**ENERGY SAVINGS IN ONE-PIPE
STEAM HEATING SYSTEMS FITTED WITH
HIGH-CAPACITY AIR VENTS**

Final Report

Prepared for

**THE NEW YORK STATE
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ABSTRACT

Multifamily buildings heated by one-pipe steam systems experience significant temperature gradients from apartment to apartment, often reaching 15°F. As a result, many tenants are too cold, or, if the heating system output is increased so as to heat the coldest apartment adequately, too hot. While both are undesirable, the second is particularly so because it wastes energy.

It was thought that insufficient air venting of the steam pipes contributed to the gradient. Theoretically, if steam mains and risers are quickly vented, steam will reach each radiator at approximately the same time and balance apartment temperatures.

The project's objective was to determine if the installation of large-capacity air vents at the ends of steam mains and risers would economically reduce the temperature gradient between apartments and reduce the amount of space heating energy required.

The test was conducted by enabling and disabling air vents biweekly in 10 multifamily buildings in New York City between December 1992 to May 1993. The temperatures of selected apartments and total space heating energy were compared during each venting regime.

There was no difference in energy consumption between "vents on" and "vents off" periods (see Tables 2 and 5); however, there was a reduction in the maximum spread of apartment temperatures.

Keywords:

steam heating
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one-pipe steam

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SUMMARY

Anecdotal evidence has suggested that rapid air venting from one-pipe steam systems would produce more even distribution of apartment space temperatures, greater occupant comfort and reduced fuel consumption. Ten multifamily buildings in New York City were fitted with large capacity air vents at the ends of the steam mains and the tops of risers. The vents at the ends of the mains were alternately enabled and disabled on a two-week cycle for seven months during the 1992-93 heating season. Apartment temperatures were recorded hourly and the time for steam to reach the farthest radiator was noted for each steam cycle.

There was no difference in energy consumption between "vents on" and "vents off" periods (see Tables 2 and 5); however, there was a reduction in the maximum spread of apartment temperatures (see Table 3).

We recommend that building owners install a large-capacity air vent at the top of each riser and then make certain that each radiator in the building is properly pitched, valved and vented. Since the radiator treatments should be performed in any event, the marginal cost of such a regime is minimal.

More research needs to be done to establish the most critical variables that establish system balance. For example, future experiments should focus on:

- o Oversizing and undersizing of radiators;
- o Excessive air infiltration or exfiltration; and
- o Solar gain.

Section 1

DESCRIPTION OF STUDY

Most multifamily buildings in New York City are heated with low pressure steam through one-pipe distribution systems that use the same piping for both the steam supply and the condensate return; thus, the term "one-pipe". One-pipe systems were economical when first installed if properly maintained. Over the years, however, maintenance has lapsed and improper modifications have been made to many of these systems so they no longer perform effectively.

The phenomenon of uneven heat distribution in buildings employing a one-pipe steam heating system is well-known to all persons who live with one. Temperature variations of as much as 15°F or more are common from apartment to apartment. Smaller swings are common within individual apartments as well.

A promising method to improve uneven heat distribution in these buildings involved installing large-capacity air vents at the ends of steam mains and at the tops of steam risers. The work of Gerety¹, Biederman and Katrakis², Peterson³ and others, along with strong anecdotal evidence, suggested that this relatively simple, low-cost approach would permit steam to arrive at all radiators in the building at virtually the same time, thus eliminating the primary obstacle to even distribution.

The idea was that the air trapped inside the steam piping provided such a large resistance to the flow of steam that the steam entered radiators topologically close to the boiler first, and then entered progressively distant radiators as the steaming cycle continued. All the air in the system was vented by the radiator vents, which have a very low vent capacity.

Since the steaming cycle was controlled by a device that allotted a fixed period of boiler on-time out of a 60-minute cycle as a function of outdoor temperature, the result would be that the radiators topologically farther away from the boiler would often not receive any steam before the boiler on-time period ended.

To combat this, building staff would increase the on-time period for any given outdoor temperature by adjusting the boiler control, which theoretically had the effect of overheating the apartments near the boiler to properly heat the apartments farther away. Another approach to this problem that has a similar effect is the widespread practice of increasing the cutout pressure setting on the boiler pressuretrol.

Rapidly venting the mains and risers would cause the steam to reach every radiator quickly, thus bringing heat to every apartment at the same time. The large difference in temperatures among apartments would shrink considerably, with underheated apartments now warmer and overheated apartments now cooler.

This would increase comfort, of course, and save energy. The boiler would be on for a shorter period because the air venting was faster, and the lower apartment-to-apartment temperature difference would permit adjusting the boiler control to a lower level. There would be no need to overheat the apartments close to the boiler to make the certain there was adequate heat for distant apartments.

THE EXPERIMENT

The research goal was to determine three things: first, if rapid air venting saved energy; second, if it minimized the apartment-to-apartment temperature difference; and third, if it resulted in a much more rapid delivery of steam to the radiators further away.

Ten multifamily buildings were selected to vent and monitor during one heating season. All buildings used a heating control manufactured by Optimum Applied Systems (OAS). This device controls the boiler by sensing the temperature in several apartments (usually five or ten, and usually located on the top two floors). It also is capable of communicating with a central PC via modem, making it useful for daily downloading of data.

The OAS provided data on apartment temperatures, domestic hot water (DHW) flow, burner on-time and oil or gas flow. The OAS was customized to provide data on steam travel time to the farthest radiator. Fuel consumption for DHW (DHWFC) would be subtracted from total fuel consumption (TFC) to yield space heating fuel consumption (SHFC).

The boilers in nine of the ten buildings used a combination boiler that supplies both steam for heating and domestic hot water. One building included a separate direct-fired domestic hot water heater.

The ten buildings were fitted with large-capacity air vents at the ends of the steam mains and the tops of the risers according to the methodology developed by Gerety. The vents on the mains included valves that could be used to enable or disable the vents. It was not possible to enable and disable riser vents as well, due to the unpredictability of apartment

access; the only variable that was manipulated was the main vents.

Also installed were oil flow meters, DHW flow meters, gas on-time and steam-travel-time sensors.

The air vents at the ends of the mains were enabled and disabled every two weeks. SHFC was calculated for the enabled and disabled periods from December 1992 to May 1993.

BUILDING LIST

We obtained a list of several hundred buildings that have the OAS heating control system. The list was first pared down by eliminating buildings that had fewer than 20 units or more than 80 units. The list was further reduced through phone interviews with building owners/managers that eliminated buildings with two-pipe steam systems, severe water hammer, and those not in the range of four to eight stories. Finally, building surveys conducted at approximately 50 sites eliminated sites with poor maintenance and inaccessible mains or risers.

In summary, the main selection criteria were:

- 1) OAS heating control in place;
- 2) Appeared to make dry steam;
- 3) Well-maintained heating system;
- 4) 20 to 80 dwelling units;
- 5) One-pipe steam heating system with exposed risers; and
- 6) Four to eight stories tall.

Ten buildings selected from the original list are described in Table 1.

TABLE 1
Participating Buildings

<u>Bldg. #</u>	<u>Address</u>	<u># of Units</u>	<u>Stories</u>	<u>Fuel Type</u>
1	4 West 103rd St., New York, NY	20	5	gas
2	2968 Perry Ave., Bronx, NY	30	6	#4 oil
3	2933 Grand Concourse, Bronx, NY	42	6	#4 oil
4	575 Riverside Drive, New York, NY	42	6	#4 oil
5	517 West 113th St., New York, NY	48	8	gas
6	1644 Anthony Ave., Bronx, NY	50	5	#6 oil
7	1117 Manor Ave., Bronx, NY	54	6	#2 oil
8	2105 Burr Ave., Bronx, NY	60	6	#6 oil
9	410 State St., Brooklyn, NY	60	6	#6 oil
10	225 E. Mosholu Pkwy N., Bronx, NY	70	6	#6 oil

DATA GATHERING

The key to determining energy savings was accurate measurement of both TFC and DHWFC. TFC was to be determined using flow meters for oil consumption and corroborated by the readings from burner on-time. None of the burners was set up for modulation.

The Ista line of oil flow meters were selected. Ista meters had been used for other Energy Authority projects and performed satisfactorily; the company agreed to provide meters at a discount. Ista indicated that the meters were appropriate for the rate of flow, oil type and temperature expected. However, the oil meters performed poorly. They caused excessive pressure drops in the burner oil lines and, in many cases, made lightoffs impossible. By the end of the project, most of the meters had been bypassed. The meters that held out the longest were an older model, no longer offered by Ista, found in two buildings that had participated in a previous Energy Authority project.

Not only did the Ista meters perform unreliably, they also provided inaccurate readings. There is no explanation for their poor performance; Ista was unresponsive throughout the project.

DHW MEASUREMENT

DHW Consumption data were obtained from the OAS equipment. We could estimate the BTUs used to heat the DHW daily were estimated as follows:

$$\text{DHWFC} = G \times (T_h - T_c) \times 8.33 \times \text{SH} / \text{SSE}$$

Where

- G = Total metered gallons dhw
- T_h = Hot water temperature, °F, taken by averaging the 24 hourly readings
- T_c = Cold water temperature, estimated from readings taken in nearby buildings in other research projects
- SH = Specific heat of water = 1.0
- SSE = Steady state efficiency, taken by averaging monthly readings

Since all but one building used a tankless coil to make DHW, we were eager to find an alternative to deducting DHW use from total use. Thus, as a first approximation, it was assumed that over the course of the heating season DHW consumption in each building was the same during vent-on and vent-off periods, and that fuel consumption, over the long term, was directly proportional to burner on-time.

APARTMENT TEMPERATURE SENSORS

The OAS system gathers apartment temperature information from five to 10 wall-mounted sensors. Some or all of these sensors are allowed to "vote", and when a predetermined number of them indicate below a preselected setpoint, the burner is turned on. The reverse happens when the temperature goes above a preselected setpoint.

We assumed for the sake of this research that these sensors represented the apartment-to-apartment temperature variation in the building. We also assumed that if venting worked as expected, the difference between the coldest and hottest sensor temperature would decrease.

TIME-TO-STEAM SENSORS

EME developed a custom approach to obtaining time-to-steam data. We used an OAS channel usually reserved for malfunction annunciation and made an apparatus that would send a brief pulse to the channel when the temperature of the riser to which the sensor was attached rose above 185°F.

Apartment access was problematic and in one case, the tenant decided the sensor was an electronic "bug" and ripped it out after it was installed.

Of the seven sensors that operated consistently, the one in building 5 signaled during every heating cycle, often before there was a call for steam. We were never able to determine the reason. Thus we were only able to obtain meaningful time-to-steam data from six buildings (#2, 3, 6, 8, 9, 10).

Section 2

ANALYSIS OF RESULTS

As mentioned previously, the intent was to determine three things:

- 1) Energy savings from venting;
- 2) Balancing of apartment temperatures; and
- 3) Reduction of time needed to heat farthest radiators.

SAVINGS FROM VENTING

The data did not show significant savings from using air vents. As Table 2 shows, on average there were no energy savings from venting.

TABLE 2		
Average Burner On-Time per Degree-Day per Apartment, Vents On vs. Vents Off (not corrected for DHW consumption)		
On-time per Degree-Day per Apartment (in minutes)		
<u>Building</u>	<u>Vents Off</u>	<u>Vents On</u>
1	0.62	0.61
2	0.63	0.63
3	0.38	0.37
4	0.44	0.44
5	0.25	0.24
6	0.31	0.32
7	0.34	0.36
8	0.29	0.31
9	0.18	0.18
10	<u>0.33</u>	<u>0.34</u>
Average	0.38	0.38

BALANCING APARTMENT TEMPERATURES

Since part of the purpose of venting is to equalize the temperature between apartments, the data was analyzed to determine if the spread between the warmest and coolest apartments was reduced when the vents were on.

For the period including January 5 to February 1, the data was analyzed to determine the average spread (delta) between the warmest and coolest apartments with sensors for each building when the vents were off and when they were on. The average building temperature was also determined to ensure the results were not skewed by large differences therein.

TABLE 3					
Reduction of Temperature Difference Between Warmest and Coolest Apartments (apartments with sensors only) (1/5/93 to 2/1/93)					
<u>Building</u>	<u>Vent-Off Delta(°F)</u>	<u>Avg. Bldg. Temp.</u>	<u>Vent-On Delta(°F)</u>	<u>Avg. Bldg. Temp.</u>	<u>°F Delta Difference</u>
1	4	72	4	72	0
2	6	73	5	73	-1
3	10	72	10	72	0
4	6	73	3	73	-3
5	10	73	9	73	-1
6	9	71	11	72	+2
7	12	71	8	72	-4
8	14	72	13	72	-1
9	5	73	5	72	0
10	9	71	8	71	-1

Note: Degree-day totals were within 5 percent of each other for vent-on and vent-off periods.

As shown in Table 3, there was a reduction in apartment temperature differences in most of the buildings. Thus it possible that tenant comfort was enhanced in those buildings. However, any energy savings that might have resulted was not evident in the other data.

We also considered how the maximum apartment temperature differential changed with outdoor temperature and found that even when the boiler was not on due to mild weather, there is a large difference among apartments.

Bldg.	Date	Time	Outdoor Temp.	Apt. High	Apt. Low	"Natural" Delta	Vent-On Delta
1	5/25/93	09:00am	73	76	71	5	4
1	5/25/93	03:00am	71	76	70	6	4
2	5/25/93	07:00am	71	79	75	4	5
2	5/25/93	02:00am	71	78	76	2	5
3	5/25/93	09:00am	74	79	76	3	10
3	5/25/93	02:00am	71	80	75	5	10
4	5/25/93	09:00am	64	77	74	3	3
4	5/25/93	02:00am	62	76	74	2	3
5	5/25/93	09:00am	71	76	70	6	9
5	5/25/93	02:00am	70	76	70	6	9
6	5/25/93	09:00am	78	79	76	3	11
6	5/25/93	02:00am	71	78	76	2	11
7	5/25/93	09:00am	72	81	61(76)	20(5)	8
7	5/25/93	02:00am	69	81	61(75)	20(6)	8
8	5/25/93	09:00am	72	78	75	3	13
8	5/25/93	02:00am	69	78	75	3	13
9	5/25/93	09:00am	73	79	76	3	5
9	5/25/93	02:00am	71	79	76	3	5
10	5/25/93	09:00am	74	77	74	3	8
10	5/25/93	02:00am	72	79	73	6	8

Table 4 shows clearly that apartment temperatures are not balanced even when the heating system is not activated. It is also interesting to note that in most cases the lowest sensor temperature is higher than the outdoor temperature, which suggests that internal heat gains play a significant role in the balancing process (see Section 3, Discussion of Results).

Since we did show a tendency towards reduction of temperature deltas (Table 3), this table suggests that the apparently modest reductions in temperature deltas were actually more significant than they first appear because there is apparently a "natural" temperature delta in these buildings that is unaffected by venting. If we compare the vents-on deltas with the "natural" deltas, we see that venting may well have brought these buildings close to the limit of what vents can achieve.

TIME-TO-STEAM

To calculate the effect of venting on the time it took for steam to reach the farthest radiator, we looked at the buildings that gave good time-to-steam data (#2, 3, 6, 8, 9 and 10). For each building, we determined time from a call for heat to the signal from the sensor. We calculated the average time over the course of the entire vent-on and vent-off periods. The results are given in Table 5.

TABLE 5			
Average Time-To-Steam, Vents On vs. Vents Off (in minutes)			
<u>Building</u>	<u>Vent-Off</u>	<u>Vent-On</u>	<u>Difference(minutes)</u>
2	21	17	+4
3	20	21	-1
6	11	11	0
8	25	26	-1
9	26	28	-2
10	<u>18</u>	<u>19</u>	-1
Average	20	20	0

Section 3

DISCUSSION OF RESULTS

ENERGY SAVINGS

Based on this research, there are no significant energy savings from venting single pipe steam systems; vents should be installed only at the tops of the risers.

Building owners have historically hired engineers to design a venting plan. This time-consuming, labor-intensive process of mapping the steam mains and calculating vent deployment may now be eliminated. Building managers who wish to install riser vents may use a simple sizing method for risers. In general, buildings six stories and under may install one vent, such as a Gorton #1, near the top of each riser. Taller buildings may wish to add a second Gorton #1 or use a single Heat-Timer Vari-Valve vent at full opening.

Table 6 shows the relative volume of the mains and risers for each building. The large volume of air contained in the risers mandates that vents be installed on the risers.

TABLE 6			
Volume of Steam Mains and Risers			
<u>Building</u>	<u>Mains Volume</u> <u>(Cu. ft.)</u>	<u>Riser Volume</u> <u>(Cu. ft. est.)</u>	<u>Riser Percent</u> <u>of Combined Volume</u>
1	9.5	8	46
2	16.7	15	47
3	27.5	23	46
4	36.7	33	47
5	42.9	42	49
6	30.3	26	46
7	22.7	30	57
8	54.7	36	40
9	27.4	29	51
10	72.0	41	<u>36</u>
			Avg. = 47

APARTMENT TEMPERATURE DIFFERENCES

It was noted in Table 3 that apartment temperature differences were somewhat affected by changes in vent capacity.

But perhaps what is more important is that the average deltas were quite wide during both the heating and non-heating mode, suggesting that other factors such as solar gain and internal loads contribute significantly to heat imbalance. Thus while venting affects apartment temperature differences, it may not be the most important factor.

TIME-TO-STEAM

We do not have information about time-to-steam in a non-venting regime, and cannot make definitive statements about it outside the results of the data acquired for the buildings in which adequate sensor data were obtained.

Section 4

RECOMMENDATIONS

The problem of unbalanced apartment temperatures affects almost every building heated with one-pipe steam in New York City.

There is still a problem in this area that will continue to demand a solution. In light of the outcome of this project, it is possible to find clues as to the direction of future research.

OTHER VARIABLES

While failure of steam to reach radiators in a timely fashion may well be an important factor in apartment temperature imbalance, there are other factors that could have an equal or even greater effect. An apartment may be consistently underheated for any of these reasons:

- 1) Radiation too small. Often occurs when radiators have been replaced.
- 2) Cold draft on occupants or on temperature sensor. We have encountered numerous examples where the apartment air temperature is adequate, but chilling drafts from stack effect make the occupants feel cold. In other cases, a low-reading sensor was next to an open window or other source of cold air.
- 3) Open window.
- 4) Apartment exposed to prevailing winds.
- 5) Radiator air vent or steam valve shut or blocked.
- 6) Radiator runout plugged with condensate.
- 7) Riser supply uninsulated, passes through cold area in basement.
- 8) Radiator output blocked by furniture, debris or cover.

An apartment may be consistently overheated for any of these reasons:

- 1) Excessive radiation. This is more common than previously thought. Just to give an example, a room in one apartment had a radiator and riser with a capacity more than double the heat loss of the room. Often the radiator will be properly sized but the riser will be the extra factor. Apartments with storm windows or new windows are likely candidates for overheating.
- 2) First floor apartment. Often such apartments receive excessive heat through the floor because of limited steam main or boiler insulation.

- 3) Solar gain. A particular problem for south-facing apartments. Due to the dense nature of NYC housing, this can vary by floor and by month because some apartments will be blocked from the sun by buildings across the street, and the sun's position in the sky changes over the winter.
- 4) Internal gains. Factors include number of people and pets, refrigerators, lights, stoves and other appliances.
- 5) Excessive boiler on-time. If all apartments are overheated, the boiler control system has not been adjusted to reduce on-time. If adjustments lower overall temperatures but create some cold apartments, see the previous description of underheated apartments.

DIRECTIONS FOR FUTURE RESEARCH

Since the problem of temperature imbalance manifests itself primarily as a comfort issue rather than an energy issue, any future research on this subject should focus on improving occupant comfort. Savings, while difficult to measure, will automatically follow by lowering the average temperature of the building.

We recommend this approach for any future research:

- 1) Building Selection: Study one building with a history of imbalance problems to use as a base for a systematic approach. At the beginning of the study, establish the extent of the imbalance; then monitor changes in balance as different techniques are attempted.

To make comparisons easier, the building should have separate DHW and should preferably be fueled by gas.

- 2) Instrumentation: The monitoring of a number of factors, especially apartment temperatures, should be handled by a dedicated datalogger or loggers. This will not only improve data gathering, but will permit easy downloading of the data into a spreadsheet format.

Monitor every apartment temperature. The temperature sensors should be the RTD type and calibrated (the temperature sensors in this study were not calibrated). Local outdoor temperature should be monitored as well, for local degree-day information.

The building should fire either light oil or natural gas due to the difficulties associat-

ed with metering heavy oil.

- 3) **Experimental Approach:** After a temperature profile of the building is developed, a heat loss calculation should be made to determine the extent of over- and under-radiation. A separate test of riser heat output should be made so its effect can be ascertained.

Each apartment should be visited to determine the technique(s) most likely to correct its problem. The results should be cataloged and then tried in order of estimated cost-effectiveness. As each technique is tried, changes in apartment temperatures and fuel use should be monitored.

In this way, a direct cause-and-effect relationship can be established, and the results immediately observed. When the most cost-effective techniques are established, they can be tried on other buildings to confirm their applicability.

CONCLUSION

This project demonstrated that adding large-capacity air vents to the mains and risers of one-pipe steam heating systems improves distribution of temperatures throughout a building (see Table 3), but does not save space heating energy. Thus the costly measurement and calculation of the amount and location of steam main air vents and the cost of installing them, can be eliminated.

It cannot be stated, on the basis of this research, whether riser vents alone would be helpful in improving apartment temperatures or saving space heating energy. It does appear, however, that venting alone is insufficient to balance apartment temperatures, and, given the many factors that affect these temperatures, that other factors are more important.

APPENDIX A - REFERENCES

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APPENDIX B - FUEL CONSUMPTION COMPARISON

Comparison of Calculated Space Heating Fuel Consumption During Venting
vs.
Calculated Space Heating Consumption (based on historical fuel records)
During Period Prior to Venting.
(1 page)

VENT BUILDINGS

DHW FUEL CONSUMPTION SUMMARY

PERIOD: DECEMBER 92 - MAY 93

	----- DHW FUEL CONSUMPTION (MMBTU'S) -----							AVG DAILY CONS.	PROJ. ANNUAL CONS.	TOTAL METERED CONS.	NET HEATING CONS.	NET HEATING CONS. MMBTU/DD	% DHW CONS.	PROJ. TOTAL CONS.	AVG PRE-VENT CONS.	AVG HEATING CONS.	AVG HEATING CONS. MMBTU/DD
	DEC	JAN	FEB	MAR	APR	MAY	TOTAL CONS.										
MANOR	122.34	166.77	180.96	197.81	160.51	115.13	943.52	6.13	2,236.26	2,460.47	1,516.95	0.4535	59.58	3,753.21	4,591.00	2,354.74	0.5343
ANTHONY	151.45	214.62	205.79	214.93	200.91	134.77	1,122.47	7.10	2,593.05	3,598.42	2,475.95	0.7026	51.16	5,069.00	5,076.00	2,482.95	0.5634
BURR	66.89	144.27	124.66	99.07	111.11	88.98	634.98	4.38	1,598.40	4,624.06	3,989.08	1.1743	28.61	5,587.48	6,382.00	4,783.60	1.0855
MOSHOLU	281.44	588.13	657.55	630.58	300.29	136.85	2,594.84	17.07	6,231.03	5,236.63	2,641.79	0.7646	70.23	8,872.82	7,810.00	1,578.97	0.3583
G. CONCOURSE	123.04	175.04	173.25	211.82	205.12	167.00	1,055.27	6.32	2,306.43	2,688.53	1,633.26	0.4492	58.54	3,939.69	3,148.67	842.24	0.1911
PERRY	64.20	116.39	84.81	104.77	89.49	63.18	522.84	3.19	1,163.64	2,940.15	2,417.31	0.6825	32.50	3,580.95	2,401.00	1,237.36	0.2808
WEST 103RD	23.68	38.26	28.43	31.89	33.61	23.63	179.50	1.07	392.32	843.18	663.68	0.1809	37.15	1,056.00	1,262.67	870.35	0.1975
STATE	67.43	102.34	84.87	92.80	86.03	59.56	493.03	2.99	1,090.64	1,663.63	1,170.60	0.3191	48.23	2,261.24	3,404.67	2,314.02	0.5251
WEST 113TH							0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.0000
W-1 RIVERSIDE	32.56	74.44	69.34	63.52	67.95	51.02	358.83	2.36	861.66	2,111.70	1,752.87	0.5447	32.96	2,614.53	3,220.67	2,359.00	0.5353
TOTAL	933.03	1,620.26	1,609.66	1,647.19	1,255.02	840.12	7,905.28		18,473.43	26,166.77	18,261.49			36,734.92			

APPENDIX C - ON-TIME PER DEGREE DAY
(2 pages)

ON-TIME PER DEGREE DAY FOR 65 DAYS, VENTS ON

ON-TIME PER DEGREE DAY FOR 65 DAYS, VENTS OFF

Std. Dev. for Days with Degree Days 12 or
Greater=0.033, or 17% of the Average Value

APPENDIX D - DAILY SUMMARY REPORTS

Apartment Temperature Data, 1/5/93 -- 2/1/93, Buildings 1 - 10
(10 pages)

Each spreadsheet has several columns showing average daily temperature for apartments with properly operating sensors. Because vents were switched from off to on (or vice versa) during the day, data for switchover days, i.e. day 1 of the 14-day period, are ignored in the analysis.

DAILY SUMMARY REPORT

BUILDING: 4 West 103rd Street

PERIOD: 01/05/93 - 01/18/93 (Vent Off)

CONSUMPTION										TEMPERATURES										MISCELLANEOUS			
MMBTU'S							APARTMENTS					WATER			OUTSIDE			BURNER					
FUEL	WATER	CORREC	PER	DHW	HEATING	#4B	#5A	#5B	#5C	#1D	BLDG	AVG	COLD	MIX	HIGH	LOW	AVG.	DEG.	COMBUS	ON-TIME			
DAY	(MMBTU'S)	(GALS)	ON-TIME	PER HOUR	(MMBTU'S)	(MMBTU'S)	AVG	AVG	AVG	AVG	AVG	AVG	AVG	AVG	AVG	AVG	AVG	DAY	EFF	HRS	MIN		
1	2.78	1,020	2.58	1.08	0.93	1.85	72	71	71	74	71	72	55	142	61	42	52	14	0.794	2	35		
2	5.39	1,284	5.02	1.08	1.16	4.23	71	72	71	75	72	72	55	141	43	40	42	24	0.794	5	1		
3	4.86	1,181	4.52	1.08	1.12	3.74	72	71	72	75	71	72	52	142	45	40	43	23	0.794	4	31		
4	5.02	1,079	4.67	1.08	1.13	3.88	71	71	71	75	71	72	48	148	45	39	42	23	0.794	4	40		
5	6.67	1,323	6.20	1.08	1.30	5.36	70	71	72	76	71	72	52	146	40	29	35	31	0.794	6	12		
6	8.30	1,159	7.72	1.08	1.13	7.16	71	70	72	77	71	72	52	145	30	26	28	37	0.794	7	43		
7	7.81	1,593	7.27	1.08	1.47	6.34	71	70	73	77	71	72	52	140	34	26	30	35	0.794	7	16		
8	6.24	1,277	5.80	1.08	1.18	5.06	72	71	71	76	71	72	53	141	39	33	36	29	0.794	5	48		
9	5.52	1,460	5.13	1.08	1.35	4.17	72	70	72	75	71	72	52	140	39	37	38	27	0.794	5	8		
10	6.52	1,499	6.07	1.08	1.53	5.00	72	70	71	76	72	72	43	140	38	33	36	30	0.794	6	4		
11	6.09	1,251	5.67	1.08	1.23	4.86	72	71	71	75	72	72	44	138	39	33	36	29	0.794	5	40		
12	6.34	1,334	5.90	1.08	1.23	5.11	72	71	70	74	71	72	51	139	40	34	37	28	0.794	5	54		
13	6.84	1,450	6.37	1.08	1.32	5.52	72	72	71	75	71	72	51	138	40	32	36	29	0.794	6	22		
14	7.58	1,551	7.05	1.08	1.33	6.24	72	71	72	75	71	72	51	133	39	27	33	32	0.794	7	3		
15			0.00		0.00	0.00													0.794				
16			0.00		0.00	0.00													0.794				
17			0.00		0.00	0.00													0.794				
18			0.00		0.00	0.00													0.794				
TOT/AVG	83.17	17,441	77.37	1.08	16.49	66.68	72	71	71	75	71	72	50	141	39	33	36	375	0.794				

ON-TIME PER DEG. DAY MINS.

0.206 12.38

PERIOD: 01/19/93 - 02/01/93 (Vent On)

CONSUMPTION										TEMPERATURES										MISCELLANEOUS			
MMBTU'S							APARTMENTS					WATER		OUTSIDE			DEG. DAY	COMBUS EFF	BURNER				
DAY	FUEL (MMBTU'S)	WATER (GALS)	CORREC ON-TIME	PER HOUR	DHW (MMBTU'S)	HEATING (MMBTU'S)	#4B AVG	#5A AVG	#5B AVG	#5C AVG	#1D AVG	BLDG AVG	COLD	AVG MIX	HIGH	LOW			AVG.	ON-TIME HRS	MIN		
1	7.7	1,511	7.13	1.08	1.41	6.26	72	71	71	76	71	72	53	142	34	25	30	36	0.794	7	8		
2	6.7	1,379	6.20	1.08	1.29	5.38	72	70	72	75	71	72	52	141	42	30	36	29	0.794	6	12		
3	6.4	1,524	5.97	1.08	1.41	5.01	73	71	71	75	71	72	52	140	42	33	38	28	0.794	5	58		
4	5.2	1,288	4.80	1.08	1.18	3.98	72	72	70	75	71	72	52	139	51	42	47	19	0.794	4	48		
5	5.1	1,279	4.73	1.08	1.15	3.93	72	72	71	74	71	72	50	136	46	41	44	22	0.794	4	44		
6	4.7	1,723	4.35	1.08	1.45	3.23	65	73	70	74	72	71	53	133	54	41	48	18	0.794	4	21		
7	6.4	1,640	5.92	1.08	1.55	4.81	66	73	71	75	72	71	53	143	44	34	39	26	0.794	5	55		
8	7.0	1,366	6.50	1.08	1.22	5.77	67	71	72	75	71	71	56	141	36	29	33	33	0.794	6	30		
9	6.3	1,465	5.87	1.08	1.34	4.97	71	71	71	75	72	72	56	143	43	35	39	26	0.794	5	52		
10	6.8	1,146	6.30	1.08	1.06	5.71	72	71	71	74	72	72	52	140	41	30	36	30	0.794	6	18		
11	6.5	1,306	6.08	1.08	1.16	5.37	72	71	72	74	71	72	55	140	41	25	33	32	0.794	6	5		
12	7.4	1,538	6.92	1.08	1.31	6.13	71	71	73	73	71	72	54	135	37	24	31	35	0.794	6	55		
13	6.8	1,529	6.33	1.08	1.32	5.49	71	72	69	74	72	72	54	136	45	33	39	26	0.794	6	20		
14	7.9	1,560	7.38	1.08	1.37	6.56	68	72	69	74	71	71	54	138	43	14	29	37	0.794	7	23		
15			0.00		0.00	0.00													0.794				
16			0.00		0.00	0.00													0.794				
17			0.00		0.00	0.00													0.794				
18			0.00		0.00	0.00													0.794				
TOT/AVG	83.2	18,743	77.35	1.08	16.79	66.36	70	72	71	74	71	72	53	139	43	32	38	357	0.794				

ON-TIME PER DEG. DAY MINS.

0.217 13.00

DAILY SUMMARY REPORT

BUILDING: 517 West 113th Street

PERIOD: 01/05/93 - 01/18/93 (Vent Off)

CONSUMPTION							TEMPERATURES										MISCELLANEOUS									
DAY	FUEL (MMBTU'S)	WATER (GALS)	MMBTU'S			HEATING (MMBTU'S)	APARTMENTS										WATER			OUTSIDE			DEG. DAY	COMBUS EFF	BURNER ON-TIME	
			CORREC ON-TIME	PER HOUR	DHW (MMBTU'S)		#54 AVG	#55 AVG	#64 AVG	#65 AVG	#72 AVG	#73 AVG	#74 AVG	#75 AVG	#82 AVG	#86 AVG	BLDG AVG	COLD	AVG MIX	HIGH	LOW	AVG.			HRS	MIN.
1	6.81		2.22	3.07	0.00	6.81	74	75	75	72	69	75	75	73	75	68	73	55	130	61	43	52	13	0.7995	2	13
2	12.39		4.03	3.07	0.00	12.39	74	75	76	72	69	75	75	72	76	68	73	55	129	44	41	43	23	0.7995	4	2
3	13.01		4.23	3.07	0.00	13.01	74	72	76	73	68	77	76	72	76	69	73	52	129	46	40	43	22	0.7995	4	14
4	14.65		4.77	3.07	0.00	14.65	73	72	75	73	69	76	75	70	76	69	73	48	131	45	41	43	22	0.7995	4	46
5	17.06		5.55	3.07	0.00	17.06	73	71	74	72	68	76	74	71	76	68	72	52	132	41	31	36	29	0.7995	5	33
6	21.92		7.13	3.07	0.00	21.92	71	71	75	72	69	77	75	74	78	67	73	52	130	31	28	30	36	0.7995	7	8
7	19.21		6.25	3.07	0.00	19.21	71	71	76	72	69	77	77	74	77	67	73	52	129	36	28	32	33	0.7995	6	15
8	18.44		6.00	3.07	0.00	18.44	73	72	77	73	70	78	79	74	78	68	74	53	133	40	33	37	29	0.7995	6	0
9	15.47		5.03	3.07	0.00	15.47	72	72	76	72	72	78	77	73	76	67	74	52	132	40	37	39	27	0.7995	5	2
10	18.54		6.03	3.07	0.00	18.54	72	73	76	73	71	79	75	76	77	67	74	43	133	39	34	37	29	0.7995	6	2
11	15.16		4.93	3.07	0.00	15.16	71	71	76	73	71	78	77	74	76	66	73	44	131	40	33	37	29	0.7995	4	56
12	16.49		5.37	3.07	0.00	16.49	71	71	76	73	71	78	77	75	77	67	74	51	134	40	35	38	28	0.7995	5	22
13	16.75		5.45	3.07	0.00	16.75	72	71	75	72	71	77	76	73	76	66	73	51	133	42	33	38	28	0.7995	5	27
14	19.67		6.40	3.07	0.00	19.67	71	67	74	72	69	78	78	74	79	66	73	51	125	40	29	35	31	0.7995	6	24
15			0.00		0.00	0.00																		0.7995		
16			0.00		0.00	0.00																		0.7995		
17			0.00		0.00	0.00																		0.7995		
18			0.00		0.00	0.00																		0.7995		
TOT/AVG	218.75	0	71.18	3.07	0.00	218.75	72	71	76	72	70	77	76	73	77	67	73	50	131	40	34	37	362	0.7995		

ON-TIME PER DEG. DAY

MINS.

0.197

11.81

PERIOD: 01/19/93 - 02/01/93 (Vent On)

CONSUMPTION							TEMPERATURES																MISCELLANEOUS				
DAY	FUEL (MMBTU'S)	WATER (GALS)	CORREC ON-TIME	MMBTU'S		HEATING (MMBTU'S)	APARTMENTS										WATER		OUTSIDE			DEG. DAY	COMBUS EFF	BURNER ON-TIME			
				PER HOUR	DHW (MMBTU'S)		#54 AVG	#55 AVG	#64 AVG	#65 AVG	#72 AVG	#73 AVG	#74 AVG	#75 AVG	#82 AVG	#86 AVG	BLDG AVG	COLD	AVG MIX	HIGH	LOW			AVG.	HRS	MINs	
1	20.59		6.70	3.07	0.00	20.59	71	66	76	72	72	79	77	75	79	67	73	53	127	35	27	31	34	0.7995	6	42	
2	17.06		5.55	3.07	0.00	17.06	72	67	76	71	74	79	75	74	76	68	73	52	131	42	30	36	29	0.7995	5	33	
3	18.39		5.98	3.07	0.00	18.39	74	68	76	72	70	79	76	75	77	69	74	52	131	43	35	39	26	0.7995	5	59	
4	11.93		3.88	3.07	0.00	11.93	74	69	76	72	71	77	76	71	76	70	73	52	130	51	42	47	19	0.7995	3	53	
5	11.32		3.68	3.07	0.00	11.32	74	71	74	72	71	76	76	71	75	70	73	50	127	46	43	45	21	0.7995	3	41	
6	12.14		3.95	3.07	0.00	12.14	75	71	74	72	72	76	74	71	75	69	73	53	125	53	43	48	17	0.7995	3	57	
7	16.18		5.27	3.07	0.00	16.18	72	71	75	72	72	74	74	71	77	67	73	53	128	45	35	40	25	0.7995	5	16	
8	17.98		5.85	3.07	0.00	17.98	72	65	76	72	71	76	76	73	78	68	73	56	130	37	31	34	31	0.7995	5	51	
9	16.85		5.48	3.07	0.00	16.85	71	65	75	71	72	77	77	74	79	68	73	56	130	43	35	39	26	0.7995	5	29	
10	18.59		6.05	3.07	0.00	18.59	72	66	76	71	69	78	79	74	77	67	73	52	130	42	31	37	29	0.7995	6	3	
11	20.38		6.63	3.07	0.00	20.38	72	63	73	72	71	77	78	73	79	66	72	55	129	42	27	35	31	0.7995	6	38	
12	22.18		7.22	3.07	0.00	22.18	73	67	71	72	71	78	79	76	80	67	73	54	129	37	27	32	33	0.7995	7	13	
13	16.70		5.43	3.07	0.00	16.70	74	69	71	73	72	78	78	75	77	67	73	54	130	45	34	40	26	0.7995	5	26	
14	0.00		0.00		0.00	0.00																		0.7995			
15			0.00		0.00	0.00																			0.7995		
16			0.00		0.00	0.00																			0.7995		
17			0.00		0.00	0.00																			0.7995		
18			0.00		0.00	0.00																			0.7995		
TOT/AVG	199.69	0	64.98	3.07	0.00	199.69	73	68	74	72	71	77	77	73	77	68	73	53	129	44	34	39	311	0.7995			

ON-TIME PER DEG. DAY

MINS.

0.209

12.56

DAILY SUMMARY REPORT

BUILDING: 1644 Anthony Avenue

PERIOD: 01/05/93 - 01/18/93 (Vent Off)

CONSUMPTION							TEMPERATURES											MISCELLANEOUS								
MMBTU'S							APARTMENTS										WATER			OUTSIDE			BURNER			
FUEL	WATER	CORREC	PER	DHW	HEATING	#5A	#5B	#5D	#5C	#5E	#5F	#5G	#5H	#5J	#5K	BLDG	AVG	COLD	MIX	HIGH	LOW	AVG.	DEG.	COMBUS	ON-TIME	
DAY	(MMBTU'S)	(GALS)	ON-TIME	HOUR	(MMBTU'S)	AVG	AVG	AVG	AVG	AVG	AVG	AVG	AVG	AVG	AVG	AVG							DAY	EFF	HRS	MIN
1	13.2	5,986	3.58	3.68	6.22	6.95	71	70	69	74	71	71	67	73	73	71	55	155	64	41	53	13	0.8015	3	35	
2	16.4	5,724	4.47	3.68	6.07	10.35	71	69	69	73	71	70	65	72	72	70	55	157	43	37	40	25	0.8015	4	28	
3	18.2	6,021	4.95	3.68	6.82	11.37	72	69	69	74	71	71	66	73	73	71	52	161	46	37	42	24	0.8015	4	57	
4	17.2	5,788	4.68	3.68	6.80	10.41	69	70	78	71	70	71	68	72	73	71	48	161	44	37	41	25	0.8015	4	41	
5	20.6	5,976	5.60	3.68	7.20	13.38	69	69	79	71	69	70	68	72	74	71	52	168	37	26	32	34	0.8015	5	36	
6	25.1	6,229	6.82	3.68	6.99	18.06	72	69	75	71	69	71	68	71	72	71	52	160	28	23	26	40	0.8015	6	49	
7	23.6	5,638	6.43	3.67	6.62	17.02	71	68	71	72	69	71	67	71	74	70	52	165	33	24	29	37	0.8015	6	26	
8	22.5	6,141	6.12	3.68	6.77	15.71	69	68	71	73	69	72	67	72	73	70	53	159	37	32	35	31	0.8015	6	7	
9	19.0	4,960	5.17	3.68	5.77	13.21	70	68	75	72	70	71	64	71	73	70	52	164	39	35	37	28	0.8015	5	10	
10	19.7	5,993	5.37	3.68	7.16	12.56	71	69	77	73	69	72	66	71	73	71	43	158	37	30	34	32	0.8015	5	22	
11	21.7	6,004	5.92	3.67	7.43	14.32	71	69	77	74	69	70	67	72	75	72	44	163	41	32	37	29	0.8015	5	55	
12	19.4	5,917	5.27	3.68	6.64	12.71	70	70	76	75	70	70	64	72	75	71	51	159	41	32	37	29	0.8015	5	16	
13	20.3	6,867	5.53	3.67	7.35	12.98	71	70	82	75	68	70	65	73	74	72	51	154	41	31	36	29	0.8015	5	32	
14	19.4	6,521	5.28	3.68	7.05	12.37	71	69	80	73	69	69	66	73	76	72	51	155	38	25	32	34	0.8015	5	17	
15			0.00		0.00	0.00																		0.8015		
16			0.00		0.00	0.00																		0.8015		
17			0.00		0.00	0.00																		0.8015		
18			0.00		0.00	0.00																		0.8015		
TOT/AVG	263.1	77,779	71.60	3.68	88.67	174.46	71	69	75	****	73	69	71	66	72	74	71	50	160	39	31	35	392	0.8015		

ON-TIME PER DEG. DAY MINS.
0.183 10.96

PERIOD: 01/19/93 - 02/01/93 (Vent On)

CONSUMPTION							TEMPERATURES															MISCELLANEOUS				
DAY	FUEL (MMBTU'S)	WATER (GALS)	MMBTU'S				APARTMENTS										WATER			OUTSIDE			DEG. DAY	COMBUS EFF	BURNER ON-TIME	
			CORREC ON-TIME	PER HOUR	DHW (MMBTU'S)	HEATING (MMBTU'S)	#5A AVG	#5B AVG	#5D AVG	#5C AVG	#5E AVG	#5F AVG	#5G AVG	#5H AVG	#5J AVG	#5K AVG	BLDG AVG	COLD	AVG MIX	HIGH	LOW	AVG.			HRS	MIN
1	22.8	6,489	6.22	3.67	7.15	15.70	70	68	73		73	70	70	66	73	77	71	53	159	33	23	28	37	0.8015	6	13
2	20.3	6,256	5.53	3.67	6.76	13.57	70	68	70		72	71	70	68	74	76	71	52	156	42	28	35	30	0.8015	5	32
3	22.2	6,749	6.03	3.68	7.51	14.67	70	70	79		74	70	70	67	72	74	72	52	159	41	30	36	30	0.8015	6	2
4	16.0	5,760	4.35	3.68	5.99	10.00	71	70	73		73	69	69	68	72	75	71	52	152	53	41	47	18	0.8015	4	21
5	16.4	6,319	4.47	3.68	6.96	9.45	69	71	78		74	69	69	69	73	75	72	50	156	48	40	44	21	0.8015	4	28
6	16.0	7,198	4.37	3.68	7.78	8.27	69	71	73		75	69	69	68	74	76	72	53	157	53	39	46	19	0.8015	4	22
7	18.5	6,275	5.03	3.68	6.65	11.85	72	70	75		73	71	69	64	74	77	72	53	155	43	31	37	28	0.8015	5	2
8	20.8	6,861	5.65	3.68	7.13	13.63	70	70	76		73	69	69	63	72	76	71	56	156	35	27	31	34	0.8015	5	39
9	22.8	6,790	6.20	3.68	6.99	15.80	68	70	83		72	71	70	66	72	75	72	56	155	42	32	37	28	0.8015	6	12
10	37.1	7,510	10.10	3.68	7.41	29.70	72	70	81		73	69	69	67	73	73	72	52	147	39	28	34	32	0.8015	10	6
11	28.6	7,303	7.78	3.68	7.44	21.17	73	71	83		72	69	67	63	72	74	72	55	153	42	23	33	33	0.8015	7	47
12	41.6	7,263	11.32	3.68	7.55	34.04	74	71	80		74	69	69	67	72	75	72	54	154	39	23	31	34	0.8015	11	19
13	35.7	7,376	9.72	3.68	7.90	27.81	72	71	70		75	68	70	67	71	75	71	54	157	46	31	39	27	0.8015	9	43
14	32.8	6,378	8.93	3.68	7.23	25.60	69	69	78		72	69	69	67	73	76	71	54	163	42	11	27	39	0.8015	8	56
15			0.00		0.00	0.00																		0.8015		
16			0.00		0.00	0.00																		0.8015		
17			0.00		0.00	0.00																		0.8015		
18			0.00		0.00	0.00																		0.8015		
TOT/AVG	328.9	88,038	89.48	3.68	93.29	235.56	71	70	77	****	73	69	69	66	73	75	72	53	155	43	30	37	371	0.8015		

ON-TIME PER DEG. DAY MINS.
0.242 14.49

DAILY SUMMARY REPORT

BUILDING: 2105 Burr Avenue

PERIOD: 01/05/93 - 01/18/93 (Vent Off)

CONSUMPTION							TEMPERATURES																MISCELLANEOUS			
DAY	FUEL (GALS)	WATER (GALS)	CORREC ON-TIME	GALS PER HOUR	DHW (MMBTU'S)	HEATING (MMBTU'S)	APARTMENTS										WATER			OUTSIDE			DEG. DAY	COMBUS EFF	BURNER	
							#1B AVG	#1C AVG	#1D AVG	#1H AVG	#6A AVG	#6C AVG	#6D AVG	#6G AVG	#6H AVG	#6J AVG	BLDG AVG	COLD	AVG MIX	HIGH	LOW	AVG.			HRS	MIN.
1	133.0	8,300	5.40	24.63	6.78	13.12	73	70	75	71	79	73	70	74	69		73	55	131	62	43	53	13	0.7745	5	24
2	222.1	8,880	7.15	31.06	7.35	25.89	74	70	75	70	78	74	70	75	69		73	55	132	45	29	37	28	0.7745	7	9
3	230.2	6,090	7.53	30.56	5.37	29.09	74	71	73	71	79	74	71	76	68		73	52	134	44	38	41	24	0.7745	7	32
4	206.9	4,600	7.08	29.21	4.40	26.57	75	71	73	68	80	72	68	76	64		72	48	137	44	38	41	24	0.7745	7	5
5	321.8	4,680	11.42	28.19	4.23	43.94	76	72	72	67	81	72	67	77	63		72	52	136	39	27	33	32	0.7745	11	25
6	361.7	4,850	12.82	28.22	4.43	49.71	75	71	72	67	80	72	69	78	63		72	52	137	28	24	26	39	0.7745	12	49
7	313.7	5,000	11.15	28.13	4.52	42.44	74	68	73	70	80	74	69	76	65		72	52	136	33	24	29	37	0.7745	11	9
8	244.2	4,890	8.73	27.96	4.31	32.24	74	72	73	68	80	73	68	75	63		72	53	135	37	32	35	31	0.7745	8	44
9	267.7	4,780	9.55	28.03	4.27	35.80	75	73	72	69	81	73	69	75	64		72	52	135	38	35	37	29	0.7745	9	33
10	267.5	4,590	9.50	28.16	4.49	35.55	75	73	73	69	81	75	69	76	66		73	43	134	39	32	36	30	0.7745	9	30
11	241.9	4,750	8.72	27.75	4.70	31.51	73	70	74	69	80	74	69	76	68		73	44	136	40	32	36	29	0.7745	8	43
12	235.2	4,960	8.75	26.88	4.53	30.67	73	71	73	67	80	73	69	75	67		72	51	136	40	33	37	29	0.7745	8	45
13	275.4	5,610	10.32	26.69	5.25	35.98	74	68	76	70	81	72	70	77	68		73	51	138	40	33	37	29	0.7745	10	19
14	269.6	5,620	10.02	26.92	5.14	35.22	73	70	75	69	80	73	69	75	66		72	51	136	38	27	33	33	0.7745	10	1
15			0.00		0.00	0.00																		0.7745		
16			0.00		0.00	0.00																		0.7745		
17			0.00		0.00	0.00																		0.7745		
18			0.00		0.00	0.00																		0.7745		
TOT/AVG	3,457.9	69,300	122.73	28.29	63.00	454.61	74	71	73	69	80	73	69	76	66	****	72	50	136	39	31	35	391	0.7745		

ON-TIME PER DEG. DAY

MINS.

0.314

18.86

PERIOD: 01/19/93 - 02/01/93 (Vent On)

CONSUMPTION							TEMPERATURES										MISCELLANEOUS									
DAY	FUEL (GALS)	WATER (GALS)	CORREC ON-TIME	GALS PER HOUR	DHW (MMBTU'S)	HEATING (MMBTU'S)	APARTMENTS									WATER			OUTSIDE			DEG. DAY	COMBUS EFF	BURNER ON-TIME		
							#1B AVG	#1C AVG	#1D AVG	#1H AVG	#6A AVG	#6C AVG	#6D AVG	#6G AVG	#6H AVG	#6J AVG	BLDG AVG	COLD	AVG MIX	HIGH	LOW			AVG.	HRS	MIN.
1	267.5	4,720	9.60	27.86	4.26	35.78	74	70	74	69	82	74	68	74	66		72	53	137	33	25	29	36	0.7745	9	36
2	262.3	5,010	9.58	27.37	4.53	34.74	75	70	74	69	81	74	68	74	67		72	52	136	40	29	35	31	0.7745	9	35
3	261.1	4,980	9.70	26.92	4.45	34.64	76	72	74	67	81	73	69	74	66		72	52	135	40	30	35	30	0.7745	9	42
4	199.5	4,880	7.27	27.45	4.36	25.51	74	71	76	71	80	70	72	75	69		73	52	135	50	39	45	21	0.7745	7	16
5	211.1	4,690	7.75	27.24	4.29	27.31	74	71	77	70	80	72	70	74	68		73	50	135	46	40	43	22	0.7745	7	45
6	213.0	4,900	7.85	27.13	4.32	27.56	75	72	78	71	80	70	71	76	70		74	53	135	52	39	46	20	0.7745	7	51
7	241.8	4,770	8.98	26.92	4.26	31.94	73	71	77	69	78	74	66	75	68		72	53	136	45	33	39	26	0.7745	8	59
8	232.2	4,920	8.95	25.94	4.18	30.58	74	71	74	67	80	75	68	74	66		72	56	135	36	29	33	33	0.7745	8	57
9	244.7	5,180	9.42	25.99	4.40	32.23	74	71	74	68	80	74	68	74	66		72	56	135	41	32	37	29	0.7745	9	25
10	245.9	5,360	9.50	25.88	4.84	31.97	75	71	74	68	80	75	68	74	67		72	52	136	39	29	34	31	0.7745	9	30
11	250.9	4,140	9.63	26.04	3.65	33.91	75	69	75	68	82	74	68	74	66		72	55	137	40	25	33	33	0.7745	9	38
12	271.2	5,550	10.37	26.16	4.84	35.76	75	68	75	66	81	74	68	74	66		72	54	135	36	24	30	35	0.7745	10	22
13	247.3	5,450	9.38	26.36	4.75	32.27	75	69	76	69	80	74	69	74	68		73	54	135	44	32	38	27	0.7745	9	23
14	262.8	5,070	9.82	26.77	4.47	34.87	75	68	73	64	80	75	67	73	63		71	54	136	42	14	28	37	0.7745	9	49
15			0.00		0.00	0.00																		0.7745		
16			0.00		0.00	0.00																		0.7745		
17			0.00		0.00	0.00																		0.7745		
18			0.00		0.00	0.00																		0.7745		
TOT/AVG	3,143.8	64,900	118.20	26.63	57.33	413.27	75	70	75	68	80	73	69	74	67	****	72	53	135	42	30	36	372	0.7745		

ON-TIME PER DEG. DAY

MINS.

0.318

19.06

DAILY SUMMARY REPORT

BUILDING: 2933 Grand Concourse

PERIOD: 01/05/93 - 01/18/93 (Vent Off)

CONSUMPTION							TEMPERATURES																	MISCELLANEOUS			
DAY	FUEL (GALS)	WATER (GALS)	CORREC ON-TIME	GALS PER HOUR	DHW (MMBTU'S)	HEATING (MMBTU'S)	APARTMENTS							BLDG			WATER		OUTSIDE			DEG. DAY	COMBUS EFF	BURNER ON-TIME			
							#1E AVG	#2E AVG	#4E AVG	#1F AVG	#2F AVG	#3F AVG	#4F AVG	#5F AVG	#6F AVG	#7F AVG	AVG	AVG	COLD	MIX	HIGH			LOW	AVG	HRS	MIN
1	74.3	4,656	4.45	16.70	5.30	5.17	75			77	72	72	71	73	71	67	73	72	55	158	60	43	52	14	0.7535	4	27
2	103.4	4,586	6.20	16.68	5.37	9.21	76			79	72	74	71	75	70	67	74	73	55	161	44	40	42	23	0.7535	6	12
3	87.5	4,383	5.28	16.56	5.86	6.47	76			78	71	73	70	74	71	66	73	72	52	173	45	39	42	23	0.7535	5	17
4	104.0	4,160	6.22	16.73	5.06	9.61	76			73	72	73	71	74	69	65	74	72	48	158	44	39	42	24	0.7535	6	13
5	121.6	4,787	7.20	16.89	6.24	10.90	76			71	72	73	70	74	68	64	75	71	52	170	39	29	34	31	0.7535	7	12
6	139.9	4,402	8.33	16.79	5.84	13.89	77			74	73	73	70	74	68	65	75	72	52	172	32	26	29	36	0.7535	8	20
7	130.0	4,703	7.78	16.70	6.24	12.09	77			75	73	73	70	74	69	66	74	72	52	172	34	26	30	35	0.7535	7	47
8	129.0	4,260	7.72	16.72	5.56	12.64	76			77	72	73	71	73	71	66	74	73	53	171	38	33	36	30	0.7535	7	43
9	105.1	4,253	6.28	16.72	5.45	9.36	77			78	72	72	70	74	71	67	73	73	52	168	40	36	38	27	0.7535	6	17
10	123.2	4,144	7.37	16.72	5.82	11.55	76			79	72	73	70	74	70	65	74	73	43	170	37	32	35	31	0.7535	7	22
11	122.9	4,262	7.35	16.72	5.98	11.34	75			78	72	72	71	74	69	66	74	72	44	171	39	34	37	29	0.7535	7	21
12	108.4	4,348	6.48	16.72	5.86	9.42	76			78	73	73	71	74	69	65	73	72	51	173	40	33	37	29	0.7535	6	29
13	126.0	4,217	7.53	16.72	5.59	12.17	74			77	73	72	70	74	70	66	75	72	51	171	42	32	37	28	0.7535	7	32
14	129.6	4,512	7.75	16.72	5.99	12.29	72			77	73	71	70	73	68	66	75	72	51	171	38	27	33	33	0.7535	7	45
15			0.00		0.00	0.00																			0.7535		
16			0.00		0.00	0.00																			0.7535		
17			0.00		0.00	0.00																			0.7535		
18			0.00		0.00	0.00																			0.7535		
TOT/AVG	1,530.5	57,017	91.50	16.72	74.88	140.92	76	****	76	72	73	70	74	69	66	74	72	50	169	39	33	36	376	0.7535			

D-6

ON-TIME PER DEG. DAY

MINS

0.243

14.60

PERIOD: 01/19/93 - 02/01/93 (Vent On)

CONSUMPTION							TEMPERATURES															MISCELLANEOUS				
MMBTU'S							APARTMENTS							WATER			OUTSIDE			BURNER						
FUEL	WATER	CORREC	PER	DHW	HEATING	#1E	#2E	#4E	#1F	#2F	#3F	#4F	#5F	#6F	#7F	BLDG	COLD	AVG	HIGH	LOW	AVG.	DEG.	COMBUS	ON-TIME		
DAY	(MMBTU'S)	(GALS)	ON-TIME	PER HOUR	(MMBTU'S)	AVG	AVG	AVG	AVG	AVG	AVG	AVG	AVG	AVG	AVG	AVG		MIX				DAY	EFF	HRS	MIN	
1	24.75	4,731	8.53	2.90	6.17	18.58	74		77	73	73	70	73	67	68	75	72	53	171	34	26	30	35	0.7535	8	32
2	22.33	4,035	7.70	2.90	5.35	16.98	75		77	73	74	71	73	69	68	74	73	52	172	40	31	36	30	0.7535	7	42
3	21.03	4,058	7.25	2.90	5.16	15.87	76		78	73	73	71	74	70	67	69	72	52	167	42	33	38	28	0.7535	7	15
4	16.63	4,409	5.73	2.90	5.46	11.17	75		78	73	73	72	74	71	66	68	72	52	164	51	42	47	19	0.7535	5	44
5	17.64	4,267	6.08	2.90	5.47	12.17	75		78	73	73	71	75	71	66	68	72	50	166	45	42	44	22	0.7535	6	5
6	17.84	5,557	6.15	2.90	6.63	11.20	75		78	73	72	71	74	71	68	66	72	53	161	54	42	48	17	0.7535	6	9
7	19.38	4,335	6.68	2.90	5.75	13.63	73		76	74	73	71	73	71	67	66	72	53	173	45	33	39	26	0.7535	6	41
8	23.64	3,787	8.15	2.90	4.73	18.90	75		78	73	73	72	73	71	67	67	72	56	169	37	29	33	32	0.7535	8	9
9	19.96	4,059	6.88	2.90	5.16	14.80	75		75	73	71	71	73	70	67	69	72	56	171	42	33	38	28	0.7535	6	53
10	24.12	4,997	8.32	2.90	6.24	17.88	75		76	73	73	72	75	71	67	70	72	52	165	41	30	36	30	0.7535	8	19
11	18.56	3,962	6.40	2.90	4.82	13.74	72		73	73	71	72	75	71	66	66	71	55	165	41	26	34	32	0.7535	6	24
12	28.03	4,955	9.67	2.90	5.09	22.94	72		75	71	71	71	76	71	65	66	71	54	147	35	26	31	35	0.7535	9	40
13	19.09	4,730	6.58	2.90	6.07	13.03	74		75	72	72	71	75	71	64	66	71	54	170	46	34	40	25	0.7535	6	35
14	27.31	4,676	9.42	2.90	6.57	20.74	71		71	73	73	72	75	67	65	66	70	54	181	44	13	29	37	0.7535	9	25
15			0.00		0.00	0.00																		0.7535		
16			0.00		0.00	0.00																		0.7535		
17			0.00		0.00	0.00																		0.7535		
18			0.00		0.00	0.00																		0.7535		
TOT/AVG	275.55	57,827	95.02	2.90	72.51	203.04	74	****	76	73	72	71	74	70	66	68	72	53	167	43	32	38	357	0.7535		

ON-TIME PER DEG. DAY

MINS

0.267

15.99

DAILY SUMMARY REPORT

BUILDING: 1117 Manor Avenue

PERIOD: 01/05/93 - 01/18/93 (Vent Off)

DAY	CONSUMPTION						TEMPERATURES														MISCELLANEOUS					
	FUEL (GALS)	WATER (GALS)	CORREC ON-TIME	GALS PER HOUR	DHW (MMBTU'S)	HEATING (MMBTU'S)	#1D AVG	#1F AVG	#1H AVG	#1L AVG	#6C AVG	#6D AVG	#6E AVG	#6F AVG	#6H AVG	#6K AVG	BLDG AVG	WATER		OUTSIDE			DEG. DAY	COMBUS EFF	BURNER ON-TIME	
																		COLD	AVG MIX	HIGH	LOW	AVG.			HRS	MIN
1	76.3	8,750	5.40	14.13	6.61	3.97	71	72	74		66	78	71	67	74	70	71	55	133	59	43	51	14	0.86	5	24
2	102.1	7,643	6.65	15.35	5.85	8.31	72	73	75		66	78	69	67	72	70	71	55	134	44	40	42	23	0.86	6	39
3	110.4	8,036	7.37	14.99	6.30	9.01	71	73	74		66	77	68	68	71	70	71	52	133	44	40	42	23	0.86	7	22
4	100.1	8,357	6.77	14.79	6.64	7.25	73	73	73		65	78	65	66	72	69	70	48	130	44	39	42	24	0.86	6	46
5	143.9	10,570	9.17	15.70	7.99	11.97	73	73	73		65	79	63	64	72	70	70	52	130	40	29	35	31	0.86	9	10
6	145.5	9,093	9.38	15.51	7.22	12.96	74	74	72		65	79	62	64	71	68	70	52	134	30	26	28	37	0.86	9	23
7	163.9	8,783	10.68	15.34	7.06	15.67	75	75	73		67	78	64	67	71	69	71	52	135	34	26	30	35	0.86	10	41
8	147.5	8,882	9.70	15.21	6.80	13.66	74	74	73		68	75	66	65	72	70	71	53	132	38	33	36	30	0.86	9	42
9	127.7	8,451	8.22	15.54	6.71	11.00	73	73	73		67	77	66	63	73	69	70	52	134	39	36	38	28	0.86	8	13
10	126.5	9,376	8.33	15.18	8.17	9.37	73	76	73		65	77	65	65	71	69	70	43	133	38	33	36	30	0.86	8	20
11	147.7	7,433	9.38	15.74	6.48	14.00	74	76	73		66	76	65	67	73	69	71	44	134	39	33	36	29	0.86	9	23
12	110.7	8,530	7.07	15.67	6.78	8.58	72	77	72		66	78	64	66	73	68	71	51	133	39	34	37	29	0.86	7	4
13	124.2	8,853	8.15	15.24	7.03	10.19	74	75	72		65	75	65	66	73	69	70	51	133	40	33	37	29	0.86	8	9
14	159.9	9,698	9.93	16.10	7.89	14.29	75	75	73		64	76	67	67	72	72	71	51	135	39	27	33	32	0.86	9	56
15			0.00		0.00	0.00																		0.86		
16			0.00		0.00	0.00																		0.86		
17			0.00		0.00	0.00																		0.86		
18			0.00		0.00	0.00																		0.86		
TOT/AVG	1,710.1	113,705	110.80	15.41	90.92	146.26	73	74	73	****	66	77	65	66	72	69	71	50	133	39	33	36	377	0.86		

ON-TIME PER DEG. DAY MINS.

0.294 17.66

D-7

PERIOD: 01/19/93 - 02/01/93 (Vent On)

DAY	CONSUMPTION						TEMPERATURES											MISCELLANEOUS								
	FUEL (GALS)	WATER (GALS)	CORREC ON-TIME	GALS	DHW (MMBTU'S)	HEATING (MMBTU'S)	APARTMENTS									WATER		OUTSIDE			DEG. DAY	COMBUS EFF	BURNER			
				PER HOUR			#1D AVG	#1F AVG	#1H AVG	#1L AVG	#6C AVG	#6D AVG	#6E AVG	#6F AVG	#6H AVG	#6K AVG	BLDG AVG	COLD	AVG MIX	HIGH			LOW	AVG	ON-TIME HRS	MIN
1	178.4	8,533	10.88	16.39	6.78	17.96	77	76	75		68	79	68	68	73	71	73	53	135	33	26	30	36	0.86	10	53
2	163.6	8,589	10.03	16.31	6.99	15.70	78	76	75		69	76	70	69	72	71	73	52	136	40	30	35	30	0.86	10	2
3	154.9	8,068	9.45	16.39	6.33	15.15	75	76	76		70	75	71	69	72	70	73	52	133	41	33	37	28	0.86	9	27
4	103.6	8,914	6.95	14.91	6.91	7.46	73	74	74		68	77	69	67	72	71	72	52	132	49	41	45	20	0.86	6	57
5	113.8	9,775	7.48	15.21	7.76	8.02	74	74	74		66	77	69	68	73	71	72	50	132	46	42	44	21	0.86	7	29
6	111.2	9,510	7.67	14.50	7.18	8.24	74	74	73		66	76	68	68	72	72	71	53	131	51	41	46	19	0.86	7	40
7			0.00		0.00	0.00												53						0.86		
8			0.00		0.00	0.00	76	76	74		68	75	66	70	73	71	72	56	134					0.86		
9	126.5		8.45	14.97	0.00	17.54	73	75	74		68	73	66	69	73	71	71	56	135	41	34	38	28	0.86	8	27
10	141.0		9.20	15.33	0.00	19.56	72	75	74		67	70	66	69	73	71	71	52	135	40	30	35	30	0.86	9	12
11			0.00		0.00	0.00												55						0.86		
12			0.00		0.00	0.00												54						0.86		
13			0.00		0.00	0.00	75	76	74		66	74	67	68	72	72	72	54	136					0.86		
14	154.0	6,894	9.90	15.56	5.61	15.75	77	77	74		62	69	57	68	71	72	70	54	138	43	13	28	37	0.86	9	54
15			0.00		0.00	0.00																		0.86		
16			0.00		0.00	0.00																		0.86		
17			0.00		0.00	0.00																		0.86		
18			0.00		0.00	0.00																		0.86		
TOT/AVG	1,068.6	51,750	69.13	15.40	40.78	107.42	75	75	74	****	67	74	67	69	72	71	72	53	134	44	33	38	213	0.86		

ON-TIME PER DEG. DAY MINS.

0.325 19.52

DAILY SUMMARY REPORT

BUILDING: 225 East Mosholu Parkway

PERIOD: 01/05/93 - 01/18/93 (Vent Off)

DAY	CONSUMPTION						TEMPERATURES													MISCELLANEOUS						
	FUEL (GALS)	WATER (GALS)	CORREC ON-TIME	GALS	DHW (MMBTU'S)	HEATING (MMBTU'S)	APARTMENTS								WATER		OUTSIDE			DEG. DAY	COMBUS EFF	BURNER ON-TIME				
				PER HOUR			#1F AVG	#1C AVG	#6B AVG	#6C AVG	#6E AVG	#6L AVG	#6K AVG	#5K AVG	#1L AVG	#1K AVG	BLDG AVG	COLD	AVG MIX			HIGH	LOW	AVG.	HRS	MIN
1	140.7	22,450	5.93	23.71	17.43	3.63	69	72	72	67	70	70	72	78	72		71	55	130	61	45	53	12	0.8045	5	56
2	230.6	23,680	9.65	23.90	17.90	16.62	69	71	72	67	70	70	73	78	74		72	55	128	45	42	44	22	0.8045	9	39
3	221.4	20,900	9.18	24.11	17.10	16.05	69	71	71	68	71	70	72	78	73		71	52	131	47	41	44	21	0.8045	9	11
4	215.5	26,560	9.12	23.64	22.28	9.98	73	70	72	69	64	70	71	78	73		71	48	129	46	42	44	21	0.8045	9	7
5	278.7	31,610	11.72	23.79	25.53	16.19	73	69	72	70	61	70	71	79	73		71	52	130	42	33	38	28	0.8045	11	43
6	316.6	29,640	13.17	24.05	22.40	24.99	70	68	71	68	62	70	71	79	72		70	52	125	34	29	32	34	0.8045	13	10
7	330.0	33,520	13.55	24.35	27.77	21.63	70	69	73	70	69	71	65	78	74		71	52	132	37	29	33	32	0.8045	13	33
8	272.1	25,360	11.15	24.40	19.96	20.77	73	70	72	70	71	71	60	76	74		71	53	129	40	35	38	28	0.8045	11	9
9	258.6	23,970	10.42	24.83	19.86	18.85	74	70	73	69	71	71	70	78	73		72	52	132	41	38	40	26	0.8045	10	25
10	237.6	24,960	9.52	24.97	21.71	13.86	73	69	70	67	70	69	67	76	72		70	43	127	40	35	38	28	0.8045	9	31
11	256.1	26,690	10.17	25.19	23.21	15.12	77	69	71	67	72	69	68	77	72		71	44	128	40	35	38	28	0.8045	10	10
12	256.1	26,480	10.25	24.99	21.66	16.68	80	69	71	68	72	69	73	77	73		72	51	130	41	35	38	27	0.8045	10	15
13	263.3	24,630	10.55	24.96	19.89	19.52	81	69	71	67	71	68	73	76	73		72	51	129	42	34	38	27	0.8045	10	33
14	282.7	28,990	11.38	24.83	19.81	22.51	73	67	70	65	69	67	70	76	72		70	51	117	40	30	35	30	0.8045	11	23
15			0.00		0.00	0.00																		0.8045		
16			0.00		0.00	0.00																		0.8045		
17			0.00		0.00	0.00																		0.8045		
18			0.00		0.00	0.00																		0.8045		
TOT/AVG	3,419.3	346,990	139.82	24.46	279.07	232.77	73	69	71	68	69	70	70	77	73	****	71	50	128	41	35	38	349	0.8045		

ON-TIME PER DEG. DAY

MINS.

0.401

24.07

PERIOD: 01/19/93 - 02/01/93 (Vent On)

DAY	CONSUMPTION						TEMPERATURES													MISCELLANEOUS							
	FUEL (GALS)	WATER (GALS)	CORREC ON-TIME	GALS			APARTMENTS										WATER			OUTSIDE			DEG. DAY	COMBUS EFF	BURNER ON-TIME		
				PER HOUR	DHW (MMBTU'S)	HEATING (MMBTU'S)	#1F AVG	#1C AVG	#6B AVG	#6C AVG	#6E AVG	#6L AVG	#6K AVG	#5K AVG	#1L AVG	#1K AVG	BLDG AVG	COLD	AVG MIX	HIGH	LOW	AVG			HRS	MIN	
1			0.00		0.00	0.00	76	67	69	65	69	68	71	76	71		70	53	128						0.8045		
2	317.4	29,020	12.70	24.99	24.04	23.47	70	68	72	69	71	69	74	76	73		71	52	132	42	31	37	29	0.8045	12	42	
3	271.0	21,280	10.73	25.25	16.97	23.60	73	70	72	70	71	70	70	76	75		72	52	129	42	34	38	27	0.8045	10	44	
4	194.7	22,830	7.82	24.91	18.91	10.23	73	71	72	69	71	69	72	77	74		72	52	132	50	41	46	20	0.8045	7	49	
5	230.1	21,890	9.17	25.10	18.36	16.08	73	71	71	68	71	70	71	77	75		72	50	131	48	44	46	19	0.8045	9	10	
6	195.2	23,240	7.93	24.61	18.29	10.93	75	71	72	67	71	70	68	73	74		71	53	129	53	43	48	17	0.8045	7	56	
7	272.1	26,270	11.23	24.22	21.49	19.24	74	71	72	68	70	69	69	76	74		71	53	132	47	35	41	24	0.8045	11	14	
8	285.1	30,430	11.42	24.97	23.95	18.73	70	70	72	70	71	71	67	77	73		71	56	132	37	31	34	31	0.8045	11	25	
9	256.7	28,110	9.92	25.89	20.67	17.76	71	70	74	69	70	71	68	75	72		71	56	127	43	35	39	26	0.8045	9	55	
10	304.3	25,750	12.12	25.11	21.33	24.22	72	71	74	69	72	70	66	76	74		72	52	132	41	32	37	29	0.8045	12	7	
11	292.1	35,730	11.63	25.11	29.23	14.50	67	70	74	69	72	70	66	75	74		71	55	134	42	27	35	31	0.8045	11	38	
12	325.1	28,400	12.70	25.60	23.23	25.43	71	70	73	70	73	70	62	76	73		71	54	133	37	27	32	33	0.8045	12	42	
13	265.9	27,250	10.72	24.81	22.01	17.79	73	70	71	71	72	69	62	76	73		71	54	132	45	35	40	25	0.8045	10	43	
14	352.2	43,160	14.40	24.46	36.20	16.52	67	70	74	70	69	72	67	78	75		71	54	135	44	16	30	35	0.8045	14	24	
15			0.00		0.00	0.00																		0.8045			
16			0.00		0.00	0.00																		0.8045			
17			0.00		0.00	0.00																		0.8045			
18			0.00		0.00	0.00																		0.8045			
TOT/AVG	3,561.9	363,360	142.48	25.00	294.66	238.53	71	70	73	69	71	70	68	76	74	****	71	53	132	44	33	39	344	0.8045			

ON-TIME PER DEG. DAY

MINS.

0.414

24.85

DAILY SUMMARY REPORT

BUILDING: 2968 Perry Avenue

PERIOD: 01/05/93 - 01/18/93 (Vent Off)

DAY	CONSUMPTION						TEMPERATURES										MISCELLANEOUS					
	FUEL (GALS)	WATER (GALS)	CORREC ON-TIME	GALS	DHW (MMBTU'S)	HEATING	APARTMENTS					BLDG AVG	WATER			OUTSIDE			DEG. DAY	COMBUS EFF	BURNER	
				PER HOUR		(MMBTU'S)	#1F AVG	#2F AVG	#4A AVG	#5A AVG	#5F AVG		COLD	AVG MIX	HIGH	LOW	AVG.	ON-TIME HRS			MIN	
1	62.8	4,309	5.78	10.86	4.02	4.84	73	72	74	75	75	74	55	144	61	42	52	14	0.7955	5	47	
2	73.6	3,557	6.77	10.88	3.09	7.29	71	69	74	75	76	73	55	138	43	38	41	25	0.7955	6	46	
3	74.1	3,305	6.82	10.87	3.01	7.44	70	73	73	74	77	73	52	139	44	38	41	24	0.7955	6	49	
4	79.4	3,689	7.30	10.88	3.28	7.91	70	74	73	75	77	74	48	133	43	38	41	25	0.7955	7	18	
5	96.1	5,171	8.85	10.86	4.06	9.49	69	73	72	74	76	73	52	127	38	28	33	32	0.7955	8	51	
6	117.8	5,983	10.85	10.86	5.58	11.03	68	74	72	76	78	74	52	141	28	24	26	39	0.7955	10	51	
7	101.0	5,384	9.32	10.84	4.28	9.96	68	74	71	74	75	72	52	128	33	24	29	37	0.7955	9	19	
8	104.9	4,749	9.67	10.85	4.58	10.22	68	73	73	77	75	73	53	145	37	32	35	31	0.7955	9	40	
9	99.9	3,985	9.20	10.86	3.59	10.50	68	72	74	77	76	73	52	138	37	35	36	29	0.7955	9	12	
10	91.6	3,732	8.43	10.86	3.83	9.08	68	71	73	75	76	73	43	141	37	31	34	31	0.7955	8	26	
11	91.2	3,029	8.40	10.86	3.14	9.72	70	74	73	76	75	74	44	143	39	32	36	30	0.7955	8	24	
12	94.8	4,194	8.73	10.86	3.95	9.42	70	75	71	75	75	73	51	141	39	32	36	30	0.7955	8	44	
13	86.2	4,185	7.93	10.86	3.99	8.16	70	75	72	75	72	73	51	142	40	32	36	29	0.7955	7	56	
14	113.1	4,621	10.42	10.86	4.26	11.69	71	78	73	76	71	74	51	139	38	27	33	33	0.7955	10	25	
15			0.00		0.00	0.00													0.7955			
16			0.00		0.00	0.00													0.7955			
17			0.00		0.00	0.00													0.7955			
18			0.00		0.00	0.00													0.7955			
TOT/AVG	1,223.7	55,584	112.68	10.86	50.64	121.91	69	73	73	75	75	73	50	138	38	32	35	392	0.7955			

ON-TIME PER DEG. DAY MINS.

0.288 17.27

PERIOD: 01/19/93 - 02/01/93 (Vent On)

DAY	CONSUMPTION						TEMPERATURES										MISCELLANEOUS				
	FUEL (MMBTU'S)	WATER (GALS)	CORREC ON-TIME	MMBTU'S		HEATING (MMBTU'S)	APARTMENTS					WATER		OUTSIDE			DEG. DAY	COMBUS EFF	BURNER		
				PER HOUR	DHW (MMBTU'S)		#1F AVG	#2F AVG	#4A AVG	#5A AVG	#5F AVG	BLDG AVG	COLD	AVG MIX	HIGH	LOW			AVG.	ON-TIME HRS	MIN
1	28.19	3,597	10.23	2.76	3.24	24.95	71	78	73	74	73	74	53	139	35	25	30	35	0.7955	10	14
2	26.49	4,560	9.62	2.76	4.30	22.20	71	79	73	75	74	74	52	142	41	30	36	30	0.7955	9	37
3	22.96	4,059	8.33	2.76	3.78	19.18	71	75	72	75	75	74	52	141	41	31	36	29	0.7955	8	20
4	18.73	3,623	6.80	2.76	3.38	15.36	71	75	74	75	75	74	52	141	51	41	46	19	0.7955	6	48
5	20.62	4,470	7.48	2.76	4.21	16.40	71	75	73	74	74	73	50	140	47	42	45	21	0.7955	7	29
6	19.70	4,360	7.15	2.76	4.02	15.68	71	73	74	77	75	74	53	141	55	41	48	17	0.7955	7	9
7	22.77	4,004	8.27	2.76	3.65	19.13	71	76	74	75	74	74	53	140	48	33	41	25	0.7955	8	16
8	21.40	3,663	7.77	2.76	3.26	18.14	69	75	73	73	74	73	56	141	41	28	35	31	0.7955	7	46
9	23.23	4,315	8.43	2.76	3.84	19.39	70	76	72	73	74	73	56	141	41	32	37	29	0.7955	8	26
10	23.10	4,209	8.38	2.76	3.88	19.22	71	75	73	73	75	73	52	140	39	31	35	30	0.7955	8	23
11	24.15	3,612	8.77	2.76	3.29	20.86	71	76	73	75	74	74	55	142	46	26	36	29	0.7955	8	46
12	25.16	3,942	9.13	2.76	3.55	21.61	69	76	73	74	74	73	54	140	37	25	31	34	0.7955	9	8
13	23.14	4,393	8.40	2.76	3.91	19.23	69	74	74	75	75	73	54	139	45	32	39	27	0.7955	8	24
14	26.45	3,666	9.60	2.76	3.30	23.15	69	76	73	72	69	72	54	140	42	13	28	38	0.7955	9	36
15			0.00		0.00	0.00													0.7955		
16			0.00		0.00	0.00													0.7955		
17			0.00		0.00	0.00													0.7955		
18			0.00		0.00	0.00													0.7955		
TOT/AVG	297.91	52,876	108.13	2.76	48.37	249.54	70	75	73	74	74	73	53	141	44	31	38	356	0.7955		

ON-TIME PER DEG. DAY MINS.

0.304 18.25

DAILY SUMMARY REPORT

BUILDING: 575 Riverside Drive

PERIOD: 01/05/93 - 01/18/93 (Vent Off)

DAY	CONSUMPTION						TEMPERATURES										MISCELLANEOUS				
	FUEL (GALS)	WATER (GALS)	CORREC ON-TIME	GALS PER HOUR	DHW (MMBTU'S)	HEATING (MMBTU'S)	APARTMENTS					WATER			OUTSIDE			DEG. DAY	COMBUS EFF	BURNER	
							#21 AVG	#42 AVG	#44 AVG	#56 AVG	#57 AVG	BLDG AVG	COLD	AVG MIX	HIGH	LOW	AVG.			ON-TIME HRS	ON-TIME MINS
1	66.1	3,220	4.18	15.80	2.30	7.02	72	73	76	73	75	74	55	122	59	44	52	14	0.7815	4	11
2	88.9	2,945	5.55	16.02	2.10	10.43	71	72	75	74	75	73	55	122	46	42	44	21	0.7815	5	33
3	83.6	2,689	5.43	15.39	1.98	9.81	71	71	75	74	75	73	52	121	47	42	45	21	0.7815	5	26
4	86.7	2,793	5.75	15.08	2.14	10.08	70	72	73	73	75	73	48	120	47	41	44	21	0.7815	5	45
5	127.1	3,629	8.03	15.82	2.79	15.14	71	72	73	74	77	73	52	124	43	34	39	27	0.7815	8	2
6	128.3	3,357	8.38	15.30	2.54	15.55	70	71	75	74	76	73	52	123	36	30	33	32	0.7815	8	23
7	136.9	2,630	8.97	15.27	2.02	17.28	70	70	73	76	77	73	52	124	37	30	34	32	0.7815	8	58
8	113.2	2,926	7.53	15.03	2.15	13.81	70	70	74	76	77	73	53	122	40	34	37	28	0.7815	7	32
9	94.6	2,852	6.10	15.51	2.16	11.18	70	70	73	75	75	73	52	123	41	37	39	26	0.7815	6	6
10	122.6	3,309	7.92	15.49	2.75	14.54	70	70	73	76	77	73	43	121	39	35	37	28	0.7815	7	55
11	111.2	3,037	7.43	14.96	2.49	13.19	69	71	74	75	76	73	44	121	41	34	38	28	0.7815	7	26
12	137.9	3,441	9.27	14.88	2.60	16.84	70	72	73	75	77	73	51	122	40	36	38	27	0.7815	9	16
13	121.0	3,181	8.17	14.82	2.37	14.69	70	72	75	74	73	73	51	121	43	34	39	27	0.7815	8	10
14	155.2	3,265	9.82	15.81	2.44	19.45	69	73	76	72	72	72	51	121	40	31	36	30	0.7815	9	49
15			0.00		0.00	0.00													0.7815		
16			0.00		0.00	0.00													0.7815		
17			0.00		0.00	0.00													0.7815		
18			0.00		0.00	0.00													0.7815		
TOT/AVG	1,507.2	40,054	98.35	15.34	30.54	181.98	70	71	74	74	76	73	50	122	42	35	38	345	0.7815		

D-10 ON-TIME PER DEG. DAY MINS.
0.285 17.10

PERIOD: 01/19/93 - 02/01/93 (Vent On)

	CONSUMPTION						TEMPERATURES										MISCELLANEOUS					
	FUEL (GALS)	WATER (GALS)	CORREC ON-TIME	GALS		DHW (MMBTU'S)	HEATING (MMBTU'S)	APARTMENTS					BLDG AVG	WATER		OUTSIDE			DEG. DAY	COMBUS EFF	BURNER	
DAY				PER HOUR	AVG			#21 AVG	#42 AVG	#44 AVG	#56 AVG	#57 AVG		COLD	AVG MIX	HIGH	LOW	AVG.			ON-TIME HRS	ON-TIME MINS
1	167.4	3,151	10.57	15.84	2.32	21.29	71	72	77	72	73	73	53	122	36	29	33	33	0.7815	10	34	
2	134.9	3,311	8.28	16.29	2.51	16.52	71	72	76	73	73	73	52	123	41	32	37	29	0.7815	8	17	
3	103.0	2,646	6.48	15.89	1.95	12.58	71	71	74	74	73	73	52	121	43	36	40	26	0.7815	6	29	
4	97.3	3,851	6.07	16.04	2.91	10.80	72	73	78	73	73	74	52	123	49	42	46	20	0.7815	6	4	
5	112.5	3,420	6.78	16.58	2.77	13.09	72	73	75	73	73	73	50	126	46	43	45	21	0.7815	6	47	
6	87.9	3,680	5.38	16.33	2.71	9.69	72	72	75	74	73	73	53	122	53	43	48	17	0.7815	5	23	
7	137.1	2,993	8.35	16.42	2.27	17.07	72	72	76	73	73	73	53	124	46	36	41	24	0.7815	8	21	
8	125.8	3,197	7.83	16.06	2.28	15.45	72	71	73	74	73	73	56	123	40	32	36	29	0.7815	7	50	
9	130.8	3,012	8.37	15.63	2.18	16.26	72	71	76	73	73	73	56	124	42	36	39	26	0.7815	8	22	
10	126.4	3,036	7.78	16.24	2.30	15.52	72	71	75	73	73	73	52	123	43	33	38	27	0.7815	7	47	
11	165.2	2,974	10.35	15.96	2.19	21.11	72	72	76	72	72	73	55	124	43	29	36	29	0.7815	10	21	
12	151.3	3,504	9.43	16.04	2.65	18.68	73	73	76	73	72	73	54	125	38	29	34	32	0.7815	9	26	
13	113.6	3,828	6.92	16.42	2.77	13.24	73	72	74	74	72	73	54	122	46	35	41	25	0.7815	6	55	
14	183.7	3,223	11.57	15.88	2.40	23.50	71	72	73	68	71	71	54	124	45	18	32	34	0.7815	11	34	
15			0.00		0.00	0.00													0.7815			
16			0.00		0.00	0.00													0.7815			
17			0.00		0.00	0.00													0.7815			
18			0.00		0.00	0.00													0.7815			
TOT/AVG	1,669.5	42,675	103.60	16.14	31.89	203.51	72	72	75	73	73	73	53	123	44	34	39	336	0.7815			

ON-TIME PER DEG. DAY MINS.
0.309 18.53

DAILY SUMMARY REPORT

BUILDING: 410 State Street

PERIOD: 01/05/93 - 01/18/93 (Vent Off)

DAY	CONSUMPTION						TEMPERATURES										MISCELLANEOUS				
	FUEL (MMBTU'S)	WATER (GALS)	CORREC ON-TIME	MMBTU'S			APARTMENTS					WATER			OUTSIDE			DEG. DAY	COMBUS EFF	BURNER	
				PER HOUR	DHW (MMBTU'S)	HEATING (MMBTU'S)	#60 AVG	#61 AVG	#62 AVG	#65 AVG	#67 AVG	BLDG AVG	COLD	AVG MIX	HIGH	LOW	AVG			ON-TIME HRS	MIN
1	7.04	4,429	2.93	2.40	4.02	3.02	69	73	73	75	74	73	55	129	63	42	53	13	0.6795	2	56
2	9.40	3,628	3.92	2.40	3.29	6.11	68	75	71	75	73	72	55	129	44	40	42	23	0.6795	3	55
3	10.72	3,545	4.47	2.40	3.26	7.46	70	75	71	75	73	73	52	127	47	40	44	22	0.6795	4	28
4	10.24	3,343	4.27	2.40	3.32	6.92	69	76	72	74	71	72	48	129	46	41	44	22	0.6795	4	16
5	12.12	3,757	5.05	2.40	3.55	8.57	68	75	72	74	71	72	52	129	41	30	36	30	0.6795	5	3
6	16.52	3,736	6.88	2.40	3.39	13.13	71	77	72	77	71	74	52	126	31	27	29	36	0.6795	6	53
7	14.00	3,612	5.83	2.40	3.45	10.55	72	76	70	74	72	73	52	130	36	27	32	34	0.6795	5	50
8	12.48	3,263	5.20	2.40	3.00	9.48	72	75	71	74	72	73	53	128	42	35	39	27	0.6795	5	12
9	11.68	3,103	4.87	2.40	2.97	8.71	72	76	71	75	72	73	52	130	42	38	40	25	0.6795	4	52
10	11.84	3,207	4.93	2.40	3.38	8.46	71	77	71	75	72	73	43	129	38	34	36	29	0.6795	4	56
11	12.16	3,192	5.07	2.40	3.25	8.91	72	75	71	73	72	73	44	127	42	33	38	28	0.6795	5	4
12	10.96	3,419	4.57	2.40	3.27	7.69	70	74	73	72	72	72	51	129	40	35	38	28	0.6795	4	34
13	12.88	3,609	5.37	2.40	3.54	9.34	70	73	70	75	73	72	51	131	42	34	38	27	0.6795	5	22
14	13.60	3,769	5.67	2.40	3.60	10.00	71	72	69	74	74	72	51	129	40	29	35	31	0.6795	5	40
15			0.00		0.00	0.00													0.6795		
16			0.00		0.00	0.00													0.6795		
17			0.00		0.00	0.00													0.6795		
18			0.00		0.00	0.00													0.6795		
TOT/AVG	158.60	45,183	66.08	2.40	43.27	115.33	70	75	71	74	72	73	50	129	41	34	37	358	0.6795		

ON-TIME PER DEG. DAY MINS.

0.185 11.08

PERIOD: 01/19/93 - 02/01/93 (Vent On)

DAY	CONSUMPTION						TEMPERATURES										MISCELLANEOUS				
	FUEL (GALS)	WATER (GALS)	CORREC ON-TIME	MMBTU'S			APARTMENTS					WATER			OUTSIDE			DEG. DAY	COMBUS EFF	BURNER ON-TIME	
				PER HOUR	DHW (MMBTU'S)	HEATING (MMBTU'S)	#60 AVG	#61 AVG	#62 AVG	#65 AVG	#67 AVG	BLDG AVG	COLD	AVG MIX	HIGH	LOW	AVG			HRS	MIN
1	15.64	3,643	6.52	2.40	3.44	12.20	72	72	69	75	75	73	53	130	37	27	32	33	0.6795	6	31
2	13.52	3,296	5.63	2.40	3.15	10.37	71	73	69	75	74	72	52	130	44	30	37	28	0.6795	5	38
3	11.12	3,651	4.63	2.40	3.36	7.76	71	74	69	74	73	72	52	127	46	34	40	25	0.6795	4	38
4	10.28	3,385	4.28	2.40	3.15	7.13	69	74	71	73	72	72	52	128	52	43	48	18	0.6795	4	17
5	8.88	3,554	3.70	2.40	3.44	5.44	68	73	73	74	72	72	50	129	47	41	44	21	0.6795	3	42
6	8.76	3,993	3.65	2.40	3.72	5.04	70	72	69	76	73	72	53	129	56	39	48	18	0.6795	3	39
7	13.88	4,318	5.78	2.40	4.08	9.80	71	72	69	76	74	72	53	130	44	34	39	26	0.6795	5	47
8	12.08	2,994	5.03	2.40	2.72	9.36	70	73	69	74	73	72	56	130	37	30	34	32	0.6795	5	2
9	11.76	2,985	4.90	2.40	2.71	9.05	70	72	69	75	74	72	56	130	46	35	41	25	0.6795	4	54
10	12.76	3,318	5.32	2.40	3.09	9.67	68	73	68	74	73	71	52	128	40	31	36	30	0.6795	5	19
11	13.84	2,776	5.77	2.40	2.38	11.46	70	71	69	76	74	72	55	125	42	26	34	31	0.6795	5	46
12	12.48	3,687	5.20	2.40	2.98	9.50	68	69	72	74	71	71	54	120	38	25	32	34	0.6795	5	12
13	13.64	3,078	5.68	2.40	2.94	10.70	71	72	70	77	75	73	54	132	48	33	41	25	0.6795	5	41
14	14.00	3,580	5.83	2.40	3.29	10.71	72	71	68	76	73	72	54	129	43	15	29	36	0.6795	5	50
15			0.00		0.00	0.00													0.6795		
16			0.00		0.00	0.00													0.6795		
17			0.00		0.00	0.00													0.6795		
18			0.00		0.00	0.00													0.6795		
TOT/AVG	157.00	44,615	65.42	2.40	41.02	115.98	70	72	70	75	73	72	53	128	45	32	38	346	0.6795		

ON-TIME PER DEG. DAY MINS.

0.189 11.36

APPENDIX E - AIR VENT INSTALLATION GUIDE
(6 pages)

AIR VENT INSTALLATION GUIDE

**SPECIFICATION FOR AIR VENTING OF ONE-PIPE
STEAM SYSTEMS**

INSTALLATION SUGGESTIONS

- 1) When tapping into risers, tap deeply so the nipple can be screwed as far as possible into the pipe.
- 2) Clear all existing tapings of filings, debris, etc., before installing vents.
- 3) Pitch close nipple slightly towards riser.
- 4) Use only Teflon tape.
- 5) Squirt WD-40 or equivalent into vent outlet to improve sealing.
- 6) Plug all existing vent holes that are improperly located.

MAINS

Basement mains shall be vertically tapped and fitted with a 1/2-inch NPT pipe nipple and shutoff valve, 1/2-inch reducing tee (to 3/8-inch NPT) and all 3/8-inch nipples and elbows necessary to mount the specified number and model of air vents with a 3/8-inch connection (see Figure 1). This setup is called the "tree".

As an alternative, and subject to the approval of the engineer, a weldolet or a nipple may be welded in place rather than drilling and tapping for a nipple. Also, vents from different manufacturers have different shank sizes; in some cases smaller nipples and tees may be employed, subject to the approval of the engineer.

▽
TO WET
RETURN

FIGURE 1
TYPICAL END OF MAIN
INSTALLATION

MAINS (cont.)

The hole for the "tree" described on the preceding page shall typically be drilled approximately 18 inches from the end of the main (see Figure 1). Ideally, the tree should be sized so that the bases of the vents are 6 to 10 inches from the top of the main. Where clearance is limited, the hole may be drilled 45 degrees from the vertical, in which case a 45 degree elbow must be employed below the reducing tee (see Figure 2).

When venting dry returns, the aim should be to locate the bases of the vents 6 to 10 inches above the MAIN. In any event, the vent bases should be above the top of the main.

FIGURE 2
INSTALLATION WHERE OVERHEAD
CLEARANCE IS LIMITED

RISERS

If all risers terminate on the top floor of the building, drill horizontally and tap for a 3/8-inch NPT close nipple and a 3/8-inch NPT elbow approximately 12 to 18 inches below the top of the riser. Typically, only one vent will be employed per riser; for multiple vent configuration, see Figure 3.

FIGURE 3
TYPICAL VENT INSTALLATION
AT THE TOP OF A RISER

RISERS(cont.)

If risers terminate at the radiators on the top floor, vent all risers on the floor below as shown (see Figure 4).

FIGURE 4

INSTALLATION WHERE RISER TERMINATES
AT THE RADIATOR