

EVALUATION REPORT 346



Koenders Model KV18 Ventilation Fan

A Co-operative Program Between



ALBERTA
FARM
MACHINERY
RESEARCH
CENTRE



PRAIRIE AGRICULTURAL MACHINERY INSTITUTE

KOENDERS MODEL KV18 VENTILATION FAN

MANUFACTURER AND DISTRIBUTOR:

Koender's Sales & Service
 Box 171
 Englefeld, Sask.
 S0K 1N0

RETAIL PRICE:

\$175.00 (March 1984, f.o.b. Lethbridge, Alberta, complete with optional shutter).

SUMMARY OF RESULTS

TABLE 1. Koenders Model KV18 Fan Performance at Typical Levels of Operation.

SETTING	STATIC PRESSURE in wg (Pa)		AIR FLOW RATE cfm (L/s)		INPUT POWER hp (W)	TOTAL EFFICIENCY %	FAN SPEED rpm
Single Speed	0	(0)	2830	(1340)	0.38 (281)	17	1727
	0.05	(12.5)	2730	(1290)	0.38 (285)	19	1727
	0.10	(24.9)	2600	(1230)	0.39 (291)	21	1721
	0.125	(31.1)	2530	(1200)	0.39 (294)	22	1719
	0.25	(62.3)	2150	(1010)	0.41 (305)	25	1713
Variable Maximum	0	(0)	2790	(1320)	0.35 (258)	18	1705
	0.05	(12.5)	2720	(1290)	0.35 (263)	20	1704
	0.10	(24.9)	2580	(1220)	0.36 (271)	22	1701
	0.125	(31.1)	2500	(1180)	0.37 (275)	24	1699
	0.25	(62.3)	2120	(1000)	0.38 (287)	26	1692
Variable Mid Range	0	(0)	2590	(1220)	0.29 (219)	17	1587
	0.05	(12.5)	2500	(1180)	0.30 (224)	19	1580
	0.10	(24.9)	2330	(1100)	0.31 (232)	21	1568
	0.125	(31.1)	2240	(1060)	0.32 (235)	22	1563
	0.25	(62.3)	1770	(837)	0.34 (254)	22	1537
Variable Minimum	0	(0)	1950	(919)	0.24 (182)	9	1192
	0.05	(12.5)	1660	(783)	0.25 (187)	10	1140
	0.10	(24.9)	1300	(614)	0.26 (191)	9	1066
	0.125	(31.1)	1030	(484)	0.26 (197)	8	996
	Single Speed with Shutter	0	(0)	2780	(1310)	0.37 (279)	16
0.05		(12.5)	2680	(1270)	0.38 (285)	18	1726
0.10		(24.9)	2540	(1200)	0.39 (293)	20	1723
0.125		(31.1)	2450	(1160)	0.40 (297)	21	1721
0.25		(62.3)	1970	(932)	0.42 (311)	22	1712

GENERAL DESCRIPTION

The Koenders model KV18 ventilation fan is a 17.5 in (445 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 Koenders model KV18 is a flush mounted unit equipped with an inlet bell, variable speed control, optional shutter and optional insulated door. An air tube is available as an option but was not supplied with the fan. The six blade propeller and hub are made of aluminum and are mounted directly on the 0.33 hp (249 W), single phase 115/230V electric motor. The housing and motor mounts are constructed of galvanized sheet metal. The variable speed control is a light dimmer switch which is adjusted manually to vary the speed.

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

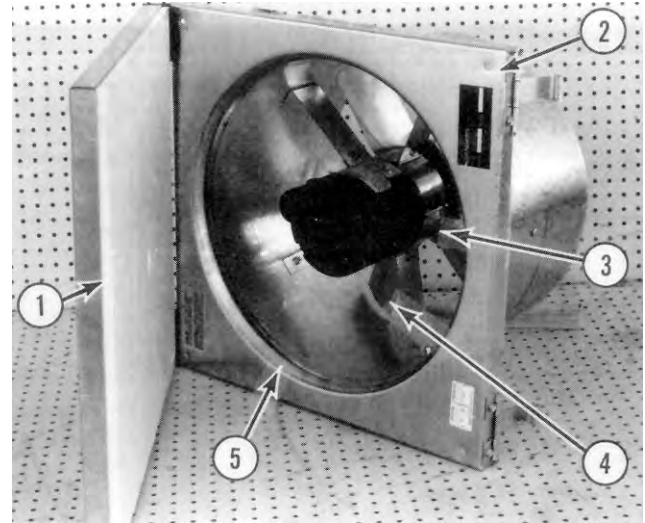


FIGURE 1. Koenders Model KV18 Fan: (1) Insulated Door, (2) Mounting Flange, (3) Motor Mounts, (4) Propeller, (5) Inlet Bell.

RECOMMENDATIONS

It is recommended that the manufacturer consider:

1. Supplying fan performance data over a complete range of static pressures.
2. Supplying an optional inlet guard grill to meet CSA standards.
3. Modifying the motor mounts to adequately secure the motor in the proper position.
4. Supplying a detailed operator's manual containing illustrations and information on general operation, installation, maintenance, rated performance, 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. This information will be provided in the future.
2. We will consider making inlet guard grills available, as an option, in the future.
3. On all new fans, a heavier gauge material will be used for the motor mounts.
4. Operating instructions will be provided in the future.

SCOPE OF TEST

The Koenders model KV18 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.

Fan performance was determined at 115V in both the variable speed and the single speed mode. With the 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 be obtained without exceeding the rated amperage of the motor. The variable speed control supplied tended to overheat and cut out at higher static pressures or at reduced fan speeds. Another variable speed control was purchased, with cooling fins, to overcome this problem.

The effect of the shutter on fan performance was determined in the single speed mode only.

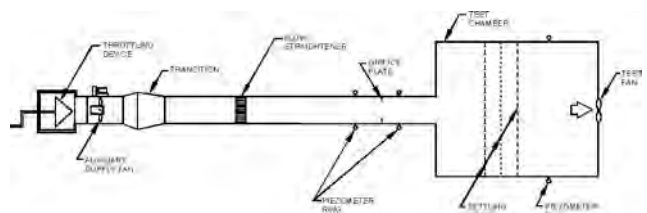


FIGURE 2. Schematic of Fan Test Apparatus - Inlet Chamber Setup.

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 single speed mode and at the maximum setting in the variable speed mode were 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 settings, reduced the air flow rate from 2500 cfm (1180 L/s) to 2240 cfm (1060 L/s) to 1030 cfm (484 L/s) respectively. At higher static pressures the reductions are 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 (31.1 Pa). PAMI's measured flow rate at this condition in the single speed mode was 2530 cfm (1200 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.

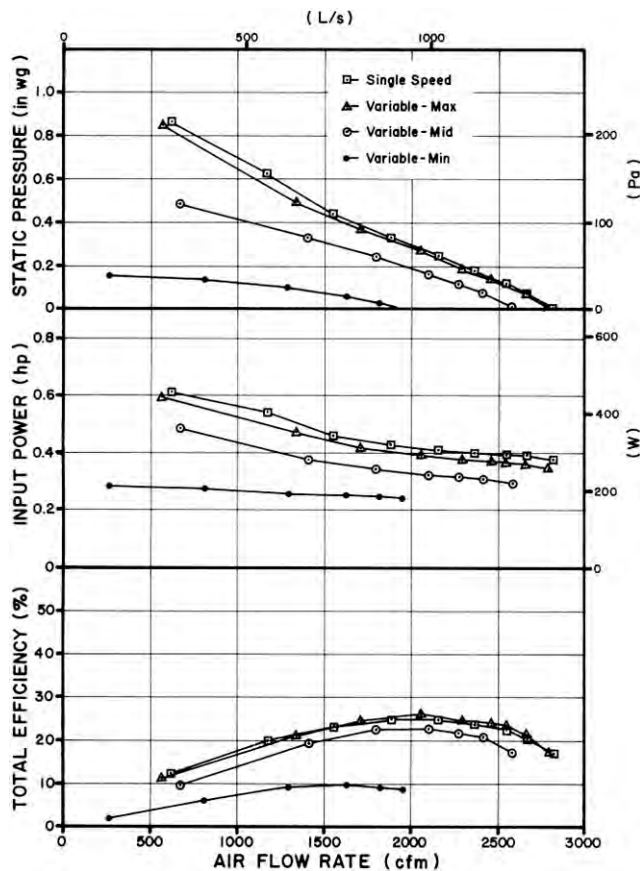


FIGURE 3. Koenders KV18 Fan Performance Curves in Both the Single Speed Mode and at Three Speed Settings in the Variable Speed Mode.

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).

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).

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 0.35 to 0.38 hp (258 to 287 W) at maximum speed, from 0.29 to 0.34 hp (219 to 254 W) at mid-range and from 0.24 to 0.26 hp (182 to 197 W) at minimum speed. The rated amperage of the motor was 3.8 amps. The rated motor amperage was exceeded at static pressures greater than 0.8 in wg (199 Pa) at maximum speed, 0.38 in wg (94.6 Pa) at mid-range and 0.14 in wg (34.9 Pa) at minimum speed. Prolonged operation above the rated amperage will reduce motor life.

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 1a to 26% at maximum speed, 17 to 22% at mid-range and 8to10% at minimum speed. The total efficiency at maximum fan speed and a static pressure of 0.125 in wg (31.1 Pa) was 24%.

Effect of Shutter: The optional shutter was installed on the outlet side of the fan (FIGURE 4) to determine the effect on fan output. The fan was tested under these conditions in the single speed mode only. Using the shutter reduced the air flow rate by 2 to 8% (FIGURE 5) over the typical range of operation. For example, at a static pressure of 0.125 in wg (31.1 Pa), the shutter reduced the air flow rate by 3%, from 2530 cfm (1200 L/s) to 2450 cfm (1160 L/s). The efficiency was in turn reduced from 22 to 21%. Because of the shutter's very light construction, it had a minimal effect at higher air flow rates. This, however, could be a disadvantage if the fan and shutter were operated under windy outdoor conditions. Additional protection such as a discharge hood may be required to ensure proper operation of the shutter. The use of other control devices such as louvers, 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.

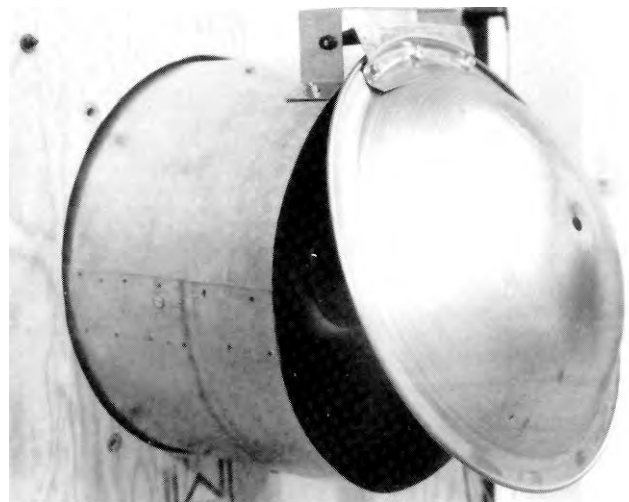


FIGURE 4. Shutter Located on Fan Discharge.

EASE OF OPERATION

Maintenance: No maintenance instructions were supplied. The absence of a protective fan inlet guard grill (see below) allowed easy access for fan cleaning.

OPERATOR SAFETY

There was no inlet guard grill provided. There was a caution sticker supplied that stated the fan be mounted at least 8 ft (2.4 m) above the floor or grade level. Because many wall mounted fans are usually mounted at less than 8 ft (2.4 m) above the floor or grade level, it is recommended that the manufacturer consider supplying an optional inlet guard grill that meets CSA standards.

It was observed that the motor mounts (FIGURE 6) did not adequately secure the motor in position. The motor mounts

consisted of five sheet metal brackets that bolted together around the circumference of the motor casing. The brackets generally did not hold the motor securely, which resulted in excessive motor vibration and creeping of the motor out of its mounts. It was also unclear where the motor was supposed to be positioned with respect to the housing and motor mounts. It is recommended that the manufacturer consider modifying the motor mounts to adequately secure the motor.

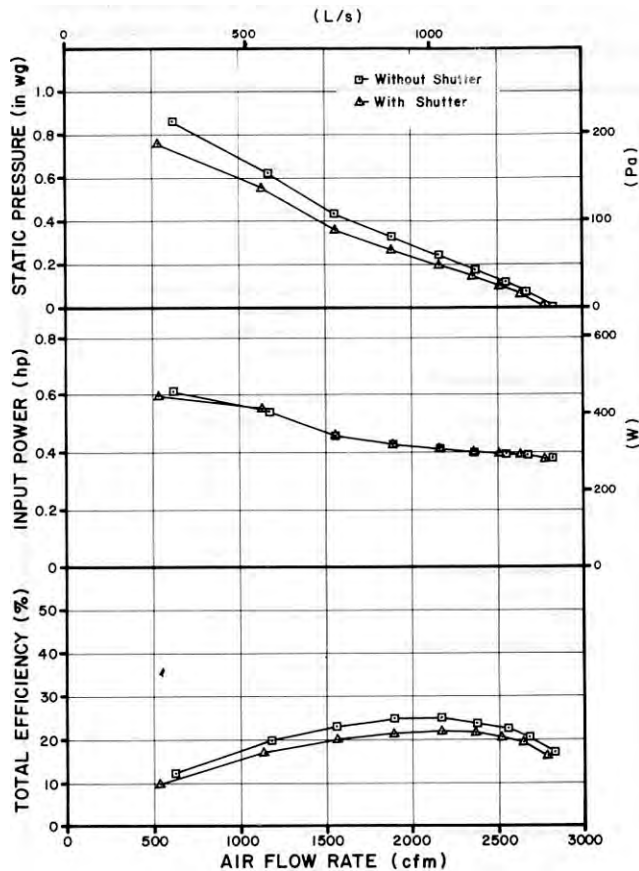


FIGURE 5. Effect of Shutter in KV18 Fan Performance when Operated in the Single Speed Mode.

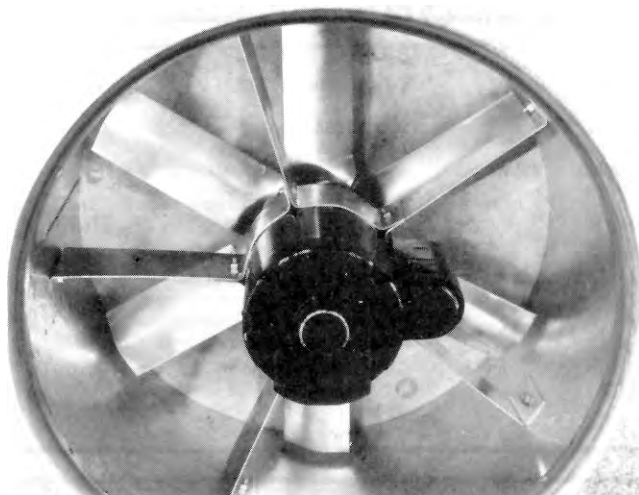


FIGURE 6. Inadequate Mounting of Motor.

The noise level³ of the Koenders KV18, while operating at 0.125 in wg (31.1 Pa) static pressure, was 76 dB(A). Higher noise levels could be expected if the fan was operated in the vicinity of other buildings. The Koenders KV18 falls within range 3 of the PAMI noise level range classification (APPENDIX II). The

³PAMI Test Procedure for Determining Fan Noise Level.

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

There was no operator's manual supplied. 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	
MAKE:	Koenders
MODEL:	KV18
SERIAL NUMBER:	22983
MANUFACTURER:	Koender's Sales & Service P.O. Box 171 Englefeld, Sask. S0K 1N0
OVERALL DIMENSIONS:	
- housing width	22.5 in (572 mm)
- housing height	22 in (559 mm)
- housing depth	
with insulated door	15 in (381 mm)
- housing diameter	18.1 in (460 mm)
PROPELLER:	
- diameter	17.5 in (445 mm)
- hub diameter	5.5 in (140 mm)
- number of blades	6
- blade angle	22°
WEIGHT:	49.5 lb (22.5 kg)
MOTOR NAMEPLATE DATA:	
- make	beeson
- model	A4P17NZ7A
- frame	N48Y
- class	B
- type	PN
- duty	air over
- rpm	1625
- service factor	1
- ambient temperature rise	40°C
- volts	115/230V
- amps	1.9/3.8 amps
- phase	1
- cycles	60 Hz
- horsepower	0.33 hp (249 W)

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 gauge (in wg) x 249.1	pascals (Pa)
pounds (lb) x 0.45	kilograms (kg)

SUMMARY CHART
KOENDERS MODEL KV18 VENTILATION FAN

RETAIL PRICE:	\$175.00 (March, 1984, f.o.b. Lethbridge)
FAN DESCRIPTION:	17.5 in (445 mm) propeller fan, variable speed, direct drive 0.33 hp (249 W) electric motor
FAN SPEED:	
- single speed	1713 to 1727 rpm
- variable	996 to 1075 rpm
EFFICIENCY RANGE:	
- without shutter	17 to 25%
- with shutter	16 to 22%
EFFICIENCY AT 0.125 in wg (31 Pa):	
- without shutter	22%
- with shutter	21%
AIR FLOW RATE:	
- range	1030 to 2830 cfm (484 to 1340 L/s)
- at 0.125 in wg (31 Pa)	2530 cfm (1200 L/s) without shutter and 2450 cfm (1160 L/s) with shutter
INPUT POWER:	0.24 to 0.42 hp (182 to 311 W)
OPERATOR SAFETY:	no inlet guard provided CSA approved noise level -- 76 dB(A)
OPERATOR'S MANUAL:	none supplied



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