

FEFCO RECOMMENDATION N°110
(September 2018)

**DETERMINATION OF THE WARP FACTOR OF CORRUGATED
BOARD ARTICLES**

This FEFCO recommendation is one of a series numbered from 101 upwards, which gives guidance to FEFCO Members appropriate to the issue as described in the title, in practical matters dealing with production, or customer-related problems. It is hoped that it will provide a uniform means of operation, for example in a comparative study of a problem.

The issuing body is the FEFCO Standards Committee working under the auspices of the FEFCO Board. The FEFCO Recommendations are supplementary to the internationally recognized FEFCO Testing Methods. The latter will continue to be developed for testing corrugated board products.

1. **OBJECTIVE:** To define the procedure for determining the Warp Factor of corrugated board articles.

Note: A related measurement is specified in FEFCO Recommendation No.109.

2. **DEFINITIONS:**

$$\text{Warp \%} = H/L \%$$

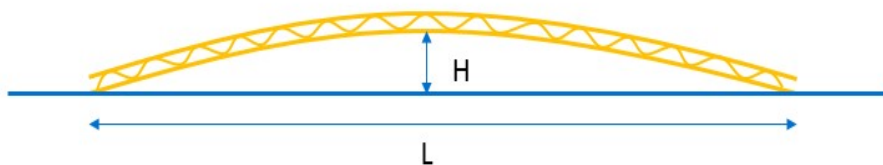


Fig.1

3. MEASUREMENT

Traditional measurement of warp has represented a percentage indicator as a measurement method within a mathematical function. This can only be measured when warp is of a uniform profile across the board. As H is not linear to L at all points of the curve the curve warp % will vary relative to sheet size.

Sheets with the same warp % will not demonstrate the same curve, as the warp percentage is dependant solely upon sheet size. Therefore a more appropriate measurement method classified as the **Warp Factor** can be used:

The Warp Factor

$$WF = H * \left(\frac{500}{L}\right)^2$$

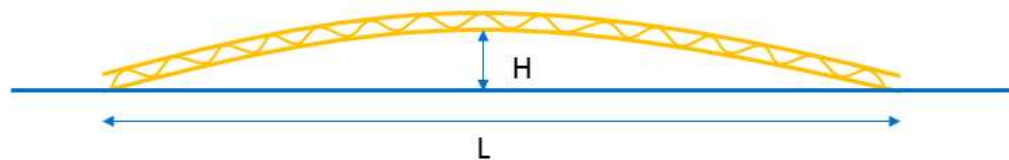


Fig.2

With this method the same curve will always be represented by the same Warp Factor.

For example;



Fig.3

$$WF = 20 * (500/500) / 2 = 20$$

$$WF = 5 * (500/250) / 2 = 20$$

The measurement uses a standard reference length of a sheet as 500mm

4. APPARATUS:

- 4.1 A flat reference surface.
- 4.2 Rulers of suitable length graduated down to half millimetre increments
- 4.3 Other appropriate approved tools may be used

5. **PROCEDURE:**

- 5.1 Bring the article and the reference flat surface into contact to materialise the warp variables H,L.
- 5.2 Take the measurement of “H” to the nearest half millimetre. “H” is the deflection which can be measured between the flat surface and the concave side of article.
- 5.3 Take the measurement of the subtended chord “L”
- 5.4 Insert the measurements H, L in the above equation to calculate Warp Factor