

Arne's Chain Calculator or...

How I do to make guessing on camber a little less inaccurate...

Version 20120519, based on ver. 20120509, based on ver. 20071228, based on ver. 20060618 based on ver.20030618, based on ver.19990704

This method is used to find the needed rounding R which will produce the desired camber in a horizontal batten panel of a junk sail. It works quite well within the camber/chord range 5-10% at least.

Note: A much simpler and only a bit less accurate method can be found on page 3.

1. See fig 1 on page 3. Decide where max camber point should be (A - B). I have used 34-40% aft of the luff, works ok.
2. Decide how deep camber you want at (A - B). (e.g. if you have a sail with 5m chord and you want 7% camber/chord, then the absolute camber should be 35cm)
3. Mark the distance A' -B' (=A-B) horizontally on a wall and hang a chain on nails in A' and B' (fig 2a).
4. Adjust chain-length until you get a bight as deep as the desired camber you decided in # 2.
5. But!! A real sail will take the flatter shape of fig 2b, not the 'chain-shape' of fig 2a. Therefore you must make the bight or 'chain camber' in par.4 about 20% bigger than the sail camber you really want. If you want a real camber/chord deeper than 10% I guess you will have to increase the correction factor from 20% to 25 or even 30%. A test-panel will here be required. The reason for this oddity is, I believe, that the stretch in the sail-panel from C to D (fig 1) will resist the bulging of the sail-cloth.
6. Measure how much chain you used between A' and B'. Then you can calculate the rounding you need along each batten to get the desired camber. See fig 3.
7. The calculated rounding R can then be used when drawing the panel. Use a wooden batten on the floor; fasten it with a few well placed nails to get the rounding you like. I prefer to cut out a template for the rounding in thick paper first, and use the template on the upper and lower side of the panel. Now I guess you understand why I prefer to make 4 or 5 identical panels! As the batten-rise increases above 10°, everything gets a lot more complicated, and in the top panel everything is guesswork. Just remember that in the top-panel the wind will blow across the panel more than along it. For that reason the camber must be small. The rounding along the yard should be guesstimated to about ¼ or 1/5 of the rounding in the lower panels.
8. This is rough engineering, but don't worry. Compared to the flat junk sail it will be far superior.

ARNE'S CHAIN CALCULATOR

FIG 1 BATTEN PANEL

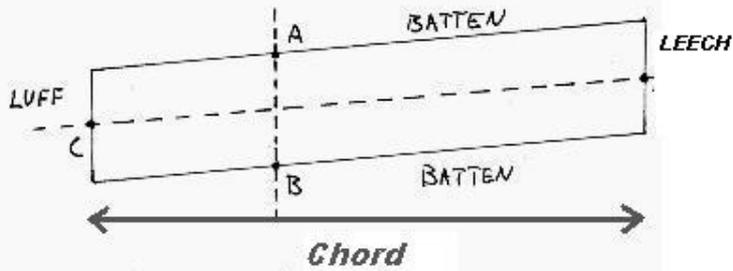


FIG 2A

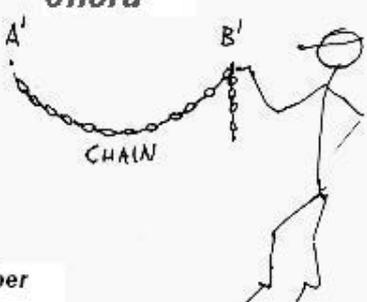


FIG 2B

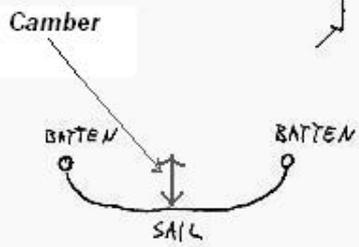
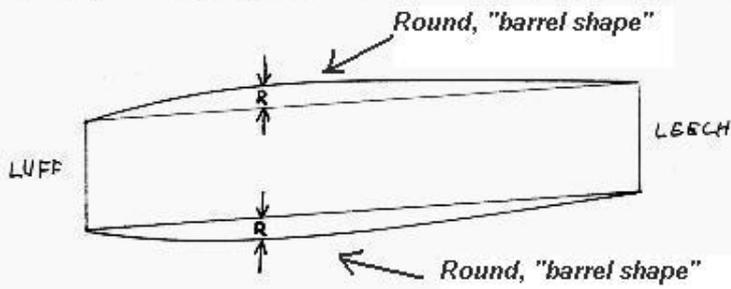


FIG 3 BATTEN PANEL CUT WITH ROUNDING ALONG BATTENS



$$R = \frac{\text{CHAINLENGTH} - \text{BATTENDISTANCE}}{2}$$

Simplified method of finding the rounding **R** (also called *round*)

After having used my chain calculator and checked the resulting camber in some sails, I have found that there is a fairly constant ratio between the rounding **R** and the resulting camber in each batten panel. The rounding varies between 54% and 57% of the camber.

If you don't want to fiddle with the Chain Calculator, you may skip step 3 – 6 on page one. Instead you simply calculate the needed camber in cm/inches (step 1 – 3) and then find the rounding **R** by saying that..

Rounding **R is 55% of the desired camber**

As simple as that!

For better accuracy I still recommend the Chain Calculator, but for a “normal” sail with “normal” camber/chord ratio (say 6 – 9%) you will hit closely enough.



.. Broremann's sail with the dept of camber explained...

Confusion:

Somehow some of the readers have ended up mixing *camber* with *round/rounding*.

I try once more: The *camber* is the final (horizontal) curve that the sail takes when it is filled with wind. In the photo above I have tried to draw the dept of the camber at one single point in the sail.

The *round/rounding*/"barrel shape" is the curve to which each batten panel is being cut along the battens to give the desired camber. In Fig 3 of p. 2 the round **R** is showing the max point of that round curve. This **R** which in the end hopefully produces the desired *max dept of camber* is what these calculations are about. Sorry folks, this is the closest I get in my Stavanger-English.

Stavanger, 2012 05 19

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(..cont...)

PS1:

Wrinkles and broadseams.

To make the panels bulge well, you may tie the sail with a bit slack along the battens, about 1-2% of the batten lengths with 8% camber. This may result in some “smiling wrinkles” along the battens (see photo of Johanna’s sail which I slackened 10cm on 5.8m battens), but I reckon that they do little harm. If you are put off by the look of them, you could always install 3 broadseams along the rounded (batten-) edges which will crimp the edges about 2% of the batten length. The joining of the batten panels along these batten edges should not be much more difficult than without the broadseams fitted. When a sail with broadseams is rigged, you will not need to keep it slack along the battens.



.. Johanna,

wrinkles along the battens clearly visible in evening sunshine. I could have stretched the sail just a bit along the battens to get rid of most of them without losing much camber, but I never got around doing it as the boat performs so well...

PS2: The leech of the two top panels is cut with about 5cm hollow to avoid a hooked leech and fluttering.

PS3: 2003 06 18. I have mostly aimed for 8% camber/chord in the horizontal panels. That is a modest camber compared to many conventional sails. My idea is that the boat shall carry almost as big sail upwind as downwind with moderate camber.

PS4: 2006 06 18. In heavier boats where the size of the sails or height of the mast become a problem, I would start experimenting with more camber, say 10, 12 or even 15%!