	A	B	C	D	E	F	G	H	I
1	**I. Bocal**		Original bocal; Heckel4 no						
2	dia reed end		inside diameter of reed end of bocal						
3	bocal string length (0, 1)		length of bocal inserted into receiver						
4	metal bocal length top (0, 1)		meas. along top of bocal						
5	metal bocal length bot (0, 1)		meas. along bottom of bocal						
6	dia wj end		inside diameter of bocal						
7									
8	bocal logic	2	if bocal logic = 0 => bocal is choke; if bocal logic = 1 =>choke in wing joint calc; if bocal logic = 2 => no bocal						
9									
10									
11									
12									
13	**II. Wing Joint Lengths**		bocal receiver; Heckel4 there is NOT a bocal receiver						
14	choke bore dia.	10.5	Heckel4, vrfd, larger than othere Heckels; logic 1; bore diameter of choke; logic 0; either diameter bocal bottom or beginning of bore at bottom or receiver						
15	receiver length (1, 0) (formally choke length)	50	logic 1; length of choke from top of wing joint; logic 0; length of receiver (same as string length)						
16	wing joint length	500	Heckel4 vrfd; total wing joint length, including tenon and socket						
17	tenon length	35	tenon length						
18									
19	wj f2	223	dist top of wing to where tone hole enters bore [not at the center of the tone hole]						
20	wj e	295							
21	wj d	335							
22									
23	Bore dia. Bottom of wing joint	15.9							
24	Bore dia. top of boot joint small side	16.5							
25	Bore dia. top of boot joint large side	24.1							
26									
27	**III. Boot Lengths**								
28	bj logic	1	logic=> if bj logic = 0 => plug removed; if bj logic = 1 => plug cannot be removed						
29	bj c	56	Heckel4 vrfd short; dist from top of boot to where topmost tone hole enter bore [not at center of tone hole]						
30	bj b	114	Heckel4 vrfd short						
31	bj a	275	Heckel4 Two tone holes, down bore tone hole 275mm See Extra Measures sheet						
32									
33	bjstotal [Needed for both boot logics]	365	Heckel4 vrfd; total length of boot, include socket, along the small bore side						
34	bjltotal [Needed for both boot logics]	365	total length of boot, include socket, along large bore side						
35	plug small [Need for logic 0 only]	0	plug thickness, large bore side						
36	plug large [Need for logic 0 only]	0	plug thickness, small bore side						
37									
38	boots [Needed for both boot logics]	365	hook length along s bore => bjs-septum length = boot - septum <= calc the septum						
39	bootl [Needed for both boot logics]	365	hook length along l bore => bjl-septum length = boot - septum <= calc the septum						
40			Note: Heckel4 hook length and boot joint total the same, U-tube						
41	boots bottom [Needed for both boot logics]	20.7	Heckel4 length to bottom of U-tube; use hook, dist of bore [dist on stick plus 7mm, diff between hook and bot of stick]						
42	bootl bottom [Needed for both boot logics]	20.7	use hook, dist of bore [same as boots bot except tenon depth will be different]						
43									
44	extreme bore [Needed for logic 1 only]	43.3	Outside dia of plug [measured] = small bore dia + large bore dia + the septum width						
45									
46	septum length exp [Need for logic 0 only]		dist. from very bottom of boot to septum [point between the large and small bore]						
47	septum length calc - do not imput value	0	dist. From very bottom of boot to spetum [bjl - bootl]	do not imput value					
48	septum length - do not imput value	0	if bj logic = 0 => septum = septum exp; if bj logic = 1 => septum = septum calc	do not imput value					
49									
50	sbore dia sep* [Needed for both boot logics]	19.9	septum small bore dia [assume = lbore dia sep]						
51	lbore dia sep* [Needed for both boot logics]	20	septum large bore dia [assume = sbore dia sep] [mesure if cork can be removed; for Logic 0]						
52	sep width exp [Need for logic 0 only]		septum width; direct measurement if remove plug						
53	sep width calc - do not imput value	3.4	septum width; calc. => extreme bore - sbore - lbore	do not imput value					
54	sep width - do not imput value	3.4	if bj logic = 0 => sep width = sep width exp; if bj logic = 1 => sep width = sep width calc	do not imput value					
55									
56	bj g	310	dist from top of boot (socket) to where G hole enters bore [not at cent of tone hole]						
57	bj f1	108	dist from top of boot (socket) to where F1 hole enters bore [not at cent of tone hole]						
58									
59									
60									
61									
62									
63	**IV. Tone Hole Diameters**								
64	f2	5.9							
65	e	7.3							
66	d	6.3							
67									
68	c	7.1							
69	b	7.2							
70	a	9.8	Heckel4; A tone hole venting for G key; two tones going into different bores.						
71	g	10.7	Heckel4; A tone venting into large bore: 9.0mm diameter; both have metal inserts						
72	f1	11.5	Heckel4; G tone hole note lined						
73									
74	e1	15.5	e1 tone hole dia, on long joint [need to average NS and EW dias, NS usually greater]						
75	d1	17.7	d1 tone hole dia, on long joint						
76	c1	15.4	c1 tone hole dia, on long joint [need to average NS and EW dias, NS usually greater]						
77									
78									
79									
80									
81									
82	**V. Tone Hole Depths**								
83	f2	27.2							
84	e	28.7							
85	d	32.6							
86									
87	c	20.5							
88	b	21.5							
89	a	22.5	Heckel4; down bore tone hole 22.5; up bore tone hole 16.3mm. two tones going into different bores						
90	g	16.5	meas along bot tone hole wall [north wall, toward reed,tone hole usually at angle]						
91	f1	20	meas along east side tone hole wall [north wall, toward reed,t hole usually at angle]						
92									
93	e1	5.7	e1 tone hole depth;meas east/west with deapth gauge [at center, or shortest dist]						
94	d1	5.2	d1 tone hole depth; meas east/west with deapth gauge [at center, or shortest dist]						
95	c1	5	c1 tone hole depth; meas east/west with deapth gauge [at center, or shortest dist]						
96									
97									
98									
99									
100									
101	**VI. Long Joint**		Heckel4 a table along long joint						
102	lg_length	610	SaxCJ5 vrfd; total length of long joint						
103	lg_tenon_bot	36.4	length bottom tenon on long joint [tenon going into boot joint]						
104	lj_bot_bore	24.2	long joint bottom tenon bore diameter [tenon going into boot joint]						
105	lj_top_bore	34.5	long joint top tenon bore diameter [tenon going into bell]						
106	lg_tenon_top	38.4	length top tenon on long joint [tenon going into bell]						
107	e1_distance	48	dist long joint tenon to e1 [from bot of tenon to where tone hole enters bore]						
108	d1 distance	259	dist long joint tenon to d1 [from bot of tenon to where tone hole enters bore]						
109	c1 distance	544	dist long joint tenon to c1 [from bot of tenon to where tone hole enters bore]						
110									
111									
112									
113									
114									
115	**VII. Bore diameters at Tone Holes**								
116	f2	13.8							
117	e	14							
118	d	14.2	Heckek4 wing bore in bad state, too large						

	A	B	C	D	E	F	G	H	I
119									
120	c	16.2							
121	b	17							
122	a	19	Heckel4 A Tone hole veniting on down bore 19.0mm vrfd; Two tones going into different bores						
123	g	20.1	Heckel4 A Tone hole veniting on up bore 21.4mm vrfd; Two tones going into different bores						
124	f1	23.2							
125									
126	e1	25.6	e1 tone hole bore diameter on long joint						
127	d1	29.4	d1 tone hole bore diameter on long joint						
128	c1	33.3	c1 tone hole bore diameter on long joint						
129									
130									
131									
132									
133									
134	**VIII. Bell**								
135	bell_logic	0	If bell_logic = 0 => normal conical bore; if bell_logic = 1 => inverted concial bore; if bell_logic = 2 => bell expansion						
136	bell_length (0, 1, 2)	336	total length of bell						
137	bell_bot_bore (0, 1, 2)	34.5	dia bore at the bottom of bell [end with socket];						
138	bell_top_bore 0, (1, 0, 2)	37.5	dia bore at the top of bell [where low Bb exits]						
139	bell_center_bore (only for logic 2)		dia bore at max center of expansion						
140	bell_wall (only for logic 2)		bell wall thickness, Just for David						
141	bell_bot_bore_expansion (only for logic 2)		dist of bottom to maxium of expansion [including bell socket length,if bell logic=0 =>100]						
142	Outside diameter of wood at expansion		Just for David						
143	bell_tenon (0, 1, 0, 2)	38.5	bell socket length						
144	bell_expansion_length (only for logic 2)		distance of maxium expansion to top of bell [where Bb exits]						
145	belflq	74.9	Usually about 10mm more than line 138;						
146									
147									
148	**IX. PITCH**								
149	pitch	440	input the historical pitch of the bassoon, must input value, best guess						
150	freq_init	380	Initial frequency range variable						
151	Delta frequency	3	frequency increment parameter						
152	Number of frequencies	18	number of frequencies to scan for min chi sq						
153	Frequency adjust	1.05	frequency adjustment parameter						
154	**X. Title**								
155	title		Bassoon Calculation: Heckel4-O-Murry-Wq1-WOB-DNM						
156									
157			Notes on long joint bore: Heckel4 normal						
158			Notes on boot joint bore: Heckel4 OOR in regions						
159	**XI. Bore Diameter Locations**		Notes on wing joint bore: Heckel4 very bad state, too large						
160		20	Number of diameters						
161	**Bell Bore;** almost cylindrical, very OOR	10.5	Initial bore diameter [do not include in line 160 counting]						
162	34.5mm dia. at socket	0	dist1; measured from the bottom of the wing joint- 10mm				1		
163	35mm rod 130mm from bell top	395	Heckel4 vrfd large bore; dist2; measured from the bottom of the wing joint- 11mm				1		
164	36.5mm dia.at bell end	375	Heckel4 vrfd large bore; dist3; measured from the bottom of the wing joint- 12mm				1		
165		320	Heckel4 vrfd large bore; dist4; measured from the bottom of the wing joint- 13mm				1		
166		210	dist5; measured from the bottom of the wing joint- 14mm				1		
167		125	dist6; measured from the bottom of the wing joint- 15mm	Bottom wing jt	15.9		1		
168		0	dist7; measured from the top of the bootjoint - small bore side- 16mm	top boot small	16.5		1		
169		120	dist8; measured from the top of the bootjoint - small bore side- 17mm	top boot large	24.1		2		
170		195	dist9; measured from the top of the bootjoint - small bore side- 18mm				2		
171		280	dist10; measured from the top of the bootjoint - large bore side- 19mm	sbore dia sep	19.9		2		
172		345	dist11; measured from the top of the bootjoint - large bore side- 20mm	lbore dia sep	20		3		
173		285	dist12; measured from the top of the bootjoint - large bore side- 21mm	Hook Length	365		3		
174		225	dist13; measured from the top of the bootjoint - large bore side- 22mm				3		
175		142	dist14; measured from the top of the bootjoint - large bore side- 23mm				3		
176		0	dist15; measured from the top of the long joint- 24mm	lj_bot_bore	24.2		3		
177		587	dist16; measured from the top of the long joint- 25mm				4		
178		545	dist17; measured from the top of the long joint- 26mm				4		
179		470	dist18; measured from the top of the long joint- 27mm				4		
180		420	Heckel4 OOR; dist19; measured from the top of the long joint- 28mm				4		
181		365	dist20; measured from the top of the long joint- 29mm				4		
182		310	dist21; measured from the top of the long joint- 30mm				4		
183		240	dist22; measured from the top of the long joint- 31mm				4		
184		195	dist23; measured from the top of the long joint- 32mm	lj_top_bore	34.5		4		
185	135 Rod 33mm								