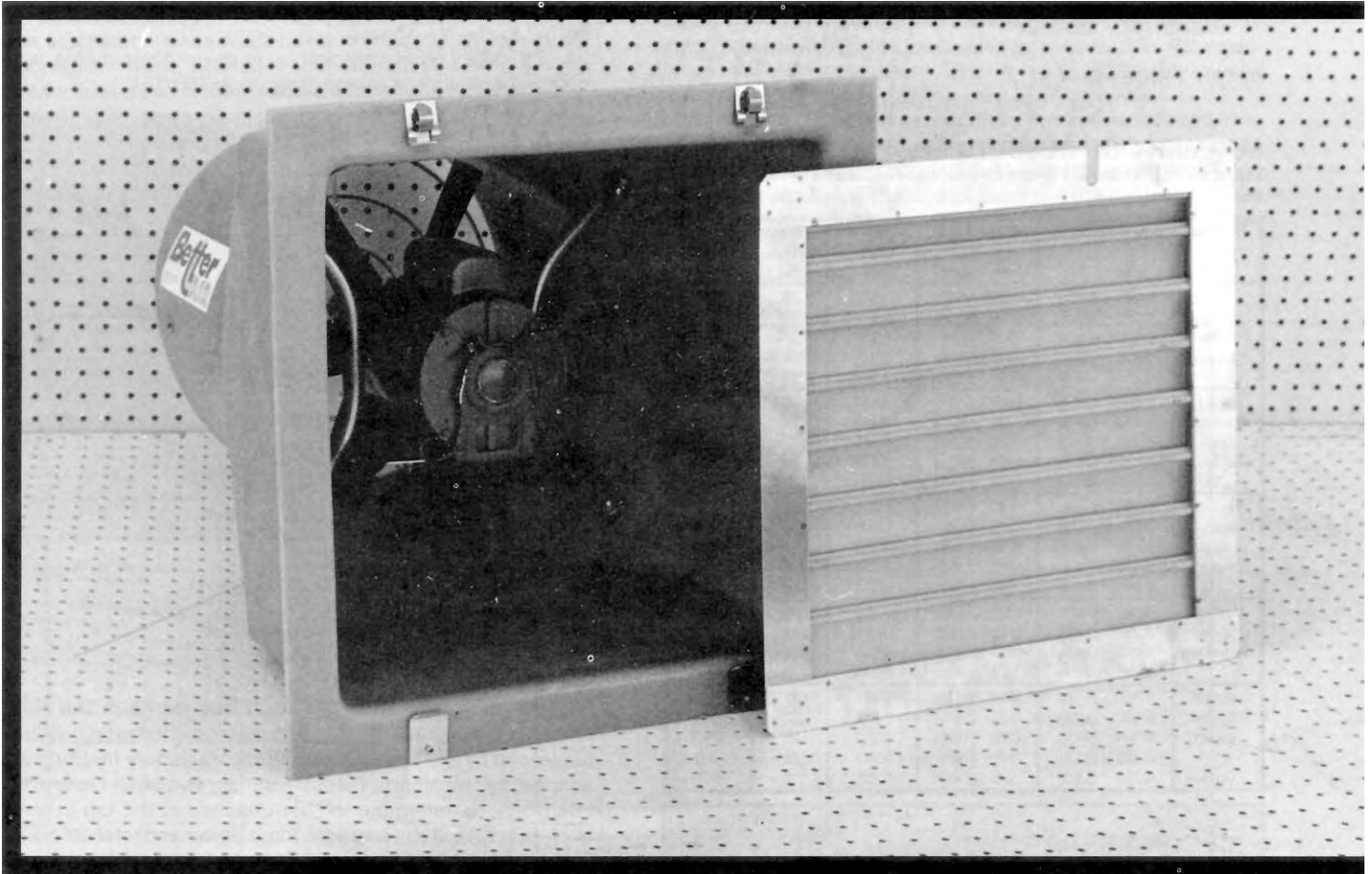


Evaluation Report 580



Better Air Model PF 1400 Ventilation Fan

A Co-operative Program Between



ALBERTA
FARM
MACHINERY
RESEARCH
CENTRE



PRAIRIE AGRICULTURAL MACHINERY INSTITUTE

BETTER AIR MODEL PF 1400 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: \$340.10

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

SUMMARY OF RESULTS

TABLE 1. Better Air Model PF 1400 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)	2480 (1170)	0.312	25	1717
	0.050 (12.5)	2400 (1130)	0.312	27	1715
	0.100 (24.9)	2310 (1090)	0.313	29	1713
	0.125 (31.1)	2240 (1060)	0.313	29	1712
Variable Speed Maximum	0.250 (62.3)	1790 (843)	0.298	27	1720
	0.000 (0.0)	2480 (1170)	0.312	25	1715
	0.050 (12.5)	2400 (1130)	0.314	27	1713
	0.100 (24.9)	2320 (1090)	0.317	27	1712
Variable Speed Mid Range	0.125 (31.1)	2250 (1060)	0.317	29	1711
	0.250 (62.3)	1800 (849)	0.303	27	1718
	0.000 (0.0)	2080 (981)	0.244	19	1450
	0.050 (12.5)	1920 (904)	0.249	19	1443
Variable Speed Minimum	0.100 (24.9)	1760 (830)	0.250	19	1434
	0.125 (31.1)	1690 (799)	0.255	19	1433
	0.250 (62.3)	736 (347)	0.234	10	1514
	0.000 (0.0)	1330 (625)	0.204	6	967
Single Speed With Louvres	0.050 (12.5)	1130 (534)	0.191	7	947
	0.100 (24.9)	938 (443)	0.181	9	1094
	0.125 (31.1)	420 (198)	0.189	4	944
	0.000 (0.0)	2360 (1110)	0.311	22	1717
Single Speed Direct	0.050 (12.5)	2260 (1070)	0.313	23	1716
	0.100 (24.9)	2170 (1020)	0.313	25	1715
	0.125 (31.1)	2100 (991)	0.312	25	1716
	0.250 (62.3)	989 (467)	0.285	12	1727

RECOMMENDATIONS

It is recommended that the manufacturer consider:

1. Supplying a table or curve of air flow rates 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. Shimek

Project Technologist: B. Storozynsky

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 1400 is a 14.5 in (368 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 1400 ventilation fan is equipped with inlet louvres, a flush mounting face plate, a wire outlet guard grill and integral moulded polyethylene fan shroud. The 6 blade polypropylene propeller and aluminum hub are mounted directly on a 0.25 hp (186 W), single phase, 115/230 V electric motor. The motor mounts on a tubular steel frame that is bolted to the fan shroud.

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

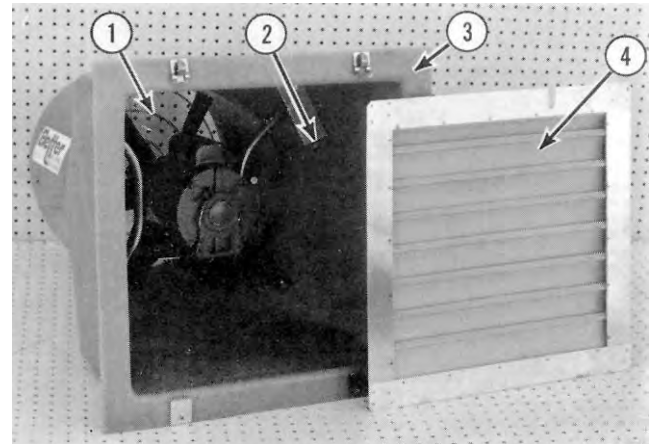


FIGURE 1. Better Air Model PF 1400 Fan: (1) Outlet Guard Grill, (2) Polyethylene Housing, (3) Mounting Face Plate, (4) Inlet Louvres.

SCOPE OF TEST

The Better Air Model PF 1400 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.

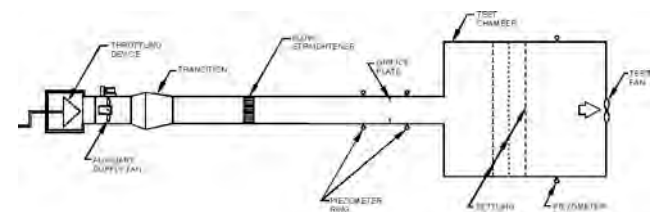


FIGURE 2. Schematic of Fan Test Apparatus - Inlet Chamber Set-Up.

RESULTS AND DISCUSSION

FAN PERFORMANCE

All fan performance results in this report are given at standard air¹ 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 pressure². 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 2250 cfm (1060 L/s) to 1690 cfm (799 L/s) to 420 cfm (198 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 2240 cfm (1060 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.

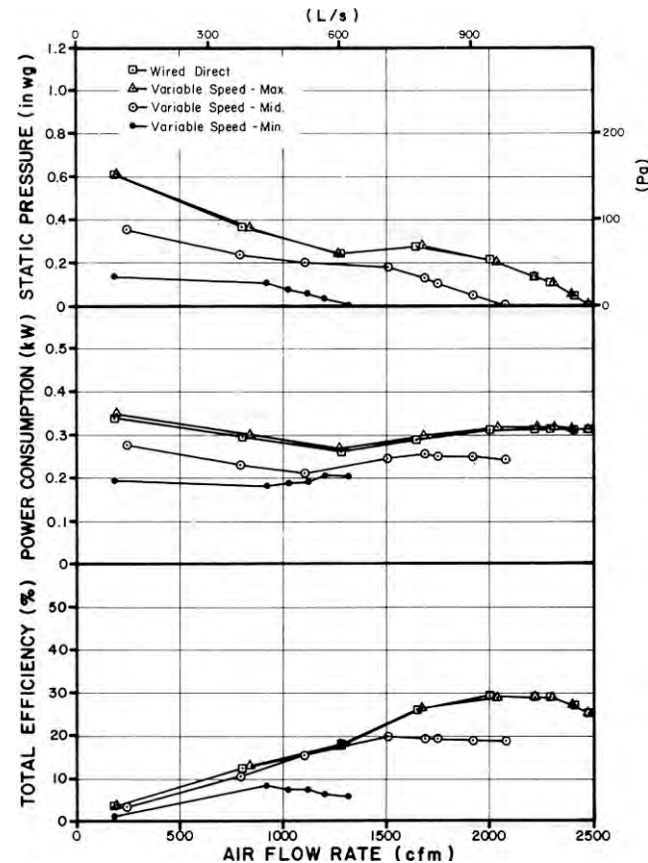


FIGURE 3. Better Air Model PF 1400 Fan Performance Curves.

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

¹Standard air is air with a density of 0.075 lbm/ft³ (1.2 kg/m³) which occurs at 68°F (20°C), 50% relative humidity and a barometric pressure of 29.92 in Hg (101.325 kPa).

²Static 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 0.298 to 0.313 kW in the single speed mode, from 0.303 to 0.317 kW at maximum speed, from 0.234 to 0.255 kW at mid-range and from 0.181 to 0.240 kW at minimum speed. The maximum amperage drawn by the motor was less than the rated motor amperage of 1.70 amps.

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, η (TABLE 1), using the variable speed control, ranged from 25 to 29% at maximum speed, 10 to 19% at mid-range and 4 to 9% at minimum speed. The total efficiency at maximum fan speed and a static pressure of 0.125 in wg (31.1 Pa) was 29%.

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 5 to 45% (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 6%, from 2240 cfm (1060 L/s) to 2100 cfm (991 L/s) (TABLE 1). The efficiency was in turn reduced from 29 to 25%. 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.

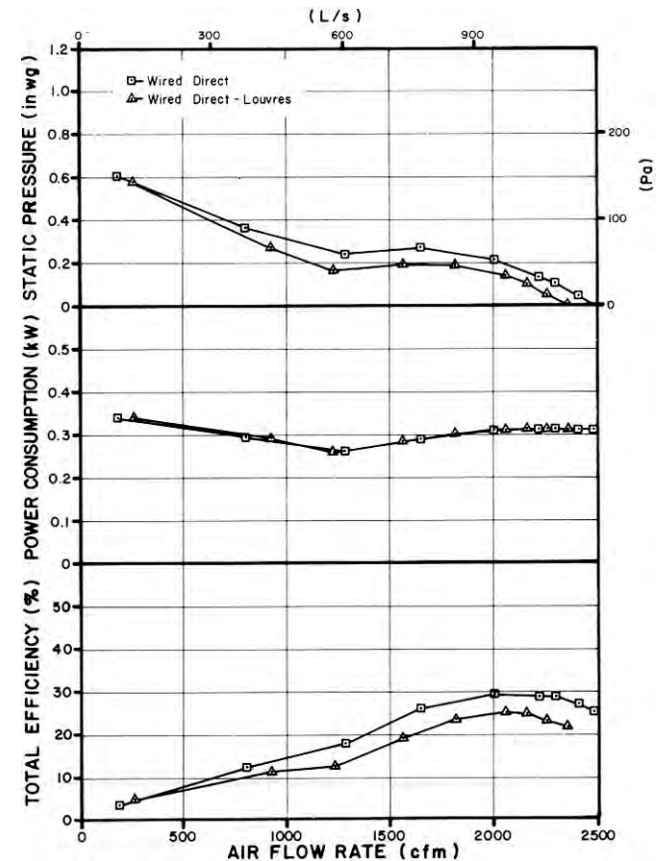


FIGURE 4. Effect of Louvres on Fan Performance.

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 1400 was CSA approved.

The noise level of the Better Air PF 1400, 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 77 dB(A). Higher noise levels could be expected if the fan was operated in the vicinity of other buildings. The Better Air Model PF 1400 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 I SPECIFICATIONS

MAKE:	Better Air
MODEL:	PF 1400
MANUFACTURER:	Better Air Manufacturing P.O. Box 490 Macgregor, Manitoba R0H 0R0
OVERALL DIMENSIONS:	
- housing width	21.0 in (533 mm)
- housing depth (motor included)	26.0 in (660 mm)
- housing height	21.5 in (540 mm)
- discharge opening	14.75 in (375 mm)
- guard grill diameter	13.25 in (337 mm)
- grill opening	0.188 in (5 mm) dia. wire spaced at 2.0 in (51 mm)
- discharge inside diameter	14.75 in (375 mm)
IMPELLERS:	
- diameter	14.5 in (368 mm)
- hub diameter	3.75 in (95 mm)
- number of blades	6
- blade angle	Hub 43.3°, Tip 33.6°
WEIGHT:	100 lb (45 kg)
MOTOR NAMEPLATE DATA:	
make	Century
model	7-164971-03
frame	K487
class	B
type	CX
code	G
duty	L
duty	Cont.
rpm	1700
service factor	1
ambient temperature rise	40°C
volts	115/230
amps	3.4/1.7
phase	1
cycles	60
horsepower	0.25 hp (186 W)

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.

SUMMARY CHART BETTER AIR MODEL PF 1400 VENTILATION FAN

RETAIL PRICE:	\$340.10 (April 1989, f.o.b. Lethbridge)
FAN DESCRIPTION:	14.5 in (368 mm) propeller fan, variable speed, direct drive, 0.25 hp (186 W), 115/230 V electric motor.
FAN PERFORMANCE:	
Air Flow Rate:	
- range	420 to 2480 cfm (198 to 1170 L/s)
- at 0.125 in wg (31.1 Pa)	2240 cfm (1060 L/s) without louvres 2100 cfm (991 L/s) with louvres
Power Consumption:	0.181 to 0.317 kW
Efficiency Range:	
- without louvres	4 to 29%
- with louvres	21 to 25%
Efficiency at 0.125 in wg (31.1 Pa):	
- without louvres	29%
- with louvres	25%
OPERATOR SAFETY:	Outlet guard provided CSA approved noise level = 77 dB(A) at 4.9 ft (1.5 m) from fan inlet
OPERATOR'S MANUAL:	none supplied



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