



Section 2

Ventilation Capacity of A 4-Inch Diameter Relief Vent With And Without Louvered Caps

2.1 Objective

The purpose of this part of the investigation was to evaluate the ventilation capacity of a 4-in. relief vent with and without louvered caps. These test articles were provided by Active Ventilation Products, Inc. The 4-in. relief vent can be used for a whole house as well as room to room ventilation. The relief vent was tested with the 8-in. diameter Aura vent mounted on the roof of the test house and simulated ceiling described below in the experimental setup section. Volume flow measurements were made at five different wind speeds.

2.2 Experimental Setup

A schematic of the test setup is shown in Figure 14. the 8-in. Aura vent was used for these tests. A 6-in. flexible duct was attached to the underside of the 8-in. Aura vent. This duct was approximately 3 ft. long. At the opposite end of the duct, a ceiling vent and a cardboard shroud were attached. This arrangement was used to simulate a ceiling mounting in a home. The ceiling vent measured 10 in. by 6.25 in. The shroud had similar dimensions and was 10 in. high. The shroud was sealed around the 6-in. duct with caulk. (See Figures 15 and 16.)

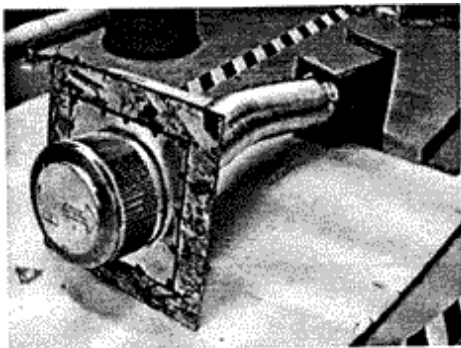


Figure 15. 8 in. Aura vent with simulated ceiling.

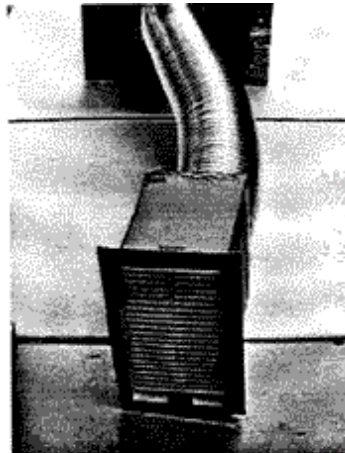


Figure 16. Close up of ceiling vent.

The 8 in. Aura vent was then mounted on the roof of the simulated house in the manner described in Section 1. The hole for the 16-in inlet duct, as described in Section 1, was sealed off, and a 4-in. diameter hole was used for the relief vent. The 4-in. relief vent was used with and without the caps. (See Figures 17 and 18.)

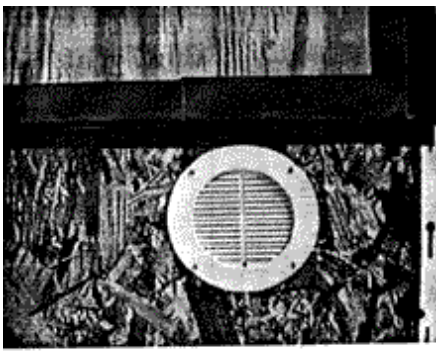


Figure 17. 4 in. inlet with caps.

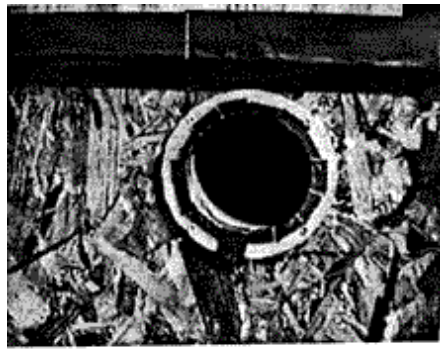
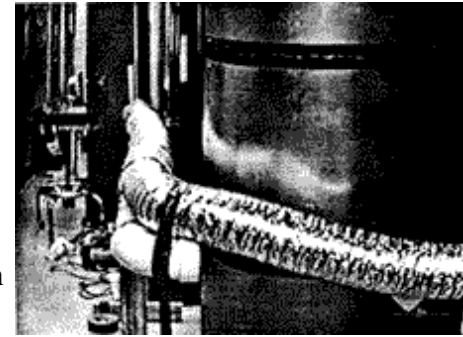


Figure 18. 4 in. inlet without caps.



A 6-in. diameter flexible hose was added around the relief vent to provide a shroud and a means of making flow measurements (See Figure 19).

To determine the effect of pipe length, additional tests were later performed using a longer length of 21'3". (See Figure 20).



The same anemometer that was used in the previous tests was used to make the air intake volume flow measurements. The open area of the 6-in. duct was greater than the open area of the 4-in. inlet. This was done to prevent the inlet duct from causing restriction to the flow.

All other details such as the placement of the house remained the same as that described in Section 1.

Initially, the end of the 16-in. diameter duct used in Section 1 was used to cover the relief vent. Attempts were made to measure the flow velocity at the other end. No measurable flow velocity was detected indicating that the relief vent was not providing a large amount of ventilation. Instead of giving up the testing it was decided to use a smaller diameter duct. Although the volume flow rates using a smaller diameter duct were not expected to be highly accurate without establishing the effects of the duct length, it was felt that the trends on the effect of louvered cap would still become apparent.

2.3 Experimental Procedure

The 8 in. Aura vent was fastened and sealed to the roof of the house. the 6-in. duct and simulated ceiling were allowed to dangle inside of the house. Air intake measurements were made for five wind speeds: 3.6, 5.0, 7.5, 10.0, and 11.3 mph. The 4-in. relief vent was tested with and without the louvered caps.

2.4 Results

2.4.1 Relief valve with caps; 10 ft inlet duct

The following table provides the volume flow rates exhausted from the test house by the 8 in. Aura vent with the relief vent with caps and a 10-ft long flexible duct.

4 in. relief vent with caps / 10 ft inlet duct

Wind Speed	Volume Flow
<i>mph</i>	<i>cfm</i>
3.5	No measurable flow
5.0	9.82
7.5	13.55
10.0	20.81

11.3	23.95
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At a wind speed of 3.6 mph, the anemometer fan blades did not move, indicating that there was no measurable amount of flow entering or leaving the house.

2.4.2 Relief valve without caps; 10 ft inlet duct

The following table lists the volume flow rates exhausted from the house by the 8 in. Aura vent with no cap and a 10-ft long flexible duct.

4 in relief vent without caps / 10 ft inlet duct

Wind Speed		Volume Flow
<i>mph</i>		<i>cfm</i>
3.5		32.00
5.0		42.80
7.5		57.14
10.2		81.88
11.5		89.34

For each test condition, the direction of the spin of the anemometer blades was monitored. It was found that the air was indeed being drawn into the house through the inlet.

The data shown in the last two table is plotted in Figure 21 in the form of ventilated volume flow rates versus wind speed with and without the cap. Clearly, ventilation is obtained in both cases. The ventilation capacity is significantly higher without the louvered cap.

2.4.3 Relief valve with caps; 21 ft 3 in. inlet duct

In an effort to establish the effect of pipe length on ventilated volumes flow rates, additional tests were performed by roughly doubling one length of the six inch flexible inlet hose through which air was sucked from the ambient before passing through the relief vent. Because a flexible hose with corrugated walls was used, it was expected that a longer duct will provide higher friction and thus lower volume rates of ventilated air.

The following table lists the volume flow rates in cubic feet per minute exhausted from the house by the 8-in. Aura vent with a 21-ft. 3-in. long inlet duct with caps.

4 in. relief vent with caps / 21 ft 3 in. inlet duct

Wind Speed	Volume Flow
<i>mph</i>	<i>cfm</i>
3.6	No measurable flow
5.0	8.64
7.5	10.80
10.0	14.92
11.3	16.10

At the 3.6 mph case, the anemometer did not move, indicating that there was no measurable amount of flow entering or leaving the house.

2.4.4 Relief vent without caps; 21 ft 3 in. inlet duct

The following table lists the volume flow rates exhausted from the house by the 8-in. Aura vent with the 21-ft. 3-in. long inlet duct and no caps.:

4 in. relief vent without caps

21 ft 3 in. inlet duct

Wind Speed Volume Flow

<i>mph</i>	<i>cfm</i>
3.6	27.1
5.0	31.81
7.5	48.69
10.0	58.71
11.4	68.72

The result for the longer inlet duct with and without caps are shown in the form of volume flow rate versus wind speed in Figure 22. Ventilation is noticed with and without the caps at almost all wind speed. Higher volume flow rates are obtained without the cap.

The effect of pipe length on ventilation is seen in Figure 23 with louvered caps and in Figure 24 without these caps. Clearly, for the reasons above, higher volume rates are obtained for the smaller length duct. It is worth pointing out that this length effect is not of major concern in the test described in Section 1 where an inlet duct of much larger diameter was used (16-in. instead of 6-in.).

2.5 Conclusions

- * The 4-in. relief vent with caps causes the air intake to be severely restricted.
- * The longer inlet duct caused a decrease in the amount of flow ventilated from the house. This is attributable to increased friction associated with the roughness of the inner walls of the inlet duct.
- * Rough calculations indicate the the volume flow exhausted is about 75% less with the caps in place than without. This is shown in the following two tables.

4 in. inlet; 21 ft 3 in. inlet hose			
	With cap	Without cap	
Wind Speed	Volume Flow	Volume Flow	%Difference
<i>mph</i>	<i>cfm</i>	<i>cfm</i>	
3.6	N/A	27.10	N/A
5.0	8.64	31.81	72.84
7.5	10.80	48.69	77.82
10.0	14.92	58.71	74.59
11.3	16.10	68.72	76.57

4 in. inlet; 10 ft inlet hose			
	With Cap	Without Cap	
Wind Speed	Volume Flow	Volume Flow	%Difference
<i>mph</i>	<i>cfm</i>	<i>cfm</i>	
3.5	N/A	32.00	N/A
5.0	9.82	42.80	77.06
7.5	13.55	57.14	76.29
10.0	20.81	81.88	74.58
11.3	23.95	89.34	73.19

