

(draft - this document is a work in progress)

End-grain Bolt-on Neck Joint

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Abstract:

On how-to attach a neck of a stringed instrument onto its body by pressing the flat end-grain face of a wooden neck against the instrument body, using bolts.

Although, variants of this neck joint may be derived for different flavours of stringed musical instruments, is the described neck joint specifically suitable for solid-body or semi-solid-body guitars. Described end-grain bolt-on neck joint allows for precision neck to body positioning retaining minimal vibration/sound damping properties of the joint (imho). The joint also enables the player to comfortably access the highest frets.

Disclaimer:

The main purpose of this document is to publicly provide information without any restrictions to anyone, to be able to understand and make this neck joint by her/himself. I would also encourage everyone to share this information in the interest of patent-free innovation.

Provided information is the result of my personal experience building my own solid-body electric-guitars in years 2023 and 2024. You can find licensing terms about the provided information here: <https://creativecommons.org/licenses/by-nc-sa/4.0/legalcode.en> [1].

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1 Background

1.1 Introduction

Hi, my name is Samo Pogačnik, living with my beautiful family in a small town of Škofja Loka (Slovenia, EU). Being an electrical engineer by profession and working as a software developer for more than thirty years, a need to build something physical with my own hands grew in me.

We, as a family are strongly related to music and most of our family members are fine musicians. My second son Krištof is a really good guitarist and through the years quite a few guitars gathered at home. Unfortunately I could not use them, being left-handed. Although I am only able to play some chords, I was frustrated being bound to my single left-handed guitar. That frustration led to re-learning basics on the right-handed guitars, which was and is a challenge. However, now I can at least touch different guitars.

Through the process of re-learning playing I discovered and loved many Youtube channels with great guitar lessons (Pebber Brown[2], Paul Davids[3], Rick Beato[4], ..., to name only a few). Of course I lost myself meanwhile in all general woodworking and guitar building Youtube channels as well. I would like to thank to all of you for giving out precious information and allow me to say hello to my favourite guitar builders Chris from High Line Guitars[5], Matt from Texas Toast Guitars[6], Ben from Crimson Custom Guitars[7], ... Thank you all for the insight into how and what is possible.

I found myself thinking a lot about how I could build some guitar details my own way. Slowly, a design based on everything I learned about guitars and guitar building, together with my ideas kind of came together. However, I was still in my head and far away from doing.

Finally, when my wife encouraged and helped me turning our little shed into a minimalistic woodworking workshop, my guitar building journey began.

At the beginning I had no tools nor jigs, I had no real experience except helping my father building a ferocement sailboat and building a windsurfing board as a teenager. I had a head full of other people's experience on how to do things properly, together with a bunch of my own ideas of which some my work or maybe not. But, I had to try it.

I thought, if I can make a guitar neck, then I can build a whole solid-body electric guitar as well.

1.2 Solid-body electric guitar design

A T-style guitar is the basis for the guitars I built, regarding the general dimensions and here are the specifics, that include the presented neck joint:

1. Slightly angeled headstock (to avoid the need for string trees) using a specific scarf-joint completely inside the headstock (for maximum neck integrity) - Figure 1

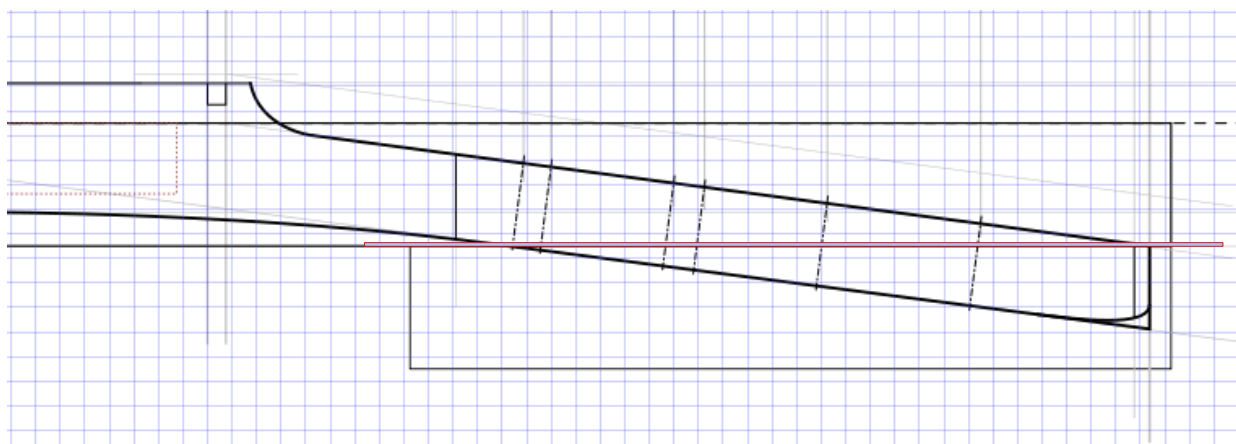


Figure 1: Headstock scarf joint

2. Unique headstock and body design
3. Strings flowing in a straight line over the nut in a top-view
4. Zero-fret at the nut to allow for a simpler nut requirements
5. Conical fretboard radius
6. Stainels steel frets, ...
7. And the end-grain bolt-on neck joint utilizing hanger bolts

2 What is end-grain bolt-on neck joint

I define end-grain bolt-on neck joint as a physical connection of instrument neck and body, where only the flat end-grain face of the wooden neck contacts the flat surface (potentially also end-grain) of the instrument body and bolts are used to fixate the contact.

The idea for this kind of neck joint grew out of the fact, that strings them self pull the neck towards the instrument body at the fretboard side of the neck and I was looking for a way to counterbalance strings tension at the back of the neck, while being able to adjust the neck to body position without shimming (Figure 2).

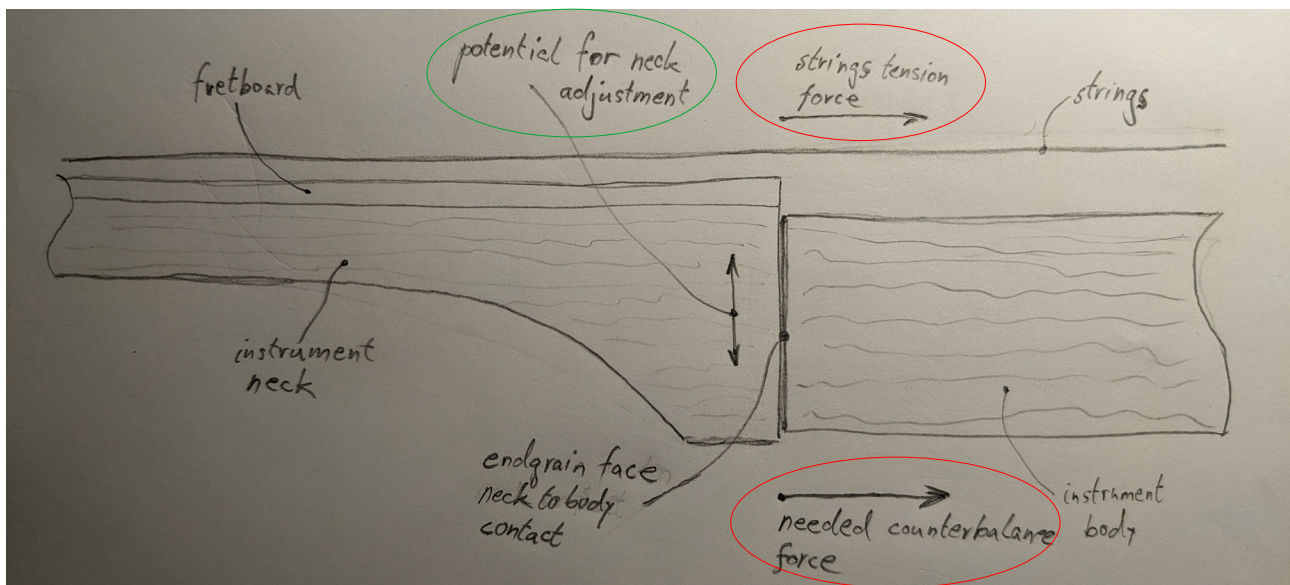


Figure 2: End-grain neck joint principle

3 Using hanger bolts

To create needed counterbalance force against strings tension force, a pair of hanger bolts (Figure 3) are being used.



Figure 3: Hanger bolt (length 20 cm)

Both hanger bolts are being screwed into the instrument neck through its end-grain face at a slight angle of around 10 degrees. After the bolts are being inserted into the neck, they are both bent, so that of both hanger bolts, sticking out of the neck fit into oversized holes drilled into the body and that the flat end-grain surface of the neck fits prepared body surface (neck pocket). The oversized body holes allow for a slight adjustment of the neck position, before tightening the nuts at the end of hanger bolts. Additional cavity is carved out of the body to enable tightening the neck on to the body with a washer plate and two nuts. Note that the beginning of the oversized body holes is countersunk to make room for the curved hanger bolt (see Figure 4).

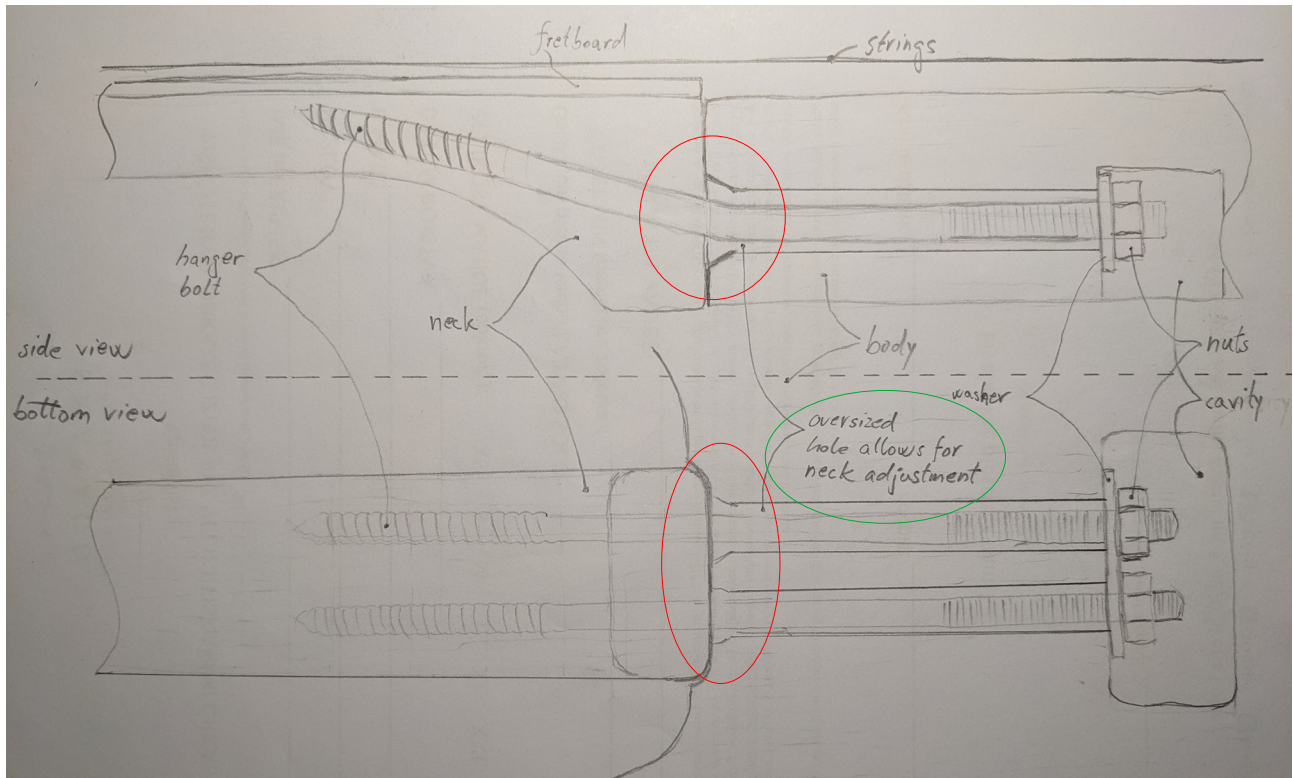


Figure 4: Side and Bottom view of hanger bolts installation

Adding cross grain wooden inserts to the body is advised to protect the body against cracking under the hanger bolts tension (see Figure 5, Figure 8 and Figure 9).

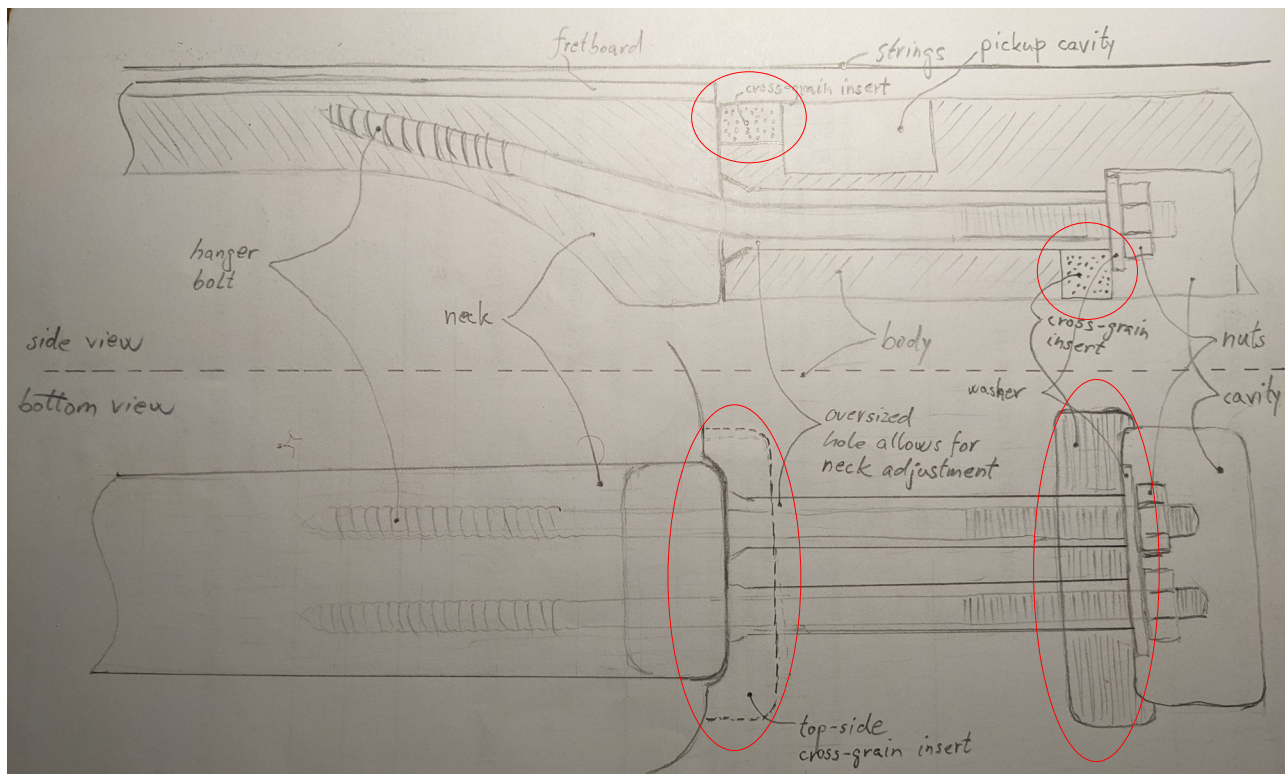


Figure 5: Side and bottom view with cross-grain inserts

3.1 Neck side



Figure 6: Inserted hanger bolts before being bent

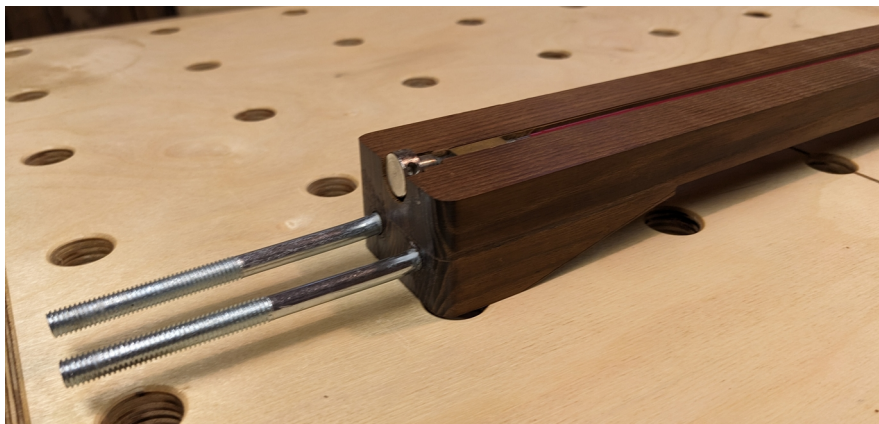


Figure 7: Inserted hanger bolts after being bent

3.2 Body side

The top side cross-grain insert between the neck pocket and the pickup cavity enforces otherwise fragile endgrain wall, being under the neck pressure (see Figure 8).



Figure 8: Top side cross-grain insert

The bottom side cross-grain insert (see Figure 9) together with top side insert protect the body against cracking. **Note that hanger bolt nuts must not be overtighten, otherwise the body could crack!**



Figure 9: Bottom side cross-grain insert

3.3 Assembled neck and body



Figure 10: Top view of the assembled neck and body



Figure 11: Bottom view of the assembled neck and body

3.4 Finished guitars

I completed the right guitar in september 2023 and the left one dates in december 2024.



Figure 12: Guitars on the wall

4 References

- [1] *CC BY-NC-SA licensing web page,*
<https://creativecommons.org/licenses/by-nc-sa/4.0/legalcode.en>
- [2] <https://www.youtube.com/@pebberbrown>
- [3] <https://www.youtube.com/@PaulDavids>
- [4] <https://www.youtube.com/@RickBeato>
- [5] <https://www.youtube.com/@HighlineGuitars>
- [6] <https://www.youtube.com/@TexasToastGuitars>
- [7] <https://www.youtube.com/@CrimsonCustomGuitars>