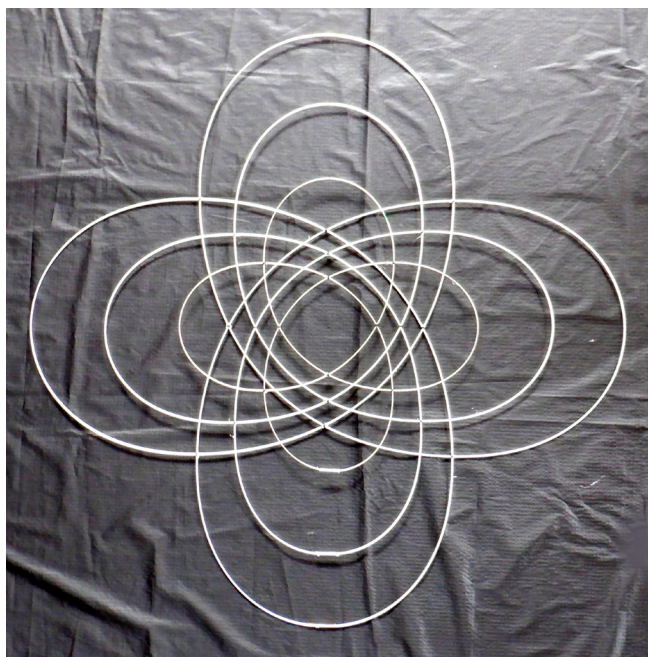
Middle: Mark 100 in other colour.

9. Or, instead of continued aggregated measuring: start measuring from the other end of the rod using measurements for sections 1 - 8.

Put a mark in different colour on the middle of the stick, 100 cm, just to keep track of the middle.

## Size comparison.

### Shape A

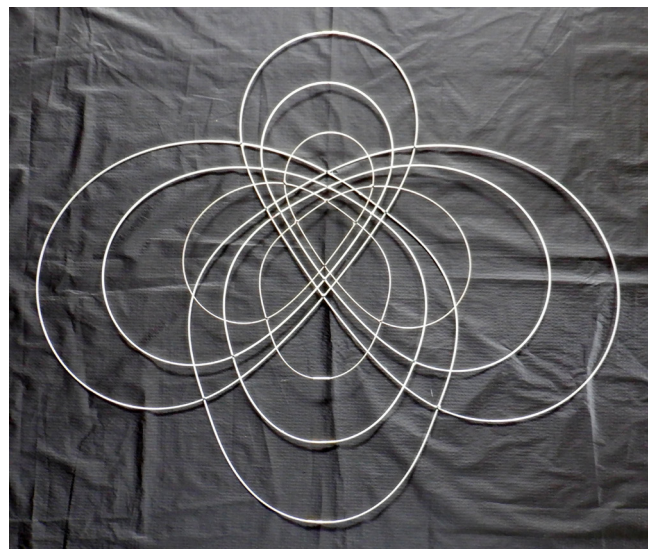


*Frames*



*Kites*

### Shape B



*Frames*



*Kites*



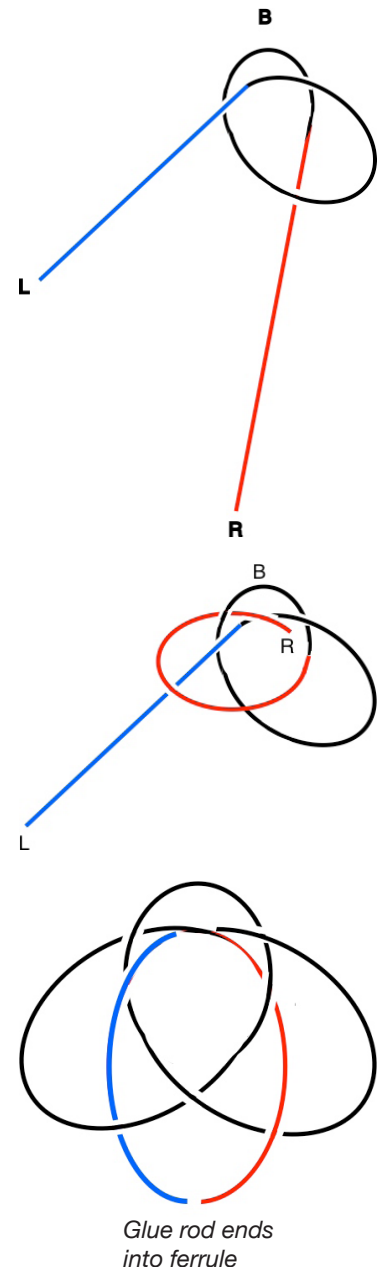
## Tying a #2287 knot with a fibreglass rod.

Start from the middle, B, of the rod (joined rods).

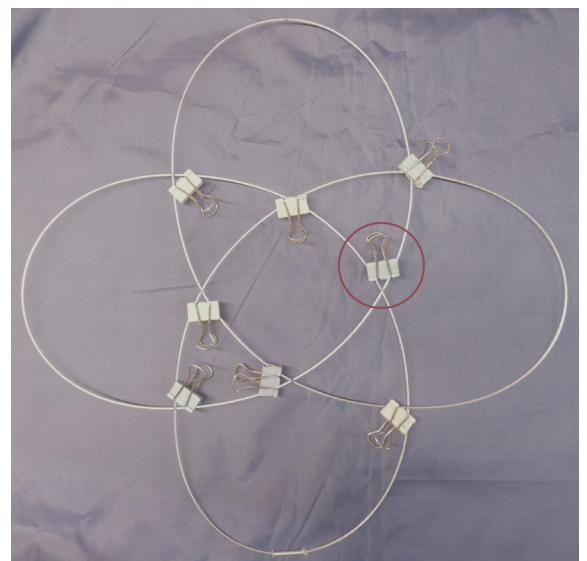
- Pull the right end R down for the top bight.
- Make the right side bight by bending the left end L over the right side rod part, with the left part always on top of the right part.

The intersections can be kept in place using clips throughout the continued “tying”.

- Take the right end R over the left part L, then insert it from the underside of the top bight, through the top part, then over the bent rod parts according to the figure.
- Continue to pull the R end through the knot: under the right side of the top bight and finally over the bottom part of the right bight.
- Join the two ends with a ferrule.



- Start to create the shape by gently pulling the top (B) and bottom (A) apart and then the wing parts. Adjust the intersections according to the marks on the rod: corresponding marks should be exactly on top of each other. Keep the intersections in place using clips.
- Secure the intersections by tying a thin thread around each intersection and put a drop of super glue at every intersection when the shape is as desired (all marks hidden under the tied knots).



*If the clips are put just outside the intersections (as indicated by the red circle) it is easier to tie the thread precisely over the intersection.*

## Skins for #2287.

Suitable material for the skin is plastic bags (not too soft), washi, emergency/rescue film, ripstop etc. As mentioned earlier the bights lengthways have a plain skin while the bights across have vented wings.

### Wing skin.

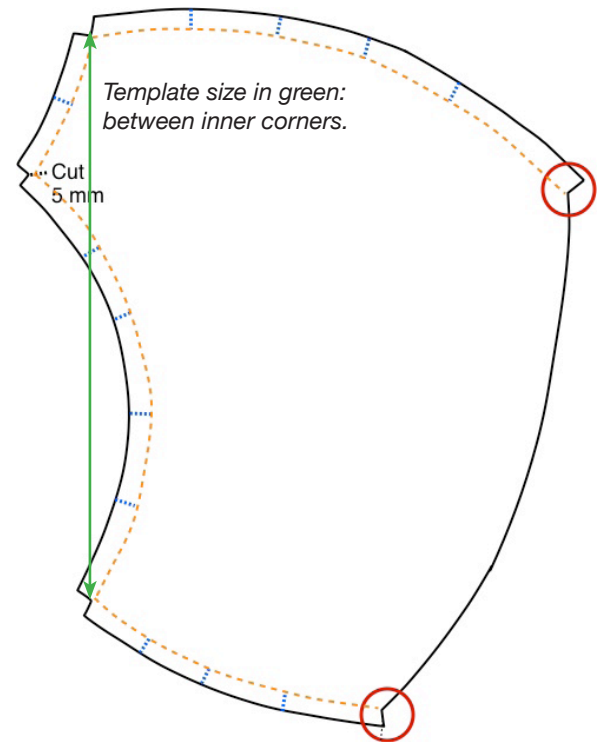
Templates for the wing shapes and different skin sizes of the are included in this description.

The templates are in PDF format and of A3 size. It is important to use a printer that print out the templates so the wings get exactly the size (wing height) that is indicated in the measurement on the green arrow for each template.

The template for the B shape consists of two A3 pages which need to be glued together. There are criss-cross blue guide lines that should facilitate the exact alignment.

- Cut out the two wing skins using the template on the selected material.
- If the wing material is easily tearable some reinforcement needs to be done: At the outside edge of the wing skin (see encircled areas in the figure to the right).
- If the material is paper or plastic bag: crumple up the material.
- Cut a 5 mm slit at the “head/body” join to allow the rear part of the skin to be rotated away from the body.
- Draw with a pencil guide lines for the position of the frames 10 mm inside the edges, see figure.
- Glue front part of the “body” edge to the frame.
- Rotate out the rear part and glue it to the “body” edge.
- Cut the slits on the curved edges as indicated in the figure.
- Glue the front and rear wing edges onto the frame.
- Wrap the padding around the frame and glue.

If other shapes than included in this description are used, the vented wing shape needs to be “calculated” as shown in the three figures on next page.



Guide lines for frame rod position in dotted orange.

Encircled areas indicate where reinforcement may be done.

Cut short slits (marked blue) in the curves that are to be glued to the frame to facilitate the bending of the skin to the frame.

The green arrow indicates the exact measurement between the two inner corners that is printed in the template.

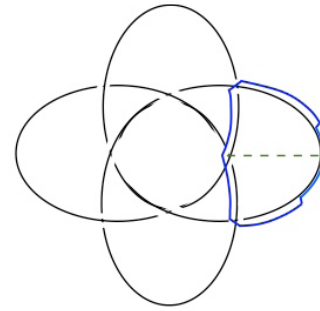


All padded edges of the wing skin (as well as the leading and trailing edges of the body skin) should be wrapped around the frame.

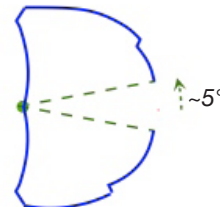
### Calculation of vented wing shape.

The wing skins need to be considerably larger than the wing frame in order to create the in-sail dihedral.

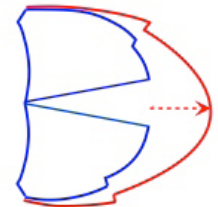
- Draw the contour of one wing with the extra padding for gluing the skin onto the frame on a piece of paper.
- Cut it out and cut the paper horizontally in half.
- Rotate each half  $\sim 5^\circ$  anti-clockwise respectively clockwise (to a total of  $\sim 10^\circ$  angle between the halves) and glue the halves on a second piece of paper.
- Expand the contour, making the front and rear edges less bent. Also expand the width 30 - 50%



1 cm padding on front, rear and side.



Green dot denotes rotating point.



Expand 30-50 %

### Body skin.

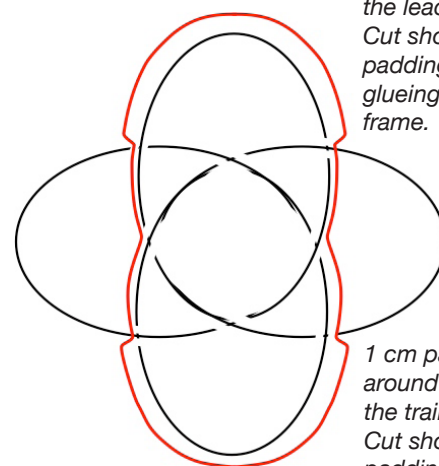
Templates for the body skin, either the whole body or the separate panels within the body, need to be hand drawn for each shape by tracing the outer contour of the body.

For the leading and trailing edges the body skin should have 1 cm extra padding so it can be wrapped and glued around the frame. Along the frame parts which are shared with the wings the extra padding only needs to be 2-3 mm since the skin will be glued flat on the the wing inner edge.

The body skin can of course be split up in different panels.

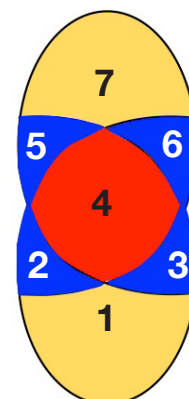
Since the body skin is completely plain non-soft materials such as cellophane panel may well be used.

Suggested working order for multiple panels:  
Glue the body panels from rear to front: 1 to 7.



1 cm padding around the leading edge. Cut short slits in the padding to facilitate glueing around the frame.

1 cm padding around the trailing edge. Cut short slits in the padding to facilitate glueing around the frame.



Example of multiple body panels.

The skin parts are attached to the frame overlapping the already glued skin parts.



Side of body edges: body skin (blue) glued flat onto the frame, overlapping the wing skin.

### Using cellophane.

A word of caution regarding cellophane: some brands of cellophane shrink at higher temperature ( $> 30^{\circ}\text{C}$ ). If used at the head of the body it will become very taught and distort the fibreglass edge, making it look like a propeller and making a good flight impossible.

This drawback can be circumvented by crumpling the cellophane before cutting the panel pieces according to the template (step 7d. to above).

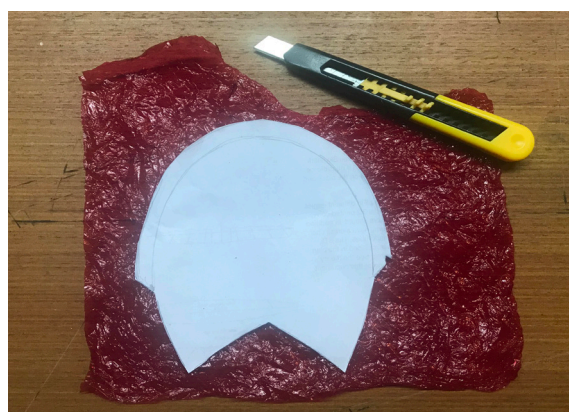
- Cut a piece of cellophane that is at least 20% larger than the intended panel.
- Crumple the cellophane piece thoroughly a couple of times.
- Smooth out the cellophane piece.
- Put the panel template on top of the crumpled cellophane and cut.



Warped rod edge due to shrunk cellophane skin.



Crumpled cellophane sheet.

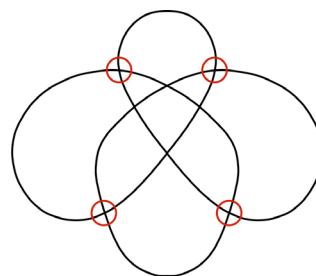


### Bridle.

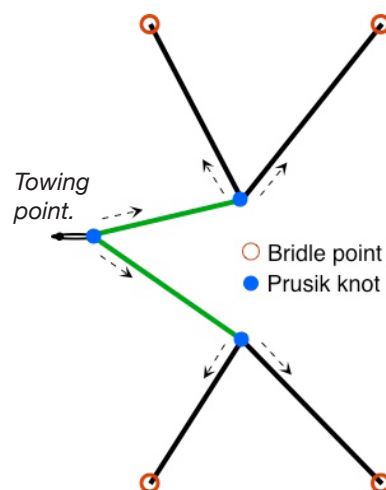
A two-point bridle can work well, but a four point bridle (Rokkaku type) gives more scope for tuning: using Prusik knots the knots can be slid left and right and the towing point can be adjusted up and down. For the larger Abok #2287 kites with thin rods the wings keep their shape better (not flexing backwards) with a four-point bridle.

Bridle lengths:

- Large kite (4 m fibreglass rod): 3 pcs of 1 m.
- Medium size kite (3 m fibreglass rod): 3 pcs of 0.75 m.
- Small kite (2 m fibreglass rod): 3 pcs of 0.5 m.



Bridle points for four point bridle.



Prusik knots on bridle to facilitate tuning.