HYBR
Definitive pipes as made, tuned and measured::

* f0 = fundamental resonant frequency
* l/d = pipe length to internal diameter ratio
* f1 = first overtone frequency, followed by the ratio to the fundamental
* f2 = second overtone frequency, followed by the ratio  to the fundamental
* f3 = thirth overtone frequency, followed by the ratio to the fundamental
* L = pipe length in mm
* De = outer diameter of the tube in mm
* Di = internal diameter of the tube in mm
* SPL= Sound pressure level with a 5Vrms sine wave drive, in dBA measured at 30cm from open end.
* The first column gives the MIDI-note number.

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|   | f0 | l/d | f1 | f2 | f3 | L | De | Di | SPL |
| 33 | 55.0 | 31.8 | 165 [3.00] | 219 [3.98] | 270 [4.91] | 1461 | 50 | 46.4 | 68 |
| 34 | 58.3 | 29.9 | 175 [3.00] | 233 [4.00] | 288 [4.94] | 1378 | 50 | 46.4 | 78 |
| 35 | 61.7 | 28.2 | 183 [2.96] | 245 [3.97] | 286 [4.63] | 1295 | 50 | 46.4 | 77 |
| 36 | 65.4 |  26.4 |  195 [2.98] |  258 [3.94] |  306 [4.68] |  1216 |  50 |  46.4 |  81 |
| 37 | 69.3 |  24.8 |  210 [3.03] |  274 [3.95] |  323 [4.66] |  1142 |  50 |  46.4 |  76 |
| 38 | 73.4 |  23.3 |  218 [2.97] |  291 [3.96] |  344 [4.68] |  1073 |  50 |  46.4 |  82 |
| 39 | 77.8 | 21.8 | 235 [3.25] | 359[4.61] | 772 [9.92] | 1005 | 50 | 46.4 |   |
| 40 | 82.4 | 20.5 | 244 [2.96] | 330 [4.00] | 468 [5.68] | 949.5 | 50 | 46.4 |  82 |
| 41 | 87.3 | 19.9 | 262 [3.00] | 352 [4.03] | 700 [8.02] | 880 |  50 |  46.4 |   |
| 42 | 92.5 |  17.9 |  274 [2.96] | 377 [4.08]  |  523 [5.65] |  833 |  50 |  46.4 |  82 |
| 43 | 98.0 | 16.8 | 193 [1.97] | 260 [2.65] | 384 [3.92] | 780.5 | 50 | 46.4 |  86 |
| 44 | 103.8 |  16.6 |  202 [1.95] | 271 [2.61]  | 412 [3.97]  |  732 |  50 |  44 |  88 |
| 45 | 110.0 |  15.6 |  212 [2.02] | 291 [2.64] |  428 [3.89] |  686 |  50 |  44 |  88 |
| 46 | 116.5 |  14.6 |  231 [1.98] |  312 [2.68] | 444 [3.82]   |  643 |  50 |  44 |  84 |
| 47 | 123.5 |  13.7 |  246 [1.99] | 328 [2.66]  | 460 [3.72]  |  601 |  50 |  44 |  88 |
| 48 | 130.8 |  12.8 |  262 [2.00] |  342 [2.61] | 484 [3.7]  | 563.5  |  50 |  44 |  90 |
| 49 | 138.6 |  11.9 |  286 [2.06] | 356 [2.57]  | 614 [4.43]  |  523.5 |  50 |  44 |  91 |
| 50 | 146.8 |  11.1 |  302 [2.06] |  642 [4.37] | 858 [5.84]  |  488.6 |  50 |  44 |  89 |
| 51 | 155.6 | 9.8 | 310 [1.99] | 340 [2.18] | 583 [3.74] | 451 | 50 | 46.4 |   |
| 52 | 164.8 | 10.9 |  341[2.07] |  651[3.95] |  1035 [6.28] | 405 | 40 | 37 |  88 |
| 53 | 174.6 | 9.8 |  387 [2.21] |  725 [4.15] | 1160 [6.64]  | 362 | 40 | 37 |  93 |
| 54 | 185 | 9.5 |  395 [2.13] | 739 [3.99]  |  1199 [6.45] | 352 | 40 | 37 |  87 |
| 55 | 196 | 9.3 |  497 [2.53] | 996 [5.08]  | 1596 [8.14]  | 263 | 32 | 28.4 |  93 |
| 56 | 207.6 | 7.7 |  549 [2.64] | 1146 [5.52]  | 1848 [8.90]  | 220 | 32 | 28.4 |  89 |
| 57 | 220 | 7.3 |  545 [2.48] | 1196 [5.44]  | 1964 [8.92]  | 208 | 32 | 28.4 |   |
| 58 | 233.1 | 5.7 | 762 [3.26] | 1715 [7.36] | - | 125 | 25 | 22 |  92 |
| 59 | 246.9 |  4.97 |  840 [3.4] | 1900 [7.69] |  - |  109.5 |  25 |  22 |  83 |
| 60 | 261.6 |  51.0 |  466 [1.78] | 664 [2.54]  | 863 [3.30]  |  689 |  20 |  17 |  83 |
| 61 | 277.2 |  38.3 |  470 [1.69] |  682 [2.46] | 900 [3.25] |  652 |  20 |  17 |  86 |
| 62 | 293.7 |  35.7 |  513 [1.75] | 726 [2.47] | 962 [3.27]  |  607 |  20 |  17 |   |
| 63 | 311.1 |  33.2 |  538 [1.73] |  768 [2.47] | 1004 [3.22] |  565 |  20 |  17 |  86 |
| 64 | 329.6 |  30.0 | 606 [1.84]  | 978 [2.97]  | 1129 [3.43]  |  511 |  20 |  17 |   |
| 65 | 349.2 |  28.1 | 628 [1.80]  | 909 [2.6]  | 1206 [3.46]  | 478  |  20 |  17 |   |
| 66 | 370 |  26.5 | 658 [1.78]  | 936 [2.53]  | 1243 [3.36]  | 451  |  20 |  17 | 83  |
| 67 | 392 |  31.4 |  711 [1.81] | 973 [2.48]  | 1312 [3.35]  |  427 |  16 |  13.6 |   |
| 68 | 415.3 |  29.0 |  750 [1.81] | 1005 [2.42]  | 1368 [3.3]  |  395 |  16 |  13.6 |  78 |
| 69 | 440.0 |  27.2 |  764 [1.74] | 1063 [2.42]  | 1450 [3.3]  | 370  |  16 |  13.6 |   |
| 70 | 466.2 |  25.2 |  776 [1.66] | 1104 [2.37]  | 1544 [3.31]  | 342  |  16 |  13.6 | 85  |
| 71 | 493.9 |  23.4 | 820 [1.66]  | 1186 [2.4]  | 1665 [3.37]  |  318.1 |  16 |  13.6 | 86  |
| 72 | 523.2 |  21.3 |  893 [1.70] |  1325 [2.53] | 1866 [3.56]  |  290.2 | 16  |  13 |  87 |