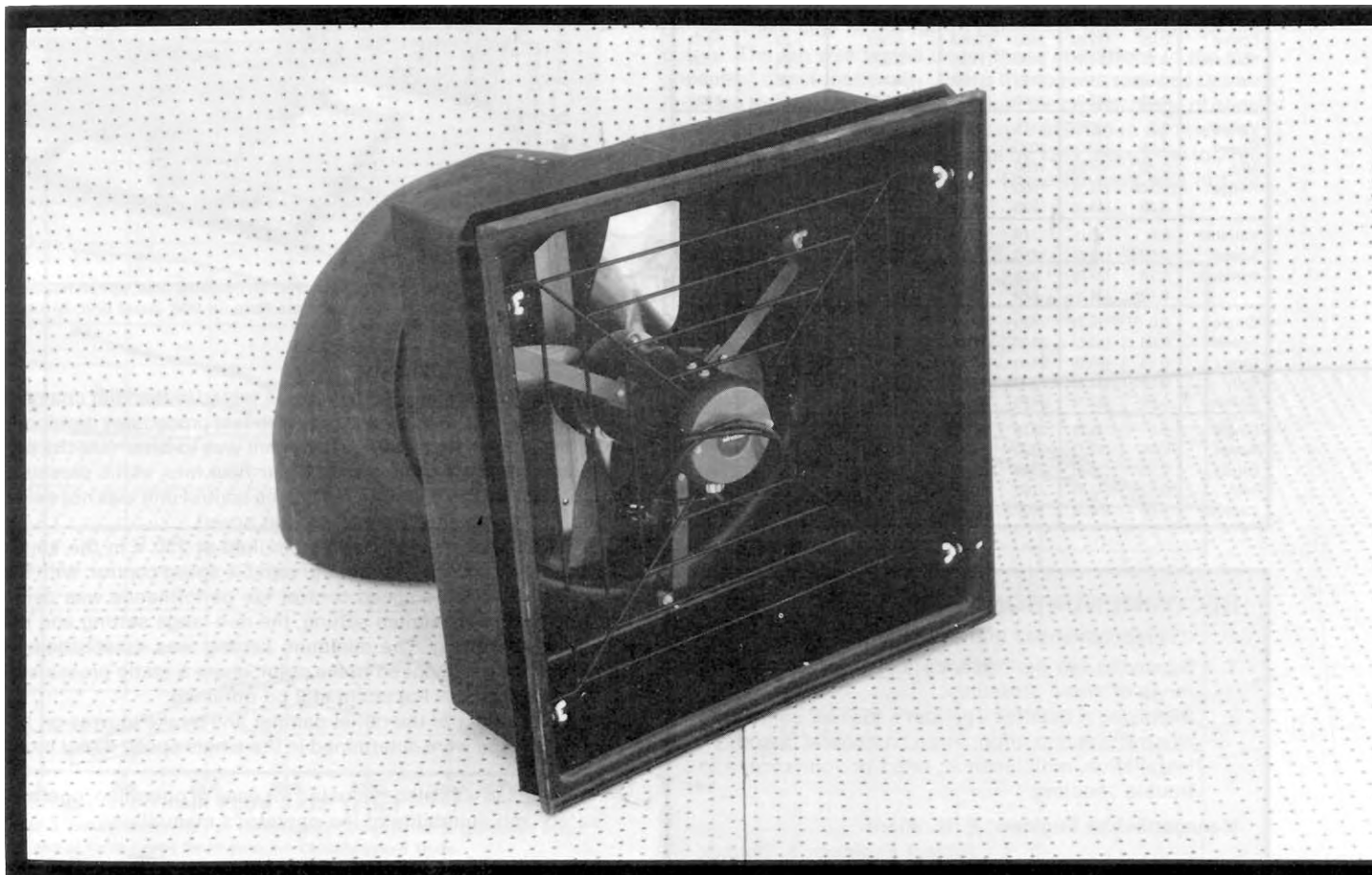


# Evaluation Report

# 483



## Del-Air Model F16 Ventilation Fan

A Co-operative Program Between



## DEL-AIR MODEL F16 VENTILATION FAN

### MANUFACTURER AND DISTRIBUTOR:

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

### RETAIL PRICE:

\$465.00 (June, 1986, f.o.b. Lethbridge, Alberta).

## SUMMARY OF RESULTS

TABLE 1. Del-Air Model F16 Fan Performance at Typical Levels of Operation.

SETTING	STATIC PRESSURE		AIR FLOW RATE		POWER CONSUMPTION	TOTAL EFFICIENCY	FAN SPEED
	in wg	(Pa)	cfm	(L/s)	kw	%	rpm
Single Speed Direct	0.0	(0.0)	2700	(1270)	0.370	21	1649
	0.05	(12.5)	2620	(1240)	0.370	23	1647
	0.10	(24.9)	2530	(1190)	0.374	25	1644
	0.125	(31.1)	2480	(1170)	0.377	25	1643
	0.25	(62.3)	2200	(1040)	0.383	28	1639
Variable Speed Maximum	0.0	(0.0)	2680	(1260)	0.368	20	1632
	0.05	(12.5)	2600	(1230)	0.367	23	1634
	0.10	(24.9)	2490	(1180)	0.371	24	1629
	0.125	(31.1)	2460	(1160)	0.377	25	1626
	0.25	(62.3)	2140	(1010)	0.375	27	1624
Variable Speed Mid Range	0.0	(0.0)	2170	(1020)	0.311	13	1333
	0.05	(12.5)	2020	(953)	0.314	14	1313
	0.10	(24.9)	1880	(887)	0.312	15	1294
	0.125	(31.1)	1800	(850)	0.313	16	1288
	0.25	(62.3)	1220	(576)	0.285	15	1418
Variable Speed Minimum	0.0	(0.0)	1370	(647)	0.230	4	855
	0.05	(12.5)	1190	(562)	0.228	6	844
	0.10	(24.9)	938	(443)	0.221	6	1025
	0.125	(31.1)	676	(319)	0.224	5	902
	Single Speed Direct with Damper	0.0	(0.0)	2670	(1260)	0.369	20
0.05		(12.5)	2540	(1200)	0.376	21	1648
0.10		(24.9)	2440	(1150)	0.381	22	1645
0.125		(31.1)	2390	(1130)	0.378	23	1643
0.25		(62.3)	2020	(953)	0.367	25	1643
Single Speed Direct with Louvres	0.0	(0.0)	2420	(1140)	0.371	15	1657
	0.05	(12.5)	2320	(1100)	0.371	17	1652
	0.10	(24.9)	2230	(1050)	0.367	19	1654
	0.125	(31.1)	2190	(1030)	0.373	20	1652
	0.25	(62.3)	1690	(798)	0.346	20	1665

### 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 F16 ventilation fan is a 15.5 in (394 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 F16 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 0.45 hp (335 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.

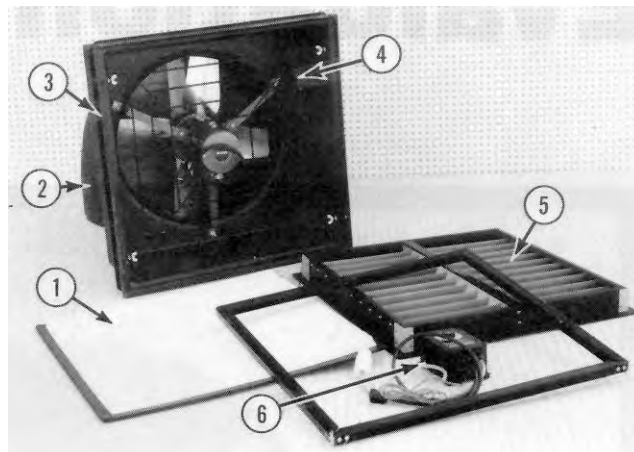


FIGURE 1. Del-Air Model F16 Ventilation Fan: (1) Insulated Door, (2) Fan Hood and Outlet Butterfly Damper, (3) Mounting Face Plate, (4) Inlet Guard Grill, (5) Intake Louvres, (6) Variable Speed Control.

### SCOPE OF TEST

The Del-Air Model F16 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.

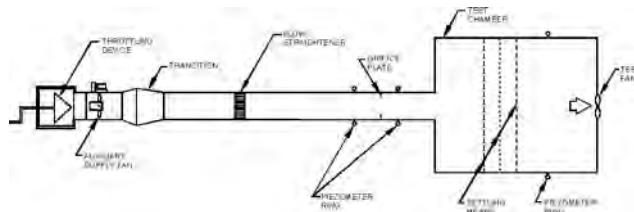


FIGURE 2. Schematic of Fan Test Apparatus - Inlet Chamber Setup.

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

<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).

**Air Flow Rate:** Fan output in both the single speed direct mode and at the maximum setting on the variable speed direct 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 2460 cfm (1160 L/s) to 1800 cfm (850 L/s) to 676 cfm (319 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 2480 cfm (1170 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.

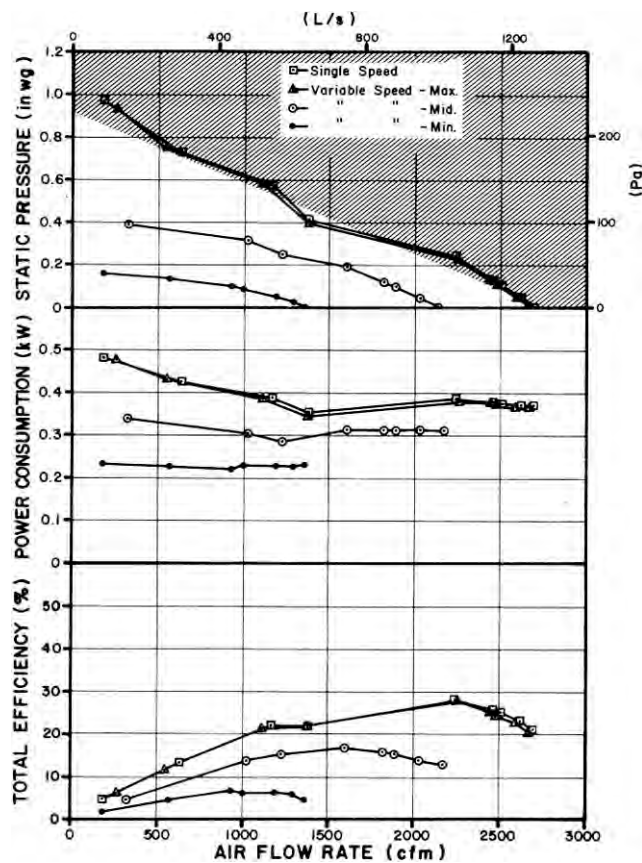


FIGURE 3. Del-Air Model F16 Fan Performance Curves in the Single Speed Direct Mode and at Three Speed Settings in the Variable Speed Mode.

**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 0.370 to 0.383 kW in the single speed direct mode, from 0.367 to 0.377 kW at maximum speed, from 0.285 to 0.314 kW at mid range and from 0.221 to 0.230 kW at minimum speed. The maximum amperage drawn by the motor was 2.17 amps, which was greater than the rated motor amperage of 1.5 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 20 to 27% at maximum speed, 13 to 16% at mid range and 4 to 6% 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 25%.

**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 1 to 8% (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 4%, from 2480 to 2390 cfm (1170 to 1130 L/s) (TABLE 1). The efficiency was in turn reduced from 25 to 23%.

**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 23% (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 2480 to 2190 cfm (1170 to 1030 L/s) (TABLE 1). The efficiency was in turn reduced from 25 to 20%.

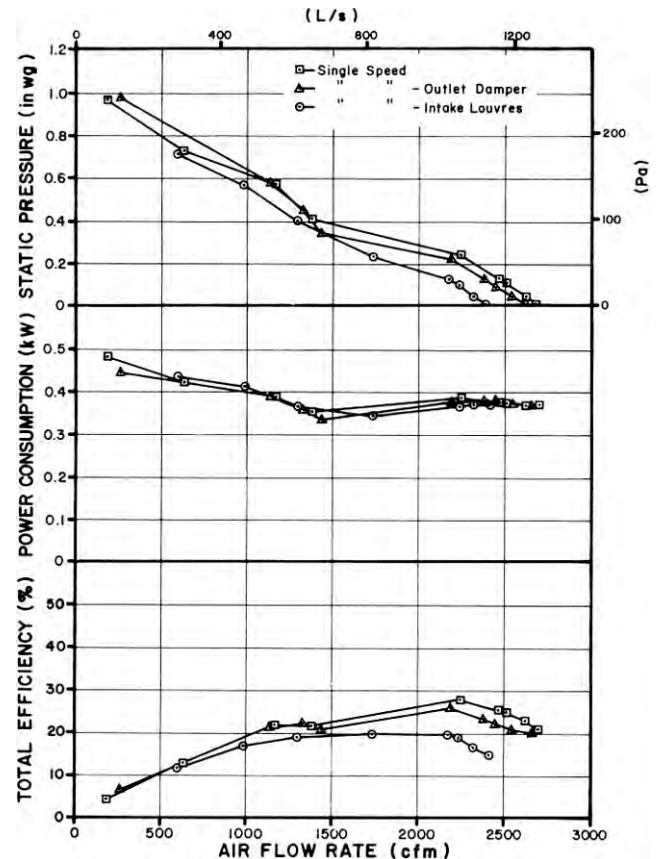


FIGURE 4. Effect of Butterfly Damper and Louvres on Fan Performance.

## 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 F16 was CSA approved.

The noise level of the Model F16, 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 73 dB(A). Higher noise levels could be expected if the fan was operated in the vicinity of other buildings. The Model F16 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.

#### APPENDIX I

##### SPECIFICATIONS

<b>MAKE:</b>	Del-Air
<b>MODEL:</b>	F16
<b>SERIAL NUMBER:</b>	FC16-123
<b>MANUFACTURER:</b>	Del-Air Systems Limited P.O. Box 2500 Humboldt, Saskatchewan S0K 2A0
<b>OVERALL DIMENSIONS:</b>	
housing width	23.1 in (586 mm)
housing height	23.1 in (586 mm)
housing depth	36.4 in (924 mm)
housing diameter	15.9 in (403 mm)
guard grill diameter	16.1 in by 16.1 in (409 mm by 409 mm)
grill opening	0.2 in (6 mm) diameter wire spaced at 1.5 in (38 mm)
<b>IMPELLERS:</b>	
diameter	15.5 in (394 mm)
hub diameter	6.3 in (160 mm)
number of blades	4
blade angle	variable - 30° at tip, 43° at hub
<b>WEIGHT:</b>	40 lb (18 kg)
<b>MOTOR NAMEPLATE DATA:</b>	
make	Indola
type	V14/1
rpm	1660
volts	240 V
amps	1.5 A
cycles	60 Hz
horsepower	0.45 hp (335 W)

#### 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.
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)

#### SUMMARY CHART DEL-AIR MODEL F16 VENTILATION FAN

<b>RETAIL PRICE:</b>	\$465.00 (June, 1986, f.o.b. Lethbridge)
<b>FAN DESCRIPTION:</b>	15.5 in (394 mm) propeller fan, single or variable speed, direct drive, 0.45 hp (335 W) 240 V electric motor
<b>FAN SPEED:</b>	
- single speed direct	1639 to 1649 rpm
- variable speed	844 to 1634 rpm
<b>EFFICIENCY RANGE:</b>	
- without dampers or louvres	21 to 28%
- with damper	20 to 25%
- with louvres	15 to 20%
<b>EFFICIENCY AT 0.125 in wg (31.1 Pa):</b>	
- without damper or louvres	25%
- with damper	23%
- with louvres	20%
<b>AIR FLOW RATE:</b>	
- range	676 to 2700 cfm (319 to 1270 L/s)
- at 0.125 in wg (31.1 Pa)	2480 cfm (1170 L/s) without dampers or louvres 2390 cfm (1130 L/s) with damper 2190 cfm (1030 L/s) with louvres
<b>POWER CONSUMPTION:</b>	0.221 to 0.383 kW
<b>OPERATOR SAFETY:</b>	inlet guard provided CSA approved noise level = 73 dB(A) at 4.9 ft (1.5 m) from fan discharge
<b>OPERATOR'S MANUAL:</b>	installation instructions only.



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