

# Evaluation Report

# 533



## Denouden Model ILC21/18-312 Aeration Fan

A Co-operative Program Between



# DENOUDEN MODEL ILC21118-312 AERATION FAN

## MANUFACTURER:

Caldwell Manufacturing Company  
 P.O. Box 338  
 Kearney, Nebraska  
 U.S.A. 68848

## DISTRIBUTOR:

Denouden Agri  
 559 Park St.  
 Regina, Saskatchewan  
 S4N 5B2

## RETAIL PRICE:

\$1149.00 (May, 1987, f.o.b. Lethbridge, Alberta).

## SUMMARY OF RESULTS

TABLE 1. Denouden Model ILC21/18-312 Fan Performance at Typical Levels of Operation

Static Pressure		Air Flow Rate		Power Consumption	Total Efficiency	Fan Speed
in wg	(Pa)	cfm	(L/s)	kW	%	rpm
0.5	(125)	4150	(1960)	2.78	15	3544
1.0	(249)	4050	(1910)	2.92	21	3539
1.5	(374)	3940	(1860)	3.07	27	3535
2.0	(498)	3840	(1810)	3.20	32	3530
2.5	(623)	3740	(1760)	3.33	36	3526
3.0	(747)	3630	(1710)	3.46	40	3522
3.5	(872)	3520	(1660)	3.58	43	3518
4.0	(996)	3400	(1600)	3.69	45	3514
4.5	(1120)	3270	(1540)	3.80	47	3511
5.0	(1250)	3120	(1470)	3.90	49	3508
5.5	(1370)	2970	(1400)	3.97	50	3506
6.0	(1490)	2820	(1330)	4.02	51	3504
6.5	(1620)	2660	(1260)	4.04	51	3504
7.0	(1740)	2070	(977)	3.82	48	3512
7.5	(1870)	1340	(632)	2.99	35	3535
8.0	(1990)	543	(256)	2.07	14	3558
8.2	(2040)	224	(106)	2.01	10	3560

## 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.

Station Manager: R. P. Atkins

Project Engineer: K. Shimek

## THE MANUFACTURER STATES THAT

With regard to recommendation number:

1. "The PAMI air flow performance results correspond with the manufacturer's design performance. The PAMI information can be used for determining the application of the fan. For future production, manuals will include a separate sheet to provide specific information on the installation and operation for the ILC21/18-312."

## GENERAL DESCRIPTION

The Denouden Model ILC21/18-312 fan is a 15.375 in (391 mm) diameter, single speed, direct drive, inline centrifugal flow fan. It is primarily used for grain aeration or grain drying systems.

The Denouden Model ILC21/18-312 fan is equipped with a steel housing that forms a transition from a 24 in inlet to an 18 in outlet. The fan also has a wire mesh guard grill, an inlet bell, duct mounting flange and motor control. The aluminium impeller consists of a hub backplate, 9 backward curved blades and a shroud. The impeller is directly mounted on the 3 hp (2.24 kW), single phase, 230 V electric motor. The fan housing, motor mounts, straightening vanes, angles and supports are of steel construction with a painted finish for corrosion protection.

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

## SCOPE OF TEST

The Denouden Model ILC21/18-312 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.

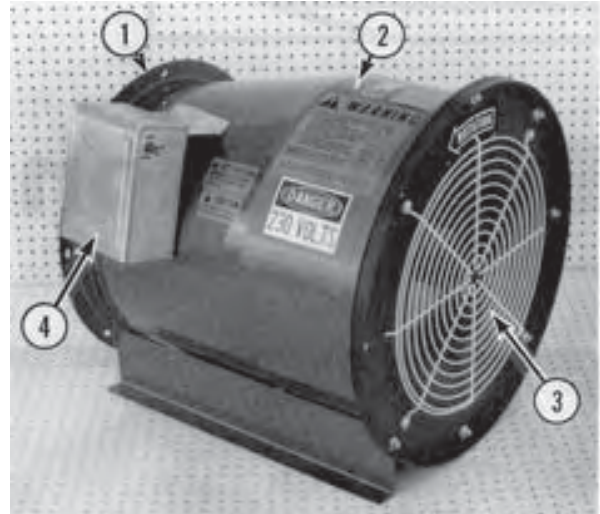


FIGURE 1. Denouden Model ILC21/18-312 Aeration Fan: (1) Mounting Flange, (2) Fan Housing, (2) Guard Grill and Inlet Bell, (3) Motor Control.

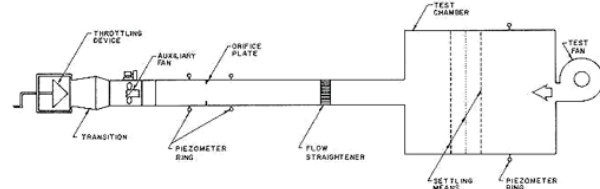


FIGURE 2. Schematic of Fan Test Apparatus - Outlet Chamber Setup.

## RESULTS AND DISCUSSION

### FAN PERFORMANCE

All fan performance results in this report are given at standard air<sup>1</sup> 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 pressure<sup>2</sup>) are given in TABLE 1. The air flow rate ranged from 224 cfm (106 L/s) at 8.2 in wg (2040 Pa) to 4150 cfm (1960 L/s) at 0.5 in wg (125 Pa). FIGURE 3 illustrates the fan performance curves for the Denouden Model ILC21/18-312 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 2.01 kW at maximum static pressure and minimum air flow rate to 4.04 kW at 6.5 in wg (1620 Pa) static pressure and an air flowrate of 2660 cfm (1260 L/s). The maximum amperage drawn by the motor was 16.45 amps, which was greater than the rated motor amperage of 16.0 amps, but well within the ±10% allowable actual amperage draw to rated nameplate amperage as established by CSA Standards.

**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,

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

<sup>2</sup>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).

the total efficiency (TABLE 1) ranged from 10 to 51%. The maximum total efficiency of 51% occurred at 2820 cfm (1330 L/s) at a static pressure of 6.0 in wg (1490 Pa).

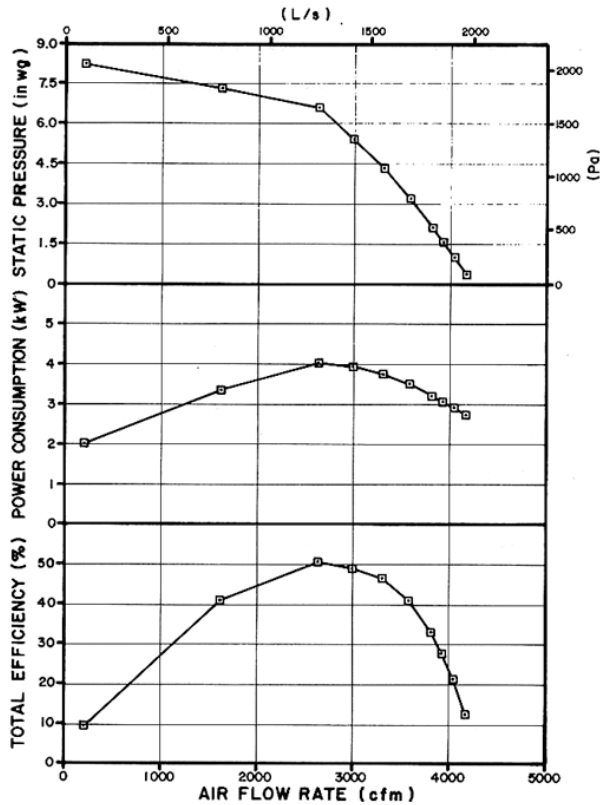


FIGURE 3. Denouden Model ILC21/18-312 Fan Performance Curves.

### EASE OF OPERATION

**Maintenance:** Seasonal inspection of the switch control box and fan motor was required. Sealed bearings are used for the fan motor, which should be inspected seasonally to assure a long service life. The inlet bell and guard grill could be easily removed for seasonal cleaning of the fan wheel. During the off season, operation of the fan for 30 minutes every three weeks was required to ensure bearing lubrication.

### OPERATOR SAFETY

The guard grill provided adequate protection from the fan blades. The motor was totally enclosed within the housing and presented no safety hazards. The Denouden Model ILC21/18-312 fan was CSA approved.

The noise level of the Denouden Model ILC21/18-312 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 81 dB(A). Higher noise levels could be expected if the fan was operated in the vicinity of other buildings. The Denouden Model ILC21/18-312 fan 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 operator's manual was very informative and contained information on operation, specifications, installation, wiring, maintenance, safety, performance, service, and troubleshooting. However, the manual does require updating to include information specifically for the Denouden ILC21/18-312 fan.

APPENDIX I SPECIFICATIONS	
<b>MAKE:</b>	Denouden
<b>MODEL:</b>	ILC21/18-312
<b>SERIAL NUMBER:</b>	87B3
<b>MANUFACTURER:</b>	Caldwell Manufacturing Company P.O. Box 338 Kearney, Nebraska USA 68848
<b>OVERALL DIMENSIONS:</b>	
-- housing width	27.0 in (686 mm)
-- housing depth	25.0 in (635 mm)
-- housing height	24.5 in (622 mm)
-- inlet bell diameter	9.25 in (235 mm)
-- guard grill diameter 1	7.5 in (445 mm)
-- grill opening	0.125 in (3 mm) diameter wire spaced at 0.75 in (19 mm)
-- discharge opening	18.0 in (457 mm)
<b>IMPELLER:</b>	
-- diameter	15.325 in (389 mm)
-- inside flange diameter	10.625 in (270 mm)
-- number of blades	9
-- blade angle	62.6°
<b>WEIGHT:</b>	112.0 lb (50 kg)
<b>MOTOR NAMEPLATE DATA:</b>	
-- make	Century
-- model	8-350716-01
-- frame	R145T
-- class	B
-- type	CX
-- code	L
-- duty	Air over
-- rpm	3450
-- service factor	1.00
-- ambient temperature rise	40°C
-- volts	230
-- amps	16
-- phase	1
-- cycles	60
-- horsepower	3 hp (2.24 kW)

APPENDIX II NOISE LEVEL RANGES		
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.

SUMMARY CHART DENOUEN MODEL ILC21/18-312 AERATION FAN	
<b>RETAIL PRICE:</b>	\$1149.00 (May, 1987, f.o.b. Lethbridge)
<b>FAN DESCRIPTION:</b>	15.375 in (391 mm) single speed, direct drive, 3.0 hp (2.24 kW) electric motor.
<b>FAN PERFORMANCE:</b>	224 to 4150 cfm (106 to 1960 L/s)
<b>AIR FLOW RATE:</b>	
-- range	224 to 4150 cfm (106 to 1960 L/s)
-- at maximum efficiency	2820 cfm (1330 lds) at a 6.0 in wg (1490 Pa) static pressure
<b>POWER CONSUMPTION:</b>	2.01 to 4.04 kW
<b>TOTAL EFFICIENCY:</b>	maximum 51%
<b>OPERATOR SAFETY:</b>	guard grill provided, CSA approved noise level = 81 dB(A) at 4.9 ft (1.5 m) from fan inlet
<b>OPERATOR'S MANUAL:</b>	very good, needs specific information for the Denouden ILC21/18-312 fan.



**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
---	---

This report is published under the authority of the minister of Agriculture for the Provinces of Alberta, Saskatchewan and Manitoba and may not be reproduced in whole or in part without the prior approval of the Alberta Farm Machinery Research Centre or The Prairie Agricultural Machinery Institute.