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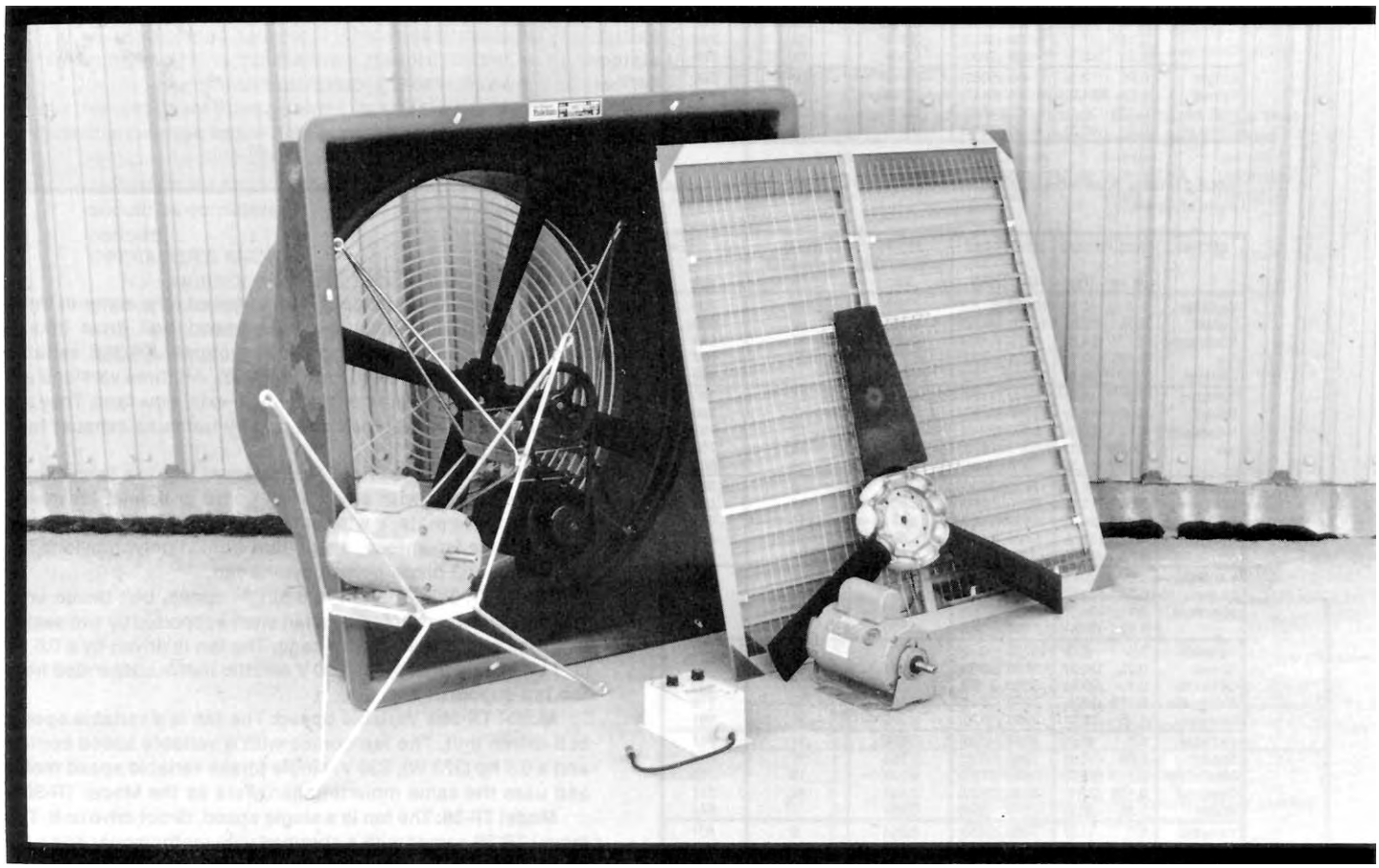
Evaluation Report 509



Prairie Pride TR-36 Series Ventilation Fans

A Co-operative Program Between

ALBERTA FARM MACHINERY RESEARCH CENTRE

PAMI
PRAIRIE AGRICULTURAL MACHINERY INSTITUTE

PRAIRIE PRIDE TR-36 SERIES VENTILATION FANS

MANUFACTURER AND DISTRIBUTOR:

Prairie Pride Enterprises Limited
217 - 79 Eagle Drive
Winnipeg, Manitoba
R2R 1V4

RETAIL PRICE:

TR36 - $1122.00 (June, 1987, f.o.b. Lethbridge, Alberta.)
TR36B - $920.00 (June, 1987, f.o.b. Lethbridge, Alberta.)
TR36BV- $990.00 (June, 1987, f.o.b. Lethbridge, Alberta.)

SUMMARY OF RESULTS

TABLE 1. Prairie Pride Model TR-36B Fan Performance at Typical Levels of Operation.

SETTING	STATIC PRESSURE in wg (Pa)	AIR FLOW RATE cfm (L/s)	POWER CONSUMPTION kW	TOTAL EFFICIENCY %	FAN SPEED rpm
Single Speed	0.0 (0.0)	10200 (4810)	0.998	14	800
	0.05 (12.5)	9290 (4380)	1.008	17	796
	0.1 (24.9)	8550 (4040)	0.986	19	797
	0.125 (31.1)	8100 (3823)	0.970	19	799
	0.25 (62.3)	4230 (2000)	0.984	14	795
Single Speed with no Louvres	0.05 (12.5)	11400 (5380)	0.978	30	796
	0.01 (24.9)	10900 (5140)	0.993	29	797
	0.125 (31.1)	10300 (4860)	0.991	24	796
	0.25 (62.3)	6030 (2850)	0.913	22	796

TABLE 2. Prairie Pride Model TR-36B Variable Speed Fan Performance at Typical Levels of Operation.

SETTING	STATIC PRESSURE in wg (Pa)	AIR FLOW RATE cfm (L/s)	POWER CONSUMPTION kW	TOTAL EFFICIENCY %	FAN SPEED rpm
Variable Speed Maximum; No Louvres	0.0 (0.0)	10900 (5140)	0.686	26	700
	0.05 (12.5)	10100 (4770)	0.678	29	698
	0.1 (24.9)	8770 (4140)	0.675	30	694
	0.125 (31.1)	8220 (3880)	0.668	30	697
	0.25 (62.3)	1680 (793)	0.674	7	689
Variable Speed Maximum	0.0 (0.0)	8840 (4170)	0.683	14	700
	0.05 (12.5)	8040 (3790)	0.667	17	700
	0.1 (24.9)	6800 (3210)	0.659	18	701
	0.125 (31.1)	6070 (2870)	0.652	18	703
	0.25 (62.3)	976 (461)	0.682	4	690
Variable Speed Mid-Range	0.0 (0.0)	7410 (3500)	0.622	9	587
	0.05 (12.5)	6340 (2990)	0.614	12	591
	0.1 (24.9)	4550 (2150)	0.601	11	603
	0.125 (31.1)	3160 (1490)	0.607	8	599
	0.25 (62.3)	259 (122)	0.635	1	584
Variable Speed Minimum	0.0 (0.0)	6170 (2910)	0.580	6	500
	0.05 (12.5)	4510 (2130)	0.557	7	509
	0.1 (24.9)	1520 (717)	0.560	3	500
	0.125 (31.1)	298 (141)	0.570	1	494
Variable Speed Optional Blade; No Louvres	0.0 (0.0)	10700 (5050)	0.588	28	722
	0.05 (12.5)	9860 (4650)	0.601	31	722
	0.1 (24.9)	8860 (4180)	0.599	33	719
	0.125 (31.1)	8140 (3840)	0.593	33	718
	0.25 (62.3)	2900 (1370)	0.662	13	691
Variable Speed Maximum Optional Blade	0.0 (0.0)	8540 (4030)	0.606	14	717
	0.05 (12.5)	7660 (3620)	0.598	17	711
	0.1 (24.9)	6600 (3120)	0.599	19	712
	0.125 (31.1)	5930 (2800)	0.603	19	711
	0.25 (62.3)	1070 (505)	0.687	4	674
Variable Speed Mid Range Optional Blade	0.0 (0.0)	7060 (3330)	0.555	9	601
	0.05 (12.5)	6280 (2960)	0.556	12	603
	0.1 (24.9)	4030 (1900)	0.575	10	591
	0.125 (31.1)	2710 (1280)	0.599	5	567
	0.25 (62.3)	381 (180)	0.637	1	530
Variable Speed Minimum Optional Blade	0.0 (0.0)	6620 (3120)	0.546	7	560
	0.05 (12.5)	5170 (2440)	0.539	9	557
	0.1 (24.9)	1850 (873)	0.562	4	490
	0.125 (31.1)	361 (170)	0.585	1	462

TABLE 3. Prairie Pride Model TR-36 Fan Performance at Typical Levels of Operation.

SETTING	STATIC PRESSURE in wg (Pa)	AIR FLOW RATE cfm (L/s)	POWER CONSUMPTION kW	TOTAL EFFICIENCY %	FAN SPEED rpm
Single Speed	0.0 (0.0)	10800 (5100)	1.060	16	845
	0.05 (12.5)	10200 (4810)	1.054	19	839
	0.1 (24.9)	9320 (4400)	1.056	21	839
	0.125 (31.1)	9000 (4250)	1.053	22	841
	0.25 (62.3)	5960 (2810)	1.055	19	839
Single Speed with no Louvres	0.05 (12.5)	11800 (5570)	1.080	30	827
	0.01 (24.9)	11400 (5380)	1.081	32	825
	0.125 (31.1)	11200 (5290)	1.082	33	824
	0.25 (62.3)	7180 (3390)	1.005	26	834

RECOMMENDATIONS

It is recommended that the manufacturer consider:

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

Station Manager: R. P. Atkins
Project Engineer: K. Shimek

THE MANUFACTURER STATES THAT

With regard to recommendation number:

1. We provide data for three static pressures (ie 0, 0.1 and 0.125 in wg). If more information is required then we refer to the complete PAMI report.
2. Wiring diagrams, service centre locations, installation and maintenance data will be supplied with each unit.

GENERAL DESCRIPTION

The Prairie Pride Model TR-36 series of fans come in three possible configurations; a single speed belt drive (model TR-36B), a variable speed belt drive (model TR-36B variable speed), and a direct drive (model TR-36). All three versions are 36 in (914 mm) diameter, propeller type axial flow fans. They are primarily used in livestock and poultry barns as exhaust fans located in the wall.

Each of the Prairie Pride TR-36 series of fans is a flush mounted unit equipped with a wire inlet guard grill, inlet louvres, a mounting face plate, a wire outlet guard grill, integral molded polyethylene fan shroud, a standard 4 blade polypropylene fan and optional 3 blade polypropylene fan.

Model TR.36B: The fan is a single speed, belt driven unit. The fan blade is mounted on a fan shaft supported by two sealed bearings on a chromed wire cage. The fan is driven by a 0.5 hp (373 W), single phase, 115/230 V electric motor suspended from the fan support.

Model TR-36B Variable Speed: The fan is a variable speed, belt driven unit. The fan comes with a variable speed control and a 0.5 hp (373 W), 230 V, single phase variable speed motor and uses the same mounting hardware as the Model TR-36B.

Model TR-36: The fan is a single speed, direct drive unit. The model TR-36 comes with a chromed wire motor mount and a 0.9 hp (671 W), 230 V, single phase motor.

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

SCOPE OF TEST

The Prairie Pride Model TR-36 series fans were 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 fans 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 all three models. With the Triac 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 louvres on fan performance for the Model TR-36B and Model TR-36 was determined in the single speed

mode. For the Model TR-36B Variable Speed the effect was determined at the variable speed maximum setting.

The effect on performance of the optional three blade fan was determined for the Model TR-36B Variable Speed only at maximum, mid-range and minimum speed settings.

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

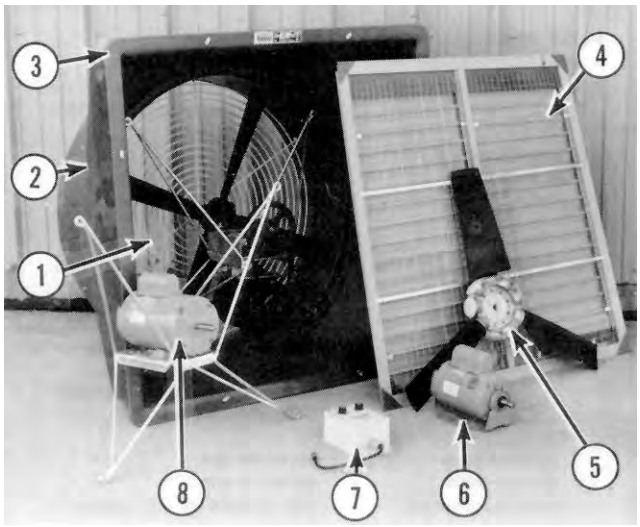


FIGURE 1. Prairie Pride Model TR-36B Ventilation Fan: (1) Outlet Guard Grill, (2) Polyethylene Housing, (3) Mounting Face Plate, (4) Inlet Guard Grill and Louvres, (5) Optional 3-Wing Fan, (6) Optional Variable Speed Motor, (7) Optional Variable Speed Control, (8) Optional Direct Drive Motor and Motor Mount.

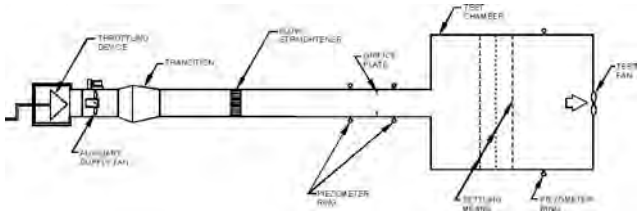


FIGURE 2. Schematic of Fan Test Apparatus - Inlet Chamber Setup.

RESULTS AND DISCUSSION

FAN PERFORMANCE

All fan performance results in this report are given at standard air[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.

Model TR-36B Belt Drive Fan

Air Flow Rate: Air flow rates at typical levels of operation (i.e. static pressure[2]) are given in TABLE 1. Ventilation fans are often rated on their ouput at a static pressure of 0.125 in wg (31.1 Pa). PAMI's measured flow rate at this condition was 8100 cfm (3820 L/s). There was no manufacturer's 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.

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.

[1]Standard air is air with a density of 0.075 lbm/ft^3 (1.2 kg/m^3) which occurs at 68°F (20°C), 50% relative humidity and a barometric pressure pressure of 29.92 in Hg (101.325 kPa).

[2]Static pressure is a measure of the 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).

For typical levels of static pressure (TABLE 1), the power consumption varies from 0.970 to 1.008 kW. The maximum amperage drawn by the motor was 5.27 amps, which was greater than the rated motor amperage of 5.06 amps but within the +- 10% allowable limit established by CSA Standards.

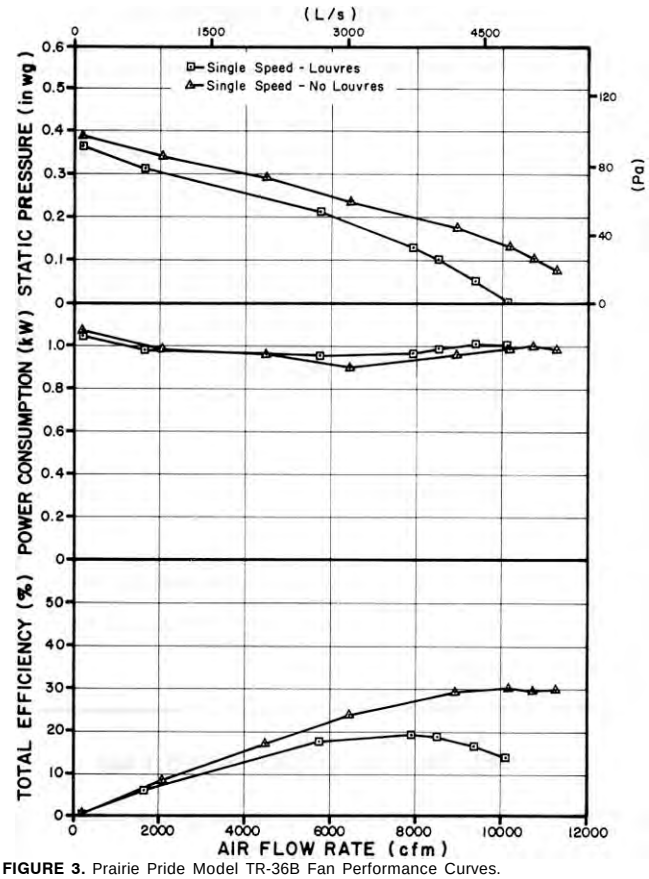


FIGURE 3. Prairie Pride Model TR-36B Fan Performance Curves.

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 14 to 19%. The total efficiency at a static pressure of 0.125 in wg (31.1 Pa) was 19%.

Effect of Louvres: The louvres were removed from the inlet side of the fan to determine their effect on fan output. Removing the louvres increased the air flow rate by 23 to 43% (FIGURE 3) over the typical range of operation. For example, at a static pressure of 0.125 in wg (31.1 Pa), the louvres increased the air flow rate by 27%, from 8100 to 10300 cfm (3820 to 4860 L/s) (TABLE 1). The efficiency increased from 19 to 24%.

Model TR-36B Variable Speed Fan

Air Flow Rate: Reducing the fan speed, greatly reduced the air flow rate for a given static pressure. 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 6070 cfm (2870 L/s) to 3160 cfm (1490 L/s) to 298 cfm (141 L/s), respectively. Air flow rates at typical levels of operation are given in TABLE 2.

Power Consumption: For typical levels of static pressure (TABLE 2), the power consumption varied from 0.652 to 0.683 kW at maximum speed, from 0.601 to 0.635 kW at mid range and from 0.560 to 0.580 kW at minimum speed. The maximum amperage drawn by the motor was 3.4 amps, which was greater than the rated motor amperage of 2.5 amps plus the 10% allowable limit established by CSA standards. The shaded zone in FIGURE 4 illustrates operating levels where the rated motor amperage was exceeded. Prolonged operation in excess of the rated amperage could reduce motor life.

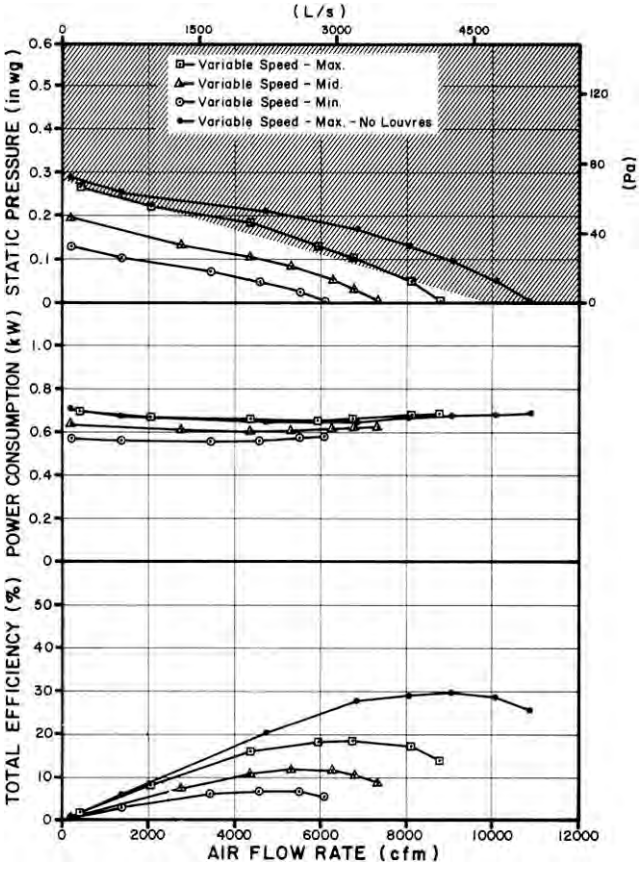


FIGURE 4. Prairie Pride Model TR-36B Variable Speed Fan Performance Curves at Three Speed Settings in the Variable Speed Mode.

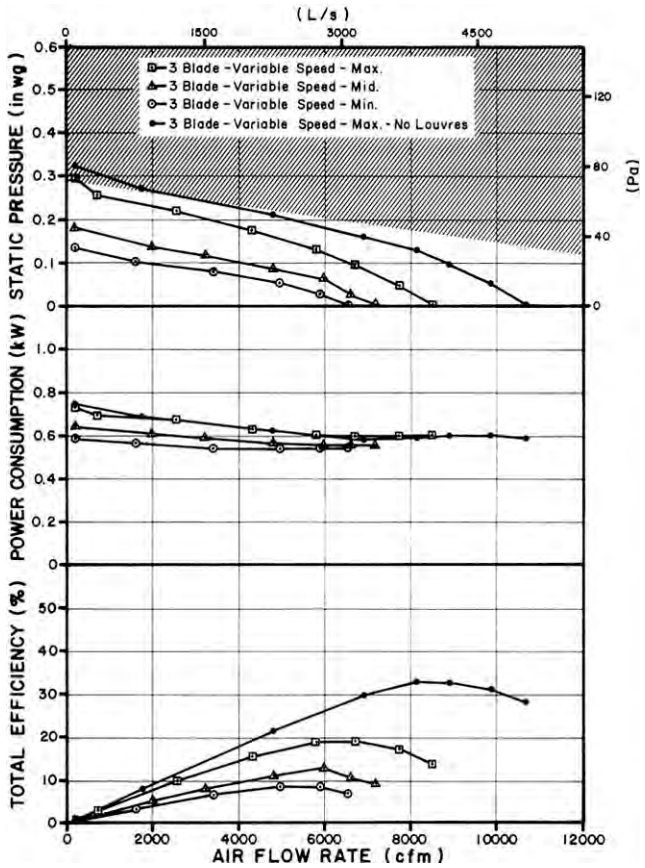


FIGURE 5. Prairie Pride Model TR-36B Variable Speed Fan Performance Curves with Optional Three Wing Fan.

Total Efficiency: For typical levels of operation, the total efficiency (TABLE 2), using the variable speed control, ranged from 4 to 18% at maximum speed, 8 to 12% at mid range and 1 to 7% at minimum speed. The total efficiency at variable speed maximum at a static pressure of 0.125 in wg (31.1 Pa) was 18%.

Effect of Optional Three Blade Fan: The fan was tested with the three blade fan at the three variable speed settings. Fan output from the standard blade and optional blade were similar (FIGURES 4 and 5). For example, at a static pressure of 0.125 in wg (31.1 Pa) at variable speed maximum, the air flow rate for the standard blade was 6070 cfm (2870 L/s) while for the three blade fan the rate was 5930 cfm (2800 L/s), a difference of 2%. The efficiencies were 18 and 19%, respectively.

Effect of Louvres: The intake louvres were removed from the intake side of the fan to determine their effect on fan output. The fan was tested under these conditions in the variable speed maximum mode for both the standard fan and the optional three blade fan. Removing the louvres increased the air flow rate by 23 to 72% (FIGURE 4) over the typical range of operation. For example at a static pressure of 0.125 in wg (31.1 Pa), removing the louvres increased air flow rate by 35%, from 6070 to 8220 cfm (2870 to 3880 L/s) (TABLE 2). The efficiency increased from 18 to 30%. Similar results were achieved for the optional three blade fan.

Model TR-36 Direct Drive Fan

Air Flow Rate: Air flow rates at typical levels of operation are given in TABLE 3. PAMI'S measured flow rate at 0.125 in wg (31.1 Pa) was 9000 cfm (4250 L/s).

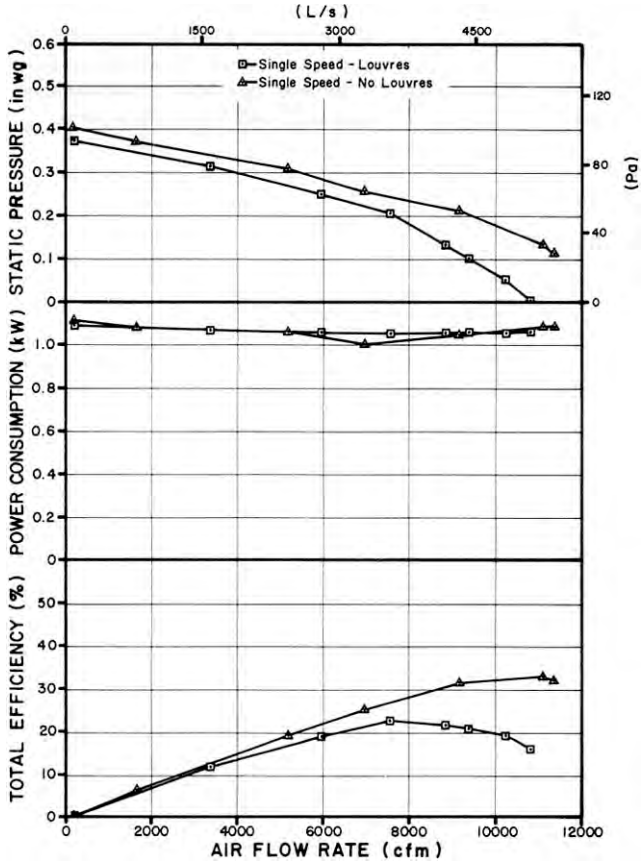


FIGURE 6. Prairie Pride Model TR-36 Fan Performance Curves.

Power Consumption: For typical levels of static pressure (TABLE 3), the power consumption varied from 1.053 to 1.060 kW. The maximum amperage drawn by the motor was 4.9 amps, which was less than the rated motor amperage of 5.2 amps.

Total Efficiency: For typical levels of operation, the total efficiency (TABLE 3), ranged from 16 to 22%. The total efficiency at a static pressure of 0.125 in wg (31.1 Pa) was 22%.

Effect of Louvres: The louvres were removed from the inlet side of the fan to determine their effect on fan output. Removing

the louvres increased the air flow rate by 16 to 24% (FIGURE 6) over the typical range of operation. For example, at a static pressure of 0.125 in wg (31.1 Pa), the louvres increased the air flow rate by 24%, from 9000 to 11200 cfm (4250 to 5290 L/s) (TABLE 3). The efficiency in turn increased from 22 to 33%.

EASE OF OPERATION

Maintenance: No maintenance instructions were supplied. The inlet guard grill and louvres were easily removed. This made for easy access for cleaning the housing and fan blades. Regularly scheduled cleaning and maintenance will ensure longer motor life and optimum performance.

OPERATOR SAFETY

The inlet and outlet guard grills provided adequate protection from the fan blades. The variable speed and direct drive motors were totally enclosed units while the single speed motor was a drip proof unit. None of the motors presented any safety hazards. The Prairie Pride TR-36 series of fans were CSA approved.

The noise level of the Prairie Pride series TR-36 fans, 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 85 dB(A). Higher noise levels could be expected if the fan was operated in the vicinity of other buildings. The Prairie Pride series TR-36 fans fall 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 blower for prolonged periods.

OPERATOR'S MANUAL

No operator's manual was supplied. It is recommended that the manufacturer supply a detailed manual containing illustrations and information on general operation, maintenance, rated performance, safety aspects and trouble shooting.

MANUFACTURER:	Prairie Pride Enterprises Ltd. 217 - 79 Eagle Drive Winnipeg, Manitoba R2R 1V4
OVERALL DIMENSIONS:	
- housing and flange height	44.75 in (1137 mm)
- housing and flange width	44.5 in (1130 mm)
- housing depth at top	30.0 in (762 mm)
- housing depth at bottom	25.5 in (648 mm)
- housing dimensions	41.0 in (1041 mm) by 41.0 in (1041 mm)
- inside tube diameter	36.75 in (933 mm)
- inlet guard grill dimensions	42.0 in (1067 mm) by 42.0 in (1067 mm)
- inlet grill opening	0.06 in (2 mm) diameter wire on 1.0 in (25 mm) grid
- outlet guard grill diameter	35.0 in (889 mm)
- outlet grill opening	0.250 in (6 mm) diameter wire spaced at 1.0 in (25 mm)

IMPELLERS:	**Standard**	**Optional 3-blade**
- impeller diameter	36.0 in (914 mm)	36.0 in (914 mm)
- hub diameter	5.25 in (133 mm)	8.25 in (210 mm)
- number of blades	4	3
- blade angle	variable - 47° at hub to 13° at tip	variable - 44° at hub to 20° at tip

WEIGHT: (Model TR-36B, standard blade) 93.0 lb (42 kg)

MOTOR NAMEPLATE DATA:	**Model TR-36B Belt Drive**	**Model TR-36B Variable Speed**	**Model TR-36 Direct**
make	Leeson	Leeson	Leeson
model	M6C17FB11B	A4P17NJ2A	U6PBNB1A
frame	D56	RS56	H56HZ
class	B*	B*	F
type	CF	PN	PN
code	M	C	A
design	N		
duty	Cont.	Air Over	Air Over
rpm	1725	1625	850
service factor	1.15	1.0	1.0
ambient temperature rise	40°	40°	40°
volts	115/208/230	115/230	230
amps	8.8/4.4	5.0/2.5	5.2
phase	1	1	1
cycles	60	60	60
horsepower	0.5 hp (0.375 kW)	0.5 hp (0.375 kW)	0.9 hp (0.675 kW)

APPENDIX I

SPECIFICATIONS

MAKE:	Prairie Pride
MODEL:	TR-36B, TR-36B Variable Speed, TR-36
SERIAL NUMBER:	018766

APPENDIX II

NOISE LEVEL 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 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
PRAIRIE PRIDE TR-36 SERIES
VENTILATION FANS

MODEL TR-36B BELT DRIVE FAN

RETAIL PRICE:	$920.00 (June, 1987, f.o.b. Lethbridge)
FAN DESCRIPTION:	36.0 in (914 mm) propeller fan, single speed, belt drive, 0.5 hp (0.373 kW), electric motor.
FAN PERFORMANCE:	
Air Flow Rate:	
- range	4230 to 10200 cfm (2000 to 4810 L/s)
- at 0.125 in wg (31.1 Pa)	8100 cfm (3820 L/s) with inlet louvres 10300 cfm (4860 L/s) without inlet louvres
Fan Speed:	795 to 800 rpm
Power Consumption:	0.970 to 1.008 kW
Efficiency Range:	
- with louvres	14 to 19%
- without louvres	22 to 30%
Efficiency at 0.125 in wg (31.1 Pa):	
- with louvres	19%
- without louvres	24%
OPERATOR SAFETY:	inlet and outlet guards provided CSA approved noise level = 85 dB(A) at 4.9 ft (1.5 m) from fan inlet
OPERATOR'S MANUAL:	none supplied

MODEL TR-36B DIRECT DRIVE FAN

RETAIL PRICE:	$1122.00 (June, 1987, f.o.b. Lethbridge)
FAN DESCRIPTION:	36.0 in (914 mm) propeller fan, single speed, direct drive, 0.9 hp (0.671 kW), electric motor.
FAN PERFORMANCE:	
Air Flow Rate:	
- range	5960 to 10800 cfm (2810 to 5100 L/s)
- at 0.125 in wg (31.1 Pa)	9000 cfm (4250 L/s) with inlet louvres 11200 cfm (5290 L/s) without inlet louvres
Fan Speed:	839 to 845 rpm
Power Consumption:	1.053 to 1.082 kW
Efficiency Range:	
- with louvres	16 to 22%
- without louvres	26 to 33%
Efficiency at 0.125 in wg (31.1 Pa):	
- with louvres	22%
- without louvres	33%

MODEL TR-36B VARIABLE SPEED FAN

RETAIL PRICE:	$990.00 (June, 1987, f.o.b. Lethbridge)
FAN DESCRIPTION:	36.0 in (914 mm) propeller fan, variable speed, belt drive, 0.5 hp (0.373 kW), electric motor.
FAN PERFORMANCE:	
Air Flow Rate:	
- range	259 to 8840 cfm (122 to 4170 L/s) with standard blade 361 to 8540 cfm (170 to 4030 L/s)
- at 0.125 in wg (31.1 Pa)	6070 cfm (2870 L/s) with standard blade and inlet louvres 10900 cfm (5140 L/s) with standard blade and without inlet louvres 5930 cfm (2800 L/s) with optional blade and inlet louvres 8140 cfm (3840 L/s) with optional blade and without louvres
Fan Speed:	
- standard blade	494 to 703 rpm
- optional blade	462 to 712 rpm
Power Consumption:	0.557 to 0.686 kW with standard blade 0.539 to 0.687 kW with optional blade
Efficiency Range:	
- standard blade	
- with louvres	1 to 18%
- without louvres	7 to 30%
- optional blade	
- with louvres	1 to 19%
- without louvres	13 to 33%
Efficiency at 0.125 in wg (31.1 Pa):	
- standard blade	
- with louvres	18%
- without louvres	30%
- optional blade	
- with louvres	19%
- without louvres	33%

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