# Skeleton measurement sheet

| | |
|---|---|
| Location: | Frankfurt |
| Inv. N°: | X4267 |
| Measured: | 10/04/2000 |
| | & 23/06/2006 |
| Pitch @ a=440hz: | d' |
| Total length: | 549 |
| Speaking length: | 504 |
| Windway length: | 45 |
| Material: | Sycamore or maple, dark stained |
| mark: | *ff* below window, P M under bell |

| | FINGERHOLES | | | | | External diameters | |
|---|---|---|---|---|---|---|---|
| | length | | diameter | | direction | from top | Ø |
| | *(from top)* | (from bl) | east/w | north/s | ⇧⇨⇩⇦ | bl | 32.4 |
| **X** | *235* | 190 | 5.7 | 6.5 | | hole X | 26.5 |
| **1** | *247.5* | 202.5 | 5.8 | 6.4 | | 1 | 26.3 |
| **2** | *283* | 238 | 6.3 | 6.9 | | 2 | 25.3 |
| **3** | *319* | 274 | 6.9 | 7.3 | | 3 | 24.6 |
| **4** | *367.5* | 322.5 | 7.0 | 7.6 | | 4 | 24.3 |
| **5** | *403* | 358 | 6.5 | 6.8 | | 5 | 24.1 |
| **6** | *436.5* | 391.5 | 6.7 | 6.9 | | 6 | 24.1 |
| **7 west (r hand player)** | *471* | 426 | 5.2 | 5.5 | ⇩ | 7 | 25.0 |
| **7 east** | | none | | | | | |

| | | | | | |
|---|---|---|---|---|---|
| Step: | | Window width: | 11.6 | | |
| Edge thickness: | c. 0.5 | Cutup | 5.2 | | |
| | | | | bottom | 47.8 |
| Windway exit chamfers: up | no visible | Ramp width north | 12.5 | | |
| down | very slight | south | 13.8 | | |
| W/W entrance: width | 15.1 | Ramp length: west | 17 | | |
| height | 2.5 | east | 16.6 | | |
| | | middle | 21 | | |
| Beak cut away: | 30 | | | | |

**NOTES:**

block is completely round, labium curvature is bore radius

lump "choke" glued into bore just below hole 7, bore measurements below hole 6 are infulenced by contraction. likely bore at this point is cylindrical

taper at top of bore most unusual, contributing in all probability to the narrow octaves

instrument is mate to X 4268

both instruments fit nicely into case number X 4269, which has turned out flare to accommodate bell flare

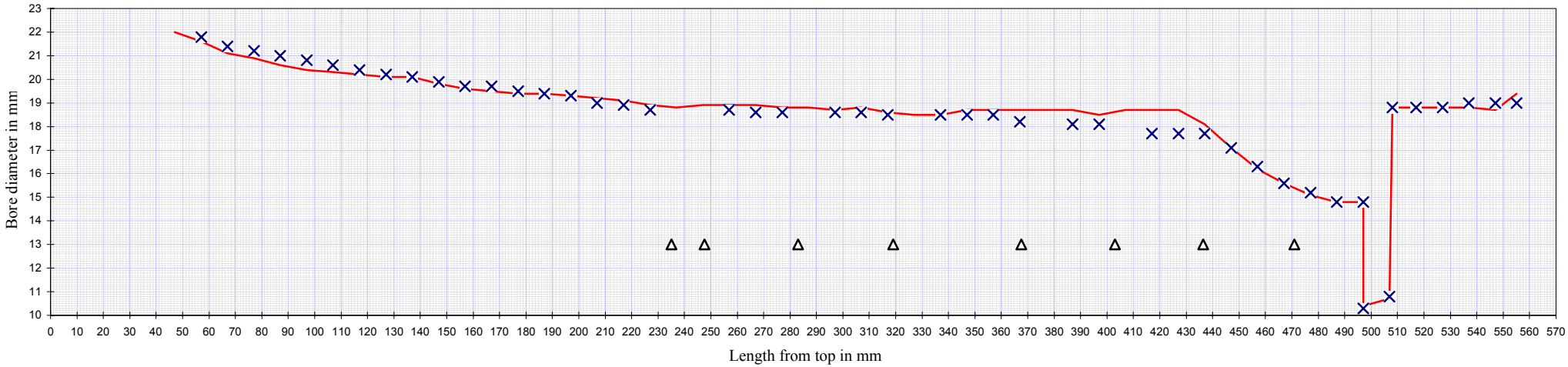
instruments in good condition, but both play badly. soft low notes and very narrow octaves.

van Eyck fingering

# Frankfurt X4267 FF.PM tenor.xls, Bore from top

| Length | Ø⇦⇨ | Ø⇧⇩ | | Length | Ø⇦⇨ | Ø⇧⇩ | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 47 | 22.0 | | | 347 | 18.7 | 18.5 | | | | |
| 57 | 21.6 | 21.8 | | 357 | 18.7 | 18.5 | | | | |
| 67 | 21.1 | 21.4 | | 367 | 18.7 | 18.2 | | | | |
| 77 | 20.9 | 21.2 | | 377 | 18.7 | | | | | |
| 87 | 20.6 | 21.0 | | 387 | 18.7 | 18.1 | | | | |
| 97 | 20.4 | 20.8 | | 397 | 18.5 | 18.1 | | | | |
| 107 | 20.3 | 20.6 | | 407 | 18.7 | | | | | |
| 117 | 20.2 | 20.4 | | 417 | 18.7 | 17.7 | | | | |
| 127 | 20.1 | 20.2 | | 427 | 18.7 | 17.7 | | | | |
| 137 | 20.1 | 20.1 | | 437 | 18.1 | 17.7 | | | | |
| 147 | 19.8 | 19.9 | | 447 | 17.1 | 17.1 | | | | |
| 157 | 19.6 | 19.7 | | 457 | 16.2 | 16.3 | | | | |
| 167 | 19.5 | 19.7 | | 467 | 15.6 | 15.6 | | | | |
| 177 | 19.4 | 19.5 | | 477 | 15.1 | 15.2 | | | | |
| 187 | 19.4 | 19.4 | | 487 | 14.8 | 14.8 | | | | |
| 197 | 19.3 | 19.3 | | 497 | 14.8 | 14.8 | | | | |
| 207 | 19.2 | 19.0 | | 497 | 10.4 | 10.3 | | | | |
| 217 | 19.1 | 18.9 | | 507 | 10.7 | 10.8 | | | | |
| 227 | 18.9 | 18.7 | | 508 | 18.8 | 18.8 | | | | |
| 237 | 18.8 | | | 517 | 18.8 | 18.8 | | | | |
| 247 | 18.9 | | | 527 | 18.8 | 18.8 | | | | |
| 257 | 18.9 | 18.7 | | 537 | 18.8 | 19.0 | | | | |
| 267 | 18.9 | 18.6 | | 547 | 18.7 | 19.0 | | | | |
| 277 | 18.8 | 18.6 | | 555 | 19.4 | 19.0 | | | | |
| 287 | 18.8 | | | | | | | | | |
| 297 | 18.7 | 18.6 | | | | | | | | |
| 307 | 18.8 | 18.6 | | | | | | | | |
| 317 | 18.6 | 18.5 | | | | | | | | |
| 327 | 18.5 | | | | | | | | | |
| 337 | 18.5 | 18.5 | | | | | | | | |

# Frankfurt X4267 FF.PM tenor.xls, bore graph

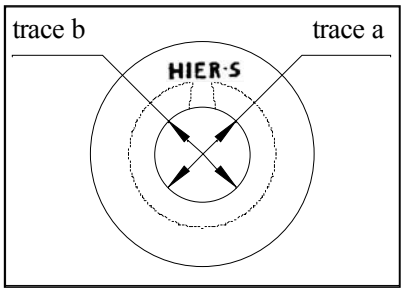


| | I = | d' | | | Temp. | 19° | |
|---|---|---|---|---|---|---|---|
| | Tuner set to | a=440hz | Equal tempered | | Humidity | 52% | |
| **Note** | **Cents deflection from 0** | **Pressure mm $H_2O$** | **Fingering, where different** | **Note** | **Cents deflection from 0** | **Pressure mm $H_2O$** | **Fingering, where different** |
| **I** | -5 | 7 | | **VIII** | -40 | 12 | |
| | | | | | | | |
| **II** | +30 | 5 | | **IX** | -55 | 13 | |
| | | | | | | | |
| **III** | +20 | 10 | | **X** | -60 | 18 | |
| **IV** | +20 | 10 | | **XI** | | | |
| | | | | | | | |
| **V** | 0 | 10 | | **XII** | -40 | 25 | |
| | | | | | | | |
| **VI** | -20 | 10 | | **XIII** | -10 | 26 | |
| | | | | | | | |
| **VII** | -50 | 11 | | **XIV** | -30 | 28 | |
| | | | | **XV** | -60 | 35 | |
| | | | | | | | |

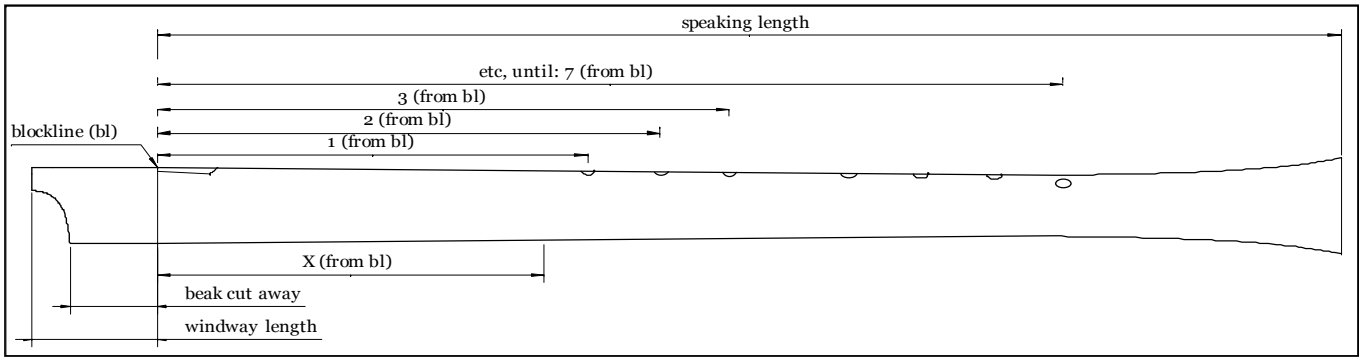
I has a harmonic strength that was obviously the idea behind these instruments, but II is very weak and the octaves are worse than 4268
Sound is better however and more focused

# KEY AND NOTES TO MEASUREMENT SHEETS

All attempts at measuring are necessarily subjective and the current survey was undertaken with some finite objectives: To undertake an inclusive study of ALL the recorders, using a skeleton format of the most important measurements and minimal intervention. The bores were measured from the bottom, using a strain gauge based digital internal caliper. This has the advantage that bores can be measured with the blocks in situ, thus preventing damage to this sensitive part. Normally, two traces were made, at approximately 90° from each other, avoiding the fingerholes where possible. Calculations were then made to give internal diameters from the top of the instruments, and allow bore traces to be plotted.



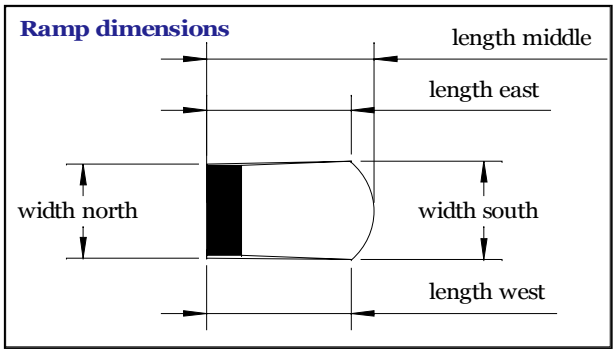

| FIELD | TYPICAL VALUE | EXPLANATION |
|---|---|---|
| Location: | | Town, collection or both, where the instrument is currently located |
| Inv. N°: | | Inventory number of the instrument |
| Measured: | | Name of measurer |
| Date: | | Date of measurements, where known |
| Pitch @ a=440hz: | | Pitch in terms of lowest note, all holes covered, relative to modern pitch (a=440hz). + or - indicates a quarter tone step, relative to modern pitch |
| Material: | | Material from which the instrument is made |
| mark: | | Mark or stamp visible on the instrument, branded or embossed by maker or owner |

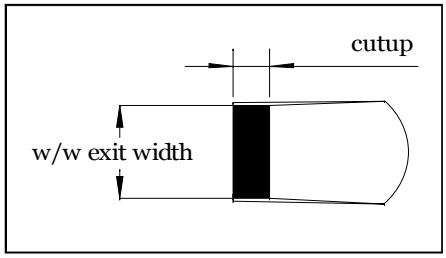



| | | |
|---|---|---|
| FINGERHOLES | | Tone, or fingerholes of the instrument |
| length | | |
| (from bl) | | (See drawing above) |
| *(from top)* | | Sum of length from blockline and windway length |
| diameter | | |
| east/w | | Fingerhole minimum diameter in an east to west direction |
| north/s | | Fingerhole minimum diameter in a north to south direction |
| direction | | |
| ⇧⇨⇩⇦ | | Indicates if a fingerhole is bored obliquely, or undercut with an unusual bias, and in which direction |
| Step: | | Difference between lower surface of edge (labium) and upper surface of windway ceiling. Typically, this measurment is a visual estimate, given that the blocks would not normally be removed |
| Edge thickness: | | Thickness of edge (labium). Measured by impression made in fine gum and compared using feeler gauges |
| Windway exit chamfers: up | small, c. 0.6 | Chamfer on upper surface of windway exit (on ceiling) |
| | flat | An estimate of its angle |
| down | 2.0 | Chamfer on lower surface of windway exit (on block) |
| | 45° | An estimate of its angle |

(These measurements have either been obtained by the same method as the edge thickness, or are a visual estimate)

| | | |
|---|---|---|
| W/W entrance: width | | Width of windway entrance, |
| height | | Height of windway entrance, distance between windway ceiling and block surface |
| External diameters (east - west) | | Diameter of the instrument's exterior<br>Measured at 90 degrees to the longitudinal plane of the fingerholes |
| distance from top | | Distance from the north end of the instrument, at which measurement was taken. Note: On basses with fontanelles, the aproximate measurements of beads and fontanelle supports were also included. |




| | | |
|---|---|---|
| **Cap** | | Measurements relative to cap |
| Overall length | 99 | Total length of the cap |
| internal Ø | 57.6 | Approximate internal diameter of cap recess |
| depth | 73 | Maximum depth of cap recess |
| largest external Ø | 74.7 | Maximum diameter of caps external turning |
| hole Ø | 11.8 | Diameter of crook hole, where appropriate |
| blow hole | | Width and height of blowing hole, where appropriate |
| ring width | 21.6 | Width of brass strengthening ring |
| Ø | 64 | Diameter of brass strengthening ring |
| **Fontanelle** | | Measurements relative to fontanelle |
| Overall length | 151 | Total length of fontanelle |
| internal Ø south | 69.5 | Approximate internal diameter of lower end |
| internal Ø north | 64.3 | Approximate internal diameter of upper end |
| largest external Ø | 81.2 | Maximum exterior diameter, typically scored with a line though the middle of the roses |
| north ring width | 22.5 | Width of upper brass strengthening ring |
| Ø | 71.7 | Diameter of upper brass strengthening ring |
| south ring width | 22.9 | Width of lower brass strengthening ring |
| Ø | 78.5 | Diameter of lower brass strengthening ring |
| rose Ø | 28 | Diameter of the largest ring of hole arrangement. Typically holes are arranged in three rings, with an extra hole in the centre. |
| holes | 3 | Diameter of the rose holes |

For the exterior of the instruments, measurements were taken at strategic points, relative to the functionality of the instruments. Some decorative details, particularly with regard to the bass instruments, were also recorded to allow a faithful reproduction to be made.
Concerning the voicing of the instruments, only the most basic details such as those concerning the window and ramp, windway width could be recorded with any surety. Many of the blocks are badly damaged, missing or replacements and it was felt that little would be gained by miniscule examination of these areas. From instruments with an undamaged labium or chamfers, estimates were made to give instrument makers an idea of the sort of degree of voicing these recorders might have originally had.
The recorders were mouth blown and measurements taken with a Korg tuner calibrated in equal temperament at a=440hz, Readings were taken as cents deflection from this two pitch standard. The pressure measurements were read in millimetres of water column, using an Appleby and Ireland pressure gauge with the range 0 to 100 mm/H2O.
Each instrument was blown to find the centre of the sound and the pressure and pitch recorded. Where fingerings other than the st
The following fingerings were tested.

| Note | Fingering |
|---|---|
| I | 1234567 |
| II | 0123456- |
| III | 012345-- |
| IV | 01234-5- |
| V | 0123---- |
| VI | 012----- |
| VII | 01------ |
| VIII | 0-2----- |
| IX | -------- |
| X | 0/12345-- |
| XI | Not recorded |
| XII | 0/123---- |
| XIII | 0/12----- |
| XIV | Various |
| XV | Various |

It was not deemed necessary to take readings for note XI due to different half holing of hole 6. All recorders were tried for Jambe de Fer and Ganassi fingerings and where this was successful, the fingerings were recorded.