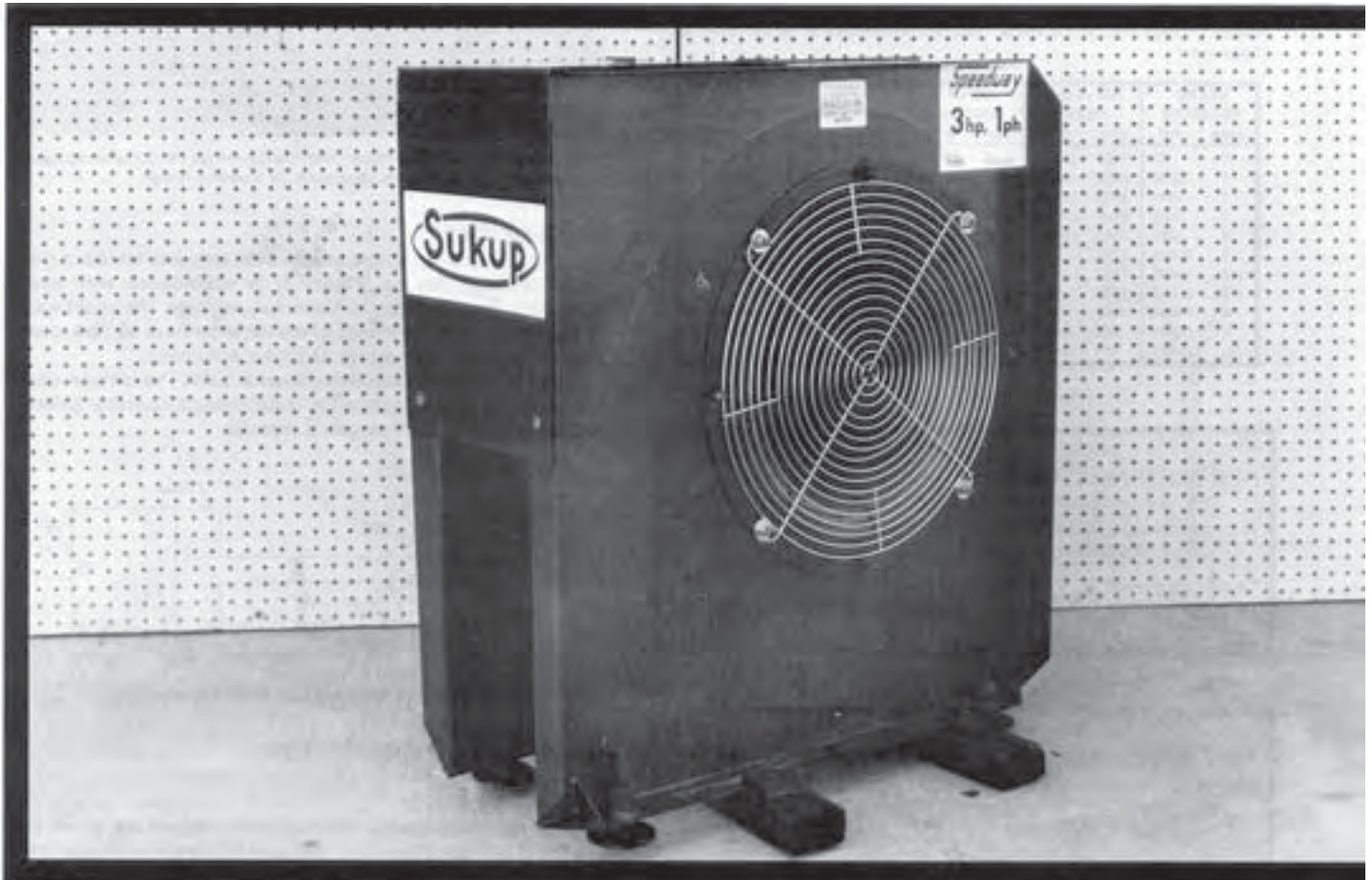


Evaluation Report

397



Sukup 3 hp Single Phase-3450 rpm Centrifugal Fan

A Co-operative Program Between



SUKUP 3 HP - SINGLE PHASE - 3450 RPM CENTRIFUGAL FAN

MANUFACTURER:

Sukup Manufacturing Company
Sheffield, Iowa
50475

DISTRIBUTOR:

United Farmers of Alberta Co-operative Limited
1016 - 68 Avenue S.W.
Calgary, Alberta
T2V 4J2

RETAIL PRICE:

\$1195.00 (November, 1984, f.o.b. Lethbridge, Alberta, complete with optional control assembly).

SUMMARY OF RESULTS

TABLE 1. Sukup 3 hp - Single Phase - 3450 rpm Performance at Typical Levels of Operation

Static Pressure		Air Flow Rate		Input Power		Total Efficiency	Fan Speed
in wg	(Pa)	cfm	(L/s)	hp	(W)	%	rpm
0	(0)	2860	(1350)	3.46	(2580)	7	3489
1	249	2660	(1260)	3.69	(2750)	17	3484
2	497	2500	(1180)	3.85	(2870)	24	3478
3	747	2340	(1110)	3.97	(2960)	29	3472
4	996	2180	(1030)	4.07	(3040)	33	3467
5	1240	1980	(935)	4.14	(3090)	36	3462
6	1490	1750	(826)	4.18	(3110)	37	3459
7	1740	1470	(696)	4.14	(3090)	37	3461
8	1990	1150	(544)	4.00	(2980)	33	3468
9	2240	783	(355)	3.71	(2770)	26	3479
10	2490	373	(176)	3.25	(2430)	15	3495

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.

Senior Engineer: E. H. Wiens

Project Engineer: R. P. Atkins

THE MANUFACTURER STATES THAT

With regard to recommendation number:

1. Air flow information is available and will be supplied with each fan in the future.

GENERAL DESCRIPTION

The Sukup 3 hp, single phase, 3450 rpm centrifugal fan is a 15.8 in (400 mm) diameter, single speed, direct drive, centrifugal flow fan. It is primarily used for grain aeration or grain drying systems.

The Sukup 3 hp, single phase, 3450 rpm fan is equipped with a wire mesh guard grill, an inlet bell, duct mounting flange and levelling lugs. An optional control assembly consisting of a magnetic motor starter, motor overload protection and a start-stop switch was supplied with the fan. The impeller consists of a steel and cast iron hub-backplate, 9 sheet metal, backward inclined airfoil blades and a steel flange. The impeller is directly mounted on the 3 hp (2240 W), single phase, 115/208-230 V electric motor. The fan housing and motor mount is of steel construction with an enamel coating for corrosion protection.

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

SCOPE OF TEST

The Sukup 3 hp, single phase, 3450 rpm was tested in the outlet chamber set up (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 230V. The fan was also evaluated for ease of operation, maintenance, operator safety and suitability of the operator's manual.

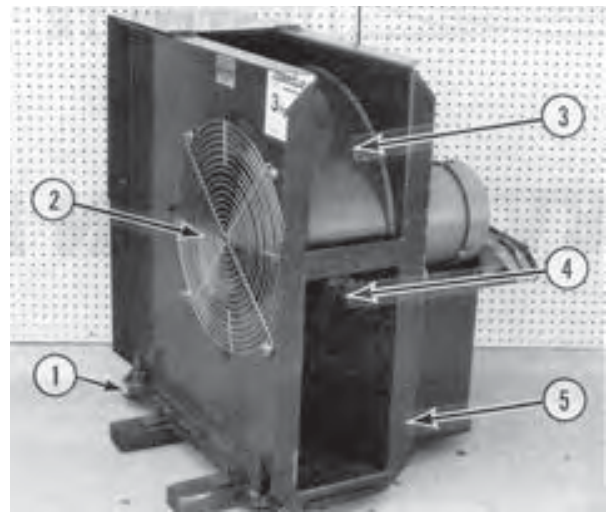


FIGURE 1. Sukup 3 hp - Single Phase - 3450 rpm Centrifugal Fan: (1) Levelling Lugs, (2) Guard Grill, (3) Fan Housing, (4) Impeller, (5) Mounting Flange.

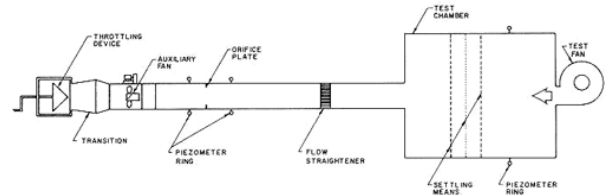


FIGURE 2. Schematic of Fan Test Apparatus - Outlet Chamber Setup.

RESULTS AND DISCUSSION

FAN PERFORMANCE

All fan performance results in this report are given at standard 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 373 cfm (176 L/s) at 10 in wg (2490 Pa) to 2860 cfm (1350 L/s) at 0 in wg (0 Pa). FIGURE 3 illustrates the fan performance curves for the Sukup 3 hp, single phase, 3450 rpm fan. There was no manufacturer's performance information provided. It is recommended that for fan selection purposes, the manufacturer provide a table or curve of air flow rates over a complete range of static pressures.

Power Requirements: The power required to run the fan depended upon the point of operation of the fan. The input power required varied from 3.25 hp (2430 W) at maximum static pressure and minimum air flow rate to 4.18 hp (3110 kW) at 6 in wg (1490 Pa) static pressure and an air flow rate of 1750 cfm (826 L/s). The maximum amperage drawn by the motor was 14.2 amps, which was less than the rated motor amperage of 14.5 amps.

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 37%. The maximum total efficiency of 37% occurred at 1690 cfm (798 L/s) at a static pressure of 6.2 in wg (1540 Pa).

EASE OF OPERATION

Maintenance: Seasonal inspection of the control assembly, fan blades, housing and mounts was required. Covering of the fan inlet during the off season was recommended to keep out weather and pests and to prevent windmilling of the motor. Every six weeks during the off season the motor required a 10-minute run to redistribute grease in the motor bearings and to expel condensation

¹Standard air is air with a density of 0.075 lb/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).

from the motor housing. The removable guard grill and inlet bell allowed easy access for maintenance.

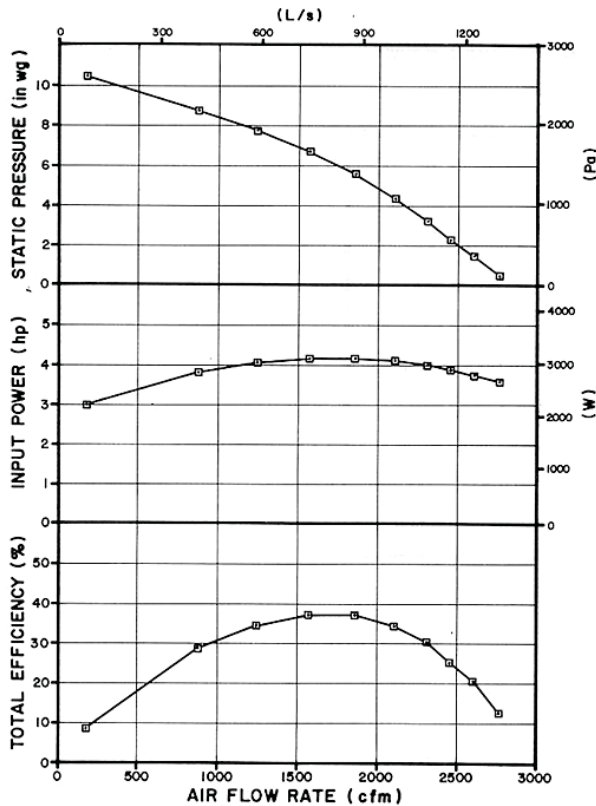


FIGURE 3. Sukup 3 hp - Single Phase - 3450 rpm Fan Performance Curves.

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 Sukup 3 hp, single phase, 3450 rpm fan was not CSA approved. The manufacturer indicated that application for CSA approval has been made and is expected in 1985.

The noise level³ of the Sukup 3 hp, single phase, 3450 rpm 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 86 dB(A). Higher noise levels could be expected if the fan was operated in the vicinity of other buildings. The Sukup 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

The operating instructions contained information on preparation, installation, wiring, safety, maintenance, service and trouble shooting.

³PAMI Test Procedure for Determining Fan Noise Level.

APPENDIX I SPECIFICATIONS

MAKE: Sukup
MODEL: 3 hp - single phase - 3450 rpm
SERIAL NUMBER: 04159
MANUFACTURER: Sukup Manufacturing Company
 Sheffield, Iowa 50475

OVERALL DIMENSIONS:
 -- housing width: 26.8 in (681 mm)
 -- housing depth: 29.2 in (743 mm)
 -- housing height: 32 to 33.8 in (813 to 857 mm)
 -- inlet bell diameter: 9.2 in (235 mm)
 -- guard grill diameter: 17.1 in (435 mm)
 -- grill opening: 0.125 in (3 mm) diameter, spaced at 0.5 in (13 mm) in a circular pattern
 -- discharge opening: 7.5 x 15.8 in (190 x 400 mm)

IMPELLER:
 -- diameter: 15.8 in (400 mm)
 -- inside flange diameter: 10.4 in (264 mm)
 -- number of blades: 9
 -- blade angle: 60°

WEIGHT: 259 lb (118 kg)

MOTOR NAMEPLATE DATA:
 -- make: Baldor
 -- model: L3606T
 -- frame: 184T
 -- class: F
 -- code: G
 -- design: L
 -- duty: continuous
 -- rpm: 3450
 -- service factor: 1.15
 -- ambient temperature rise: 40°C
 -- volts: 115/208-230 V
 -- amps: 29/15-14.5 A
 -- phase: 1
 -- cycles: 60 Hz
 -- horsepower: 15 hp (2240 W)

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	= millimeters (mm)
inches water gauge (in wg) x 249.1	= pascals (Pa)
pounds (lb) x 0.45	= kilograms (kg)

**SUMMARY CHART
 SUKUP 3 HP - SINGLE PHASE - 3450 RPM CENTRIFUGAL FAN**

RETAIL PRICE: \$1195.00 (November, 1984, f.o.b. Lethbridge)
FAN DESCRIPTION: 15.8 in (400 mm) single speed, direct drive, 3 hp (2240 W) electric motor.
FAN SPEED: 3459 to 3495 rpm
MAXIMUM EFFICIENCY: 37%
AIR FLOW RATE:
 -range: 373 to 2860 cfm (176 to 1350 L/s)
 -at maximum efficiency: 1690 cfm (798 L/s) at a 6.2 in wg (1540 Pa) static pressure
INPUT POWER: 3.25 to 4.18 hp (2430 to 3110 W)
OPERATOR SAFETY: Guard grill provided not CSA approved Noise level = 86 dB(A) at 4.9 ft (1.5 m) from fan inlet
OPERATOR'S MANUAL: adequate



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