

Evaluation Report

606



Del-Air Model J-16 Ventilation Fan

A Co-operative Program Between



ALBERTA
FARM
MACHINERY
RESEARCH
CENTRE



PRAIRIE AGRICULTURAL MACHINERY INSTITUTE

DEL-AIR MODEL J-16 VENTILATION FAN

MANUFACTURER AND DISTRIBUTOR:

Del-Air Systems Ltd.
P.O. Box 2500
1704 Fourth Avenue
Humboldt, Saskatchewan
S0K 2A0
Ph: (306) 682-5011

RETAIL PRICE: \$500.00

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

SUMMARY OF RESULTS

TABLE 1. Del-Air Model J-16 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	0.000	(0.0)	2630	(1240)	0.303	22	1520
	0.050	(12.5)	2550	(1200)	0.310	24	1512
	0.100	(24.9)	2480	(1170)	0.312	27	1506
	0.125	(31.1)	2430	(1146)	0.311	28	1505
Direct	0.250	(62.3)	1980	(935)	0.295	29	1524
	0.000	(0.0)	2560	(1210)	0.319	20	1534
	0.050	(12.5)	2560	(1210)	0.324	23	1515
	0.100	(24.9)	2430	(1150)	0.322	25	1510
Variable Speed Maximum	0.125	(31.1)	2330	(1100)	0.319	25	1513
	0.250	(62.3)	1660	(786)	0.304	22	1527
	0.000	(0.0)	1770	(837)	0.240	9	1102
	0.050	(12.5)	1560	(735)	0.237	10	1080
Variable Speed Mid Range	0.100	(24.9)	1240	(587)	0.227	9	1197
	0.125	(31.1)	1050	(495)	0.226	9	1207
	0.250	(62.3)	323	(152)	0.247	4	980
	0.000	(0.0)	1070	(507)	0.183	3	808
Variable Speed Minimum	0.050	(12.5)	791	(373)	0.175	3	792
	0.100	(24.9)	310	(146)	0.181	2	745
	0.125	(31.1)	226	(107)	0.180	2	730
	0.000	(0.0)	2590	(1220)	0.318	20	1532
Single Speed	0.050	(12.5)	2540	(1200)	0.319	23	1519
	0.100	(24.9)	2440	(1150)	0.319	26	1511
	0.125	(31.1)	2360	(1120)	0.317	26	1511
	0.250	(62.3)	1690	(798)	0.299	23	1525

RECOMMENDATIONS

It is recommended that the manufacturer consider:

1. Supplying fan performance data over a complete range of static pressures.

Manager: R. P. Atkins

Project Engineer: Robert Maze

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 Del-Air J series fans at varying static pressures.

GENERAL DESCRIPTION

The Del-Air Model J-16 ventilation fan is a 15.75 in (400 mm) diameter, 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 J-16 ventilation fan is a flush-mounted unit equipped with an inlet guard grill, optional inlet louvres, a mounting face plate, integral fan shroud, outlet dampers and an insulating door. The 6-blade polypropylene propeller and aluminum hub are mounted directly on a 0.25 hp (186 kW), single

phase, 115/230 V electric motor. The motor mount is integral with the wire inlet guard grill and is bolted to the motor and the fan housing.

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

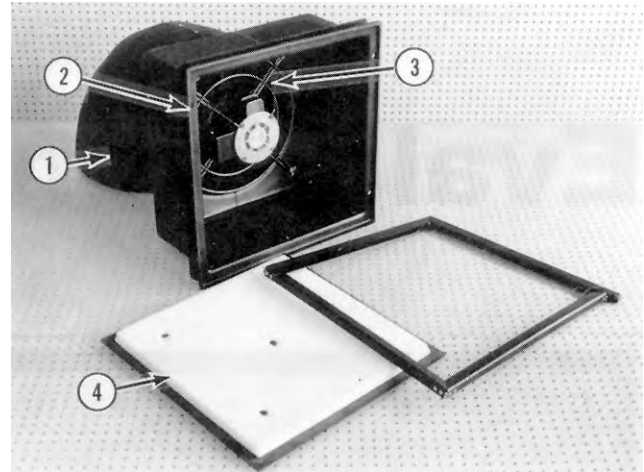


FIGURE 1. Del-Air Model J-16 Ventilation Fan: (1) Outlet Damper, (2) Mounting Face Plate, (3) Inlet Guard Grill, (4) Insulating Door.

SCOPE OF TEST

The Del-Air Model J-16 was tested in the inlet 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 for both single speed and variable speed modes. 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 dampers on fan performance was determined in the single speed setting.

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

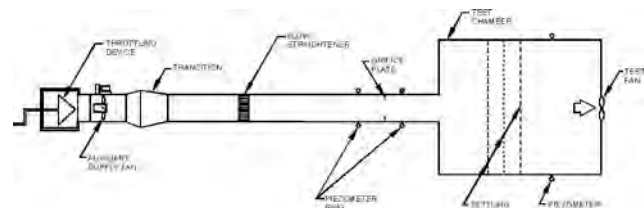


FIGURE 2. Schematic of Fan Test Apparatus - Inlet Chamber Set-Up.

RESULTS AND DISCUSSION

FAN PERFORMANCE

All fan performance results in this report are given at standard 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

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).

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 mid-range to minimum setting reduced the air flow rate from 2330 cfm (1100 L/s) to 1050 cfm (495 L/s) to 226 cfm (107 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 2430 cfm (1150 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.

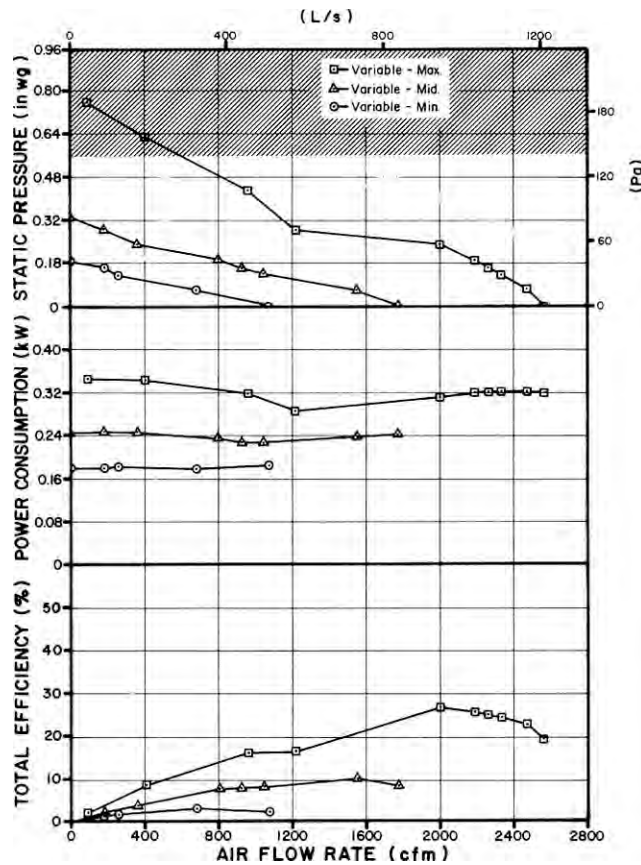


FIGURE 3. Del-Air Model J-16 Fan Performance Curves.

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 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 0.295 to 0.312 kW in the single speed mode, from 0.304 to 0.324 kW at maximum speed, from 0.226 to 0.247 kW at mid-range and from 0.175 to 0.183 kW at minimum speed. The maximum amperage drawn by the motor was 1.58 amps, which was greater than the rated motor amperage of 1.35 amps plus the +/-10% allowable limit established by CSA Standards. The shaded zone in FIGURES 3 and 4 illustrates operation levels where the rated motor amperage was exceeded. Prolonged operation in excess of rated amperage could reduce motor life.

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).

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 25% at maximum speed, 4 to 10% at mid-range and 2 to 3% at minimum speed. The total efficiency at maximum fan speed and a static pressure of 0.125 in wg (31.1 Pa) was 25%.

Effect of Dampers: The optional dampers were installed on the outlet 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 dampers reduced the air flow rate by 1 to 15% (FIGURE 4) over the typical range of operation. For example, at a static pressure of 0.125 in wg (31.1 Pa), the dampers reduced the air flow rate by 3% from 2430 cfm (1150 L/s) to 2360 cfm (1120 L/s) (TABLE 1). The efficiency was in turn reduced from 28 to 26%. The use of other control devices such as shutters, 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.

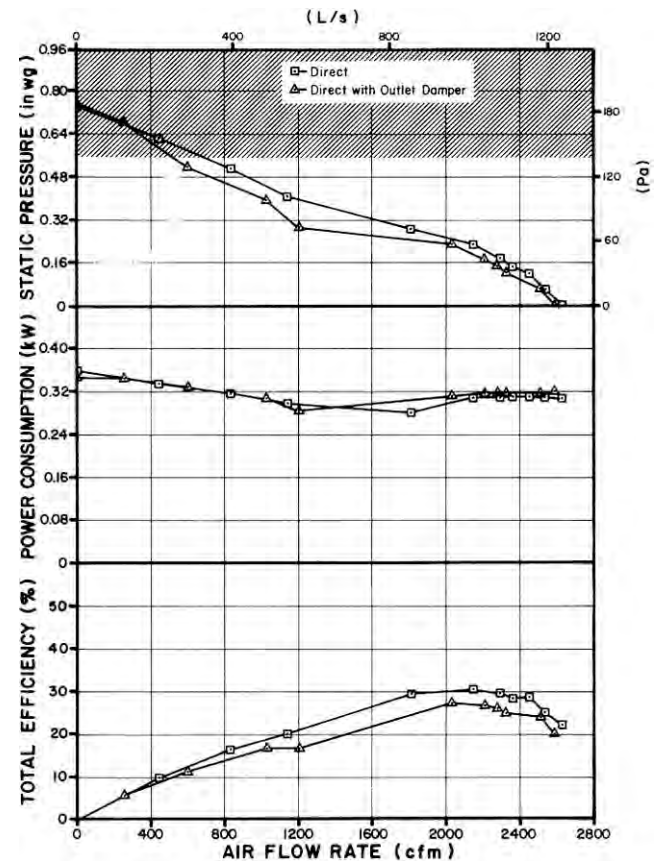


FIGURE 4. Effect of Dampers on Fan Performance.

EASE OF OPERATION

Maintenance: The operator's manual advised a routine cleaning program to remove dust and dirt build-up and yearly check of the free movement of the fan if it had been idle for long periods. The inlet louvres were easily removed, which made for easy access to clean the fan blades and housing.

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 Del-Air Model J-16 was CSA approved.

The noise level of the Del-Air Model J-16 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 75 dB(A). Higher noise levels could be expected if the fan was operated in the

vicinity of other buildings. The Del-Air Model J-16 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

The operator's manual provided detailed information on installation, maintenance 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	
MAKE:	Del-Air
MODEL:	J-16
SERIAL NUMBER:	PAMI-2
MANUFACTURER:	Del-Air Systems Ltd. P.O. Box 2500 1704 Fourth Avenue Humboldt, Saskatchewan S0K 2A0
OVERALL DIMENSIONS:	
- housing width	23.0 in (584 mm)
- housing depth (motor included)	36.0 in (914 mm)
- housing height	23.0 in (584 mm)
- discharge opening	16.0 in (406 mm)
- guard grill diameter	16.0 in (406 mm)
- grill opening	0.25 in (6 mm) dia. wire spaced at 2.0 in (51 mm)
IMPELLERS:	
- diameter	15.75 in (400 mm)
- hub diameter	3.75 in (95 mm)
- number of blades	6
- blade angle	Hub 41°, Tip 27°
WEIGHT:	34 lb (15 kg)
MOTOR NAMEPLATE DATA:	
make	FASCO
model	7124-0776
class	B
type	V24B1
rpm	1650
ambient temperature rise	40°C
volts	115/230
amps	2.7/1.35
phase	1
cycles	60
horsepower	0.25 hp (186 W)

SUMMARY CHART	
DEL-AIR MODEL J-16 VENTILATION FAN	
RETAIL PRICE:	\$500.00 (June 1989, f.o.b. Lethbridge)
FAN DESCRIPTION:	15.75 in (400 mm) propeller fan, variable speed, direct drive, 0.25 hp (186 W), 115/230 V electric motor.
FAN PERFORMANCE:	
Air Flow Rate:	
- range	226 to 2630 cfm (107 to 1240 L/s)
- at 0.125 in wg (31.1 Pa)	2430 cfm (1150 L/s) without dampers 2360 cfm (1120 L/s) with dampers
Power Consumption:	0.175 to 0.324 kW
Efficiency Range:	
- without dampers	2 to 29%
- with dampers	23 to 26%
Efficiency at 0.125 in wg (31.1 Pa):	
- without dampers	28%
- with dampers	26%
OPERATOR SAFETY:	Inlet guard provided CSA approved noise level - 75 dB(A) at 4.9 ft (1.5 m) from fan inlet
OPERATOR'S MANUAL:	Good, provided information on installation, maintenance and troubleshooting.



ALBERTA FARM MACHINERY RESEARCH CENTRE

3000 College Drive South
Lethbridge, Alberta, Canada T1K 1L6
Telephone: (403) 329-1212
FAX: (403) 329-5562
<http://www.agric.gov.ab.ca/navigation/engineering/afmrc/index.html>

Prairie Agricultural Machinery Institute
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
---	---