

Evaluation Report

551



Midwest 3 HP Centrifugal Fan

A Co-operative Program Between



MIDWEST 3 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:

\$985.00 (December, 1987 f.o.b. Lethbridge, Alberta).

SUMMARY OF RESULTS

TABLE 1. Midwest 3 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
0.75	(187)	3400	(1610)	4.61	22	3451
1	(249)	3370	(1590)	4.62	23	3447
2	(498)	3220	(1520)	4.71	29	3436
3	(747)	3060	(1440)	4.77	33	3430
4	(996)	2890	(1360)	4.79	37	3422
5	(1250)	2700	(1270)	4.77	41	3420
6	(1490)	2500	(1180)	4.70	43	3423
7	(1740)	2290	(1080)	4.60	46	3424
8	(1990)	2060	(972)	4.43	46	3434
9	(2240)	1770	(835)	4.18	46	3445
10	(2490)	1370	(647)	3.74	44	3464
11	(2740)	771	(364)	2.92	34	3503
11.7	(2910)	186	(88)	1.91	13	3542

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 3 hp centrifugal fan is a 15 in (381 mm) diameter, single speed, direct drive, centrifugal flow fan. It is primarily used for grain aeration or grain drying systems.

The Midwest 3 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 3 to 4.5 hp (2.24 to 3.36 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.

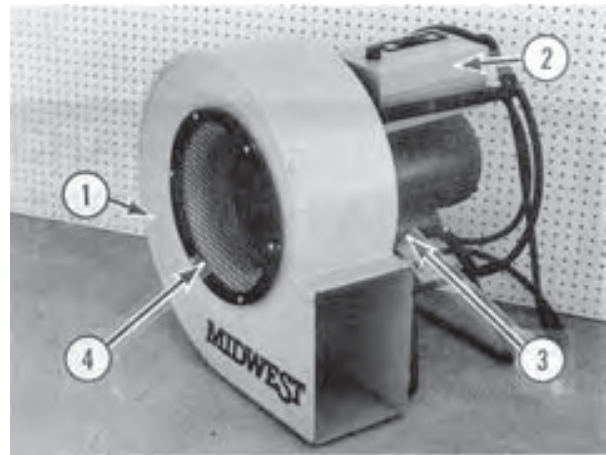


FIGURE 1. Midwest 3 hp Centrifugal Fan: (1) Fan Housing, (2) Motor Control, (3) Motor Mount, (4) Inlet Bell and Guard Grill.

SCOPE OF TEST

The Midwest 3 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.

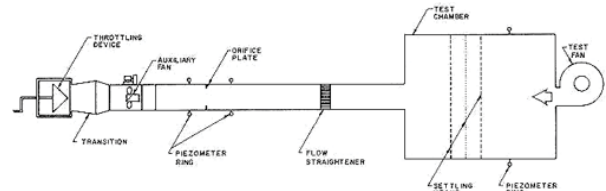


FIGURE 2. Schematic Fan Test Apparatus - Outlet Chamber Setup.

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 186 cfm (88 L/s) at 11.7 in wg (2910 Pa) to 3400 cfm (1610 L/s) at 0.75 in wg (187 Pa). FIGURE 3 illustrates the fan performance curves for the Midwest 3 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 1.91 kW at maximum static pressure and minimum air flow rate to 4.79 kW at 4.0 in wg (996 Pa) static pressure and an air flow rate of 2890 cfm (1360 L/s). The maximum amperage drawn by the motor was 21 amps, which was less than the rated motor amperage of 22 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 k Pa).

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).

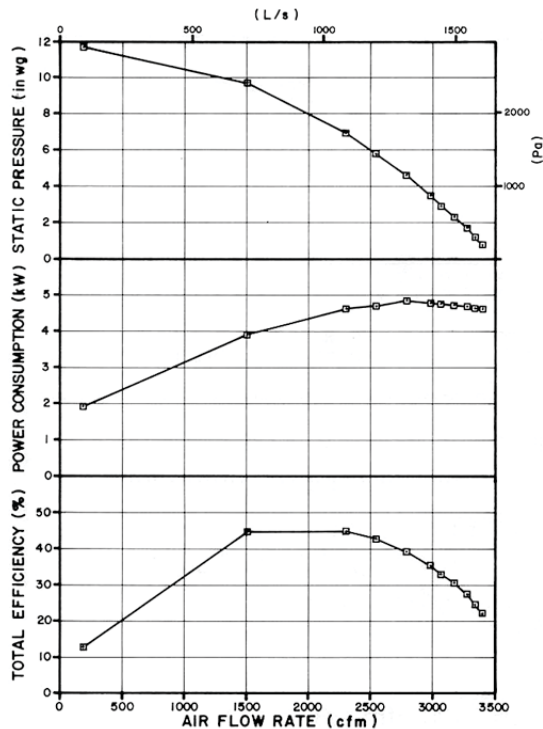


FIGURE 3. Midwest 3 hp Centrifugal Fan Performance Curves.

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 13 to 46%. The maximum total efficiency of 46% occurred at 2060 cfm (972 L/s) at a static pressure of 8.0 in wg (1990 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 3 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 94 dB(A). Higher noise levels could be expected if the fan was operated in the vicinity of other buildings. The Midwest 3 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:	3 hp
SERIAL NUMBER:	N/A
MANUFACTURER:	REM Manufacturing Limited P.O. Box 1207 Swift Current, Saskatchewan S9H 3X4
OVERALL DIMENSIONS:	
-- housing width	21.5 in (546 mm)
-- housing depth	23.0 in (584 mm)
-- housing height	24.75 in (629 mm)
-- inlet bell diameter	9.62 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)
-- discharge opening	7.8 in (200 mm) by 11.0 in (279 mm)
IMPELLER:	
-- diameter	15 in (381 mm)
-- inside flange diameter	9.75 in (248 mm)
-- number of blades	9
-- blade angle	43°
WEIGHT:	138 lb (63 kg)
MOTOR NAMEPLATE DATA:	
-- make	Baldor
-- specifications	36F549-2510
-- frame	182Z
-- class	F
-- code	F
-- design	L
-- duty	Continuous
-- rpm	3450
-- service factor	1.0
-- ambient temperature rise	40°C
-- volts	230
-- amps	22
-- phase	1
-- cycles	60
-- horsepower	3 - 4.5 hp (2.24 - 3.36 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 3 HP CENTRIFUGAL FAN**

RETAIL PRICE:	\$985.00 (December, 1987, f.o.b. Lethbridge)
FAN DESCRIPTION:	15 in (381 mm) single speed, direct drive, 3 to 4.5 hp (2.24 to 3.36 kW) 230 V electric motor
FAN PERFORMANCE:	
Air Flow Rate:	
-range	186 to 3400 cfm (88 to 1610 L/s)
-at maximum efficiency	2060 cfm (972 L/s) at a 8.0 in.wg (1990 Pa) static pressure
Power Consumption:	1.91 to 4.79 kW
Total Efficiency:	maximum 46%
OPERATOR SAFETY:	guard grill provided awaiting CSA approval noise level = 94 dB(A) at 4.9 ft (1.5 m) from fan inlet
OPERATOR'S MANUAL:	none supplied



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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