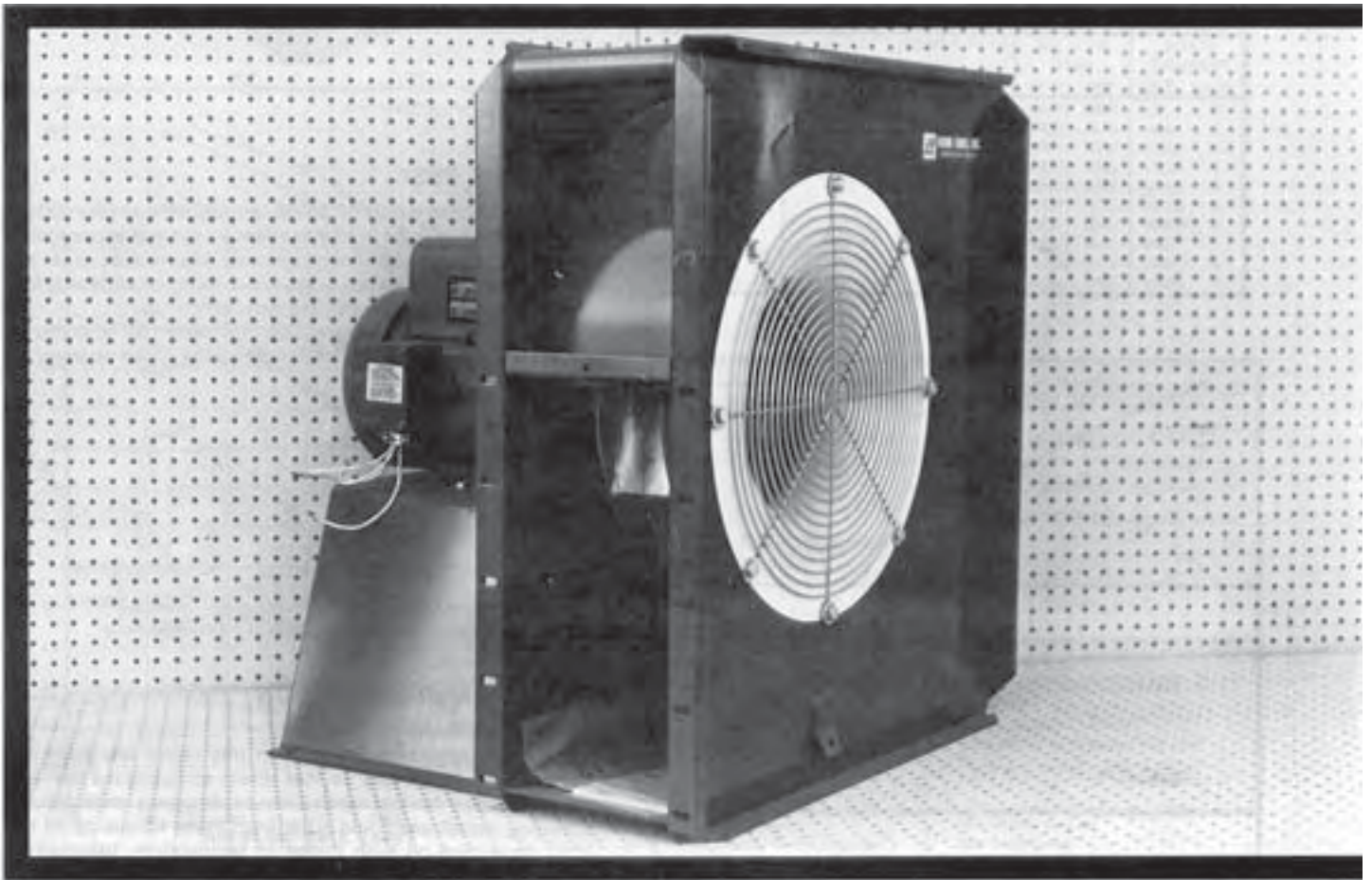


# Evaluation Report

# 338



## Farm Fan Model FFC 515E Centrifugal Aeration Fan

A Co-operative Program Between



# FARM FAN MODEL FFC 515E CENTRIFUGAL FAN

## MANUFACTURER:

Farm Fans, Inc.  
5900 Elmwood Ave.  
Indianapolis, Indiana 46203

## DISTRIBUTOR:

Westeel-Rosco Limited  
Box 792  
Winnipeg, Manitoba  
R3C 2N5

## RETAIL PRICE:

\$1654.00 (February 1984, f.o.b. Lethbridge, Alberta, complete with optional motor control assembly).

## SUMMARY OF RESULTS

TABLE 1. Farm Fan Model FFC 515E Performance at Typical Levels of Operation

Static Pressure		Airflow Rate		Input Power		Total Efficiency	Fan Speed
in wg	Pa	cfm	L/s	hp	W	%	rpm
0	0	3660	1730	4.41	3290	14	3528
1	249	3430	1620	4.56	3400	21	3527
2	497	3220	1520	4.69	3500	27	3526
3	747	3020	1430	4.90	3650	33	3522
4	996	2850	1350	5.10	3800	37	3517
5	1240	2700	1270	5.25	3920	41	3513
6	1490	2540	1200	5.36	4000	43	3510
7	1740	2370	1120	5.41	4040	46	3507
8	1990	2160	1020	5.38	4010	48	3507
9	2240	1890	892	5.23	3900	48	3509

## RECOMMENDATIONS

It is recommended that the manufacturer consider:

- Updating the operator's manual on centrifugal fans to include the model FFC 515E.

Senior Engineer: E. H. Wiens

Project Engineer: R.P. Atkins

## THE MANUFACTURER STATES THAT

With regard to recommendation number:

- We are presently in the process of including the model 515E in our operator's manual.

## GENERAL DESCRIPTION

The Farm Fan model FFC 515E aeration fan is a 15 in (381 mm) diameter, single speed, direct drive, centrifugal flow fan. It is primarily used for grain aeration or grain drying systems.

The Farm Fan FFC 515E is equipped with a chromed guard grill, an inlet bell and a square duct mounting flange. A control assembly consisting of a magnetic motor starter, motor overload protection and a start-stop switch is available as an option, but was not supplied with the fan. The aluminum impeller consists of a hub-backplate, 9 backward inclined blades and a flange. The impeller is directly mounted on the 5 hp (3730 W), single phase, 230 V electric motor. As with other Farm Fans, the FFC 515E can be used to push air up or pull air down through the grain, depending on transition pieces used. 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 Farm Fan model FFC 515E 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.

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

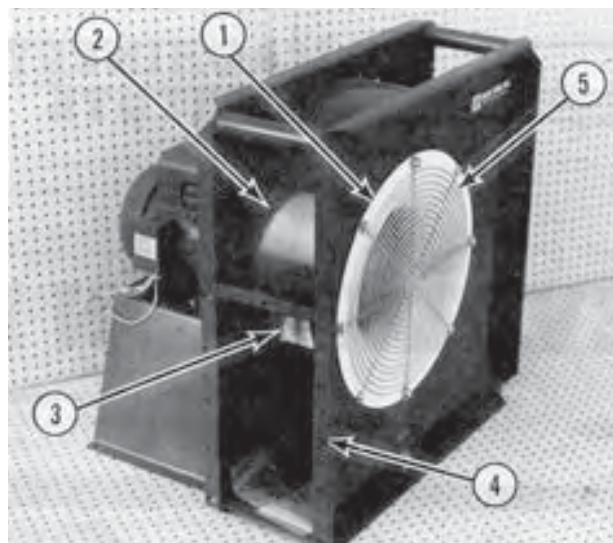


FIGURE 1. Farm Fan Model FFC 515E Fan: (1) Inlet Bell, (2) Fan Housing, (3) Impeller, (4) Mounting Flange, (5) Guard Grill.

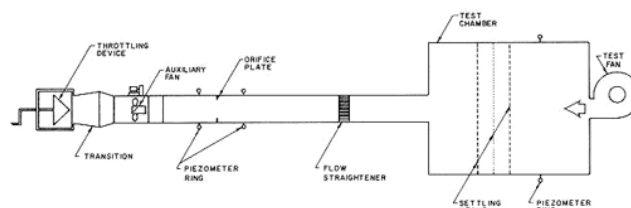


FIGURE 2. Schematic of Fan Test Apparatus - Outlet Chamber Setup.

## 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 level of operation (i.e. static pressure<sup>2</sup>) are given in TABLE 1. The air flow rate ranged from 1890 cfm (892 L/s) at 9 in wg (2240 Pa) to 3660 cfm (1730 L/s) at 0 in wg (0 Pa). FIGURE 3 illustrates the fan performance curves for the Farm Fan FFC 515E aeration fan and a comparison to the manufacturer's rated performance. The manufacturer's literature provided fan performance information over a range of static pressures from 2 to 10 in wg (497 to 2490 Pa) in increments of 1 in wg (249 Pa). The difference in output between the manufacturer's and PAMI's results varied depending upon the level of operation. For example, PAMI's measured air flow rate, at the peak efficiency of 48%, was 2000 cfm (944 L/s) at a static pressure of 8.65 in wg (2150 Pa). This was 12% lower than the manufacturer's rated output of 2270 cfm (1070 Us) at a static pressure of 8.65 in wg (2150 Pa).

**Power Requirements:** The power required to run the fan depended upon the point of operation of the fan. The minimum input power of 4.41 hp (3290 W) occurred at zero static pressure and maximum air flow rate (free air flow). The peak power input of 5.41 hp (4040 W) occurred at 7 in wg (1740 Pa) static pressure and an air flow rate of 2370 cfm (1120 L/s). The maximum amperage drawn by the motor was 17.5 amps, which was well below the rated motor amperage of 21 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 14 to 48%. The maximum total efficiency of 48% occurred at 2000 cfm (944 L/s) at a static pressure of 8.65 in wg (2150 Pa).

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

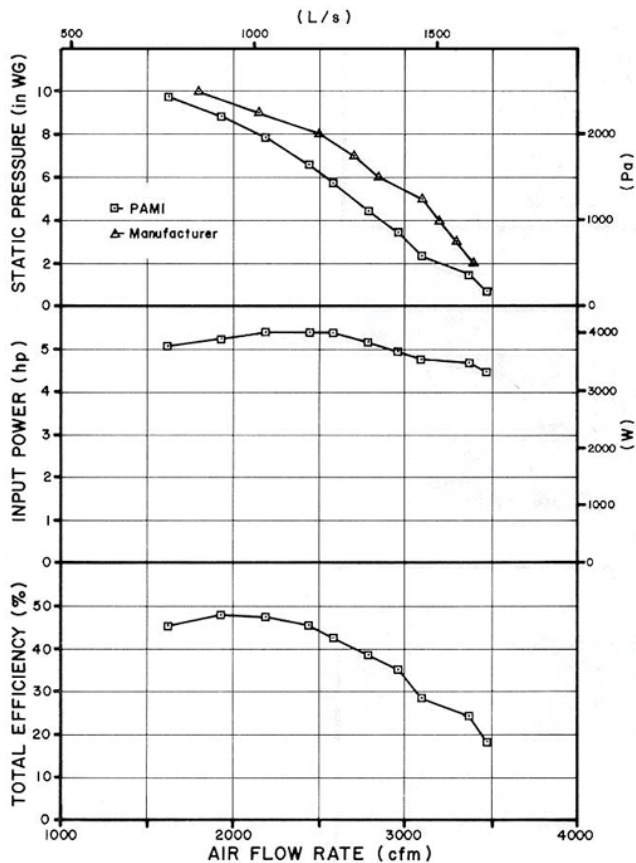


FIGURE 3. Farm Fan Model FFC 515E Fan Performance Curves.

### EASE OF OPERATION

**Maintenance:** Seasonal inspection of the motor mounts, impeller mounts, condition of the impeller, impeller clearance and motor bearings was required. Motor bearings required lubrication every 2 to 3 seasons or annually under continuous use. The removable guard grill and inlet bell allowed easy access for maintenance.

### 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 Farm Fan FFC 515E was CSA approved.

The noise level<sup>3</sup> of the Farm Fan FFC 515E, while operating at a 1 in wg (249 Pa) static pressure, was 89 dB (A). Higher noise levels could be expected if the fan was operated in the vicinity of other buildings. The Farm Fan FFC 515E 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

A very informative operator's manual containing detailed information on operation, specifications, installation, maintenance, rated performance, safety aspects and trouble shooting was provided for

<sup>3</sup>PAMI Test Procedure for Determining Fan Noise Level.

other Farm Fans, Inc. centrifugal fans. The model FFC 515E was not included. It is recommended that the manufacturer consider updating the operator's manual on centrifugal fans to include the model FFC 515E. Also included was a general bulletin on grain bin drying and aeration systems, which contained useful application and design information.

APPENDIX I SPECIFICATIONS	
<b>MAKE:</b>	Farm Fan
<b>MODEL:</b>	FFC 515E-1 L/C
<b>SERIAL NUMBER:</b>	91721
<b>MANUFACTURER:</b>	Farm Fans, Inc. 5900 Elmwood Ave. Indianapolis, Indiana 46203
<b>OVERALL DIMENSIONS:</b>	
-- housing width	24.5 in (622 mm)
-- housing height	30.5 in (775 mm)
-- housing length	28.5 in (724 mm)
-- inlet bell diameter	9.1 in (231 mm)
-- guard grill diameter	16.5 in (419 mm)
-- grill opening	0.125 in (3 mm) diameter spaced at 0.5 in (13 mm) in a circular pattern.
-- discharge opening	7.75 in (197 mm) x 16.5 in (419 mm)
<b>IMPELLER:</b>	
-- diameter	15.2 in (386 mm)
-- inside flange diameter	10.5 in (267 mm)
-- number of blades	9
-- blade angle	4°
<b>WEIGHT:</b>	213 lb (97 kg)
<b>MOTOR NAMEPLATE DATA:</b>	
-- make	Baldor
-- model	36E 04W501
-- frame	184T
-- class	B
-- duty	continuous
-- rpm	3450
-- service factor	1
-- ambient temperature rise	40°C
-- volts	230 V
-- amps	21 amps
-- phase	1
-- cycles	60 Hz
-- horsepower	5 hp (3720 W)

APPENDIX II NOISE LEVEL RANGES		
SOUND LEVEL		
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.

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 FARM FAN FFC 515E CENTRIFUGAL AERATION FAN	
<b>RETAIL PRICE:</b>	\$1654.00 (February, 1984, f.o.b. Lethbridge)
<b>FAN DESCRIPTION:</b>	15 in (381 mm) single speed, direct drive, 5 hp (2730 W) electric motor
<b>FAN SPEED:</b>	3507 to 3528 rpm
<b>MAXIMUM EFFICIENCY:</b>	48%
<b>AIR FLOW RATE:</b>	
- range	1890 to 3660 cfm (892 to 1730 L/s)
- at maximum efficiency	2000 cfm (944 Us) at a 8.65 in wg (2150 Pa) static pressure
<b>INPUT POWER:</b>	4.41 to 5.41 hp (3290 to 4040 W)
<b>OPERATOR SAFETY:</b>	guard grill provided CSA approved noise level = 89 dB(A)
<b>OPERATOR'S MANUAL:</b>	complete and very informative



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