Mast Check System (MCS)

The Apparatus

The MCS bending apparatus is best set up permanently along a fixed wall.

One end of the bending jig should always be the base end and have a fixed suspension point. Make a backstop for the base end of the mast that is 50 mm beyond the base suspension point. This makes it easy to ensure the correct placement of the mast on the bending jig. The opposite end should always be for the tip of the mast and have an adjustable suspension point or multiple suspension points for different lengths of masts. The suspension points should be level with each other.

The distance between the suspension points is the "test length". The test length is always 100 mm shorter than the full length of the mast. There should be a 50 mm overhang of the mast past the suspension point at each end. For example, a 460 mast has a test length of 4500 mm.

Above the suspension points a reference line is required. It is more practical to have the reference line above the suspension points so that the bending of the mast does not interfere with the reference line. The reference line should also be level (i.e. a parallel offset of the suspension points). A taut piece of thread or fishing line makes a good reference line.

The ¼, ½, and ¾ points for each mast length commonly measured should be permanently (and accurately) marked upon the wall behind the bending jig. The ¼, ½, and ¾ points are divisions of the **test length.** It is more practical and less prone to error if the quarterly location point permanently marked behind the bending jig as opposed to measure separately on every mast. Measuring the ¼ and ¾ points on the mast also introduces a radial error and the relative position of the ¼ and ¾ points become closer to the suspension point resulting in lower deflection values recorded at these stations.

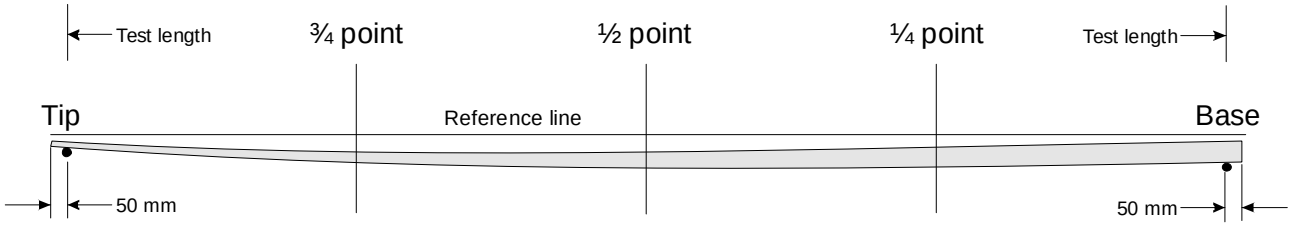
Measure the offsets perpendicular to the reference line. It is handy to hold a small level along the ruler to ensure a true perpendicular measurement is made. All length measurements are made in millimeters. All weight measurements are made in kilograms.

The Test

Prepare a standardized form or spreadsheet database to record all mast data.

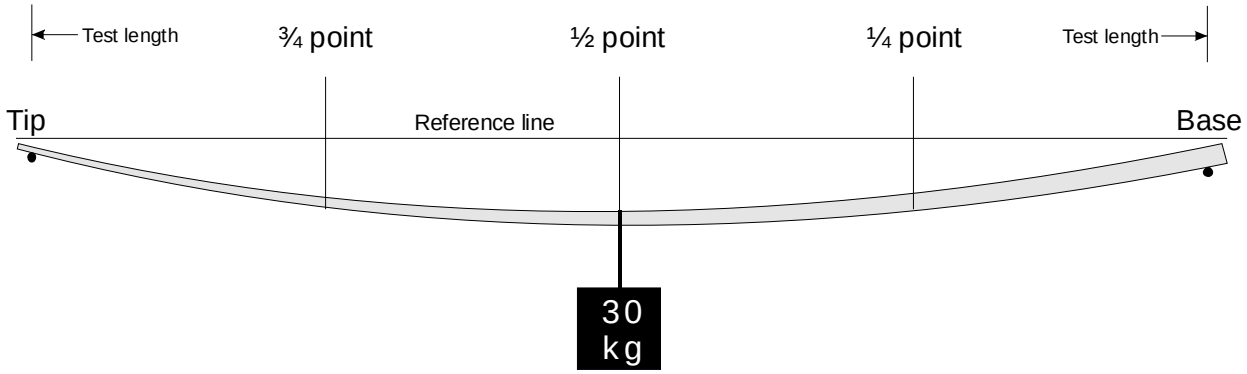
1. Record date, mast model, and serial number.
2. Weigh the mast (± 0.02 kg).
3. Locate the center of gravity (CG) of the mast by balancing the mast level on the edge of a ruler. Measure this distance from the base of the mast (mm). The CG is be expressed as a percentage of the overall length. For example a CG of 1932 mm from the base on a 4600 mm mast is a CG 42%.
4. Load the mast onto the bending jig. Check the overhang lengths are correct.
5. Measure the pre-bend sag at the ¼, ½, and ¾ points in mm.

MEASURING THE PRE-BEND SAG



6. Apply the 30 kg weight to the mid-point of the mast.
7. Measure the loaded deflections at the ¼, ½, and ¾ points in mm.

MEASURING THE LOADED BEND



8. Tabulate the results by subtracting the pre-bend from the loaded bend at each point. This is the net deflection for each point.
9. The MCS stiffness is calculated by dividing the test length by the net mid-point deflection.
10. The mast curve is defined by expressing the ¼ and ¾ point net deflections as percentages of the mid-point net deflection. The mast curve type is expressed as the difference in the ¼ and ¾ point percentages.
11. The IMCS stiffness is a mathematical calculation with standardizes the measured MCS stiffness to common length of 460 cm. The IMCS coefficient allows masts of different lengths to be compared for stiffness. The formula for this calculation is:

$$\frac{\text{length (mm) x length (mm) x length (mm)}}{\text{mid-point net deflection (mm) x 4600 x 4600}}$$

Example data for Lightstick 490 mast

Test length: 4800 mm

	Pre-Bend (mm)	Loaded Bend (mm)	Net Deflection (mm)	Ratio to Mid Point
¼ point	46.0	165.5	119.5	64.8%
mid point	53.5	238.0	184.5	---
¾ point	60.0	201.5	141.5	76.7%
MCS stiffness	26.0			
IMCS stiffness	30.1			

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