

SOLRS - Waterloo Central Railway
50 Isabella Street, P.O.Box 546, St. Jacobs, ON. N0B 2N0

Steam Locomotive 124

CLC 0-4-0 SN: 1896

Boiler Thickness Measurements



Prepared by Stephen Leis
3/5/2017

Locomotive:

Steam Locomotive Number 124

0-4-0 Standard Gauge Saddle Tank Industrial Switcher

Built –February 1930 by Canadian Locomotive Company Ltd. in Kingston, Ontario

Original owner Beauharnois Construction Company

Serial Number: 1896

Boiler Pressure 170 PSI; Originally fired on Oil



<http://www.kingstonist.com/2012/07/24/canadian-locomotive-company/> By Queens Archives. Three locomotives of the same model photographed to document the engines at CLC ready to be shipped to the client eager to take delivery.

Ultrasonic Thickness Measurement

Chalk grid applied to boiler at 4" x 4" intervals.

Equipment: Mitutoyo MU Gage Meter; Model Std 179-201; calibrated daily.

Flues and tubes were removed from main barrel allowing access to perform thickness measurements inside the barrel, thus full coverage was obtained. All dimensions in all tables are in units of 0.001" of an inch.

Photo on front cover: Kaitlyn and Peter Leis (brother and sister team) chalking grid on No. 124 prior to measurements. Feb. 7, 2015 (Photo by David Banks)



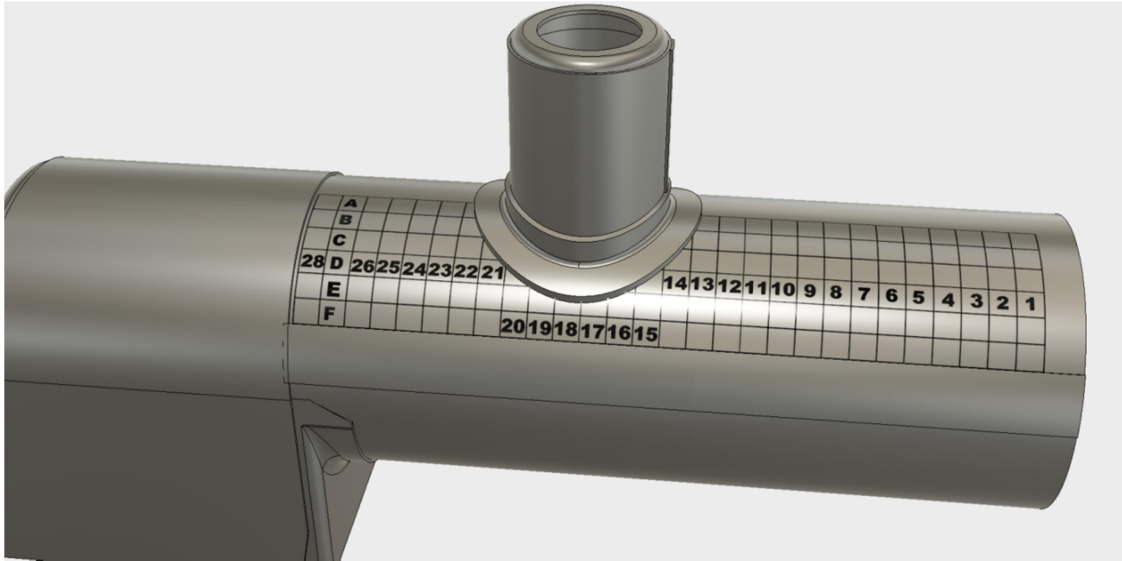
Peter Leis inside Main Barrel after removing most of the tubes and flues. (Photo by Stephen Leis)



Rendered image of Boiler component of Locomotive

Main Barrel – Engineer Side

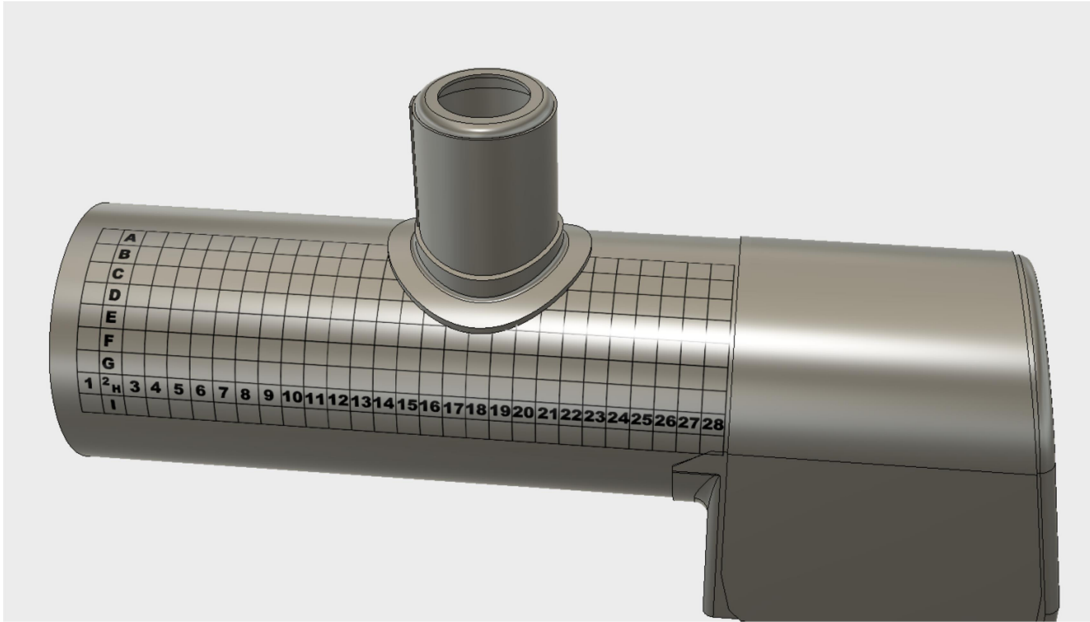
Grid from top dead center until exterior butt plate on engineer side. Design Thickness ½" (0.500")



	A	B	C	D	E	F
1	517	529	515	541	563	545
2	542	564	541	529	540	527
3	562	562	524	535	536	540
4	545	516	561	558	527	534
5	535	530	522	520	518	534
6	555	568	527	524	565	535
7	520	541	525	535	539	550
8	X	X	531	540	538	537
9	X	X	548	534	536	558
10	569	550	550	535	544	553
11	567	568	558	549	550	554
12	550	576	550	545	548	543
13	542	544	541	547	553	560
14	.	547	544	548	559	563
15	.	.	.	564	525	537
16	.	.	.	.	533	537
17	.	.	.	.	567	532
18	.	.	.	.	575	542
19	.	.	.	.	531	538
20	.	.	.	.	528	563
21	.	.	.	513	534	563
22	.	.	524	531	525	530
23	520	530	518	521	525	525
24	517	523	516	528	514	523
25	522	523	513	516	515	527
26	516	552	516	512	517	506
27	X	X	536	511	517	513
28	X	X	509	530	540	527

Main Barrel – Fireman Side

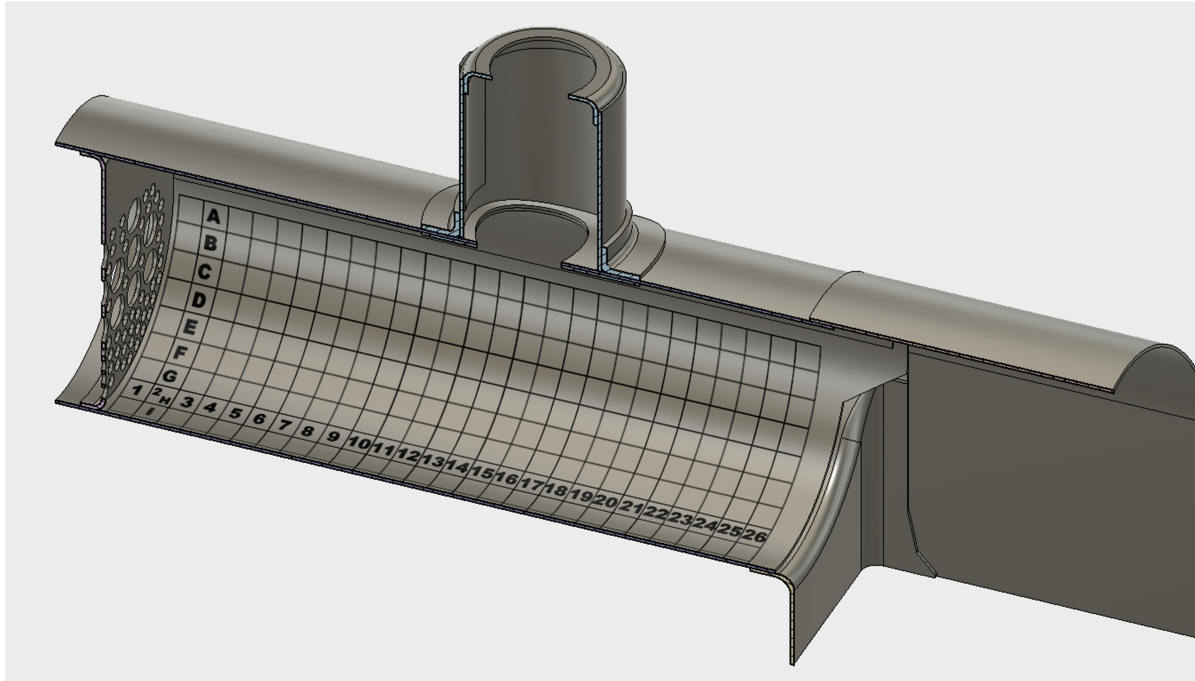
Grid from top dead center following down fireman side



	A	B	C	D	E	F	G	H	I
1	521	517	567	537	532	560	528	525	517
2	536	537	560	566	565	525	535	546	533
3	546	526	545	566	574	534	535	536	543
4	560	549	543	551	552	577	535	522	531
5	545	546	516	569	564	547	546	574	541
6	546	560	550	540	540	555	551	542	553
7	531	563	540	567	581	566	553	556	587
8	B	B	583	559	556	564	578	534	517
9	B	B	563	573	571	542	583	544	555
10	584	576	571	573	566	549	580	550	545
11	571	571	570	544	569	552	580	543	554
12	546	563	551	542	541	544	562	555	540
13	548	547	595	570	546	570	550	576	542
14	.	.	566	555	577	548	550	543	535
15	.	.	.	543	549	550	564	538	544
16	.	.	.	.	547	553	542	549	541
17	.	.	.	.	544	541	562	539	539
18	.	.	.	.	X	X	551	543	544
19	.	.	.	.	549	545	550	556	529
20	.	.	.	.	539	540	547	556	550
21	.	.	.	557	571	565	563	541	531
22	.	.	563	565	556	544	531	531	535
23	528	543	564	540	541	540	535	521	544
24	514	522	545	535	567	540	538	534	531
25	540	550	539	531	562	547	561	X	X
26	563	546	548	526	561	541	539	574	550
27	X	534	562	551	529	549	540	539	529
28	X	526	545	544	529	527	515	535	535

Main Barrel – Interior Engineer Side

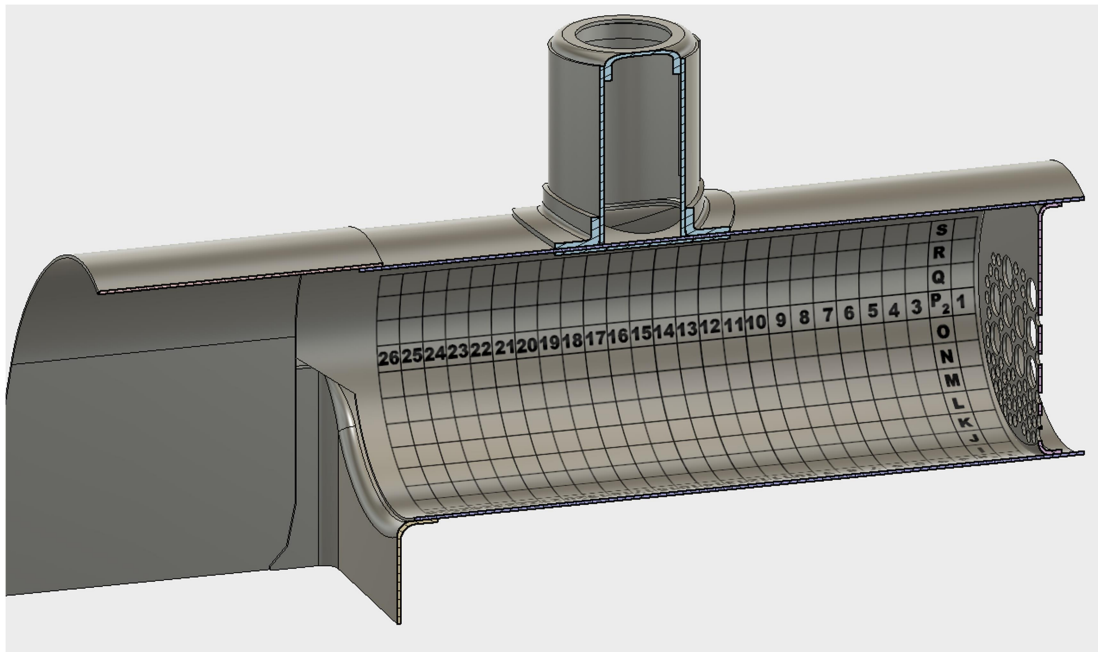
Grid started from 3" below Interior Butt plate toward bottom of main barrel



	A	B	C	D	E	F	G	H	I
1	496	498	499	496	491	500	480	476	P
2	502	499	508	505	495	501	512	476	P
3	506	505	494	494	500	486	480	476	473
4	503	505	502	504	492	495	480	503	503
5	492	508	P	505	496	510	502	492	506
6	498	497	507	515	522	506	505	508	512
7	512	533	500	519	505	517	520	506	518
8	540	499	531	507	503	519	509	503	493
9	517	505	501	507	506	512	516	513	517
10	505	526	502	517	504	500	522	512	503
11	513	512	520	512	495	498	525	516	498
12	506	527	519	516	514	513	519	530	514
13	530	512	505	515	508	504	523	530	513
14	526	519	525	521	521	524	529	523	517
15	535	529	525	523	526	521	523	535	515
16	524	523	518	524	524	521	523	539	516
17	534	526	528	524	524	524	515	515	511
18	526	528	524	527	524	524	526	516	516
19	532	524	525	524	559	521	562	513	504
20	516	516	515	513	510	513	515	515	511
21	517	529	506	520	520	515	519	517	496
22	511	509	509	511	523	402	426	410	453
23	512	520	513	545	519	492	522	504	520
24	523	505	503	527	501	481	482	515	481
25	506	509	503	534	515	510	X	X	X
26	504	529	524	525	525	510	X	509	493

Main Barrel – Interior Fireman Side

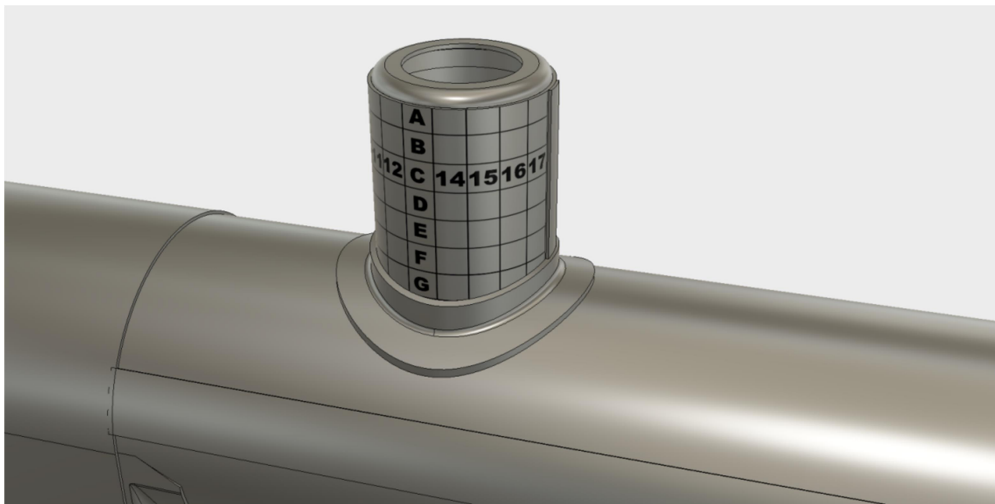
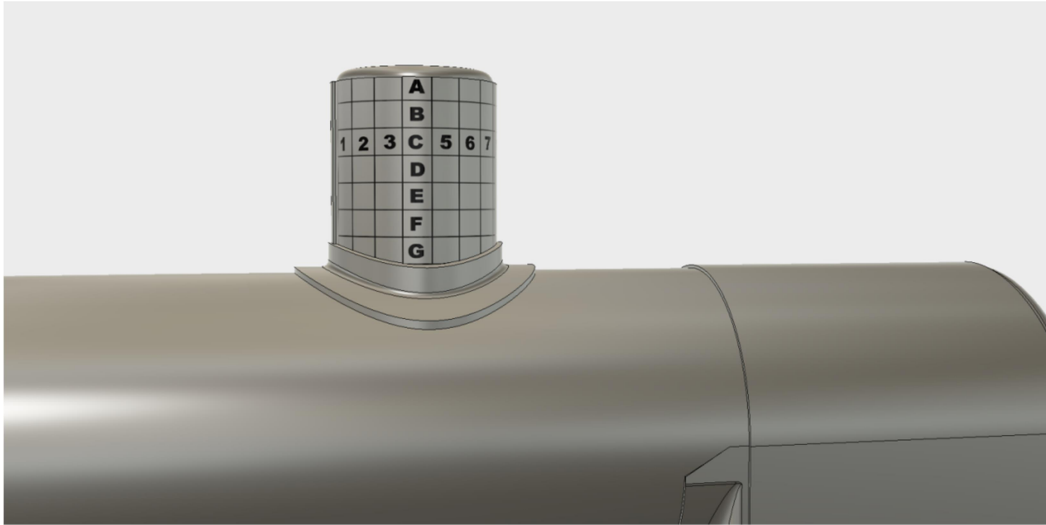
Grid continues from bottom of main barrel and will overlap some of the measurements taken on the outside of the main barrel.



	J	K	L	M	N	O	P	Q	R	S
1	454	455	453	511	520	498	506	511	502	501
2	P	511	483	494	505	522	515	507	507	516
3	468	482	480	499	497	515	515	516	513	510
4	507	480	490	507	513	510	513	513	517	506
5	494	501	506	502	506	507	P	520	520	512
6	493	502	510	512	524	526	512	515	513	513
7	523	538	496	497	508	519	515	520	520	530
8	513	503	504	513	521	524	519	527	524	515
9	536	504	503	518	520	527	522	528	514	502
10	535	507	505	513	517	520	534	513	513	525
11	513	511	518	515	516	518	528	524	521	527
12	526	520	523	522	537	520	525	529	525	531
13	520	523	526	529	540	528	519	533	524	512
14	521	520	528	528	526	529	532	535	529	525
15	516	523	529	529	527	535	529	535	527	533
16	507	510	529	530	536	530	530	525	528	532
17	520	554	534	537	532	533	528	532	532	526
18	512	518	533	529	531	530	527	528	534	529
19	503	511	526	526	521	525	525	526	529	529
20	518	519	516	514	521	523	521	523	528	530
21	510	520	559	519	517	521	525	526	525	557
22	543	515	498	508	492	507	521	527	521	531
23	474	478	476	501	507	520	521	518	521	522
24	497	482	480	516	505	506	509	515	523	516
25	X	X	X	510	503	509	504	515	511	528
26	456	X	X	487	491	500	509	510	501	511

Steam Dome Barrel

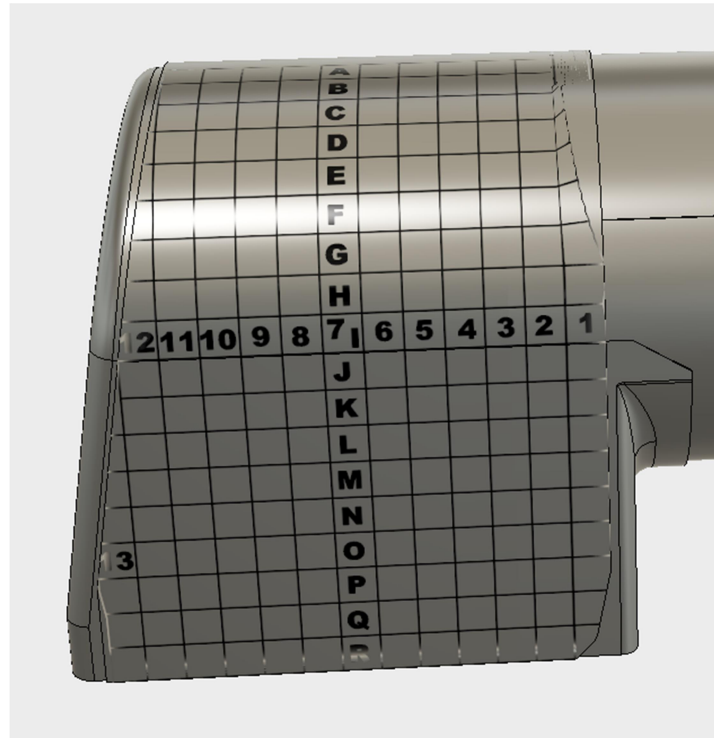
Grid starts beside the butt plate on the fireman side and continues towards engineer side. Design Thickness (0.400")



	A	B	C	D	E	F	G
1	386	386	384	388	382	392	.
2	384	383	386	388	395	398	.
3	388	388	386	389	393	399	.
4	X	382	383	392	394	395	396
5	X	387	388	389	399	390	394
6	394	393	389	394	397	394	.
7	401	395	392	396	401	395	.
8	406	401	398	404	406	400	.
9	401	394	406	406	400	403	.
10	401	397	392	398	402	404	.
11	402	395	394	397	399	399	.
12	395	405	391	388	391	404	.
13	405	391	390	389	392	398	399
14	405	395	399	397	392	397	405
15	386	386	383	391	385	398	398
16	396	385	385	385	385	389	.
17	390	391	384	389	390	390	.

Wrapper Sheet - Engineer Side

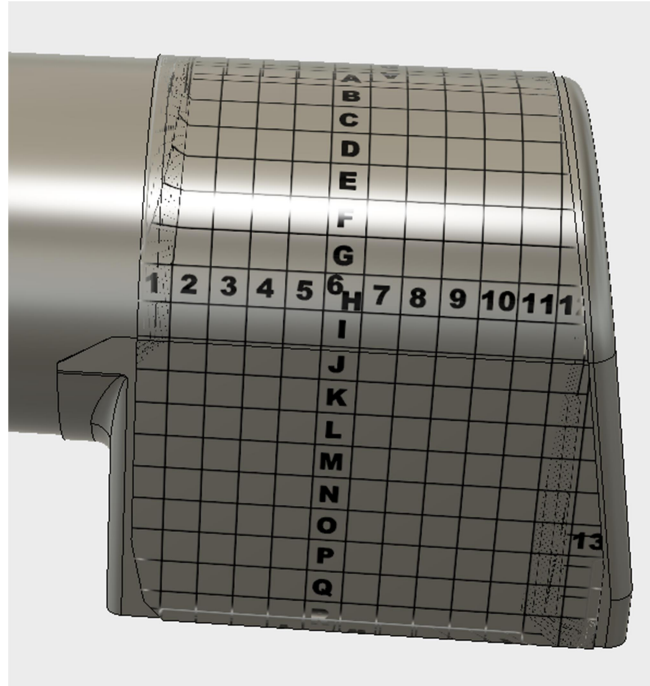
Grid starts top dead center and continues towards engineer side. Design Thickness ½" (0.500")



	1	2	3	4	5	6	7	8	9	10	11	12	13
A	510	534	538	524	X	X	X	X	X	X	X	.	.
B	519	533	520	526	553	511	525	527	515	495	531	.	.
C	511	519	519	X	501	514	519	522	521	500	505	.	.
D	518	525	525	529	539	518	522	555	523	520	508	.	.
E	516	510	520	525	510	514	506	514	519	525	509	.	.
F	502	513	507	516	522	518	516	519	516	523	512	.	.
G	506	510	518	505	515	515	516	519	522	523	517	.	.
H	506	510	515	522	509	517	524	519	523	513	516	512	.
I	513	519	512	503	516	528	532	524	525	525	537	533	.
J	502	514	519	519	521	527	515	514	516	531	529	520	.
K	513	519	516	516	516	518	522	522	531	517	522	517	.
L	507	516	516	519	514	524	528	525	531	514	528	525	.
M	X	X	X	X	520	520	526	523	525	524	527	524	X
N	515	506	515	515	520	527	530	527	515	514	509	514	X
O	523	X	525	522	510	532	512	515	512	524	525	516	X
P	523	X	516	525	501	501	500	519	504	511	525	528	X
Q	524	494	507	515	X	X	X	493	528	519	510	516	X
R	533	456	514	508	X	X	X	X	X	X	X	X	X
S	509	467	455	492	471	451	X	X	X	X	X	X	X

Wrapper Sheet - Fireman Side

Grid starts top dead center and continues down fireman side.

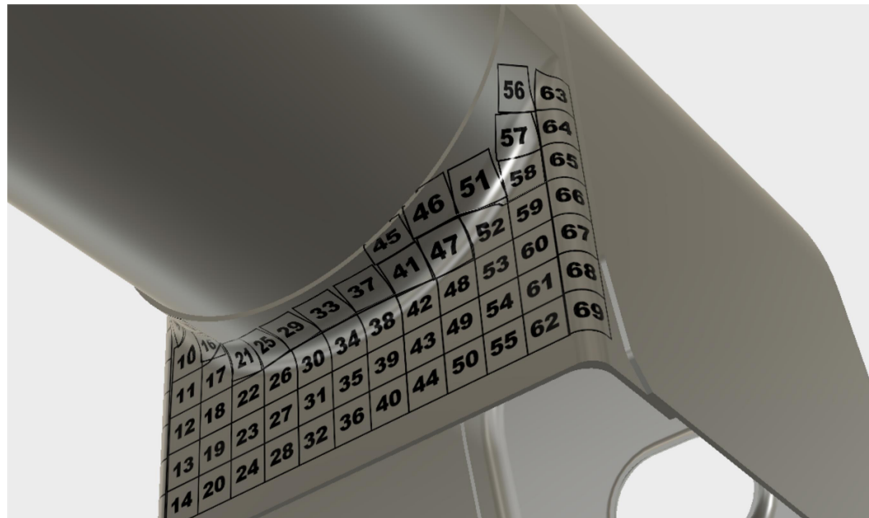
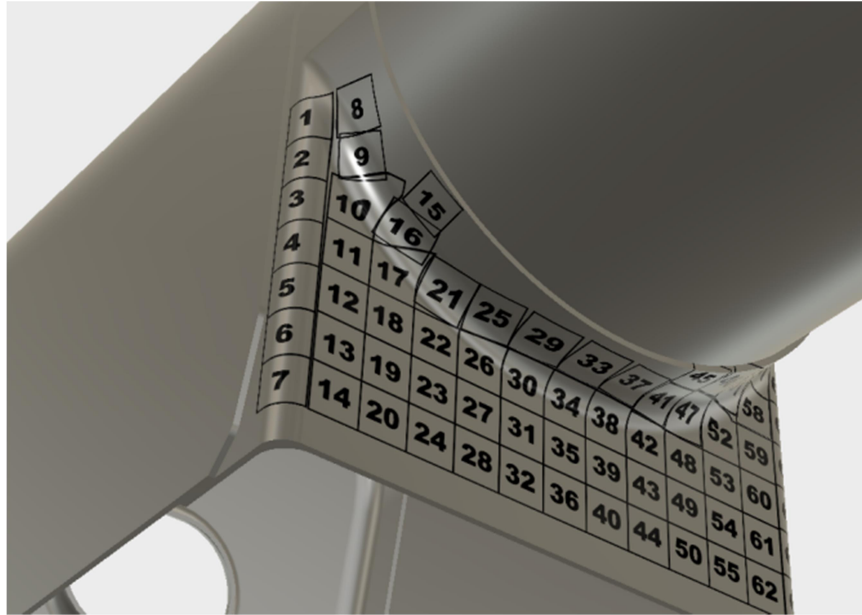


	1	2	3	4	5	6	7	8	9	10	11	12	13
A	510	499	529	527	X	X	X	540	X	X	X	.	.
B	501	520	522	520	508	511	540	509	502	X	521	.	.
C	494	521	X	X	532	503	516	520	507	502	476	523	.
D	526	524	542	X	505	516	515	511	530	484	498	521	.
E	501	542	516	535	507	514	523	513	517	509	544	512	.
F	534	524	543	536	513	521	521	527	503	508	505	523	.
G	504	536	529	541	512	526	515	501	525	517	509	505	.
H	538	516	575	526	515	515	526	520	526	524	510	505	.
I	560	520	X	559	512	507	519	514	519	516	510	514	.
J	519	556	X	517	510	504	516	511	507	515	511	514	.
K	502	524	531	539	514	518	522	500	502	511	528	520	.
L	559	516	534	561	520	502	516	502	517	519	527	523	.
M	540	542	530	543	529	505	511	514	509	511	520	511	523
N	519	556	548	535	508	507	510	506	509	511	516	522	516
O	580	540	565	533	509	516	511	499	517	516	523	523	518
P	554	535	539	516	507	515	493	494	493	507	490	506	517
Q	515	527	563	518	495	X	508	505	464	480	471	518	509
R	502	520	598	517	506	X	524	X	X	X	X	X	409
S	562	519	508	447	449	438	X	X	X	X	X	X	X

Note: Grooves were cut into wrapper sheet located at the connection of the front of the cab parallel to the front partition between columns 4 and 5 on both fireman and engineer sides. Measured: 0.090" deep at deepest location

Throat Plate

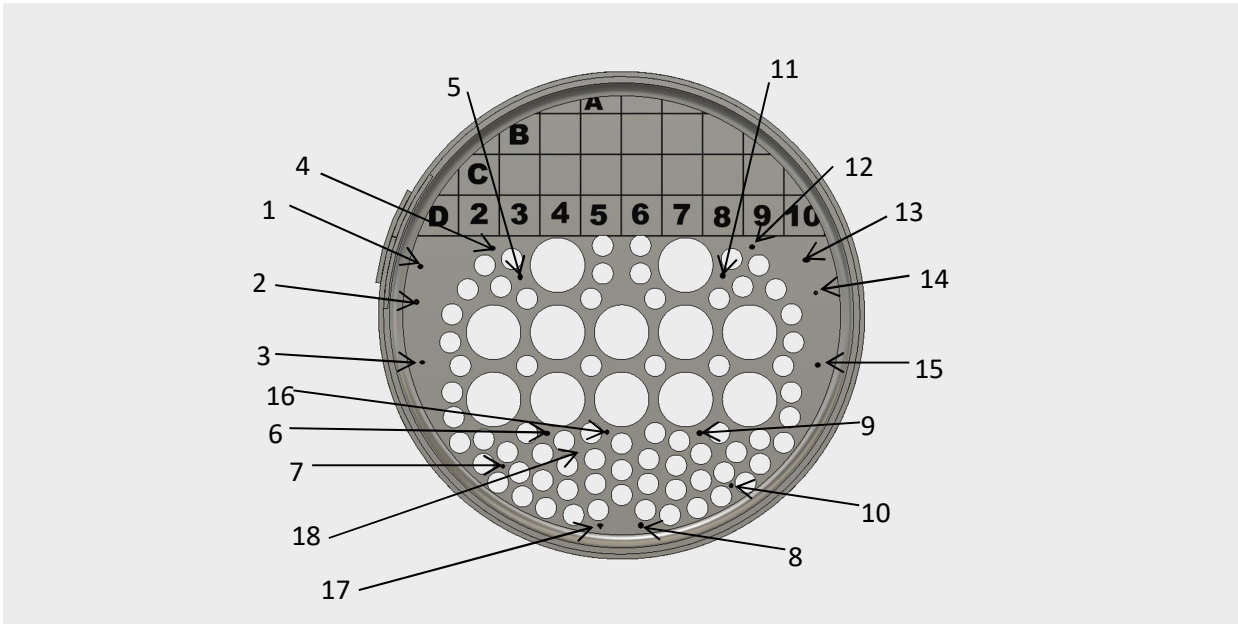
A numbered grid was used for this plate. Design Thickness 5/8" (0.625")



1) 639	15) 576	29) 535	43) 576	57) 588
2) 601	16) 560	30) 610	44) 467	58) 591
3) 578	17) 598	31) 594	45) 533	59) 613
4) 608	18) 557	32) 534	46) 553	60) 582
5) 528	19) 563	33) 541	47) 567	61) 572
6) 558	20) 517	34) 576	48) 556	62) 518
7) 560	21) 546	35) 561	49) 560	63) 614
8) 584	22) 573	36) 542	50) 480	64) 600
9) 600	23) 562	37) 586	51) 605	65) 581
10) 584	24) 458	38) 588	52) 626	66) 588
11) 583	25) 553	39) 491	53) 597	67) 590
12) 591	26) 573	40) 502	54) 560	68) 559
13) 601	27) 570	41) 580	55) 449	69) 437
14) 462	28) 547	42) 576	56) 566	

Front Flue Sheet

Design Thickness 5/8" (0.625")



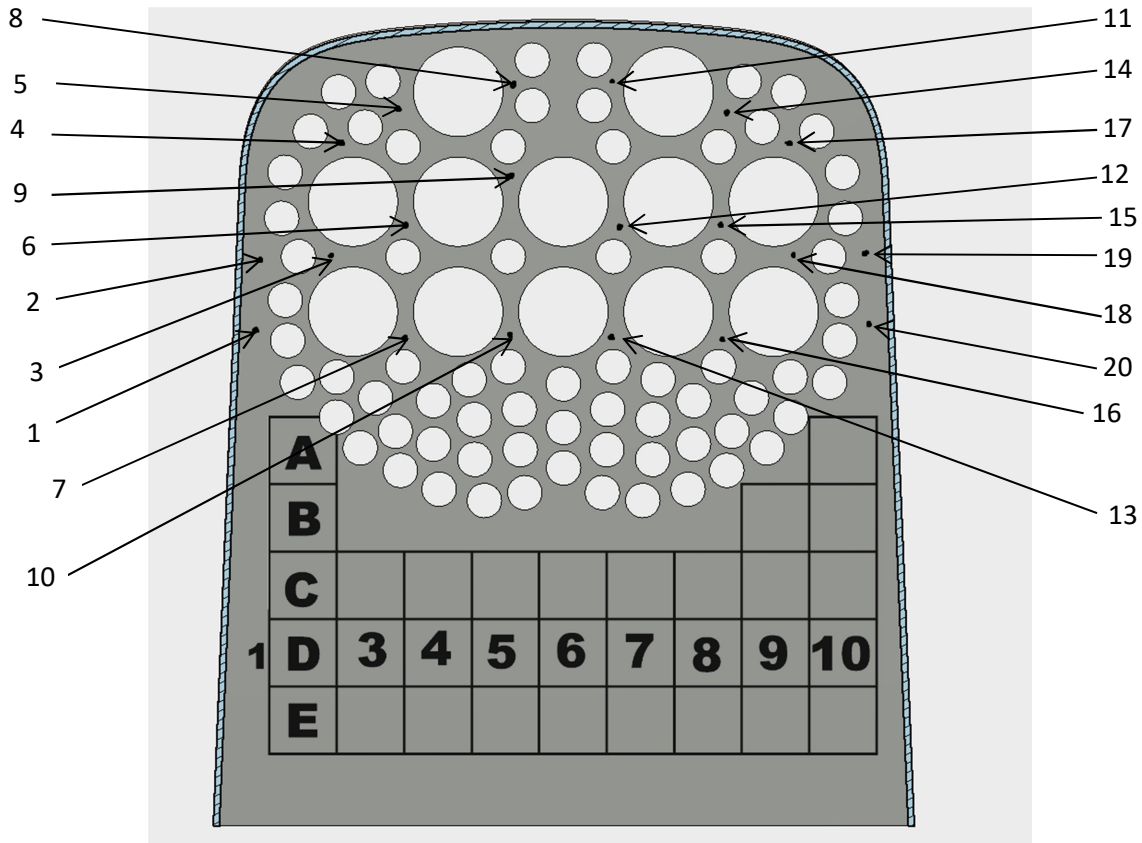
	1	2	3	4	5	6	7	8	9	10
A	.	.	.	610	615	628	613	.	.	.
B	.	609	614	631	X	X	587	605	632	.
C	608	636	611	620	X	X	620	619	635	611
D	624	617	588	619	599	607	618	588	611	614

1) 609	6) 549	11) 593	16) 583
2) 606	7) 601	12) 607	17) 370
3) 602	8) 387	13) 601	18) 582
4) 585	9) 570	14) 615	
5) 626	10) 586	15) 609	

Small visible pit located at D6. Dry pipe opening not shown but is in grid positions B5, B6, C5, C6

Rear Flue Sheet

Inside Fire Box - Design Thickness 1/2" (0.500")

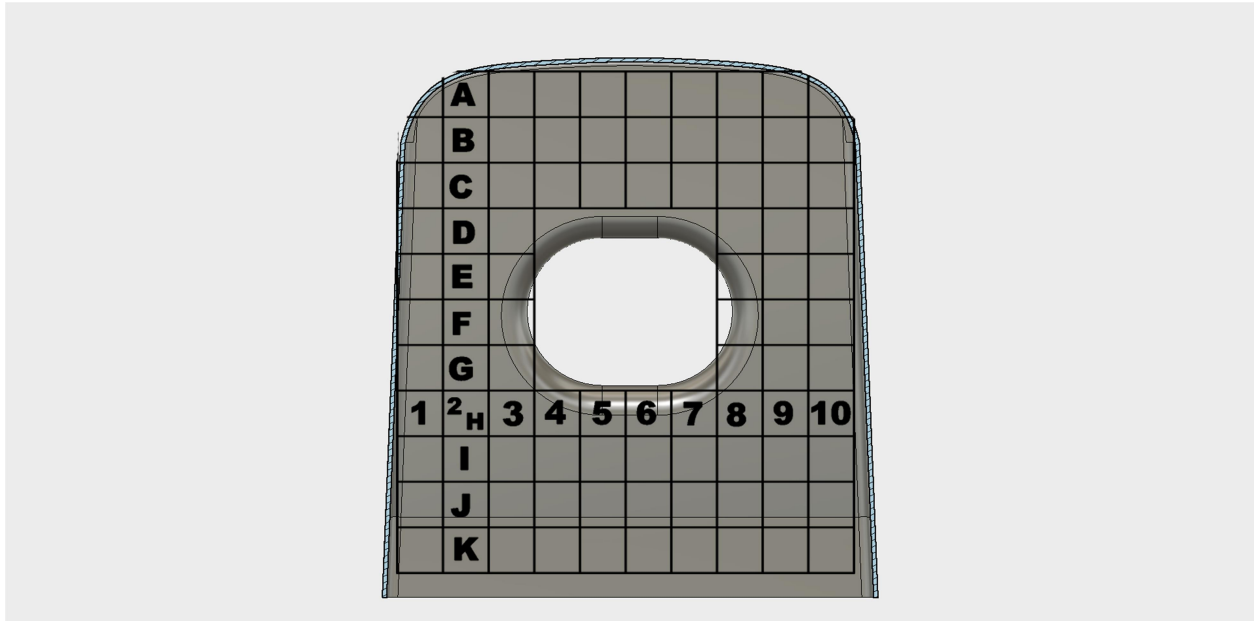


	1	2	3	4	5	6	7	8	9	10
A	521	526	.	.	.	.	.	.	.	570
B	498	501	511	516	520	503	517	529	527	543
C	496	475	451	527	439	461	481	527	526	524
D	496	490	492	476	531	555	470	510	521	497
E	400	505	529	500	509	491	495	473	492	528

1) 527	6) 482	11) 522	16) 488
2) 517	7) 492	12) 476	17) 445
3) 496	8) 464	13) 465	18) 488
4) 496	9) 503	14) 487	19) 540
5) 481	10) 519	15) 481	20) 531

Inside Firebox Rear head

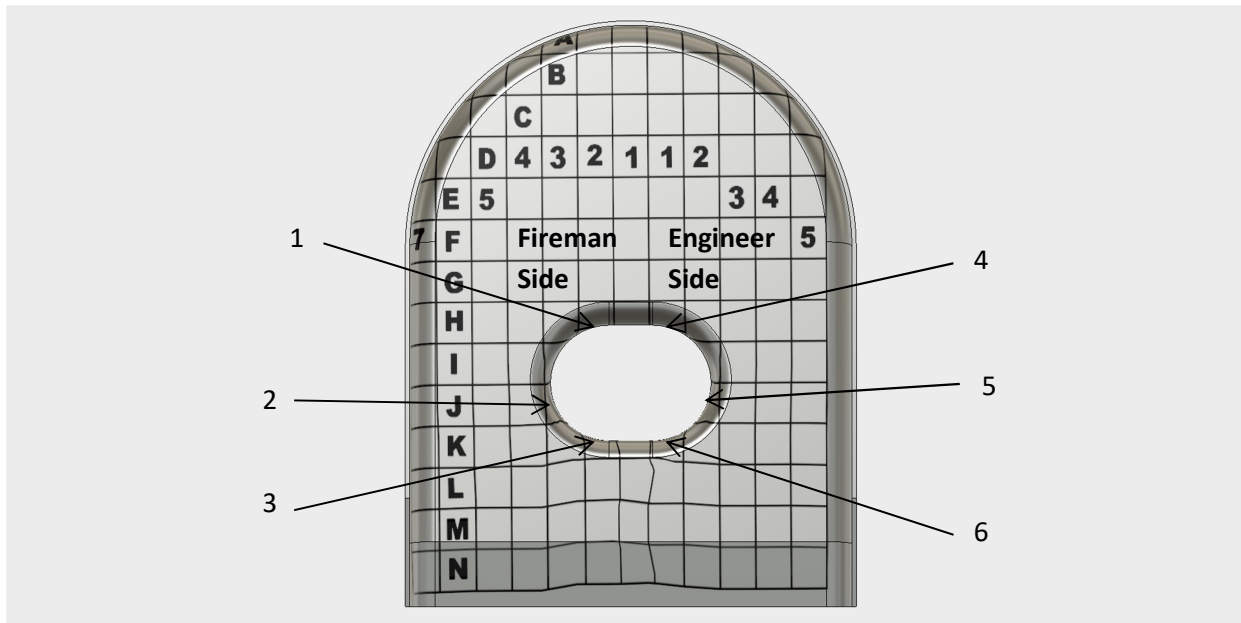
Design Thickness 3/8" (0.375")



	1	2	3	4	5	6	7	8	9	10
A	.	.	382	335	351	361	348	377	397	.
B	370	361	358	365	360	320	349	270	312	372
C	370	324	379	364	357	327	365	353	273	359
D	393	352	359	353	.	.	327	327	289	390
E	395	341	294	.	.	.	.	273	378	379
F	358	320	336	.	.	.	.	299	307	324
G	388	402	318	398	.	.	407	339	325	322
H	351	393	340	351	324	328	289	275	364	333
I	416	354	398	274	345	266	261	319	305	353
J	349	356	328	345	313	333	320	336	280	368
K	322	382	379	385	366	382	382	396	382	404

Rear Flanged Head

Outside Firebox - Design Thickness 1/2" (0.500")



Fireman Side

Engineer Side

	7	6	5	4	3	2	1	1	2	3	4	5
A	.	.	.	500	492	484	475	492	509	529	.	.
B	.	.	525	521	488	506	522	530	519	511	524	.
C	.	516	510	525	520	520	504	498	492	512	485	482
D	527	492	488	505	511	520	520	500	520	512	506	520
E	503	490	482	506	520	473	514	530	533	501	490	520
F	512	481	529	476	494	498	511	497	519	525	506	X
G	488	498	520	501	475	512	497	504	500	508	503	515
H	493	502	517	510	471	475	.	480	514	500	521	522
I	527	510	513	481	.	.	.	.	.	502	524	503
J	508	510	483	420	.	.	.	.	.	523	520	501
K	506	516	496	450	430	.	.	.	445	511	520	508
L	501	496	518	510	414	452	507	470	480	503	520	514
M	496	492	512	519	515	487	512	484	512	501	519	474
N	501	476	460	X	X	518	516	505	497	516	502	480

Brake Stand on Engineer side interfered with measuring column 6

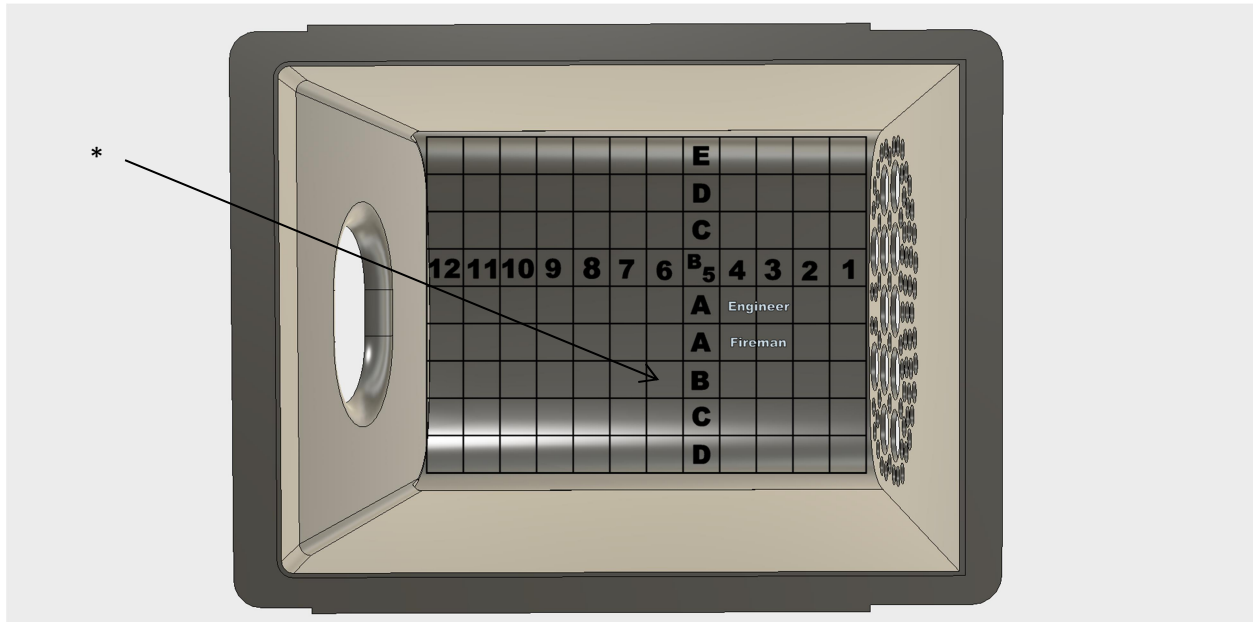
1) 469	4) 490
2) 470	5) 465
3) 467	6) 484

Measurements taken on curved surface into fire door

Inside Firebox

Crown Sheet

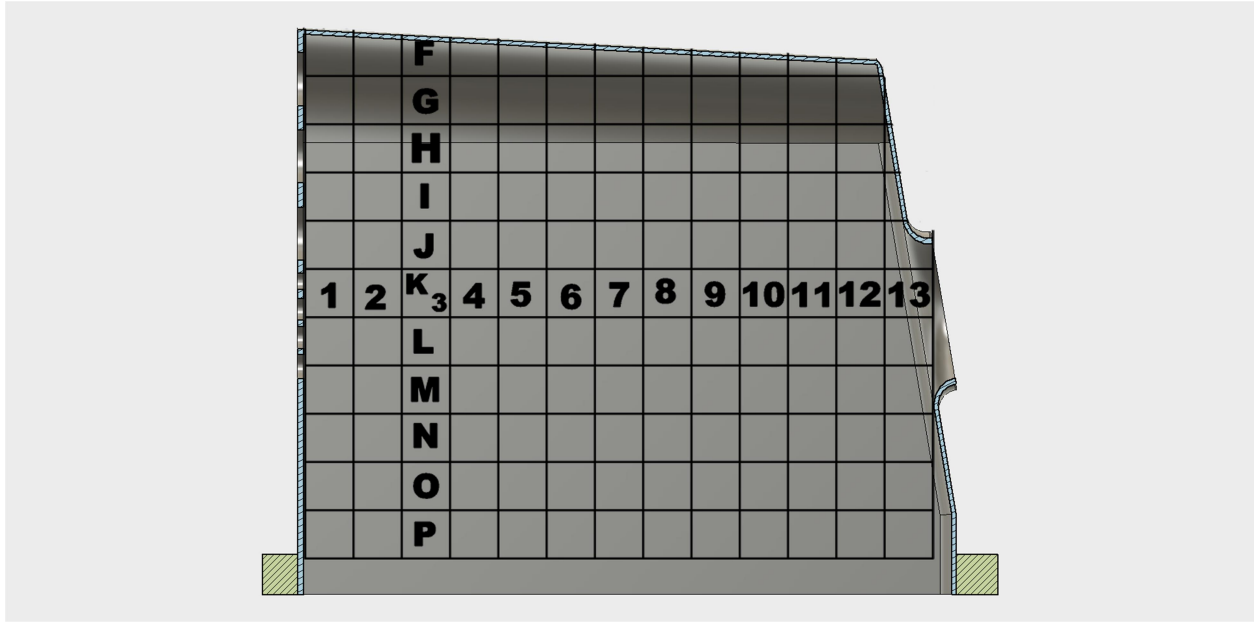
Design Thickness 3/8" (0.375")



	Engineer E	D	C	B	A	Fireman A	B	C	D
1	368	374	314	284	329	354	347	375	324
2	346	376	317	264	352	352	375	385	370
3	344	354	368	319	338	360	365	359	340
4	350	348	338	329	323	353	365	366	375
5	338	350	347	373	366	317	351	383	380
6	340	350	355	327	302	308	324	351	369
7	352	349	341	354	321	318	316	320	327
8	348	347	360	367	354	325	296	312	317
9	350	342	359	360	343	323	337	325	330
10	336	357	346	326	333	350	325	304	301
11	349	343	356	313	345	340	320	300	342
12	343	356	321	338	367	324	303	311	275

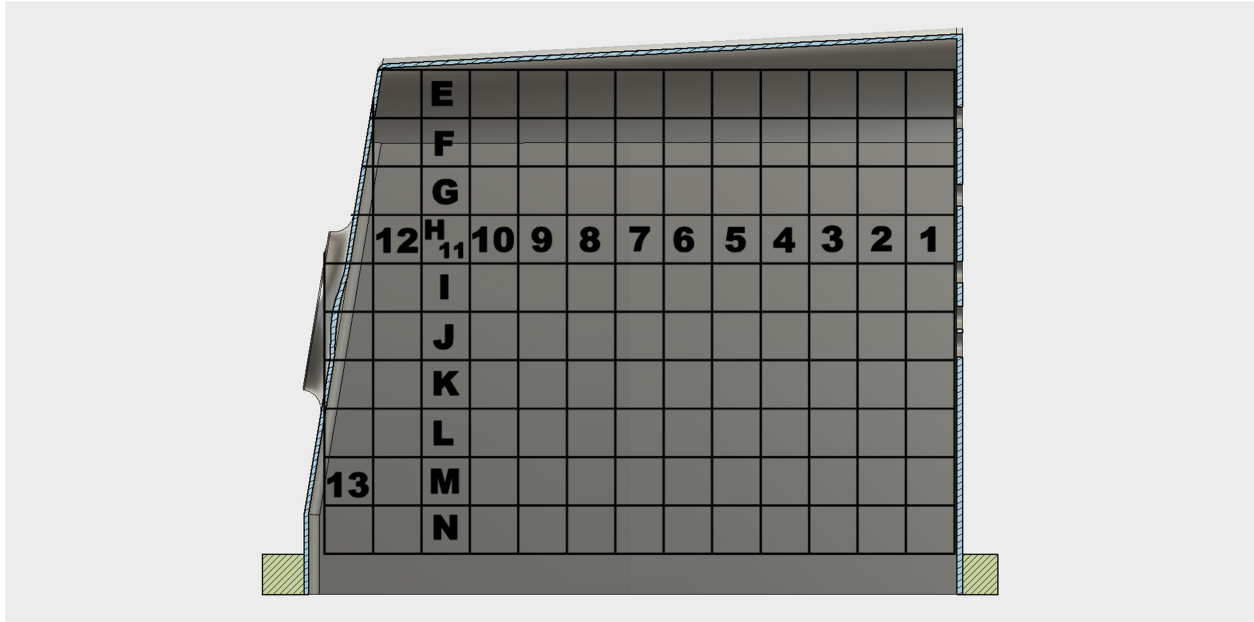
* Location of pit or bubble in casting (not visible) on 6B but very difficult to isolate. Location is smaller than the head of the ultrasonic transceiver head. 0.117".

Inside Firebox Engineer Side



	F	G	H	I	J	K	L	M	N	O	P
1	349	343	330	357	365	363	383	381	382	356	372
2	330	357	373	368	376	369	371	378	374	384	368
3	338	362	365	371	375	371	389	388	355	357	399
4	356	358	345	360	398	398	386	391	356	372	399
5	.	361	349	359	370	386	390	389	360	351	337
6	361	354	332	372	367	387	372	392	358	372	395
7	365	370	343	371	379	389	380	384	340	374	363
8	391	372	330	382	363	373	398	382	382	361	348
9	355	373	342	357	384	387	383	370	359	388	332
10	368	361	351	376	392	371	376	388	356	374	365
11	352	369	345	384	376	387	369	375	364	365	362
12	361	370	334	380	379	370	366	392	352	392	360
13	358	371	345	364	351	390	375	387	363	350	383

Inside Firebox Fireman Side



	E	F	G	H	I	J	K	L	M	N
1	356	345	400	400	357	349	362	256	346	392
2	366	383	400	400	363	380	368	357	351	363
3	353	381	356	388	357	365	351	256	346	368
4	365	371	350	303	352	349	335	306	357	344
5	375	400	359	378	379	340	300	335	352	352
6	375	400	345	349	340	309	400	400	359	357
7	365	357	376	374	341	317	400	400	303	363
8	315	327	262	344	332	312	400	400	323	309
9	333	308	325	356	332	292	400	400	347	304
10	350	340	316	337	353	302	400	400	350	355
11	324	329	315	336	376	314	315	278	313	308
12	388	334	319	355	375	344	312	292	319	365
13	x	x	404	436	338	372	321	352	313	355

Small pit or bubble in casting (not visible) located on L3 but very difficult to isolate. Location is smaller than the head of the ultrasonic transceiver head. 0.118"

Green squares are replacement patches with new stays welded into place and nominally 0.400" thick.