BAMBOO FERRULES

By Alberto Poratelli

After having written my presentation for the European Gathering in 2008, I realized that in the last years , I have gathered quite a vast knowledge of Bamboo Ferrules. These articles are a collection in a single text which will be published in the BJ of all my experiences and research on the matter .In this issue, the introduction and Chapter One and to follow the other articles on dimensioning, construction techniques, maintenance and my continuous attempt to improvement.
It is a vast subject and I hope it will be of interest to the readers. But first of all I would like to thank two friends.

Without these two exquisite people, who always gave me excellent technical advice I would have probably stopped my research on the making of practical good looking and reliable bamboo ferrules.

Gabriele Gori

Gabriele is a great Italian rodmaker of the last generation and he has done some interesting research on the comparison of the moment of inertia in solid and hollow rods with various different geometries. He is always available to help anyone and his advice on theoretical and practical issues were indispensable for my work and my technical deficiencies.
"The Engineer" from Florence, is a friend, a companion and President in the IBRA adventure and was the person who in moments when I wanted to give up, gave me the right foothold to continue in my endeavours.

Marco Orlando Giardina

Marco, known by everyone the world over as "MOG" is the most knowledgeable person in Italy of the history and the universe of bamboo fly rods; his blog is unanimously known as the Encyclopaedia of Rodmaking. .
Wise and learned, his Neapolitan spirit makes him an excellent companion during our endless evenings during which we discuss bamboo related topics. His words of appreciation on my work convinced me that maybe I was doing something useful for all Rodmakers. Rodmakers

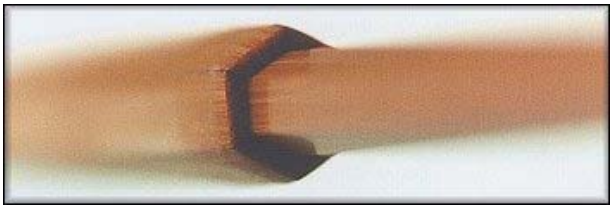
Meditations and research on bamboo ferrules

Or: "The art of bamboo rodmaking is attractive because it has no limits".

Introduction

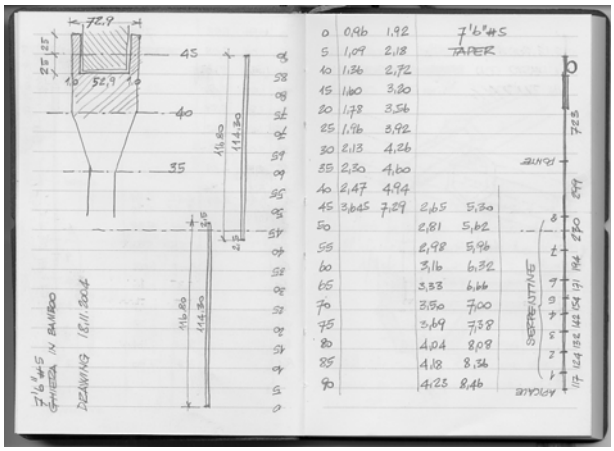
How the interest in bamboo ferrules was born

When in 2004, I began my adventure with bamboo ferrules, I did so because I was fascinated by the pictures of those made by Bjarne Fries. With their simplicity, they made bamboo rods look even more attractive than what they were.



From a purely aesthetic point of view, the ones by the Argentine Marcelo Calviello were unsurpassable, the longer swell and the brightly coloured wrappings make his ferrules really harmonious. From a construction point of view, the little metal mini ferrule placed on the tip of the butt section was an intrusion which reduces the quality.

I therefore began studying a method of making bamboo ferrules without the need for special tools especially as far as the swell goes. I wanted to make a ferrule that was good looking, harmonious and functional, using only the tools that every rodmaker has in his shop; so a standard planing form, with setting screws at every 5" (12.7 cm) station. In the beginning I was quite sceptical about its mechanical strength because I didn't realise the strength of a bamboo plate 0.04" (1 mm thick).



So in that period I looked for the extreme limits, not for the pleasure of doing so, not to make something no one had seen before but only for the curiosity that pushes a man to do something for the sake of research. In my work, I have always borne this limit in mind because let's not forget, we are making fishing instruments not showcase rods.

During the first IBRA gathering in Sansepolcro 2005, I presented my first rod with a bamboo ferrule and there was much appreciation and many rodmakers became interested in it. What pushed me to drastically reduce the thickness of the walls of the ferrule, was a paper that I was given by the laboratory of the physics of materials of the Università di Milano Bicocca and which I presented at the 2006 Gathering.

Tension Test

I analyzed singularly with a tension test various samples that I was given. The results are all very similar in the non impregnated samples while the impregnated sample had different characteristics which were probably due to the impregnation

SAMPLE ANALYZED	Breakage under tension
I – Giovanni Nese – Impregnated	820 kg/cm2
II – Giovanni Nese – Not impregnated	730 kg/cm2
III – Alberto Poratelli – from Andy Royer - USA	700 kg/cm2
IV – Alberto Poratelli – from Andy Royer - USA	700 kg/cm2
V – Alberto Poratelli – from Centre Cane - UK	695 kg/cm2
VI – Alberto Poratelli – from Alain Ourtilani - France	700 kg/cm2

The results are that bamboo in theory is an excellent material. The culm with internodal spaces which are shorter at the bottom where the highest forces act, shows high values of efficiency due to its tubular structure reinforced by nodes. Impregnation increases the resistence to traction which is a fundamental characteristic for certain sectors.

Martina Poratelli

I shamelessly took advantage of the fact that my daughter Martina had access to the use of sophisticated laboratory instruments and I gave her the samples of Arundinaria Amabilis we had purchased from Andy Royer, Alain Ourtilani and a few supplied by my friend Giovanni Nese; I was curious to find out the chemical and physical differences between bamboo from different cultivations. Instead I was surprised to discover from the tests that our splendid wood has a breaking point of 700 kg/cm² (9955 pounds/inch²) !
Simply fantastic – why not take advantage? I never stopped my research even when I thought I had achieved good results because for me the greatest pleasure in rodmaking is always making something new.

Chapter 1

Why a bamboo ferrule?

Justification for the adoption of this connection.

If 99% of all bamboo fly rods, excluding the single piece ones, have metal ferrules, there must be a reason. Before justifying the construction of bamboo ferrules, I want to understand why the majority of rodmakers choose the metal ones.
I believe that the metal ferrules are so prevalent essentially because it is commonly thought that a non metal ferrule cannot have the necessary strength to support the stresses during fishing and for some unmistakable qualities:

1) Metal ferrules are good to look at, especially the new ones with modern profiles like Super Z, which look so attractive that they are often an added value to mediocre blanks.

2) The strength of the metal lets you make very thin walled ferrules which impact lightly on the rod taper.

3) The rodmaker can find a variety of metal ferrules on the market – different sizes, different metals. The metal can be blued electrically or chemically.

4) The metal ferrules are relatively easy to fit and the commercial ones do not need calibration. They are ready to use and have minimal tolerances.

It is also equally true that metal ferrules have a series of defects which are not negligable on a bamboo rod.

A) Weight

Let's consider the most commonly used NS ferrules – they look good and are easy to use: their weight is on average between 6 grams (0,211 Oz) and 9 grams (0,317 Oz), without considering the extra large ones used on spey rods.

The weight of a bamboo ferrule made with my method and considering the same sizes, weighs between 1,3 grams (0,045 Oz) and 2,0 grams (0,070 Oz). That's 80% less.

So we can safely say that a bamboo ferrule reduces mass from the rod which weighs on average 6 grams(0,211 Oz). For someone who is not familiar with dry fly rods, this can seem a negligible weight, but for an expert caster it weighs a ton.

To those who object that 6 grams on the total weight of a rod which including reel and line is around 300 grams (10,582 Oz) and 400 grams (14,109 Oz) is negligible, I normally ask to carry out a simple experiment. I ask them to get out their best rod with their favourite reel and line to carry out a series of casts.

After this I ask them to attach a 6 gram weight with tape to the spigot of the rod and to try the same series of casts. The rod will not be the same. A mass of 6 grams attached to the rod about 110 cm /120 cm (43"/47")n from the grip produces an enormous change in the flexing moment of the rod.

With this I don't mean that metal ferrules are not valid but undoubtedly their presence must be taken into consideration when designing a rod, especially if we are discussing light rods for dry fly fishing. In three piece rods the metal ferrules have a great influence on the action.

We have considered only NS ferrules which regarding weight have an intermediate position;

if we consider titanium this influence is much less while with brass it is higher as they weigh more.

The specific gravity of the main metals used are summarized in the following table:

	g/dm³	Oz/inch³
316 Stainless Steel	7980	4,603
Alluminium	2600	1,499
Nickel Silver	6880	3,968
Brass	8650	4,989
Titanium	4870	2,809

B) Rigidity

Metal ferrules are rigid. This isn't a characteristic that is tested but that must be taken into consideration. A fishing rods is flexible, if it were completely rigid it could not carry out its main two functions: cast a line but above all dampen the weight of a fish on the leader during the strike and while playing the fish.
So the metal ferrule constitutes an element of rigidity in the central part of the rod if in two pieces and 1/3 and 2/3 if in three pieces. This also influences the action of the rod even though not so much as the weight.
The factors that greatly influence the action of the rod are: *Number, Position, Weight, Rigidity of the ferrules.* The same taper made in three sections is completely different to the one made in two. Rodmakers have always kept this in mind when designing a taper.

C) Sliding

One of the main problems encountered by fishermen using bamboo rods is the ferrule which gets stuck. How many times has it happened that you go home with your 7' 6" fully mounted in your car because at the end of the day you cannot get the tip off the butt!

This is a typical problem with metal ferrules and in particular those in aluminium. The ferrules must have a perfect fit and the tolerances are calculated in the order of thousandths.

Unfortunately this creates a situation of friction which in some metals can lead to the blocking of the male ferrule sliding on the female ferrule. That's why it is common to lubricate the male ferrule before mounting it in the female one but sometimes it's not enough.

D) Transmission of force

Fishing rods and in particular fly rods are fundamentally instruments that transmit the force exerted by the fisherman to the line so that it turns over. I didn't want to go into this detail but in the study of ferrules, I must keep in consideration the transmission of the forces from the butt to the tip and then to the line. Let's imagine these forces that start from the grip and that are transmitted along the fibres towards the tip, this transmission takes place thanks to the friction between the fibres and this is favourable in bamboo because the fibres are long and they overlap each other.

When these forces reach the metal ferrule, they "discharge" completely in the metal and are "recharged" again in bamboo fibres above.

This bottle neck doesn't effect the casting action but creates an enormous accumulation of forces at the beginning of the ferrule on the butt section which "needs" to be discharged. On the butt, the beginning of the ferrule is the one that receives the heaviest forces. This is where they usually break.

E) Turning the hex into a round section

It isn't a negligible factor. In order to fit the ferrule, the hex needs to be rounded off to remove the corners so that it fits into the ferrule which is round.

Turning the hex into a cylinder should "never" be done by rodmakers because it means removing the best external power fibres.

If we consider that this rounding is carried out in the exact spot where the highest forces act , it is clear that we create a very weak point.

So summarising, metal ferrules have a series of Pros :

- They are or they can look good
- They are strong
- They are ready for use – no need to make them
- Easy to fit

Cons:

- They are heavy
- They are more rigid than the bamboo of the rod.
- They often grip
- They are an obstacle to the even transmission of forces
- You need to round off the rod in an area where the greatest forces act in order to fit them

So drawing the sums between Pros and Cons, I believe that the latter overweigh the former. All this is compensated by their availability and easy fitting.
When I started making bamboo ferrules I kept all this in great consideration.

So my answer to the opening question of this chapter :

"why a bamboo ferrule?"

is:

"Simply because:

- *A bamboo ferrule can look just as good and be equally valid as one in metal*
- *A bamboo ferrule can be as strong as one in metal*
- *A bamboo ferrule can be or better still " must" be easy to make*
- *A bamboo ferrule is always lighter than a corresponding metal one*
- *A bamboo ferrule is not rigid*
- *A bamboo ferrule doesn't grip*
- *A bamboo ferrule allows for even transmission of forces*
- *A bamboo ferrule doesn't need a reduction of power fibres*

…… to be continued

Alberto Poratelli

Architect and Rodmaker, lives and works in Bovisio Masciago in Brianza country.

www.aprods.it

THE BAMBOO FERRULES

Di Alberto Poratelli

Chapter 2

Designing a bamboo ferrule

In this chapter, I will describe the calculation method and the design of a bamboo based on my theory. It isn't the only method but simply the method I use.

In the design process of the bamboo ferrule, it is very important to achieve a pleasant profile that will look good with the rod – it's really a concept of Design.

Designing is an expression of man's activities and this gives shape to the materials he uses.

Things may look simple in this field but the designing of something that one takes for granted, is a complex operation because we want to achieve an object that embraces both functionality and looks, it must be easy to achieve and without the need for complex tools.

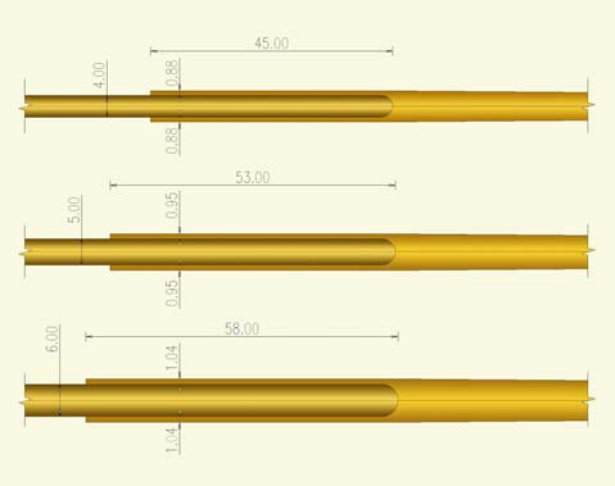
possibilità di costruzione senza attrezzature particolarmente complesse.

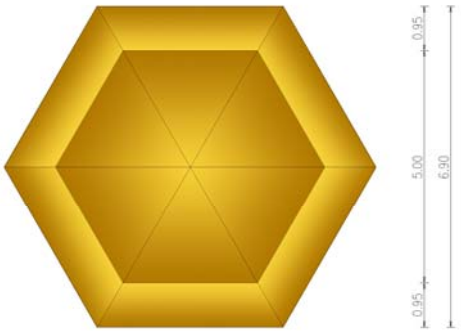
The ferrule is that part of the rod which is needed to connect two or more sections of a rod in a simple but secure way. A simple ferrule that does not guarantee a stable bond during fishing would be as useless as a ferrule with a stable bond but that isn't strong enough.

Substantially, the parts that make up a ferrule are two: a male part and a female part.

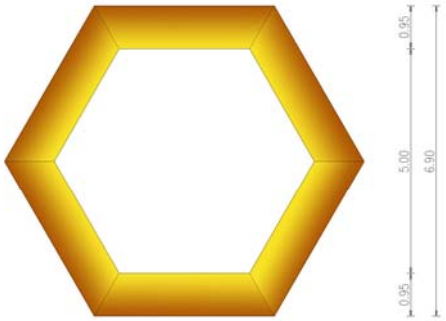
In general but not always, in metal ferrules, the male part is on the tip while the female part is on the butt. With bamboo ferrules the opposite happens, the male on the butt and the female on the tip.

This is not an absolute value – in fact it is possible to invert the male and the female parts but from a purely aesthetic point of view, I feel that my suggestion is the ideal solution.





SEZIONE TIPO DELLA GHIERA IN BAMBOO DA 5 mm



SEZIONE DELLA GHIERA FEMMINA DA 5 mm

When we are required to dimension a bamboo ferrule, there are three variables to take into account:

How long must the ferrule be?
How thick must the walls of the female part be?
How long must the swell be in the female?

These questions must take a few fundamental factors into account:

The dimensions must guarantee sufficient strength
The dimensions must guarantee sufficient stability
The dimensions must guarantee an impact that is as small as possible with respect to the action of the rod
The dimensions must guarantee that the finished rod looks good.

My experiences on the subject have brought me to draw a few conclusions and after a number of trials that can be summarized in the table below. These can be easily used to calculate the dimensions of bamboo ferrules.

My experiments helped me to determine the parameters that I used when elaborating the table and that can be used for the dimensioning of the ferrules and these parameters were elaborated for rods from 6' to 8' and for rods that measured between a minimum of 3.5 mm and 6.5 mm at the joint. These measurements comprise almost all bamboo rods.

How long must the ferrule be?

The length of the ferrule is given by the length of the cavity of the female element and it must guarantee sufficient fiction and distribution of forces to ensure enough strength and tightness of the ferrule.

Friction because it is the coefficient of adherence between the walls of the ferrule . This ensures that the connection is stable. It is of no use to make longer ferrules which must be limited to the minimum. For these reasons the ferrule must be between 41 mm and 59 mm.

What must the wall thickness of the female be?

The general characteristics and especially the compactness of the fibres in Pseudosasa amabilis make it possible to achieve thicknesses which are very closet o Nickel Silver. In fact I carried out experiments with some really thin thickness and I even made one ferrule with a wall thickness of 0,3 mm which from a strength point of view do not give problems

but because of their extreme thinness, they drastically lose in rigidity. This means that during casting they become oval and they lose adherence (friction) and this leads to the tip coming loose.

In order to guarantee sufficient rigidity, the wall thickness must not be less than o,85mm thick.

Considering the disposition of the power fibres in the culm which are concentrated externally, I've determined that by increasing the wall thickness we can achieve an increase in strength up to a limit of 1,10 mm; thicker than this you only have an increase in thickness but not in strength. So the maximum strength is achieved with a thickness of 1,10 mm and I feel anything above that to be useless – at least with the type of rods I have taken into consideration.

How long must the swell of the female be?

The answer to this question keeps one main factor in mind – simplicity. I have always been convinced that we should be able to make bamboo rods only with the simplest materials and tools, without having to resort to complicated ones. In this particular case I decided to design bamboo ferule that could be made by all rodmakers with their standard planing forms i.e. with screws every 5 inches (127 mm).

That's why my swells for all my rods are 127 mm (5 inches).

So bearing this basic data in mind:

Depth of the ferrule:
minimum 41 mm, max 59 mm

Wall thickness of the female:
minimum 0,85 mm, max 1,10 mm

Lenght of the swell: 127 mm

I drew up a table in which the various dimensions are in relation to each other in order to guarantee maximum strength, stability and aesthetics.

TABLE "A" – DIMENSIONING A BAMBOO FERRULE

Length of the rod	Metal ferrule	BAMBOO FERRULE							
		Section of the rod at the dividing point		Length of the cavity - mm.	Wall thickness - mm.	Length of the Swell - mm.	Relationship between the section and the wall thickness		Relationship between the length of the cavity and the wall thickness	
		inch.	mm.	10 x a / c						
		a	a	B	c	d				
6'0"	9/64"	0,1378	3,50	41,00	0,85	127,00	1/	4,12	1/	11,71
		0,1417	3,60	42,00	0,86	127,00	1/	4,19	1/	11,67
		0,1457	3,70	43,00	0,86	127,00	1/	4,30	1/	11,62
		0,1496	3,80	44,00	0,87	127,00	1/	4,37	1/	11,58
	10/64"	0,1535	3,90	45,00	0,87	127,00	1/	4,48	1/	11,54
		0,1575	4,00	45,00	0,88	127,00	1/	4,55	1/	11,25
6'6"		0,1614	4,10	46,00	0,88	127,00	1/	4,66	1/	11,22
		0,1654	4,20	47,00	0,89	127,00	1/	4,72	1/	11,19
	11/64"	0,1693	4,30	48,00	0,90	127,00	1/	4,78	1/	11,16
		0,1732	4,40	49,00	0,90	127,00	1/	4,89	1/	11,14
7'0"		0,1772	4,50	49,00	0,91	127,00	1/	4,95	1/	10,89
		0,1811	4,60	50,00	0,92	127,00	1/	5,00	1/	10,87
	12/64"	0,1850	4,70	51,00	0,93	127,00	1/	5,05	1/	10,85
		0,1890	4,80	51,00	0,93	127,00	1/	5,16	1/	10,63
		0,1929	4,90	53,00	0,94	127,00	1/	5,21	1/	10,82
		0,1969	5,00	53,00	0,95	127,00	1/	5,26	1/	10,60
7'3"	13/64"	0,2008	5,10	54,00	0,96	127,00	1/	5,31	1/	10,59
		0,2047	5,20	54,00	0,97	127,00	1/	5,36	1/	10,38
		0,2087	5,30	55,00	0,98	127,00	1/	5,41	1/	10,38
		0,2126	5,40	55,00	0,99	127,00	1/	5,45	1/	10,19
	14/64"	0,2165	5,50	56,00	0,99	127,00	1/	5,56	1/	10,18
		0,2205	5,60	57,00	1,00	127,00	1/	5,60	1/	10,18
7'6"		0,2244	5,70	57,00	1,01	127,00	1/	5,64	1/	10,00
		0,2283	5,80	57,00	1,02	127,00	1/	5,69	1/	9,83
	15/64"	0,2323	5,90	57,00	1,03	127,00	1/	5,73	1/	9,66
		0,2362	6,00	58,00	1,04	127,00	1/	5,77	1/	9,67
		0,2402	6,10	58,00	1,06	127,00	1/	5,75	1/	9,51
		0,2441	6,20	58,00	1,07	127,00	1/	5,79	1/	9,35
8'0"	16/64"	0,2480	6,30	58,00	1,08	127,00	1/	5,83	1/	9,21
		0,2520	6,40	59,00	1,09	127,00	1/	5,87	1/	9,22

AT this point with the table in front of you, who do you begin designing your ferrule?

The first thing to do is to determine the size of the rod at the point where the ferrule goes. For a two piece rod, this point will be the halfway point of the taper. So if it is 7' rod, it will be at 42' (84'/2); for a 7' 6" rod it will be at 45' (90'/2) and so on...

Once this point has been determined, from the table you can extrapolate the rest of the data you need.

For example, let's consider the taper of a well known rod - 7'0" DT#4 by Cattanach, and we will have:

taper :

	inches
0	0,068
5	0,070
10	0,082
15	0,102
20	0,123
25	0,137
30	0,152
35	0,166
40	0,184
45	0,206
50	0,214
55	0,220
60	0,244
65	0,258
70	0,272
75	0,300
80	0,300
84	0,300

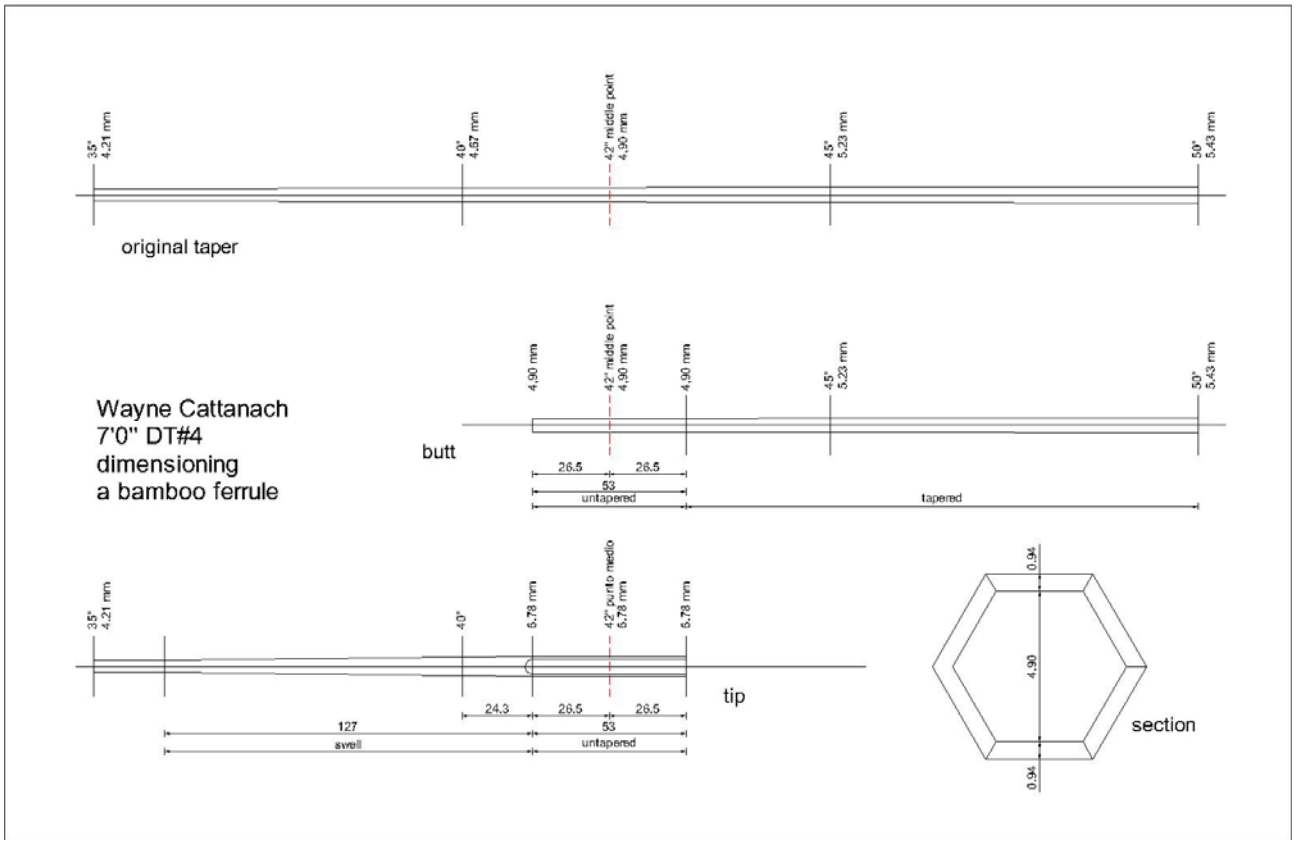
The dimensions at the median point (42') i.e. where the ferrule will be positioned can be determined with the following simple linear interpolation:

Dimensions at point 42" = 0,184+(0,206-0,184)/5x2 = 0,1928 inch
In millimetres = 0,1928 x 25,4 = 4,897 mm rounded off to 4,90 mm

From the table we obtain the data for the ferrule:

Depth of the ferrule (cavity)	mm.	53,00
Wall thickness	mm.	0,94
Lenght of the swell	mm.	127,00

With these figures we can now design our ferrule:



At this point we have designed our ferrule.

In the next chapter we will examine how to transform it in “Streamlined” – the theory and the practice.

THE BAMBOO FERRULES

By Alberto Poratelli

Chapter 3

Designing a "Streamlined" bamboo ferrule

In this chapter we will discuss "Streamlined" Ferrules.

This type of ferrule was devised by me and Gabriele Gori in order to make the connection as small as possible and which would be made exclusively in bamboo and that above all would guarantee strength and resistance.

When I made it for the first time in 2008 and after its presentation, it drew a lot of interest from the rodmaking community and in these three years many have tried their hand at it.

I received many opinions from rodmakers al lover the world but in particolar I was pleased with the one by Bjarne Fries – Inventor of the Bamboo Ferrule.

This is what Bjarne Fries, wrote:

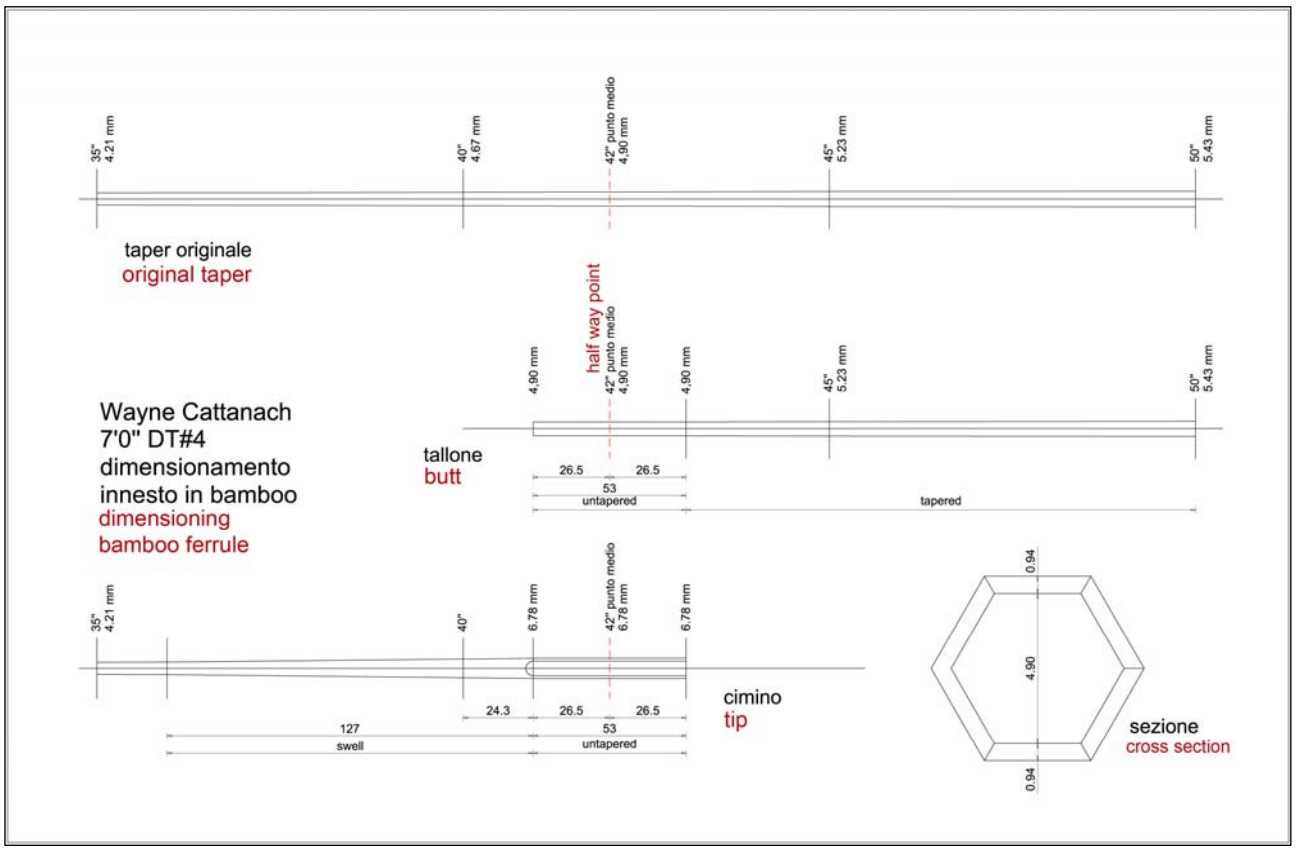
"Alberto, congratulation on your clever idea!! I think you really made a very nice improvement of the Bamboo ferrule, and I look forward to hear about the results of the testing of this pleasing design."

Much has been said about bamboo ferule and so I will not discuss why they have this shape nore how they are made as we have discussed this amply in previous occasions. In this article I will discuss how to design them.

In practice: "What must be done if we want to design a streamlined ferrule?"

In order to design a streamlined, you must start from the design of a "normal" bamboo ferrule and proceed in transforming it.

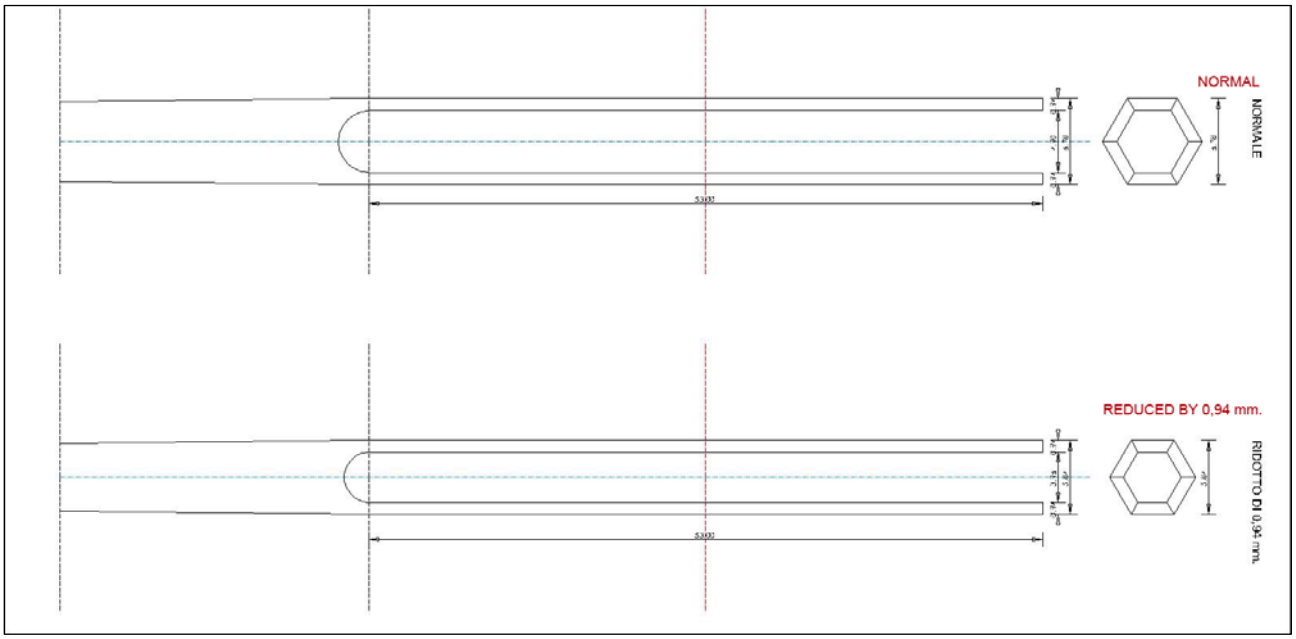
As an example let's examine the ferrule designed in Chapter 2 (Bamboo Journal N. 4), using a 7'0'' DT4 Wayne Cattanach taper. (fig. 1)

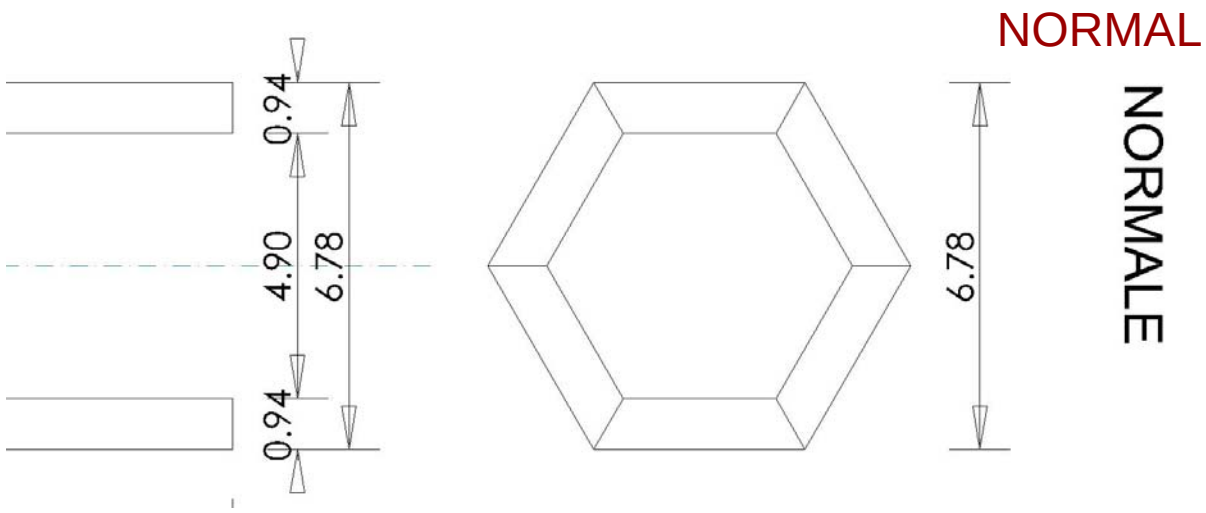


To transform this ferrule into a Streamlines, you need to reduce the dimensions of the male by the thickness of the wall in the female part. In this case 0,96 mm.

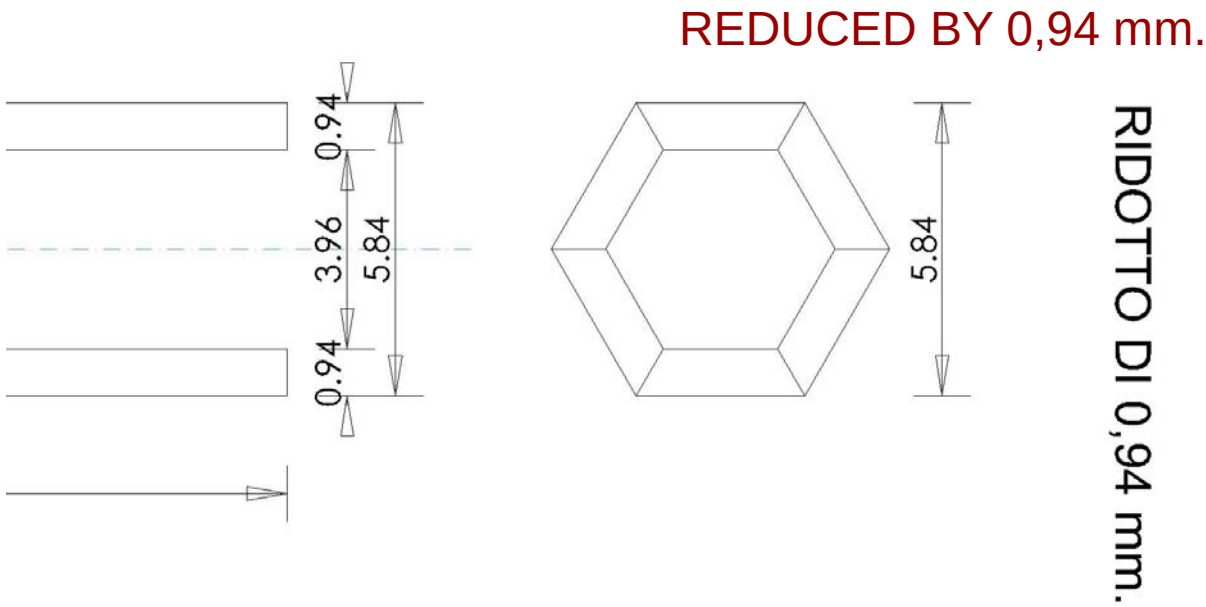
Let's see how in practice:

Step 1 - *designing the female part of the ferrule reduced by the thickness of the wall.*





Dettaglio innesto "normale"

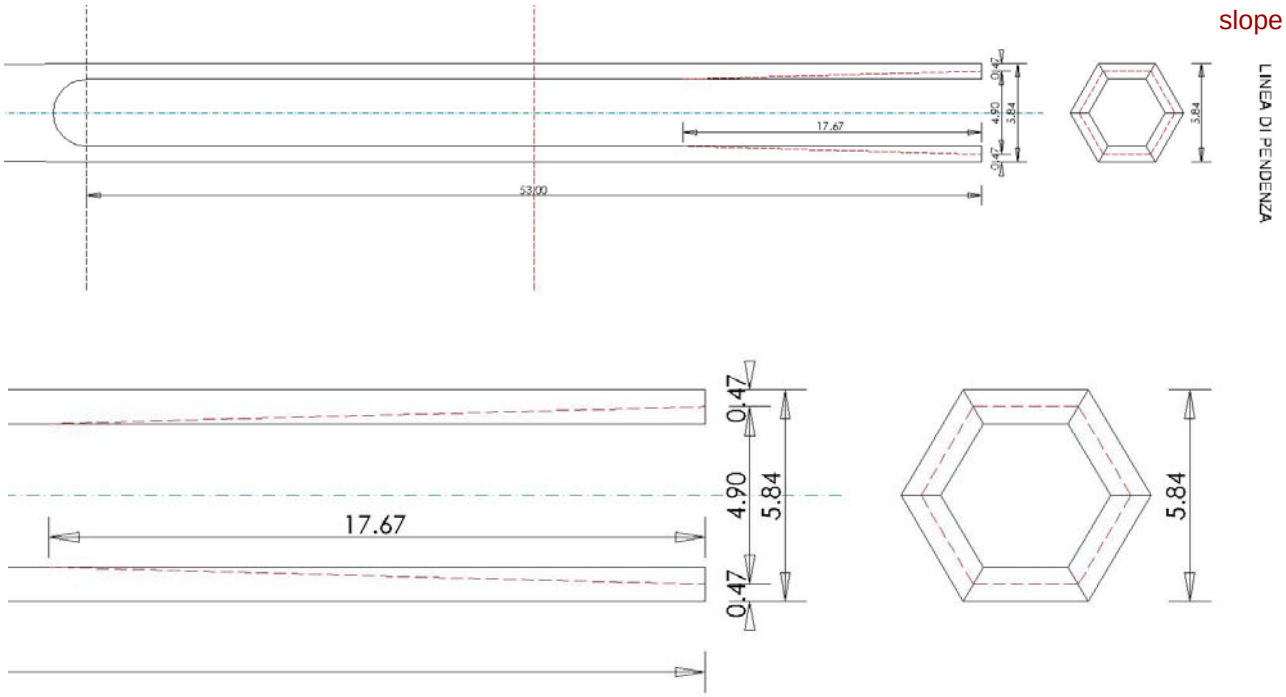


Close up of the "reduced" ferrule

The next step looks at the connecting slope, i.e.:

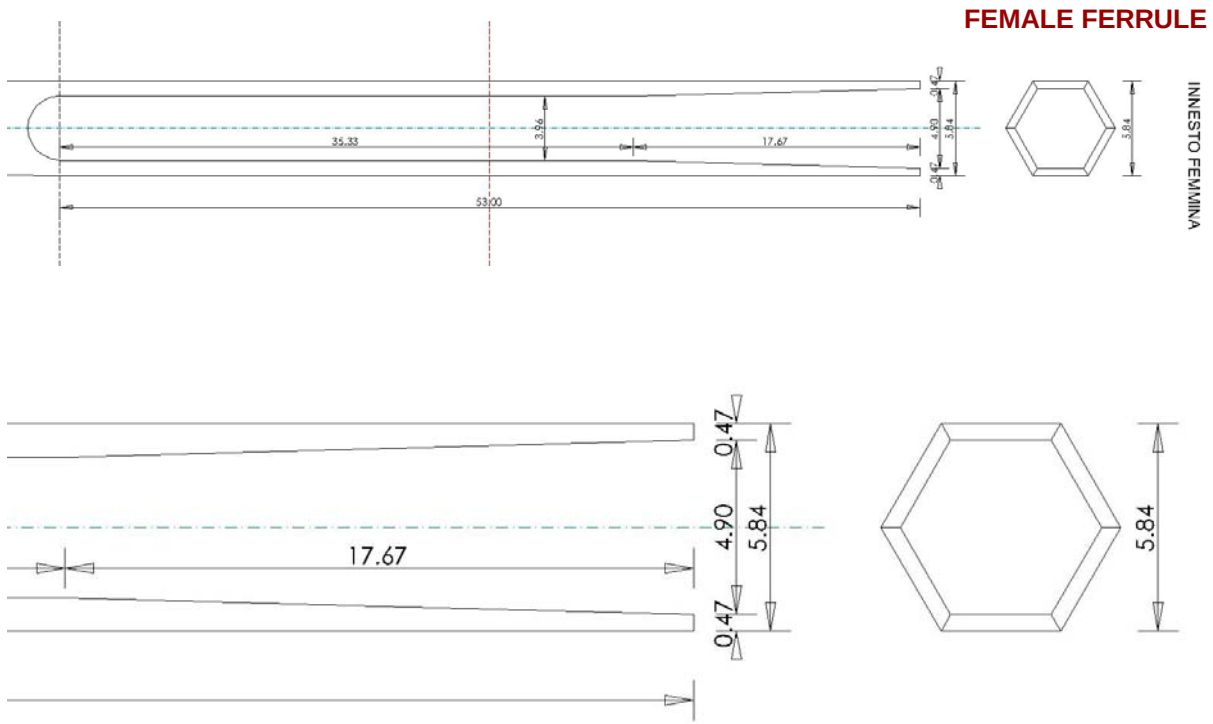
Step 2 – *designing the slope that guarantees strength in the ferrule.*

This slope is determined by the line that unites a point 1/3 of the depth of the ferrule with a median point within the thickness of the wall of the female.



Close up of the slope

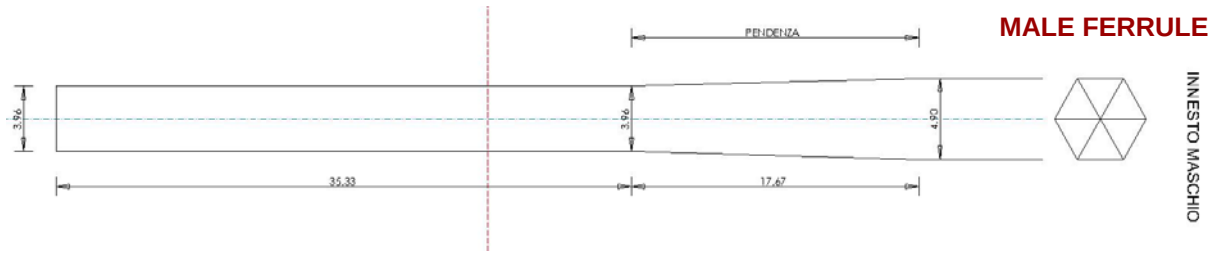
At this point we have designed the female ferrule:

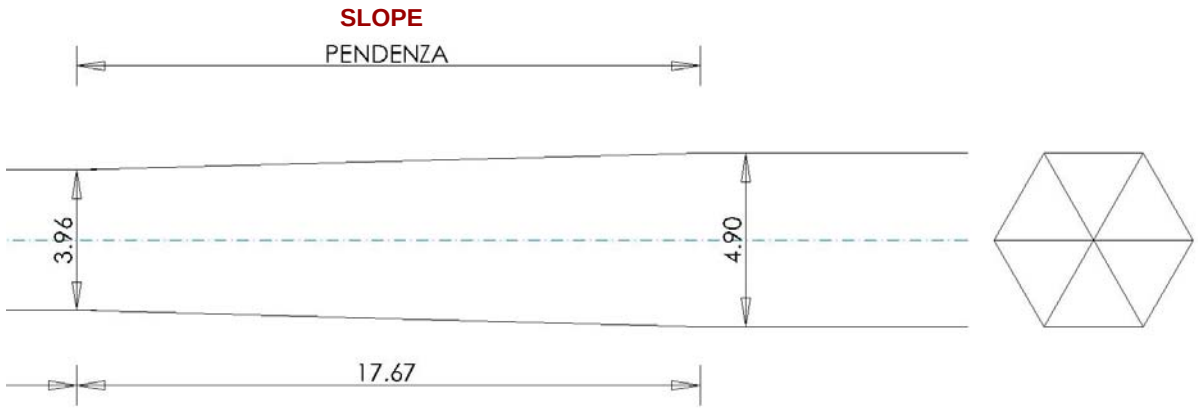


Close up of the female ferrule

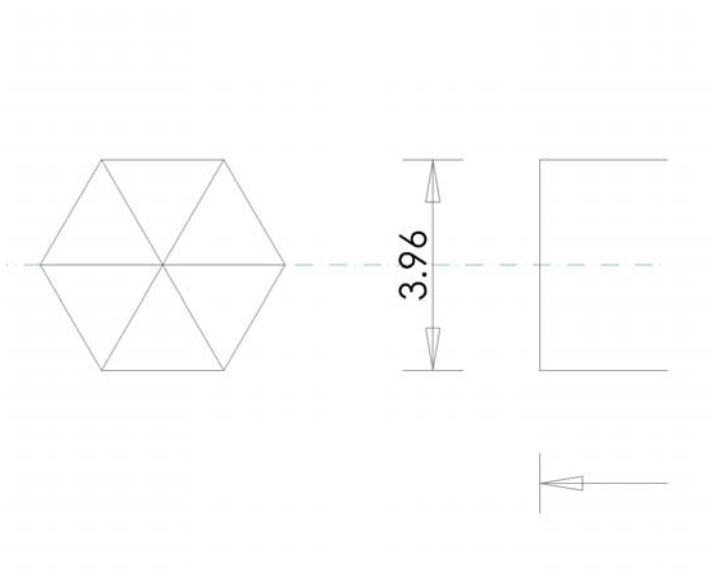
Now you need to design the male part of the ferrule which is exactly the opposite and must have the same slope as the female part.

Step 3 – designing the male ferrule





Close up of the male ferrule



Close up of the male ferrule

The streamlined ferrule is quite easy to design. All that is needed, is to bear three parameters in mind:

1. Reduce the dimensions of the female by the thickness of the wall in the femal part.
2. The length of the slope must be 1/3 the depth of the ferrule
3. Thickness of the wall at the opening = ½ the thickness at the closed end

I believe that these parameters must be considered as indicative and every rodmaker must adapt them to suit the type rod, its length and the taper he is making and also the use he will make of the rod or... to his personal taste because in my opinion there is nothing written in stone.

Alberto **P**oratelli
www.aprods.it