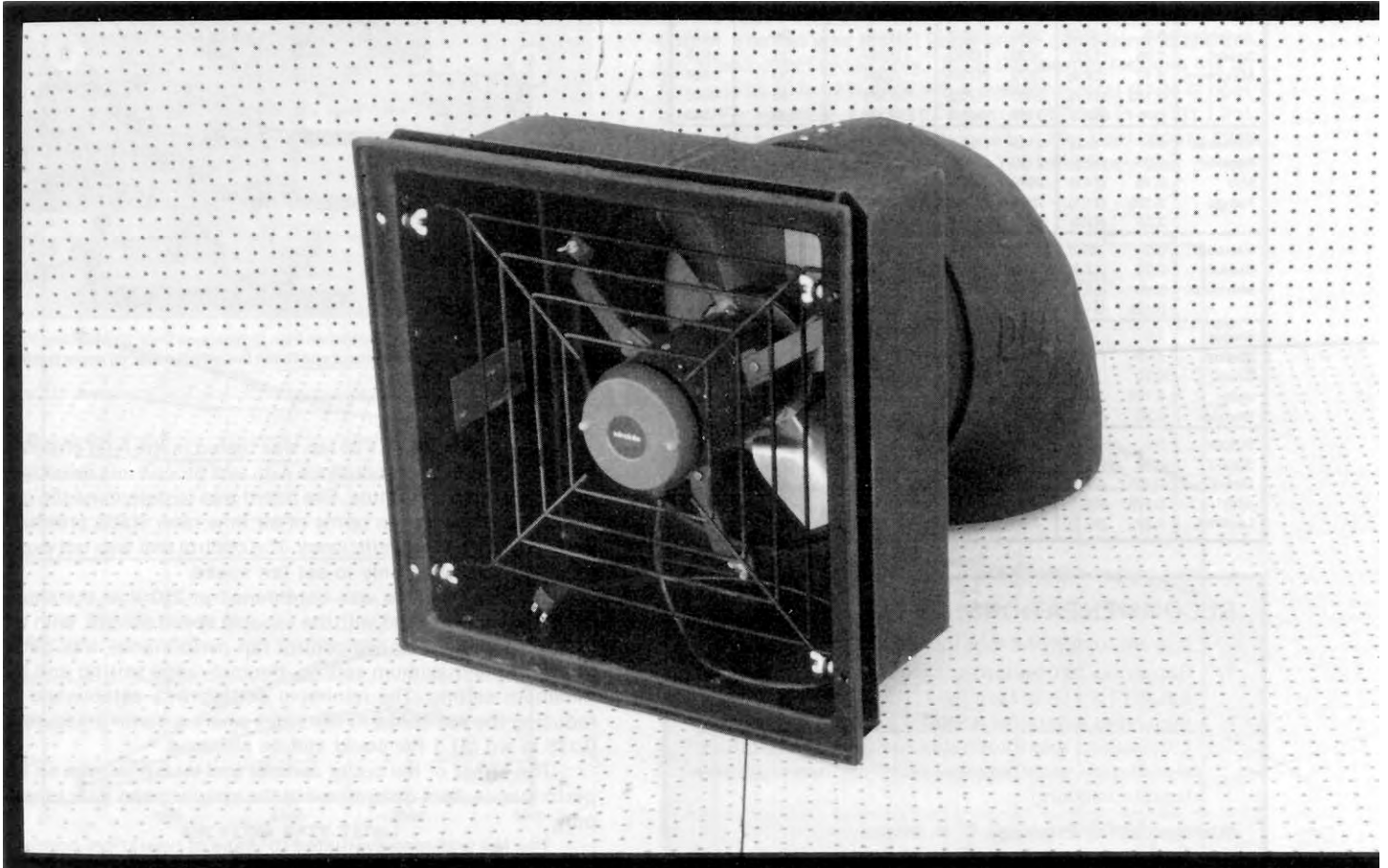


# Evaluation Report

# 484



## Del-Air Model F20 Ventilation Fan

A Co-operative Program Between



ALBERTA  
FARM  
MACHINERY  
RESEARCH  
CENTRE

**PAMI**

PRAIRIE AGRICULTURAL MACHINERY INSTITUTE

## DEL-AIR MODEL F20 VENTILATION FAN

### MANUFACTURER AND DISTRIBUTOR:

Del-Air Systems Limited  
P.O. Box 2500  
Humboldt, Saskatchewan S0K 2A0

### RETAIL PRICE:

\$555.00 (June, 1986, f.o.b. Lethbridge, Alberta).

## SUMMARY OF RESULTS

TABLE 1. Del-Air Model F20 Fan Performance at Typical Levels of Operation.

SETTING	STATIC PRESSURE in wg (Pa)		AIR FLOW RATE cfm (L/s)		POWER CONSUMPTION kW	TOTAL EFFICIENCY %	FAN SPEED rpm
Single Speed Direct	0.0	(0.0)	3990	(1880)	0.345	28	1634
	0.05	(12.5)	3840	(1810)	0.351	31	1629
	0.10	(24.9)	3720	(1760)	0.360	34	1626
	0.125	(31.1)	3660	(1730)	0.364	35	1621
	0.25	(62.3)	3210	(1510)	0.388	37	1606
Variable Speed Maximum	0.0	(0.0)	3980	(1880)	0.349	28	1624
	0.05	(12.5)	3820	(1800)	0.353	31	1616
	0.10	(24.9)	3670	(1730)	0.361	33	1606
	0.125	(31.1)	3600	(1700)	0.371	33	1600
	0.25	(62.3)	3160	(1490)	0.388	36	1582
Variable Speed Mid Range	0.0	(0.0)	3440	(1620)	0.328	19	1409
	0.05	(12.5)	3190	(1500)	0.332	21	1377
	0.10	(24.9)	2970	(1400)	0.343	22	1350
	0.125	(31.1)	2840	(1340)	0.347	22	1335
	0.25	(62.3)	1930	(911)	0.370	18	1238
Variable Speed Minimum	0.0	(0.0)	2200	(1040)	0.239	7	907
	0.05	(12.5)	1790	(845)	0.244	8	832
	0.10	(24.9)	1260	(595)	0.242	7	808
	0.125	(31.1)	778	(367)	0.246	5	710
Single Speed Direct with Damper	0.0	(0.0)	3930	(1850)	0.350	27	1638
	0.05	(12.5)	3790	(1790)	0.359	30	1631
	0.10	(24.9)	3640	(1720)	0.372	31	1627
	0.125	(31.1)	3560	(1680)	0.372	33	1623
	0.25	(62.3)	3150	(1490)	0.392	36	1604
Single Speed Direct with Louvres	0.0	(0.0)	3600	(1700)	0.369	19	1627
	0.05	(12.5)	3430	(1620)	0.378	23	1618
	0.10	(24.9)	3320	(1570)	0.383	25	1614
	0.125	(31.1)	3240	(1530)	0.386	26	1612
	0.25	(62.3)	2860	(1350)	0.397	30	1600

## RECOMMENDATIONS

It is recommended that the manufacturer consider:

1. Supplying fan performance data over a complete range of static pressures.
2. Supplying a detailed operator's manual containing illustrations and information on general operation, installation, maintenance, rated performance, and trouble shooting.

Manager/Senior Engineer: E. H. Wiens

Project Engineer: K. Shimek

## THE MANUFACTURER STATES THAT

With regard to recommendation number:

1. The manufacturer is considering the revision of all printed material containing fan performance data to include performance of the 5 sizes of Del-Air fans at varying static pressures.
2. The manufacturer, at PAMI's suggestion, is preparing a detailed Operator's Manual to be included with each fan.

## GENERAL DESCRIPTION

The Del-Air Model F20 ventilation fan is a 19.4 in (492 mm) diameter, single or variable speed, direct drive, propeller type axial flow fan. It is primarily used in livestock and poultry barns as an exhaust fan located in the wall.

The Del-Air Model F20 is a flush mounted unit equipped with an inlet guard grill, mounting face plate, fan hood, optional PVC intake louvres, outlet butterfly damper, variable speed control and insulated door. The fan hood is an integral part of the fan housing. The 4 blade aluminum propeller and plastic hub are mounted directly on a 0.54 hp (400 W), single phase, 240 V electric motor. The motor mount consists of three flat iron braces bolted to the motor casing and molded PVC fan housing. The steel guard grill is plastic coated for corrosion protection.

FIGURE 1 shows the location of major components while detailed specifications are given in APPENDIX I.

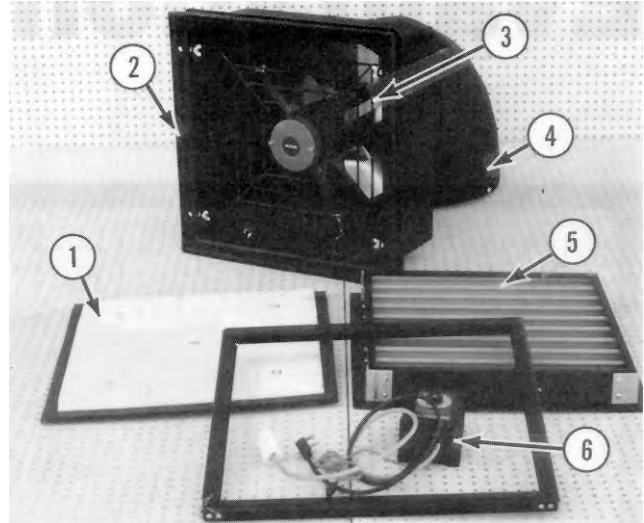


FIGURE 1. Del-Air Model F20 Ventilation Fan: (1) Insulated Door, (2) Mounting Face Plate (3) Inlet Guard Grill, (4) Fan Hood and Outlet Butterfly Damper, (5) Intake Louvres, (6) Variable Speed Control.

## SCOPE OF TEST

The Del-Air Model F20 fan was tested in the inlet chamber setup (FIGURE 2) in accordance with test procedures developed by the Machinery Institute. 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. With the SCR type variable speed control fan performance was determined at the maximum setting, the mid-range setting and the minimum setting. 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 the outlet damper and intake louvres on fan performance were determined in the single speed direct mode only.

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

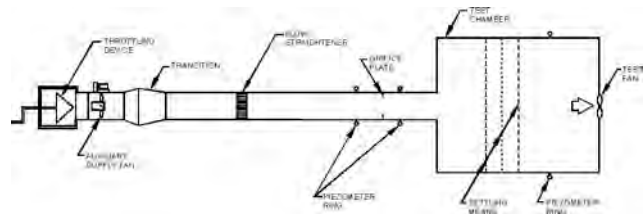


FIGURE 2. Schematic of Fan Test Apparatus - Inlet Chamber Setup.

## 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%.

<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).

depending on such things as temperature, barometric pressure, humidity and elevation above sea level.

**Air Flow Rate:** Fan output in both the single speed direct 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 mid range to minimum setting, reduced the air flow rate from 3600 cfm (1700 L/s) to 2840 cfm (1340 L/s) to 778 cfm (367 L/s) respectively.

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). PAMI's measured flow rate in the single speed direct mode at this condition was 3660 cfm (1730 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.

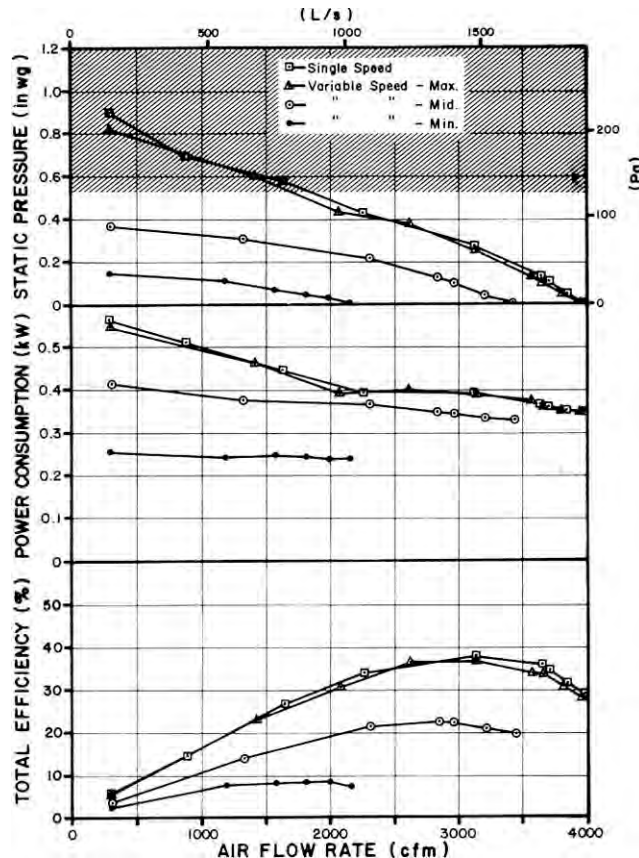


FIGURE 3. Del-Air Model F20 Fan Performance Curves in the Single Speed Direct Mode and at Three Speed Settings in the Variable Speed Mode.

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

For typical levels of static pressure (TABLE 1), the power consumption varied from 0.345 to 0.388 kW in the single speed direct mode, from 0.349 to 0.388 kW at maximum speed, from 0.328 to 0.370 kW at mid range and from 0.239 to 0.246 kW at minimum speed. The maximum amperage drawn by the motor was 2.4 amps, which was greater than the rated motor amperage of 1.7 amps. The shaded zone in FIGURE 3 illustrates operating levels where the rated motor amperage was exceeded. Prolonged operation in excess of the rated amperage could reduce motor life.

<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).

**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 28 to 36% at maximum speed, 18 to 22% at mid range and 5 to 8% at minimum speed. The total efficiency in the single speed direct mode at a static pressure of 0.125 in wg (31.1 Pa) was 35%.

**Effect of Outlet Butterfly Damper:** The optional outlet butterfly damper was installed within the fan hood on the outlet side of the fan to determine its effect on fan output. The fan was tested under these conditions in the single speed direct mode only. Using the butterfly damper reduced the air flow rate by 2 to 3% (FIGURE 4) over the typical range of operation. For example, at a static pressure of 0.125 in wg (31.1 Pa), the damper reduced the air flow rate by 3%, from 3660 to 3560 cfm (1730 to 1680 L/s) (TABLE 1). The efficiency was in turn reduced from 35 to 33%.

**Effect of Louvres:** The optional intake louvres were installed on the intake side of the fan to determine their effect on fan output. The fan was tested under these conditions in the single speed direct mode only. Using the louvres reduced the air flow rate by 10 to 12% (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 12%, from 3660 to 3240 cfm (1730 to 1530 L/s) (TABLE 1). The efficiency was in turn reduced from 35 to 26%.

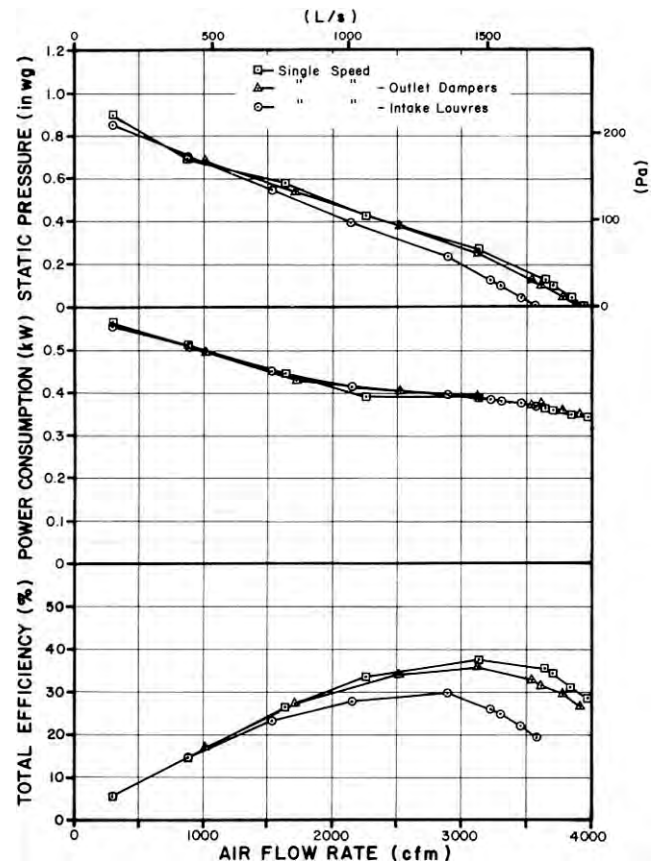


FIGURE 4. Effect of Butterfly Damper and Louvres on Fan Performance.

#### EASE OF OPERATION

**Maintenance:** The inlet guard grill, motor mount and motor could all be easily removed for cleaning. Regularly scheduled cleaning and maintenance will ensure longer motor life and optimum performance.

#### OPERATOR SAFETY

The inlet guard grill provided adequate protection from the fan blades. The motor was a totally enclosed unit and presented no safety hazards. The Model F20 was CSA approved.

The noise level of the Model F20, at a distance of 4.9 ft (1.5 m) from the centre of the fan discharge, while operating at a 0.125 in wg (31.1 Pa) static pressure, was 74 dB(A). Higher noise levels could be expected if the fan was operated in the vicinity of other buildings. The Model F20 falls within range 3 of the PAMI 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

The operator's instruction sheet contained information on installation of the fan. It is recommended that the manufacturer supply a detailed manual containing illustrations and information on general operation, installation, maintenance, rated performance, safety aspects and trouble shooting.

4 over 85 Could damage hearing, depending on level and exposure time. Ear protection is definitely recommended.

**APPENDIX III**

**CONVERSION TABLE**

cubic feet/minute (cfm) x 0.472	= litres/second (L/s)
horsepower (hp) x 745.7	= watts (W)
inches (in) x 25.4	= millimeters (mm)
inches water gauge (in wg) x 249.1	= pascals (Pa)
pounds (lb) x 0.45	= kilograms (kg)

**APPENDIX I**

**SPECIFICATIONS**

<b>MAKE:</b>	Del-Air
<b>MODEL:</b>	F20
<b>SERIAL NUMBER:</b>	FD20-142
<b>MANUFACTURER:</b>	Del-Air Systems Limited P.O. Box 2500 Humboldt, Saskatchewan S0K 2A0
<b>OVERALL DIMENSIONS:</b>	
housing width	28.5 in (724 mm)
housing height	28.5 in (724 mm)
housing depth	42.4 in (1076 mm)
housing diameter	20.0 in (508 mm)
guard grill diameter	20.2 (513 mm)
grill opening	0.2 in (6 mm) diameter wire spaced at 2.1 in (54 mm)
<b>IMPELLERS:</b>	
diameter	19.4 in (492 mm)
hub diameter	6.3 in (160 mm)
number of blades	4
blade angle	variable - 24° at tip, 33° at hub
<b>WEIGHT:</b>	56 lb (25 kg)
<b>MOTOR NAMEPLATE DATA:</b>	
make	Indola
type	VW50
rpm	1600
volts	240 V
amps	1.7A
cycles	60 Hz
horsepower	0.54 hp (400 W)

**SUMMARY CHART**  
**DEL-AIR MODEL F20**  
**VENTILATION FAN**

<b>RETAIL PRICE:</b>	\$555.00 (June, 1986, f.o.b. Lethbridge)
<b>FAN DESCRIPTION:</b>	19.4 in (492 mm) propeller fan, single or variable speed, direct drive, 0.54 hp (400 W) 240 V electric motor
<b>FAN SPEED:</b>	
- single speed direct	1606 to 1634
- variable speed	710 to 1624 rpm
<b>EFFICIENCY RANGE:</b>	
- without damper or louvres	28 to 37%
- with damper	27 to 36%
- with louvres	19 to 30%
<b>EFFICIENCY AT 0.125 in wg (31.1 Pa):</b>	
- without damper or louvres	35%
- with damper	33%
- with louvres	26%
<b>AIR FLOW RATE:</b>	
- range	778 to 3990 cfm (367 to 1880 L/s)
- at 0.125 in wg (31.1 Pa)	3660 cfm (1730 L/s) without damper or louvres 3560 cfm (1680 L/s) with damper 3240 cfm (1530 L/s) with louvres
<b>POWER CONSUMPTION:</b>	0.239 to 0.397 kW
<b>OPERATOR SAFETY:</b>	inlet guard provided CSA approved noise level = 74 dB(A) at 4.9 ft (1.5 m) from fan discharge
<b>OPERATOR'S MANUAL:</b>	installation instructions only.

**APPENDIX II**

**NOISE LEVELS**

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.



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