

## Acceptable Methods For Determining EC-12 Girth Measurements

### Background:

There are three commonly used methods by which the girth stations on the leech can be determined. It is from these points that the girth dimensions are taken, namely the distances from these points to the nearest point on the luff.

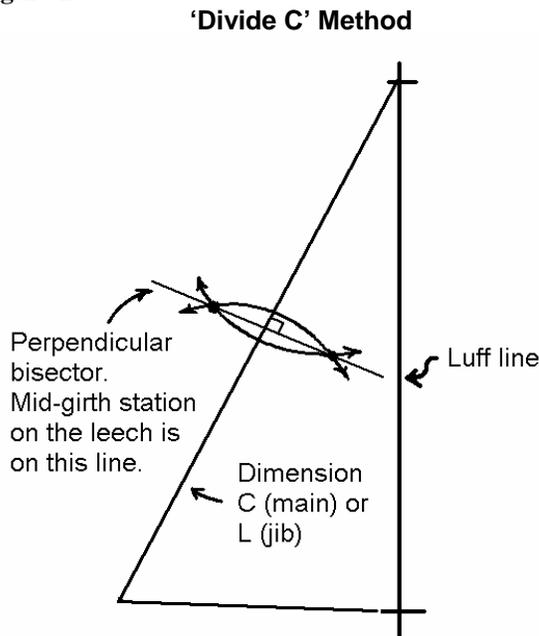
The methods are:

1. **'Divide C' method:** points on the leech are found by dividing a line from the corner of the clew to the top-forward point of the headboard into 4 equal lengths. At the  $\frac{1}{4}$ ,  $\frac{1}{2}$ , and  $\frac{3}{4}$  points along this line, perpendiculars are erected past the leech. The girth stations from which the girth is measured are on these perpendiculars. See Figure 1. This is the method shown in the current EC-12 Sail Diagram. For the purpose of the document, this approach will be called the 'divide C' method after the 'C' dimension on the mainsail.
2. **'Fold' Method:** points on the leech are found by folding the sail as shown in Figure 2. The forward-top point of the head is folded to lie over the corner of the clew. Although not shown, the  $\frac{1}{4}$  and  $\frac{3}{4}$  points are found by folding the appropriate corner to the midpoint on the leech. This is one of the two standard ISAF measurement methods for determining the location of the aft ends of the girth dimension lines.
3. **'Equidistant' Method:** in the other ISAF measurement method, points on the leech are found by first locating the aft end of the mid-girth line as a point equidistant (as the crow flies) from the top-forward point of the head and the corner of the clew. The  $\frac{1}{4}$  and  $\frac{3}{4}$  points are found as points that are equidistant from the mid-girth station on the leech and the appropriate corner. See Figure 3. This technique gives exactly the same result as the 'fold' method for all three points needed.

### Differences Between The Methods:

Although the two ISAF methods give identical results, the 'divide C' method gives a very slightly different result at the  $\frac{1}{4}$  and  $\frac{3}{4}$  girth stations.

Figure 1



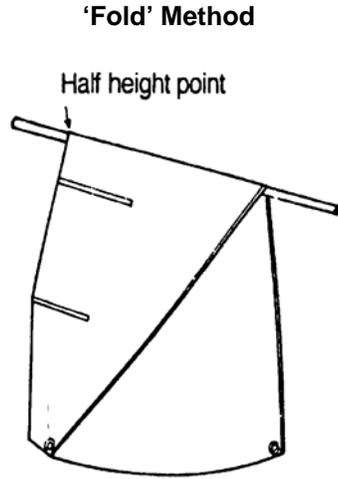
Although the midpoint location on the leech can be shown to be geometrically identical for all three methods, this is not the case for the other two leech points. Nonetheless, for the EC-12 sailplan, the differences are very small. For example, using the two ISAF methods results in the  $\frac{3}{4}$  girth line on the main to be displaced upwards  $\sim.080$  inches as compared to the 'divide C' method. The result is that at the  $\frac{3}{4}$  girth station, the leech line would be displaced outwards  $\sim.030$  inches. This is about 12% of the tolerance in this girth measurement.

Conversely, the  $\frac{1}{4}$  girth line on the main will be displaced downwards using the ISAF methods by about  $.05$  inches, causing the leech to move inwards about  $.014$  inches at this point. This is about 6% of the tolerance of the girth measurement at this point. The net effect is that the ISAF methods may allow an extra  $\frac{1}{4}$  square inch sail area (about 0.04%)

**History:**

In 1995, [correction, 1991 LR] the class voted to adopt the sail plan of the International East Coast Class Rule. The sail diagram associated with this rule showed the girth lines labeled only as  $\frac{1}{4}$ ,  $\frac{1}{2}$  and  $\frac{3}{4}$ .

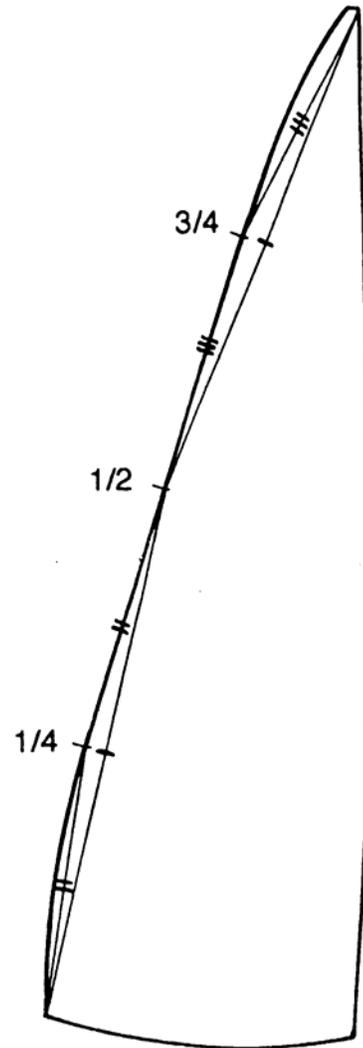
**Figure 2**



This implied that the locations of these lines were to be determined by one of the two IYRU (now ISAF) methods above. After a successful vote, a new sail diagram was prepared. Unfortunately, this showed the girth lines passing thru the  $\frac{1}{4}$ ,  $\frac{1}{2}$  and  $\frac{3}{4}$  points not on the leech, but through these points on a line directly from head to clew. The result was that girth lines would be  $\sim\frac{3}{4}$  inch lower than intended. After a request for interpretation was received, the diagram was corrected to show the current 'divide C' method. Since the correction was made, a clarifying detail has been added on the sail diagram that will appear in the

**Figure 3**

**'Equidistant' Method**



new (7-97) *AMYA Handbook*.

**Usefulness Of The Different Methods:**

For the purpose of laying out a sail board, the 'divide C' method is perhaps the easiest. It is only necessary to draw one line from head to clew and divide it into quarters. Perpendiculars are then erected as noted above. The equidistant method requires one to first locate the mid-girth location on the leech, and then draw lines from the corners to this point. Perpendicular bisectors are erected from these two new lines. The  $\frac{1}{4}$  and  $\frac{3}{4}$  points on the leech are somewhere on these bisectors. So there is an extra step with the equidistant method.

(Presumably, one could lay the sail out on paper and use the fold method, then glue the paper to the sail board. Because the paper may change dimension as it is glued, this may not be as accurate.)

When measuring finished sails however, the 'divide C' method leaves something to be desired. It would be quite difficult to accurately measure a sail on a spar this way. On the other hand, the two ISAF methods are rather easy. There are a number of ways to find the required points on the leech using only a long ruler, or even just a piece of string.

**Conclusion:**

Although the class voted to adopt ISAF measurement methods for determining the points on the leech from which girth measurements are taken, it is doubtful that much consideration was given to this issue at the time of the vote. Since that time, the 'divide C' method has been taken as the approved method.

Nonetheless, all three measurement methods give identical results at the mid-girth positions, and at the  $\frac{1}{4}$  and  $\frac{3}{4}$  positions the results are very similar, and within the range of error ( $\pm$ )

0.03 inches) to which sails can typically be measured at these points. Additionally, a change in sail area of a few hundredths of a percent cannot be considered significant.

Therefore, when sail girth measurements are required as a condition for participation in a sailing event, any of the three methods discussed in this article may be used. For similar reasons, sailmakers may employ the method of their choice when dimensioning their sails. However, because of the vagaries in measuring sails, sailmakers are encouraged to size their sails near the middle of the allowable tolerance for all measured dimensions, including the girth tolerances. This will greatly reduce the chance that a sail will be found out of tolerance by a Regatta Measurement Committee.

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Prepared at the request of and with the assistance and approval of Jerry Brower, EC-12 Class Secretary at the time. Typo in the history section corrected and initialed.

Larry Robinson, 12-02