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Saxophone without mouthpiece

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Chapter 2
Air Pitch

2.1 - Description of Technique - https://youtu.be/Ll2O2s8LrSU

Air Pitch is a technique where air is blown through the neckpiece of the saxophone and resultant pitches are produced. [Performs an improvisation using the air pitch technique]. Pitch is affected by the fingerings. Timbre and sound quality are affected by the position of the mouth and the pressure of the air. Since the air is inherent in the timbre of the sound, a purely pitch-based result is impossible; in other words, there will always be an airy timbre to the sound. However, by changing positions of the mouth – for example blowing from the right or left, from above, from below, straight on, or enclosing the neckpiece around the lips, etc. [demonstrates all sounds] – a resultant timbral shift can become apparent. Air pressure affects the balance between air and pitched sound.

2.2 - Technical Parameters - https://youtu.be/FT2w-ZGOdPs

Transposition:
As with all SWMP techniques, a standard and all-encompassing transposition is impossible to deduce for each saxophone. However, below this main video you will find a transposition chart for each saxophone – soprano, alto, tenor, and baritone.

Range:
The use of the octave key has no bearing on the sound of the air pitch; therefore this technique has a rather limited range. Mainly speaking, the range starts from B♭3 (or A3 on baritone) and chromatically extends to C#5. [Demonstrates range]. Then by bypassing the normal fingerings from D5 to F#5 (G5 on soprano) and instead using the C1-C5 (or C6) side keys, we can further extend the range by five half steps (six on soprano) [Demonstrates range]. So then the full range would be: [plays full range].

Discussion:
Air pitch has been described by Daniel Kientzy (2007) as *Flûtage* due to the windy temperament of the sound. In describing the air pitch technique, he says that it is "the most efficient [means] in which it is possible to produce a melodic 'air' sound on the saxophone" (Kientzy 2007: 453).[33] He goes on to argue that although the technique is suited for melodic situations, it produces a rather weak sound result (Kientzy 2007: 453-4). The reason he explains that air pitch produces a weak sound is because of the balance between air and pitch that is produced by the aforementioned pressure of air. Saxophonists and composers should be wary of this balance issue.

The air pitch technique is effective on all saxophones. Kientzy mistakenly makes the assessment that the acoustic rendering is relatively weak for the tenor, baritone, and bass saxophones (Kientzy 2007: 453). While the larger bodies of these saxophones make it difficult, in any case, to blow through the instrument, the effective acoustic rendering of

[33] Translations from French by Don-Paul Kahl.

pitch is not weak. In fact, with a proper balance of air pressure, the sound is more present than with the smaller saxophones.

2.3 - Performance and Practice - https://youtu.be/4ocuBggJFgg

The mouth and lips should remain in a relaxed and natural position depending on the vowel or consonant shape that is asked. Kientzy describes the lip shape as if one were blowing out a flame (Kientzy 2007: 453). This is an excellent way to think about the air pitch technique; however, one should not be limited to the pressure that this imagery represents. The lips and subsequent air pressure variations can function as a sound distorter as well as a pitch creator. By subtly changing the pressure of the air, the balance of airy sound versus the amount of pitch can change drastically. Developing the technique even further, one must develop flexibility in the lips in order to be able to create disparate sounds and timbres.

Changing Vowel and Consonant Colors:
It is important to become fluent in changing the shape of the mouth in various vowel or consonant colors while performing the air pitch technique. While a "pure" air pitch sound – meaning one without any specified vowel or consonant shape – is often asked, other times a specific mouth shape is demanded. For a pure air pitch technique, the performer should keep a relaxed yet consistent vowel shape to the lips, adjusting the pressure according to the dynamic. With textural changes such as morphing the vowel shape from "ahhh" to "ohhh" to the consonant "ffff," for example, one should exaggerate the evolution between these various vowel and consonant shapes to best produce a distinguishable listening experience while also respecting the dynamic contour and rhythm demanded by the composer. I will slowly demonstrate this change for you. [Demonstrates]. I will demonstrate that change a little bit faster now. [Demonstrates].

Exhalations vs. Inhalation:
While most manuals on saxophone technique discuss the difference between inhaling and exhaling air sounds, without the mouthpiece the distinction is not as evident. Mostly all air pitch sounds are produced with exhalation. Only when the lips are enclosed around the neckpiece can a proper inhalation sound occur. The sonic result is, however, close to the sound when exhaling. What changes, especially when a lot of pressure is used, is the timbral result. [Demonstrates].

Dynamic Range:
The balance between the airy sound and resultant pitch is crucial for effectively producing air pitch techniques. A relatively large dynamic range is possible. Without any amplification, the technique can be performed from *niente* attacks to *f*, *ff* or even louder. However, this dynamic scaling is relative to the technique and should not be considered equivalent to common practice saxophone playing.

Articulation:
Single Tongue:
Articulation variance is also possible. Tonguing must be adapted from traditional forms of playing. However, the tongue should avoid touching the neckpiece itself - this will create a pseudo tongue ram. The tongue should approach the articulation in much the same way that one produces the consonant shapes and attacks without the saxophone, for example "Too Too Too Too," or "P P P P," "F F F F," or "Kah Kah Kah Kah." [Demonstrates sounds].

Double Tonguing:
Double tonguing is also possible and easily achieved in comparison to traditional playing techniques since there is an absence of resistance created by the mouthpiece. Here again, a composer can demand many different consonant variations. Here I will demonstrate the "Too Koo Too Koo" and "Duh Guh Duh Guh" attacks. [Demonstrates].

Flutter Tongue:
As an additional articulation structure, the flutter tongue technique is effective here as well, and does not pose problems either for the front rolling or back rolling "r" sounds. The intensity of the flutter tongue will also affect the air pressure balance. For this reason, for softer sections in which pitch must be present, it is best to employ the back rolling "r" instead of the front rolling one. The back rolling "r" possesses a less effective sound. I will demonstrate both of these now. [Demonstrates].

2.4 - Personal Development - https://youtu.be/qqtOB-CyqNI

A saxophonist might find it easiest to start their learning process of the air pitch technique by exploring each pitch of the saxophone as a long tone. This will also allow for adjustments to the limited resistance without the mouthpiece. I would personally start by using a neutral vowel and playing four long tones on the lowest note and working my way upward, chromatically exploring the sound and gaining familiarity with the "newness." Here I will demonstrate this for you. [Demonstrates].
Afterwards, start to integrate more rapid passages, again starting on neutral vowels. [Demonstrates].
From here, it is good to start becoming familiar with different articulations. Start with "K K K K" transforming to "Kuh Kuh Kuh Kuh" transforming to "Koo Koo Koo Koo," for example. [Demonstrates].
It would then be quite natural to integrate double tongue as well. First start on one pitch and then integrate more rapid passages. [Demonstrates].

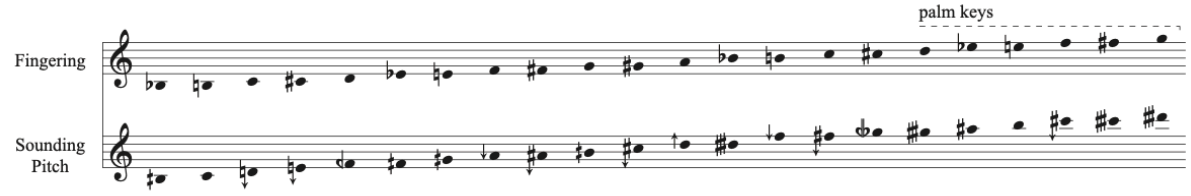
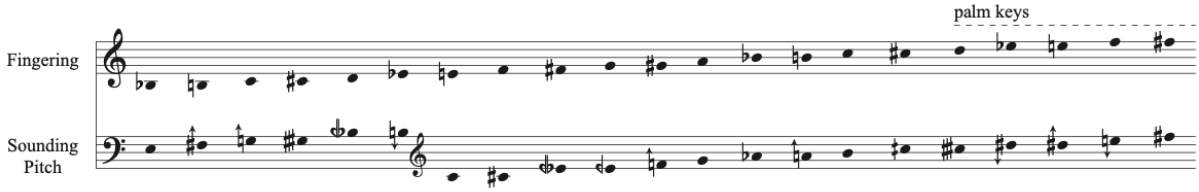
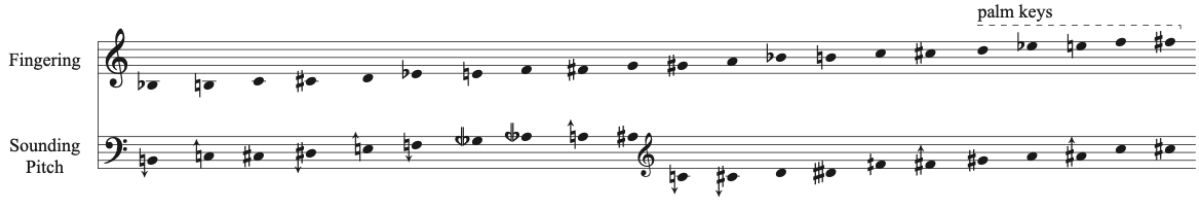
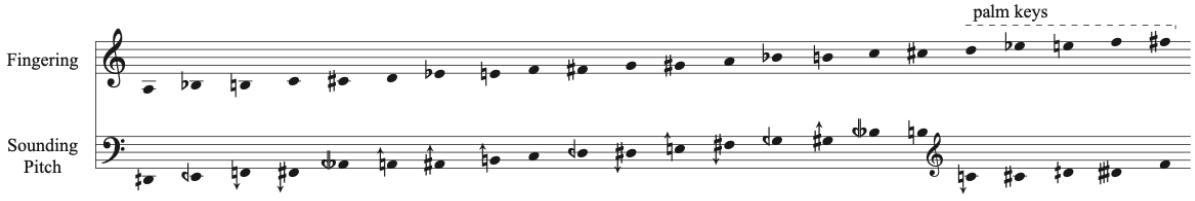
Some of my best and most illuminating practice sessions on this technique, and SWMP in general, have an element of self-discovery. Additionally, working with composers have also led to enlightening discoveries. For example, when working with Stratis Minakakis on his *For Felipe M.* (2021), he wanted the air pitch to have more texture and density in the sound quality in addition to the dynamic volume demanded. I began exploring and

demonstrating for him new consonant and vowel combinations until we found, together, the texture that we were both happy with. The following is a video excerpt from a live performance of this section of Minakakis' work. [Video excerpt plays]. In any case, develop your own method for yourself or your students depending upon your or their needs.

2.5 - Pedagogy - https://youtu.be/KbysMNsZ0Wg

If necessary, adjust the neckstrap to the proper height so that the neckpiece is aligned with the mouth. [Demonstrates]. Prepare the desired fingering. [Demonstrates]. Prepare the desired distance from the neckpiece. [Demonstrates]. Breathe in. [Demonstrates]. Upon exhale, form the vowel or consonant shape desired with the mouth and then exhale into the saxophone producing the air pitch technique. [Demonstrates].

2.6 - Transposition Charts

Soprano Saxophone

Alto Saxophone

Tenor Saxophone

Baritone Saxophone

2.7 - Demonstration Videos for Air Pitch

Below, I will demonstrate the air pitch technique on all four main saxophones, show various transitions with the other SWMP techniques, and perform combinations with singing and common practicing saxophone playing. Each video is accompanied by a brief text for further elaboration.

Chromatic Scale Played on Soprano, Alto, Tenor, and Baritone Saxophones:
https://youtu.be/a6LKQjOwlPk
Here I demonstrate the air pitch technique on all four main saxophones using a neutral vowel with a basic and simple articulation. Please notice a rather even balance between pitch and the air sound.

Vowel and Consonant Color Combinations:
https://youtu.be/fPqwClWW6zQ
Many vowel and consonant combinations can be imagined resulting in various colors and textures. The saxophonist takes on the role of an actor or a singer by being asked to produce different textual elements through the saxophone. Proper pronunciation should be practiced away from the saxophone and then slowly integrated into practice with the instrument. Proper pronunciation and diction can be learned from and referenced by the International Phonetic Alphabet (IPA) to avoid confusion.[34] The speed of transitions between various vowel and consonant combinations is beholden to how fast a saxophonist can produce them.

Playing Positions:
https://youtu.be/CiPOSM2w7So
Altering the playing position to which one is asked to blow through the saxophone can result in different color and dynamic shadings that cannot be achieved otherwise. Changing the position of the instrument from one point to another (from the left to the right, for example) allows for an evolution of the sound through movement - effective in the sounding result and as a means of musical theater. However, unless otherwise noted, one should assume a normal “straight on” approach when performing the air pitch technique. The speed at which a transition occurs can be quite fast. Saxophonists should take caution in avoiding hitting their mouth, lips, or teeth when transitioning between playing positions.

The air pitch playing position should be considered when switching between or in combination with other techniques.

[34] A future elaboration of this research could involve the recording and cataloguing of different IPA pronunciations in order to hear and analyze the timbral shifts present from one phonetic pronunciation to the next. I was unable to explore this properly during this research project due to time constraints in the recording studio, but it is a gap that should be filled in the future.

Articulations:
https://youtu.be/WkHXFi4w5fE
Articulation variance is an important facet of the complex sound world that can be created with air pitch. While many combinations are possible, three basic approaches are presented in the video: single tonguing, double tonguing, and flutter tonguing. All approaches can be used in combination with each other. Many times, the tempo, rhythm, and vowel and consonant shapes demanded by a composer will force a saxophonist to use single or double tonguing. Speed of articulation is dependent on the technique of the saxophonist and the precise fingering combinations that are asked.

Flutter tonguing might pose a problem for some saxophonists depending on if they are physically able to perform the alveolar trill, more commonly known as a rolling "R."[35] There are two main areas in which the flutter tongue takes place: either in the back or the front of the oral cavity. The front "R" is commonly referred to as the "Spanish R" and is a harder, more pronounced attack. It is my preferred way to produce the flutter tongue ability with air pitch. The back "R" is commonly referred to as the "French R" and produces a softer sound with a rather weak sounding result. It is suited for more delicate passages or where amplification is present.

Air Pitch in Combination with other SWMP Techniques:
Air Pitch to Saxo-Flute Hybridity:
https://youtu.be/AVEZi7Yk8k4
Combining air pitch with saxo-flute hybridity is quite logical. One can interpret the air pitch technique as a precursor to saxo-flute hybridity. The pitched sound from air pitch is a "shadow" of the resultant fully-fledged sound present in saxo-flute hybridity. Here it is best to use an air pitch from a playing position that favors the saxo-flute hybridity technique depending on how fast the transition must be made.

Air Pitch to Tongue Rams:
https://youtu.be/fI4G1KKoTrk
Tongue rams are easily combined with the air pitch technique. Composers should note the pitch difference between an identical fingering using tongue ram and air pitch techniques. Transition speed between these techniques can be quite fast; however, the tongue ram will momentarily stop the flow of air. This means that a slight pause will occur after the tongue ram to allow the tongue to retract back from the neckpiece before other musical material can be performed.

Air Pitch to Trumpet Sounds:
https://youtu.be/7fcl2KDud0E
Trumpet sounds are rather easily combined with air pitch. Although a similar fingering can be used, the resultant pitches between the two techniques will vary. Composers

[35] For more information on developing an alveolar trill and the physical technique that should take place to make one, see Cheryl Lu (2019).

should indicate the saxophonist to perform the air pitch technique with a “straight on” playing position when they wish to combine it with trumpet sounds. There is an inherent dynamic inconsistency between these two techniques that must either be overcome by the saxophonist with dynamic scaling or taken advantage of by a composer. The speed of transition can be quite fast depending on the distance between the neckpiece and the saxophonist's mouth while performing the air pitch technique. In this way, the two techniques can be performed with a seamless transition.

In combination with other techniques:
Air Pitch and Singing:
https://youtu.be/TALjVDslbtk
Performing air pitch techniques while singing is possible and can be used to produce harmonies through the instrument, air pitch having one role and singing another. The two voices can be performed independently from each other in two-part counterpoint. The singing is produced from the back of the throat, much in the same way that one produces a growl on the instrument. The dynamic balance is something to take into consideration. The air pitch will naturally have a weaker dynamic than the voice. The speed of transition between the two can occur seamlessly. Composers should take note of the voice type of the performer and allow for the singing to be produced in a different octave depending on their individual comfort and tessitura.

Air Pitch to Normal Playing:
https://youtu.be/UBhJuvCIMFQ
Combining any of the SWMP techniques with common practice playing with the mouthpiece attached is possible. However, there are a few important factors that should be noted. The first is the transition time required to put the mouthpiece back on the saxophone. Allow the saxophonist around 5-10 seconds to pick up their mouthpiece, properly place it on the saxophone, potentially adjust the neckstrap, and finally prepare to play with the mouthpiece again. This delay can be used to create a sense of musical drama through silence or a theatrical gesture by taking off or placing back the mouthpiece. Alternatively, a composer can use a transition based on different musical materials and techniques. For example, while the saxophonist replaces or removes the mouthpiece, they could be instructed to sing, speak text, create different air sounds, or create key clicks with the saxophone.

The second factor is the possibility that the mouthpiece will make a sound as it rubs against the cork of the neckpiece. If this is a problem, it may be solved with the use of cork grease before performing the piece, although this is not a foolproof solution. However, it could also be a moment where a composer uses that sound as part of the work.

A third potential factor is the tuning of the instrument after placing the mouthpiece back on. This is typically not a major problem, as a practicing saxophonist will intuitively know where to place their mouthpiece to play in tune. If it is necessary to have the saxophonist

play perfectly in tune, composers should make sure to insert a bespoke moment in the piece where the performer can retune.

2.8 - Pitch Manual for Air Pitch

Soprano Saxophone							
Fingering	**Test 1 (Hz)**	**Test 2 (Hz)**	**Test 3 (Hz)**	**Test 4 (Hz)**	**Average (Hz)**	**Std Dev (Hz)**	**Musical Notation**
A#3 / B♭3	255.95	254.347	256.79	254.45	**255.38425**	1.19	**C4 minus 42 cents**
B3	263.9	266.47	261.6	259.22	**262.7975**	3.11	**C4 plus 8 cents**
C4	288.4	287.84	296.86	288.21	**290.3275**	4.36	**D4 minus 20 cents**
C#4 / D♭4	323.32	326.76	326.9	326.14	**325.78**	1.67	**E4 minus 20 cents**
D4	348	338.22	330.04	345.31	**340.3925**	8.04	**F4 minus 44 cents**
D#4 / E♭4	355.59	358.52	357.04	357.95	**357.275**	1.28	**F4 plus 39 cents**
E4	388.46	401.98	404.39	400.44	**398.8175**	7.09	**G4 plus 30 cents**
F4	432.61	433.08	432.07	433.47	**432.8075**	0.60	**A4 minus 29 cents**
F#4 / G♭4	458.41	457.42	458.64	461.97	**459.11**	1.98	**A#4 minus 26 cents**
G4	501.38	503.65	508.82	503.67	**504.38**	3.15	**B4 plus 36 cents**
G#4 / A♭4	555.67	547.41	534.45	543.24	**545.1925**	8.83	**C#5 minus 29 cents**
A4	583.11	593.51	597.32	601.65	**593.8975**	7.92	**D5 plus 19 cents**
A#4 / B♭4	641.94	640.94	635.21	640.46	**639.6375**	3.02	**D#5 plus 48 cents**
B4	684.08	693.18	683.77	685.49	**686.63**	4.43	**F5 minus 30 cents**
C5	738.45	727.86	746.1	700.19	**728.15**	20.08	**F#5 minus 28 cents**
C#5 / D♭5	811.58	817.63	813.01	815.47	**814.4225**	2.67	**G#5 minus 34 cents**
D5 (with palm keys)	846.19	844.32	846.53	850.27	**846.8275**	2.49	**G#5 plus 33 cents**
D#5 / E♭5 (with palm keys)	932.5	936.31	937.87	939.72	**936.6**	3.07	**A#5 plus 8 cents**
E5 (with palm keys)	992.2	973.01	934.33	1054.45	**988.4975**	50.12	**B5 plus 1 cent**
F5 (with palm keys)	1064.39	1094.39	1118.2	1099	**1093.995**	22.27	**C#6 minus 23 cents**
F#5 / G♭5 (with palm keys)	1127.5	1119.84	1108.34	1160.52	**1129.05**	22.41	**C#6 plus 31 cents**
G5 (with palm keys)	1224.49	1316.4	1338.24	1234.2	**1278.3325**	57.40	**D#6 plus 46 cents**

Alto Saxophone							
Fingering	**Test 1 (Hz)**	**Test 2 (Hz)**	**Test 3 (Hz)**	**Test 4 (Hz)**	**Average (Hz)**	**St Dev (Hz)**	**Musical Notation**
A#3 / B♭3	164.4	165.11	164.93	164.02	**164.615**	0.50	**E3 minus 2 cents**
B3	186.94	187.82	191.03	182.47	**187.065**	3.53	**F#3 plus 19 cents**
C4	197.64	201.5	199.12	193.69	**197.9875**	3.28	**G3 plus 17 cents**
C#4 / D♭4	210.37	211.82	209.11	212.71	**211.0025**	1.59	**G#3 plus 28 cents**
D4	220.55	232	229.54	228.76	**227.7125**	4.97	**A#3 minus 40 cents**
D#4 / E♭4	231.01	246.72	247.71	248.57	**243.5025**	8.36	**B3 minus 24 cents**
E4	262.41	262.81	263.33	259.28	**261.9575**	1.82	**C4 plus 2 cents**
F4	272.82	280.57	274.89	282.06	**277.585**	4.43	**C#4 plus 3 cents**
F#4 / G♭4	309.58	287.88	309.17	309.53	**304.04**	10.77	**D#4 minus 40 cents**
G4	318.18	320.3	320.8	323.98	**320.815**	2.40	**E4 minus 47 cents**
G#4 / A♭4	356.49	351.32	353.45	353.67	**353.7325**	2.12	**F4 plus 22 cents**
A4	392.93	392.42	388.25	391.68	**391.32**	2.11	**G4 minus 3 cents**
A#4 / B♭4	416.14	419.22	417.37	415.3	**417.0075**	1.70	**G#4 plus 7 cents**
B4	443.64	442.04	443.25	444.16	**443.2725**	0.90	**A4 plus 13 cents**
C5	496.71	493.31	497.46	496.74	**496.055**	1.86	**B4 plus 8 cents**
C#5 / D♭5	539.72	532.75	534.05	535.93	**535.6125**	3.03	**C5 plus 40 cents**
D5 (with palm keys)	559.09	571.61	578.76	562.34	**567.95**	8.95	**C#5 plus 42 cents**
D#5 / E♭5 (with palm keys)	613.47	613.3	614.02	613.78	**613.6425**	0.32	**D#5 minus 24 cents**
E5 (with palm keys)	630.95	628.68	630	630.54	**630.0425**	0.99	**D#5 plus 22 cents**
F5 (with palm keys)	690.89	684.48	692.9	692.21	**690.12**	3.85	**F5 minus 21 cents**
F#5 / G♭5 (with palm keys)	746.54	742.82	742.61	743.17	**743.785**	1.85	**F#5 plus 9 cents**

Tenor Saxophone							
Fingering	**Test 1 (Hz)**	**Test 2 (Hz)**	**Test 3 (Hz)**	**Test 4 (Hz)**	**Average (Hz)**	**St Dev (Hz)**	**Musical Notation**
A#3 / B♭3	121.73	123.03	122.16	122.31	**122.3075**	0.54	**B2 minus 16 cents**
B3	131.12	131.92	133.37	131.13	**131.885**	1.06	**C3 plus 14 cents**
C4	137.78	137.82	136.83	139.36	**137.9475**	1.05	**C#3 minus 8 cents**
C#4 / D♭4	154.12	152.07	153.09	153.04	**153.08**	0.84	**D#3 minus 28 cents**
D4	166.55	167.75	166.27	164.3	**166.2175**	1.43	**E3 plus 15 cents**
D#4 / E♭4	172.59	172.64	172.45	173.42	**172.775**	0.44	**F3 minus 18 cents**
E4	180.21	181.53	181.11	180.44	**180.8225**	0.61	**F#3 minus 40 cents**
F4	205.14	204.98	203.59	202.6	**204.0775**	1.21	**G#3 minus 30 cents**
F#4 / G♭4	220.28	224.18	224.66	223.26	**223.095**	1.96	**A3 plus 24 cents**
G4	232.58	232.51	233.33	231.98	**232.6**	0.56	**A#3 minus 4 cents**
G#4 / A♭4	255	254.13	254.08	254.12	**254.3325**	0.45	**C4 minus 49 cents**
A4	273.65	273.75	273.39	272.79	**273.395**	0.43	**C#4 minus 24 cents**
A#4 / B♭4	295.75	295.63	294.6	295.09	**295.2675**	0.53	**D4 plus 9 cents**
B4	317.25	316.38	317.78	318.24	**317.4125**	0.80	**D#4 plus 35 cents**
C5	358.56	355.99	357.17	360.98	**358.175**	2.14	**F4 plus 44 cents**
C#5 / D♭5	375.12	375.12	374.81	375.45	**375.125**	0.26	**F#4 plus 24 cents**
D5 (with palm keys)	414.23	414.99	414.33	414.31	**414.465**	0.35	**G#4 minus 4 cents**
D#5 / E♭5 (with palm keys)	439.87	440.55	440.73	441.13	**440.57**	0.53	**A4 plus 2 cents**
E5 (with palm keys)	473.93	474.85	475.28	473.53	**474.3975**	0.81	**A#4 plus 30 cents**
F5 (with palm keys)	523.59	523.66	523.28	524.01	**523.635**	0.30	**C5 plus 1 cent**
F#5 / G♭5 (with palm keys)	557.53	558.3	554.72	554.86	**556.3525**	1.83	**C#5 plus 6 cents**

Baritone Saxophone							
Fingering	**Test 1 (Hz)**	**Test 2 (Hz)**	**Test 3 (Hz)**	**Test 4 (Hz)**	**Average (Hz)**	**St Dev (Hz)**	**Musical Notation**
A3	74.6	74.95	74.7	74.87	**74.78**	0.16	**D2 plus 32 cents**
A#3 / B♭3	82.47	80.09	80.5	80.55	**80.9025**	1.07	**E2 minus 32 cents**
B3	85.9	86.14	86.03	86.24	**86.0775**	0.15	**F2 minus 25 cents**
C4	91.61	90.93	91.35	92.68	**91.6425**	0.75	**F#2 minus 16 cents**
C#4 / D♭4	101.36	101.83	101.97	100.74	**101.475**	0.56	**G#2 minus 40 cents**
D4	111.22	112.29	111.37	111.46	**111.585**	0.48	**A2 plus 25 cents**
D#4 / E♭4	117.89	117.12	117.68	116.58	**117.3175**	0.59	**A#2 plus 11 cents**
E4	124.41	127.2	123.37	122.33	**124.3275**	2.09	**B2 plus 12 cents**
F4	131.75	130.16	130.81	130.57	**130.8225**	0.67	**C3 plus 0 cents**
F#4 / G♭4	143.71	143.91	144.86	143.65	**144.0325**	0.56	**D3 minus 33 cents**
G4	153.72	155.02	153.6	153.52	**153.965**	0.71	**D#3 minus 18 cents**
G#4 / A♭4	165.06	166.12	165.06	167.37	**165.9025**	1.10	**E3 plus 11 cents**
A4	183.54	181.89	183.36	183.49	**183.07**	0.79	**F#3 minus 18 cents**
A#4 / B♭4	190.29	190.75	192.15	191.76	**191.2375**	0.86	**G3 minus 43 cents**
B4	211.42	207.71	210.24	211.15	**210.13**	1.69	**G#3 plus 21 cents**
C5	227.33	226.4	228.54	224.78	**226.7625**	1.59	**A#3 minus 48 cents**
C#5 / D♭5	247.12	247.75	248.39	248.49	**247.9375**	0.64	**B3 plus 7 cents**
D5 (with palm keys)	260.15	258.68	259.02	258.8	**259.1625**	0.67	**C4 minus 16 cents**
D#5 / E♭5 (with palm keys)	276.21	278.22	276.84	277.45	**277.18**	0.86	**C#4 plus 0 cents**
E5 (with palm keys)	299.49	298.62	298.52	299.69	**299.08**	0.60	**D4 plus 32 cents**
F5 (with palm keys)	320.03	320.29	320.44	320.09	**320.2125**	0.19	**D#4 plus 50 cents**
F#5 / G♭5 (with palm keys)	349.98	348.86	349.73	349.54	**349.5275**	0.48	**F4 plus 1 cent**