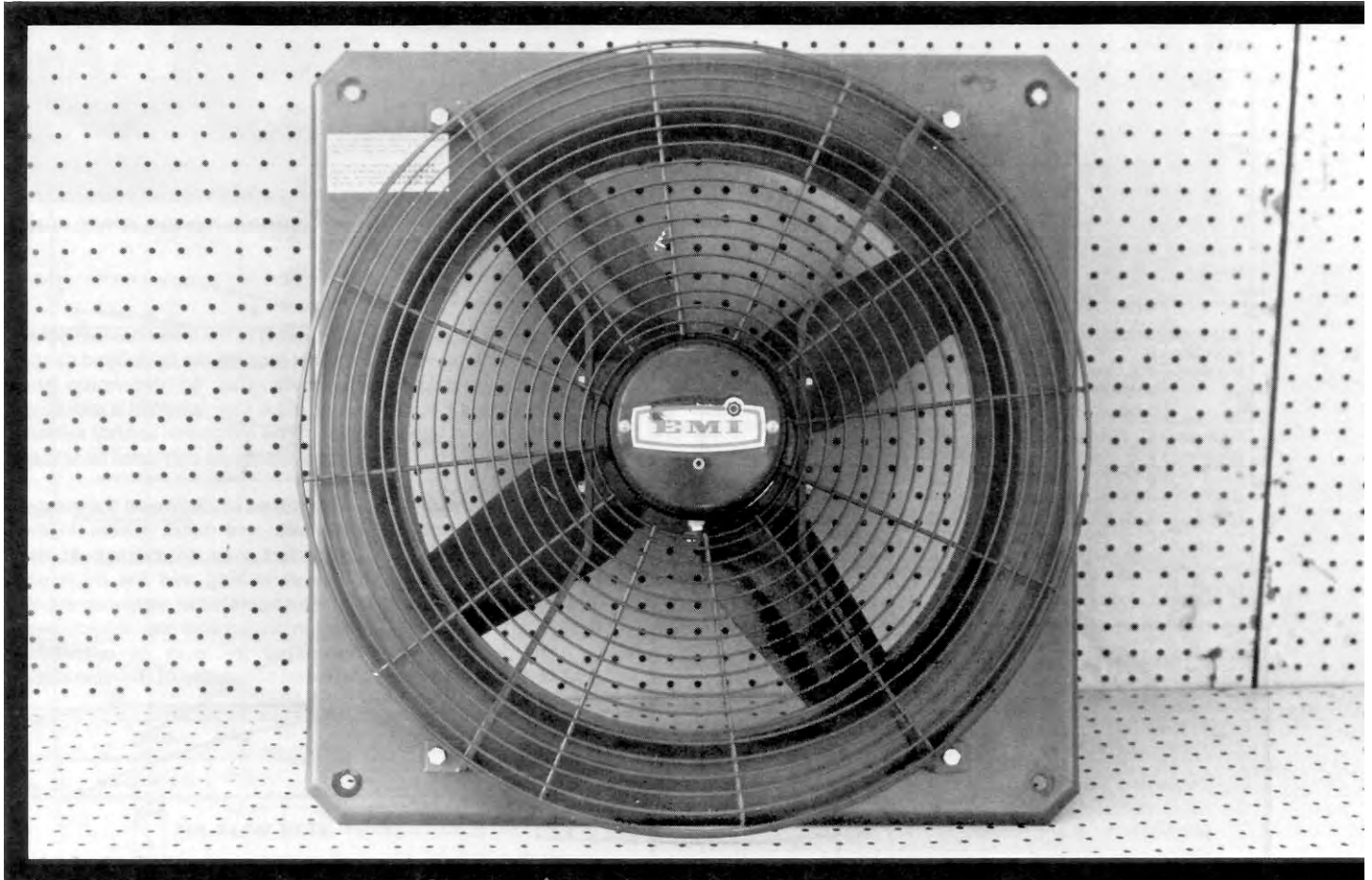


EVALUATION REPORT 339



EMI WLA 4/50 Ventilation Fan

A Co-operative Program Between



ALBERTA
FARM
MACHINERY
RESEARCH
CENTRE



PRAIRIE AGRICULTURAL MACHINERY INSTITUTE

EMI WLA 4/50 VENTILATION FAN

MANUFACTURER:

EMI Verkoop B.C.
P.O. Box 8100
3503 RC
Utrecht, Holland

DISTRIBUTOR:

Langer Manufacturing Limited
4603a - 13 Street N.E.
Calgary, Alberta
T2E 6M3

RETAIL PRICE:

\$894.00 (December 1983, f.o.b. Lethbridge, Alberta, complete with inlet guard grill, louvres, master control unit and temperature sensor.)

SUMMARY OF RESULTS

TABLE 1. EMI Fan Performance at Typical Levels of Operation.

SETTING	STATIC PRESSURE		AIR FLOW RATE		INPUT POWER		TOTAL EFFICIENCY %	FAN SPEED rpm
	in wg	(Pa)	cfm	(L/s)	hp	(W)		
Direct	0	(0)	4400	(2080)	0.45	(333)	36	1672
	0.05	(12.5)	4170	(1970)	0.47	(350)	40	1662
	0.10	(24.9)	4080	(1920)	0.48	(356)	41	1658
	0.125	(31.1)	4030	(1900)	0.48	(360)	42	1655
	0.25	(62.3)	3670	(1730)	0.51	(384)	45	1637
Automatic Maximum	0	(0)	4360	(2060)	0.44	(328)	37	1661
	0.05	(12.5)	4200	(1980)	0.46	(340)	40	1651
	0.10	(24.9)	4060	(1920)	0.47	(349)	41	1642
	0.125	(31.1)	4000	(1890)	0.47	(354)	42	1637
	0.25	(62.3)	3640	(1720)	0.50	(374)	44	1616
Automatic Mid Range	0	(0)	3320	(1570)	0.32	(241)	16	1268
	0.05	(12.5)	2930	(1380)	0.33	(247)	18	1171
	0.10	(24.9)	2350	(1110)	0.34	(251)	21	1069
	0.125	(31.1)	2160	(1020)	0.34	(251)	24	1036
Automatic Minimum	0	(0)	1600	(755)	0.17	(127)	4	692
	0.05	(12.5)	900	(425)	0.17	(130)	4	525
Direct with Louvres	0	(0)	4140	(1950)	0.47	(349)	29	1650
	0.05	(12.5)	3950	(1860)	0.49	(363)	31	1641
	0.10	(24.9)	3790	(1790)	0.50	(374)	32	1634
	0.125	(31.1)	3720	(1750)	0.51	(379)	33	1631
	0.25	(62.3)	3300	(1560)	0.54	(400)	34	1615

RECOMMENDATIONS

It is recommended that the manufacturer consider:

1. Supplying fan performance data over a complete range of static pressures.
2. Supplying more detailed operating instructions containing illustrations and information on general operation, installation, maintenance, safety aspects and trouble shooting

Senior Engineer: E. H. Wiens

Project Engineer: R. P. Atkins

THE MANUFACTURER STATES THAT

With regard to recommendation number:

1. & 2. Both will be supplied in the future.

GENERAL DESCRIPTION

The EMI WLA 4/50 ventilation fan is a 19.5 in (495 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 or ceiling. The fan is part of an environmental control system which can include a series of 18

fans, slave control units, temperature sensors and a master control unit. The control units regulate the fan speed according to the temperature in the barn.

The EMI WLA 4/50 fan is equipped with an inlet guard grill, a mounting face plate and optional louvres. The four blade propeller is mounted directly on the 0.56 hp (420 W), single pha.se, 240 V electric motor. The entire unit is of steel construction with a heavy enamel coating for corrosion protection.

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

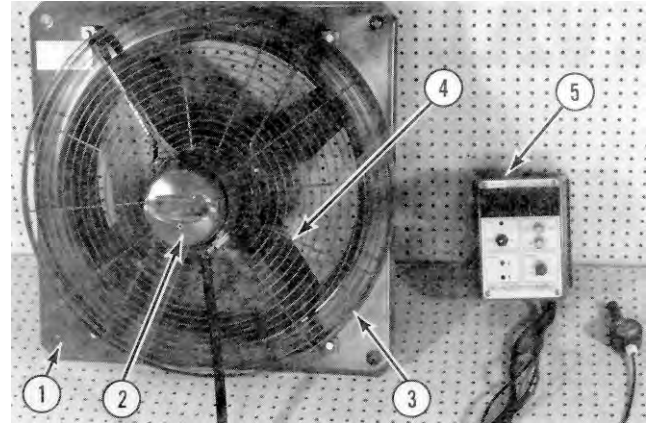


FIGURE 1. EMI WLA 4/50 Ventilation Fan: (1) Mounting Face Plate, (2) Motor, (3) Grill, (4) Propeller Blades, (5) Master Control Unit.

SCOPE OF TEST

The EMI WLA 4/50 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 automatic control system was not evaluated. The control system was only used to set fan speed.

Fan performance was determined at 230 V with the master control unit in both the automatic and direct modes. In the automatic mode, fan performance was determined at the maximum setting, the mid-range setting and the minimum setting. In the direct mode, the fan operated at maximum speed only. The effect of louvres on fan output was also determined.

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

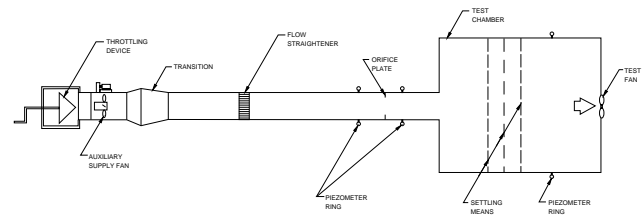


FIGURE 2. Schematic of Fan Test Apparatus -- Inlet Chamber Setup.

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 direct mode and in the automatic mode at maximum setting were similar (FIGURE

¹Standard air is air with a density of 0.075 lbf/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).

3). Reducing the fan speed, greatly reduced the air flow rate for a given static pressure². For example, at a static pressure of 0.05 in wg (12.5 Pa), reducing the speed from maximum to mid range to minimum master control unit settings, reduced the air flow rate from 4200 cfm (1980 L/s) to 2930 cfm (1380 L/s) to 900 cfm (425 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. Livestock building ventilation fans are often rated on their output at a static pressure of 0.125 in wg (31.0 Pa). The manufacturer's rated air flow rate at 0.125 in wg (31.0 Pa) at maximum speed was 4700 cfm (2220 L/s). PAMI's measured flow rate at the same conditions was 4030 cfm (1900 L/s) or 14% lower than the manufacturer's setting.

The manufacturer only provided fan performance information for a static pressure of 0.125 in wg (31.0 Pa). Since building ventilation design at other static pressures is possible, 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.

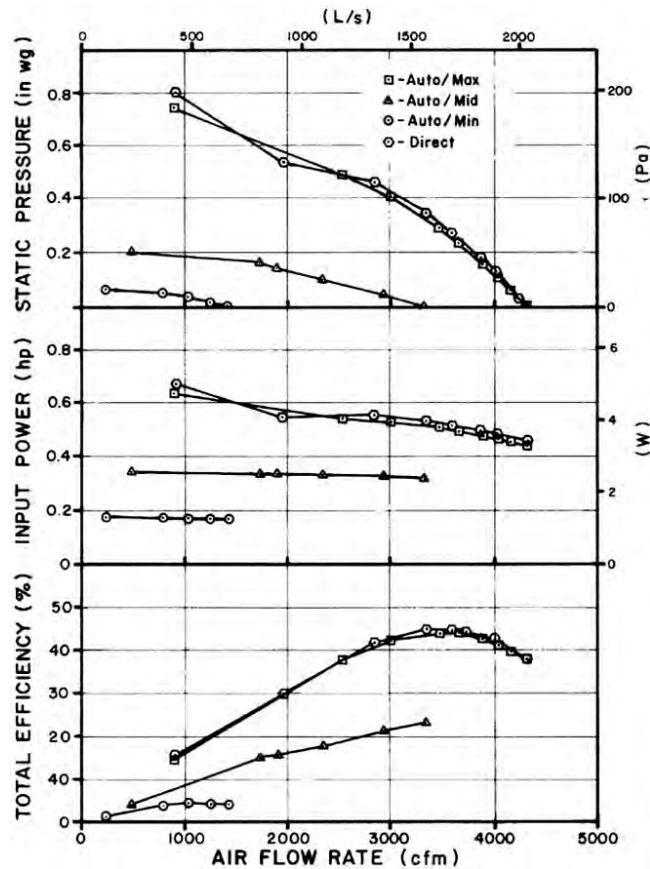


FIGURE 3. EMI Fan Performance Curves in the Direct Mode and at Three Speeds in the Automatic Mode.

Power Requirements: The power required to run the fan depended on fan speed and static pressure. For typical levels of static pressure (TABLE 1), the input power required varied from 0.44 to 0.50 hp (328 to 384 W) at maximum speed, from 0.32 to 0.34 hp (241 to 251 W) at mid range, to 0.17 hp (130 W) at minimum speed. The maximum amperage drawn by the motor at these levels of operation was 1.5 amps, which was well below the rated motor amperage of 1.7 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 (i.e. static pressure), the total efficiency (TABLE 1) ranged from 36 to 45% at maximum speed,

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).

from 16 to 24% at mid range and was about 4% at minimum speed. The total efficiency at maximum fan speed and a static pressure of 0.125 in wg (31.0 Pa) was 42%.

Effect of Louvres: The optional louvres were installed on the outlet side of the fan (FIGURE 4) to determine their effect on fan output. The fan was tested under these conditions in the direct mode only. Using louvres reduced the air flow rate by 7 to 8% (FIGURE 5) over the typical range of operation. For example, at a static pressure of 0.125 in wg (31.0 Pa), louvres reduced the air flow rate from 4030 cfm (1900 L/s) to 3720 cfm (1750 L/s) (TABLE 1). The efficiency was in turn reduced from 42 to 33%. 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. Louvres Located on Fan Discharge.

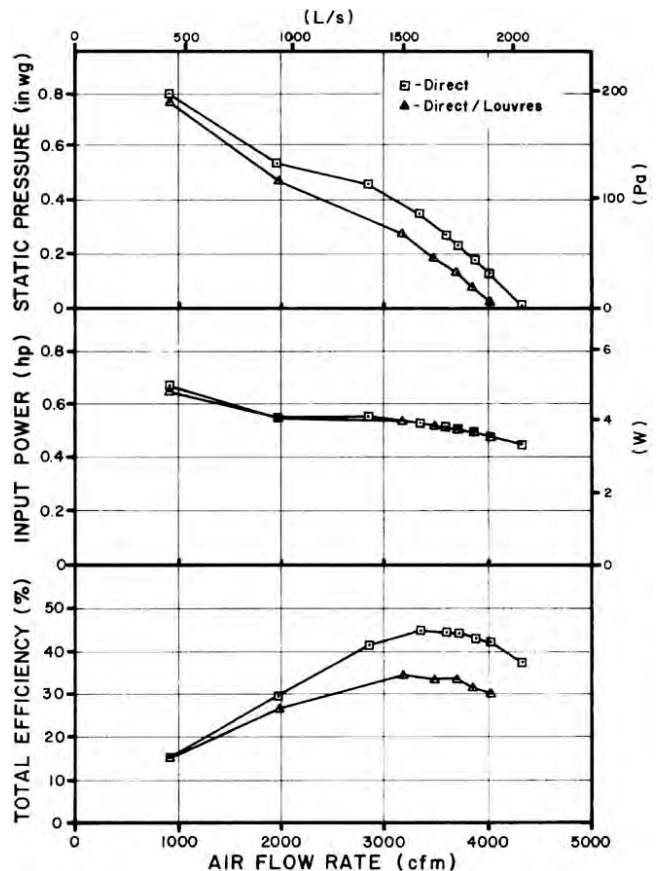


FIGURE 5. Effect of Louvres on EMI Fan Performance When Operated in the Direct Mode.

EASE OF OPERATION

Master Control Unit: The master control unit could be set to operate the fan in either the direct or automatic mode. The

direct mode operated the fan at maximum speed only. The automatic mode allowed the operator to set the minimum and maximum fan speeds and the desired temperature in the barn. A temperature sensor fed information back to the master control unit and regulated fan speed accordingly. Fan speed varied between 500 and 1600 rpm, depending on temperature.

Maintenance: The motor bearings required lubrication every 200 hours. The fan housing and blades required cleaning every 2000 hours or as required. The removeable inlet guard grill allowed easy access for fan cleaning.

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 EMI WLA 4/50 was CSA approved.

The noise level³ of the EMI WLA 4/50, 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 EMI WLA 4/50 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 operating instructions consisted of several printed sheets that briefly covered wiring and installation instructions. It is recommended that the manufacturer supply a more detailed manual containing illustrations and information on general operation, installation, maintenance, rated performance, safety aspects and trouble shooting.

- rpm	1600
- volts	240
- amps	1.7
- phase	1
- cycles	60

APPENDIX II		
NOISE LEVEL RANGES		
RANGE	SOUND (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 gage (in wg) x 249.1	= pascals (Pa)
pounds (lb) x 0.45	= kilograms (kg)

APPENDIX I	
SPECIFICATIONS	
MAKE:	EMI
MODEL:	WLA 4/50
SERIAL NUMBER:	4585
MANUFACTURER:	EMI Verkoop B.C. P.O. Box 8100 3503 RC Utrecht, Holland
OVERALL DIMENSIONS:	
housing width	25 in (635 mm)
housing height	25 in (635 mm)
housing depth	5.75 in (146 mm)
total depth with motor	125 in (320 mm)
housing diameter	19.5 in (495 mm)
guard grill diameter	25.5 in (650 mm)
grill opening	0.125 in (3 mm) diamter spaced at 0.56 in (14 mm) in a circular pattern.
PROPELLER:	
- diameter	19.25 in (490 mm)
- hub diameter	6.25 in (160 mm)
- number of blades	4
- blade angle	variable - 20 degrees at tip to 45 degrees at hub
WEIGHT:	50 lb (22.7 kg)
MOTOR NAMEPLATE DATA:	
- make	EMI
- type	WLA 4/50
- hp	0.54 hp (420 W)

SUMMARY CHART

EMI WLA 4/50 VENTILATION AERATION FAN

RETAIL PRICE:	\$894.00 (December, 1983, f.o.b. Lethbridge)
FAN DESCRIPTION:	19.5 in (495 mm) variable speed, direct drive, 0.56 hp (420 W) electric motor
FAN SPEED:	
- direct mode	1637 to 1672 rpm
- variable mode	525 to 1661 rpm
MAXIMUM EFFICIENCY:	
- without louvres	45% at 0.25 in wg (62.3 Pa)
- with louvres	34% at 0.25 in wg (62.3 Pa)
EFFICIENCY AT 0.125 in wg (31 Pa):	
- without louvres	42%
- with louvres	33%
AIR FLOW RATE:	
- range	900 to 4400 cfm (425 to 2080 L/s)
- at 0.125 in wg (31 Pa)	4030 cfm (1900 L/s) without louvres and 3720 cfm (1750 L/s) with louvres
INPUT POWER:	0.17 to 0.54 hp (127 to 400 W)
OPERATOR SAFETY:	inlet guard provided CSA approved noise level = 74 dB(A)
OPERATOR'S MANUAL:	more detail required

³PAMI Test Procedure for Determining Fan Noise Level.



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