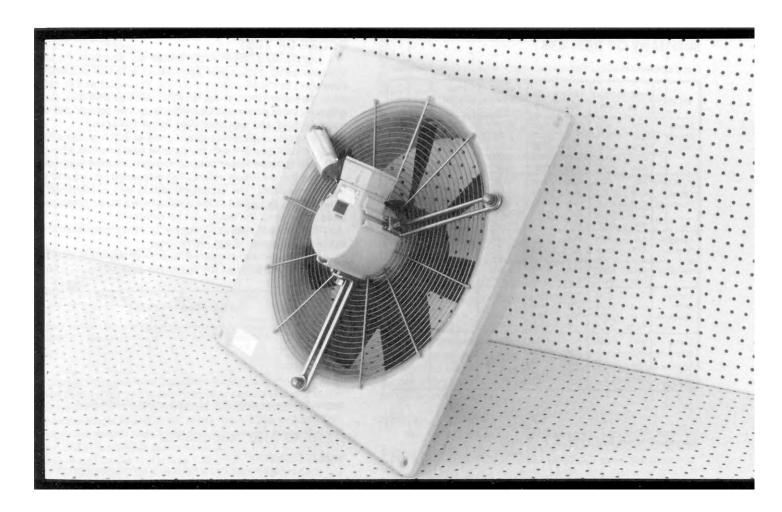
Printed: January 1986 Tested at: Lethbridge ISSN 0383-3445 Group 5i

# **Evaluation Report**

465



# Siemens Model 2CC2-506 Ventilation Fan

A Co-operative Program Between





# SIEMENS MODEL 2CC2-506 VENTILATION FAN

#### MANUFACTURER:

Siemens Electric Limited 9829, 45 Avenue Edmonton, Alberta T6F 5C8

#### DISTRIBUTOR:

Ziehl Ventilating Equipment 803 - 30 Street North Lethbridge, Alberta T1H 5G5

#### RETAIL PRICE:

\$274.00 (January, 1986, f.o.b. Lethbridge, Alberta.)

# **SUMMARY OF RESULTS**

TABLE 1. Siemens Model 2CC2-506 Fan Performance at Typical Levels of Operation.

SETTING	STATIC F	PRESSURE (Pa)	AIR FLO	OW RATE (L/s)	POWER Consumption kWh	TOTAL EFFICIENCY %	FAN SPEED
Single Speed Direct	0.0	(0.0)	4010	(1890)	0.315	35	1105
	0.05	(12.5)	3880	(1830)	0.328	37	1100
	0.10	(24.9)	3670	(1730)	0.334	38	1092
	0.125	(31.1)	3590	(1700)	0.339	39	1089
	0.25	(62.3)	2800	(1320)	0.336	23	1087
Variable Speed Maximum	0.0	(0.0)	4000	(1890)	0.326	34	1097
	0.05	(12.5)	3860	(1820)	0.331	36	1090
	0.10	(24.9)	3660	(1730)	0.339	38	1081
	0.125	(31.1)	3600	(1700)	0.340	39	1080
	0.25	(62.3)	2870	(1350)	0.340	37	1081
Variable Speed Mid Range	0.0	(0.0)	3620	(1710)	0.289	28	995
	0.05	(12.5)	3350	(1580)	0.301	28	968
	0.10	(24.9)	3000	(1420)	0.299	28	936
	0.125	(31.1)	2890	(1360)	0.302	27	931
	0.25	(62.3)	1520	(719)	0.301	17	984
Variable Speed Minimum	0.0	(0.0)	2600	(1730)	0.222	14	677
	0.05	(12.5)	1900	(896)	0.217	11	619
	0.10	(24.9)	1480	(697)	0.215	10	643
	0.125	(31.1)	670	(316)	0.083	5	554
Single Speed	0.0	(0.0)	3620	(1710)	0.333	24	1089
	0.05	(12.5)	3400	(1600)	0.341	25	1083
Direct	0.10	(24.9)	3160	(1490)	0.344	26	1082
with	0.125	(31.1)	3020	(1430)	0.347	26	1083
Louvres	0.25	(62.3)	1660	(795)	0.327	17	1096

Manager/Senior Engineer: E. H. Wiens

Project Engineer: R. P. Atkins

# **GENERAL DESCRIPTION**

The Siemens Model 2CC2-506 ventilation fan is a 19.5 in (495 mm) diameter, variable speed, direct drive, propeller type axial flow fan. It is primarily used in livestock and poultry barns as an exhaust fan located in the wall or ceiling.

The Siemens Model 2CC2-506 is a flush mounted unit equipped with an inlet guard grill, a mounting face plate, optional PVC louvres, thermostat and variable speed control. The 7 blade propeller and hub are made of plastic and are mounted directly on a 0.268 hp (200 W), single phase, 240 V electric motor. The motor mount consists of three steel double rod brackets mounted directly to the motor casing. The steel face plate and cast motor housing are coated with a heavy enamel for corrosion protection.

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

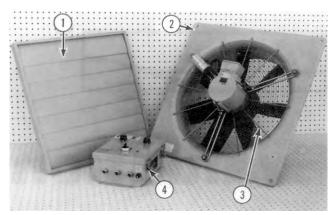


FIGURE 1. Siemens Model 2CC2-506 Ventilation Fan: (1) Optional Louvres, (2) Mounting Face Plate, (3) Inlet Guard Grill, (4) Variable Speed Control.

# SCOPE OF TEST

The Siemens Model 2CC2-506 fan was tested in the inlet 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. The control unit was not evaluated and was used only to set fan speed.

Fan performance was determined at 230 V in the single speed direct mode and with the variable speed control. With the SCR type variable speed control, fan performance was determined at the maximum setting, the mid-range setting and the minimum setting. The minimum setting was established by reducing the fan speed to the point where a static pressure of 0.125 in wg (31.1 Pa) could still be obtained.

The effect of louvres on fan performance was determined in the single speed direct mode only.

The fan was also evaluated for ease of operation, operator safety and suitability of the operator's manual.

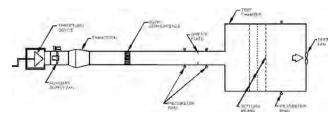


FIGURE 2. Schematic of Fan Test Apparatus -- Inlet Chamber Setup.

# **RESULTS AND DISCUSSION**

# FAN PERFORMANCE

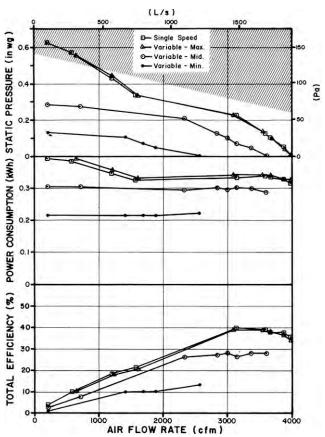
All fan performance results in this report are given at standard air¹ conditions so that direct comparisons can be made with other fan test reports. Fan performance under actual operating conditions could differ from these results by up to 10%, depending on such things as temperature, barometric pressure, humidity and elevation above sea level.

Air Flow Rate: Fan output in both the single speed direct mode and at the maximum setting on the variable speed control were similar (FIGURE 3). Reducing the fan speed, greatly reduced the air flow rate for a given static pressure<sup>2</sup>. For example, at a static pressure of 0.125 in wg (31.1 Pa), reducing the speed from maximum to mid range to minimum setting, reduced the air flow rate from 3600 cfm (1700 L/s) to 2890 cfm (1360 L/s) to 670 cfm (316 L/s) respectively.

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

<sup>&</sup>lt;sup>2</sup>Static 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).

Air flow rates at typical levels of operation (i.e. static pressure) are given in TABLE 1. Ventilation fans are often rated on their output at a static pressure of 0.125 in wg (31.1 Pa). The manufacturer's rated air flow rate at 0.125 in wg (31.1 Pa), in the single speed direct mode, was 3396 cfm (1603 L/s). PAMI's measured flow rate at the same conditions was 3590 cfm (1700 L/s) or 6% greater than the manufacturer's rating.



**FIGURE 3.** Siemens Model 2CC2-506 Fan Performance Curves in the Single Speed Mode and at Three Speed Settings in the Variable Speed Mode.

Power Consumption: Power consumption is the amount of energy (kWh) used by the fan motor. For typical levels of static pressure (TABLE 1), the input power varied from 0.315 to 0.339 kWh in the single speed direct mode, from 0.326 to 0.340 kWh at maximum speed, from 0.289 to 0.302 kWh at mid range and from 0.083 to 0.222 kWh at minimum speed. The maximum amperage drawn by the motor was 1.60 amps, which was greater than the rated motor amperage of 1.45 amps. The shaded zone in FIGURE 3 illustrates operating levels where the rated motor amperage was exceeded. Prolonged operation in excess of the rated amperage could reduce motor life.

**Total Efficiency:** Total efficiency is the ratio of air horse-power 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), using the variable speed control, ranged from 34 to 39% at maximum speed, 17 to 28% at mid range and 5 to 14% at minimum speed. The total efficiency in the single speed direct mode at a static pressure of 0.125 in wg (31.1 Pa) was 39%.

Effect of Louvres: The optional louvres were installed on the outlet side of the fan to determine their effect on fan output. The fan was tested under these conditions in the single speed direct mode only. Using the louvres reduced the air flow rate by 10 to 40% (FIGURE 4) over the typical range of operation. For example, at a static pressure of 0.125 in wg (31.1 Pa), the louvres reduced the air flow rate by 16%, from 3590 cfm (1700 L/s) to 3020 cfm (1430 L/s) (TABLE 1). The efficiency was in turn

reduced from 39 to 26%. The use of other control devices such as shutters, dampers, screens, and hoods would also reduce air flow rates by varying amounts. The use of such control devices have to be taken into consideration when designing a ventilation system.

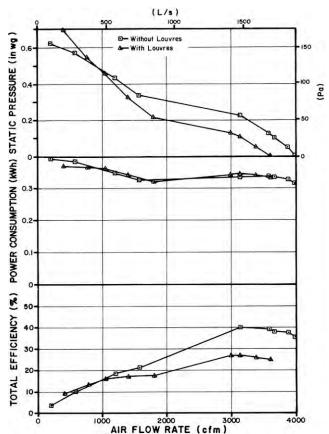


FIGURE 4. Effect of Louvres on Fan Performance.

#### **EASE OF OPERATION**

**Maintenance:** The inlet guard grill, motor mount and motor could all be easily removed for cleaning. Regularly scheduled cleaning and maintenance will ensure longer motor life and optimum performance.

# **OPERATOR SAFETY**

The inlet guard grill provided adequate protection from the fan blades. The motor was a totally enclosed unit and presented no safety hazards. The Model 2CC2-506 was CSA approved. The noise level of the Model 2CC2-506, at a distance of 4.9 ft (1.5 m) from the centre of the fan discharge, while operating at a 0.125 in wg (31.1 Pa) static pressure, was 73 dB(A). Higher noise levels could be expected if the fan was operated in the vicinity of other buildings. The Model 2CC2-506 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 operating instructions contained information on general operation, installation, maintenance, and safety. Fan performance data was given in a separate brochure.

#### APPENDIX I

#### SPECIFICATIONS

MAKE: Siemens MODEL: 2CC2-506

Siemens Electric Limited MANUFACTURER:

> 9829. 45 Avenue Edmonton, Alberta

T6F 5C8

OVERALL DIMENSIONS:

25.75 in (654 mm) - housing width - housing height 25.75 in (654 mm)

- housing depth

9.25 in (235 mm) (motor included) - housing diameter 19.50 in (495 mm) - guard grill diameter 22 in (559 mm)

- grill opening 0.063 in (2 mm) diameter wire

spaced at 0.313 in (8 mm) in a circu-

lar pattern

IMPFLLERS:

19.1 in (486 mm) - diameter - hub diameter 7.1 in (179 mm)

- number of blades

variable - 28° at the tip, - blade angle

43° at the hub

40 lb (18 kg) WEIGHT:

MOTOR NAMEPLATE DATA:

Siemens make model 2CC2-506 rpm volts 240 V 1.45 A amps phase 60 Hz cvcles

0.268 hp (200 W) horsepower

#### APPENDIX II

# NOISE LEVEL RANGES

RANGE	SOUND LEVEL (dBA)	COMMENTS
1	up to 45	Tolerable, iow 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

= litres/second (L/s) cubic feet/minute (cfm) x 0.472 = watts (W) horsepower (hp) x 745.7 = millimetres (mm) inches (in) x 25.4 = pascals (Pa) inches water gauge (in wg) x 249.1 = kilograms (kg) pounds (lb) x 0.45

# **SUMMARY CHART SIEMENS MODEL 2CC2.506 VENTILATION FAN**

RETAIL PRICE:

(January, 1986, f.o.b. Lethbridge)

19.5 in (495 mm) propeller fan, varia-FAN DESCRIPTION: ble speed, direct drive, 0.268 hp (200

W) 240 V electric motor.

FAN SPEED:

- single speed direct 1087 to 1105 rpm - variable speed 554 to 1097 rpm

EFFICIENCY RANGE:

OPERATOR'S MANUAL:

- without louvres 5 to 39% - with louvres 17 to 26% - with louvies

EFFICIENCY AT 0.125 in wg (31.1 Pa):
39%

- with louvres

AIR FLOW RATE:

670 to 4010 cfm (316 to 1890 L/s) - range 3590 cfm (1700 L/s) single speed - at 0.125 in wg (31.1 Pa)

without louvres and 3020 cfm (1430

L/s) with louvres

0.083 to 0.347 kWh POWER CONSUMPTION: OPERATOR SAFETY: inlet guard provided

CSA approved

noise level -- 73 dB(A) at 4.9 ft

(1.5 m) from fan discharge

adequate



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 P.O. Box 1150

Portage la Prairie, Manitoba, Canada R1N 3C5 Humboldt, Saskatchewan, Canada S0K 2A0

Telephone: (204) 239-5445 Telephone: (306) 682-5033 Fax: (204) 239-7124 Fax: (306) 682-5080