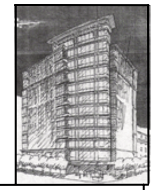
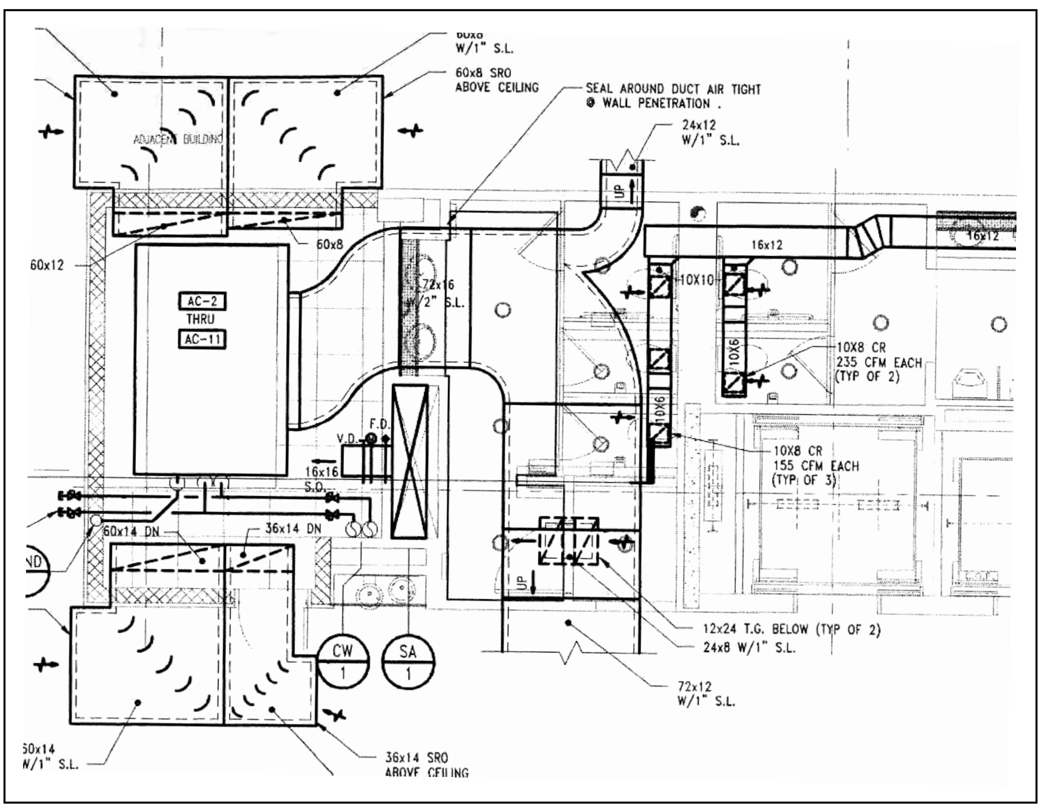


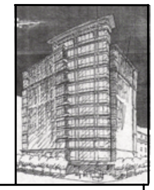
MECHANICAL BREADTH

INTRODUCTION

The Executive Tower's mechanical system is compiled of cooling towers on the penthouse floor that feeds the entire building below. The supply is located in the mechanical room on each floor in the main corridor adjacent to the restrooms. The main supply follows a path over the restroom and splits to feeds to the corridor and the rear of the building. The ducts at this point are nominally 14 inches for the main feed and 12 and 10 after the split (see Figure 10-1).

The goal for this study is to cut the depths of these ducts to reduce the ceiling depths per floor up to three inches. At first, it was assumed that by doing this would require a completely alternative system such as a DOAS system which would allow the total air flow per floor to be reduced up to 15%. However, upon further investigation it was realized that by rerouting ducts to evenly distribute air could produce a more efficient system.

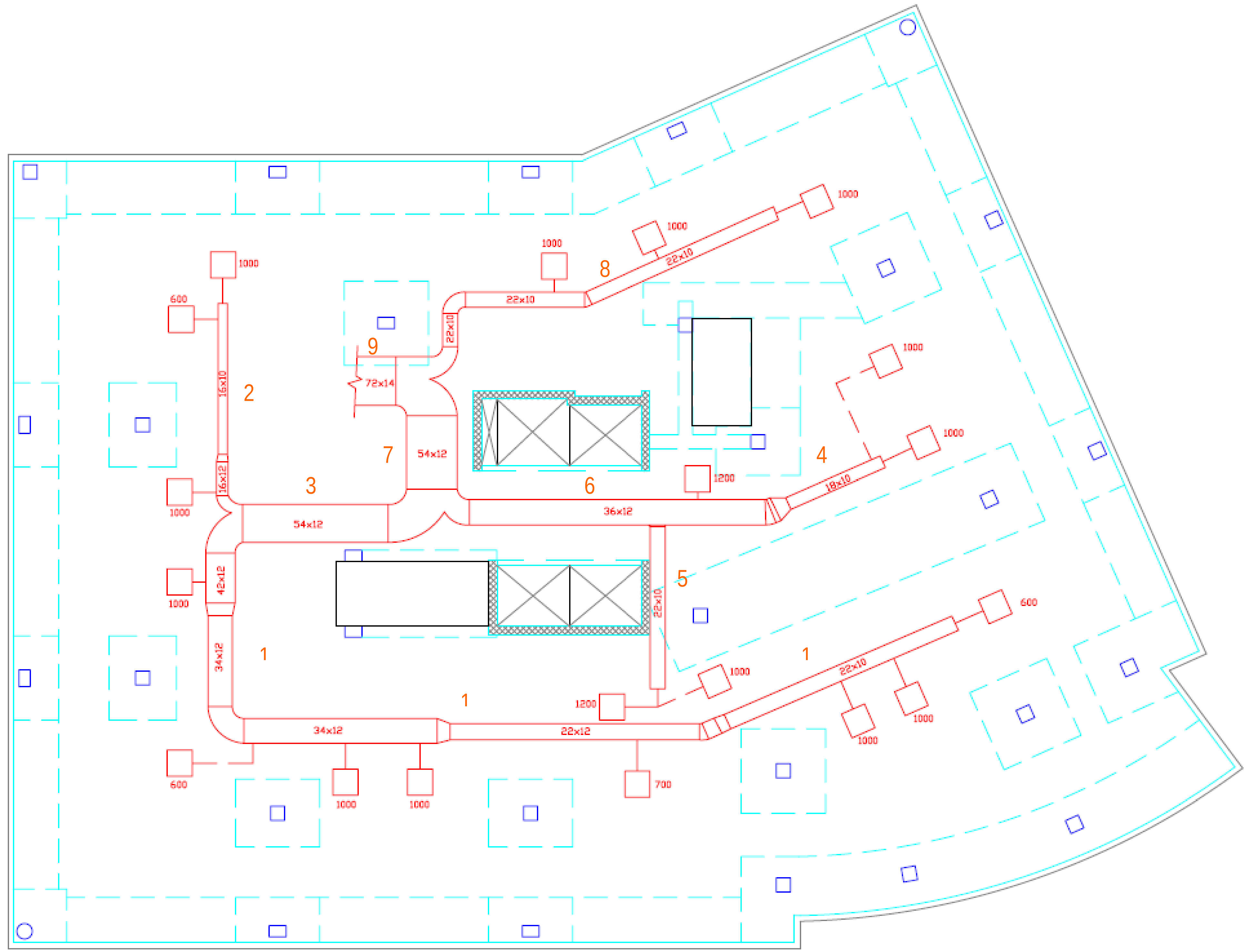


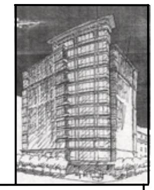


DESIGN

Some of the parameters set while following this procedure are designing ducts with similar air velocities, a friction loss of less the 0.65, and the assumption that the ceiling entering and within the restroom can be considered to be lower than the rest of the floor. The current duct system is laid out on the following page. The ceiling over the restrooms is a non-critical area and is going to be allowed to be lowered for this study if needed. In the table below, the air flow through each leg of the duct is used to calculate the air velocity, friction loss and equivalent diameter ducts. Designing the new duct system to have similar air velocities and friction losses will insure the new system is still equivalent to the old system.

Duct section	Duct Size	Equiv. Dia.	Air Flow	Velocity	Friction Loss
	(in x in)	(in)	(cfm)	(fpm)	(water/100')
1	22x10	16	2600	1900	0.31
	22x12	18	3300	2200	0.33
	34x12	21	5900	2300	0.32
	42x12	23	6900	2300	0.30
2	16x10	14	1600	1600	0.26
	16x12	15	2600	2100	0.40
3	54x12	26	9500	2500	0.30
4	18x10	15	2000	2300	0.29
	36x12	22	3200	1200	0.09
5	22x10	16	2200	1600	0.24
6	36x12	22	5400	2000	0.24
7	72x12	30	14900	3100	0.39
8	22x10	16	3000	2300	0.40
9	72x16	35	17900	2800	0.28


1000
600
16x10
2
16x12
1000
3
54x12
42x12
1000
34x12
1
34x12
600
1000
1000
9
72x14
22x10
22x10
1000
8
1000
22x10
1000
7
54x12
6
36x12
1200
4
18x10
1000
1000
5
22x10
1
22x10
1000
1200
22x12
700
1000
1000
600

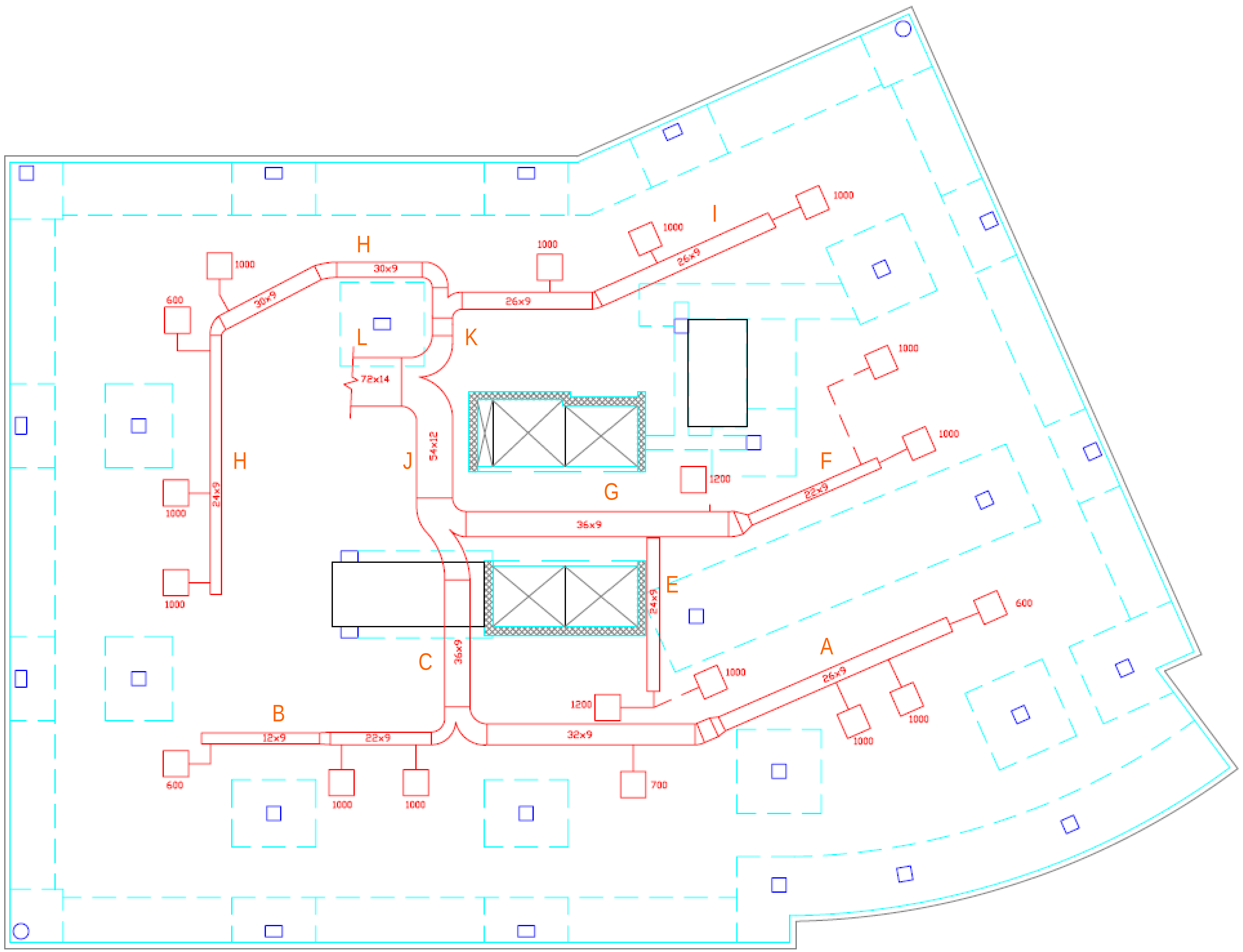


Rearranging the air velocities in descending order, it was found that the ducts with the faster air flow were the ones in the restroom or in the corridor. The ducts around the offices were all approximately 2300 fpm to reduce the noise in these areas. In the new plans, the ducts are sized to be less than 2300 fpm around offices, 2700 fpm in the corridor and less than 3100 fpm over the restroom and into the mechanical room.

Duct section	Velocity
7	3100
9	2800
3	2500
8	2300
4	2300
1	2300
2	2100
6	2000
5	1600

CONCLUSION

The new plan is designed on the following page and follows the parameters initially set. The deepest section ducts are 14 inches and 12 inches. This is five inches deeper than the goal of sizing the new ducts; however these deep sections only occur over the restroom and part of the corridor. This section of the building does not detract from the overall design to lower from nine foot ceilings to eight and half feet. Using this assumption, the remaining ducts are all controlling with nine inch section depths still allowing the building ceiling depth to be lowered three inches per floor. The rerouted duct system can be seen on the following page along with the design calculations.



Duct section	Duct Size	Equiv. Dia.	Air Flow	Velocity	Friction Loss
	(in x in)	(in)	(cfm)	(fpm)	(water/100')
A	26x9	16	600	450	0.02
	26x9	16	1600	1200	0.12
	32x9	17.5	2600	1550	0.20
	32x9	17.5	3300	2200	0.46
B	12x9	11.5	600	900	0.10
	22x9	15	1600	1300	0.17
	22x9	15	2600	2100	0.43
C	36x9	19	5900	3000	0.62
E	24x9	16	2200	1600	0.24
F	22x9	15.7	2000	1900	0.30
G	36x9	19	5400	2800	0.58
H	24x9	15.5	1000	750	0.06
	24x9	15.5	2000	1500	0.14
	30x9	17.5	2600	1600	0.08
	30x9	17.5	3600	2200	0.34
I	26x9	16	1000	700	0.05
	26x9	16	2000	1400	0.28
	26x9	16	3000	2100	0.39
J	54x12	26	11300	3000	0.43
K	40x9	19.5	6600	3000	0.60
L	72x14	32	17900	3000	0.30