Racquet deflection - Racquet support – Tension Calculation

Stress and deflection of the racquet.

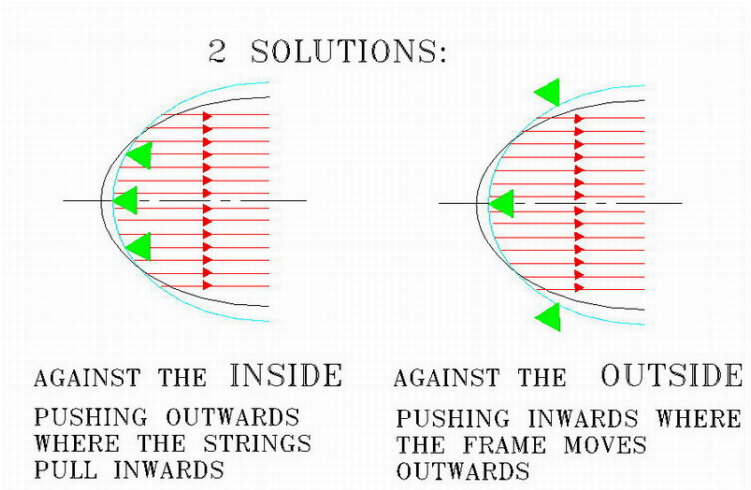
The deflection of a racquet during stringing and during play must be as small a possible. The more deflection the more stress in the racquet material and the higher the chance of cracks.

A racquet will be damaged when the stress, the force per square mm, is higher than the racquet material can stand.
As shown below the stress in the racquet is not always minimal when the deflection is minimal.

The stress in the racquet material during stringing depends on the quality of the cradle and the racquet support of the machine and during play on the stringing tensions of the main and the cross strings

Direct and indirect racquet supports.

The major task of the racquet support of a stringing machine is to protect it at the moment that all the main strings are tensioned and shorten the racquet head.
There are 2 types of racquet supports.



Direct supports.

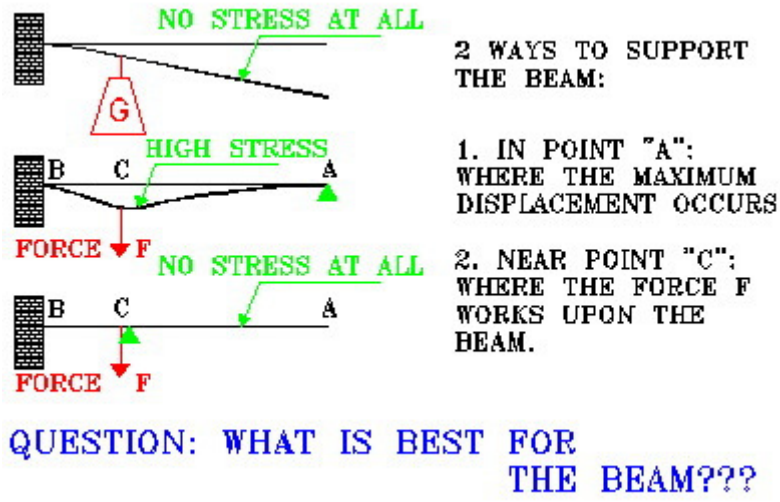
Direct supports support the racquet against the inside pushing the racquet outwards where the main strings pull it inwards. There are 2, 4, and 5 point direct support systems

Indirect supports

When the racquet head gets shorter it also gets wider. Indirect supports prevent the racquet from getting wider.
Indirect racquet supports have 2 inside supports at 12 and 6 hrs and 4 outsides supports at 10 – 2 – 4 - 9.

Stress in the racquet with direct and indirect supports.
It is important to understand that a minimum deflection of the racquet does not always result in minimum stress in the racquet material.
And the stress is the major criterion not the deflection.

This picture of the beam in the wall describes the difference between deflection and (bending) stress.

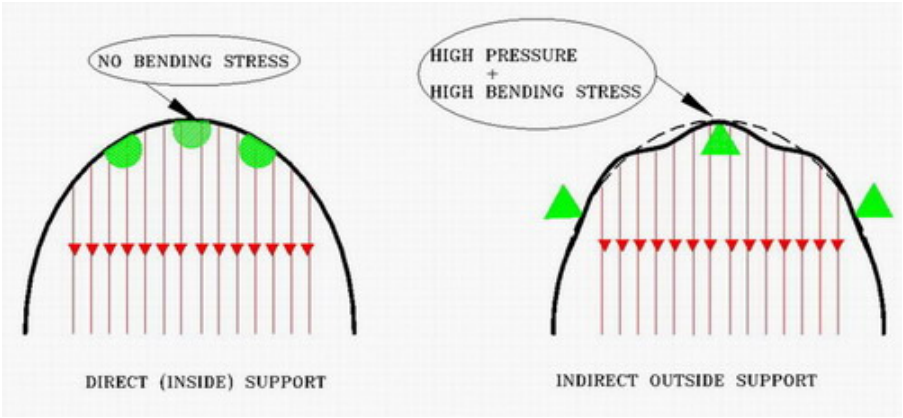


The weight G is too heavy for the beam so the beam needs a support.
There are 2 options:
1. An indirect support in A where the deflection of the beam is maximum.
2. A direct support near C close to the position of the Force F (=G).

What is the difference in stress in the racquet?
- Without support there is no bending stress between C and A.
- With the support in A the bending stress near C is very high.
- With the support close to C there is no bending stress between C and A.

>>> So: The indirect support in A causes stress in the beam that was not there without that support.

This picture shows the stress in the racquet with direct and indirect support.



Stress in the racquet after stringing.

After the racquet is out of the stringing machine the deflection and the stress depends on the balance between the tensions of the mains and the crosses.

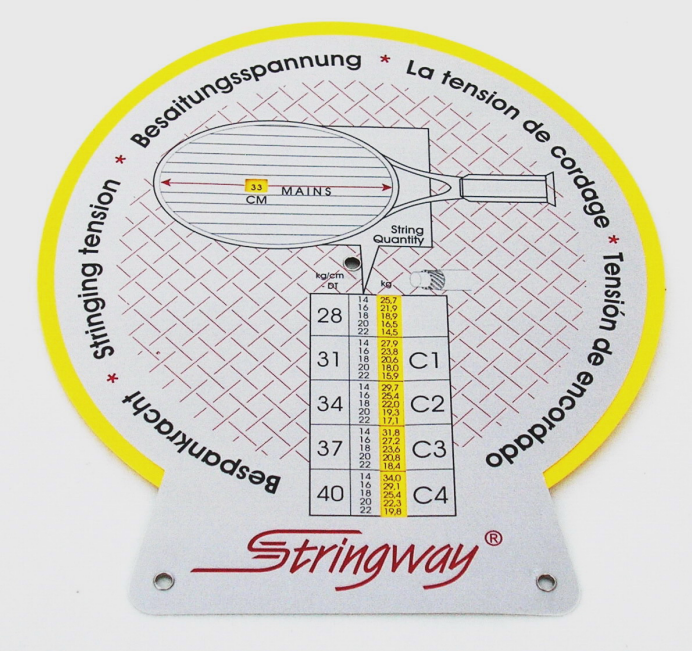
The tensions of the main strings want to make the racquet head shorter and wider, the tensions in the crosses must pull back the widening caused by the mains.

Perfect string job.

In the perfect string job the forces of all the mains are exactly in balance with the forces of all the crosses, so that the length and the width of the racquet head are the same before and after stringing.
The stress in the racquet will then be minimal.

Calculating the stringing tensions

The total force of all the cross strings must be adjusted at the total force of the mains so that the widening of the racquet is “zero” after stringing.
The more cross strings the lower the tension that is needed to supply the necessary total force.



The Tension Advisor calculates the tensions for mains and crosses so that:
- The string bed has the chosen stiffness after stringing.
- The deflection of the racquet is minimum.

The disc is adjusted at the length / width of the stringarea, the tensionsfor mains and crosses (other side) is shown behind the desired stiffness and number of main/ cross strings.

The online Tension advisor calculates the stringing tensions for a certain racquet based on the entered answers for a certain player.
https://www.stringwaynederland.nl/SW-TA-online/SwingCalc/tad-en.php

The stringing result.

Direct support
With a direct support system it is very simple to check the used stringing tensions for mains and crosses.
When the racquet fits exactly on the support system with contact between the supports and racquet the length after stringing is the same as before stringing (without strings!). So the deflection is minimal!

When the racquet is difficult to lift of the support the racquet has become shorter so the used tension in the cross strings was too low.

When there is clearance between the supports and the inside of the racquet the tension on the crosses was too high. This can be noticed already during stringing.

Sliding of the racquet.
When the tension on the crosses is too high the racquet will move away from the support already during stringing. This can cause the racquet to slide when a cross string is tensioned.

It is important to understand that sliding of the racquet does not have any negative effect or danger for the racquet.
It means that the forces of mains and crosses are in balance again and most of the stress is gone.
Of course when the racquet is 5 or more mm longer after stringing, there will be remaining stress in the racquet which can result in cracks during play.

Warning.
There are still many stringers who string the mains and the crosses at the same tension without paying attention to the change of the racquet head after stringing.
This is also caused by the general stringing advises that many racquet suppliers put on their racquets.

Different string patter >>>different difference in tension between mains and crosses.

The string patterns are very different nowadays and there are many problems with racquets with extreme patterns.

Let us assume that 2 racquets have the same racquet head, but one has a 16x19 pattern and the other such a new 18x16.
The L X W of 32,5 x 25 cm
The tensions for the 16x19 are 23,2 x 23 kg
For the 18 x 16 tensions are 20,2 x 28 kg.

So it is very wrong not to use very different tensions for 18x16 for mains and crosses.
