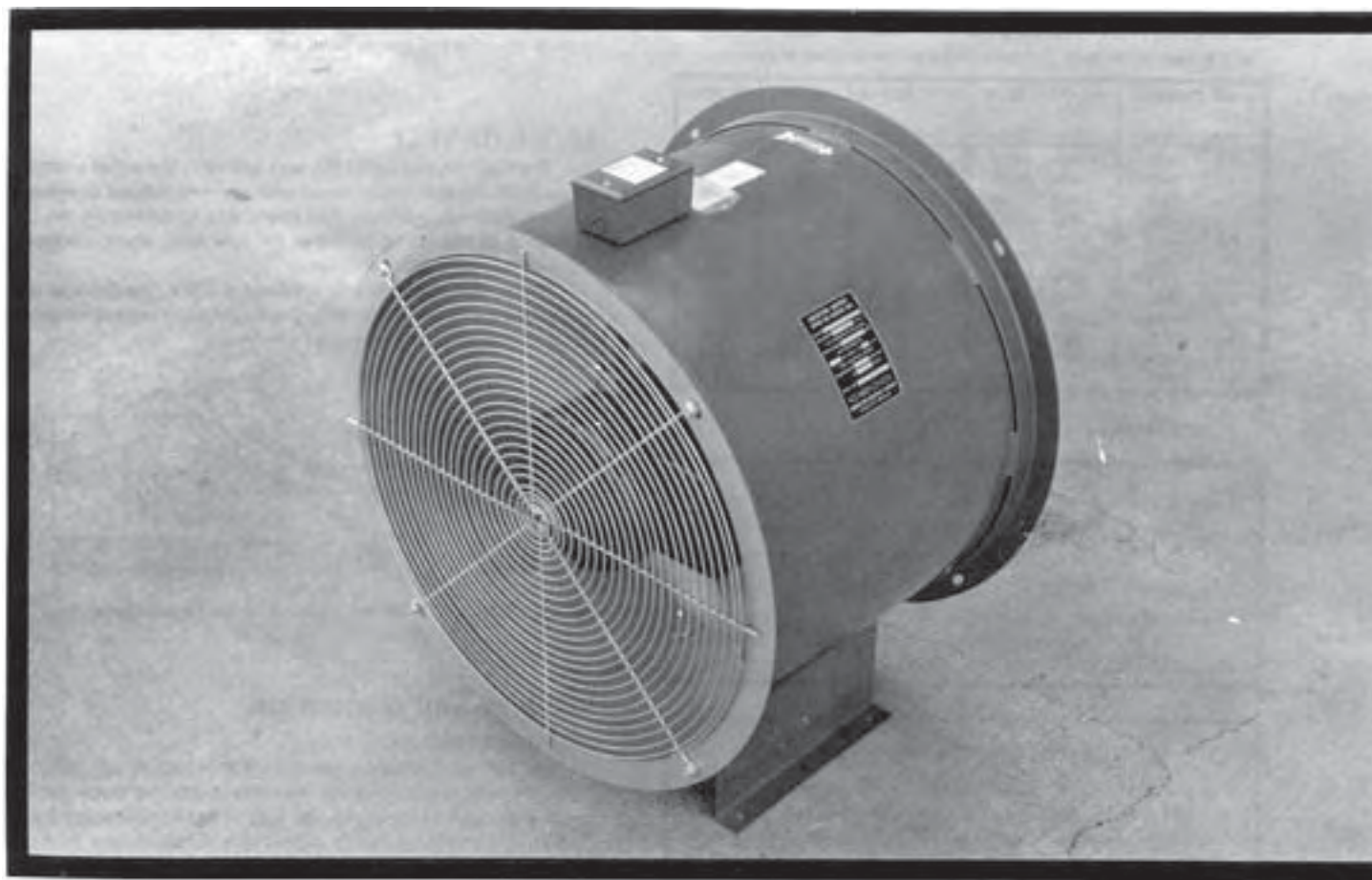


# Evaluation Report

# 560



## Ceco Model 24501 Axial Fan

A Co-operative Program Between



## CECO MODEL 24501 AXIAL FAN

### MANUFACTURER:

Combustion Equipment Company  
Division of Luffland Industries  
P.O. Box 228  
Bates City, MO 64011

### DISTRIBUTOR:

Flaman Sales Ltd.  
Box 280  
Southey, Sask. S0G 4P0

### RETAIL PRICE:

\$1195.00 (February, 1988, f.o.b. Lethbridge, Alberta).

## SUMMARY OF RESULTS

TABLE 1. Ceco Model 24501 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
0.5	(125)	11600	(5480)	5.36	35	3471
1.0	(249)	11000	(5190)	5.67	40	3463
1.5	(374)	10300	(4860)	5.89	42	3455
2.0	(498)	9490	(4480)	6.10	47	3447
2.5	(623)	8670	(4090)	6.25	48	3443
3.0	(747)	7730	(3650)	6.24	48	3443
3.5	(872)	6670	(3150)	6.12	47	3445
4.0	(996)	5540	(2620)	5.96	44	3450
4.5	(1120)	4420	(2090)	5.78	41	3455
5.0	(1250)	3440	(1620)	5.57	36	3461
5.5	(1370)	2680	(1270)	5.40	32	3468
5.8	(1440)	2320	(1100)	5.29	29	3473

## 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. A table or curve of air flow rates over a range of static pressure will be supplied in the future.

## GENERAL DESCRIPTION

The Ceco Model 24501 fan is a 23.9 in (610 mm) diameter, single speed, direct drive, axial flow fan. It is primarily used for grain aeration or grain drying systems.

The Ceco Model 24501 fan is equipped with a wire mesh guard grill and duct mounting flange. The six airfoil blades and hub are a single aluminum casting which is directly mounted on the 7.2 hp (5.4 W) single phase, 230 V electric motor. The propeller is designed to push air up through the grain. By reversing the fan housing and the guard grill the fan is capable of drawing air down through the grain. The fan housing, motor mount, flanges 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 Ceco Model 24501 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.

## 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.

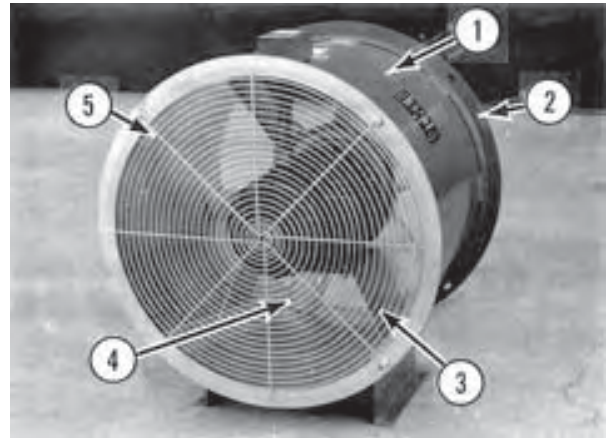


FIGURE 1. Ceco Model 24501 Axial Fan: (1) Fan Housing, (2) Mounting Flange, (3) Motor Mount, (4) Propeller, (5) Guard Grill.

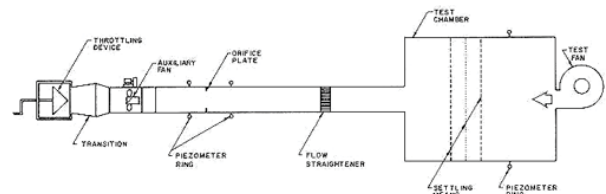


FIGURE 2. Schematic of Fan Test Apparatus - Outlet Chamber Setup.

**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 2320 cfm (1100 L/s) at 5.8 in wg (1440 Pa) to 11600 cfm (5480 L/s) at 0.5 in wg (125 Pa). FIGURE 3 illustrates the fan performance curves for the Ceco 24501 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.

## OPERATOR'S MANUAL

The operator's manual was very informative and contained illustrations and information on operation, installation, wiring, maintenance and trouble shooting.

**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 5.29 kW at maximum static pressure and minimum air flow rate to 6.25 kW at 2.5 in wg (623 Pa) static pressure and an air flow rate of 8670 cfm (4090 L/s). The maximum amperage drawn by the motor was 25.8 amps, which was less than the rated amperage of 28 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 29 to 48%. The maximum total efficiency of 48% occurred at 8670 cfm (4090 L/s) at a static pressure of 2.5 in wg (623 Pa).

## EASE OF OPERATION

**Maintenance:** Weekly inspection of the fan and of the electrical connections were required. Seasonal lubrication of the motor bearings was required.

## OPERATOR SAFETY

The guard grill provided adequate protection from the fan

<sup>1</sup>Standard air is air with a density of 0.075 lbm/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 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).

blades. The motor was a totally enclosed unit and presented no safety hazards.

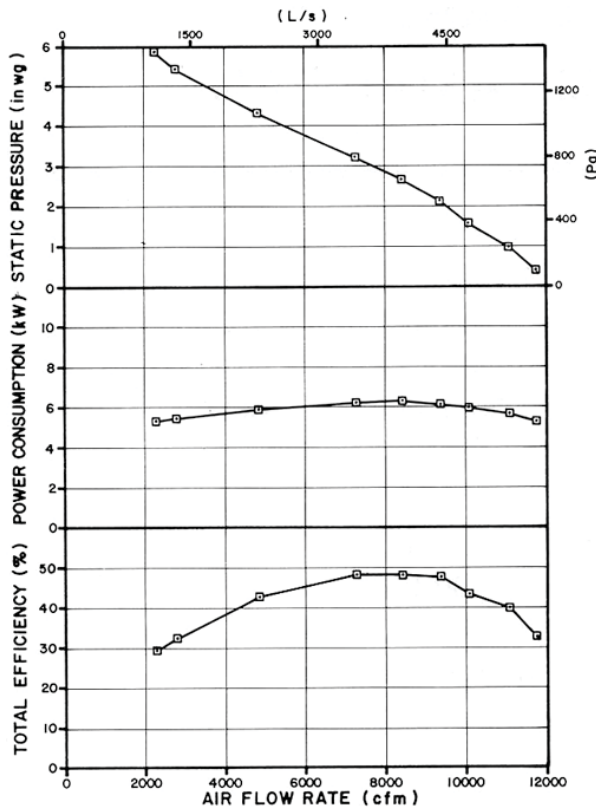


FIGURE 3. Ceco Model 24501 Fan Performance Curves.

The noise level of the Ceco 24501 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 103 dB(A). Higher noise levels could be expected if the fan was operated in the vicinity of other buildings. The Ceco 24501 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.

APPENDIX I SPECIFICATIONS	
<b>MAKE:</b>	Ceco
<b>MODEL:</b>	24501
<b>SERIAL NUMBER:</b>	21231
<b>MANUFACTURER:</b>	Combustion Equipment Company A Division of Luffland Industries P.O. Box 228 Bates City, MO 64011
<b>OVERALL DIMENSIONS:</b>	
-- housing width	27.0 in (686 mm)
-- housing depth	20.0 in (508 mm)
-- housing height	30.0 in (762 mm)
-- guard grill diameter	24.0 in (610 mm)
-- grill opening	0.125 in (3 mm) diameter wire, spaced at 0.5 in (13 mm)
-- discharge opening	24.0 in (610 mm)

<b>IMPELLERS:</b>	
-- diameter	23.9 in (606 mm)
-- inside flange diameter	10.5 in (267 mm)
-- number of blades	6
-- blade angle	22 degrees at hub, 14 degrees at tip
<b>WEIGHT:</b> 152 lb (68 kg)	
<b>MOTOR NAMEPLATE DATA:</b>	
-- make	Baldor
-- specifications	36F533W844
-- frame	184TZ
-- class	F
-- code	F
-- duty	Continuous
-- rpm	3500
-- service factor	1.0
-- ambient temperature rise	40°C
-- volts	230
-- amps	19-28
-- phase	1
-- cycles	60
-- horsepower	7.2 hp (5.4 kW)

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  
CECO MODEL 24501 AXIAL FAN**

<b>RETAIL PRICE:</b>	\$1195.00 (February, 1988, f.o.b. Lethbridge)
<b>FAN DESCRIPTION:</b>	24.0 in (610 mm) single speed, direct drive, 7.2 hp (5.4 kW), single phase, 230 V electric motor.
<b>FAN PERFORMANCE:</b>	
<b>Air Flow Rate:</b>	
-- range	2320 to 11600 cfm (1100 to 5480 L/s)
-- at maximum efficiency	8670 cfm (4090 L/s) at a 2.5 in wg (623 Pa) static pressure
<b>Power Consumption:</b>	5.29 to 6.25 kW
<b>Total Efficiency:</b>	maximum 48%
<b>OPERATOR SAFETY:</b>	guard grill provided, CSA approved noise level = 103 dB(A) at 4.9 ft (1.5 m) from fan inlet
<b>OPERATOR'S MANUAL:</b>	informative



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