

Evaluation Report

552



Midwest 5 HP Centrifugal Fan

A Co-operative Program Between



MIDWEST 5 HP CENTRIFUGAL FAN

MANUFACTURER:

REM Manufacturing Limited
P.O. Box 1207
Swift Current, Saskatchewan
S9H 3X4

DISTRIBUTOR:

REM Manufacturing Limited
P.O. Box 1207
Swift Current, Saskatchewan
S9H 3X4

United Farmers of Alberta Cooperative Limited
1016 - 68 Ave. S.W.
Calgary, Alberta
T2V 4J2

Saskatchewan Wheat Pool
Wheat Pool Building
2625 Victoria Ave.
Regina, Saskatchewan
S4T 7T9

RETAIL PRICE:

\$1,285.00 (December, 1987 f.o.b. Lethbridge, Alberta).

SUMMARY OF RESULTS

TABLE 1. Midwest 5 hp Centrifugal Fan Performance at Typical Levels of Operation

Static Pressure		Air Flow Rate		Input Power	Total Efficiency	Fan Speed
in wg	(Pa)	cfm	(L/s)	kW	%	rpm
1	(249)	4430	(2090)	7.12	25	3512
2	(498)	4240	(2000)	7.20	30	3507
3	(747)	4100	(1940)	7.21	34	3506
4	(996)	3920	(1850)	7.17	38	3504
5	(1250)	3690	(1740)	7.09	41	3503
6	(1490)	3450	(1630)	6.97	42	3503
7	(1740)	3200	(1510)	6.84	45	3506
8	(1990)	2980	(1410)	6.71	46	3505
9	(2240)	2760	(1300)	6.67	48	3507
10	(2490)	2520	(1190)	6.40	49	3510
11	(2740)	2200	(1040)	6.08	48	3516
12	(2990)	1720	(812)	5.43	45	3527
13	(3240)	1050	(496)	4.10	28	3543
14	(3490)	161	(76)	3.08	7	3563

RECOMMENDATIONS

It is recommended that the manufacturer consider:

1. Supplying a table or curve of air flow rates over a complete range of static pressures.
2. Supplying a detailed operator's manual containing information on maintenance, installation, rated performance, safety aspects and trouble shooting.

Station Manager: R. P. Atkins

Project Engineer: K. Shimek

THE MANUFACTURER STATES THAT

With regard to recommendation number:

1. A graph of air flow rates over a complete range of static pressures will be contained in each operators manual.
2. Detailed operators manuals will be supplied with each blower. They will contain a general description, installation, operation, and safety, maintenance, parts numbers and identification, specifications, performance data, and warranty information.

GENERAL DESCRIPTION

The Midwest 5 hp centrifugal fan is a 15.5 in (394 mm) diameter, single speed, direct drive, centrifugal flow fan. It is primarily used for grain aeration or grain drying systems.

The Midwest 5 hp centrifugal fan is equipped with a wire mesh guard grill, an inlet bell and motor control. The aluminium impeller consists of a hub backplate, 9 backward curved blades and a flange. The impeller is directly mounted on the 5 to 7 hp (3.73 to 5.22 kW), single phase, 230 V electric motor. The fan housing, motor mounts, and supports 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.

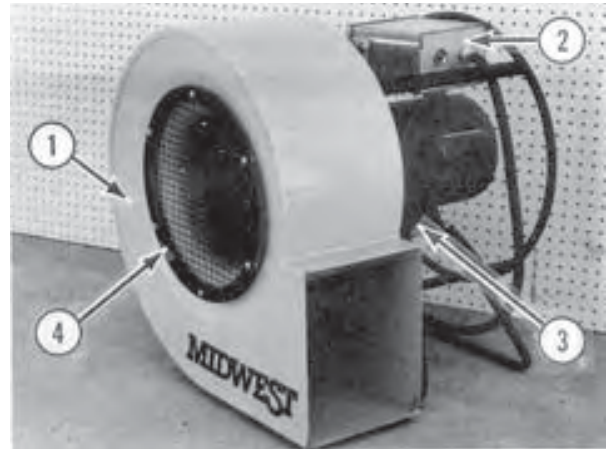


FIGURE 1. Midwest 5 hp Centrifugal Fan: (1) Fan Housing, (2) Motor Control, (3) Motor Mount, (4) Inlet Bell and Guard Grill.

SCOPE OF TEST

The Midwest 5 hp centrifugal fan 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.

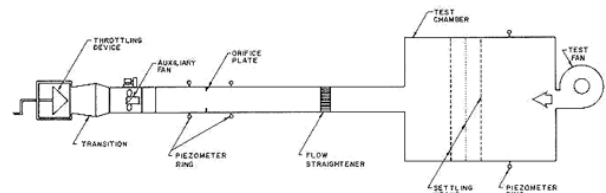


FIGURE 2. Schematic Fan Test Apparatus - Outlet Chamber Setup.

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 at typical levels of operation (i.e. static pressure²) are given in TABLE 1. The air flow rate ranged from 161 cfm (76 L/s) at 14 in wg (3490 Pa) to 4430 cfm (2090 L/s) at 1.0 in wg (249 Pa). FIGURE 3 illustrates the fan performance curves for the Midwest 5 hp centrifugal 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 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 upon the point of operation of the fan. The power consumption varied from 3.08 kW at maximum static pressure and minimum air flow rate to 7.21 kW at 3.0 in wg (747 Pa) static pressure and an air flow rate of 4100 cfm (1940 L/s). The maximum amperage drawn by the motor was 32.3 amps, which was less than the rated motor amperage of 35 amps.

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).

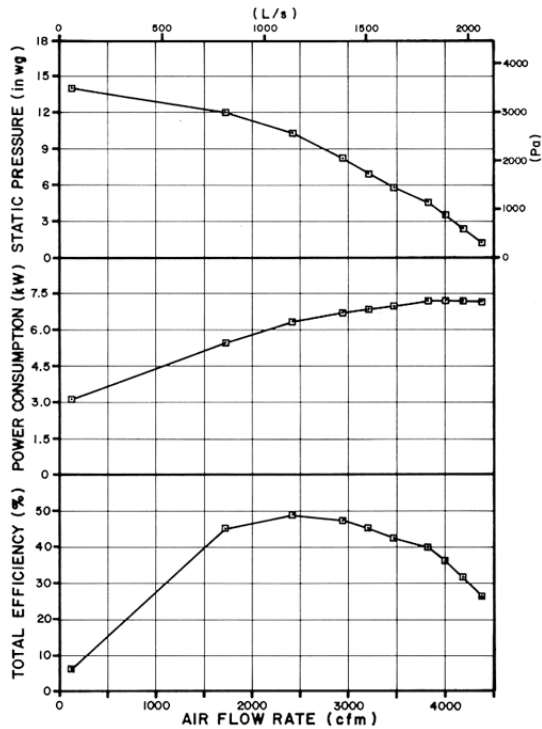


FIGURE 3. Midwest 5 hp Centrifugal Fan Performance Curves.

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 7 to 49%. The maximum total efficiency of 49% occurred at 2520 cfm (1190 L/s) at a static pressure of 10.0 in wg (2490 Pa).

EASE OF OPERATION

Maintenance: The inlet screen was easily removed which allowed for cleaning of the wheel and fan housing. No other maintenance was required.

OPERATOR SAFETY

The guard grill provided adequate protection from the fan blades. The motor was a totally enclosed unit and presented no safety hazards. CSA approval was pending at the time of the test.

The noise level of the Midwest 5 hp centrifugal fan, at a distance of 4.9 ft (1.5 m) from the centre of the fan inlet, while operating at a 1 in wg (249 Pa) static pressure, was 96 dB(A). Higher noise levels could be expected if the fan was operated in the vicinity of other buildings. The Midwest 5 hp centrifugal fan falls within range 4 of the PAMI noise level range classification (APPENDIX II). The noise level produced could damage hearing, depending on exposure time. Ear protection is definitely recommended.

OPERATOR'S MANUAL

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

APPENDIX I SPECIFICATIONS	
MAKE:	Midwest
MODEL:	5 hp
SERIAL NUMBER:	N/A
MANUFACTURER:	REM Manufacturing Limited P.O. Box 1207 Swift Current, Saskatchewan S9H 3X4
OVERALL DIMENSIONS:	<ul style="list-style-type: none"> -- housing width 22.75 in (578 mm) -- housing depth 23.0 in (584 mm) -- housing height 24.75 in (629 mm) -- inlet bell diameter 9.63 in (244 mm) -- guard grill diameter 13.75 in (349 mm) -- grill opening 0.063 in (2 mm) diameter wire spaced at 0.5 in (13 mm)
IMPELLER:	<ul style="list-style-type: none"> -- diameter 15.5 in (394 mm) -- inside flange diameter 10.0 in (254 mm) -- number of blades 9 -- blade angle 45°
WEIGHT:	159 lb (72 kg)
MOTOR NAMEPLATE DATA:	<ul style="list-style-type: none"> -- make Baldor -- specifications 36F550-3027 -- frame 182 TZ -- class F -- code M -- design L -- duty Continuous -- rpm 3450 -- service factor 1.0 -- ambient temperature rise 40°C -- volts 230 -- amps 35 -- phase 1 -- cycles 60 -- horsepower 5 - 7 hp (3.73 - 5.22 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	= millimeters (mm)
inches water gauge (in wg) x 249.1	= pascals (Pa)
pounds (lb) x 0.45	= kilograms (kg)

SUMMARY CHART MIDWEST 5 HP CENTRIFUGAL FAN	
RETAIL PRICE:	\$1,285.00 (December, 1987, f.o.b. Lethbridge)
FAN DESCRIPTION:	15.5 in (394 mm) single speed, direct drive, 5 to 7 hp (3.73 to 5.22 kW) 230 V electric motor
FAN PERFORMANCE:	
Air Flow Rate:	
-range	161 to 4430 cfm (76 to 2090 L/s)
-at maximum efficiency	2520 cfm (1190 L/s) at a 10.0 in wg (2490 Pa) static pressure
Power Consumption:	3.08 to 7.21 kW
Total Efficiency:	maximum 49%
OPERATOR SAFETY:	guard grill provided awaiting GSA approval noise level = 96 dB(A) at 4.9 ft (1.5 m) from fan inlet
OPERATOR'S MANUAL:	none supplied

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
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