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(Air-Fed Incinerator)

Dear Sir:

We have just completed a thorough review of all factors influencing the selection of a (suitable wheel diameter for the Model 1 blower.) In view of your impending visit here on February 27, we are summarizing our findings in this letter, to aid in the discussion of blower performance, power requirements, and the associated burning rates. Information on motors and switch gear for 50/60-cycle operation is not included, but will be discussed on February 27.

From the data shown in Table 1, we believe that a 15-1/2-inch wheel diameter is an excellent choice for this application. It meets all of the power requirements and maintains the desired burning rate, except for an estimated reduction of 5 per cent in burning rate at the 50-cycle speed when a long stack is used. A wheel diameter larger than 15-1/2 inch would require a motor larger than 7.5 hp for 60-cycle operation (in addition to good 50-cycle operation).

This 5 per cent reduction in burning rate can be avoided if the diameter of a long stack is increased to about 24 inches to reduce gas velocity and pressure drop. The "long stack" assumed for this calculation would be equivalent to about 160 feet of straight, round pipe of 16-inch diameter, or 50 ft of pipe with four 45-degree elbows and three 90-degree elbows, similar to that installed on your first Model 2 unit. The short stack used for the calculations is a straight length of 16-inch-

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diameter pipe, 6 feet long. Of course, intermediate lengths of stack would result in intermediate burning rates between +3 per cent and -5 per cent of normal for 16-inch-diameter stacks. A 21 foot length of straight 16-inch pipe has the same flow resistance as one 90-degree elbow.

The term, normal burning rate, in Table 1 represents the average rate from past experience with the second Model 1 unit for the 60-cycle, 3500 rpm blower with the 14-1/2-inch-diameter wheel. The average rate depends upon the type of paper, of course, but it is assumed that any variation of air flow will result in a proportionate variation in burning rate, regardless of paper type.

Barometric pressure, altitude, and air temperature affect air density which, in turn, influences air flow, pressure, and power requirements of any blower. It was decided that burning rates would be based on blower performance with air at 80 F and at a barometric pressure normal for 1000 ft altitude. Suitable corrections were applied to experimental data and to the data supplied by the blower manufacturer to convert all data to this base condition. Experimental burning rates were obtained under essentially these conditions. Further information on the effect of much higher altitudes will be discussed on February 27.

Figure 1 is a set of curves showing the relation of blower horsepower and static pressure to flow rate and to flow resistance of the incinerator and stack. The upper curves show the relation of horsepower to flow rate for three wheel diameters at 50- and 60-cycle motor speeds. The intermediate curves show the relation of static pressure to flow from

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varies directly as the air mass flow rate. This assumption has not been verified experimentally, but is reasonably accurate over the narrow range of interest here.

All of the values in Table 1 were obtained from Figure 1.

As you can see by study of Figure 1, if the blower is to be mounted on the motor shaft and driven at synchronous speed, increasing wheel diameter increases power consumption and flow rate. To eliminate the 5 per cent reduction of burning rate under the worst condition considered for 50-cycle operation would require use of a slightly larger blower wheel and a larger motor to cover the power requirements for 60-cycle operation. We believe that it may be preferable to use a stack of larger diameter and low flow resistance for those few marginal installations where the 5 per cent reduction in burning rate may occur, and where it is undesirable.

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TABLE 1. BURNING RATES AND POWER REQUIREMENTS

Blower-wheel diameter, inches	14½			15½						16⅞					
Motor frequency, cycles		60			50			60			50			60	
Blower speed, rpm		3500			2900			3500			2900			3500	
Burning-rate change; blower power; and damper setting. See footnote (a) and (b)	Burning Rate % change	Blower Power hp	Damper Setting No.	Burning Rate % change	Blower Power hp	Damper Setting No.	Burning Rate % change	Blower Power hp	Damper Setting No.	Burning Rate % change	Blower Power hp	Damper Setting No	Burning Rate % change	Blower Power hp	Damper Setting No.
Normal operating procedure when short stack is used and damper is set properly.	0	6.7	2	+3	5.8	3	+3	8.6	1	0	6.7	2	-25	8.6	—(c)
Maximum capability when short stack is used and damper is at the maximum opening which does not exceed 8.6 hp.	+13	7.3	3	+3	5.8	3	+3	8.6	1	+13	7.3	3	-25	8.6	—(c)
Normal operation when long elbowed stack is used and damper is set properly.	+3	6.8	3	-5	5.4	3	+3	8.6	2	+3	6.8	3	-25	8.6	—(c)
Maximum capability when long elbowed stack is used and damper is at the maximum opening which does not exceed 8.6 hp	+3	6.8	3	-5	5.4	3	+3	8.6	2	+3	6.8	3	-25	8.6	—(c)

(a) Above operating data are based on an air density which corresponds to an elevation of 1,000 ft (28.8 in Hg barometer) and at an air temperature of 80 F.

(b) Damper setting No 3 corresponds to wide-open condition; No 2 represents the present "operating" notch position; and No 1 represents a condition which is slightly more closed than is No 2, as achieved by using the wedging block which was supplied.

(c) Damper must be set below setting No 1 to reduce power to 8.6 hp. A 10-hp motor would be needed to maintain normal burning rate under these blower conditions

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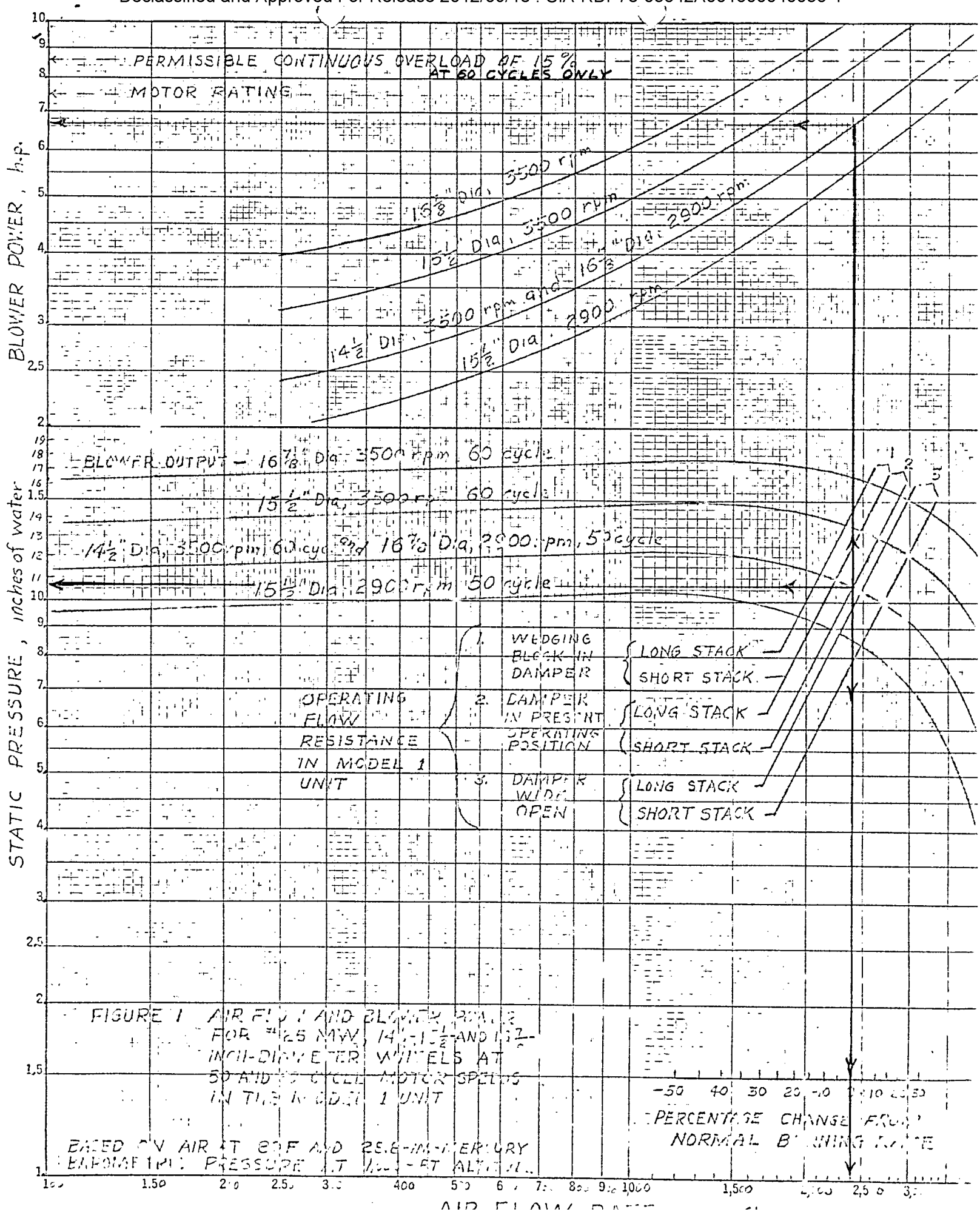

FIGURE 1 AIR FLOW AND BLOWER POWER FOR 125 MW, 14 1/2- 15 1/2- AND 16 7/8-INCH-DIAMETER WHEELS AT 50 AND 60 CYCLE MOTOR SPEEDS IN THE MODEL 1 UNIT

BASED ON AIR AT 80°F AND 29.6-IN.-MERCURY BAROMETRIC PRESSURE AT 1,000-FT ALTITUDE

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