

$$\text{Uncertainty} = t * \text{SE}(Y_{\text{new}})$$

where t = test statistic, taken from a standard statistical table of values of t as a function of both n , the number of data points, and the confidence interval, which is here taken to be 95 percent. For this work, with n ranging from 63 to 138, t is equal to 2.00 or 1.98;

Y_{new} = predicted value of either design or seasonal energy consumption; and
 $\text{SE}(Y_{\text{new}})$ = standard error of Y_{new} .

Y_{new} and $\text{SE}(Y_{\text{new}})$ come from the following:

$$Y_{\text{new}} = a + b * X_{\text{new}}$$

where a = intercept value from the linear regression of energy consumption versus indoor-outdoor temperature difference;

b = slope value from the linear regression of energy consumption versus indoor-outdoor temperature difference; and

X_{new} = design or seasonal indoor-outdoor temperature difference.

And:

$$\text{SE}(Y_{\text{new}}) = S * (1 + 1/n + (X_{\text{new}} - \bar{x})^2 / SS_{xx})^{0.5}$$

where $S = ((SS_{yy} - b * SS_{xy}) / (n - 2))^{0.5}$;

\bar{x} = mean of x-values (indoor-outdoor temperature differences);

$SS_{xx} = \sum(x_i - \bar{x})^2$; sum of the squares around the mean of the x-values;

x_i = individual values of x (indoor-outdoor temperature difference) for each data point;

$SS_{yy} = \sum(y_i - \bar{y})^2$; sum of the squares around the mean of the y-values;

\bar{y} = mean of y-values;

y_i = individual values of y (energy consumption) for each data point; and

$SS_{xy} = \sum(x_i - \bar{x})(y_i - \bar{y})$; sum of the cross product around the means of the x- and y-values.

As with distribution efficiency, each predicted uncertainty $t * SE(Y_{new})$ is in units of Y_{new} .
The following is used to obtain the percent uncertainty:

$$\text{Percent Uncertainty} = 100 * t * SE(Y_{new}) / Y_{new}$$

Following the estimation of percent uncertainties in design or seasonal energy consumption for two different duct configurations, the uncertainty in the percentage difference between the two (the quotient of the two) is calculated according to the following:

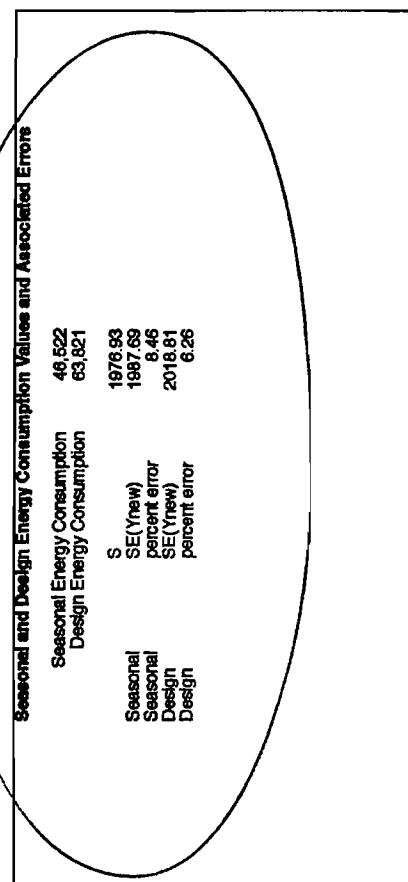
Let DY_{new1} and DY_{new2} be the percent uncertainties in Y_{new1} (design or seasonal energy consumption for duct configuration #1) and Y_{new2} (design or seasonal energy consumption for duct configuration #2), respectively, and let Q equal Y_{new1} / Y_{new2} and DQ be the percent uncertainty in Q to the same level of confidence. Then:

$$DQ = (DY_{new1}^2 + DY_{new2}^2)^{0.5}$$

SOFTWARE OUTPUTS FOR INDIVIDUAL HEATING CYCLES										ERROR CALCULATION PARAMETERS									
AT					ENERGY					DISTRIBUTION EFFICIENCY					DISTRIBUTION EFFICIENCY				
Date	Time	Duration (min)	Average Distribution Efficiency (percent)	Average Outside Temp (F)	Total Energy Out of Furnace	Wind Speed (mph)	Average Inside Temp (F)	At (F)	Xtbar1	Xtbar2	Wtbar1	Wtbar2	(Wtbar1)(Ytbar1)	(Wtbar2)(Ytbar2)	(Ytbar1)(Wtbar1)	(Ytbar2)(Wtbar2)			
12/05/98	02:00	60.3	93.3	40.5	67.2	1.02	18.543	24.5	-17.9	32.2	20.229	3	40.8246	450	383.005	0.14	0.01872	-2.45540	
12/05/98	12:00	56.6	94.6	39.6	67.2	1.00	20.275	26.7	-15.7	24.5	-187.80	6	353.095	650	295.683	0.95	0.02307	-2.36205	
12/05/98	22:00	54.4	94.1	38.1	67.2	1.02	21.481	27.4	-13.3	22.8	-186.63	8	328.121	723	270.775	0.94	0.02097	-2.17139	
12/05/98	31:00	51.9	94.7	39.1	67.2	1.06	22.318	30.9	-11.5	12.5	-188.62	8	294.016	236	223.958	0.95	0.02275	-2.00434	
12/05/98	40:00	50.1	97.1	38.4	67.3	1.08	23.473	31.2	-11.3	12.5	-160.17	9	258.571	227	184.366	0.97	0.017	-0.03045	
12/05/98	45:00	48.7	93.1	38.1	67.3	1.02	23.602	31.2	-11.3	12.5	-1486.0	9	220.844	583	167.244	0.93	0.13	-0.01815	
12/05/98	54:00	47.4	92.6	38.1	67.3	1.01	23.602	31.2	-11.3	12.5	-1473.1	8	196.837	583	93.13	0.93	0.13	-1.51622	
12/05/98	62:00	46.6	88.2	36.2	67.2	1.00	24.840	31.0	-11.4	130.6	-1368.9	8	167.521	270	156.494	0.88	0.09	-0.00731	
12/05/98	47:00	89.9	37.3	67.2	1.05	23.238	29.9	-12.5	12.5	-1509.7	8	227.944	750	189.403	0.90	0.10	-0.01062		
12/05/98	53:00	46.5	91.9	35.6	67.2	1.07	23.959	31.4	-11.0	12.5	-143.75	8	268.894	792	158.586	0.92	0.12	-0.01456	
12/05/98	58:00	46.0	91.8	34.8	67.2	1.11	24.845	32.4	-10.0	100.7	-1348.8	8	181.948	820	135.389	0.92	0.12	-0.01110	
12/05/98	43:00	43.5	91.5	33.4	67.1	1.00	26.270	34.2	-8.6	12.5	-123.18	8	151.778	472	106.086	0.92	0.12	-0.01420	
12/05/98	32:00	43.3	91.7	33.0	67.1	1.00	26.270	34.2	-8.2	12.5	-126.63	8	145.538	250	99.418	0.92	0.12	-0.02606	
12/05/98	43:00	43.1	92.9	32.1	67.1	1.01	26.575	35.0	-7.4	12.5	-125.00	8	138.270	332	87.110	0.93	0.13	-0.00442	
12/05/98	41:50	87.8	32.5	67.2	1.03	27.858	34.7	-7.7	12.5	-1047.7	8	140.785	143	88.8	0.88	0.08	-0.00765		
12/05/98	42:1	86.0	33.3	67.2	1.13	27.758	33.9	-8.5	12.5	-1075.6	8	111.848	404	80.233	0.86	0.08	-0.00407		
12/05/98	42:8	85.0	33.6	67.2	1.10	27.687	33.4	-9.0	12.5	-1066.6	8	113.781	488	86.182	0.85	0.05	-0.00288		
12/05/98	42:5	85.8	33.5	67.1	1.33	26.809	33.6	-9.0	12.5	-105.022	6	94.553	076	101.896	0.86	0.05	-0.01426		
12/05/98	42:00	43:1	78.7	37.7	67.2	1.43	26.182	29.5	-12.8	12.5	-1215.1	8	147.687	226	167.124	0.79	-0.01	-0.00098	
12/05/98	43:1	78.2	37.6	67.2	1.47	26.473	29.8	-12.8	12.5	-125.5	8	1168.0	8	151.677	78	-0.01	0.00019	0.17511	
12/05/98	20:00	43:8	78.0	37.3	67.2	1.42	26.494	29.9	-12.5	12.5	-1163.8	8	140.181	826	148.046	0.79	-0.01	0.00004	0.07869
12/05/98	21:00	43:0	78.3	37.3	67.2	1.27	26.484	29.9	-12.6	12.5	-1167.5	8	138.325	253	146.625	0.78	-0.01	0.00006	0.16003
12/05/98	42:1	78.6	35.5	67.1	1.48	27.837	31.7	-10.8	12.5	-1049.6	8	110.83	662	112.883	0.80	0.00	0.00000	-0.02298	
12/05/98	40:00	41:3	78.4	35.2	67.1	1.42	28.810	31.7	-10.6	12.5	-972.8	8	94.553	076	101.896	0.78	-0.01	0.00015	0.12882
12/05/98	40:3	61.0	34.5	67.1	1.09	28.361	32.7	-8.7	94.8	-972.8	8	89.457	548	81.148	0.81	0.01	0.00019	-0.35117	
12/05/98	40:7	82.9	32.0	67.1	1.07	26.045	34.2	-8.3	94.8	-972.8	8	88.282	559	76.726	0.83	0.03	0.00106	-0.26942	
12/05/98	40:0	39.6	61.0	32.0	67.2	1.20	29.781	34.2	-8.2	94.8	-9552.8	8	73.151	082	70.005	0.81	0.01	0.00003	0.11448
12/05/98	32:00	39.6	79.1	33.9	67.3	1.44	28.645	33.3	-8.1	92.9	-968.8	8	75.495	931	78.103	0.79	-0.01	0.00028	-0.13351
12/05/98	39:00	42:1	81.2	33.1	67.2	1.07	28.584	34.1	-8.3	94.8	-978.8	8	78.910	104	73.149	0.81	0.02	0.00027	0.13913
12/05/98	44:00	81:2	32.2	67.1	1.07	29.408	34.0	-8.5	927.3	-927.3	8	75.798	337	75.898	0.76	0.04	0.00019	-0.20721	
12/05/98	40:3	82.9	34.5	67.1	1.09	28.361	34.7	-7.7	94.8	-970.8	8	73.459	308	65.859	0.82	0.03	0.00073	-0.12923	
12/05/98	40:7	82.9	32.0	67.1	1.12	26.252	34.9	-7.5	94.8	-980.8	8	68.316	147	60.845	0.81	0.02	0.00029	-0.08450	
12/05/98	24:10	80.7	32.0	67.2	1.20	29.781	34.7	-7.8	94.8	-9050.3	8	64.816	034	52.515	0.81	0.01	0.00012	-0.24907	
12/05/98	32:00	39.6	79.1	33.9	67.3	1.44	28.645	35.2	-7.2	92.9	-972.8	8	32.773	900	41.374	0.78	-0.03	0.00019	-0.24084
12/05/98	39:00	40:2	81.2	33.1	67.2	1.07	28.584	34.1	-8.3	94.8	-980.8	8	53.123	083	88.850	0.75	-0.05	0.00027	0.33971
12/05/98	44:00	81:2	32.2	67.1	1.07	29.408	34.0	-8.4	94.8	-980.8	8	46.373	929	67.203	0.76	0.04	0.00019	0.30194	
12/05/98	39:3	82.3	32.4	67.2	1.02	28.763	34.7	-7.7	94.8	-970.8	8	45.425	451	66.028	0.76	-0.04	0.00016	0.29514	
12/05/98	39:3	81:3	32.3	67.3	1.12	30.283	34.7	-7.5	94.8	-980.8	8	60.945	76	60.782	0.76	-0.03	0.000105	0.28488	
12/05/98	39:4	80.7	32.6	67.3	1.09	30.283	34.7	-7.8	94.8	-9050.3	8	64.816	334	51.288	0.76	-0.03	0.000105	0.25687	
12/05/98	36:3	76.2	32.0	67.2	1.30	32.689	35.2	-7.2	92.9	-972.8	8	42.691	073	49.141	0.77	-0.02	0.00048	0.16519	
12/05/98	37:0	74.6	32.2	67.2	1.41	31.548	34.5	-7.7	94.8	-978.8	8	46.047	682	50.054	0.78	-0.02	0.000247	0.14808	
12/05/98	37:7	78.0	33.3	67.3	1.10	31.524	34.0	-8.4	94.8	-980.8	8	78.634	831	88.850	0.75	-0.05	0.000237	0.33971	
12/05/98	37:7	78.1	33.1	67.2	1.24	31.594	34.1	-9.3	94.8	-973.6	8	89.973	076	87.76	0.76	-0.04	0.000147	0.39713	
12/05/98	37:6	78.3	33.7	67.3	1.25	31.033	33.6	-8.8	94.8	-973.6	8	53.594	707	54.585	0.76	-0.03	0.000126	-0.02848	
12/05/98	37:6	78.4	32.6	67.3	1.20	31.854	34.5	-7.8	94.8	-973.6	8	64.816	334	51.288	0.76	-0.03	0.000105	0.25687	
12/05/98	37:7	77.3	32.5	67.4	1.21	31.809	34.9	-7.5	94.8	-973.6	8	67.479	358	41.540	0.84	0.05	0.00022	-0.30022	
12/05/98	37:7	74.9	32.8	67.2	1.40	31.548	34.8	-7.7	94.8	-978.8	8	68.336	740	41.540	0.84	0.05	0.00022	-0.22589	
12/05/98	37:7	74.9	32.0	67.2	1.60	31.495	34.7	-7.4	94.8	-978.8	8	48.769	740	34.174	0.84	0.05	0.00022	-0.22450	
12/05/98	37:7	74.0	32.3	67.2	1.23	32.001	37.9	-4.5	20.1	-63.32	8	40.104	810	28.416	0.84	0.04	0.00019	-0.18504	
12/05/98	36:5	82.2	29.0	67.2	1.44	32.877	34.2	-4.3	18.1	-64.56	8	23.777	108	23.208	0.82	-0.04	0.00017	-0.11218	
12/05/98	36:5	77.6	35.2	67.3	1.22	30.810	32.9	-9.8	94.8	-973.6	8	59.223	8	59.223	0.76	-0.02	0.000127	-0.03418	
12/05/98	36:5	70.0	36.7	67.2	1.22	30.208	36.1	-8.4	94.8	-973.6	8	36.1	109	26.183	0.78	-0.02	0.00037	0.06392	
12/05/98	36:5	84.3	31.2	67.3	1.05	32.816	37.9	-3.5	12.5	-12.5	8	35.703	122	9.179	0.79	-0.02	0.00052	0.07877	
12/05/98	36:1	84.2	30.4	67.2	1.21	30.816	36.8	-5.6	94.8	-973.6	8	37.4	108	22.988	0.8	-0.05	0.00021	0.20284	
12/05/98	37:7	84.0	30.4	67.2	1.60	31.495	34.8	-7.4	94.8	-978.8	8</								

Config 1 At20

Config 1 At20



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Univariate Efficiency Regression sentence						
SUMMARY OUTPUT						
Regression Statistics						
Multiple R	0.56897					
R Square	0.324865					
Adjusted R Square	0.3199					
Standard Error	0.05032					
Observet	138					
Total	137					
ANOVA						
	df	SS	MS	F	Significance F	
Regression	1	0.6873	0.6873	63.4406	3E-13	
Residual	138	0.34442	0.00253253			
Total	137	0.51016				
Coefficients Standard Err						
Intercept	0.83423	0.01761	53.045284	9.5E-38	0.88345	0.1
X Variable 1	-0.00014	0.00014	0.00014	0.00014	0.00014	0.00014

Seasonal and Design Distribution Efficiency Values and Associated Errors		
Seasonal Distribution Efficiency	0.771	
Design Distribution Efficiency	0.719	
S	0.05	
SE(Ynew)	0.05	
Percent error	12.89	
SE(Ynew)	0.05	
Seasonal		
Design		

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SOFTWARE OUTPUTS FOR INDIVIDUAL TRAINING CYCLES										ERROR CALCULATION PARAMETERS									
					AT					ENERGY					DISTRIBUTION EFFICIENCY				
Date	Time	Duration (min)	Average Distribution Efficiency (percent)	Average Outside Temp (F)	Average Inside Temp (F)	Average Wind Speed (mph)	Total Energy Out of Furnace	Δt (F)	x̄-x̄bar	(x̄-x̄bar)²	W̄-W̄bar	(W̄-W̄bar)²	123.709	0.83	0.07	0.00474	-0.07889	-0.00482	
121498	65800	33.533	83.169	25.731	67.197	1.321	354.47	41.5	-9.9	97.1	-125.516	151.844	123.709	0.83	0.07	0.00474	-0.07889	-0.00482	
121698	31200	34.4	62.272	27.019	67.183	1.2344	346.60	40.2	-11.2	124.5	-133.386	148.832	82.0	0.82	0.08	0.00359	-0.06825	-0.00348	
121898	34.183	82.186	28.697	67.251	67.337	1.0222	350.47	40.6	-10.8	115.9	-129.496	139.441	82.0	0.82	0.08	0.00359	-0.06825	-0.00348	
123198	5800	26.15	76.031	11.185	67.337	1.0596	527.02	56.2	4.8	23.3	4703.4	22.121.629	22.717	0.76	0.00	0.00001	-0.01217	-0.00001	
123198	12400	26.5	76.822	10.544	67.447	1.0222	528.81	56.9	5.6	1.1	482.4	5010.4	23.837.370	27.249	0.77	0.01	0.00003	0.03036	0.00003
123198	15000	26.217	77.377	9.9369	67.387	1.0033	530.09	57.4	6.1	37.3	5010.4	25.103.637	30.604	0.77	0.01	0.00012	0.06828	0.00012	
123198	21700	26.183	78.193	8.6143	67.321	1.0084	536.67	58.7	7.4	54.5	588.4	5010.4	41.859	0.78	0.02	0.00036	0.14056	0.00036	
123198	24300	26.385	78.368	8.2258	67.45	1.0343	534.03	69.3	8.0	84.6	540.4	6270.4	29.207.031	42.977	0.79	0.03	0.00095	0.24516	0.00095
123198	30800	26.187	78.215	8.0558	67.415	1.0222	532.69	69.4	8.0	84.6	6270.4	30.398	35.689.000	48.034	0.78	0.02	0.00037	0.15528	0.00037
123198	33500	25.75	78.198	8.3222	67.352	1	539.71	59.0	7.7	59.4	5972.4	34.236.331	27.894	0.74	0.02	0.00037	0.14745	0.00037	
123198	40100	26.386	75.961	8.2185	67.236	1	546.68	58.0	6.7	44.8	6570.4	43.169.638	43.992	0.76	0.00	0.00001	-0.02129	-0.00001	
123198	42700	26.383	77.052	8.0222	67.474	1	542.16	58.5	7.1	50.8	6217.4	38.555.478	44.328	0.77	0.01	0.00001	0.05488	0.00001	
123198	45400	26.6	75.974	8.6321	67.286	1	549.39	58.4	7.1	50.2	638.4	48.154.619	49.144	0.76	0.00	0.00001	-0.02189	-0.00001	
123198	52100	28.733	75.869	9.0214	67.289	1	548.82	58.3	6.9	48.0	688.4	47.380.548	47.809	0.76	0.00	0.00002	-0.02873	-0.00002	
123198	54700	26.187	75.495	10.104	67.343	1	541.95	57.2	5.9	35.0	6146.5	36.368	57.5	0.71	0.01	0.00006	0.04683	0.00006	
123198	61300	26.187	74.322	11.285	67.374	1	538.50	56.1	4.8	22.7	585.14	34.236.331	27.894	0.74	0.02	0.00038	-0.08944	-0.00038	
123198	63800	26.387	73.987	11.581	67.393	1	500.11	55.8	4.5	10.0	5810.4	33.760.201	26.089	0.74	0.02	0.00052	-0.10284	-0.00052	
10989	5900	29.9	69.151	25.074	67.271	1	426.65	42.2	-9.1	83.3	-5015.6	25.156.715	45.768	0.76	0.07	0.00509	0.05050	0.00050	
10989	12800	29.6	70.884	25.197	67.389	1	419.53	42.2	-9.1	83.3	-6040.6	55.145	6.9	0.71	0.05	0.00287	0.49744	0.00287	
10989	16500	30.183	70.362	25.128	67.224	1	420.73	42.0	-9.3	85.3	-5925.6	35.113.283	54.960	0.70	0.06	0.00348	0.54732	0.00348	
10989	22800	30.733	72.069	25.171	67.255	1	411.26	42.1	-9.2	86.0	-6872.6	47.233.278	63.489	0.72	0.04	0.00031	0.05113	0.00031	
10989	30000	30.797	70.418	25.444	67.186	1	417.09	41.7	-9.8	82.2	-7389.6	60.380	0.70	0.08	0.00344	0.56310	0.00344		
10989	33100	30.355	71.539	26.819	67.181	1	408.12	41.3	-10.0	100.6	-7388.6	54.582.555	74.073	0.72	0.05	0.00225	0.47575	0.00225	
10989	40200	31.05	73.11	26.116	67.258	1	395.94	41.1	-10.2	93.7	-8414.6	70.805.285	85.676	0.73	0.08	0.00101	0.32398	0.00101	
10989	43800	31.223	72.486	26.505	67.208	1	394.74	40.7	-10.6	112.8	-8524.6	90.549	70.426.206	88.737	0.73	0.04	0.00144	0.40332	0.00144
10989	50400	31.583	72.808	26.844	67.224	1	388.75	40.4	-10.9	118.7	-8023.6	81.426.206	81.426.206	0.73	0.03	0.00121	0.38024	0.00121	
10989	54000	27.7	78.037	18.863	67.285	1	438.88	48.4	-2.9	8.5	-4010.6	16.085.280	11.691	0.78	0.02	0.00031	0.13186	0.00031	
10989	54800	27.7	82.045	13.679	67.285	1	445.83	48.4	-2.9	8.7	-3415.6	11.886.645	10.073	0.77	0.01	0.00004	0.05113	0.00004	
10989	21300	27.917	76.938	18.848	67.321	1	408.87	49.4	-1.9	3.5	-3023.6	9.142.442	5.687	0.78	0.02	0.00031	-0.03288	-0.00031	
10989	24100	28.533	78.031	18.968	67.407	1	461.75	49.4	-1.9	3.5	-3023.6	13.374	-1.456	0.73	0.02	0.000171	0.11242	0.000171	
10989	31000	28.5	77.545	16.877	67.212	1	461.98	49.4	-1.0	1.0	-1.894.6	3.551.895	1.986	0.78	0.01	0.00016	0.08878	0.00016	
10989	33800	27.887	78.729	16.103	67.358	1	457.03	51.3	-0.1	0.0	-2.295.6	5.269.885	1.54	0.80	0.03	0.00119	-0.00234	-0.00018	
10989	40500	27.7	81.38	14.65	67.384	1	481.17	50.8	1.4	1.9	-1.881.6	3.640.586	2.619	0.81	0.05	0.00258	0.07067	0.00258	
10989	45300	27.7	82.045	13.679	67.285	1	495.30	53.6	2.3	5.2	-1.480.6	2.133.490	3.338	0.82	0.06	0.00332	0.13186	0.00332	
10989	50100	27.817	78.921	14.572	67.31	1	457.09	52.7	1.4	2.0	-1.029.6	1.060.173	-1.458	0.80	0.04	0.00132	0.05151	0.00132	
10989	52600	27.367	80.416	13.325	67.387	1	408.73	57.387	1.0	2.7	-1.156.6	13.374	-3.15	0.80	0.04	0.000171	0.11242	0.000171	
10989	55000	27.193	79.53	13.264	67.271	1	461.46	54.0	2.7	7.2	-347.4	120.654	9.33	0.80	0.04	0.00016	0.08878	0.00016	
10989	62300	27.317	78.111	13.897	67.198	1	478.70	53.3	2.0	3.9	-28.6	821	-56.0	0.79	0.03	0.00080	0.05574	0.00080	
10989	65000	27.35	74.555	14.914	67.285	1	490.52	52.4	1.1	53.4	-2.847	5.847	56	0.78	0.01	0.0016	0.01336	0.0016	
11199	184400	27.467	73.748	14.083	67.257	1	511.61	53.0	1.7	2.8	3162.4	10.000.476	5.297	0.74	0.02	0.00064	-0.04462	-0.00064	
11199	201100	27.283	73.334	14.935	67.154	1	453.45	510.09	92.6	1.2	3010.4	2.082.225	3.730	0.73	0.03	0.00087	-0.04680	-0.00087	
11199	222500	26.8	73.891	14.368	67.214	1	480.83	52.8	1.5	2.3	2643.4	8.084.656	4.333	0.74	0.02	0.00053	-0.03463	-0.00053	
11199	222500	26.5	75.397	14.546	67.181	1	434.29	486.65	52.6	1.3	1.7	1.667.4	2.760.656	2.156	0.75	0.01	0.00018	0.01448	0.00018
11199	231800	26.833	74.733	14.704	67.489	1	481.303	502.76	52.8	1.5	2.1	2277.4	5.188.336	3.332	0.75	0.02	0.00024	-0.02288	-0.00024
11199	231800	27.35	73.611	15.921	67.214	1	460.7	545.40	51.3	0.0	0.0	154.14	2.375.769	-45	0.74	0.03	0.00071	0.00077	0.00071
11199	24300	25.317	73.176	15.921	67.423	1	497.78	650.63	66.3	1.5	3010.4	17.084.4	281.192.141	259.078.932	0.73	0.03	0.00018	-0.48609	-0.00018
11199	24700	25.183	71.373	1.1	67.31	1	448.84	687.09	66.3	1.5	225.1	187.04.4	280.731	0.71	0.05	0.00241	-0.73870	-0.00241	
11199	24700	25.067	71.012	1.0923	67.542	1	482.46	671.79	66.4	1.5	228.8	19180.4	367.985.939	290.155	0.71	0.05	0.00278	-0.79759	-0.00278
11199	25800	25.817	73.316	1.0222	67.407	1	478.70	52.0	3.9	2.8	2.1	1757.4	30.752.444	0.73	0.73	0.03	0.00018	0.01448	0.00018
11199	25800	25.818	72.438	1.1	67.541	1	474.58	678.20	66.5	1.5	2.1	226.9	1702.4	256.103	0.73	0.03	0.00088	-0.44692	-0.00088
11199	25800	25.818	72.822	1	67.557	1	481.68	66.3	15.3	0.0	0.0	301							

Config 1 A40

	Config 1 A40									
11298	231800	31.6	78.182	24	67.058	1.0994	38834	43.1	-8.3	68.3
11299	235100	31.933	80.023	23.894	67.021	1.244	38005	43.1	-8.2	67.2
11300	22700	30.867	77.847	22.491	67.081	1.3588	40568	44.6	-6.7	45.3
11301	25700	30.25	78.114	22.377	67.158	1.3809	40503	44.8	-6.5	42.8
11302	32800	30.8	79.25	22.3	67.128	1.483	39967	44.8	-6.5	42.2
11303	42800	29.987	78.313	22.027	67.25	1.4642	40305	45.2	-6.1	37.2
11304	42200	27.35	77.023	14.8	67.121	1.4278	48335	52.3	1.0	1.0
11305	44900	27.15	76.52	14.458	67.246	1.2287	49334	52.8	1.5	2.2
11306	54300	27.15	76.233	14.7	67.388	1.3078	49191	52.7	1.4	1.9
11307	61000	26.733	75.826	14.626	67.232	1.0756	49379	52.6	1.3	1.8
11308	63700	27.117	77.136	14.754	67.286	1.0415	48467	52.5	1.2	1.5
Averages and Sums:		76.3			47.999	51.3	4.243			
Config 1 A40										

Energy Regression Statistics

SUMMARY OUTPUT						
Regression Statistics						
Multiple R						
R Square						
Adjusted R Square						
Standard Error						
Observations						
ANOVA						
Regressions	df	33	MS	F	Significance F	
Residual		66	2.6E+08	3923671.6	1.4E-43	
Total		67	4.8E+09			
Coefficients Standard Error t Stat P-value						
Intercept	-5310.3	1579.01	-3.3630847	0.00129	0.953% Lower 95.0% Upper 95.0%	
X Variable 1	1038.72	30.4087	34.155552	1.1E-43	-8482.9 -2157.72 -8482.91 -2157.72	

Seasonal and Design Energy Consumption Values and Associated Errors

Seasonal and Design Energy Consumption Values and Associated Errors						
Seasonal Energy Consumption						
Design Energy Consumption						
S						
SE(Ynew)						
Seasonal						
Design						
Design						
SE(Ynew)						
Percent error						
SE(Ynew)						
Percent error						
6.47						

SUMMARY OUTPUT						
Regression Statistics						
Multiple R						
R Square						
Adjusted R Square						
Standard Error						
Observations						
ANOVA						
Regressions	df	33	MS	F	Significance F	
Residual		66	2.6E+08	3923671.6	1.1E-43	
Total		67	4.8E+09			
Coefficients Standard Error t Stat P-value						
Intercept	-5310.3	1579.01	-3.3630847	0.00129	0.953% Lower 95.0% Upper 95.0%	
X Variable 1	1038.72	30.4087	34.155552	1.1E-43	-8482.9 -2157.72 -8482.91 -2157.72	

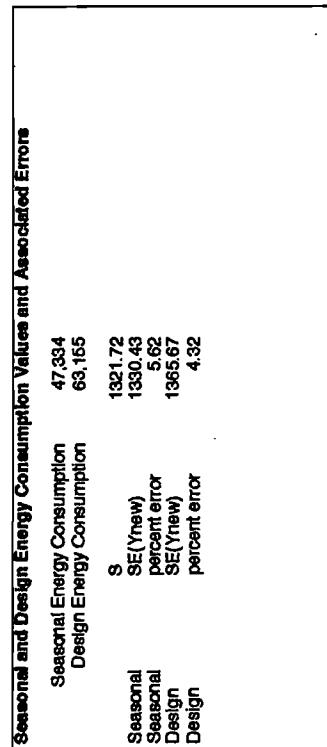
9

Seasonal and Design Distribution Efficiency Values and Associated Errors						
Seasonal Distribution Efficiency						
Design Distribution Efficiency						
S						
SE(Ynew)						
Seasonal						
Design						
Design						
SE(Ynew)						
Percent error						
SE(Ynew)						
Percent error						
0.764						
0.751						
0.03						
0.03						
0.62						
0.03						
8.98						

SOFTWARE OUTPUTS FOR INDIVIDUAL HEATING CYCLES

ERROR CALCULATION PARAMETERS											
ENERGY						DISTRIBUTION EFFICIENCY					
Date	Time	Duration (min)	Average Outside Temp (F)	Average Inside Temp (F)	Average Wind Speed (mph)	Total Energy Out of Furnace	Δt (F)	Δt (°F)	Δt (°Bar)	Δt (W-Bar)	Distribution Efficiency (fraction)
11/99	202800	49.76	74.983	33.9	67.584	1.0871	31264	33.7	-11.3	126.7	-11069.2
11/99	211700	48.317	71.94	34.386	67.604	1.065	32063	33.2	-11.7	137.6	-10270.2
11/99	220500	48.317	73.944	32.914	67.605	1.1193	32671	34.7	-10.3	106.1	-9662.2
11/99	225300	48	74.461	32.753	67.605	1.0621	32805	34.9	-10.1	101.8	-94637.451
11/99	231700	53.487	75.828	34.02	67.507	1.3671	30642	33.5	-11.5	131.2	-16912.1
12/99	200100	49.587	61.068	27.98	67.512	1.0111	33870	39.8	-5.3	28.2	-9463.2
12/99	204900	48.3	61.068	26.924	67.518	1.07	35199	40.6	-4.3	18.9	-7134.2
12/99	215700	47.983	60.162	28.282	67.485	1.0079	38155	41.2	-3.7	14.0	-6178.2
12/99	222400	46.5	79.072	26.173	67.45	1.0012	39577	41.3	-3.7	13.4	-5906.2
12/99	231000	46.1	78.272	26.145	67.494	1.0146	37171	41.3	-3.6	12.9	-5162.2
12/99	235500	45.717	77.723	25.226	67.557	1.0895	38370	42.3	-2.6	6.8	-9863.2
12/99	4000	44.95	77.912	24.592	67.393	1.1284	38811	42.9	-2.1	4.2	-5522.2
12/99	12500	44.85	77.426	23.546	67.396	1.0007	38872	43.9	-1.1	1.2	-2361.2
12/99	20800	43.2	76.76	23.443	67.543	1.0474	41096	44.1	-0.6	0.7	-1237.2
12/99	25200	43.367	78.751	22.624	67.387	1.055	41205	44.8	-0.2	0.0	-1128.2
12/99	33500	43.487	76.267	22.384	67.42	1.0976	41733	45.0	0.1	0.0	-600.2
12/99	41800	42.767	75.072	22.441	67.45	1.1423	42370	45.0	0.1	0.0	-36.8
12/99	50100	43.017	76.571	22.486	67.357	1.002	41407	44.9	-0.1	0.0	-926.2
12/99	54400	45.95	76.792	21.425	67.575	1	42450	46.1	1.1	1.3	-116.8
12/99	62800	43.183	77.933	21.471	67.355	1.0007	41648	45.9	0.9	0.9	-885.2
12/99	204300	56.483	75.098	36.732	67.482	1.0037	28279	30.6	-14.2	201.4	-14054.2
12/99	214000	57.033	72.825	36.922	67.444	1.0087	28828	30.5	-14.4	207.9	-13404.2
12/99	229600	56.193	73.284	36.849	67.493	1.0031	28877	30.8	-14.3	204.5	-13456.2
12/99	233300	74.597	76.792	21.425	67.485	1.0002	28838	30.3	-14.7	215.0	-14295.2
12/99	2800	55.917	72.697	37.489	67.514	1.0303	28247	30.0	-14.9	222.5	-13861.2
12/99	12500	55.75	75.808	38.64	67.486	1.0016	28107	30.8	-14.1	198.7	-14226.2
12/99	22100	56.633	78.801	35.791	67.512	1.0026	28588	32.1	-13.2	174.8	-13745.2
12/99	31700	55.617	76.856	35.444	67.444	1	28833	32.0	-12.9	167.5	-13500.2
12/99	41300	56.117	77.398	35.275	67.486	1.0466	28852	32.2	-12.7	162.1	-1481.2
12/99	50700	55.733	74.5	37.188	67.485	1.0002	28838	30.3	-13.0	127.7	-161.2
12/99	52690	55.033	70.071	35.279	67.529	1.0303	28270	32.3	-12.7	161.1	-12563.2
12/99	85900	54.95	74.414	35.391	67.512	1.0508	28904	32.1	-12.8	164.4	-14249.2
12/99	205200	48.115	77.111	24.151	67.443	1	38589	43.3	-1.7	2.7	-2734.2
12/99	213800	46.5	77.164	22.7	67.415	1.0431	40928	44.7	-0.2	0.1	-1405.2
12/99	222200	44.539	77.419	22.251	67.48	1.0027	41298	45.2	0.3	0.1	-1037.2
12/99	230800	43.983	76.928	23.447	67.483	1.02472	41373	44.0	-0.9	0.9	-980.2
12/99	256000	43.4	72.828	24.224	67.495	1.0233	4293	43.3	-1.7	2.8	-137.2
12/99	3800	43.783	71.071	25.882	67.538	1.492	41258	41.7	-3.3	10.8	-1077.2
12/99	33700	48.465	76.465	21.151	67.443	1	38511	39.1	-5.8	33.7	-8282.2
12/99	38900	46.983	71.605	25.854	67.555	1	37657	40.7	-4.3	18.3	-4876.2
12/99	51100	47.2	71.184	28.737	67.468	1.1423	38777	41.7	-3.2	10.5	-4456.2
12/99	55800	47.2	73.134	28.968	67.453	1.2472	38866	42.2	-6.2	38.6	-4187.2
12/99	12900	44.325	78.078	22.918	67.527	1.0303	42895	44.5	-0.4	0.2	-1455.2
12/99	147300	47.783	74.035	28.033	67.429	1.1394	38804	38.4	-8.5	42.1	-20749.649
12/99	20800	47.767	76.239	28.184	67.487	1.0025	38810	38.4	-5.5	30.8	-1609.046
12/99	25500	46.683	71.605	25.854	67.555	1	37657	40.7	-4.3	18.3	-1513.487
12/99	34000	45.7	72.992	25.854	67.492	1	37877	41.7	-3.2	10.5	-4456.2
12/99	42800	45.217	76.918	25.215	67.438	1.0006	38866	42.2	-2.7	7.4	-5667.2
12/99	51000	44.335	73.333	24.344	67.48	1.2472	38853	43.1	-1.8	3.3	-2880.2
12/99	55400	44.25	78.078	22.918	67.459	1.0303	40295	44.5	-0.4	0.2	-2038.2
12/99	63800	44.3	78.252	22.48	67.346	1.0331	40512	44.9	-0.1	0.0	-1821.2
12/99	14700	48.95	76.465	21.139	67.429	1.3292	38881	38.5	-8.5	71.4	-1452.2
12/99	23700	50.05	74.684	31.059	67.45	1.1427	34045	36.4	-8.6	73.1	-5286.2
12/99	32700	49.687	76.48	31.047	67.449	1.4561	33866	38.4	-8.5	72.9	-5647.2
12/99	41600	49.2	75.837	31.118	67.538	1.3346	33707	36.4	-8.5	4.841	-71.183.355
12/99	61100	58.4	77.098	31.13	67.572	1.4504	50454	54.6	9.6	8.1	-154.170
12/99	202800	42.25	73.237	22.042	67.47	1.0552	43802	45.4	0.5	0.2	-148.8
12/99	210500	42.55	72.688	22.807	67.42	1.471	43557	44.6	-0.3	0.1	-1023.8

	<i>t</i> Statistic	MS	S	df	F Statistic	df	Multiple R	Residual	Total	Coefficients	t Stat	P-value	Intercept
Config 2 Δ30	43.21	67.495	44.4	-0.6	987.8	975.782	0.01581	-0.00076	-0.00076	42.748	-4.16	0.00064	0.02537
215000	41.65	72.328	28.126	-0.6	42.414	67.456	1.2414	-0.03	-0.03	1.0359	-1.0	0.4148	172.077
12899	223300	42.75	72.655	-0.6	42.020	67.395	1.2284	-0.03	-0.03	1.2207	-1.0	1.1	51.157
12868	231600	42.85	72.558	-0.6	42.020	67.418	1.1633	-0.03	-0.03	1.2207	-1.0	1.1	52.8
12899	235800	42.95	72.807	-0.6	42.020	67.456	1.0102	-0.03	-0.03	1.0102	-1.0	0.6	278.652
13099	4200	43.05	74.383	-0.6	42.020	67.391	1.0224	-0.03	-0.03	1.0224	-1.0	1.2	1.38648
13099	12400	41.65	75.566	-0.6	42.021	67.421	1.0405	-0.03	-0.03	1.0405	-1.0	2.0	1.831.889
13099	20500	41.917	72.917	-0.6	42.021	67.571	1.0405	-0.03	-0.03	1.0405	-1.0	1.4	3.413
13099	33000	42.533	72.959	-0.6	42.021	67.483	1.2406	-0.03	-0.03	1.2406	-1.0	2.414.8	5.831.364
13099	41800	42.6	68.812	-0.6	42.021	67.495	1.0278	-0.03	-0.03	1.0278	-1.0	2.9	5
13099	45700	43.517	71.078	-0.6	42.021	67.433	1.1683	-0.03	-0.03	1.1683	-1.0	3.5	12.0
13099	54100	44.083	70.069	-0.6	42.021	67.431	1.1537	-0.03	-0.03	1.1537	-1.0	4.1	16.6
13099	62400	43.833	69.941	-0.6	42.021	67.052	1.0366	-0.03	-0.03	1.0366	-1.0	4.5	20.3
13099	220800	39	76.979	-0.6	42.021	67.447	1.2198	-0.03	-0.03	1.2198	-1.0	7.0	49.0
13099	224400	38.633	77.647	-0.6	42.021	67.4523	1.0092	-0.03	-0.03	1.0092	-1.0	5.4	5.4
13099	232200	37.7	78.009	-0.6	42.021	67.456	1.0291	-0.03	-0.03	1.0291	-1.0	2.3	5
13199	0	38.233	76.022	-0.6	42.021	67.518	1.0048	-0.03	-0.03	1.0048	-1.0	8.0	88.0
13199	38010	37.317	78.953	-0.6	42.021	67.385	1.0064	-0.03	-0.03	1.0064	-1.0	10.0	100.8
13199	11500	37.4	75.744	-0.6	42.021	67.508	1.0361	-0.03	-0.03	1.0361	-1.0	11.5	138.2
13199	15200	37.2	76.886	-0.6	42.021	67.483	1.0298	-0.03	-0.03	1.0298	-1.0	12.3	15.1
13199	22800	37.283	76.033	-0.6	42.021	67.532	1.0173	-0.03	-0.03	1.0173	-1.0	13.6	184.4
13199	30700	37.183	74.254	-0.6	42.021	67.408	1.0281	-0.03	-0.03	1.0281	-1.0	7.5	72.5
13199	34300	36.883	74.983	-0.6	42.021	67.658	1.0024	-0.03	-0.03	1.0024	-1.0	9.4	88.0
13199	42000	36.683	74.286	-0.6	42.021	67.486	1.0055	-0.03	-0.03	1.0055	-1.0	15.0	100.5
13199	45600	35.467	73.339	-0.6	42.021	67.433	1.0016	-0.03	-0.03	1.0016	-1.0	15.3	234.1
13199	53200	38.483	72.654	-0.6	42.021	67.575	1.0298	-0.03	-0.03	1.0298	-1.0	15.1	15.1
13199	22800	37.283	76.093	-0.6	42.021	67.532	1.0173	-0.03	-0.03	1.0173	-1.0	14.0	14.0
13199	30700	37.183	74.254	-0.6	42.021	67.408	1.0281	-0.03	-0.03	1.0281	-1.0	14.2	202.6
13199	34300	36.883	74.983	-0.6	42.021	67.658	1.0024	-0.03	-0.03	1.0024	-1.0	15.0	220.6
13199	42000	36.683	74.286	-0.6	42.021	67.486	1.0055	-0.03	-0.03	1.0055	-1.0	15.3	248.2
13199	45600	35.467	73.339	-0.6	42.021	67.433	1.0016	-0.03	-0.03	1.0016	-1.0	15.1	268.6
13199	53200	38.483	72.654	-0.6	42.021	67.575	1.0298	-0.03	-0.03	1.0298	-1.0	16.6	242.7
13199	60800	36.183	73.33	-0.6	42.021	67.473	1.0173	-0.03	-0.03	1.0173	-1.0	16.4	267.7
13199	64500	36.5	73.33	-0.6	42.021	67.434	1.0283	-0.03	-0.03	1.0283	-1.0	16.4	208.6
13199	208000	40.833	78.37	-0.6	42.021	67.431	1.0028	-0.03	-0.03	1.0028	-1.0	14.6	214.617.278
13199	204700	40.433	76.211	-0.6	42.021	67.402	1.0207	-0.03	-0.03	1.0207	-1.0	15.0	220.636.022
13199	212700	40.3	76.804	-0.6	42.021	67.441	1.0233	-0.03	-0.03	1.0233	-1.0	15.3	222.808
13199	220700	40.15	76.806	-0.6	42.021	67.476	1.0209	-0.03	-0.03	1.0209	-1.0	15.1	240.112
13199	224700	39.783	74.949	-0.6	42.021	67.473	1.0177	-0.03	-0.03	1.0177	-1.0	16.4	247.167.278
13199	232800	39.1	76.076	-0.6	42.021	67.48	1.0283	-0.03	-0.03	1.0283	-1.0	17.0	208.541
20199	500	39.217	76.13	-0.6	42.021	67.431	1.0028	-0.03	-0.03	1.0028	-1.0	14.6	220.636.022
20199	4900	38.187	75.98	-0.6	42.021	67.422	1.0208	-0.03	-0.03	1.0208	-1.0	14.8	248.223.271
20199	12200	38.383	74.572	-0.6	42.021	67.483	1.0243	-0.03	-0.03	1.0243	-1.0	14.8	246.134
20199	20000	38.333	72.961	-0.6	42.021	67.133	67.505	-0.03	-0.03	67.505	-1.0	15.0	288.523.126
20199	238800	37.55	74.271	-0.6	42.021	67.441	1.1957	-0.03	-0.03	1.1957	-1.0	16.4	263.212.393
20199	31600	36.117	75.822	-0.6	42.021	67.478	1.0421	-0.03	-0.03	1.0421	-1.0	17.0	289.343.435
20199	35400	38.067	73.377	-0.6	42.021	67.492	1.0107	-0.03	-0.03	1.0107	-1.0	16.4	3.284.605
20199	43100	37.5	73.718	-0.6	42.021	67.537	1.0086	-0.03	-0.03	1.0086	-1.0	16.4	6.905
20199	50800	37.433	73.346	-0.6	42.021	67.387	1.1892	-0.03	-0.03	1.1892	-1.0	17.0	19.242
20199	54800	37.033	71.341	-0.6	42.021	67.482	1.0502	-0.03	-0.03	1.0502	-1.0	16.4	19.389.531
20199	62300	37.567	72.861	-0.6	42.021	67.492	1.0667	-0.03	-0.03	1.0667	-1.0	16.4	33.344
20199	76.1	Average and Sum:	76.1	-0.6	42.021	67.492	42.933	-0.03	-0.03	42.933	-1.0	17.0	7.883



X Vahakn 088.783 15.0793 65.573038 2.2E+03 958.872 1018.71 958.872 1018.71

Dichotomous Efficiency Regression Statistics
SUMMARY OUTPUT

Regression Statistics		ANOVA			
		<i>d.f.</i>	<i>SS</i>	<i>MS</i>	<i>F</i>
Multiple R	0.01553	1	1.4E-05	1.407E-05	0.023886
R Square	0.00024	89	0.05834	0.00061883	0.8775
Adjusted R Square	-0.00399				
Standard Error	0.02428				
Observations	101				

Coefficient Standard Err.	t Stat.	P-value	Coefficient Standard Err.	t Stat.	P-value

Seasonal and Design Distribution Efficiency Values and Associated Errors

Design Distribution Efficiency	
	S SE(Ynew) percent error SE(Ynew) percent error
Seasonal	0.02
Seasonal	0.02
Design	6.51
Design	0.03
	6.67

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SOFTWARE OUTPUTS FOR INDIVIDUAL HEATING CYCLES

		ERROR CALCULATION PARAMETERS						DISTRIBUTION ENERGY											
		AT			AT (F)			xi-xbar			(xi-xbar)^2			(Vi-Vbar)^2			Distribution Efficiency (fraction)		
Date	Time	Distribution Efficiency (percent)	Average Outside Temp (F)	Average Inside Temp (F)	Average Wind Speed (mph)	Total Energy Out of Furnace	At (F)	xi-xbar	(xi-xbar)^2	Vi-Vbar	(Vi-Vbar)^2	(Vi-Vbar)(Vi-Vbar)	At (F)	xi-xbar	(xi-xbar)^2	Vi-Vbar	(Vi-Vbar)^2	(Vi-Vbar)(Vi-Vbar)	
20599	204400	40.767	78.158	23.944	67.3	1,2617	39144	43.4	-0.2	0.0	-1329.4	-1,767,393	290	0.78	0.02	0.00038	-0.00424		
20599	210400	39.933	77.174	23.36	67.254	1,0007	39194	43.7	-0.1	0.0	-559.4	-312,966	456	0.77	0.01	0.00010	0.00079		
20599	220400	39.3	76.798	22.995	67.141	0.0051	40866	44.1	0.6	0.3	132.7	-17,574	76	0.77	0.01	0.00003	0.00030		
20599	224300	39.233	76.188	23.48	67.235	1,2065	40526	43.8	0.2	0.0	55.6	-3,088	10	0.76	0.00	0.00000	0.00001		
20599	232200	38.717	74.575	23.622	67.194	1,1284	41288	43.7	0.1	0.0	794.6	-631,336	78	0.75	-0.02	0.00023	-0.00148		
20699	100	38.887	73.822	23.738	67.223	1,2584	41500	43.6	-0.1	0.0	1026.6	-1,053,839	91	0.74	-0.02	0.00051	0.00201		
20699	4000	38.983	74.444	24.268	67.212	1,3012	40641	42.9	-0.7	0.4	167.6	-28,079	-111	0.74	-0.02	0.00030	0.01147		
20699	11900	39.333	73.461	25.2	67.235	1,3042	4201	42.0	-1.5	2.4	-192.4	-37,031	296	0.73	-0.02	0.00072	0.00141		
20699	15800	39.483	71.84	25.73	67.229	1,3176	40858	41.6	-2.0	4.1	184.6	-34,065	-372	0.72	-0.04	0.00180	0.00555		
20699	23800	40.117	71.832	26.815	67.268	1,42884	39731	40.7	-2.9	8.5	-742.4	-551,207	2,168	0.72	-0.04	0.00181	0.12412		
20699	55800	40.117	71.816	26.988	67.233	1,3927	39598	40.3	-3.2	10.4	-884.4	-762,222	2,854	0.72	-0.05	0.00208	0.14739		
20699	63700	39.75	71.858	26.734	67.3161	3,9859	40.6	-3.0	8.8	-807.4	-661,949	2,397	0.72	-0.04	0.00178	0.12539			
20799	40700	45.987	74.383	33.087	67.319	1,2722	32021	34.2	-9.3	87.3	-852.4	-71,443,629	78.963	0.74	-0.02	0.00032	0.16801		
20799	54900	45.933	74.063	32.651	67.349	1,2221	32855	34.7	-8.9	78.8	-784.4	-81,597,306	69,683	0.74	-0.02	0.00045	0.18803		
20799	62800	45.617	75.03	32.057	67.337	1,0102	32705	35.3	-8.3	68.8	-7705.4	-58,373,703	63,909	0.75	-0.01	0.00013	0.08301		
20799	200800	45.95	80.121	28.666	67.239	1,06868	32820	37.6	-6.0	36.0	-7653.4	-58,575,042	45,923	0.80	0.04	0.00155	-0.23642		
20799	205400	45.717	80.809	28.291	67.283	1,1472	32904	38.0	-5.6	31.4	-7589.4	-42,412	42.1	0.81	0.05	0.00214	-0.25829		
20799	213800	44.783	78.813	28.162	67.283	1,2399	33898	38.1	-5.4	29.6	-8858.4	-57,286,321	35,845	0.79	0.03	0.00069	-0.14324		
20799	222300	45.087	77.943	29.315	67.127	1,142	34099	38.0	-5.6	31.6	-6374.4	-40,633,400	35,818	0.78	0.02	0.00031	-0.08898		
20799	230800	44.533	78.715	28.826	67.159	1,1168	34171	38.3	-5.2	27.5	-852.4	-40,383,409	33,283	0.79	0.03	0.00084	-0.13279		
20799	235200	44.183	76.558	28.884	67.284	1,059	35341	38.6	-5.0	24.7	-5132.4	-28,341,872	25,529	0.77	0.00	0.00015	0.01873		
20899	31700	44.45	78.837	28.9	67.191	1,0622	34915	38.3	-5.3	27.9	-5558.4	-30,888,181	29,365	0.77	0.01	0.00004	-0.03484		
20899	62000	43.85	78.188	28.075	67.282	1,2148	35130	38.2	-5.4	28.8	-5343.4	-28,952,280	28,423	0.76	0.00	0.00000	-0.00335		
20899	20500	44.167	75.477	28.217	67.185	1,2087	35225	38.0	-5.6	31.4	-5248.4	-27,546,052	28,423	0.75	-0.01	0.00005	0.03949		
20899	24900	44.033	78.318	29.084	67.187	1,3207	34941	38.1	-5.5	29.9	-5332.4	-30,607,819	30,288	0.76	0.00	0.00000	-0.01078		
20899	33200	43.9	77.884	27.78	67.257	1,2074	35070	38.5	-4.1	16.8	-493.4	-24,043,658	20,089	0.77	-0.02	0.00029	-0.07017		
20899	41500	42.1	77.409	26.843	67.148	1,1335	37643	41.3	-2.3	5.1	-2830.4	-8,687,440	8,649	0.77	0.01	0.00015	-0.02785		
20899	45700	42.487	78.555	25.423	67.202	1,1526	37443	41.6	-1.8	3.2	-3150.4	-9,159,526	5,440	0.79	0.02	0.00056	-0.04261		
20899	53800	41.567	77.848	24.45	67.147	1,1713	37978	42.0	-1.6	2.5	-6295.4	-6,227,188	3,968	0.78	0.02	0.00028	-0.02365		
20899	62000	41.45	77.567	24.45	67.179	1,2265	38132	42.7	-0.6	0.7	-2341.4	-4,542,310	1,979	0.79	0.03	0.00078	-0.08894		
20899	195800	43.767	79.507	26.729	67.328	1,0716	35895	40.6	-3.0	8.9	-4578.4	-20,982,052	13,621	0.80	0.03	0.00111	-0.08855		
20899	204000	42.417	80.486	25.923	67.266	1,0669	34849	41.6	-1.9	3.8	-4064.4	-16,519,818	7,889	0.80	0.04	0.00185	-0.04056		
20899	212200	41.687	79.046	25.008	67.167	1,0097	37568	42.2	-1.4	2.0	-2057.4	-8,453,169	4,117	0.79	0.03	0.00082	-0.04056		
20899	220200	40.317	78.29	24.11	67.215	1,0706	38137	43.1	-0.5	0.2	-1648.4	-2,717,332	773	0.78	0.02	0.00044	-0.00989		
20899	224200	40.517	77.584	23.695	67.215	1,0706	38255	43.5	-0.1	0.0	-694.4	-808,980	49	0.78	0.01	0.00020	-0.00078		
20899	228200	40.063	78.086	23.179	67.055	1,049	38659	43.9	0.3	0.1	-604.4	-647,113	-43	0.78	0.02	0.00036	0.00569		
20899	200	39.45	77	23.138	67.155	1,0142	40535	44.0	0.4	0.2	-18.4	-14,026	-52	0.77	0.01	0.00007	0.00365		
20899	4200	39.7	75.443	23.773	67.107	1,0204	40552	43.3	-0.2	0.1	-56.8	-3,430	-14	0.77	-0.01	0.00006	0.00184		
20899	12100	39.483	74.179	24.157	67.185	1,2102	40900	43.0	-0.5	0.3	-426.8	-181,959	-233	0.74	-0.02	0.00040	0.01083		
20899	20000	39.067	73.515	24.04	67.135	1,173	41387	43.1	-0.5	0.2	-653.8	-745,747	-414	0.74	-0.03	0.00071	0.01277		
20899	24000	39.45	72.929	24.11	67.125	1,1651	40900	42.4	-1.1	1.3	-67.6	-367,923	-684	0.73	-0.03	0.00114	0.03810		
20899	31800	39.687	72.944	25.307	67.185	1,044	40422	41.9	-1.7	2.9	-51.4	-2,645	87	0.73	-0.03	0.00105	0.05491		
20899	39.75	72.214	25.454	67.083	1,1807	40577	41.6	-1.9	3.8	-10,726	-201	-52	0.72	-0.04	0.00157	0.07717			
20899	46.033	72.512	25.822	67.083	1,0685	40298	41.5	-2.1	4.4	-225.4	-474	-14	0.73	-0.04	0.00135	0.07717			
20899	45.183	71.916	26.516	67.114	1,0775	40715	41.8	-2.0	3.9	-241.8	-68,354	-477	0.72	-0.04	0.00182	0.08424			
20899	44.393	72.303	26.407	67.134	1,1273	39826	40.7	-2.8	8.1	-871.4	-745,747	-414	0.72	-0.04	0.00150	0.11042			
20899	43.493	70.058	27.692	67.129	1,1651	39547	39.5	-4.1	16.8	-926.4	-886,279	-3,795	0.70	-0.03	0.00375	0.25088			
21099	203000	48.517	83.381	30.918	67.316	1,0186	30495	36.4	-7.2	51.4	-9878.4	-98,559,132	71,585	0.68	0.07	0.00518	-0.51636		
21099	211700	46.983	83.114	29.483	67.31	1,0182	31882	37.8	-5.7	32.8	-8591.4	-73,812,727	49,203	0.68	0.07	0.00481	-0.39703		
21099	220300	46.033	81.318	29.019	67.33	1,0018	33098	38.3	-5.3	38.3	-7465.4	-55,792,695	39,291	0.68	0.05	0.00264	-0.27034		
21099	224800	45.183	80.506	28.622	67.291	1,0078	33672	38.7	-4.9	24.1	-6801.4	-46,258,495	33,361	0.61	0.04	0.00187	-0.21212		
21099	233200	44.393	79.898	28.313	67.358	1,0053	34200	39.0	-4.5	20.5	-6193.4	-38,358,616	28,050	0.60	0.04	0.00137	-0.16787		
21099	1600	43.493	70.058	27.718	67.236	1,0053	34691	38.5	-4.1	16.5	-5892.4	-34,603,022	23,859	0.60	0.04	0.00160	-0.16243		
21199	5800	42.667	80.41	27.226	67.279	1,0049	34998	40.1	-3.5	12.4	-5485.4	-30,089,979	18,314	0.60	0.04	0.00179	-0.14889		
21199	14100	42.833	78.95	27.223	67.206	1,0051	35476	39.9	-3										

Energy Regression Statistics

Seasonal and Design Energy Consumption Values and Associated Errors	
Seasonal Energy Consumption	47,227
Design Energy Consumption	64,044
S	1548.41
SE(Ynew)	1568.62
percent error	6.64
SE(Yraw)	1692.13
percent error	5.28
Seasonal	
Seasonal	
Design	
Design	

Seasonal and Design Distribution Efficiency Values and Associated Errors

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SUMMARY OUTPUT

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Config 3 A130

R Square	0.06106
Adjusted R Square	0.05598
Standard Error	0.03008
Observations	80

ANOVA	df	SS	MS	F	Significance F
Regression	1	0.00518	0.0051772	5.72305	0.01887
Residual	88	0.07861	0.0008646		
Total	89	0.08478			

Coefficient	Standard Err	t Stat	P-value	Other 95% CI	Other 95% Other 95.0%	
Intercept	0.82165	0.02521	32.591712	6.7E-51	0.77155	0.77155
X Variable	-0.0014	0.00057	-2.392289	0.01887	-0.00025	-0.00023

S	0.03
SE(Ynew)	0.03
Percent error	8.09
SE(Ynew)	0.03
Percent error	8.99

Seasonal Design
Seasonal Design

SOFTWARE OUTPUTS FOR INDIVIDUAL HEATING CYCLES										ERROR CALCULATION PARAMETERS										
					AT					ENERGY					DISTRIBUTION EFFICIENCY					
Date	Time	Duration (min)	Distribution Efficiency (percent)	Average Outside Temp (F)	Average Inside Temp (F)	Average Wind Speed (mph)	Total Energy Out of Furnace	x1-xbar	Δt (F)	x1-xbar	Δt (F)	y1-ybar	(y1-ybar)2	(x1-xbar)(y1-ybar)	(x1-xbar)(y1-ybar)2	Distribution Efficiency (fraction)	y1-year	(y1-ybar)2	(x1-xbar)(y1-ybar)	(x1-xbar)(y1-ybar)2
20599	20400	40.767	78.128	23.944	67.73	1.20517	39144	43.4	-2.9	8.2	-4234.9	17,834.519	12,158	0.78	0.00067	0.00028	-0.07411	-0.04187		
20599	212400	38.953	77.174	23.6	67.254	1.0007	38914	43.7	-2.6	8.6	-3484.9	12,005.648	8,915	0.77	0.02	0.00015	-0.02523	-0.01585	-0.02227	
20599	220400	39.3	76.759	22.985	67.141	1.0051	40608	44.1	-2.1	4.3	-2772.9	7,889.067	5,770	0.77	0.01	0.00004	0.00004	0.00008	0.00008	
20599	224300	39.223	76.188	23.48	67.285	1.20865	40529	43.8	-2.5	6.1	-2849.9	8,122.026	7,044	0.76	0.01	0.00004	0.00004	0.00008	0.00008	
20599	232600	38.717	74.875	23.522	67.194	1.1334	41268	43.7	-2.6	6.1	-2110.9	4,451.969	5,388	0.76	-0.01	0.00008	0.00008	0.00022	0.00022	
20599	100	38.887	73.922	23.738	67.223	1.2594	41500	43.5	-2.7	7.5	-1878.9	3,530.326	5,152	0.74	-0.02	0.00026	0.00026	0.004454	0.004454	
20599	4000	38.983	74.444	24.286	67.212	1.3012	40641	42.9	-3.3	11.0	-2737.9	7,496.185	8,070	0.74	-0.01	0.00012	0.00012	0.03653	0.03653	
20599	11900	39.323	73.491	26.2	67.285	1.3042	40281	42.0	-4.2	17.6	-3097.9	9,597.088	12,986	0.73	-0.02	0.00042	0.00042	0.08817	0.08817	
20599	16800	39.483	71.94	25.733	67.29	1.3176	40658	41.6	-4.7	21.8	-2703.9	7,403.385	12,708	0.72	-0.04	0.000130	0.000130	0.16842	0.16842	
20599	22800	40.117	71.832	26.615	67.288	1.4284	38731	40.7	-5.6	31.1	-3847.9	13,307.296	20,383	0.72	-0.04	0.00131	0.00131	0.20147	0.20147	
20599	55800	40.117	71.816	26.886	67.283	1.3827	38589	40.3	-5.9	34.6	-3789.9	14,983.486	22,284	0.72	-0.04	0.00154	0.00154	0.23111	0.23111	
20599	63700	39.75	71.958	26.735	67.34	1.3181	38668	40.6	-5.6	31.6	-3712.9	13,785.750	20,873	0.72	-0.04	0.00129	0.00129	0.20174	0.20174	
20599	41500	42.1	77.409	25.843	67.148	1.1385	37543	41.3	-4.9	24.2	-5835.9	28,723	0.77	0.02	0.00035	0.00035	-0.09166	-0.09166		
20599	42487	78.555	25.423	67.220	1.1526	1.3042	37443	41.8	-4.4	19.8	-5835.9	35,235.107	28,402	0.73	-0.03	0.00081	0.00081	-0.13381	-0.13381	
20599	53800	41.587	77.848	25.163	67.147	1.1713	37973	42.0	-4.2	18.0	-5400.9	29,189.801	22,915	0.78	0.02	0.00053	0.00053	-0.09764	-0.09764	
20599	62000	41.45	78.98	24.45	67.179	1.2285	38132	42.7	-3.5	12.2	-5246.9	27,530.135	18,353	0.79	0.03	0.00118	0.00118	-0.12039	-0.12039	
20599	195800	43.767	79.507	26.729	67.328	1.0716	38695	40.6	-5.6	31.7	-7493.9	56,008.009	42,118	0.80	0.04	0.00167	0.00167	-0.22288	-0.22288	
20599	204000	42.417	80.486	25.623	67.258	1.0069	38404	41.6	-4.6	21.1	-6989.9	49,579.736	32,019	0.80	0.05	0.00244	0.00244	-0.22891	-0.22891	
20599	20899	41.587	79.046	25.009	67.167	1.0097	37566	42.2	-4.1	16.6	-5812.9	33,790.000	23,652	0.79	0.03	0.00122	0.00122	-0.14238	-0.14238	
20599	212200	41.587	79.317	24.11	67.215	1.0097	38825	43.1	-3.1	9.7	-4953.9	14,738.157	14,216	0.78	0.03	0.00075	0.00075	-0.08584	-0.08584	
20599	224200	40.317	78.29	24.637	67.215	1.0097	38574	43.5	-2.7	7.3	-3804.9	14,477.391	10,289	0.78	0.02	0.00042	0.00042	-0.05515	-0.05515	
20599	228200	40.083	78.066	23.179	67.055	1.049	38668	43.9	-2.4	5.5	-3799.9	13,763.482	8,721	0.78	0.03	0.00063	0.00063	-0.05212	-0.05212	
20599	200	39.46	77.	23.138	67.195	1.0142	40355	44.0	-2.2	4.9	-3023.9	9,144.072	6,632	0.77	0.01	0.00021	0.00021	-0.03212	-0.03212	
20599	4200	39.7	75.413	23.773	67.107	1.0204	40532	43.3	-2.9	8.4	-2846.9	8,104.835	8,295	0.75	0.03	0.00009	0.00009	-0.03548	-0.03548	
20599	12100	39.483	74.179	24.157	67.185	1.2102	40900	43.0	-3.2	10.2	-2476.9	6,145.028	7,890	0.74	-0.01	0.00019	0.00019	-0.04975	-0.04975	
20599	20000	39.097	73.516	24.04	67.185	1.173	41337	43.1	-3.1	9.8	-2041.9	4,168.424	6,395	0.74	-0.02	0.00041	0.00041	-0.06863	-0.06863	
20599	20999	39.406	72.804	24.637	67.083	1.1627	41080	42.4	-3.6	14.3	-2288.9	5,285.018	8,692	0.73	-0.03	0.00075	0.00075	-0.10369	-0.10369	
20599	21399	39.687	72.944	25.307	67.185	1.044	40422	41.9	-4.3	14.9	-2865.9	8,743.365	12,859	0.73	-0.03	0.00068	0.00068	-0.11318	-0.11318	
20599	31900	39.687	72.95	25.214	67.083	1.0677	41.6	-4.6	4.6	-2801.9	7,650.737	7,883	0.73	-0.03	0.00111	0.00111	-0.15323	-0.15323		
20599	33600	39.75	72.612	25.622	67.093	1.06855	40243	41.5	-4.6	22.6	-3130.9	9,802.639	14,860	0.73	-0.03	0.00002	0.00002	-0.14432	-0.14432	
20599	43800	39.853	72.612	25.515	67.114	1.0775	40715	41.6	-4.6	21.4	-2863.9	7,098.452	12,328	0.72	-0.04	0.000132	0.000132	-0.16802	-0.16802	
20599	51800	39.1	71.916	24.179	67.185	1.2123	40802	40.7	-5.5	30.2	-3776.9	14,265.100	20,772	0.72	-0.03	0.000105	0.000105	-0.17839	-0.17839	
20599	55800	40.12	72.303	26.407	67.184	1.1934	38652	40.7	-5.5	30.2	-3776.9	60,638.071	37,389	0.72	-0.03	0.000404	0.000404	-0.30324	-0.30324	
21399	21500	43.5	81.902	25.684	67.108	1.0152	38695	41.4	-4.8	23.1	-7786.9	69,460.882	77,233	0.75	0.01	0.00005	0.00005	-0.26635	-0.26635	
21399	21399	43.1	81.639	25.396	67.191	1.244	38697	41.9	-4.4	19.1	-7281.9	53,026.310	31,885	0.82	0.08	0.00371	0.00371	-0.13871	-0.13871	
21399	34000	41.867	78.302	25.572	67.165	1.0677	41.6	-4.6	21.5	-5809.9	35,891.083	27,781	0.75	-0.03	0.00005	0.00005	-0.12768	-0.12768		
21499	32300	34.483	76.013	23.177	67.164	1.04493	53.8	7.6	5.7	-7084.1	49,901.273	53,660	0.76	0.00	0.00002	0.00002	-0.03543	-0.03543		
21499	35900	34.517	75.168	25.622	67.093	1.1574	51370	54.2	6.0	63.4	-2863.9	63,957.413	63,628	0.75	0.00	0.000134	0.000134	-0.13413	-0.13413	
21499	43200	33.9	72.277	12.457	66.829	1.30403	51403	54.5	6.2	6.7	-2519.1	6,734.468	12,190	0.75	0.01	0.00088	0.00088	-0.14885	-0.14885	
21499	50500	33.26	74.837	12.457	66.978	1.3403	52298	54.9	6.7	75.1	-6914.1	6,225.902	15,219	0.74	0.02	0.00031	0.00031	-0.16867	-0.16867	
21499	324900	35.417	74.849	10.815	66.885	1.471	53424	56.0	9.8	96.3	-1045.1	5178.1	32,416	0.75	-0.01	0.00005	0.00005	-0.03904	-0.03904	
21499	194300	36.15	79.749	19.205	67.164	1.0237	48228	48.0	1.7	3.0	-750.9	4642.1	28,615	0.78	0.02	0.00044	0.00044	-0.12890	-0.12890	
21499	202000	36.86	79.718	17.916	67.086	1	497.49	49.1	2.9	8.5	-370.1	138,862	30,485	0.76	0.00	0.00000	0.00000	0.00126	0.00126	
21499	205600	38.183	78.036	17.054	67.092	1.0016	44945	50.0	3.6	14.5	-1586.1	2,452.817	21,190	0.75	-0.01	0.00008	0.00008	-0.03984	-0.03984	
21499	218200	35.417	76.637	16.132	67.134	1.1226	45974	50.9	4.4	19.4	-4802.1	23,060.004	21,190	0.75	0.01	0.00081	0.00081	-0.12769	-0.12769	
21499	21499	34.7	73.797	15.581	67.114	1.641	48247	51.5	6.3	28.2	-2595.1	6,734.468	12,190	0.75	0.02	0.00031	0.00031	-0.14885	-0.14885	
21499	21499	34.483	74.846	14.478	67.164	1.04493	48557	52.5	6.3	39.2	-5178.1	30,352	32,416	0.77	0.01	0.00019	0.00019	-0.03904	-0.03904	
21499	21499	34.987	73.072	15.711	66.989	1.0472	48930													

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21598	54100	34.087	72.312	14.649	66.974	1.2922	51489	52.3	6.1	37.2	8110.1	65.773,452	49,457	0.72	-0.03	0.00105	0.00086	-0.19725
21598	61500	34.117	72.455	15.083	67.051	1.2224	51022	62.0	6.7	33.0	7843.1	58.416,728	43,880	0.72	-0.03	0.00115	0.00119	-0.17749
21598	64900	34.233	72.096	15.491	66.929	1.1644	50791	51.5	5.3	27.8	7412.1	54.938,979	39,070	0.72	-0.03	0.00115	0.00119	-0.16189
Averages and Sums:		76.68				43,378	48.2		1,414		1,622,343,225	1,423,420	0.78			0.04653	0.02050	-0.92050

Energy Regression Statistics

SUMMARY OUTPUT

Regression Statistics						
Multiple R	0.98302					
R Square	0.90824					
Adjusted R Square	0.90666					
Standard Error	1602.15					
Observations	60					

ANOVA						
	df	SS	MS	F	Significance F	
Regression	1	1.5E+09	1.47E+09	574,104	9E-32	
Residual	58	1.5E+08	2566892.8			
Total	59	1.6E+09				

Coefficients Standard Error						
	t Stat	P-value	Coeff 95% CI Lower	Coeff 95% CI Upper	Other 95% CI Lower	Other 95% CI Upper
Intercept	-3816.5	1980.55	-1.9269738	0.05889	-7781	148,031
X Variable	1020.95	42.6099	23.960468	9E-32	835.66	1106.25

Seasonal and Design Energy Consumption Values and Associated Errors

Seasonal and Design Energy Consumption						
Seasonal Energy Consumption						
Design Energy Consumption						
S						
SE(Ynew)						
Percent error						
SE(Ynew)						
percent error						
5.73						

Distribution Efficiency Regression Statistics

SUMMARY OUTPUT

Regression Statistics						
Multiple R	0.11					
R Square	0.0121					
Adjusted R Square	-0.0049					
Standard Error	0.02805					
Observations	60					

ANOVA						
	df	SS	MS	F	Significance F	
Regression	1	0.006	0.0005933	0.71036	0.40279	
Residual	58	0.04893	0.0008437			
Total	59	0.04953				

Coefficients Standard Error						
	t Stat	P-value	Coeff 95% CI Lower	Coeff 95% CI Upper	Other 95% CI Lower	Other 95% CI Upper
Intercept	0.78556	0.03591	21.876035	1E-29	0.71359	0.85744
X Variable	-0.0007	0.00077	-0.844826	0.40279	-0.0022	0.0022

Seasonal and Design Distribution Efficiency Values and Associated Errors

Seasonal and Design Distribution Efficiency						
Seasonal Distribution Efficiency						
Design Distribution Efficiency						
S						
SE(Ynew)						
Percent error						
SE(Ynew)						
percent error						
8.90						

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SOFTWARE OUTPUTS FOR INDIVIDUAL HEATING CYCLES

ERROR CALCULATION PARAMETERS									
AT					ENERGY				
Date	Time	Duration (min)	Average Efficiency (percent)	Average Outside Temp (F)	Average Inside Temp (F)	Total Energy Out of Furnace	Δt (F)	xi-xbar (xi-xbar)2	yi-ybar (yi-ybar)2
22099	2500	32.135	78.325	26.247	67.521	1,452.6	3107.4	-9.8	95.7
22099	5700	32.15	77.968	26.621	67.586	1,253.8	3693.32	-10.1	9480.1
22099	44100	31.95	79.739	24.03	67.617	1,445.5	3856.69	-7.5	102.3
22099	61300	30.317	80.756	22.31	67.639	1,1732	3868.82	-5.7	55.8
22099	25.667	78.551	11.292	67.654	1,2168	51.209	56.4	32.8	7985.1
22099	230800	25.338	76.67	10.365	67.581	1,2718	5327.0	5.3	6882.1
22099	11500	25.3	76.114	8.1667	67.6153	6.963	58.7	62	4644.9
22099	14100	25.867	77.581	7.8577	67.474	1	5465.3	59.3	6705.9
22099	20600	25.263	77.44	7.8269	67.538	1	5529.8	59.8	6552.9
22099	23100	24.917	77.018	7.8722	67.654	1,3039	5847.1	6.3	93.3
22099	25000	25.417	78.049	9.3148	67.477	1,2353	5324.9	5.7	47.945
22099	5000	25.067	78.159	8.8268	67.523	1,0482	5588.0	7.1	50.5
22099	34800	25.633	76.114	6.6153	67.623	1,0963	58.7	7.6	6848.9
22099	41200	24.917	78.676	5.508	67.688	1,0429	5659.3	8.2	8861.9
22099	45800	25.187	77.358	5.4778	67.422	1,0276	5734.9	61.9	876.3
22099	56300	25.167	76.79	5.4077	67.548	1,0023	5861.4	8.9	876.4
22099	52800	25.283	75.239	5.4385	67.411	1,0022	5851.4	60.4	87.7
22099	65300	24.933	77.831	6.3769	67.587	1	583.02	61.2	9949.9
22099	61800	25.4	77.447	6.0963	67.459	1	567.92	61.4	103.0
22099	22399	24.917	78.676	4.2769	67.584	1,13038	5917.1	10.3	10162.9
22099	196300	28.983	78.608	19.733	67.706	1	4926.0	62.2	11.1
22099	202100	28.887	78.979	19.007	67.624	1	49661	68.0	10.9
22099	22399	28.487	78.242	18.793	67.669	1,0011	5824.6	62.1	11.1
22099	211900	28.767	79.492	18.347	67.419	1,0447	58042	62.2	11.2
22099	22399	28.13	78.4	6.574	67.673	1,0688	59126	63.2	12.1
22099	214700	28.167	76.685	4.2769	67.584	1,13038	5917.1	63.3	12.2
22099	22399	21.503	78.795	17.369	67.585	1	4926.0	63.2	12.2
22099	224300	27.617	78.867	16.814	67.514	1,0041	4868.0	6.1	10784.9
22099	231000	27.833	78.355	16.983	67.684	1	49661	68.0	12.7
22099	238800	27.887	77.757	17.107	67.503	1,0134	48044	50.4	126.039
22099	24900	500	27.183	77.51	16.543	67.546	1,0543	4877.1	51.0
22099	33000	27.567	79.634	15.6	67.548	1,2077	48403	51.9	11477.9
22099	22399	21.503	78.199	14.886	67.428	1,01985	47817	50.2	122.0
22099	224300	27.617	78.136	14.675	67.675	1,0107	49281	53.0	11.1
22099	22499	26.8	78.645	14.646	67.461	1,2748	47803	52.8	1.8
22099	22200	27.15	77.56	14.7	67.599	1,3557	48554	52.9	3.4
22099	24900	26.717	77.453	14.879	67.539	1,4271	48392	52.7	1.6
22099	31600	27.017	76.689	15.121	67.611	1,2801	47921	52.5	2.6
22099	22499	26.767	78.925	15.349	67.656	1,339	48447	52.3	2.0
22099	34200	26.767	78.408	15.515	67.541	1,071	48591	52.0	1.6
22099	40900	26.75	75.762	15.671	67.464	1,3184	48623	51.8	1.8
22099	45800	26.753	74.602	15.892	67.557	1,3536	48311	51.7	0.7
22099	56300	27.033	75.34	16.05	67.489	1,3706	48547	51.4	0.7
22099	53000	26.838	74.608	16.093	67.489	1,2854	48981	51.4	0.3
22099	55700	27.083	75.803	15.857	67.507	1,0256	48457	51.7	0.3
22099	22499	31.85	82.169	24.87	67.682	1,047	36728	42.8	0.8
22099	62300	26.567	76.167	15.515	67.541	1,071	48591	52.0	1.0
22099	65000	26.567	75.098	15.536	67.536	1,0479	49105	51.8	0.6
22099	195000	32.8	82.161	26.976	67.75	1,0737	34892	40.8	105.8
22099	202300	32.433	82.587	26.015	67.628	1,0123	35465	41.6	-9.4
22099	205000	32.2	83.891	25.312	67.703	1,0145	35802	42.4	-8.7
22099	212700	31.85	82.169	24.87	67.682	1,047	36728	42.8	-8.2
22099	215800	31.5	81.148	24.847	67.738	1,0084	31262	42.9	-8.2
22099	223000	31.383	80.068	25.139	67.566	1,0163	37338	42.4	-8.6
22099	230000	30.75	78.683	25.152	67.834	1,0087	38234	42.7	70.2
22099	233100	30.493	79.327	25.022	67.5	1,0298	47732	42.5	-8.6

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22599	100	30.693	77.825	24.787	67.715	1.0483	38889	42.9	-8.1	66.1	-7675.1	58.906.904	62.407	.78	0.00	0.00001
22599	3200	30.683	78.674	24.691	67.593	1.1062	38446	42.9	-8.2	66.5	-8118.1	65.803.277	66.220	.79	0.01	0.00003
22599	10300	30.55	78.129	24.265	67.584	1.0531	39123	43.3	-7.7	59.7	-7441.1	55.369.721	57.483	.78	0.00	0.00000
22599	13300	30	77.809	23.898	67.584	1.0298	38580	43.6	-7.4	55.0	-6984.1	48.777.420	51.781	.78	0.00	0.00001
22599	20300	30.033	79.263	23.288	67.642	1.0308	38536	44.4	-6.7	44.7	-7028.1	49.393.925	48.984	.79	0.01	0.00013
22599	23200	28.85	77.943	23.587	67.65	1.0001	38910	44.1	-7.0	44.1	-6654.1	44.276.825	46.553	.78	0.00	0.00000
22599	30200	28.3	78.052	22.6	87.51	1.0442	40658	44.9	-6.1	37.8	-5906.1	34.881.820	38.317	.78	0.00	0.00000
22599	38100	29.387	79.029	22.33	67.62	1.0258	41564	45.3	-5.8	33.3	-5000.1	25.000.833	28.846	.77	-0.01	0.00012
22599	40000	28.317	79.806	.211.8	67.59	1.0089	41168	46.4	-4.6	21.5	-5386.1	29.117.715	25.039	.80	0.02	0.00029
22599	43000	29.15	79.459	20.203	67.474	1.2809	42141	47.3	-3.8	14.3	-4423.1	18.563.638	16.755	.79	0.01	0.00018
22599	45800	28.767	79.798	19.759	67.607	1.3085	42499	47.8	-3.2	10.3	-4065.1	16.524.903	13.054	.80	0.02	0.00028
22599	52700	28.5	77.938	19.963	67.553	1.0795	43238	47.6	-3.5	12.2	-3326.1	11.062.830	11.638	.78	0.00	0.00000
22599	55600	28.617	78.917	20.413	67.598	1.1223	42411	47.2	-3.9	15.0	-4153.1	17.248.101	16.085	.79	0.01	0.00003
22599	62400	28.617	78.674	20.134	67.648	1.0308	42791	47.5	-3.5	12.6	-3773.1	14.236.158	13.376	.79	0.01	0.00003
22599	65300	28.617	79.298	19.663	67.483	1.3042	42722	47.8	-3.3	10.6	-3842.1	14.761.604	12.522	.79	0.01	0.00014
Averages and sums:		78.1				48.584	51.1	3.219					3.333.117	.78	0.02220	-4.82435

Energy Regression Statistics
SUMMARY OUTPUT

Distribution Efficiency Regression Statistics						
SUMMARY OUTPUT						
Regression	1	3.5E+09	3.452E+09	5337.95	8E-98	F
Residual	70	4.5E+07	648635.09			
Total	71	3.5E+09				
Coefficients Standard Err. t Stat P-value						
Intercept	-6311.7	729.897	-8.6474031	1.2E-12	-7767.4	Over 95% lower 95.0% over 95.0% higher 95.0%
X Variab1	1035.58	14.1741	73.061298	8E-68	-4855.98	-7767.44
					1063.85	-4855.98
					1007.31	1063.85

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Seasonal and Design Distribution Efficiency Values and Associated Errors						
SUMMARY OUTPUT						
Seasonal						
Distribution						
Efficiency						
Seasonal Energy Consumption						
Design Energy Consumption						
45.467						
62.037						
S						
SE(Ynew)						
804.14						
SE(Yold)						
809.84						
percent error						
3.56						
SE(Ynew)						
836.94						
percent error						
2.70						
Seasonal						
Seasonal						
Design						
Design						

Seasonal and Design Distribution Efficiency Values and Associated Errors						
SUMMARY OUTPUT						
Seasonal						
Distribution						
Efficiency						
Seasonal Distribution Efficiency						
Design Distribution Efficiency						
0.783						
0.759						
S						
SE(Ynew)						
0.01						
SE(Yold)						
0.01						
percent error						
3.76						
SE(Ynew)						
0.02						
percent error						
4.01						
Design						
Design						

Seasonal and Design Distribution Efficiency Values and Associated Errors						
SUMMARY OUTPUT						
Regression	1	0.00723	0.0072312	33.825	1.7E-07	F
Residual	70	0.01496	0.0002138			
Total	71	0.0222				
Coefficients Standard Err. t Stat P-value						
Intercept	0.8577	0.01327	64.827587	3.8E-64	0.83123	Over 95% lower 95.0% over 95.0% higher 95.0%
X Variab1	-0.0015	0.00026	-5.8159287	1.7E-07	-0.002	-4855.98
					1007.31	1063.85

ERROR CALCULATION PARAMETERS												DISTRIBUTION EFFICIENCY											
SOFTWARE OUTPUTS FOR INDIVIDUAL HEATING CYCLES						AT						ENERGY											
Date	Time	Distribution Efficiency (percent)	Average Outside Temp (F)	Average Inside Temp (F)	Average Speed (mph)	Total Energy Out & Furnace	Δt (F)	xi-xbar	xi-xbar)²	(Y-Y-bar)	(Y-Y-bar)²	xi-xbar)(Y-Y-bar)	Y-Y-bar	(Y-Y-bar)²	(xi-xbar)(Y-Y-bar)	Y-Y-bar	(Y-Y-bar)²	(xi-xbar)(Y-Y-bar)	Y-Y-bar	(Y-Y-bar)²	(xi-xbar)(Y-Y-bar)	Y-Y-bar	(Y-Y-bar)²
3/09/99	203400	29.587	84.142	84.765	21.413	67.91	1.4791	39856	46.1	-3.6	6.6	-2596.7	6.742	760	7.76	0.84	0.00	0.0000	0.0000	0.0000	0.0000	0.0000	
3/09/99	210300	29.217	84.765	21.413	67.91	38826	46.5	1.2813	-3.6	6.6	6.384	-125	6.480	0.85	0.01	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	
3/09/99	220100	28.95	83.739	21.573	67.867	39121	46.3	1.3857	-2.8	7.7	4.980	-407	6.176	0.84	0.00	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	
3/09/99	232700	28.8	83.517	20.028	67.924	40649	47.9	1.4185	-1.2	1.4	495.169	820	0.84	-0.1	0.00003	0.00003	0.00003	0.00003	0.00003	0.00003	0.00003		
3/09/99	235500	27.867	85.027	19.217	67.855	40574	48.6	1.3784	-0.4	0.2	-778.7	606.346	330	0.85	0.01	0.00009	0.00009	0.00009	0.00009	0.00009	0.00009	0.00009	
3/10/99	2300	28.233	85.337	17.848	67.834	1.072	45958	50.0	0.9	0.9	245.3	60.181	227	0.85	0.01	0.00016	0.00016	0.00016	0.00016	0.00016	0.00016	0.00016	
3/10/99	5200	28.2	86.747	67.822	67.742	1.0109	41717	50.9	1.9	3.4	364.3	132.727	675	0.87	0.03	0.00072	0.00072	0.00072	0.00072	0.00072	0.00072	0.00072	
3/10/99	11800	26.667	86.759	16.17	67.807	1.0751	42327	51.6	2.6	6.6	974.3	949.295	2509	0.87	0.03	0.00073	0.00073	0.00073	0.00073	0.00073	0.00073	0.00073	
3/10/99	14600	27.317	86.611	15.097	67.61	1.0206	43205	52.5	3.5	12.0	1852.3	3.431.080	6406	0.87	0.02	0.00060	0.00060	0.00060	0.00060	0.00060	0.00060	0.00060	
3/10/99	21300	27.183	85.968	14.979	67.836	1	42768	52.9	3.8	14.4	2415.3	5.833.759	9.167	0.86	0.02	0.00037	0.00037	0.00037	0.00037	0.00037	0.00037	0.00037	
3/10/99	24000	26.7	87.595	14.025	67.849	1.0032	42779	53.8	4.8	22.7	2422.3	5.867.622	11.536	0.88	0.04	0.00045	0.00045	0.00045	0.00045	0.00045	0.00045	0.00045	
3/10/99	308000	26.35	88.2	12.978	67.852	1.0055	44356	54.9	5.8	33.8	3003.3	9.019.916	17.456	0.88	0.04	0.00172	0.00172	0.00172	0.00172	0.00172	0.00172	0.00172	
3/10/99	333000	26.265	86.959	12.161	67.778	1	45571	55.6	6.5	42.2	4218.3	17.794.202	27.400	0.87	0.03	0.00084	0.00084	0.00084	0.00084	0.00084	0.00084	0.00084	
3/10/99	359000	26.367	87.747	11.559	67.928	1.0099	45843	56.4	7.3	53.4	4493.3	20.189.902	32	0.88	0.04	0.00136	0.00136	0.00136	0.00136	0.00136	0.00136	0.00136	
3/10/99	42400	25.467	88.289	10.988	67.931	1	46043	56.9	7.9	62.1	4690.3	21.999.078	36.925	0.88	0.04	0.00180	0.00180	0.00180	0.00180	0.00180	0.00180	0.00180	
3/10/99	45000	25.717	87.784	10.73	67.789	1.0177	46412	57.1	8.0	64.0	5059.3	25.596.639	40.461	0.88	0.04	0.00139	0.00139	0.00139	0.00139	0.00139	0.00139	0.00139	
3/10/99	51500	25.154	86.169	10.10	67.941	1.0528	48042	57.9	8.9	78.8	6683.9	44.746.968	59.397	0.86	0.04	0.00045	0.00045	0.00045	0.00045	0.00045	0.00045	0.00045	
3/10/99	54100	25.183	86.988	9.4074	67.652	1	47847	58.2	9.2	84.3	6494.3	42.176.159	59.637	0.87	0.03	0.00059	0.00059	0.00059	0.00059	0.00059	0.00059	0.00059	
3/10/99	60600	25.75	87.638	9.2192	67.953	1.0069	47907	58.7	9.7	93.6	6554.3	42.959.077	63.395	0.88	0.04	0.00128	0.00128	0.00128	0.00128	0.00128	0.00128	0.00128	
3/10/99	63200	25.4	86.59	9.0338	67.596	1.0155	48339	58.6	9.5	90.3	6986.3	48.808.632	66.378	0.87	0.03	0.00064	0.00064	0.00064	0.00064	0.00064	0.00064	0.00064	
3/10/99	65700	25.167	86.607	9.0165	67.881	1	48697	58.8	9.8	95.2	8344.3	59.0.312	3.633	0.87	0.03	0.00040	0.00040	0.00040	0.00040	0.00040	0.00040	0.00040	
3/10/99	195300	28.3	86.65	19.226	68.024	1.3167	39949	48.8	-0.3	0.1	-1403.7	1.970.325	1.970.325	0.87	0.03	0.00067	0.00067	0.00067	0.00067	0.00067	0.00067	0.00067	
3/10/99	202200	28.417	86.483	18.34	67.877	1.0785	40660	49.5	0.5	0.2	-692.7	47.9.809	3.73	0.87	0.03	0.00059	0.00059	0.00059	0.00059	0.00059	0.00059	0.00059	
3/10/99	205000	27.683	87.449	17.456	67.782	1	40979	50.4	1.4	1.9	-317.3	139.639	-5.16	0.87	0.03	0.00059	0.00059	0.00059	0.00059	0.00059	0.00059	0.00059	
3/10/99	211700	27.883	85.68	16.943	67.964	1	42327	51.0	2.0	3.8	974.3	949.295	1.998	0.86	0.02	0.00026	0.00026	0.00026	0.00026	0.00026	0.00026	0.00026	
3/10/99	214500	28.05	86.637	17.052	67.928	1.33753	41735	50.9	1.8	3.3	382.3	146.167	694	0.87	0.03	0.00064	0.00064	0.00064	0.00064	0.00064	0.00064	0.00064	
3/10/99	221300	27.25	85.769	16.917	67.752	1.35573	42121	50.8	1.8	3.1	758.3	590.312	1.363	0.86	0.02	0.00029	0.00029	0.00029	0.00029	0.00029	0.00029	0.00029	
3/10/99	224000	27	84.464	17.214	67.828	1.4568	42579	50.6	1.6	2.4	1226.3	1.503.855	1.994	0.84	0.00	0.00002	0.00002	0.00002	0.00002	0.00002	0.00002	0.00002	
3/10/99	230700	27.05	84.074	17.382	67.846	1.4654	42844	50.5	1.4	2.0	129.3	1.667.501	1.811	0.84	0.00	0.00027	0.00027	0.00027	0.00027	0.00027	0.00027	0.00027	
3/11/99	2800	27.2	83.55	17.493	67.782	1.3632	42756	50.3	1.2	1.5	1403.3	1.969.300	1.722	0.84	-0.01	0.00003	0.00003	0.00003	0.00003	0.00003	0.00003	0.00003	
3/11/99	14700	26.2	82.087	18.111	67.915	1.3369	43080	49.8	0.7	0.6	1727.3	2.983.626	1.292	0.82	-0.02	0.00039	0.00039	0.00039	0.00039	0.00039	0.00039	0.00039	
3/11/99	194100	28.2	81.468	22.166	67.632	1.3116	43154	45.8	-3.4	10.7	-1595.7	2.555.786	5.232	0.87	0.03	0.00067	0.00067	0.00067	0.00067	0.00067	0.00067	0.00067	
3/11/99	200900	28	82.575	21.234	67.934	1.0319	40038	46.7	-2.4	5.6	-1314.7	1.728.396	3.105	0.83	-0.01	0.00046	0.00046	0.00046	0.00046	0.00046	0.00046	0.00046	
3/11/99	238700	28.4	83.223	20.514	67.834	1.0041	40279	47.3	-1.7	3.0	-1073.7	1.162.794	1.870	0.83	-0.01	0.00007	0.00007	0.00007	0.00007	0.00007	0.00007	0.00007	
3/11/99	210600	28.567	83.736	19.24	67.703	1.0199	40445	48.5	-0.6	0.4	-307.7	94.669	184	0.84	0.00	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	
3/11/99	213400	28.117	84.038	18.859	67.983	1.0514	41364	49.0	-0.1	0.0	11.3	455.3	207.314	280	0.84	0.00	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001
3/11/99	220200	28.183	84.358	17.983	67.659	1.0514	41808	48.7	0.6	0.4	455.3	325.262	1.204	0.87	0.03	0.00074	0.00074	0.00074	0.00074	0.00074	0.00074	0.00074	
3/11/99	222900	27.353	86.77	16.632	67.804	1.0096	41923	51.2	2.1	4.5	570.3	1.264.090	2.854	0.86	0.02	0.00054	0.00054	0.00054	0.00054	0.00054	0.00054	0.00054	
3/11/99	225700	27.2	86.387	16.093	67.693	1	42477	51.6	2.5	6.4	1124.3	1.506.308	2.011	0.85	0.01	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	
3/11/99	232400	27	84.611	17.061	67.761	1.1853	42580	50.7	1.6	2.7	1227.3	2.201.314	6.249	0.82	-0.05	0.00209	0.00209	0.00209	0.00209	0.00209	0.00209	0.00209	
3/11/99	3800	28.167	79.486	22.179	67.783	1.4926	38520	45.6	-3.5	12.0	-1832.7	3.358.725	6.357	0.79</td									

Config 5 (V40)

31499	42400	29.133	83.739	22.307	67.877	1	38481	45.6	-3.5	12.2	-2871.7	8.246561	10.027	0.84	0.00	0.00001	0.01103	
31499	45300	29.217	82.966	22.3	67.819	1.005	38221	45.5	-3.5	12.5	-231.7	4.544070	7.562	0.82	-0.02	0.00040	0.07046	
31499	52200	29.287	84.367	22.363	67.837	1.0239	38110	45.5	-3.6	12.9	-3242.7	10.514980	11.633	0.84	0.00	0.00001	-0.01119	
31499	55100	28.783	84.15	21.567	67.88	1.002	38348	46.3	-2.7	7.6	-2404.7	5.792498	6.610	0.94	0.00	0.00000	-0.00261	
31499	62000	29.133	84.459	21.023	67.863	1.0328	38260	45.8	-2.2	4.9	-2884.7	4.345901	4.631	0.84	0.00	0.00002	-0.00898	
31499	64800	28.167	83.879	21.421	67.944	1.0411	39260	46.5	-2.5	6.4	-2892.7	4.379320	5.312	0.84	0.00	0.00000	0.00447	
Averages and Sums:		84.1		41.353	49.1	1321		576.830348	849.137	0.84		0.04406	6.28079					

Energy Regression Statistics SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.97279
R Square	0.94631
Adjusted R Square	0.94543
Standard Error	712.504
Observations	63

ANOVA	
Regression	df 1
Residual	df 61
Total	df 62

Coefficient Standard Error	t Stat	P-value	F Statistic	F Significance F
Intercept 9813.71 965.998	t Stat 10.159	P-value 44 9.7E-15	7882.08	11745.3 over 95% over 95% over 95.0%
X Variable 642.844 19.6043	t Stat 32.790987	P-value 1.9E-40	603.643	882.046 603.643 682.046 over 95% over 95.0%

Distribution Efficiency Regression Statistics SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.82456
R Square	0.67981
Adjusted R Square	0.67466
Standard Error	0.01521
Observations	63

ANOVA	
Regression	df 1
Residual	df 61
Total	df 62

Coefficient Standard Error	t Stat	P-value	F Statistic	F Significance F
Intercept 0.60589 0.00062	t Stat 29.437879	P-value 9.3E-38	0.58567	0.64812 over 95% over 95.0%
X Variable 0.00476 0.00042	t Stat 11.382856	P-value 1E-16	0.00393	0.0056 0.00393 0.0066 over 95% over 95.0%

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Seasonal and Design Energy Consumption Values and Associated Errors

Seasonal Energy Consumption	41,956
Design Energy Consumption	52,241
S	712.50
SE(Ynew)	718.37
Seasonal percent error	3.42
Design percent error	791.19
SE(Ynew)	3.03
Design percent error	3.67

Seasonal and Design Distribution Efficiency Values and Associated Errors

Seasonal Distribution Efficiency	0.845
Design Distribution Efficiency	0.921
S	0.02
SE(Ynew)	0.02
Seasonal percent error	3.63
Design percent error	0.02
SE(Ynew)	3.67
Design percent error	3.67

Appendix C

Data and Miscellaneous Methods

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TEST PROTOCOL FOR DUCT LEAKAGE TEST COMPARISONS

HOUSE Syracuse - 128 Circle Rd DATE 1/9/99 BY P. Strunk
 some parts earlier
 Duct Configuration 1 - sealed; uninsulated

This form is intended to facilitate a field comparison of four tests for duct leakage: fan pressurization (two-sided duct blaster test with barrier); blocked-return house pressure test; blocked-supply house pressure test; and hybrid (a single duct blaster test of the whole duct combined with the open-register portion of the house pressure test).

Preliminaries

1. All doors, windows, and other openings between conditioned space and unconditioned or outside spaces should be closed. Vents to attics and crawlspaces containing ducts should be open. Any basement that contains ducts and is considered unconditioned should have at least one door or window open to the outside for the duration of the test. Open internal doors. OK
2. Install pressure taps in supply plenum, supply trunk, return plenum, midpoint of return duct, and two additional points in the return duct, one upstream and one downstream of the midpoint. Run plastic tubes such that these taps can be connected to a digital manometer with its reference pressure within the conditioned space.

Operating Pressures in Ducts

3. Turn on the furnace fan and measure the following pressures w/r/t House.

Location	Supply Plenum	Supply Trunk	Return Pt. 1	Return Midpt. Pt. 2	Return Pt. 3	Return Plenum
Pressure (Pa)	+23	+17.1	-1.3	-2.3	-4.3	-7.4

Blower Door Envelope Leakage

4. Turn the furnace fan off. Set up the blower door and note whether pressurizing or depressurizing. Make sure the fan throat pressure is measured w/r/t inside if depressurizing and outside if pressurizing. Use 4-wall manifolding.

Automated ~~multi~~ 8-point test gives: CFM50 = 5,167; C = 464; n = 0.616
 5. Blower door test of envelope in duct test configuration. Registers unsealed.

Register Status	Target House Pressure	Actual House Pressure	Ring	Throat ΔP	CFM
Open	25 Pa				
Open	40 - 50 Pa				

Pressure Pan on Supply Registers, with Blower Door at 25 Pa

Register	1	2	3	4	5	6	7	8	9
Pan ΔP (Pa)	1.2								

stopped once suitable register was found (< 2 Pa)
did not have this form at the time of test

Register	10	11	12	13	14	15	16	17	18
Pan ΔP (Pa)									

6. Seal all the registers. Do blower door test on envelope in duct test configuration with registers sealed.

Register Status	Target House Pressure	Actual House Pressure	Ring	Throat ΔP	CFM
Sealed	25 Pa				
Sealed	40 - 50 Pa				

↑ Automated 8-point test gives: CFM₅₀ = 4,923
Hybrid Test C = 433 ; n = 0.621

7. Attach duct blaster to the point in the duct system with the best air pathway to both supply and return (typically this will be the fan access port in the furnace). Pressurize house to 25 Pa at same time use duct blaster to bring average of supply and return duct pressures to zero w/r/t house.

Target House Press.	Actual House Press.	Avg. of Supply, Return Plenums w/r/t House	Return Plenum	Supply Plenum	D/B Ring	D/B Fan ΔP	CFM
25 Pa	32	0? 0	-1	+1.5	0	31	579
40-50 Pa	45	0? 0	-3	+2.5	0	54	767

feed to average

Fan Pressurization Test, Standard Version

8 Install barrier between supply and return duct systems.

9. Unseal return register and attach duct blaster. Check supply/return barrier. Unseal one supply register. ~~Depressurize~~ house with blower door and at the same time use duct blaster to bring return duct ~~pressure~~ to zero w/r/t house.

Target House Press.	Actual House Press.	Return R-2 Plenum w/r/t House	Return Plenum w/r/t/House	D/B Ring	D/B Fan ΔP	CFM
25 Pa	25	0? 0	missing	2	244	239
40-50		20? 15	missing			

10. Move duct blaster to fan access port at furnace or to a large supply register. Leave the return register unsealed. Seal any unsealed supply register. Pressurize house with blower door and at the same time bring supply ~~pressure~~ to zero w/r/t house. Measure supply pressure at 2 registers with low pressure pan readings in part 5.

Target House Press.	Actual House Press.	Supply Plenum w/r/t Hse	Supply Register # <u>1</u>	Supply Register # <u> </u>	Return Plenum w/r/t Hse	Ring	D/B Fan ΔP	CFM
25 Pa	25	0? missing	0.0	missing	missing	2	98	152
40-50		0?	21	5	5	1n 9		

Fan Flow

11. Unseal supply registers, reseal return register. Turn on furnace fan and duct blaster. Adjust duct blaster until supply plenum pressure is the same as reading in part 3. All readings w/r/t House. Take 2 points if possible, one slightly above target, one slightly below.

Target Supply Plenum ΔP	Actual Supply Plenum ΔP (Take 5 readings)			Avg.	Return Plenum ΔP	Ring	D/B Fan ΔP	CFM
23.5	23.5			-1.0	1	360	745	
	missing							

HOUSE PRESSURE TEST-RETURN BLOCKED VS. SUPPLY BLOCKED
 conducted 1/10; 25°F; wind calm; 5-sec averages

1	FAN ON House-Attic ΔP	1.1	1.4	1.4	1.2	1.3	Avg: 1.39 1.44
		1.8	1.4	1.4	1.4	1.5	
2	FAN OFF House-Attic ΔP	1.4	1.7	1.6	1.4	2.0	Avg: 1.56 1.66
		1.5	1.0	1.7	1.9	1.4	
3	FAN ON House-Attic ΔP	1.5	1.6	1.7	1.8	1.5	Avg: 1.60
		1.5	1.5	1.6	1.6	1.7	
4	Return-House ΔP	reg.	p1-1.4	p2-2.3	p3-4.2	p4	plm -8
5	Pressure Pan ΔP	s1 43	s2 20.4	s3 17.5	s4 22	s5 missing	s6 22.5
6	FAN OFF House-Attic ΔP	1.8	1.8	1.8	1.8	1.6	Avg: 1.71
		1.6	1.6	1.6	1.7	1.8	
R	7 FAN ON-RETN BLOCKED Return-House ΔP	reg.	p1-41.5	p2-42.6	p3-44.4	p4	plm -49
N	8 House-Attic ΔP	2.4	2.4	2.5	2.4	2.4	Avg: 2.44
		2.5	2.5	2.5	2.4	2.4	
K	9 Pressure Pan ΔP	s1 44	s2 19.5	s3 16	s4 22.2	s5 missing	s6 23
S	10 FAN ON-SUPP BLOCKED Return-House ΔP	reg.	p1-1.4	p2-2.1	p3-3.7	p4	plm -7.6
P	11 House-Attic ΔP	1.0	1.0	1.0	0.8	0.8	Avg. 0.93
		0.8	0.7	1.1	1.3	0.8	
K	12 Pressure Pan ΔP	s1 124	s2 93	s3 83	s4 107	s5 missing	s6 82
13	FAN OFF House-Attic ΔP	1.5	1.5	1.6	1.5	1.8	Avg: 1.47
		1.7	1.5	1.5	1.5	1.6	
14	Blower Door		CFM @		Pa		

HOUSE PRESSURE TEST-RETURN BLOCKED VS. SUPPLY BLOCKED

1	FAN ON House-Attic ΔP	1.3	1.4	1.5	1.5	1.6	Avg:
		1.6	1.6	1.6	1.5	1.4	1.50
2	FAN OFF House-Attic ΔP	1.4	1.5	1.5	1.5	1.5	Avg:
		1.5	1.6	1.7	1.5	1.4	1.36
3	FAN ON House-Attic ΔP	1.2	1.2	1.4	1.5	1.5	Avg:
		1.6	1.4	1.4	1.3	1.2	1.37
4	Return-House ΔP	reg.	p ₁ -1.3	p ₂ -2	p ₃ -4.8	p ₄	p _{lm} -7.8
5	Pressure Pan ΔP	s ¹ 43	s ² 19	s ³ 16.5	s ⁴ 22	s ⁵ 14.5	s ⁶ 22
6	FAN OFF House-Attic ΔP	1.6	1.5	1.5	1.5	1.6	Avg:
		1.6	1.7	1.7	1.7	1.7	1.61
R	7 FAN ON-RETN BLOCKED Return-House ΔP	reg.	p ₁ -40	p ₂ -41	p ₃ -42.5	p ₄	p _{lm} -44.5
N	8 House-Attic ΔP	2.4	2.4	2.5	2.4	2.4	Avg:
B		2.4	2.5	2.4	2.3	2.4	2.41
L	9 Pressure Pan ΔP	s ¹ 43	s ² 19	s ³ 16	s ⁴ 22	s ⁵ 14.8	s ⁶ 22.5
K	10 FAN ON-SUPP BLOCKED Return-House ΔP	reg.	p ₁ -1.4	p ₂ -2.3	p ₃ -4.5	p ₄	p _{lm} -7.3
S	11 House-Attic ΔP	1.0	0.9	0.9	0.9	0.8	Avg:
U		1.3	1.0	1.2	1.0	0.7	0.97
P	12 Pressure Pan ΔP	s ¹ 115	s ² 88	s ³ 76	s ⁴ 96	s ⁵ 42	s ⁶ 80
B	13 FAN OFF House-Attic ΔP	2.0	2.2	1.8	1.6	2.1	Avg:
L		2.0	1.8	1.7	1.6	1.5	1.83
C	14 Blower Door		CFM @		Pa		

HOUSE PRESSURE TEST--RETURN BLOCKED VS. SUPPLY BLOCKED

1	FAN ON House-Attic ΔP	1.8	1.6	1.4	1.4	1.4	Avg:
		1.5	1.6	1.4	1.3	1.6	1.50
2	FAN OFF House-Attic ΔP	1.3	1.7	1.7	1.5	1.7	Avg:
		1.8	1.8	1.7	1.6	1.6	1.64
3	FAN ON House-Attic ΔP	1.6	1.6	1.5	1.5	1.6	Avg:
		1.5	1.2	0.9	0.9	1.0	1.33
4	Return-House ΔP	reg.	p ₁ -1.3	p ₂ -2	p ₃ -4.3	p ₄	p _{lm} -7
5	Pressure Pan ΔP	^{s1} 39	^{s2} 18.5	^{s3} 15	^{s4} 20.5	^{s5} 14.5	^{s6} 21.5
6	FAN OFF House-Attic ΔP	1.7	1.7	1.8	1.6	1.6	Avg:
		2.0	1.8	1.6	1.6	1.6	1.70
R	7 FAN ON-RETN BLOCKED Return-House ΔP	reg.	p ₁ -39	p ₂ -39	p ₃ -40	p ₄	p _{lm} -45
N	8 House-Attic ΔP	2.2	2.2	2.7	2.6	2.4	Avg:
		2.4	2.3	2.5	2.5	2.4	2.42
B	9 Pressure Pan ΔP	^{s1} 42	^{s2} 18.5	^{s3} 16	^{s4} 21	^{s5} 14.5	^{s6} 22
L	10 FAN ON-SUPP BLOCKED Return-House ΔP	reg.	p ₁ -1.3	p ₂ -2.2	p ₃ -4	p ₄	p _{lm} -7.2
C	11 House-Attic ΔP	0.6	0.8	1.0	1.0	0.8	Avg:
		0.7	0.8	0.7	0.7	0.7	0.78
K	12 Pressure Pan ΔP	^{s1} 114	^{s2} 82.5	^{s3} 80	^{s4} 97	^{s5} 83.37	^{s6} 83.5
13	FAN OFF House-Attic ΔP	1.6	1.5	1.6	1.7	1.7	Avg:
		1.6	1.6	1.6	1.6	1.6	1.61
14	Blower Door		CFM @		Pa		

TEST PROTOCOL FOR DUCT LEAKAGE TEST COMPARISONS

HOUSE Syracuse - 128 Circle Rd DATE 1/16/99 BY PStrunk

Duct Configuration 2 - supply leakage added

This form is intended to facilitate a field comparison of four tests for duct leakage: fan pressurization (two-sided duct blaster test with barrier); blocked-return house pressure test; blocked-supply house pressure test; and hybrid (a single duct blaster test of the whole duct combined with the open-register portion of the house pressure test).

Preliminaries

1. All doors, windows, and other openings between conditioned space and unconditioned or outside spaces should be closed. Vents to attics and crawlspaces containing ducts should be open. Any ~~basement~~ that contains ducts and is considered unconditioned should have at least one ~~door or window~~ open to the outside for the duration of the test. Open internal doors. OK
2. Install pressure taps in supply plenum, supply trunk, return plenum, midpoint of return duct, and two additional points in the return duct, one upstream and one downstream of the midpoint. Run plastic tubes such that these taps can be connected to a digital manometer with its reference pressure within the conditioned space.

Operating Pressures in Ducts

3. Turn on the furnace fan and measure the following pressures w/r/t House.

Location	Supply Plenum	Supply Trunk	Return Pt. 1	Return Midpt. P _{1/2}	Return Pt. 3	Return Plenum
Presssure (Pa)	+13.2	+9.9	-1.2	-2.5	-4.3	-6.7

Blower Door Envelope Leakage

4. Turn the furnace fan off. Set up the blower door and note whether pressurizing or depressurizing. Make sure the fan throat pressure is measured w/r/t inside if depressurizing and outside if pressurizing. Use 4-wall manifolding.

8-point test gives : CFMSD = 5,966 ; C = 478 ; n = 0.65

5. Blower door test of envelope in duct test configuration. Registers unsealed.

Register Status	Target House Pressure	Actual House Pressure	Ring	Throat ΔP	CFM
Open	25 Pa				
Open	40 - 50 Pa				

Pressure Pan on Supply Registers, with Blower Door at 25 Pa

Register	1	2	3	4	5	6	7	8	9
Pan ΔP (Pa)	2.3	3.1	2.8	3.3	2.7	4.3	1.3	1.9	1.7

Register	10	11	12	13	14	15	16	17	18
Pan ΔP (Pa)									

6. Seal all the registers. Do blower door test on envelope in duct test configuration with registers sealed. *same as configuration 1?*

Register Status	Target House Pressure	Actual House Pressure	Ring	Throat ΔP	CFM
Sealed	25 Pa				
Sealed	40 - 50 Pa	50 (curve) 2.1			4923

Hybrid Test

7. Attach duct blaster to the point in the duct system with the best air pathway to both supply and return (typically this will be the fan access port in the furnace). Pressurize house to 25 Pa at same time use duct blaster to bring average of supply and return duct pressures to zero w/r/t house.

Target House Press.	Actual House Press.	Avg. of Supply, Return Plenums w/r/t House	Return Plenum	Supply Plenum	D/B Ring	D/B Fan ΔP	CFM
25 Pa	12	0? 0	-3	+1	0	30	572
40-50 Pa	26	0? 0	-4.5	+2.5	0	71	880

duct blaster maxed out
at 26 Pa house pressure

feed to
average

Fan Pressurization Test, Standard Version

8 Install barrier between supply and return duct systems.

9. Unseal return register and attach duct blaster. Check supply/return barrier. Unseal one supply register. Depressurize house with blower door and at the same time use duct blaster to bring return duct ~~pressure~~ to zero w/r/t house.

Target House Press.	Actual House Press.	Return pressure w/r/t House	Return Plenum w/r/t/House	D/B Ring	D/B Fan ΔP	CFM
25 Pa	25	0?				239
40-50		0?				

Same as Configuration 1?

10. Move duct blaster to fan access port at furnace or to a large supply register. Leave the return register unsealed. Seal any unsealed supply register. Pressurize house with blower door and at the same time bring supply ~~pressure~~ to zero w/r/t house. Measure supply pressure at 2 registers with low pressure pan readings in part 5.

Target House Press.	Actual House Press.	Supply Plenum w/r/t Hse	Supply Register # <u>1</u>	Supply Register # <u> </u>	Return Plenum w/r/t Hse	Ring	D/B Fan ΔP	CFM
25 Pa	25 24	0? missing	0,0	missing	missing	1	105	402
40-50		0? 23	1 5 5	1 n 9				

Fan Flow kept S-1 as ΔP_{sup} even though press path in part 5 is >2Pa thought moving ref point would be worse

11. Unseal supply registers, reseal return register. Turn on furnace fan and duct blaster. Adjust duct blaster until supply plenum pressure is the same as reading in part 3. All readings w/r/t House. Take 2 points if possible, one slightly above target, one slightly below. plenum very unstable - matched trunk instead

Target Supply Plenum ΔP	Actual Supply Plenum ΔP (Take 5 readings)	Avg.	Return Plenum ΔP	Ring	D/B Fan ΔP	CFM
9	9, 19, 09, 08, 9 9, 0	9.0	0,0	0	43	684
11	10, 7 9, 9 11, 7 11, 2 11, 7	11.04	0,0	0	54	767

lin reg. gives 72

HOUSE PRESSURE TEST--RETURN BLOCKED VS. SUPPLY BLOCKED

1	FAN ON House-Attic ΔP	0	0	0.2	0.3	0.1	Avg: 0.08
		0.1	0	0	0	0.1	
2	FAN OFF House-Attic ΔP	0.4	0.5	0.5	0.6	0.6	Avg: 0.48
		0.3	0.5	0.4	0.5	0.5	
3	FAN ON House-Attic ΔP	0.2	0.2	0.1	0	0	Avg: 0.11
		0.2	0.1	0.1	0.1	0.1	
4	Return-House ΔP	reg.	p1-1.4	p2-2.7	p3-4.4	p4	p _{lm} -7.4
5	Pressure Pan ΔP	*1 35	*2 11.6	*3 12	*4 15.5	*5 12.3	*6 14.5
6	FAN OFF House-Attic ΔP	0.2	0.3	0.3	0.3	0.4	Avg: 0.33
		0.4	0.4	0.4	0.4	0.2	
R	7 FAN ON-RETN BLOCKED Return-House ΔP						
T		reg.	p1-40	p2-39	p3-41	p4	p _{lm} -45
N	8 House-Attic ΔP	0.5	0.5	0.5	0.6	0.6	Avg: 0.51
B		0.5	0.4	0.5	0.5	0.5	
L	9 Pressure Pan ΔP	*1 32	*2 9.5	*3 9.6	*4 12.4	*5 10.3	*6 12.5
C							
K	10 FAN ON-SUPP BLOCKED Return-House ΔP						
S		reg.	p1-1.2	p2-2.4	p3-4	p4	p _{lm} -7.6
U	11 House-Attic ΔP	-0.8	-0.9	-0.8	-0.8	-0.8	Avg: -0.86
P		-0.9	-0.8	-1	-1.1	-0.7	
P	12 Pressure Pan ΔP	*1 57	*2 31	*3 31	*4 37	*5 29	*6 20
B							
L	13 FAN OFF House-Attic ΔP	0.4	0.5	0.7	0.3	0.5	Avg: 0.45
C		0.7	0.7	0.3	0.1	0.3	
K	14 Blower Door		CFM @		Pa		

HOUSE PRESSURE TEST--RETURN BLOCKED VS. SUPPLY BLOCKED

1	FAN ON House-Attic ΔP	0,1	0,4	0,1	0,1	0	Avg: 0,14
		0,1	0,2	0,2	0,1	0,1	
2	FAN OFF House-Attic ΔP	0,5	0,5	0,5	0,5	0,5	Avg: 0,60
		0,7	0,6	0,6	0,9	0,7	
3	FAN ON House-Attic ΔP	0	0	0	0	0,1	Avg: 0,07
		0,1	0,2	0	0,1	0,2	
4	Return-House ΔP	reg.	p1 -1,4	p2 -2	p3 -4,8	p4	p _{lm} 7,6
5	Pressure Pan ΔP	s ¹ 32	s ² 10,8	s ³ 10,2	s ⁴ 13,5	s ⁵ 10,5	s ⁶ 13
6	FAN OFF House-Attic ΔP	0,3	0,4	0,4	0,5	0,5	Avg: 0,47
		0,5	0,7	0,6	0,5	0,3	
R	7 FAN ON-RETN BLOCKED Return-House ΔP	reg.	p1 -39,5	p2 -40	p3 -42,5	p4	p _{lm} -45
E	8 House-Attic ΔP	0,6	0,6	0,5	0,5	0,5	Avg: 0,52
		0,6	0,5	0,4	0,5	0,5	
T	9 Pressure Pan ΔP	s ¹ 32,5	s ² 10,3	s ³ 9,7	s ⁴ 12,3	s ⁵ 10,4	s ⁶ 13
N	10 FAN ON-SUPP BLOCKED Return-House ΔP	reg.	p1 -1,4	p2 -2,3	p3 -5	p4	p _{lm} -8,3
B	11 House-Attic ΔP	-0,7	-0,7	-0,8	-0,7	-0,8	Avg: -0,69
L		-0,7	-0,8	-0,9	-0,8	-0,8	
C	12 Pressure Pan ΔP	s ¹ 58	s ² 30	s ³ 31	s ⁴ 37	s ⁵ 30	s ⁶ 29
K	13 FAN OFF House-Attic ΔP	0,4	0,4	0,3	0,4	0,4	Avg: 0,37
K		0,4	0,4	0,3	0,4	0,3	
14	Blower Door		CFM @		Pa		

C-13

HOUSE PRESSURE TEST--RETURN BLOCKED VS. SUPPLY BLOCKED

1	FAN ON House-Attic ΔP	0	0	0.1	0.1	0.1	Avg: 0.03
		0	0	0	0	0	
2	FAN OFF House-Attic ΔP	0.4	0.2	0.4	0.3	0.3	Avg: 0.39
		0.4	0.5	0.4	0.5	0.5	
3	FAN ON House-Attic ΔP	0.1	0	0	0	0.1	Avg: 0.13
		0.2	0.3	0.3	0.2	0.1	
4	Return-House ΔP	reg.	p ₁ -1.5	p ₂ -2.2	p ₃ -4.8	p ₄	p _{dm} -7.9
5	Pressure Pan ΔP	^{s1} 31.7	^{s2} 10.4	^{s3} 10	^{s4} 12.9	^{s5} 10.5	^{s6} 13.2
6	FAN OFF House-Attic ΔP	0.3	0.2	0.3	0.3	0.4	Avg: 0.32
		0.4	0.3	0.4	0.3	0.3	
R	7 FAN ON-RETN BLOCKED Return-House ΔP	reg.	p ₁ -38	p ₂ -38.5	p ₃ -42	p ₄	p _{dm} -44.7
N	8 House-Attic ΔP	0.7	0.6	0.6	0.6	0.7	Avg: 0.62
		0.6	0.6	0.6	0.6	0.6	
B	9 Pressure Pan ΔP	^{s1} 32.2	^{s2} 9.8	^{s3} 9.4	^{s4} 12.2	^{s5} 10 14	^{s6} 12.4
L	10 FAN ON-SUPP BLOCKED Return-House ΔP	reg.	p ₁ -1.3	p ₂ -2.2	p ₃ -4	p ₄	p _{dm} -7.7
C	11 House-Attic ΔP	-0.9	-0.8	-0.8	-0.8	-0.9	Avg: -0.86
		-1	-0.9	-0.9	-0.8	-0.8	
K	12 Pressure Pan ΔP	^{s1} 55	^{s2} 30	^{s3} 28.8	^{s4} 36	^{s5} 30.2	^{s6} 23.4
13	FAN OFF House-Attic ΔP	0.4	0.3	0.4	0.4	0.4	Avg: 0.40
		0.5	0.4	0.5	0.4	0.3	
14	Blower Door		CFM @		Pa		

BR1

11.8

BR2

11.5

BR3

12.5

10.9

11.3

11.9

35

34

33

31

TEST PROTOCOL FOR DUCT LEAKAGE TEST COMPARISONS

HOUSE Syracuse - 128 Circle Rd. [REDACTED] DATE 2/16/99 BY P Strunk

Duct Configuration 3 - return leakage added

This form is intended to facilitate a field comparison of four tests for duct leakage: fan pressurization (two-sided duct blaster test with barrier); blocked-return house pressure test; blocked-supply house pressure test; and hybrid (a single duct blaster test of the whole duct combined with the open-register portion of the house pressure test).

Preliminaries

1. All doors, windows, and other openings between conditioned space and unconditioned or outside spaces should be closed. Vents to attics and crawlspaces containing ducts should be open. Any basement that contains ducts and is considered unconditioned should have at least one door or window open to the outside for the duration of the test. Open internal doors. **OK**
2. Install pressure taps in supply plenum, supply trunk, return plenum, midpoint of return duct, and two additional points in the return duct, one upstream and one downstream of the midpoint. Run plastic tubes such that these taps can be connected to a digital manometer with its reference pressure within the conditioned space.

Operating Pressures in Ducts

3. Turn on the furnace fan and measure the following pressures w/r/t House.

Location	Supply Plenum	Supply Trunk	Return Pt. 1	Return Midpt. Pt. 2	Return Pt. 3	Return Plenum
Presssure (Pa)	19.5	142.2	-0.9	-1.8	-4.3	-7.3

Blower Door Envelope Leakage

4. Turn the furnace fan off. Set up the blower door and note whether pressurizing or depressurizing. Make sure the fan throat pressure is measured w/r/t inside if depressurizing and outside if pressurizing. Use 4-wall manifolding.

6-point test gives: CFMSO = 7,769 ; C = 614 ; n = 0.65
 5. Blower door test of envelope in duct test configuration. Registers unsealed.

Register Status	Target House Pressure	Actual House Pressure	Ring	Throat ΔP	CFM
Open	25 Pa				
Open	40 - 50 Pa				

Pressure Pan on Supply Registers, with Blower Door at 25 Pa

Register	1	2	3	4	5	6	7	8	9
Pan ΔP (Pa)	5.2	5.7	4	5.8	7.7	5.6	4.6	5.2	4.5

Register	10	11	12	13	14	15	16	17	18
Pan ΔP (Pa)									

6. Seal all the registers. Do blower door test on envelope in duct test configuration with registers sealed.

Register Status	Target House Pressure	Actual House Pressure	Ring	Throat ΔP	CFM
Sealed	25 Pa				
Sealed	40 - 50 Pa				

Hybrid Test \uparrow 6-point test gives: CFM₅₀ = 6,034; C = 494; n = 0.64

7. Attach duct blaster to the point in the duct system with the best air pathway to both supply and return (typically this will be the fan access port in the furnace). Pressurize house to 25 Pa at same time use duct blaster to bring average of supply and return duct pressures to zero w/r/t house.

Target House Press.	Actual House Press.	Avg. of Supply, Return Plenums w/r/t House	Return Plenum	Supply Plenum	D/B Ring	D/B Fan ΔP	CFM
25 Pa.	+9	0? 0	-2	+2	0	90	990
40-50 Pa.		0?					

duct blaster max
at 9 Pa!

feed to
average

Fan Pressurization Test, Standard Version

8 Install barrier between supply and return duct systems.

9. Unseal return register and attach duct blaster. Check supply/return barrier. Unseal one supply register. ~~Depressurize house with blower door and at the same time use duct blaster to bring return duct~~ to zero w/r/t house.

Target House Press.	Actual House Press.	Return R-2 w/r/t House	Return Plenum w/r/t/House	D/B Ring	D/B Fan ΔP	CFM
25 Pa	8	0? 0	-0.3	0	33	600
40-50	13	0? 0	-0.7	0	55	774

10. Move duct blaster to fan access port at furnace or to a large supply register. Leave the return register unsealed. Seal any unsealed supply register. Pressurize house with blower door and at the same time bring supply ~~duct~~ to zero w/r/t house. Measure supply pressure at 2 registers with low pressure pan readings in part 5.

Target House Press.	Actual House Press.	Supply Plenum w/r/t Hse	Supply Register # <u>3</u>	Supply Register # <u>7</u>	Return Plenum w/r/t Hse	Ring	D/B Fan ΔP	CFM
25 Pa	20	0? 0	-1.1	-1.5	-6	1	98	389 0.8
40-50	29	0? 0	-1.7	-2.5	-9	1	148	477 1.5

5-1								
Fan Flow	19	0	-1.9	-2	-5.3	1	86	364 -0.3
	29	0	-2.3	-2.6	-8.5	1	144	471 0

11. Unseal supply registers, reseal return register. Turn on furnace fan and duct blaster. Adjust duct blaster until supply plenum pressure is the same as reading in part 3. All readings w/r/t House. Take 2 points if possible, one slightly above target, one slightly below.

plenum unstable, matched trunk

Target Trunk Supply Plenum ΔP	Actual Supply Plenum ΔP (Take 5 readings)	Avg.	Return Plenum ΔP	Ring	D/B Fan ΔP	CFM
12.2	11.0 11.2 11.9 10.0 10.5	10.9	-0.4	1	365	750
	14.9 15.2 14.9 15.8 15.1	15.2	-1	0	71	880

linear reg. gives 789 cfm @ 12.2

cont'd

HOUSE PRESSURE TEST--RETURN BLOCKED VS. SUPPLY BLOCKED

Start 8:30

1	FAN ON House-Attic ΔP	0.9	0.9	0.9	0.9	0.9	Avg: 0.86
		0.9	0.8	0.8	0.8	0.8	
2	FAN OFF House-Attic ΔP	1.2	1.2	1.1	1.2	1.1	Avg: 1.17
		1.2	1.2	1.2	1.2	1.1	
3	FAN ON House-Attic ΔP	0.8	0.7	0.7	0.7	0.8	Avg: 0.74
		0.7	0.8	0.7	0.8	0.7	
4	Return-House ΔP	reg.	p ₁ -0.9	p ₂ -4.7	p ₃ -1.9	p ₄	p _{lm} -7.5
5	Pressure Pan ΔP	s ¹ 32.4	s ² 10.1	s ³ 9.7	s ⁴ 13.3	s ⁵ 13.1	s ⁶ 10.4
6	FAN OFF House-Attic ΔP	0.9	0.9	0.9	0.9	0.9	Avg: 0.91
		0.9	0.9	1	0.9	0.9	
R	7 FAN ON-RETN BLOCKED Return-House ΔP	reg.	p ₁ -8	p ₂ -8.6	p ₃ -10.7	p ₄	p _{lm} -14.4
N	8 House-Attic ΔP	1.2	1.2	1.2	1.2	1.2	Avg: 1.2
		1.2	1.2	1.2	1.2	1.2	
K	9 Pressure Pan ΔP	s ¹ 31.3	s ² 9.6	s ³ 9.2	s ⁴ 12.1	s ⁵ 12.5	s ⁶ 9.7
S	10 FAN ON-SUPP BLOCKED Return-House ΔP	reg.	p ₁ -0.7	p ₂ -1.6	p ₃ -3.8	p ₄	p _{lm} -7.1
P	11 House-Attic ΔP	-0.2	-0.1	-0.1	-0.3	-0.2	Avg: -0.19
		-0.2	-0.2	-0.2	-0.2	-0.2	
K	12 Pressure Pan ΔP	s ¹ 52	s ² 27	s ³ 26	s ⁴ 34	s ⁵ 28	s ⁶ 27.5
13	FAN OFF House-Attic ΔP	0.4	0.4	0.4	0.4	0.4	Avg: 0.43
14	Blower Door		CFM @		Pa		

Complete 9:50

C-17

checked configuration
of house/registers
don't know why lower
than others above

HOUSE PRESSURE TEST--RETURN BLOCKED VS. SUPPLY BLOCKED Conf 3

1	FAN ON House-Attic ΔP	0.1	0.1	0.1	0.1	0.1	Avg: 0.1
		0.1	0.1	0.1	0.1	0.1	
2	FAN OFF House-Attic ΔP	0.4	0.4	0.3	0.3	0.3	Avg: 0.32
		0.3	0.3	0.3	0.3	0.3	
3	FAN ON House-Attic ΔP	0	0	0	0	0.1	Avg: 0.07
		0.1	0.2	0.2	0.1	0	
4	Return-House ΔP	reg.	p1-0.8	p2-1.8	p3-4.2	p4	plm 7.6
5	Pressure Pan ΔP	*1 32	*2 10.4	*3 9.5	*4 13.2	*5 13	*6 10.5
6	FAN OFF House-Attic ΔP	0.6	0.5	0.6	0.6	0.5	Avg: 0.65
		0.6	0.6	0.7	0.9	0.9	
R	7 FAN ON-RETN BLOCKED Return-House ΔP	reg.	p1-11.9	p2-8.9	p3-8.8	p4	plm 15.3
N	8 House-Attic ΔP	0.7	0.7	0.6	0.6	0.7	Avg: 0.7
		0.8	0.8	0.7	0.7	0.7	
K	9 Pressure Pan ΔP	*1 32.5	*2 10	*3 9.5	*4 12.5	*5 12.8	*6 10.3
S	10 FAN ON-SUPP BLOCKED Return-House ΔP	reg.	p1-0.9	p2-1.8	p3-3.3	p4	plm 7.7
P	11 House-Attic ΔP	-0.6	-0.6	-0.5	-0.6	-0.6	Avg: -0.64
		-0.6	-0.7	-0.7	-0.7	-0.7	
K	12 Pressure Pan ΔP	*1 54	*2 29	*3 28	*4 35	*5 30.5	*6 27.5
13	FAN OFF House-Attic ΔP	0.2	0.2	0.2	0.1	0.1	Avg: 0.13
		0.1	0.1	0.1	0.1	0.1	
14	Blower Door		CFM @		Pa		

complete 10:40

HOUSE PRESSURE TEST--RETURN BLOCKED VS. SUPPLY BLOCKED

Conf 3.

8/19
30

1	FAN ON House-Attic ΔP	-0.2	-0.2	-0.2	-0.3	bram	Avg:
		-0.3	-0.3	-0.2	-0.2	fade	-0.24
2	FAN OFF House-Attic ΔP	0.2	0	0.2	0.1	0.2	Avg:
		0.1	0.1	0	0	0.1	0.1
3	FAN ON House-Attic ΔP	-0.1	-0.3	-0.3	-0.2	-0.1	Avg:
		-0.1	-0.1	-0.2	-0.2	-0.2	-0.18
4	Return-House ΔP	reg.	p ₁ -0.9	p ₂ -1.8	p ₃ -4.3	p ₄	p _{lm} 7.5
5	Pressure Pan ΔP	* ¹ 35	* ² 11	* ³ 10.5	* ⁴ 14	* ⁵ 14	* ⁶ 11
6	FAN OFF House-Attic ΔP	0	0.1	0.1	0	0	Avg:
		0	0.2	0.1	0.1	0.1	0.07
R	7 FAN ON-RETN BLOCKED Return-House ΔP	reg.	p ₁ -8.7	p ₂ -8.9	p ₃ -13	p ₄	p _{lm} -15
E	8 House-Attic ΔP	0.4	0.3	0.3	0.5	0.5	Avg:
T		0.4	0.4	0.5	0.5	0.6	0.44
N	9 Pressure Pan ΔP	* ¹ 32	* ² 10.5	* ³ 9.7	* ⁴ 13	* ⁵ 13	* ⁶ 10.5
B	10 FAN ON-SUPP BLOCKED Return-House ΔP	reg.	p ₁ -0.8	p ₂ -1.7	p ₃ -3.8	p ₄	p _{lm} -7.8
L		-0.5	-0.5	-0.5	-0.6	-0.5	Avg:
C		-0.5	-0.5	-0.5	-0.5	-0.4	-0.5
K	12 Pressure Pan ΔP	* ¹ 53	* ² 28.5	* ³ 27.5	* ⁴ 34.5	* ⁵ 31	* ⁶ 27.5
13	FAN OFF House-Attic ΔP	0.2	0.3	0.3	0.2	0.2	Avg:
		0.2	0.2	0.2	0.1	0.3	0.22
14	Blower Door		CFM @		Pa		

Complete 11:40

TEST PROTOCOL FOR DUCT LEAKAGE TEST COMPARISONS

HOUSE Syracuse - 128 Circle Rd DATE 3/2/99 BY PStrunk
Duct Configuration 4 - Supply leakage Sealed

This form is intended to facilitate a field comparison of four tests for duct leakage: fan pressurization (two-sided duct blaster test with barrier); blocked-return house pressure test; blocked-supply house pressure test; and hybrid (a single duct blaster test of the whole duct combined with the open-register portion of the house pressure test).

Preliminaries

1. All doors, windows, and other openings between conditioned space and unconditioned or outside spaces should be closed. Vents to attics and crawlspaces containing ducts should be open. Any basement that contains ducts and is considered unconditioned should have at least one door or window open to the outside for the duration of the test. Open internal doors. GK

2. Install pressure taps in supply plenum, supply trunk, return plenum, midpoint of return duct, and two additional points in the return duct, one upstream and one downstream of the midpoint. Run plastic tubes such that these taps can be connected to a digital manometer with its reference pressure within the conditioned space.

Operating Pressures in Ducts

3. Turn on the furnace fan and measure the following pressures w/r/t House.

Location	Supply Plenum	Supply Trunk	Return Pt. 1	Return Midpt. <u>Pt. 2</u>	Return Pt. 3	Return Plenum
Presssure (Pa)	24.8	18.0	-0.9	-1.6	-3.9	-6.5

Blower Door Envelope Leakage

4. Turn the furnace fan off. Set up the blower door and note whether pressurizing or depressurizing. Make sure the fan throat pressure is measured w/r/t inside if depressurizing and outside if pressurizing. Use 4-wall manifolding.

6-point test gives: CFMSO = 6,901; C = 669; n = 0.60

5. Blower door test of envelope in duct test configuration. Registers unsealed.

Register Status	Target House Pressure	Actual House Pressure	Ring	Throat ΔP	CFM
Open	25 Pa				
Open	40 - 50 Pa				

Pressure Pan on Supply Registers, with Blower Door at 25 Pa

Register	1	2	3	4	5	6	7	8	9
Pan ΔP (Pa)	1.7	1.4	1.4	1.1	2.4	1.1	1.8	2.1	1.1

Register	10	11	12	13	14	15	16	17	18
Pan ΔP (Pa)									

6. Seal all the registers. Do blower door test on envelope in duct test configuration with registers sealed.

Register Status	Target House Pressure	Actual House Pressure	Ring	Throat ΔP	CFM
Sealed	25 Pa				
Sealed	40 - 50 Pa				

Hybrid Test \uparrow 6-point test gives: CFM50 = 6,327; C = 484; n = 0.66

7. Attach duct blaster to the point in the duct system with the best air pathway to both supply and return (typically this will be the fan access port in the furnace). Pressurize house to 25 Pa at same time use duct blaster to bring average of supply and return duct pressures to zero w/r/t house.

Target House Press.	Actual House Press.	Avg. of Supply, Return Plenums w/r/t House	Return Plenum	Supply Plenum	D/B Ring	D/B Fan ΔP	CFM
25 Pa	+9.5	0? 0-	-6	+4	0	80	934
40-50 Pa		0?					

duct blaster max
at 9.5 Pa

✓
feed to
average

Fan Pressurization Test, Standard Version

8 Install barrier between supply and return duct systems.

9. Unseal return register and attach duct blaster. Check supply/return barrier. Unseal one supply register. Depressurize house with blower door and at the same time use duct blaster to bring return duct ~~pressure~~ to zero w/r/t house.

Target House Press.	Actual House Press.	Return Plenum w/r/t House	Return Plenum w/r/t/House	D/B Ring	D/B Fan ΔP	CFM
25 Pa	11	0? 0	-1	0	43	684
40-50	18	0? 0	-1.1	0	63	829

10. Move duct blaster to fan access port at furnace or to a large supply register. Leave the return register unsealed. Seal any unsealed supply register. Pressurize house with blower door and at the same time bring supply ~~pressure~~ to zero w/r/t house. Measure supply pressure at 2 registers with low pressure pan readings in part 5.

Target House Press.	Actual House Press.	Supply Plenum w/r/t Hse	Supply Register # <u>4</u>	Supply Register # <u>6</u>	Return Plenum w/r/t Hse	Ring	D/B Fan ΔP	CFM	S-1
25 Pa	28	0? 0	0.5	0.8	-21	2	128	173	0.5
40-50	37	0? 0	0.7	0.9	-28	1	28	208	1.9

Fan Flow	S-1 Sup Plenum							
23	0	0.2	0.3	-19	2	108	159	0
36	0	-1.1	1.5	-24	2	210	227	0.5

11. Unseal supply registers, reseal return register. Turn on furnace fan and duct blaster. Adjust duct blaster until supply plenum pressure is the same as reading in part 3. All readings w/r/t House. Take 2 points if possible, one slightly above target, one slightly below.

Target Supply Trunk Plenum ΔP	Actual Supply Plenum ΔP (Take 5 readings)			Return Plenum ΔP	Ring	D/B Fan ΔP	CFM			
18.0	14.0	14.1	14.2	13.7	14.6	14.1	-0.5	1	271	646
	16.0	17.2	16.3	17.3	17.1	16.8	-0.8	1	320	702

linear reg. gives 727 cfm @ 18.0

HOUSE PRESSURE TEST-RETURN BLOCKED VS. SUPPLY BLOCKED Cont 4

1	FAN ON House-Attic ΔP	0.8	0.6	1.1	1.0	0.9	Avg:
		0.8	1.5	1.2	1.2	0.7	
2	FAN OFF House-Attic ΔP	0.3	0.3	0.4	0.4	0.5	Avg:
		0.3	0.2	0.4	0.5	0.4	
3	FAN ON House-Attic ΔP	1.0	0.5	1.0	0.4	0.8	Avg:
		0.6	0.5	0.4	0.7	0.8	
4	Return-House ΔP	reg.	p1-1	p2-2	p3-4.6	p4	p _{lm} -7.6
5	Pressure Pan ΔP	^{s1} 40	^{s2} 20	^{s3} 16	^{s4} 23	^{s5} 17	^{s6} 23.5
6	FAN OFF House-Attic ΔP	0.4	0.6	0.7	0.8	0.9	Avg:
		0.9	0.5	0.3	0.3	0.4	
R	7 FAN ON-RETN BLOCKED Return-House ΔP	reg.	p1-9.2	p2-10.3	p3-15.3	p4	p _{lm} -16.4
T	8 House-Attic ΔP	1.6	1.5	1.4	1.5	1.5	Avg:
		1.6	1.4	1.4	1.4	1.5	
N	9 Pressure Pan ΔP	^{s1} 38	^{s2} 20	^{s3} 17.5	^{s4} 23	^{s5} 16	^{s6} 22.5
B	10 FAN ON-SUPP BLOCKED Return-House ΔP	reg.	p1-0.8	p2-1.7	p3-4.4	p4	p _{lm} -7
L	11 House-Attic ΔP	0.6	0.2	0.1	0	0.4	Avg:
		1.0	0.8	1.0	0.8	0.5	
C	12 Pressure Pan ΔP	^{s1} 104	^{s2} 79	^{s3} 68	^{s4} 90	^{s5} 57	^{s6} 68
K	13 FAN OFF House-Attic ΔP	0.2	0	0.1	0.3	0.3	Avg:
		0.2	0.1	0.1	0.2	0.1	
14	Blower Door		CFM @		Pa		

HOUSE PRESSURE TEST-RETURN BLOCKED VS. SUPPLY BLOCKED Conf 4

1	FAN ON House-Attic ΔP	0.9	0.7	0.7	0.6	0.6	Avg:
		0.7	0.6	0.6	0.6	0.5	
2	FAN OFF House-Attic ΔP	0.3	0.3	0.3	0.4	0.4	Avg:
		0.4	0.6	0.5	0.5	0.3	
3	FAN ON House-Attic ΔP	0.7	0.8	0.7	0.6	0.3	Avg:
		0	0	0.2	0.3	0.4	
4	Return-House ΔP	reg.	p1-1.	p2-1.6	p3-4.9	p4	pdm-7.1
5	Pressure Pan ΔP	^{s1} 40	^{s2} 21	^{s3} 18	^{s4} 24	^{s5} 17.5	^{s6} 25
6	FAN OFF House-Attic ΔP	0.7	0.5	0.2	0	0.4	Avg:
		0.1	1.4	1.5	1.4	1.0	
R E T N B L C K	7 FAN ON-RETN BLOCKED Return-House ΔP	reg.	p1-9.8	p2-10.2	p3-15	p4	pdm-15.8
	8 House-Attic ΔP	1.6	1.4	1.3	1.3	1.4	Avg:
		1.7	1.7	1.9	1.8	1.5	
	9 Pressure Pan ΔP	^{s1} 42	^{s2} 21	^{s3} 18	^{s4} 24.5	^{s5} 17	^{s6} 26
S U P P B L C K	10 FAN ON-SUPP BLOCKED Return-House ΔP	reg.	p1-0.9	p2-1.7	p3-4.2	p4	pdm-7.2
	11 House-Attic ΔP	-0.3	0	0	-0.1	0	Avg:
		0	0.4	0.1	0.3	0.4	
	12 Pressure Pan ΔP	^{s1} 105	^{s2} 81	^{s3} 72	^{s4} 94	^{s5} 56	^{s6} 79
13	FAN OFF House-Attic ΔP	0.4	0.2	0.3	0.3	0.4	Avg:
		0.5	0.4	0.3	0.1	0	
14	Blower Door		CFM @		Pa		

HOUSE PRESSURE TEST-RETURN BLOCKED VS. SUPPLY BLOCKED Conf 4

1	FAN ON House-Attic ΔP	0.7	0.6	0.3	0.4	0.4	Avg:
		0.7	1.0	1.2	1.4	1.2	
2	FAN OFF House-Attic ΔP	0.2	0	0	0	-0.2	Avg:
		-0.3	-0.1	0	0.3	0.4	
3	FAN ON House-Attic ΔP	0.2	0.1	0	0	0.1	Avg:
		0	0.1	0.1	0.1	0.2	
4	Return-House ΔP	reg.	p1-1	p2-1.8	p3-4.2	p4	pdm-6.7
5	Pressure Pan ΔP	*1 38	*2 18	*3 16.5	*4 22	*5 16	*6 22
6	FAN OFF House-Attic ΔP	0.7	1.0	0.1	0.2	0.3	Avg:
		1.1	0.7	0.3	1.2	1.0	
R	7 FAN ON-RETN BLOCKED Return-House ΔP	reg.	p1-8.8	p2-8.4	p3-14.4	p4	pdm-15
		1.6	2.0	2.7	3.1	2.4	Avg:
		1.7	1.5	1.5	1.7	2.1	
K	9 Pressure Pan ΔP	*1 36	*2 19	*3 16.5	*4 22	*5 16	*6 22.5
		reg.	p1-7.7	p2-8.7	p3-4.2	p4	pdm-7.2
S	10 FAN ON-SUPP BLOCKED Return-House ΔP	0.7	0.9	0.6	0.7	0.6	Avg:
		0.7	0.8	0.8	0.6	0.7	
K	12 Pressure Pan ΔP	*1 103	*2 80	*3 72	*4 91	*5 57	*6 74
		reg.	p1-7.7	p2-8.7	p3-4.2	p4	pdm-7.2
13	FAN OFF House-Attic ΔP	0	0	0	0.3	0.4	Avg:
		0.7	0.8	0.9	0.8	0.5	
14	Blower Door		CFM @		Pa		

-1 0
-2 1 1

TEST PROTOCOL FOR DUCT LEAKAGE TEST COMPARISONS

HOUSE Syracuse - 128 Circle Rd DATE 4/2/99 BY P Strunk
 Duct Configuration S-return leakage sealed; supply insulated

This form is intended to facilitate a field comparison of four tests for duct leakage: fan pressurization (two-sided duct blaster test with barrier); blocked-return house pressure test; blocked-supply house pressure test; and hybrid (a single duct blaster test of the whole duct combined with the open-register portion of the house pressure test).

Preliminaries

1. All doors, windows, and other openings between conditioned space and unconditioned or outside spaces should be closed. Vents to attics and crawlspaces containing ducts should be open. Any basement that contains ducts and is considered unconditioned should have at least one door or window open to the outside for the duration of the test. Open internal doors.

OK

2. Install pressure taps in supply plenum, supply trunk, return plenum, midpoint of return duct, and two additional points in the return duct, one upstream and one downstream of the midpoint. Run plastic tubes such that these taps can be connected to a digital manometer with its reference pressure within the conditioned space.

Operating Pressures in Ducts

3. Turn on the furnace fan and measure the following pressures w/r/t House.

Location	Supply Plenum	Supply Trunk	Return Pt. 1	Return Midpt. P1.2	Return Pt. 3	Return Plenum
Pressure (Pa)	24.2	17.4	-1.2	-2.3	-4	-7.4

Blower Door Envelope Leakage

4. Turn the furnace fan off. Set up the blower door and note whether pressurizing or depressurizing. Make sure the fan throat pressure is measured w/r/t inside if depressurizing and outside if pressurizing. Use 4-wall manifolding.

6-point test gives: CFM50 = 6,103; C = 529; n = 0.63

5. Blower door test of envelope in duct test configuration. Registers unsealed.

Register Status	Target House Pressure	Actual House Pressure	Ring	Throat ΔP	CFM
Open	25 Pa				
Open	40 - 50 Pa				

Pressure Pan on Supply Registers, with Blower Door at 25 Pa

Register	1	2	3	4	5	6	7	8	9
Pan ΔP (Pa)	0.8	0.7	0.7	0.3	2.3	0.6	1.0	1.3	0.6

Register	10	11	12	13	14	15	16	17	18
Pan ΔP (Pa)									

6. Seal all the registers. Do blower door test on envelope in duct test configuration with registers sealed.

Register Status	Target House Pressure	Actual House Pressure	Ring	Throat ΔP	CFM
Sealed	25 Pa				
Sealed	40 - 50 Pa				

Hybrid Test

↑ 6-point test gives: CFM₅₀ = 5,964; C = 501; n = 0.63

7. Attach duct blaster to the point in the duct system with the best air pathway to both supply and return (typically this will be the fan access port in the furnace). Pressurize house to 25 Pa at same time use duct blaster to bring average of supply and return duct pressures to zero w/r/t house.

Target House Press.	Actual House Press.	Avg. of Supply, Return Plenums w/r/t House	Return Plenum	Supply Plenum	D/B Ring	D/B Fan ΔP	CFM
25 Pa	27	0? 0-	0.4	-0.5	1	154	487
40-50 Pa	47	0? 0	0.6	-0.4	1	308	689

fed to
avg.

Fan Pressurization Test, Standard Version

8 Install barrier between supply and return duct systems.

9. Unseal return register and attach duct blaster. Check supply/return barrier. Unseal one supply register. ~~Depressurize~~ house with blower door and at the same time use duct blaster to bring return duct ~~pressure~~ to zero w/r/t house.

Target House Press.	Actual House Press.	Return R-2 Plenum w/r/t House	Return Plenum w/r/t House	D/B Ring	D/B Fan ΔP	CFM
25 Pa	23	0? 0	0.2	2	290	261
40-50	36	0? 0	-0.4	2	460	328

10. Move duct blaster to fan access port at furnace or to a large supply register. Leave the return register unsealed. Seal any unsealed supply register. Pressurize house with blower door and at the same time bring supply ~~pressure~~ to zero w/r/t house. Measure supply pressure at 2 registers with low pressure pan readings in part 5.

Target House Press.	Actual House Press.	Supply Plenum w/r/t Hse	Supply Register # <u>1</u>	Supply Register # <u>4</u>	Return Plenum w/r/t Hse	Ring	D/B Fan ΔP	CFM
25 Pa	23	0? 0	0.5	0.5	-0.7	2	89	144
40-50	42	0? 0	1.7	0.7	-1.3	2	194	213

S-1 plenum

Fan Flow	25	0	0	1.0	-0.8	2	121	168
	42	0	0.8	1.3	-1	2	220	227

11. Unseal supply registers, reseal return register. Turn on furnace fan and duct blaster. Adjust duct blaster until supply plenum pressure is the same as reading in part 3. All readings w/r/t House. Take 2 points if possible, one slightly above target, one slightly below.

Target Supply Plenum ΔP	Actual Supply Plenum ΔP (Take 5 readings)	Avg.	Return Plenum ΔP	Ring	D/B Fan ΔP	CFM
17.4	16.4 16.1 15.6 16.6 16.7	16.3	1.7	1	340	724
	19.1 18.4 18.2 17.9 19.5	18.6	2.1	1	364	749

linear reg. gives 736 cfm @ 17.4

HOUSE PRESSURE TEST--RETURN BLOCKED VS. SUPPLY BLOCKED (cont'd)
mostly calm, cloudy

1	FAN ON House-Attic ΔP	0.6	1.1	0.8	0.9	1.6	Avg: 1.15
		0.9	0.8	1.8	1.1	1.9	
2	FAN OFF House-Attic ΔP	1.4	0.9	0.8	1.6	1.4	Avg: 1.26
		1.2	1.1	1.0	2.3	0.9	
3	FAN ON House-Attic ΔP	1.4	1.3	2.1	2.1	1.9	Avg: 1.89
		1.9	2.4	1.7	2.5	1.6	
4	Return-House ΔP	reg.	p1-1.3	p2-2.3	p3-5	p4	pdm-7.6
5	Pressure Pan ΔP	s ¹ 42	s ² 22	s ³ 19	s ⁴ 26	s ⁵ 19	s ⁶ 26
6	FAN OFF House-Attic ΔP	1.3	1.2	1.7	1.2	1.5	Avg: 1.71
		2.1	1.5	2.0	2.9	1.7	
R	7 FAN ON-RETN BLOCKED Return-House ΔP	reg.	p1-37	p2-37	p3-40	p4	pdm-43
T	8 House-Attic ΔP	2.0	2.5	2.7	1.1	1.3	Avg: 1.81
		1.4	1.5	1.9	1.8	1.9	
K	9 Pressure Pan ΔP	s ¹ 40	s ² 20	s ³ 17	s ⁴ 22	s ⁵ 16	s ⁶ 23
S	10 FAN ON-SUPP BLOCKED Return-House ΔP	reg.	p1-1.2	p2-2.1	p3-4.7	p4	pdm-7.7
B	11 House-Attic ΔP	2.3	2.2	0.9	0.4	0.8	Avg: 1.34
		0.9	1.2	1.9	1.6	1.2	
C	12 Pressure Pan ΔP	s ¹ 101	s ² 80	s ³ 69	s ⁴ 89	s ⁵ 56	s ⁶ 70
I	13 FAN OFF House-Attic ΔP	1.5	1.9	1.3	1.4	2.5	Avg: 1.68
3		2.0	2.1	1.0	1.2	1.9	
14	Blower Door		CFM @		Pa		