APPENDIX 7.5. BLOWER FAN CURVES

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APPENDIX 7.5. BLOWER FAN CURVES

7.5.1 INTRODUCTION

Blower manufacturers provide blower fan curves for both pressure and shaft power as functions of airflow. The Department chose four blowers from Lau Industries, a manufacturer that supplies blowers to the furnace industry, to match the four virtual model furnace blowers.

The models DOE used for the different virtual furnace blowers are listed in Table 7.5.1.1.

Table 7.5.1.1 Models Used For Virtual Furnace Blowers

Airflow Capacity	Blower Size	Lau Industries Model
800 cfm (2 ton)	9 X 8	DD9-8A
1200 cfm (3 ton)	10 X 8	DD10-8A
1600 cfm (4 ton)	10 X 10	DD10-10A
2000 cfm (5 ton)	11 X 10	DD11-10AT

Pressure and shaft power curves for these blowers are available in fan selection software from Lau Industries.[1] Figures 7.5.1.1 - 7.5.1.4 show the curves for these blowers. The Department fit polynomial equations of air flow to the static pressure and shaft power curves of these blowers. Knowing these equations permits the Department to calculate static pressure and shaft power at any airflow rate.

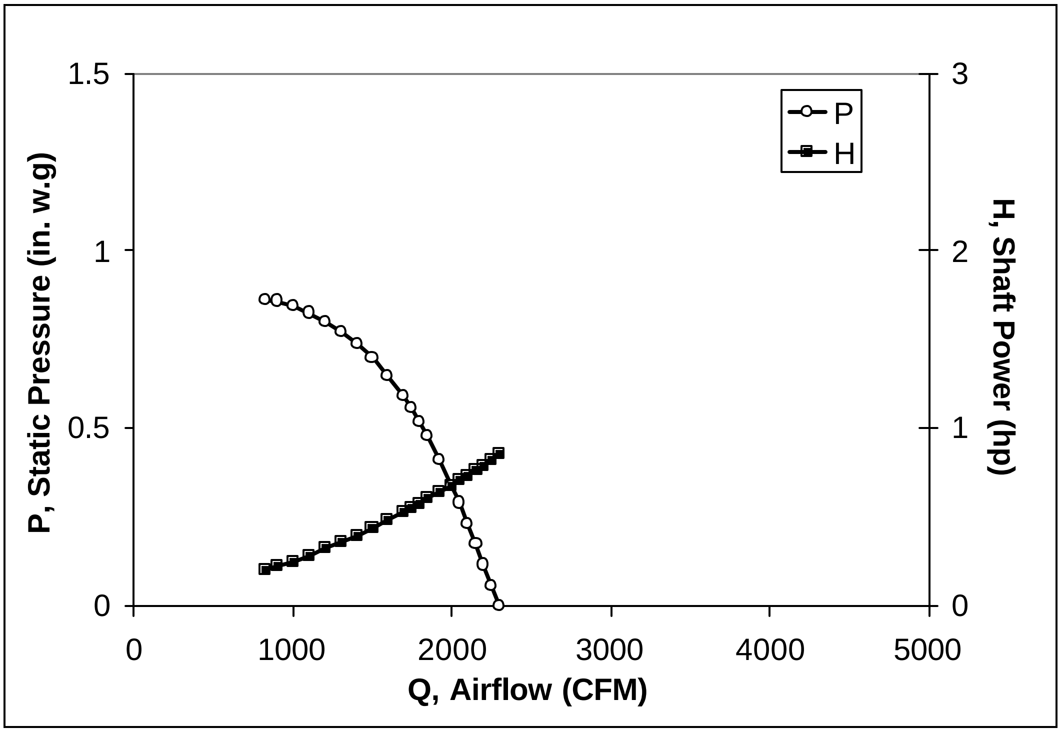

Figure 7.5.1.1 Blower Fan Curves for Lau #DD9-8A

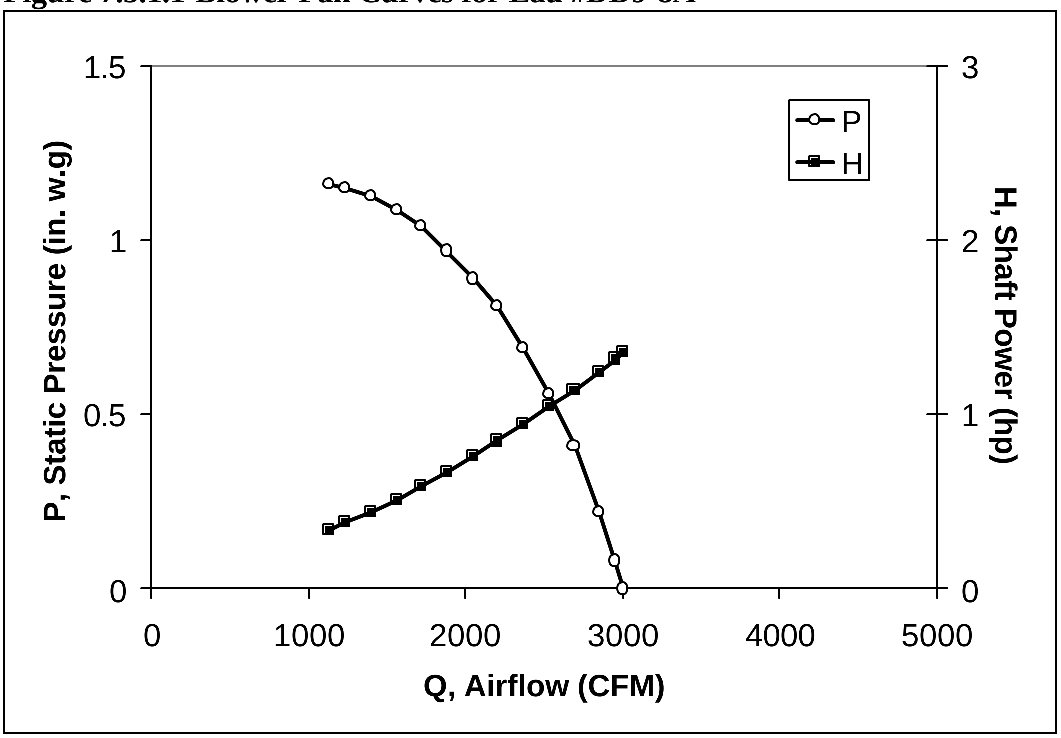

Figure 7.5.1.2 Blower Fan Curves for Lau #DD10-8A

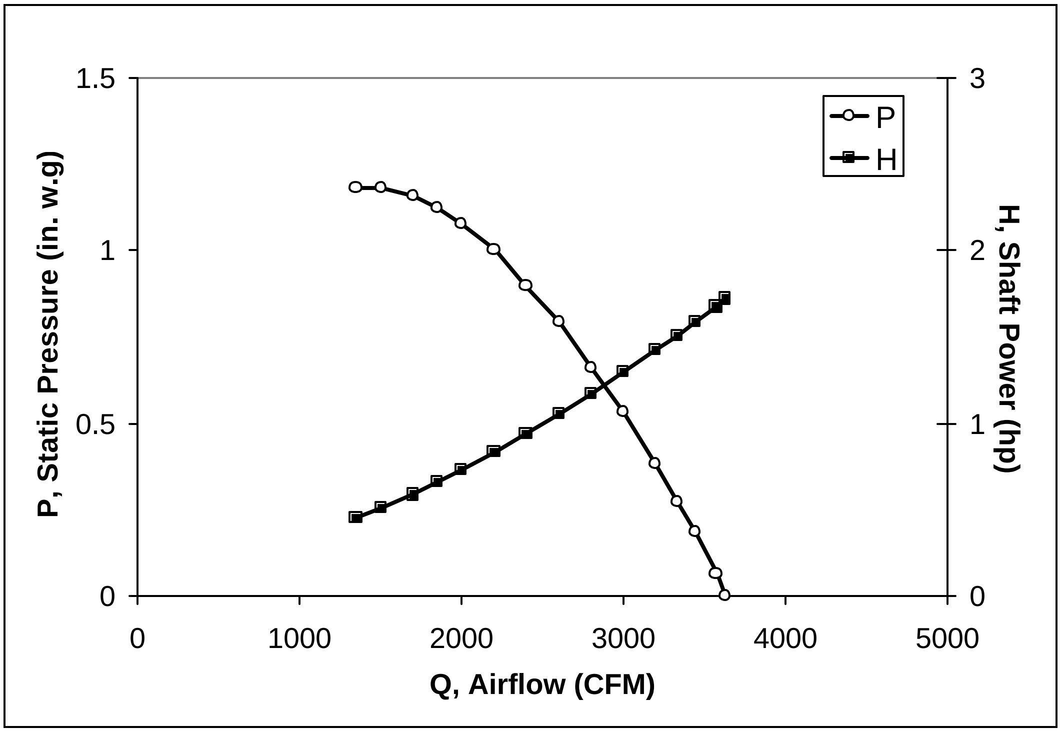

Figure 7.5.1.3 Blower Fan Curves for Lau #DD10-10A

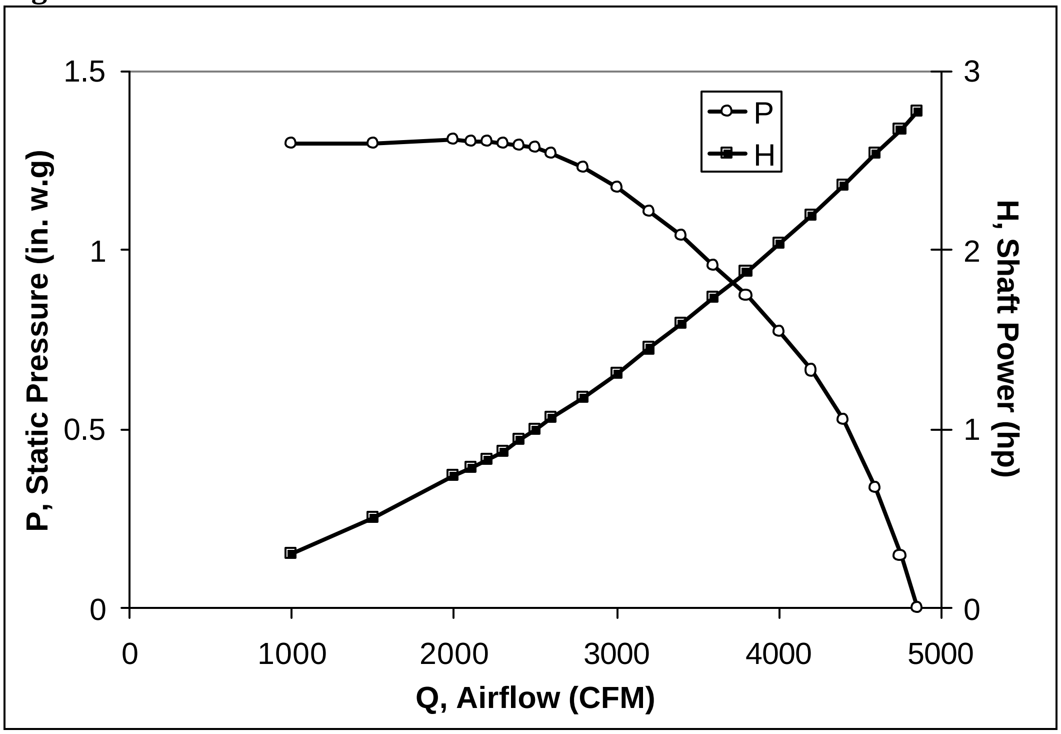

Figure 7.5.1.4 Blower Fan Curves for Lau #DD11-10AT

7.5.2 STATIC PRESSURE

The coefficients for the polynomial equation for static pressure rise across the blower as a function of airflow are shown in Table 7.5.2.1. The speeds at which they were tested are included in the table as well. The coefficients vary depending on blower size. The equation used to fit static pressure is:

$$P(Q) = c0 + c1 \times (Q/1000) + c2 \times (Q/1000)^2 + c3 \times (Q/1000)^3 + c4 \times (Q/1000)^4$$

where:

Q = airflow (cfm),
P = static pressure (in.w.g.), and
$c0$-$c4$ = coefficients.

Table 7.5.2.1 Coefficients to Calculate Pressure for Different Blower Sizes

Blower Size	Speed	c0	c1	c2	c3	c4
11 × 10*	1055	2.816408	-14.45755	50.06729	-79.1925	57.93131
10 × 10	1020	0.571842	0.952433	-0.40526	0.027687	0
10 × 8	1044	0.05092	2.51260	-1.96989	0.64310	-0.08909
9 × 8	1084	1.25829	-1.09850	1.17555	-0.56167	0.06693

* For this blower size, the coefficient Q was divided by 4000, not 1000 as shown in the equation.

7.5.3 SHAFT POWER

Shaft power is the mechanical power input to the blower. It is the power required to rotate the blower wheel at the tested speed under the tested static pressure and airflow conditions.

The Department determined shaft power using a second-order polynomial equation. The coefficients vary depending on blower size. Table 7.5.3.1 shows the different blower sizes and their corresponding coefficients that DOE used to determine shaft power.

$$H(Q) = h_0 + h_1 \times (Q/1000) + h_2 \times (Q/1000)^2$$

where:

Q = airflow (cfm),
H = shaft power (hp), and
h_0, h_1, h_2 = coefficients.

Table 7.5.3.1 Coefficients to Calculate Shaft Power for Different Blower Sizes

Blower size	Speed	h0	h1	h2
11 × 10	1055	0.02424	0.209691	0.073447
10 × 10	1020	0.052032	0.195255	0.072613
10 × 8	1044	0.012244	0.187546	0.086849
9 × 8	1084	0.044483	0.100756	0.108843

REFERENCES

1. Lau Industries, *Whirl Wind IV, Version 4.0, Fan Application Software*. 2000. http://www.lau-ind.com/whirlwind.htm