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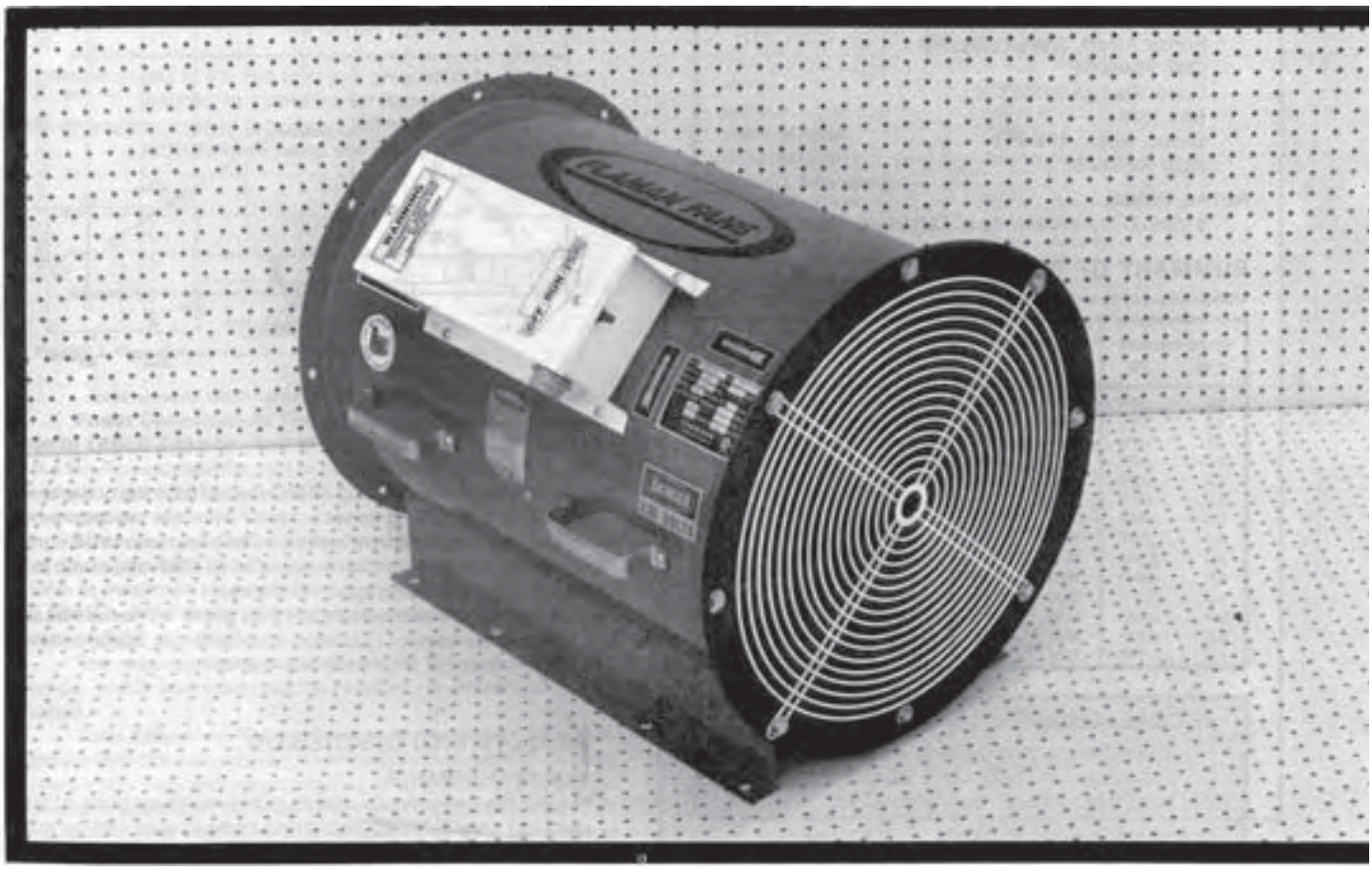
Evaluation Report 506



Flaman Model FCJ-18-3-1 In-Line Centrifugal Fan

A Co-operative Program Between
ALBERTA FARM MACHINERY RESEARCH CENTRE
PAMI
PRAIRIE AGRICULTURAL MACHINERY INSTITUTE

FLAMAN MODEL FCJ-18-3-1 IN-LINE CENTRIFUGAL FAN

MANUFACTURER:

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DISTRIBUTOR:

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Frank Flaman Supplies Ltd.
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(403) 986-0608

RETAIL PRICE:

$1095.00 (July, 1986, f.o.b. Lethbridge, Alberta).

SUMMARY OF RESULTS

TABLE 1. Flaman Model FCJ-18-3-1 Performance at Typical Levels of Operation

Static Pressure		Air Flow Rate		Power Consumption	Total Efficiency	Fan Speed
in wg	(Pa)	cfm	(L/s)	kWh	%	rpm
0.5	(124)	4100	(1940)	3.80	10	3482
1.0	(249)	3980	(1890)	3.96	16	3477
1.5	(374)	3840	(1810)	3.96	20	3472
2.0	(497)	3690	(1740)	4.01	25	3470
2.5	(623)	3530	(1670)	4.05	27	3467
3.0	(747)	3370	(1690)	4.08	31	3464
3.6	(872)	3100	(1510)	4.09	33	3463
4.0	(996)	3020	(1430)	4.08	36	3462
4.5	(1120)	2840	(1340)	4.03	38	3463
5.0	(1240)	2620	(1240)	3,93	39	3467
5.5	(1370)	2400	(1130)	3.83	41	3472
6.0	(1490)	2130	(1010)	3.63	4O	3480
6.5	(1620)	1900	(895)	3.45	40	3488
7.0	(1740)	1200	(566)	2.71	31	3516

RECOMMENDATIONS

It is recommended that the manufacturer consider:

1. Supplying a table or curve of airflow rates over a complete range of static pressures.

Project Manager: R. P. Atkins

Project Engineer: K. Shimek

THE MANUFACTURER STATES THAT

With regard to recommendation number:

1. PAMI's air flow information will be available with each fan.

GENERAL DESCRIPTION

The Flaman Model FCJ-18-3-1 fan is a 17.1 in (435 mm) diameter, single speed, direct drive, inline centrifugal flow fan. It is primarily used for grain aeration or grain drying systems.

The Flaman Model FCJ-18-3-1 is equipped with a wire mesh guard grill, an inlet bell, duct mounting flange and a motor control. The welded steel impeller consists of a hub backplate, 9 backward curved blades and a flange. The impeller is directly mounted on the 3 hp (2.24 kW) single phase, 208/230 V electric motor. The fan housing and inlet bell are of steel construction with an enamel finish for corrosion protection.

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

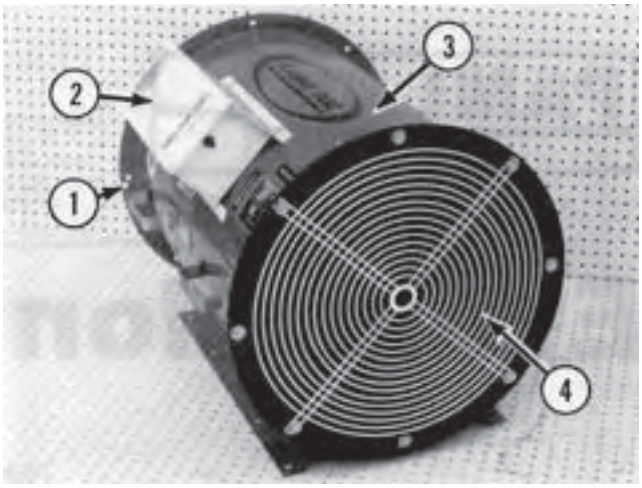

FIGURE 1. Flaman Model FCJ-18-3-1 Fan: (1) Mounting Flange, (2) Motor Control, (3) Fan Housing, (4) Guard Grill and Inlet Bell.

SCOPE OF TEST

The Flaman Model FCJ-18-3-1 was tested in the outlet 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.

Fan performance was determined at 230 V. The fan was also evaluated for ease of operation, maintenance, operator safety and suitability of the operator's manual.

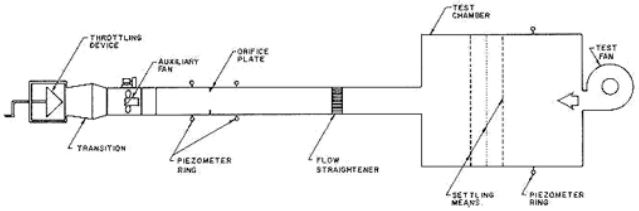

FIGURE 2. Schematic of Fan Test Apparatus - Outlet Chamber Setup.

RESULTS AND DISCUSSION

FAN PERFORMANCE

All fan performance results in this report are given at standard air[1] 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 at typical levels of operation (i.e. static pressure[2]) are given in TABLE 1. The air flow rate ranged from 1200 cfm (566 L/s) at 7.0 in wg (1740 Pa) to 4100 cfm (1940 L/s) at 0.5 in wg (124 Pa). FIGURE 3 illustrates the fan performance curves for the Flaman Model FCJ-18-3-1 fan. The manufacturer did not provide any information on rated performance. 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.

Power Consumption: The power consumed 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 upon the point of operation of the fan. The power consumption varied from 1.50 kWh at maximum static pressure and minimum air flow rate to 4.09 kWh at 3.5 in wg (872 Pa) static pressure and an air flowrate of 3100 cfm (1510 L/s).

The maximum amperage drawn by the motor was 16.7 amps, which was less than the rated motor amperage of 17.8 amps.

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[1]Standard air is air with a density of 0.075 lb/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).

[2]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).

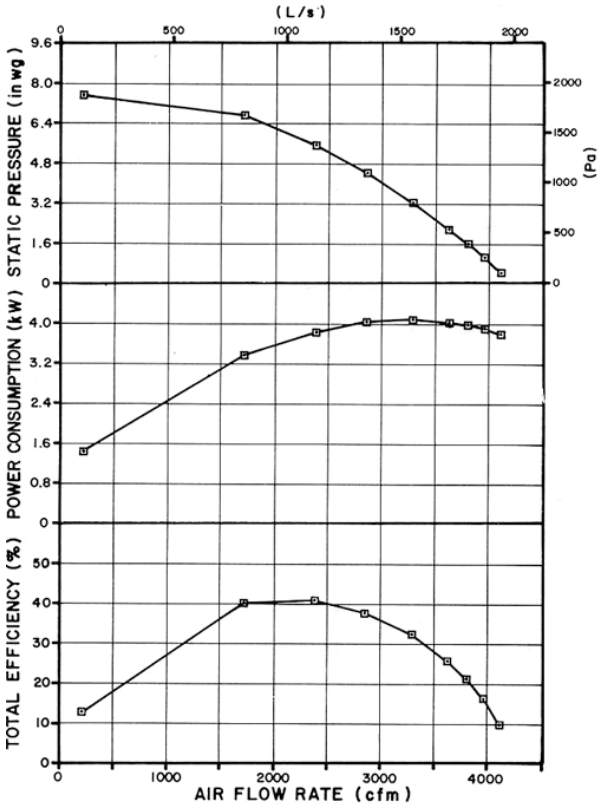

FIGURE 3. Flaman Model FCJ-18-3-1 Fan Performance Curves.

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) ranged from 10 to 41%. The maximum total efficiency of 41% occurred at 2400 cfm (1130 L/s) at a static pressure of 5.5 in wg (1370 Pa).

EASE OF OPERATION

Maintenance: The inlet guard grill and inlet bell could be easily removed which allowed for periodic cleaning of the fan wheel and housing. Other maintenance was not required as the motor had pre-lubricated and sealed bearings.

OPERATOR SAFETY

The guard grill provided adequate protection from the fan blades. The motor was a totally enclosed unit and presented no safety hazards. The Flaman Model FCJ-18-3-1 was CSA approved.

The noise level of the Flaman Model FCJ-18-3-1, at a distance of 4.9 ft (1.5 m) from the centre of the fan inlet, while operating at a 0.1 in wg (249 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 Flaman Model FCJ-18-3-1 falls within range 3 of the PAMI noise level 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 was very informative and contained information on installation, wiring, maintenance, service and trouble shooting.

APPENDIX I
SPECIFICATIONS

MAKE:	Flaman
MODEL:	FCJ-18-3-1
SERIAL NUMBER:	F65001
MANUFACTURER:	Emerson South
OVERALL DIMENSIONS:	
-- housing width	22.0 in (559 mm)
-- housing length	26.0 in (660 mm)
-- housing height	22.5 in (572 mm)
-- inlet bell diameter	17.0 in (432 mm)
-- guard grill diameter1	8.25 in (464 mm)
-- grill opening	0.125 in (3 mm) wire spaced at 0.5 in (13 mm) in a circular pattern
-- discharge opening diameter	18.25 in (464 mm)
IMPELLERS:	
-- diameter	17.1 in (435 mm)
-- inside flange diameter	15.0 in (381 mm)
-- number of blades	9
-- blade angle	39 degrees
WEIGHT:	137 lb (62 kg)
MOTOR NAMEPLATE DATA:	
-- make	Baldor
-- model	355166Y152
-- frame	145TZ
-- class	A
-- code	J
-- design	L
-- duty	continuous
-- rpm	3450 rpm
-- service factor	1.15
-- ambient temperature rise	40°C
-- volts	208/230 V
-- amps	15/14 A (17.8 max)
-- phase	1
-- cycles	60 Hz
-- horsepower	3 hp (2.24 kW)

APPENDIX II
NOISE LEVEL RANGES
SOUND LEVEL

Range	(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	= millimetres (mm)
inches water gauge (in wg) x 249.1	= pascals (Pa)
pounds (lb) x 0.45	= kilograms (kg)

SUMMARY CHART
FLAMAN MODEL FCJ-18-3-1 IN-LINE CENTRIFUGAL FAN

RETAIL PRICE:	$1095.00 (July, 1986, f.o.b. Lethbridge)
FAN DESCRIPTION:	17.1 in (435 mm) single speed, direct drive, 3 hp (2.24 kW) electric motor.
FAN SPEED:	3462 to 3516 rpm
MAXIMUM EFFICIENCY:	41%
AIR FLOW RATE:	
-range	1200 to 4100 cfm (566 to 1940 L/s)
-maximum efficiency	2400 cfm (1130 L/s) at a 5.5 in wg (1370 Pa) static pressure
POWER CONSUMPTION:	1.50 to 4.09 kWh
OPERATOR SAFETY:	guard grill provided, CSA approved noise level = 77 dB(A) at 4.9 ft (1.5 m) from fan inlet
OPERATOR'S MANUAL:	adequate

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