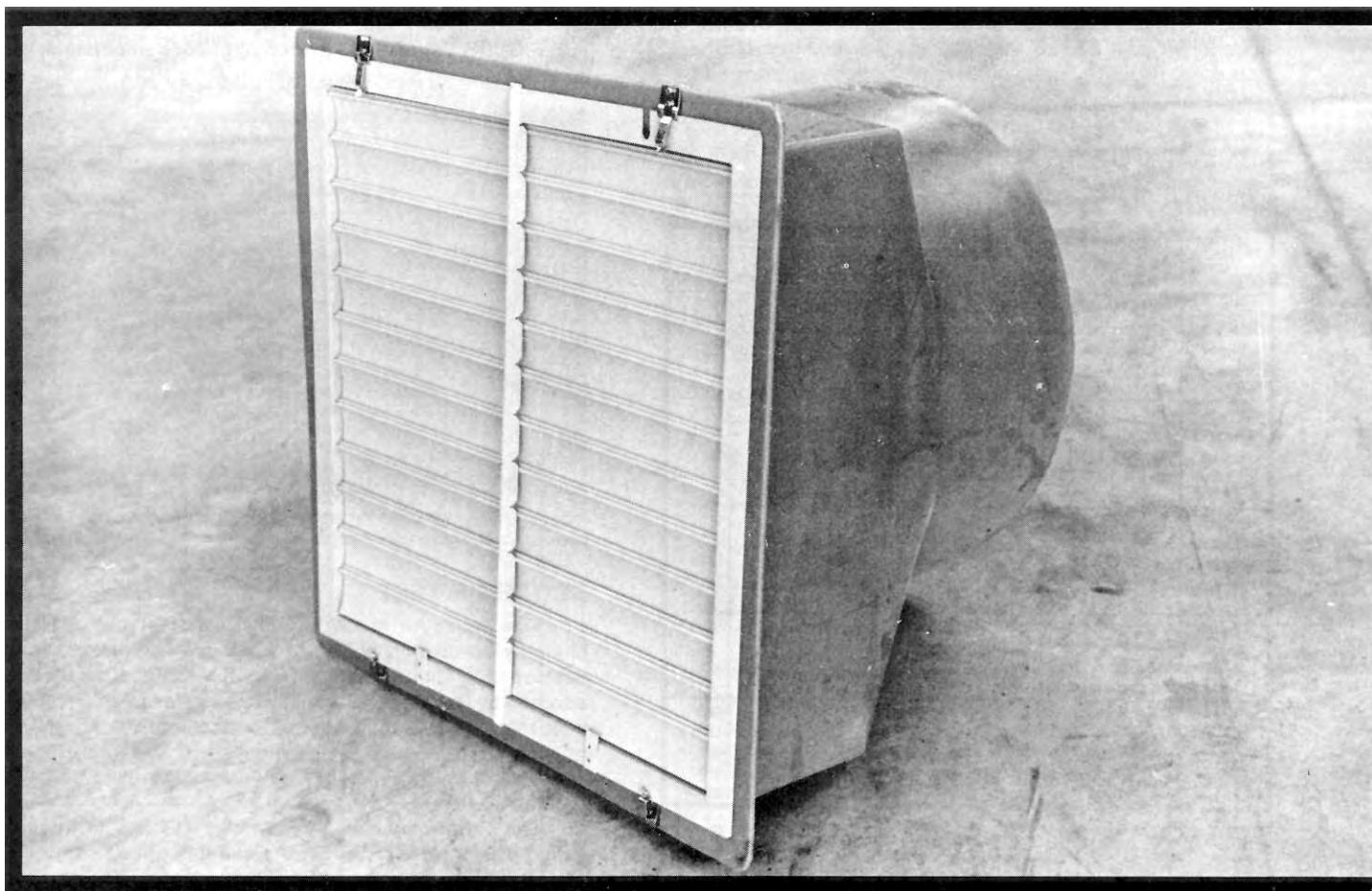


# Evaluation Report

# 584



## Better Air Model PF 2400 Ventilation Fan

A Co-operative Program Between



## BETTER AIR MODEL PF 2400 VENTILATION FAN

### MANUFACTURER:

Better Air Manufacturing  
P.O. Box 490  
Macgregor, Manitoba  
R0H 0R0

### DISTRIBUTORS:

1. Eastman Feeds  
322 - 33 Street North  
Lethbridge, Alberta  
Phone: (403) 320-0274
2. McKay Equipment Sales Ltd.  
4 - 833 Cynthia  
Saskatoon, Saskatchewan  
Phone: (306) 665-7711
3. Waldner Farms Ltd.  
P.O. Box 25  
Barnwell, Alberta  
Phone: (403) 223-2722

**RETAIL PRICE:** \$530.75

(April 1989, f.o.b., Lethbridge, Alberta)

### SUMMARY OF RESULTS

**TABLE 1.** Better Air Model PF 2400 Aeration Fan Performance at Typical Levels of Operation.

SETTING	STATIC PRESSURE		AIR FLOW RATE		INPUT POWER kW	TOTAL EFF. %	FAN SPEED rpm
	in wg	(Pa)	cfm	(L/s)			
Single Speed Direct	0.000	( 0.0)	6250	(2950)	0.54	33	1730
	0.050	(12.5)	6010	(2840)	0.56	35	1726
	0.100	(24.9)	5730	(2710)	0.56	37	1724
	0.125	(31.1)	5570	(2630)	0.56	37	1723
	0.250	(62.3)	4770	(2250)	0.56	39	1721
Variable Speed Maximum	0.000	( 0.0)	6260	(2960)	0.54	33	1724
	0.050	(12.5)	5980	(2820)	0.56	34	1721
	0.100	(24.9)	5690	(2690)	0.56	36	1721
	0.125	(31.1)	5530	(2610)	0.56	37	1721
	0.250	(62.3)	4710	(2220)	0.57	38	1717
Variable Speed Mid Range	0.000	( 0.0)	5250	(2480)	0.49	23	1452
	0.050	(12.5)	4940	(2330)	0.50	23	1437
	0.100	(24.9)	4420	(2090)	0.50	24	1419
	0.125	(31.1)	4280	(2020)	0.51	24	1419
	0.250	(62.3)	3340	(1580)	0.52	24	1525
Variable Speed Minimum	0.000	( 0.0)	3010	(1420)	0.35	6	825
	0.050	(12.5)	2120	(1000)	0.34	6	782
	0.100	(24.9)	1110	( 524)	0.34	4	733
	0.125	(31.1)	535	( 253)	0.34	2	687
Single Speed With Louvres	0.000	( 0.0)	5800	(2740)	0.55	26	1727
	0.050	(12.5)	5550	(2620)	0.56	28	1725
	0.100	(24.9)	5270	(2490)	0.56	30	1723
	0.125	(31.1)	5140	(2440)	0.57	31	1722
	0.250	(62.3)	4360	(2060)	0.56	33	1720

### RECOMMENDATIONS

It is recommended that the manufacturer consider:

1. Supplying fan performance data over a complete range of static pressures.
2. Supplying detailed operating instructions containing illustrations and information on general operation, installation, maintenance, safety aspects and troubleshooting.

**Station Manager. R. P. Atkins**

**Project Engineer: K. \$himek**

**Project Technologist: B. Storzynsky**

### THE MANUFACTURER STATES THAT

With regard to recommendation number:

1. All fan performance data will be available from any

of the Better Air distributors or dealers.

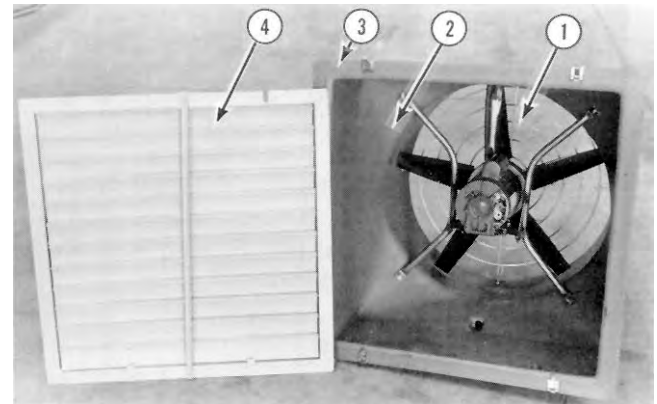
2. Further information on installation, maintenance and general operation will be available from any of the Better Air distributors or dealers.

### GENERAL DESCRIPTION

The Better Air Model PF 2400 is a 23.75 in (603 mm) diameter, variable speed, direct drive, propeller type axial flow ventilation fan. It is primarily used in livestock and poultry barns as an exhaust fan located in the wall.

The Better Air Model PF 2400 ventilation fan is equipped with an inlet louvre, a mounting face plate, a wire outlet guard grill and integral moulded polyethylene fan shroud. The 5 blade polypropylene propeller and aluminum hub are mounted directly on a 0.50 hp (373 W) single phase, 115/230 V electric motor. The motor mount consists of a tubular steel frame bolted to the motor and the fan shroud.

FIGURE 1 show the location of major components, while detailed specifications are given in APPENDIX 1.



**FIGURE 1.** Better Air Model PF 2400 Fan: (1) Outlet Guard Grill, (2) Polyethylene Housing, (3) Mounting Face Plate, (4) Inlet Louvres.

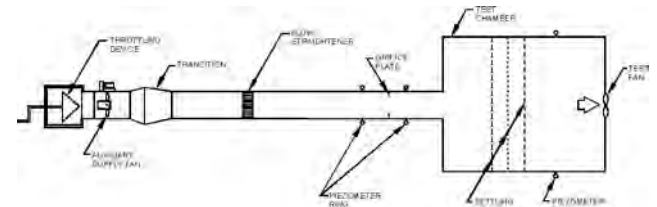
### SCOPE OF TEST

The Better Air Model PF 2400 was tested in the outlet chamber set-up (FIGURE 2) in accordance with test procedures developed by the Prairie Agricultural Machinery Institute and adopted by the Alberta Farm Machinery Research Centre. The intent was to determine the performance of the fan in terms of air flow rate, static pressure, input power and total efficiency. The control unit was not evaluated and was used only to set fan speed.

Fan performance was determined at 230 V in the single speed direct mode and with the variable speed control. Fan performance was determined at the maximum setting, the mid-range setting and the minimum setting with the variable speed control. The minimum setting was established by reducing the fan speed to the point where a static pressure of 0.125 in wg (31.1 Pa) could still be obtained.

The effect of louvres on fan performance was determined in the single speed mode.

The fan was also evaluated for ease of operation, maintenance, operator safety and suitability of the operator's manual.



**FIGURE 2.** Schematic of Fan Test Apparatus - Inlet Chamber Set-Up.

# RESULTS AND DISCUSSION

## FAN PERFORMANCE

All fan performance results in this report are given at standard air<sup>1</sup> conditions so that direct comparisons can be made with other fan test reports. Fan performance under actual operating conditions could differ from these results by up to 10%, depending on such things as temperature, barometric pressure, humidity and elevation above sea level.

**Air Flow Rate:** Fan output in both the single speed mode and at the maximum setting on the variable speed control were similar (FIGURE 3). Reducing the fan speed, greatly reduced the air flow rate for a given static pressure<sup>2</sup>. For example, at a static pressure of 0.125 in wg (31.1 Pa), reducing the speed from maximum to midrange to minimum setting, reduced the air flow rate from 5530 cfm (2610 L/s) to 4280 cfm (2020 L/s) to 535 cfm (253 L/s) respectively. At higher static pressures the reductions were even larger.

Air flow rates at typical levels of operation (i.e. static pressure) are given in TABLE 1. Ventilation fans are often rated on their output at a static pressure of 0.125 in wg (31.1 Pa). Alberta Farm Machinery Research Centre's measured flow rate in the single speed mode was 5570 cfm (2630 L/s). There was no manufacturer's performance information provided. Since building ventilation design is possible over a range of static pressures, it is recommended that, for fan selection purposes, the manufacturer include a table or curve of air flow rates over a complete range of static pressures.

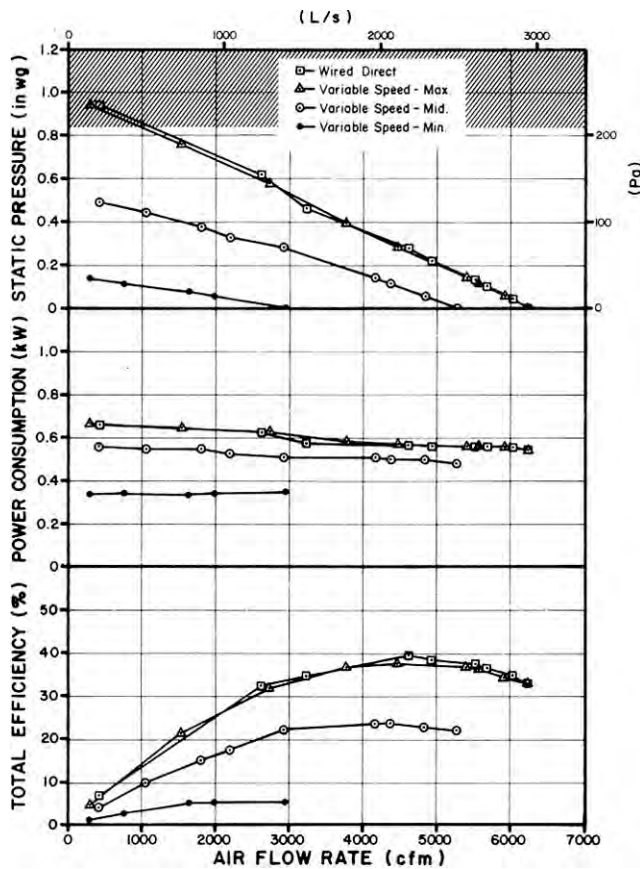


FIGURE 3. Better Air Model PF 2400 Fan Performance Curves.

**Power Consumption:** The power consumption numbers given in TABLE 1 can be used to calculate the cost of operating the fan. To calculate the cost of fan operation, multiply the

<sup>1</sup>Standard air is air with a density of 0.075 lbm/ft<sup>3</sup> (1.2 kg/m<sup>3</sup>) which occurs at 68°F (20°C), 50% relative humidity and a barometric pressure of 29.92 in Hg (101.325 kPa).

<sup>2</sup>Static pressure is a measure of the pressure difference between the pressure inside the building and the pressure on the outside of the building. Static pressure is usually expressed in inches of water gauge (in wg) or Pascals (Pa).

power consumption (kW) by the number of hours of fan operation times the cost per kilowatt hour.

The power consumed by the fan depended on fan speed. For typical levels of static pressure (TABLE 1), the input power varied from 0.54 to 0.56 kW in the single speed mode, from 0.54 to 0.57 kW at maximum speed, from 0.49 to 0.52 kW at mid-range and from 0.34 to 0.35 kW at minimum speed. The maximum amperage drawn by the motor was 2.81 amps, which was greater than the rated motor amperage of 2.50 amps plus the 10% allowable limit established by CSA standards. The shaded zone in FIGURE 3 illustrates operation levels where the rated motor amperage was exceeded. Prolonged operation in excess of rated amperage could reduce motor life.

**Total Efficiency:** Total efficiency is the ratio of air horsepower over the input power. Air horsepower is dependent upon the air flow rate and corresponding total pressure. For typical levels of operation, the total efficiency (TABLE 1), using the variable speed control, ranged from 33 to 38% at maximum speed, 23 to 24% at mid-range and 2 to 6% at minimum speed. The total efficiency at maximum fan speed and a static pressure of 0.125 in wg (31.1 Pa) was 37%.

**Effect of Louvres:** The optional louvres were installed on the inlet side of the fan to determine their effect on fan output. The fan was tested under these conditions in the single speed mode only. Using the louvres reduced the air flow rate by 7 to 9% (FIGURE 4) over the typical range of operation. For example, at a static pressure of 0.125 in wg (31.1 Pa), the louvres reduced the air flow rate by 8%, from 5570 cfm (2630 L/s) to 5140 cfm (2430 L/s) (TABLE 1). The efficiency was in turn reduced from 37 to 31%. The use of other control devices such as shutters, dampers, screens, and hoods would also reduce air flow rates by varying amounts. The use of such control devices have to be taken into consideration when designing a ventilation system.

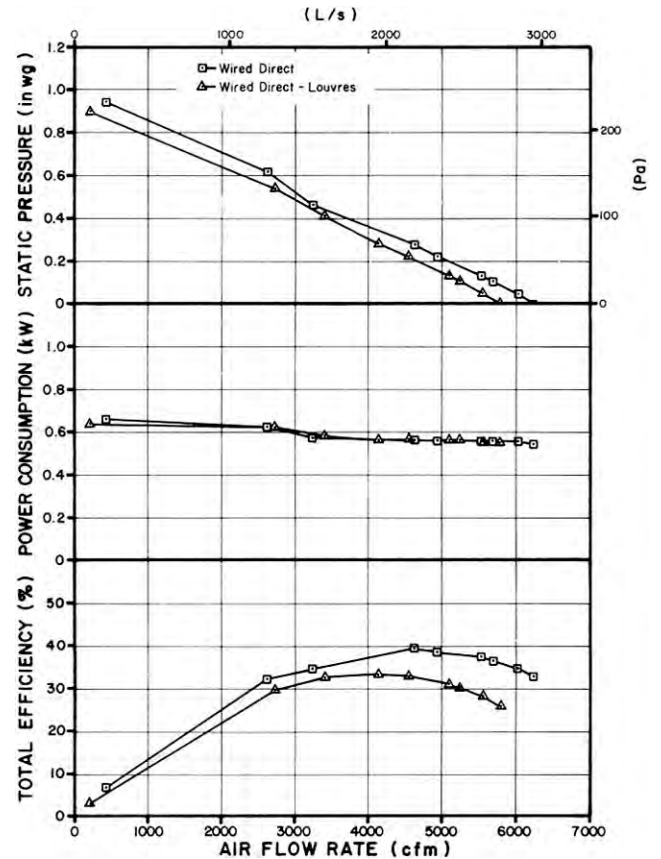


FIGURE 4. Effect of Louvres on Fan Performance.

## EASE OF OPERATION

**Maintenance:** No maintenance instructions were supplied. The inlet louvres and outlet guard grill were easily removed, which made for easy access to clean the fan blades and

housing. Regularly scheduled cleaning and maintenance will ensure longer motor life and optimum performance.

**OPERATOR SAFETY**

The outlet guard grill provided adequate protection from the fan blades. The motor was a totally enclosed unit and presented no safety hazards. The Better Air PF 2400 was CSA approved.

The noise level of the Better Air PF 2400, at a distance of 4.9 ft (1.5 m) from the centre of the fan inlet, while operating at a 0.125 in wg (31.1 Pa) static pressure, was 85 dB(A). Higher noise levels could be expected if the fan was operated in the vicinity of other buildings. The Better Air Model PF 2400 falls within range 3 of the Alberta Farm Machinery Research Centre's noise level range classification (APPENDIX II). The noise level produced by this fan can be considered annoying and be detrimental to hearing and operator performance under continuous exposure. Ear protection should be considered if working near the fan for prolonged periods.

**OPERATOR'S MANUAL**

No operator's manual was supplied. It is recommended that the manufacturer supply a detailed manual containing illustrations and information on general operation, maintenance, rated performance, safety aspects and troubleshooting.

APPENDIX II		
NOISE LEVELS RANGES		
RANGE	SOUND LEVEL (dBA)	COMMENTS
1	up to 45	Tolerable, low level background noise.
2	45 to 60	Dominating background noise that would interfere with normal conversation.
3	60 to 85	Could be annoying and be detrimental to hearing and operator performance under long-term continuous exposure. Ear protection should be considered.
4	over 85	Could damage hearing, depending on level and exposure time. Ear protection is definitely recommended.

APPENDIX I	
SPECIFICATIONS	
<b>MAKE:</b>	Better Air
<b>MODEL:</b>	PF 2400
<b>MANUFACTURER:</b>	Better Air Manufacturing P.O. Box 490 Macgregor, Manitoba R0H 0R0
<b>OVERALL DIMENSIONS:</b>	
- housing width	31.0 in (787 mm)
- housing depth (motor included)	25.5 in (648 mm)
- housing height	31.0 (787 mm)
- discharge opening	24.125 in (613 mm)
- guard grill diameter	21.25 in (540 mm)
- grill opening	0.188 in (5 mm) dia. wire spaced at 2.0 in (51 mm)
<b>IMPELLER:</b>	
- diameter	23.75 in (603 mm)
- hub diameter	6.75 in (171 mm)
- number of blades	5
- blade angle	Hub 30°, Tip 11°
<b>WEIGHT:</b>	56 lb (25 kg)
<b>MOTOR NAMEPLATE DATA:</b>	
make	Century
model	7-164973-03
frame	L48Z
class	B
type	CX
code	G
duty	Cont.
rpm	1700
service factor	1
ambient temperature rise	40°C
volts	115/230
amps	5.0/2.5
phase	1
cycles	60
horsepower	.5 hp (373 W)

**SUMMARY CHART  
BETTER AIR MODEL PF 2400  
VENTILATION FAN**

<b>RETAIL PRICE:</b>	\$530.75 (April 1989, f.o.b. Lethbridge)
<b>FAN DESCRIPTION:</b>	23.75 in (603 mm) propeller fan, variable speed, direct drive, 0.50 hp (373 W), 115/230 V electric motor.
<b>FAN PERFORMANCE:</b>	
<b>Air Flow Rate:</b>	
- range	535 to 6260 cfm (253 to 2950 L/s)
- at 0.125 in wg (31.1 Pa)	5570 cfm (2630 L/s) without louvres 5140 cfm (2430 L/s) with louvres
<b>Power Consumption:</b>	0.34 to 0.57 kW
<b>Efficiency Range:</b>	
- without louvres	2 to 39%
- with louvres	26 to 33%
<b>Efficiency at 0.125 in wg (31.1 Pa):</b>	
- without louvres	37%
- with louvres	31%
<b>OPERATOR SAFETY:</b>	Outlet guard provided CSA approved noise level = 85 dB(A) at 4.9 ft (1.5 m) from fan inlet
<b>OPERATOR'S MANUAL:</b>	None supplied



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Head Office: P.O. Box 1900, Humboldt, Saskatchewan, Canada S0K 2A0  
Telephone: (306) 682-2555

Test Stations: P.O. Box 1060 Portage la Prairie, Manitoba, Canada R1N 3C5 Telephone: (204) 239-5445 Fax: (204) 239-7124	P.O. Box 1150 Humboldt, Saskatchewan, Canada S0K 2A0 Telephone: (306) 682-5033 Fax: (306) 682-5080
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