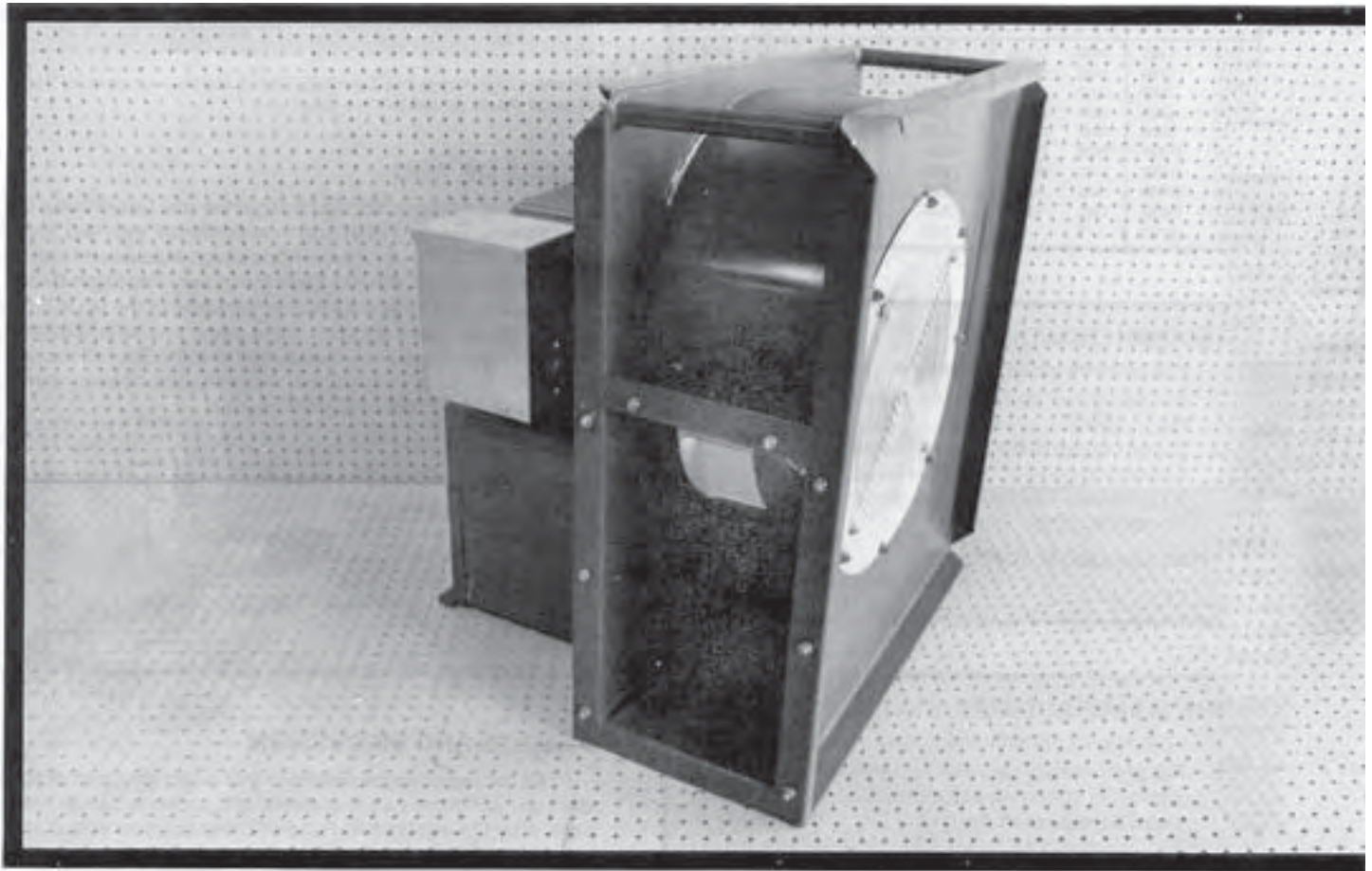


Evaluation Report

609



Indal Metals 3 HP Centrifugal Aeration Fan

A Co-operative Program Between



INDAL METALS 3 HP SINGLE PHASE 3450 RPM CENTRIFUGAL FAN

MANUFACTURER AND DISTRIBUTOR:

Indal Metals
 Division of Indal Limited
 P.O. Box 3041
 Saskatoon, Saskatchewan
 S7K 3S9

RETAIL PRICE: \$990.00 (July 1989, f.o.b., Lethbridge, Alberta)

SUMMARY OF RESULTS

TABLE 1. Indal Metals 3 HP Single Phase 3450 RPM 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
0.34	(85)	3630	(1710)	2.80	22	3518
1.00	(249)	3490	(1650)	2.90	28	3513
2.00	(498)	3310	(1560)	3.03	35	3505
3.00	(747)	3020	(1420)	3.05	43	3502
4.00	(996)	2640	(1250)	2.98	47	3503
5.00	(1280)	2460	(1130)	3.01	51	3481
6.00	(1490)	2140	(1010)	3.00	53	3497
7.00	(1740)	1840	(870)	2.95	52	3502
8.00	(1990)	1520	(718)	2.87	50	3510
8.54	(2130)	0	(0)	1.52	0	3509

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: R. C. Maze

THE MANUFACTURER STATES THAT

With regard to recommendation number:

1. Fan performance data will be supplied with each fan.
2. A detailed operating and instruction manual will be supplied with each fan.

GENERAL DESCRIPTION

The Indal Metals 3 hp, 3450 rpm centrifugal fan is a 13.5 in (343 mm) diameter, single speed, direct drive, centrifugal flow fan. It is primarily used for grain aeration or grain drying systems.

The Indal Metals 3 hp centrifugal fan is equipped with a wire mesh guard grill, an inlet bell, duct mounting flange, and motor control switch. The steel impeller consists of a hub back plate, 9 backward straight blades and a flange. The impeller is directly mounted on the 3 hp (2.24 kW), single phase, 230 volt, electric motor. The fan housing, motor mounts, 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 1.

SCOPE OF TEST

The Indal Metals 3 hp Centrifugal fan was tested in the outlet chamber setup (FIGURE 2) in accordance with test procedures developed by the Prairie Agricultural Machinery Institute and adopted by the Alberta Farm Machinery Research Centre. 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.

RESULTS AND DISCUSSION

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.

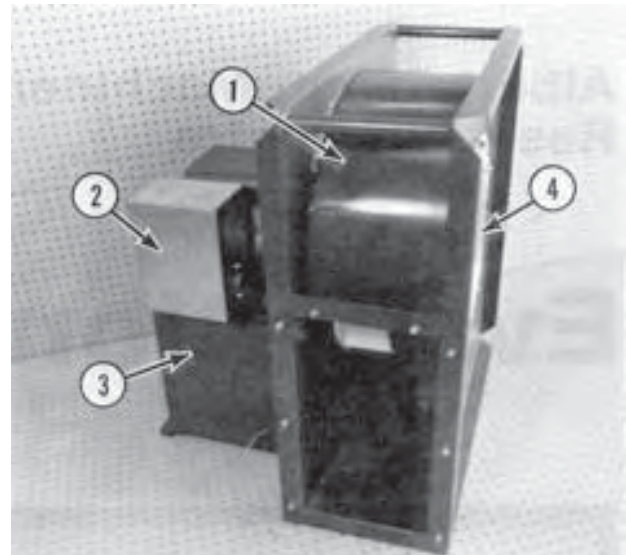


FIGURE 1. Indal Metals 3 hp Centrifugal Fan: (1) Fan Housing, (2) Motor Control, (3) Motor Mount, (4) Inlet Belt and Guard Grill.

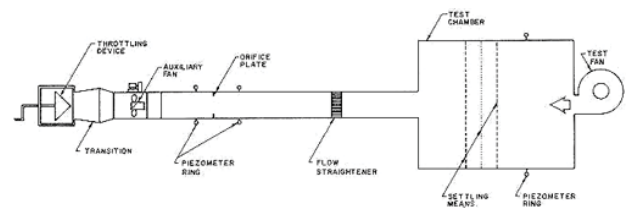


FIGURE 2. Schematic Fan Test Apparatus - Outlet Chamber Setup.

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 0 cfm (0 L/s) at 8.54 in wg (2130 Pa) to 3630 cfm (1710 L/s) at 0.335 in wg (85 Pa). FIGURE 3 illustrates the fan performance curves for the Indal Metals 3 hp centrifugal fan. The manufacturer did not provide any information on rated performance. It is recommended that for fan selection purposes, the manufacturer consider supplying 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 1.52 kW at maximum static pressure and minimum air flow to 3.03 kW at 2.0 in wg (498 Pa) static pressure and an air flow rate of 3310 cfm (1560 L/s). The maximum amperage drawn by the motor was 14.4 amps, which was less than the rated motor amperage of 15 amps with a service factor of 1.15.

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 0 to 53%. The maximum total efficiency of 53% occurred at 2140 cfm (1010 L/s) at a static pressure of 6 in wg (1490 Pa).

EASE OF OPERATION

Maintenance: No maintenance instructions were supplied. The inlet screen was easily removed, which allowed for cleaning of

¹Standard air is air with a density of 0.075 lbm/ft³ (1.2 kg/m³), 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).

the wheel and fan housing. Regularly scheduled maintenance will ensure longer motor life and optimum performance.

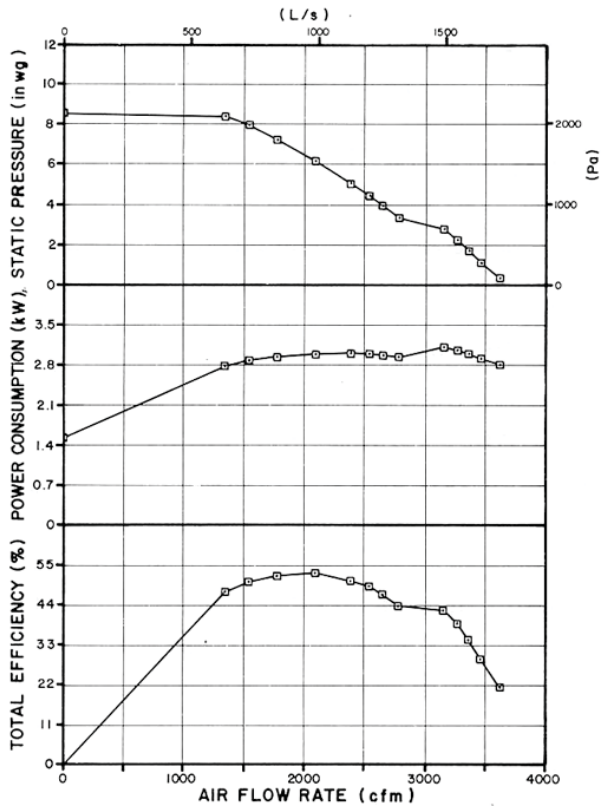


FIGURE 3. Indal Metals 3 hp Fan Performance Curves.

OPERATOR SAFETY

The guard grill provided adequate protection from the fan blades. The motor was a totally enclosed unit and presented no safety hazards. The Indal Metals 3 hp, single phase, 230 volt fan was CSA approved.

The noise level for the Indal Metals 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 91 dB(A). Higher noise levels could be expected if the fan was operated in the vicinity of other buildings. The Indal Metals 3 hp centrifugal fan falls within range 4 of the Alberta Farm Machinery Research Centre 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:** Indal Metals
- MODEL:** 3 hp Centrifugal Aeration Fan
- SERIAL NUMBER:** 388001
- MANUFACTURER:** Indal Metals - Division of Indal Ltd.
P.O. Box 3041
Saskatoon, Saskatchewan S7K 3S9
- OVERALL DIMENSIONS:**
 - housing width: 22.0 in (559 mm)
 - housing depth: 24.0 in (610 mm)
 - housing height: 28.5 in (724 mm)
 - inlet bell diameter: 9.5 in (241 mm)
 - guard grill diameter: 17.5 in (445 mm)
 - grill opening: 0.13 in (3 mm) diameter wire spaced at 0.75 in (19 mm)
 - discharge opening: 8.5 in (216 mm) by 14.9 in (378 mm)
- IMPELLER:**
 - diameter: 13.5 in (343 mm)
 - inside flange diameter: 11.5 in (293 mm)
 - number of blades: 9
 - blade width: 3.5 in (89 mm)
 - blade angle: 28 degrees
- WEIGHT:** 165 lb (75 kg)
- MOTOR NAMEPLATE DATA:**
 - make: Baldor
 - specifications: 35J333Y39
 - frame: 145T
 - class: B
 - series: F688
 - design: L
 - code: H
 - rpm: 3450
 - service factor: 1.15
 - ambient temperature rise: 40° C
 - volts: 230 V
 - amps: 15A
 - phase: single
 - cycles: 60 Hz
 - 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
INDAL METALS 3 H P CENTRIFUGAL AERATION FAN**

- RETAIL PRICE:** \$990.00 (July, 1989, f.o.b. Lethbridge)
- FAN DESCRIPTION:** 13.5 in (343 mm) single speed, direct drive, 3 hp (2.24 kW) single phase, 230 volt electric motor
- FAN PERFORMANCE:**
 - Air Flow Rate:**
 - range: 0 to 3630 cfm (0 to 1710 L/s)
 - at maximum efficiency: 2140 cfm (1010 L/s) at a 6 in wg (1490 Pa) static pressure
 - Power Consumption:** 1.52 to 3.05 kW
 - Total Efficiency:** maximum 53%
- OPERATOR SAFETY:** guard grill provided, CSA approved motor noise level = 91 dB(A) at 4.9 ft (1.5 m) from fan inlet
- OPERATOR'S MANUAL:** none supplied



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