Equal Beating Victorian Temperament (EBVT)

Detailed Temperament Sequence Instructions

These detailed instructions are for learning purposes. Once the idea is well understood, the abbreviated "Summary Instructions" which follow can be used. Well Temperament is distinctly different from Equal Temperament (ET) in that each tonality of the cycle of 5ths exhibits a different character. The Victorian style Well Temperament actually closely approximates ET, pitch for pitch. Some notes are, in fact the very same and others differ only very slightly. The fact is also that a piano tuned in the EBVT will exhibit 24 distinctly different sounding tonalities for each of the 24 Major and minor keys.

Yet, a piano tuned in the EBVT is compatible with all types of music and with other fixed pitch instruments tuned in ET, including another piano tuned in ET or an electronic keyboard or organ. The difference amounts to an internal one for the piano. The piano will exhibit a distinctly different character but it is not so different as to sound strange or unusual. Many people will think it somehow sounds more musical but some people will not be able to distinguish the difference.

1. Tune A4 to the tuning fork and then tune A3 to A4 as a 6:3 type octave. Alternatively, simply tune the A3 to the tuning fork. When A4 is tuned later, it will match the tuning fork because tuning A3 to the fork matches the 2nd partial of the A3 to the tuning fork. Because of the unique way in which octaves are expanded when tuning the EBVT, the fundamental of A4 will inevitably match the tuning fork to within a fraction of a cent.

2. Tune F3 from A3 at 6 beats per second. This is the only beat "counting" that is involved and the only assignment of a beat rate in this temperament sequence. Think of two triplets that occur with each tick of a metronome set at 60 beats per minute or three beats per tick of a metronome set at 120. It actually doesn't matter all that much if the rate is precisely 6 beats per second or not but it should be very close to that. It is just slightly slower than the familiar 7 beats per second of Equal Temperament (ET) and yields a more pleasant, slightly "sweeter" sound.

3. Tune C4 from F3 as a pure 5th. Aim for a beatless sound first but then use the test note, G#3 to prove that it is pure. Both the minor 3rd (m3) F3-G#3 and the Major 3rd (M3) G#3-C4 must beat exactly alike. When that seems to be the case, play all three notes together (an F minor triad). If the 5th is truly pure, there will be a slightly quieter sound than when either interval is played separately. The chord will seem to "just hang there" with uncanny stillness. If the interval is slightly wide or narrow, you will hear a very slow beat emerge. Playing all three notes together therefore is the ultimate test and proof. This, by the way, is what 18th and 19th Century tuners did but the "chord test" is largely useless in ET tuning and therefore has been mostly abandoned.

4. Tune F4 from F3 as a 4:2 type octave. The result will also be a pure C4-F4 4th. You may use the test note, C#3 to prove the 4:2 type octave. Both the C#3-F3 M3 and the C#3-F4 M10 must beat exactly alike. All three notes may be played together as with the test for the pure 5th. You may also play F3-C4-F4 together and listen for a perfectly still and pure sound. If any slow beat emerges, you do not have yet the proper arrangement. The resultant F Major chord, F3-A3-C4-F4 will be a very pleasant, calm and still sounding chord.

Notice that the specifications for the octave types, 4:2 for F3-F4 and 6:3 for A3-A4 are different. You will understand why later. It certainly cannot be that way in ET but there are a number of features about a Well Temperament that distinguish it from ET. Basically, the reason is this: the 4^{ths} & 5^{ths} are of different sizes in the EBVT, so to reconcile them with the octaves in the rest of the midrange and the outer octaves, the sizes of the octaves must be irregular as well. In ET, the size of the octave also changes but in a smooth progression. In the EBVT, the sizes of the octaves will change with each half step but only very slightly.

Octaves still sound like octaves but their actual width will vary ever so slightly from one note to the next. This cannot really be perceived when playing a single octave out of context. Only test intervals will reveal the different sizes but it is not necessary to perform those tests. Electronic tuning cannot handle that very well. It tends to draw a smooth curve through what should be a slightly jagged line. (See the information about electronic tuning later in this article).

5. Copy the F3-A3 beat rate (6 beats per second) at C4-E4. Tune E4 from C4 so that the beat rate sounds the very same as F3-A3. Now, you are not counting but creating what is known as "equally beating intervals". If F3-A3-C4-E4 is then played, a very crisp and pleasant sounding F Major 7th chord will be heard.

6. Tune G3 from E4 (a M6) at that same rate, (6 beats per second). Again, copy the sound of the two previous intervals rather than trying to count or estimate beats. This will create a tempered 4th, G3-C4. It will be a little more tempered than it is in ET but still only very slightly more than 1 beat per second, not a "beating" sound. If the G3-C4 4th sounds too fast, sharpen it slightly so that it sounds more tolerable and then check to see if the G3-E4 M6 still seems to match the F3-A3 and C4-E4 beat rates. If not, work back through those until they all match.

7. Tune B3 from G3 again at that same rate, (6 beats per second). Copy once again, the beat rate rather than trying to independently estimate or count the beats.

8. Check and correct each of the previous 6 beat per second beat rates for similarity. This is the foundation for the temperament, much like the initial chain of Contiguous Major Thirds is for ET. There must be four equally beating Rapidly Beating Intervals, all exactly alike and the F3-C4 5th and C4-F4 4th must be pure and the F3-F4 octave must be a 4:2 type. Check all of this before proceeding.

9. Listen to the A3-E4 5th and the B3-E4 4th. The B3-E4 4th should sound perfectly pure as a result of what has been tuned so far but the A3-E4 5th will beat a little too much to be tolerable. Sharpen E4 very slightly until BOTH the A3-E4 5th and the B3-E4 4th beat exactly alike, having the same sound. Neither will be pure but neither will now beat objectionably but both will be very slightly more tempered than the same intervals in ET. The G3-E4 M6 and C4-E4 M3 will still retain their equal beating between them but both will now be slightly faster than the originally set 6 beats per second.

You may try the resultant A minor triad, A3-C4-E4 and note that this minor triad has a milder, more tranquil, "bitter-sweet" quality than the same triad has in ET.

10. Tune D4 from A3 temporarily as a pure 4th but then immediately compare it to the G3-D4 5th which will beat objectionably. Then, sharpen the D4 slightly, again, so that BOTH the G3-D4 5th

and the A3-D4 4th beat exactly alike, having the same sound. Neither will be pure but neither will beat strongly but both may sound just a little more tempered than they would in ET.

The resultant G Major triad, G3-B3-D4 will have a very pleasant and sweet sound. Even though both the F Major triad and the G Major triad have equally beating Major Thirds, their character is distinctly different because the F Major triad contains a pure 5th and the G Major triad contains a tempered 5th. You will hear later that the sharp side of the Cycle of 5ths has a "feminine" and melodic quality to it and the flat side has a bold, clean and "masculine" quality to it. This is true of all Well Temperaments.

11. Tune A#3 (B-flat 3) from F3 temporarily as a pure 4th. Now, listen to the slow beat that occurs in the G3-C4 4th. Sharpen A#3 (B-flat 3) slightly until the F3-A#3 4th sounds exactly alike with the G3-C4 4th. This is once again copying the sound of another interval rather than trying to estimate a beat rate. If both intervals beat exactly alike, the tone cluster, F3-G3-A#3-C4 can be played and it may be noticed that the tempering in the intervals of a 4th becomes masked or mostly suppressed. It may be heard at the initial strike of the tone cluster but will soon be "swallowed" so that the tone cluster, while mildly dissonant, has that same, uncanny stillness to it as there is in other tests and checks.

12. Listen to the resultant A#3 (B-flat 3)-D4 M3. Tune the A3-C#4 M3 so that the two intervals, A3-C#4 and A#3-D4 beat exactly alike, having the same sound. Copy the sound of the two Rapidly Beating Intervals (RBI) exactly; do not estimate. Play the tone cluster A3-A#3-C#4-D4 and listen for the same, crisp but still sound. While it may be dissonant sounding, the individual rapid beats can no longer be heard or mostly suppressed.

You may, at this point play the resultant triads, A-C#4-E4 (an A Major triad) and note that it sounds about the same as it would in ET, then the B-flat Major triad in second inversion, F3-A#3-D4 and note that it has a "cleaner" and slightly milder sound than it would in ET.

13. Tune G#3 from C#4 as a pure 4th. Use the test note, E3. The E3-G#3 M3 must beat exactly alike with the E3-C#4 M6. Play all three notes together, E3-G#3-C#4 and you will hear a very still sounding C# minor triad in first inversion.

You may try the resultant F minor triad, F3-G#3-C4 and note that it will have a more "tragic" minor sound to it than it does in ET.

14. Temporarily tune D#4 from A#3 as a pure 4th but immediately compare it to the G#3-D#4 5th. Sharpen D#4 very slightly until BOTH the G#3-D#4 5th and the A#3-D#4 4th beat exactly alike, having the same sound, only a VERY SLIGHT beat, somewhat less than in ET.

You may try the resultant triad, E-flat Major in second inversion, G3-A#3-D#4 and note that it has a slightly milder and "cleaner" sound than it would in ET (you will find later that it has that perfect, "Heroic" sound for pieces by Beethoven that are written in that key).

You may also play the resultant A-flat Major triad, G#3-C4-D#4 and note that the triad has a bold character to it. Then, try the G# minor triad, G#3-B3-D#4 and A minor triad A3-C4-E4 which is right next to it. You will hear two very distinctly different minor characters. This is because the Victorian style Well Temperament retains the distinctive small minor third, a feature of all Well

Temperaments. It is narrower than an ET minor third. The G# minor triad has the small minor third which gives it the deeply gloomy sound while the A minor triad has a minor third which is not as narrow as it is in ET so it gives that chord its milder character.

15. Temporarily tune F#3 from C#4 as a pure 5th. Immediately compare it to the F#3-B3 4th, then sharpen F#3 very slightly until BOTH the F#3-B3 4th and the F#3-C#4 5th beat exactly alike, having the same sound, slightly less than the tempering would be in Equal Temperament. Play the tone cluster F#3-B3-C#4 and whatever tempering there is will not be heard if the two intervals beat exactly alike.

You may try the resultant triads, F# Major, F#3-A3-C#4 and B Major in second inversion, F#3-B3-D#4 and note that these both have a strong and vibrant character. However, do not dwell on the fact that these two triads may sound slightly harsh in that context. Pieces of any type from any era are not likely to require loud playing of either of those two chords out of context. A piece will more likely have wide, spread out chords or arpeggios that avoid the harshness in those keys but actually contribute to the vibrancy and energy of the music. In any case, the Victorian style temperament mitigates that harshness to within a range that the contemporary ear will find palatable.

Summary Sequence for tuning the EBVT

1. Tune A3 to the tuning fork or from A4 at A-440 as a 6:3 type octave.
2. Tune F3 from A3 at 6 beats per second.
3. Tune C4 from F3 as a pure 5th.
4. Tune F4 from F3 as a 4:2 type octave.
5. Copy the F3-A3 beat rate (6 beats per second) at C4-E4.
6. Tune G3 from E4 (a M6) at that same rate, (6 beats per second).
7. Tune B3 from G3 again at that same rate, (6 beats per second).
8. Check and correct each of the previous 6 beat per second beat rates for similarity.
9. Adjust E4 (slightly sharpen) to beat equally between A3 and B3.
10. Tune D4 equally beating between G3 and A3.
11. Tune A#3 from F3 so that the F3-A#3 4th beats the same as the G3-C4 4th.
12. Tune C#4 from A3 so that the A3-C#4 M3 beats the same as the A#3-D4 M3.
13. Tune G#3 from C#4 as a pure 4th.
14. Tune D#4 to beat equally between G#3 and A#3.
15. Tune F#3 to beat equally between B3 and C#4.

Expanding the octaves

Midrange from C3 to F5

1. Proceeding downward to C3 (or to the bottom end of the tenor section), tune first what sounds like a reasonable octave but then compare it immediately to the 4th and 5th above it. Try to make all three intervals, the octave, 4th and 5th have the same sound. If necessary, favor a "pure" sounding octave over the 4th and 5th above it and favor a 5th over a 4th but in most, if not all cases, the octave, 4th and 5th can and should sound alike. Only the scaling in some pianos prevents it.
2. Proceeding upwards from F#4 to C5, again first tune what sounds like a reasonable octave but then compare it to the 4th and 5th below it. Try to make all three intervals, the octave, 4th and 5th have the same sound. If necessary, favor a "pure" sounding octave over the 4th and 5th below it but stretch the upper note slightly to favor an intolerably "beating" narrow 5th. Ignore a 4th that may beat up to 2 beats per second but not beyond that.

Treble from F5 to C7

1. Beginning at F5, tune first again what sounds to be a reasonable octave, then using the Sostenuto pedal if the piano has one or using the damper pedal in the same way as the Sostenuto pedal, play the keys first, then press the pedal, play the double octave, F3-F5 and then immediately play the octave-5th, A#3-F5. Tune F5 so that both intervals, F3-F5 and A#3-F5 sound exactly alike. If it is a vertical piano, you may have a muting strip under the dampers, so no pedal at all is needed. The double octave will be slightly wide and the octave-5th will be slightly narrow but each will be so close to beatless or "pure" that they will both apparently sound as if they are completely pure. It will be a very exacting compromise that any musician will deem as perfectly tuned.
2. Continue as above from F5 to C7.

High Treble from C7 to C8

1. You may well continue the double-octave, octave-5th compromise at this point but at some level, the beats may become impossible to hear.
2. The beats between single octaves may also become intolerably rapid.
3. This is the time to make a compromise between the double-octave/octave 5th result and a single octave.
4. The "pure" single octave may sound a bit flat but the double-octave/octave 5th may sound too sharp. Find a reasonable compromise between the two.
5. At some point, at or near F7, no comparisons with notes below the single octave may be possible to hear. At this point, use only your melodic judgment to tune the very highest single octaves.

Tuning the Bass

The High Bass

1. Beginning at C3, and downward, continue to compare the octave, 4th and 5th down to F2.
2. At or about F2, both the 4th and the 5th may become too "growly" to be of much use.
3. At or near the point of F2, again use the Sostenuto pedal or damper pedal as described above.
4. Tune what sounds like a reasonable octave first, then compare it to the double octave and octave-5th above and make each interval have the same sound.

The Low Bass

1. At are near F1, you may simply tune what sound like reasonable octaves down to A0.
2. You may also check each note with the double octave and double-octave-5th above it.
3. At some point, often beginning with F1 or the first single Bass string, a good sounding octave may exhibit a faint but rapid beat. This will be the conflict between the 16th partial of the lower note and the 8th partial of the upper. It can often be in the area of 20 cents difference if measured electronically.
4. This is normal and what any smaller piano will exhibit and even the largest 9-foot concert grand will exhibit at or near D1 and below. It will be perceived by the pianist as not a rapid beat in the octave (which it actually is) but as a pleasant sounding resonance, much like that of the Rapidly Beating Intervals such as M3's, M6's, M10's and M17's above them.
5. The simplest way to make very low Bass octaves sound in tune is to first tune what sounds like a reasonable octave to your ear but then to press the damper pedal. The note can then be adjusted slightly to blend with all of the other previously tuned notes above it. An overly wide single octave will exhibit an intolerable "rumbling" sound while an octave that is too narrow will exhibit an intolerably "tight" or "growling" sound, very rapid and intolerable beating within the upper partials of the octave being tuned.
6. The faint, rapid beat that is normal can also be adjusted so that it matches with a M10 or even a M3 in the midrange above it. This will give each long chord played upon the piano a beautiful resonance. Remember that with a Victorian style Well Temperament, those rapid beats will not be evenly progressing, so the way that each of the very lowest notes of the Bass can also be finely adjusted will be so that the faint, rapid beat in an octave will match with the intervals in the midrange.

Tuning the EBVT Electronically

Many technicians have asked if the EBVT could be tuned electronically, so in 2007, Professor Owen Jorgensen RPT provided me with the electronic tuning "correction" figures. Those are still valid today. Consult the operating manual for entering a custom, non-equal temperament. The following figures are what should be used. If your electronic tuning platform already contains figures for the EBVT but they do not match those which are below, the data in the platform should be changed to reflect these figures. Most platforms accept figures in 100ths of a cent but some will only accept them rounded off to 10ths of a cent.

	(100ths)	(10ths)
C:	+3.80	+3.8
C#:	-1.29	-1.3
D:	+0.86	+0.9
D#:	+1.59	+1.6
E:	-0.41	-0.4
F:	+1.84	+1.8
F#:	-0.28	-0.3
G:	+3.11	+3.1
G#:	+0.67	+0.7
A:	0.0	0.0
A#:	+2.86	+2.9
B:	-0.03	0.0

The important difference in the results using an Electronic Tuning Platform (ETP) from that of aural tuning is that an ETP generally projects the octaves based upon a smooth, calculated curve. The aural tuning instructions however, construct the octaves in an entirely different way which causes octave sizes to vary slightly from one pitch to another. Many technicians however have reported that they simply entered the correction figures and tuned according to an otherwise default program and have been delighted with the results.

The difference is certainly quite small so if you, as a technician are only able to tune electronically but still want to enjoy the EBVT, you may do so using the electronic figures only. If you normally tune electronically but also have some aural verification skills, you can slightly improve the purely electronic results, particularly in a somewhat expanded midrange, F2 to F5. You may also first tune electronically to get a basic idea of how the temperament will sound on the piano before you attempt aural tuning or to decide whether or not the idea is worthy of pursuit for you.

To use aural verification, starting from F3 and playing downward to the end of the tenor bridge, and onward to the note F2, play 5ths chromatically first, then 4ths. Listen for any 4ths or 5ths that may sound too tempered. When you find either, assess which way you could slightly correct a pitch or pitches to improve all 4ths & 5ths to within a range that sounds tolerable. It may involve changing only one note of an interval but it can easily involve changing both. Do the same from F4 to F5. Much beyond F2 and lower and F5 and higher should not be a problem. It will be basically the midrange that will need some scrutiny. The G4-D5 5th is generally the worst offender. Try flattening G4 slightly and sharpening D5 slightly. A half cent for both may solve the problem.

Below F2 and above F5, you may want to listen to double octaves, and then listen to octave-5^{ths}. All double octaves may well sound fine but any narrow and beating octave-5^{ths} should be corrected by flattening slightly the lower note in the Bass or sharpening slightly the upper note in the treble.

Surprisingly, there will be no need to scrutinize any Rapidly Beating Intervals (RBI). All of that which is necessary to perfect an ET tuning is unnecessary when tuning the EBVT. All of the RBI's are uneven anyway so any slight adjustments to the Slowly Beating Intervals (SBI), the octaves, 4^{ths} and 5^{ths} will not change that. You will only need to be sure that all SBI's sound tolerable even though they too will be slightly irregular (some a little more tempered than others, some pure or very nearly so but none beating objectionably).

This has been a newly written method of aural tuning of the EBVT after 25 years of tuning nearly every piano that I have tuned that way. The process of describing it has been long and difficult to determine and I am open to comments on how it may be improved. It is NOT copyrighted material so anyone is free to copy and distribute it. I do not hope or expect to profit from it directly but I do hope that other piano technicians may use it, benefit by it and ultimately contribute to the perfection of the idea. I only ask that no one claim that it is their idea when it has clearly come from me.

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