

Guitar Technical Services

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25 Years

String anomalies of Intonation

Applied to the 'Plain 3rd'

For most people trying to do the intonation during a set up on a guitar, it is fraught with many pitfalls which I will come on to later.

The first issue that guitar players have to deal with is -- what are the correct notes to tune on the guitar?

Generally speaking, if the guitar is tuned correctly on the open strings, then the 12th fretted note should be exactly one octave above. The saddle is moved in order to correct the 12th fretted note. It is always worth checking the note at the 5th fret. Even if the 12th fretted note is correct, the notes ranging from the 1st to the 11th fret will be slightly inaccurate due to the placing of the frets. This is because the calculation for placement of frets is done for the composition of the first string only - which is usually a thin treble string. As the mass of the string increases, so does the error. Increasing the string length relative to its greater mass helps but does not correct the issue. This can be seen when looking at the worst area observed: the first 3 frets on the bass strings. Bringing the nut placement forwards has been one of the ways to reduce this error and has led to the sale of intonated nuts but this does not get away from the fact that there are elements of error on each string and notes played.

For acoustic guitars, there is always been an element of 10% error depending on the gauge of string used. One other obvious factor is that having a high action will automatically give you very sharp intonation. On the basis of an acoustic that has a good action height, the intonation should be less than 6%. If we look at the composition of the strings fitted to an acoustic, we find that they are made up of 2 plain strings and 4 wound strings. The interesting thing to note is how the strings differ to the electric guitar. Jazz guitar strings usually have a wound third string. The revelation that will shock most electric guitar players is that **the wound third string is actually correct for its position.**

The Plain 3rd

When a plain 3rd string is fitted and intonation adjusted for the 12th fret - as is the case with most electric guitars, the intonation is never correct between the frets 1 to 5. The introduction of the plain string used as a third string position has been attributed to something that went on in the late 1960s when guitarists bought 13 to 56 gauge strings which had a wound third.

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As I remember it, Monopole flat wounds used to be one of the favourites. Hank Marvin is said to have used 12 to 52 gauge and I am sure that the set included a wound 3rd. Even the single coil pickup with staggered pole pieces were set to compensate for a quieter wound 3rd string. Going back to the example of the 13 to 56 gauge with the wound 3rd strings, these would be listed as 56 Wound 46W 36W 26W 17Plain 13P.

Apparently somebody came up with the idea of buying a 10 gauge banjo string and moving the strings over one position. This now gives a set of strings running from 10 to 46 gauge like D'Addario and Ernie Ball - as we now know it - as 46W 36W 26W 17P 13P 10P.

We can now see that today this is an accepted norm of the third plain string. But I asked the question is this correct? The answer is no!

A simple DIY test is to fit an equitable tension wound string and check out the error at the second and fifth fret. This would be an 18W (very slightly lighter). Once the wound string is fitted and the intonation adjusted accordingly, those A and D chords suddenly sound more pleasing to the ear. Instead of the plain at the fretted 5th ('C') being up to 10% sharp the wound string is almost perfect.

The only problem with the wound third is that it doesn't have the same twangy sound and doesn't bend as smoothly as a plain string. If you do this experiment you will see that the saddle has to be moved an extreme distance to cater for a wound string as opposed to a plain one. It is my belief that the string makers bowed to what the customer wanted - i.e. a plain third - when they knew all along that the correct composition of the string should be a wound one.

Going back to the plain 3rd fretted at the 5th fret when correct at the 12th fret, Yes – you will see up to a 12% sharp error because the string is too slack. But if you now increase the tension from G to B and test the intonation at the 5th and 12th fret, you will find it suddenly corrects itself. How can that be? Well, because a plain string in the G position has not got to its optimum working tension and is too slack and presents errors in the very area where you want harmony from chordal work. Remember how the plain 3rd as a 17 was originally tuned to B? By bringing the string up to a 'working tension' the string intonates correctly. The irony is that a plain string could be fitted and tuned to G but it would be massive and the tension would not be similar to the other strings - Yet another reason why a wound string is correct.

I once had a customer asking me if I could fit a set of acoustic strings that had been specially made with a plain third. My reply, based on the knowledge and experience above, was no. He explained that they were going to be good for bending. I explained that in order for the string to be properly intonated, I would have to cut a U-shape in the saddle where the wound string had originally sat and then glue a single miniature saddle some distance behind the U-shaped in order for the intonation to be anywhere near correct. It did seem at the time that the customer was asking me to do something daft but personally I felt it was a shame that a guitar string maker had decided to yield to customer requests irrespective of it being impractical and nothing near tuneful.

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I may also add – the complete opposite situation occurs for people who buy jazz arch-tops with set ebony/rosewood bridges and fit plain 3rd strings. They will find that they have an excessively sharp 3rd string and no way of correcting it.

So in conclusion, to live with the plain 3rd its best to intonate it at the 5th fret which then makes the A and D open chords more pleasing to the ear. As chords are played mainly from the 1st the 9th fret this way of intonating makes sense. When you get to the 12th fret area the 3rd string will be 6% to 8% flat BUT as its rare to play chords in this area, the error will not be noticed. Most players are noodling away with single notes around the 12 fret area and the error is unlikely to be noticed.

Finally: If the wound strings give a very sharp reading at the 5th fret when the 12th is correct. It is usually too much finger pressure or the string has been over-stretched and ruined.